THE UNIVERSITY OF HULL

EVALUATION OF A ONE YEAR LONG, NON-DIETING, PHYSICAL ACTIVITY BASED LIFESTYLE INTERVENTION PROGRAMME FOR CLINICALLY OBESE WOMEN

being a Thesis submitted for the Degree of PhD

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by

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Abstract

Obesity is a heterogeneous, complex, and chronic condition with large individual differences. Lifestyle modification has been widely acknowledged as the primary treatment for obesity. ***Objective*** – This PhD examined the effects of a non-dieting exercise-based lifestyle intervention programme (e.g. no calorie-restriction) using the tenets of the self-determination theory (SDT; Deci & Ryan, 1985b) to inform intervention decisions and identify individual differences (e.g. SDT was used to identify self-regulatory profiles), on physical and metabolic fitness, and psychological well-being among premenopausal, clinically obese women. The programme titled WHEEL focused on health outcomes rather than weight loss. ***Design*** – A randomised, delayed start RCT feasibility study. This longitudinal study ran for one year in two phases: a) 12 weeks of intensive intervention and b) a 40-week maintenance phase. ***Setting*** – Free living, general community setting. ***Participants*** – 62 predominantly white Caucasian (97%), clinically obese (BMI $\geq$30kg/m^2), pre-menopausal women with a mean age of 40.2 years, free of obesity-related diseases and fit to for exercise were randomly assigned to a non-dieting lifestyle intervention group (n = 31) or waiting list control (n = 31). ***Intervention*** – *Exercise*: four hours of exercise per week chosen from the following options: Tai Chi, Circuit classes x 2; and Aqua aerobics. Participants were required to complete two sessions in a WHEEL class, but were encouraged to do all four. If this was not possible they had to agree the exercise of their choice with EB who checked their plan against the FITT principle of exercise. The tenets of SDT, namely autonomy, competence building, and relatedness were used to inform the design of exercise sessions. Autonomy: participants chose their own exercise programme structure. Flexibility within exercise sessions allowed for matching activities to participants' current state of fitness. Those with high functional limitations were given alternative, seated exercises. Relatedness was fostered in different ways: 1) Outside of WHEEL:

participants were encouraged to share their weight related experiences with each other. Routes to exercise venues were planned and they were encouraged to have a car-sharing scheme; and participants organised various charity walks for the group on their own accord. 2) Within WHEEL: participants generally worked in pairs whilst exercising in a group setting. After the initial 12-week intervention phase they were also allowed to invite a female friend or family member to join them in the classes. Competence building: participants were taught exercise skills; including naming and executing each exercise routine correctly, with a view of them joining 'regular' classes in the future. Furthermore, they were taught to take their own pulse and monitor their heart rate throughout sessions. The psycho-educational classes targeting dieting behaviours and eating regulation using *Brief Cognitive Behavioural Therapy (CBT) techniques*: a two one-hour session per week for three weeks, delivered in the 12-week intervention phase, challenging maladaptive eating behaviours, whilst educating participants about food labels and food choices. *Educational Sessions*: one per week for 12 weeks on physiological and psychological mechanisms of exercise and dieting (e.g. dangers of weight cycling due to dieting). *Social Support*: follow-up phone calls if two weeks of exercise sessions were missed. *Adherence*: attrition and attendance were monitored.

Data Analysis – Mixed Method: sequential QUAN-QUAL data analyses. QUAN: intention to treat analysis, repeated measures analysis of variance, regression, and correlations. QUAL: analytic induction analysis using the QSR*NVivo qualitative data analysis software. Outcome measures at baseline, 12 weeks, and 52 weeks. QUAN Psychological Instruments: General Causality Orientation Scale (GCOS; Deci & Ryan, 1985b), General Well-Being Schedule (GWB; Dupuy, 1977 & 1978), Perceived Stress Scale (PSS; Cohen, Kamarck, & Mermelstein, 1983), Self-Perception Profile (SPP; Messer & Harter, 1986), State Self-Esteem Scale (SSES; Heatherton & Polivy, 1991), Multidimensional Health Locus of Control Scales (Form C) (MHLC; Wallston,

Wallston, & DeVellis, 1978), and Social Support for Exercise Scale (SSSE; Fox & Dirkin, 1992). QUAN Physiology measures: metabolic and cardio-respiratory fitness. QUAL: 62 weight history interviews at baseline with 36 follow-up interviews, including 12 drop-outs. The semi-structured interviews explored participants' history and prevalence of self-reported dieting and eating behaviours, assessed weight cycling prevalence and development of weight status up to baseline, investigated previous exercise history and skills, perceived health status and difficulties with physical activity including barriers, and examined motivation, goals, and expectation for WHEEL from the personal point of view and from the programme's. The follow-up interviews at 52 weeks explored difficulties with exercise behaviour change, and quality of life. ***Results*** – *Baseline*: participants showed high levels of psychopathology indexed by high levels of stress, low levels of general well-being (81.8% in severely distressed category of the General Well-Being Schedule) and self-perceptions (e.g. self-esteem, body image), low autonomy and high impersonal orientation, and problems with emotional eating (78%) and dieting (86%). Also, participants had poor fitness levels (< 10% percentile for women) and metabolic profile with 50% of the participants meeting the metabolic syndrome criteria. Participants had unrealistic expectations (35% expected weight loss) and low exercise self-efficacy, low confidence in their ability to achieve, and a number of problems associated with their excess body weight. Finally, participants experienced societal prejudice in various aspects of their lives (e.g. healthcare, work). *RCT phase*: significant improvements in psychological functioning indexed by significant improvement in well-being (29.9% improvement in total score of GWB Schedule and all its subscales), self-perceptions (athletic, appearance, global self-worth scales of the SPP), and perceived received social support (reducing significantly the discrepancy between need for support and received support). In addition, cardiorespiratory fitness improved significantly in the intervention group (9.3% increase adjusted VO_2, ml·kg$^-$

$^{1}\cdot min^{-1}$; 7.8% absoluteVO_2, $ml\cdot min^{-1}$) as compared to controls (4% reduction adjusted VO_2, $ml\cdot kg^{-1}\cdot min^{-1}$ & 3.2% absoluteVO_2, $ml\cdot min^{-1}$). All these changes took place despite the absence of significant weight loss. *Maintenance*: those who continued the programme showed improved psychological functioning at 12. The participants showed significant improvements in general well-being: the average value at this stage was 74.4 (±16.6) bringing the group as a whole into the positive well-being category. Most subscales of the SPP showed significant improvements from baseline to 12 months and the discrepancy between needed and perceived provided social support for listening, information, and challenge support for exercise narrowed significantly. In support of SDT, participants felt more autonomous and more in control of their own destiny.

Conclusion - Although there was a significant dropout in the study (60%) the present intervention was successful in bringing about behavioural change in those who stayed in the programme. Both the QUAN and QUAL results provided strong support for the improved psychological profile of participants in the absence of significant weight changes. Reasons for dropout included: research design, facilities, and personal. Although the study was not without limitations the underlying philosophy adopted was rarely questioned and would provide a basis for definitive RCT trail.

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THIS THESIS IS DEDICATED TO

ALL THOSE WOMEN WHO GRABBED

THE BULL BY THE HORN

AND RAN WITH IT ...

Publications from Thesis

Publications in refereed journals

1. Carroll, S., Borkoles, E., & Polman, R. (2007). Short-term effects of a non-dieting lifestyle intervention programme on weight, cardio-metabolic risk and psychological well-being in obese pre-menopausal females with the metabolic syndrome. *Applied Physiology, Nutrition and Metabolism*, 32(1), 125-142.
2. Carroll, S., Marshall, P., Borkoles, E., Ingle L., Barker, D., & Tan, L-B. (2007). Efficacy of lifestyle intervention on peak exercise cardiac power output and reserve in premenopausal obese females: A randomised pilot study. *International Journal of Cardiology, 119,* 147-155.

Publications in Professional Journals:

1. Carroll, S., Borkoles, E., & Polman, R. (2008). Jolly, fat and fit: Are Santa Claus and his goodwife role models for the non-dieting HAHA (Happy, Active – Healthy, Active lifestyle) paradigm? *The Sport and Exercise Scientist* BASES, issue 18, December, pp. 28-29.

Abstracts/Papers in Conference Proceedings

1. Carroll, S., Borkoles, E., & Polman, R. (2007). Short-term effects of a non-dieting lifestyle intervention on metabolic fitness and psychological well-being in obese females with the metabolic syndrome. 2nd International Congress on 'Prediabetes' and the Metabolic Syndrome. Barcelona, Spain, 25-28 April.
2. Borkoles, E., Polman, R., & Carroll, S. (2007). An Exploration of Obese Pre-menopausal Females Experience of a Non-dieting Weight Management Programme that Used the Self-Determination Theory's Framework to Promote

Healthy Living: the WHEEL (Weight, Healthy Eating and Exercise in Leeds) Project. 3rd Self-Determination Conference, Toronto, Canada, May, 2007.

3. Borkoles, E., Carroll, S., & Polman, R. (2006). Short-term effects of a non-dieting lifestyle intervention programme on weight management, fitness, metabolic risk and psychological well-being in obese premenopausal females. Behavioural medicine: Advancing science, policy and practice. UK Behavioural Medicine and Society's 2nd Scientific Meeting, Cambridge, UK, 6th December 2006.

4. Borkoles, E., Carroll, S., & Polman, R. (2006). Self-determination theory: A case for evidence-based healthcare provision within the WHEEL (Weight, Healthy Eating and Exercise in Leeds) project. *4th International Biennial Self Research Conference', book of abstracts, pp. 80-81*. Ann Arbour, USA, 23-27 July.

Chapter One
Preamble

1.1. Setting the stage: Reflection on the observed experiences of severely obese patients' consultation in an obesity clinic in the UK

1.2. Purpose of Preamble

The purpose of this chapter is to explain to the reader why I have chosen to do this PhD. I am an exercise psychologist and early in my career I've noticed that there were no really big people in research based exercise interventions and I wondered why. It turned out that those with high weight status did not see exercise as an option for them and exercise scientists avoided to recruit them. Recruitment criteria in most published research is limited to a BMI of 35 and below, and often much lower, more like in the overweight range, effectively excluding those whom perhaps needs our attention the most. I knew I had to change my own understanding of what is possible to do and set out to find an alternative intervention programme that allowed participants to engage at any level they could.

The purpose of this PhD was to enable moderately to morbidly obese individuals to learn to exercise, starting from their own fitness levels. This chapter describes what I have learnt from a six months observational placement at an obesity clinic treating mainly morbidly obese clients. I wanted to be aware of what these individuals' health behaviour change experiences were, when living with obesity related co-morbidities. In particular, I wanted to understand both from the practitioner's and the individual's points of view the difficulties they experience when they try to deal with excess weight status at that level. This population is special, as perceived and actual pain, high prevalence of depressive symptoms and poor general well-being put these individuals at a much higher risk in an exercise setting, as well as a risk of dropping out. This chapter explains how my thinking developed during that six months placement, in particular trying to show how I planned for safeguarding these individuals' psychological and physical well-being within WHEEL.

1.3. Treatment of obesity in a clinical setting

Moderate to morbidly obese individuals are mainly treated in clinical settings and rarely in a community one, mainly due to obesity related co-morbidities and risks associated with such a weight status. Therefore, exercise counselling mainly takes place by medical doctors or nurses, rather than specialist exercise scientist or psychologists. Since 1985, The National Institute of Health Consensus Development Panel on Health Implications of Obesity (1985), the US Preventive Services Task Force (USPSTF, 2003), and the National Institute for Health and Clinical Excellence (NICE, 2006) within the US and UK have produced a series of comprehensive guidelines for practitioners to reach consensus on how to address obesity in clinical settings. Additionally, NICE also released information for patients about expectation and standards of care. However, doctors in GPs' surgeries and specialised clinical settings are still reluctant to discuss weight issues with their patients and often such sessions are less than adequate and rarely meet the standards of the above guidelines due to many barriers cited by doctors (Galuska, Will, Serdula, & Ford, 1999; Huang, Yu, Marin, Brock, Carden, & Davis, 2004; Jackson, Doescher, Saver, & Hart, 2005; Stafford, Farhat, Misra, & Schoenfeld, 2000). These barriers include insufficient confidence, knowledge, and skills, as well as perceptions that weight loss counselling doesn't work in the long-term and that there are no effective behavioural therapies for maintenance of weight loss (Huang et al., 2004). Exercise counselling in this population requires specialist knowledge and I wanted to observe how it was conducted in practice at these clinics. I also wanted to avoid setting my participants up for failure and to minimise drop out rates. In this chapter I will also compare this reflective work with current literature findings.

1.4. Description of a specialist obesity clinic in the UK

The Clinic: I was given full access for six months to consultations taking place in a specialist obesity clinic, where severely obese patients were referred for treatment. Typically, these patients were morbidly obese (BMI ≥35 kg/m^2 or ≥40 kg/m^2, depending on local guidelines for referral) with a number of co-morbidities requiring weight loss and with a history of previous unsuccessful weight loss attempts. For example, all patients observed had one or more of the following diseases: cardiovascular disease, osteoarthritis, diabetes, gallstones, and various other musculoskeletal and psychological problems. Therefore, this population is probably much different from the healthier obese population seeking weight loss. Typically, these patients were on various medications, some of which induced serious weight gain (e.g. antidiabetic and psychotropic medications, such as antidepressants). Patients with psychological problems were referred on to a psychologist within the hospital, if needed, but the waiting list for this service was extremely over-subscribed. Patients referred to the Clinic came from all over the County. Apart from severe obesity, all the patients varied in age and obesity-related problems. There were roughly an equal number of males and females attending to the clinic. On a weekly basis, three professionals typically saw 18 people in three hours between them. They acknowledged that it was difficult to assess patients thoroughly within clinic time. The clinic staff kindly allowed me to observe their consultations as in the future they wanted to employ an exercise specialist to improve their services, but they had difficulty in getting funding from the NHS.

Two specialist doctors ran the service working with a full-time dietician. One of the doctors was a very experienced, gentle man who prided himself in seeing and listening to patients. The other was a young doctor, who had very little sympathy to those who couldn't or wouldn't follow his advice of eating less and moving more. He once laughingly stated that most patients prefer to see his colleague. I've tried to ignore such remarks and made me more determined to be acceptant of what each patient's experience was without being judgemental. The issue of acceptance of one's state and struggle became the core philosophy of WHEEL.

The physical space: The physical space allocated to the Obesity Clinic in the hospital was less than adequate for the needs of the patients. The rooms were very small and the corridor where patients waited was very narrow. There were three chairs there. One was promptly moved out by a patient into the middle of the corridor as they felt 'uncomfortable and too cramped' sitting there. The consulting rooms were also tiny. This experience made me aware that large bodies needed space to feel comfortable; therefore in this PhD research I paid special attention and researched each and every exercise testing room and venue for suitability. For example, numerous exercise spaces and changing rooms were visited with various clinically obese volunteers prior to the start of WHEEL and the most suited to the needs of these individuals were chosen.

The following stories will illustrate how my understanding of what individuals with high weight status and co-morbidites are willing and able to do for themselves when treated in a specialist obesity clinic. I also learnt to accept that in some cases they are not able or willing to do anything at all:

A 51-year old woman with a BMI of ≥ 49 kg/m^2 came to consultation, during which she found out that she put on a lot of weight over Christmas. She said she had problems with her back and she couldn't walk, as her back has never been alright after a car accident sometime ago. She also complained about gallstones, stomach, and bowel problems, and stated that she had to be in a wheelchair, and therefore she couldn't really do much. She also stated that she lost a granddaughter before Christmas. The woman complained to the doctor about the size and type of the chair she was asked to sit on in the clinic. The chairs were of 'normal' size and with supporting bars on either side. Both doctors stated that these chairs were deliberately used to make people aware of their conditions and size, which may prompt them to do something about their weight. The woman also stated that she was unable to sleep, even with almost sitting up in bed. She started to cry explaining that she 'throws up every night'. She is on Prozac and is very depressed. Two people came in during this consultation that further distressed her. The older doctor then asked whether she was able to follow advice about exercise received at the last visit, such as leg lifts in bed and upper body arm exercises. She replied that she couldn't do any exercise as it takes her a long time to walk, and she can't even walk to the nearby supermarket. She takes a taxi now, as she was very exhausted after her last time trying to walk to it, and then she had to spend all day afterwards lying in bed. She was asking the doctor to help her to support her claim for early retirement due to disability, as she is planning to move in with her daughter who will look after her. She could hardly walk even with sticks for support. She more or less stated that she did not want to get better as it would affect her claim.

In reflection, this case study illustrates a very difficult scenario both from the patient and the health care provider's points of view. Clearly, it is difficult to ascertain what, if anything, could be done in the context of such a consultation. The doctor stated after the patient left that in the past two years she only played lip service to his advice and has never followed it up with actual behaviour, with regards to lifestyle change prompts. I've learnt three lessons from this consultation that drove my actual exercise intervention plan.

One: check that all equipments (e.g. chairs, tape measures, exercise bike, blood pressure cuffs) I will use will accommodate large sizes to avoid embarrassment and discomfort to my participants. Two: understand participants' motivation to engage with a lifestyle intervention programme to avoid setting them up for failure. Three: provide education around the benefits of exercise for independent living and quality of life and devise an exercise programme that is suitable for individuals with moderate to severe obesity who have movement difficulties with regards to their condition.

Another case study of a 29-year old woman with a BMI of ≥ 40 kg/m^2, who had an extremely poor quality of life, illustrates the complexity of managing weight with lifestyle advice within a clinic setting. The patient recently had her appendix taken out and the wound became septic after the operation, which was seen as a common problem with obese patients after any operation. She had a complicated weight history. For example, she was put on a very low calorie diet in a hospital treatment programme several times, with very poor maintenance results after initial large weight losses. After each treatment she regained the weight and more. She was a chronic dieter, with various dieting club memberships (e.g. Weight Watchers, Slimming World). She had weight problems since she was eight-years-old. She had three children, and was a single mother. Currently, her adoptive parents were looking after her and her children. She complained of bad back, diabetes, stomach ulcers, blocked bowels, water retention, and blisters on her skin, which regularly got infected. She had heavy periods and fibroids in her womb, which made walking very difficult for her.

She also raised the issue of the chair being small, which was not answered by the doctor. She stated that she smoked 10 cigarettes a day, snored at night, and kept falling asleep during the day at any place. She said that she put on weight with each of her pregnancies (her children were aged, 5, 4, and 3), but she was sterilised now. She came in with a walking stick as she had thrombosis in her left leg that was operated on. She attributed her weight gain and generally her problems with weight to genetics, as her natural parents and siblings were all clinically obese, with a number of obesity-related conditions. She didn’t exercise at all, although she liked swimming, which she enjoyed and made her feel better. She only ever swam on holidays, and she was aware that after each holiday, she was able to walk without a stick for a couple of weeks. However, she was not prepared to go swimming where people might know her. When the doctor asked her why she wanted to lose weight, she burst out in tears. She said she wanted to enjoy life, and wanted to look after her kids, which she currently couldn’t do, as she was dependent on her adoptive parents for care. She was worried about her parents’ health and the future of her children, as her parents were getting too old to look after her and the three children.

This patient taught me that the quality of life is an extremely important consideration for people with weight problems. I was astonished that at such a young age she had such a poor quality of life that she couldn’t live an independent life or provide for her children. She was entirely dependent on the health care service, her parents, and the government to provide for her and her large family. She clearly wanted to have a better quality of life but somehow the system of care failed to engage her in taking control of her life other than in a medical sense. This case influenced my decisions about theoretical frameworks and the choice of using the self-determination theory’s tenets (e.g. to satisfy participants basic needs for autonomy, choice, and connectedness and maximising motivation for behaviour change) to drive the intervention design that was hoped to enable participants to move towards a more autonomous existence.

It was evident that the majority of patients in the clinic had not just one but a number of unhealthy behaviours (e.g. overeating, lack of activity, smoking, excess alcohol consumption), as well as a lot of physical, psychological and environmental barriers to health behaviour change. One patient with a BMI of $\geq 42 \text{ kg/m}^2$ reported a four stone weight gain in two months due to smoking cessation. He said that he dealt with stress with food instead of cigarettes. Clearly, effects of multiple health behaviour change were not considered during clinic time. Staff at the time of my observations hadn't been trained in health behaviour change techniques, and therefore failed to plan for the consequences of complex behaviour change effects, such as how stopping an unhealthy behaviour affected weight loss efforts. It was evident that the clinic staff was only able to cope with a certain amount of issues during an appointment, and concentrated mainly on medical co-morbidities of obesity, with limited lifestyle counselling. The lack of time, lack of resources, lack of comprehensive evaluation of patients' weight history, and poor goal expectation management lead to some patient dissatisfaction. For example, several patients were impatient with the clinic staff, as they wanted a quick fix of weight loss, as one patient voiced: 'I am not happy. It's my second visit. How long do I have to come here to lose weight?' Although she was advised that it was too short of time to expect any big weight loss (i.e. usually there is a 1-2 months gap between appointments), her weight loss expectations were not managed well. She was told to monitor her body shape for change, to which she replied: 'I am not interested in shape change, I want to lose weight.'

This conversation made me think about goal-setting and how to manage my future participants' expectations and goals, which will be described in the methodology chapter. It is well known that low to moderate exercise does not induce substantial weight loss in this population, and therefore might be problematic for goal expectations. Furthermore, the issue of multiple behaviour change requirements within a standard obesity treatment plan, coupled with a short intervention time scale guided my intervention design plan. As a result of what I heard from patients and their documented struggles with multiple behaviour change, it was decided to actively target only one health behaviour change, namely physical activity/exercise adoption. Additionally, it became clear that in addition to a three-month intervention plan, a nine-month maintenance phase had to be included.

An example of an environmental barrier to exercise adoption was illustrated by a 55-year-old man's case with a BMI of ≥39 kg/m^2, who stated that he would like to increase his activity levels by walking to the shops, but there was a steep uphill road to the shop and he could only manage to walk the route very slowly. Therefore, he didn't have time to do it very often. He was also on benefits and couldn't afford to join a gym and had transport problems, which prevented him from being active. Another man with a BMI of ≥52 kg/m^2 and 36 years of age said that he couldn't walk, as he had a heart problem. He also believed that he was unable to stop himself eating, as he conditioned himself to overeat when he was bored. He worked as a security guard, where most of his 'unscheduled' eating took place. A number of women also described their difficulties with controlling food intake. They were either chronic dieters, restrictive, or self-confessed binge eaters. If the doctors thought that their disordered eating symptoms warranted further investigation, they were referred to the County's eating disorder unit, where again the waiting list was very long. The dietetic sessions on the whole were helping patients to switch to a low fat diet and eating less in general. Although a number of patients presented with disordered eating behaviours, such as chronic dieting, binge eating tendencies, these were not specifically addressed during my observation period spent with the dietician, but in contrast they were discussed with the doctors. However, patients did not necessarily see the dietician and the doctor at the same visit. In hindsight, such clinics could benefit from a more specialized input from an eating disorder unit to screen for signs of eating disorders, such as ‘night eating syndrome’, binge eating, and bulimia. In general, dieticians receive limited training in eating disorder management, and they should really refer patients to psychological services when such behaviours are observed. At one consultation the dietician said, ‘You are going to die early if you go on like this. Your eating is completely out of control’ to a man with a BMI of ≥58 kg/m^2, who most likely had disordered eating. The young doctor told a man with a BMI of ≥52 kg/m^2, who drank 24-30 pints of alcohol a week, ‘Unless you exercise a great deal, you won’t help your weight’ instead of focusing on how to manage excess alcohol consumption, by discussing how to reduce the number of calories gained from alcohol and explaining to a patient how alcohol is absorbed by the body. Given the clinical nature of the cases I’ve observed in the dietetic consultations, it was decided that the PhD work will only have an education dietetic advice element, focusing mainly on ‘normal’ and ‘abnormal’ eating behaviours (see the method section for the description of the dietetic intervention component).

A number of patients had been bullied for their weight as a child and still carried the scars related to psychological mistreatment by others and through battling everyday social stigmas. Therefore, it was common to observe patients on antidepressants due to clinical depression. Antidiabetic and antidepressant medications were also barriers to weight loss, motivation for behaviour change, and exercise adoption, as some patients were at the same time on Orlistat, Sibutramin or Metformin (i.e. weight loss drug) and Amitriptyline, or Mirtazapine, both causing weight gain when taken long-term. During the six-month observation period, I have never heard a discussion about the combined effects of drugs on weight loss efforts. However, this may have been down at their GPs' surgery or other health clinics they were attending. This experience influenced the content of the selection criteria of participants for the PhD study (see methodology chapter for description of selection of inclusion/exclusion criteria of participants).

Other barriers were severe hygiene problems, as patients reported their inability to clean themselves, which had major implications for their everyday life. This also prevented them from engaging in physical activity, as they did not want to shower or clean in a public place. Such patients wanted to have rapid weight loss through surgery to alleviate their weight-related physical, social, and psychological problems. Personal hygiene was only discussed with post-operative patients with regards to infections. With regards to the PhD plan, these experiences helped me to understand how important it was to explore the exercise facilities and secure a place where individual cubicles were offered for all participants.

For patients waiting for obesity surgery, it was a prerequisite to attend to an obesity clinic before they were considered for an operation. This was to start the behaviour change and the weight loss process, which was hoped would aid a faster recovery from surgery. One post-surgical patient's consultation with a dietician was particularly memorable. A 43-year-old man, with a previous BMI of ≥67 kg/m^2 came to visit the dietician six weeks after his weight loss surgery. In this period he lost 34 kilograms and he was delighted with this. He said to the dietician that his weight loss was now slowing but he was still losing about 4-5 kilograms a week. He was beaming with pride, when the dietician replied: ‘Yes, well, you shouldn’t really lose more than one kilogram per week’, which would have been a right advice for someone without weight loss surgery. However, it would have been great to acknowledge his efforts first, as the man’s face suddenly changed and he started to talk about how easy it would be to liquidise mars bars.

Another memorable consultation was the story of a ‘biscuit’. A women aged 42 with a BMI of ≥ 46 kg/m^2 came to see the younger doctor. He greeted her and asked what she had been doing since her last visit, which was two months prior to this appointment. She spoke of her efforts of taking up swimming and how much she had enjoyed it. She was swimming twice a week. However, she gained two kilograms in these two months. The doctor, instead of exploring her positive exercise behaviour, said the following: ‘Swimming is not a weight-bearing activity, and you gained two kilograms. Can you see this biscuit?’—he picked up a plain biscuit that accompanied his coffee—‘I only eat a biscuit at 10 o’clock on Mondays, with my coffee. I don’t have any other sweets or biscuits for the rest of the week.’ I am not sure what his intention was but clearly got the opposite response from the patient who promptly started to cry inconsolably. I often recite this story in my teaching; as such consultation style appeared to be contra-indicatory rather than helpful. Indeed, implying that one lacks willpower, often confirms self-perceptions of ‘I can’t be helped, so I won’t bother’.

These two observations taught me about the importance of consultation style. Therefore, I decided to go on a counselling, and a motivational interviewing course, which I hoped would help me to handle important situations like this.

1.5. Summary and comparison with existing literature

In general, my overall impression was that this obesity clinic was only really helpful to a quarter of the patients, who attended the clinic, as very few achieved substantial weight loss, even when on weight loss medication. Medical problems and co-morbidities were well attended to, but it seemed that patients were not successful in achieving their desired goals of losing weight and maintaining for a long period of time, despite considerable effort on the clinic's behalf. It appears that in general there is a distinct sense of helplessness amongst health care providers and educationalists regarding the halting of the obesity epidemic with health behaviour change initiatives, as the following news story also illustrates. Even Draconian measures didn't yield behaviour change success in the US: the Guardian newspaper (Pilkington, 2009) reported that students, at one of the oldest African-American Universities (Lincoln University) in the USA are forced to test for clinical obesity (e.g. BMI $\geq 30kg/m^2$) and are made to take a compulsory fitness course before they can graduate. Under the policy, all students are tested for their BMI and then made to take the class, and if they don't they don't graduate. As one student explained: 'I was very upset when they told me I had "tested" into the class. I think the policy should be scrapped – it's just too much to tell people they won't graduate unless they do what they are told.' After every Fitness for Life Lesson, this student would go straight to eat fried chicken at a university fast food outlet. This story clearly illustrates how good intentions lead to contraindicative behaviours and prevent progress in helping individuals to help themselves. Furthermore, telling individuals what to do without effectively engaging them is less then helpful and may potentially harmful long-term. Therefore, this PhD aimed to engage participants with the exercise behaviour change process by allowing individuals to experiment with exercise in a safe setting.

Next, experiences within the clinic will be discussed in the context of existing literature in relation to how exercise counselling is done in these clinics and why programmes like WHEEL might fill in the gap to provide a complementary service in the community for this very difficult population. All practice guidelines (e.g., NICE 2006) in the UK and USA direct primary care practitioners to routinely advise patients to modify their health behaviours (e.g. exercise) in order to lose weight. As Kreuter, Chheda, and Bull (2000) identified, there are four basic assumptions underlying these directives: 1) certain behaviours (e.g. inactivity and overeating) can lead to increased health risks and the development of chronic diseases; 2) effective strategies exist to help patients make behavioural changes; 3) making such changes can reduce a person's disease risk, and 4) patients who receive doctors' advice are more likely to be successful in changing their behaviour (p. 426). The last point has not been researched adequately, as obesity clinics in primary care widely differ in the UK, both in set-up and resources. Furthermore, a plethora of findings, including the National Audit Office's Tackling Obesity England publication (NAO, 2001) identified that NHS clinics are not adequately resourced for specifically tackling obesity, especially providing sound exercise counselling or exercise interventions for his population.

Additionally, the NAO also identified that there is confusion among primary care teams regarding roles and responsibilities, coupled with poor use of evidence-based protocols. Certainly, this was the case in the clinic where the six-month observation took place. It was unclear when and why patients were seeing the dietician or the doctor, and moreover which of the two doctors. It appeared that patients decided the latter, at least partially. The Clinic was only funded for a morning service, once a week covering a large geographical area in the UK, with a huge waiting list. As mentioned before, the dietician cautioned a weight loss surgery patient to losing more than the recommended 1 kg per week, which was an example of poor application of evidence-based protocols. In general exercise consultations at the clinic consisted of asking participants what they have done in the past month or couple of months and what they are planning to do, but only if time permitted. As per the USPSTF (2003) and NICE (2006) guidelines, the six-month observational data showed that indeed all three professionals at the clinic initiated, and discussed weight loss and the role of exercise in that process in a very different way, none of them providing consistent and informed exercise counselling. This may have been due to lack of specific training in exercise behaviour change techniques and understanding the role of exercise in weight-management (Green, McCoubric, & Cullingham, 2000).

Indeed, these professionals may have felt that they didn't have the necessary skills to advice patients about exercise. Previous research (Cabana et al., 1999) showed that self-efficacy is an important predictor of doctors' behaviour, as well as their self-confidence for counselling overweight and obese patients to lose weight (Kushner, 1995).

Huang et al. (2004) identified a number of barriers that doctors reported to providing effective weight loss counselling (e.g. exercise advice) in a context of a hospital primary care clinic, which was similar to the observational setting. These were: pessimism about patients' desire and ability to lose weight; pessimism about effectiveness of weight loss counselling; lack of comprehensive obesity management resources; insufficient time due to high patient volume; under use of dieticians or lack of experience working with dieticians; and insufficient knowledge of best clinical practices (e.g. exercise). Alexander, Ostbye, Pollack, Gradison, Bastian, and Namenek-Brouwer (2007) also identified lack of time as a key barrier.

As observed in the clinic, as well as previous research suggests that health professionals may also have negative attitudes to obese patients, and may address weight issues in a less than satisfactory way (Alexander et al., 2007; NAO, 2001; Price, Desmond, Krol, Snyder & O'Connell, 1987; USPSTF, 2003). Indeed, Price et al. (1987) showed that doctors in their research frequently thought that obesity was a result of self-indulgence, lack of self-control, and/or other personal failings. A study by Epstein and Ogden (2005) found that General Practitioners (GPs) generally believed that patients are responsible for their obesity and felt resistance to treating obesity as a medical issue as they felt they had no effective treatment options to offer. Moreover, GPs felt that patients wanted to hand over responsibility for their obesity to them. This was a case with some patients at the clinic. Patients wanted the doctors to treat them, rather than counsel them for health behaviour change. It is possible, that this role conflict might make the treatment less effective.

Furthermore, the underlying motivation of patients attending this clinic was unclear. It seemed that most wanted to lose weight for weight loss surgery and were perhaps were not open to behaviour change suggestions, which in turn made the doctors more sceptical of their efforts in trying to change. However, ideally we want patients to attend rather than avoid weight management appointments, as their experience will affect further treatment engagements. Rand and MacGregor's (1990) classic study showed that 78% of morbidly obese patients who sought bariatric surgery reported that they were always or usually 'treated disrespectfully by the medical profession' (p.1395). Borkoles' (1997) qualitative study found that (n = 4, interviewed twice) that medical doctors treated these women with prejudice, which made them avoid or delayed their medical visits. Similarly, McAffe (1997) and Smith (1994) reported that patients avoided gynaecologic and breast cancer examinations, and Papnicolaou smears, due to doctors' bias against obese individuals and embarrassment about their weight (Olson, Schumaker, & Yawn, 1994).

In contrast, a study by Wadden, Anderson, Foster, Bennett, Steinberg and Sarwer (2000) found that nearly 80% of 259 women with a BMI of ≥ 35.2 kg/m^2 did not report being treated disrespectfully or insensitively by their doctors when weight-management was discussed in a primary care practice. However, they were significantly less satisfied with their care and their doctors' expertise related to weight-management. It is worth noting that in Rand and MacGregor (1990) study patients had an average BMI of ≥ 45.4 kg/m^2 with more weight-related problems.

To date, most moderately to morbidly obese individuals are still treated at clinics similar to where I was doing my placement. Therefore, doctors' advice and their treatment of these patients are crucial in helping them to adopt a healthier lifestyle in addition to treating their medical conditions. Previous research found (Huang et al., 2004; Kreuter et al., 2000) that doctors' advice influences patients' understanding of the association between health and weight, and the benefit of weight loss, the coupling of both could lead to poor patient compliance and de-motivation for behaviour change. Therefore, for optimal treatment conditions, health care staff at such clinics need to have a non-judgemental attitude and good knowledge of behaviour change techniques, in addition to medical knowledge (National Task Force on the Prevention and Treatment of Obesity, 2000; NTFPTO). This is also true for exercise professionals who may work in conjunction with such clinics.

Making the person feel normal and the visit to the clinic relatively stress free is also important. Any treatment, including an exercise intervention is perceived to be stressful for these individuals. Therefore, thinking of the consultation style, purpose of treatment, physical space, and equipment during testing is crucial in reducing stress in this already vulnerable population. Indeed, the environment of a clinic is important. That is why NTFPTO advocated the introduction of providing large-size examination gowns and armless chairs, weighing patients in a private area, and using large cuffs when measuring blood pressure. Apart from the large cuffs, other recommendations by the NTFPTO were not followed in the clinic. On the contrary, chairs with arms were used to ‘make patients’ aware of their size, and clinic staff often used ‘victim blaming’, and upset patients who failed to comply with the doctor’s advice.

Patients’ expectations also needed to be carefully managed. Exercise alone or at a very low intensity does not induce substantial weight change in this population. In the clinic there was never a mention of the magnitude of weight loss expected due to exercise. They were reminded that exercising is part of a healthy lifestyle. It was assumed that the more they moved the more weight they will lose. However, it was not communicated to patients that it was unrealistic to expect a great weight loss through lifestyle change at the weight status they were at. A study by Foster, Wadden, Phelan, Sarwer, Swain, and Sanderson (2001) found that patients ‘could not view as successful in any way’ a 12% weight loss, and such expectations have never been discussed with patients during the six-month observation period. In fact, goals for treatment were rarely addressed in any of the consultations, perhaps due to lack of time. All these factors theoretically have major implications for patients’ motivation and engagement in the treatment programme. Therefore, this PhD will explore participants’ goals regarding their exercise behaviour change expectations.

Health behaviours, such as exercise and healthy eating were encouraged in the clinic as per current guidelines (NICE, 2006). However, the complexity of environmental and other behavioural factors on weight loss was not considered during the observation period. In their study, Johnson et al. (2008) illustrated that weight loss is not a behaviour, but rather an outcome of multiple behaviour changes, and that the goal of treatment should be to first produce significant changes in multiple behaviours, with weight loss following over time. This was not well understood or practiced in the Clinic. Unless patients lost weight, the practitioners felt that they failed in treating their patients. The primary outcome goals for both the patient and the clinic staff was weight loss, despite knowing that traditional diet and exercise treatments for obesity have been ineffective (Jeffrey, Drewnowski, Epstein, Stunkard, Wilson, Wing, & Hill, 2000; Mokdad, Bowman, Ford, Vinicor, Marks, & Koplan, 2001) and with a high rate of failure (Perri & Fuller, 1995; Stunkard & McLaren-Hume, 1995).

In the clinic exercise participation was valued by the practitioners, but their understanding of how exercise affected weight loss was problematic, as they didn't recognise fitness as a value independent of weight loss, despite the strong evidence that physical activity and regular exercise increases cardiovascular fitness in obese individuals. Fitness also attenuates the risk of various diseases, independently of weight loss (Miller, 2001). Miller, Koceja, and Hamilton (1997), in their meta-analysis, have shown that the average weekly bodyweight loss through exercise participation is only 0.2± 00.4 kg. Patients got fitter, but hadn't lost weight. That is why exercise is the least favourite treatment option with doctors and their patients compared to other weight reduction methods. Additionally the dropout rates in clinic based exercise interventions are high, 50% within the first six months and 70% within a year (Martin et al., 1984).

Furthermore, an abundance of research has shown that exercise is critical for bodyweight loss maintenance (Cowburn, Hillsdon, & Hankey, 1997; Westerterp, 1999; Wing, 1999). For example, Lamarche et al. (1992) showed that a six-month exercise programme consisting of 90-minute exercise sessions 4-5 times a week at 55% of maximal aerobic capacity improved metabolic profile of obese women in spite of the fact that these women gained 2.3kg bodyweight and 2.8kg body fat during the same period. As Miller and Lindeman (1997) suggested it is well established in the literature that regular exercise participation will improve the health of all people, regardless of size (Barlow, Kohl, Gibbons, & Blair, 1995; Westerterp, 1999; Wing, 1999).

There is no doubt that exercise should be strongly promoted to patients and an exercise specialist should be part of the multi-disciplinary obesity clinic team, as they have the necessary skills to deal with patients' attitude, knowledge, fears and anxieties when they are trying to adopt exercise into their everyday lives. In the absence of the specialist advice, patients at the clinic were less likely to choose exercise as an option to managing their weight. Although clinic staff regularly counselled patients about taking up exercise and moving more in their everyday life, the quality of consultation was poor, and patients often went away confused. Combating fears and anxieties about exercise participation when having medical conditions with obesity is a key aspect of helping people to adopt exercise. For example, diabetics may need to alter their drug dosage to avoid symptomatic hypoglycaemia whereas patients with chronic degenerative joint disease may initially require specialist exercise interventions (Hitchcock Noel, & Pugh, 2002). Therefore, in this PhD work it was decided that exercise adoption and maintenance would be the main focus of the intervention.

In conclusion, it appears that specialist obesity clinics should focus on either treating the medical aspects associated with overweight or obesity or provide a comprehensive, all-inclusive obesity treatment centre, where a multi- and inter-disciplinary health care team addresses all aspects of lifestyle and medical aspects of obesity with patients. Moreover, there should be a health behaviour change specialist working with patients helping them to become healthier at whatever weight they are without demanding complex behaviour change and substantial weight loss through adoption of exercise and/or excessive dieting. For example, this may mean to ask patients to consider their drinking (e.g. alcohol abuse is indicated in the development and maintenance of obesity), smoking, exercising, or eating habits. The health behaviour subject to change should be the person's choice. Indeed, any obesity related treatment and intervention options are complex in nature. The observations at this Clinic highlighted that actions of the clinic staff were important for a successful outcome for patients (Siriwardena, 2008), but their seemingly ineffectiveness was probably due to failures in the system of care (Nolan, 1998). There has to be a distinction between complex interventions in primary health care and university-led research programmes, with the former being a much harder environment to manage. In the obesity clinic treatment happens in a context of clinical uncertainty and heterogeneity of context (Middleton, 2008). Middleton (2008) eloquently argued that many changes in health care are not based on scientific evidence, but is a 'result of a series of complex interactions between public expectations, government, and changing clinical perspectives' (p. 422) and firmly managed policy directives. In Chapter 4, complex interventions in the research context are discussed at length.

To conclude, during the six months of observation period patients cited a number of barriers to behaviour change, mainly embedded in the discourse of medical language and illness perception. It is clear from my placement experience—and I stress that my reflections purely relate to these patients and this clinic—that these patients have experienced multiple failures in their care for their conditions. Furthermore, given the scale of the problem within the county, nationwide and internationally, we need to seek alternative and more engaging treatment options at such clinics and provide a more effective, enabling outpatient and community health care service for this population, which involves adapted movement classes, a different approach to weight loss (i.e. non-dieting) and behaviour change educational programme. Therefore, this PhD will explore through a mixed-method study on whether it is possible to provide a theoretically driven, exercise-based, lifestyle intervention programme that suits this population's needs.

The observational experience at the obesity clinic taught me the importance of managing carefully my own and my participants' expectations. Furthermore, knowing that exercising will not induce substantial weight loss in participants, but it may improve psychological health and metabolic profiles, alternative outcome measures were thought for this PhD. Quantitative approaches were chosen to measure psycho-social functioning; individual differences in self-regulation; fitness, and metabolic profile. Finally, I wanted to find out whether individuals with high weight status could benefit from exercise interventions. However, given my experience at the clinic, I expected participants to have high psychological and physical barriers to exercise participation, including ability to exercise.

Chapter Two
Introduction

2.1. Introduction

The purpose of this introduction is to articulate the need for the research conducted in this PhD work. Obesity is regarded as a major health problem in most affluent populations and the prevalence of obesity continues to rise in countries across the world. Amongst the EU's15 countries England has the highest prevalence, and one of the highest in the wider cohort of OECD countries (DoH, 2008). Obesity in both children and adults has increased substantially over the last decade, affecting 15% of children aged 2-10, and around a quarter of men and women, in 2007 (DoH, 2008). Obesity treatments in the UK are mainly conducted in specialist obesity clinics, such as the one described in the previous chapter. Numerous specialised morbid obesity services were set up in primary care settings (Department of Health, 2002), as patients with co-morbidities, and other special factors they may have with a BMI of over 35 are advised to be referred to them. Currently, there is a distinct lack of exercise classes specifically aimed at clinically obese individuals offered at leisure centres that are free of medical context. Therefore, individuals with high weight status relatively free of obesity related co-morbidities, but still wanting to exercise safely have to be referred to a GP led scheme. This does not meet the needs of those who want to exercise freely at the weight they are at. The purpose of this PhD is just that. An exploration whether an exercise intervention in a community setting, free of medical context is suitable for this population.

2.2. Why is obesity a disease that is difficult to treat?

A number of explanations have been provided as to why obesity has been increasing and why interventions have not had the desired effects. One of the explanations might be that the knowledge and attitudes of health professionals about obesity is inadequate or insufficient. Doctors in general have given low priority to obesity (Bjorntorp, 1997; Lean,

1996) partly, because obesity is a refractory problem, partly because ‘about half of male doctors have a BMI >25kg/m^2 (Lean, 1996). Lean in fact suggested that overweight doctors should treat their own conditions seriously and that a better informed personal approach might lead to better treatment and management. In addition, obesity has not been a common subject in the pre-qualification training of doctors and other health care workers (Campbell & Welborn, 1994). Similarly, Francis, Roche, Mant, Jones, and Fullard (1989) found that primary health care professionals have incomplete, confused and occasionally incorrect knowledge of obesity and nutritional issues. In the UK, no specialist training exists for dealing with the obese. Practitioners are still working in isolation almost without guidance, on a trial-error basis. Furthermore, health care professionals’ attitudes to patients are often negative and they are also pessimistic about their own ability to successfully treat obesity. They consider obesity management to be frustrating, time-consuming, and pointless and these views were clearly reflected in Orleans, George, Houpt, and Brodie’s (1985) and Cade and O’Connell’s (1991) research findings.

Outside the ‘medical’ treatment approaches, there has been little collaboration with other professionals, such as psychologists, physical activity, and lifestyle specialists. In addition, to date there are no clear guidelines as to how to manage the non-medical, especially behavioural aspects of obesity. These problems are coupled with the fact that there is an uncertainty about which interventions are effective in preventing and treating obesity (WHO, 1998). Unfortunately, preventative strategies are too late for those who are already obese and the effectiveness of treatments needs to be improved in order to slow down the rapidly rising prevalence figures.

An additional problem is that the effectiveness of non-medical treatment approaches has been chronically under researched and atheoretical in nature. For example, to date there is no research evaluating the efficacy of exercise leaders, the content and class structure when using physical activity/exercise interventions with the obese. Most studies concentrated on how exercise can attenuate energy expenditure and wrongly concluded that exercise alone is not an effective treatment for reducing either body weight or total fat (Garrow & Summerbell, 1995). In turn, many clinicians and health care professionals use these findings to justify their already negative attitude towards considering exercise as a viable treatment option for obesity (Ross, Janssen, & Tremblay, 2000). Therefore, an important aim of this thesis is to explore how effective a physical activity counselling and exercise treatment approach are when treating clinically obese pre-menopausal women.

Behavioural therapy strategies used in weight-management programmes have had also very little effect on weight loss and weight maintenance. Paradoxically, weight loss is commonly used as an outcome measure for behavioural treatment effectiveness. There are however a number of problems associated with using weight loss as one of the primary outcome measures. In obesity management, practitioners need to deal with a wide range of complex behaviours, such as eating behaviours and patterns, and physical activity/exercise behaviours. Therefore, not one approach can be effective and applicable to all individuals, and outcomes which are more suitable to measure these changes should be used. To date, research findings have failed to differentiate between people who are receptive to behavioural interventions and those who are not. Very little information is known about who is receptive to treatment. As such the present thesis will use a mixed-methodology approach to evaluate the effectiveness of behavioural change participants went through.

2.3. Aims of the research

The aim of this research was to investigate the efficacy of a year-long exercise-based and psycho-educational intervention for clinically obese women using a non-dieting approach. The intervention's psycho-educational component was based on the principles of a non-dieting approach or non-restraint pattern of eating. A qualified dietitian and cognitive behavioural therapist educated participant about the potentially adverse affects of dietary restrictions. Based on the current literature the following predictions were made for the quantitative data collection:

- Body weight would remain stable over the intervention period (no significant decrease or increase was expected).
- There would be significant improvements in fitness parameters. In particular, an improvement in $\dot{V}O_{2peak}$ normalised for body weight ($ml \cdot kg^{-1} \cdot min^{-1}$) and blood pressure.
- Following the intervention the participants would be expected to show improvement in general well-being and overall psychological health. Specifically, participants were expected to show increased general well-being, reduced stress, improved self-esteem, and improved social support.
- Based on the intervention used in the present study participants were expected to develop greater autonomy and internal locus of control.

The qualitative aspect of this study aims to explore, through weight history interviews, the following:

- The history and prevalence of self-reported dieting.
- How dieting affected participants' weight change up to the start of the study.
- Development of their current perceived weight status.

- Physical activity history and patterns.
- Health status and difficulties with physical activity and eating behaviours.
- Motivation and goals for current weight-management trial.

The follow-up interviews at 12 months aim to explore:

- Difficulties with exercise behaviour change.
- Quality of life as a result of participation in this trial.

NB. Deductive qualitative predictions and analyses are less common in qualitative research but in Britain the "framework approach" developed by Ritchie and Spencer (1993) is widely used in applied healthcare settings. This approach is common in mixed method (MM) research as there is a need to link the analysis with quantitative findings. The research objectives are set in advance and shaped by the information requirements of the research. Although the qualitative interviews are conducted in a traditional way by using the original accounts and observations of participants, it starts deductively from pre-set aims and objectives (Pope, Ziebland, & Mays, 2000).

Chapter 3: Literature Review

‘When we are no longer able to change a situation - we are challenged to change ourselves.’ Victor Frankl (1946)

3.1. Overview of lifestyle determinants of obesity

In this chapter the following topics will be discussed in four sections: In Section 1, obesity, its definition, prevalence and consequences; in Section 2, the bio-behavioural aspects of the development and maintenance of obesity; in Section 3, the effectiveness of treatments for obesity; and in Section 4, the theoretical framework adopted for the present intervention.

3.2. Obesity: Definition, prevalence, and consequences

3.2.1. Definition and classification of obesity

Most recently obesity has been defined as an "unhealthy amount of body fat" (Jeffery et al., 2000, p. 5; Seidell, 2005). However, it is unclear what constitutes an 'unhealthy amount'. In some individuals, the excess fat, in conjunction with other health risks and genetic factors thought to impair health with poorer quality of life and increased risk or morbidity and mortality whereas other individuals are unaffected (Bray & Gray, 1988; Haslam & James, 2005; Unger, 2002). This is particular important for this PhD work as it is expected that most individuals with high weight status will be able to exercise and gain substantial metabolic health benefits, regardless of weight loss. Previous studies (Flegal, Graubard, Williamson & Gail, 2007; Pischon, Nothlings, & Boeing, 2008; Sui et al., 2007) found that despite the implications of excess body fat on health and well-being, presence of increased body fat alone doesn't necessarily imply or reliably predict ill health. According to Sharma and Kushner (2009) 'the current anthropometric classification systems, based on simple clinical measures, such as height, weight or waist circumference, do not accurately reflect the presence of severity of obesity-related health risks, co-morbidities or reduced quality of life' (p. 289). They concluded that the 'current systems used to classify obesity therefore have limited application for clinicians and researchers alike' (p. 289). This is an important consideration for this PhD work, as they imply that it is still unknown at what stage of fatness excess body fat causes morbidity and/or mortality. The World Health Organisation's (WHO, 2000) classification of weight status was used in this thesis as reference values. The WHO standardised and clearly defined the various categories of overweight and obesity (see Table 3.1).

Table 3.1: WHO classification of weight status (WHO, 2000 & 1995).

Weight Status	**Body Mass Index (BMI), kg/m^2**	**Health Risks**
Underweight	<18.5	Low (but risk of other clinical problems substantially increased)
Normal Range	18.5-24.9	Average
Overweight (pre-obese)	25-29.9	Increased
Obese Class I	30-34.9	Moderate
Obese Class II	35-39.9	Severe
Obese Class III	≥40	Very Severe

Indeed, Jebb and Elia (1993) and Sharma and Kushner (2009) identified that currently there are no precise practical and economical measuring methods available for general use. Practitioners still rely on using BMI measures (See Table 3.1) which is a single number that evaluates an individual's weight status in relation to height (weight/height^2, with weight in kilograms and height in metres; WHO, 1995). The BMI is also called the Quetelet's index (Keys, Fidanza, Karvonen, Chimarera & Taylor; 1972), and is it widely used because it avoids bias arising from using a select reference population and therefore it allows for population comparisons. To help with accuracy, current guidelines (NHLBI; 1998; NIH, 1992) recommend in addition to BMI, either the Waist Circumference (WC) or Waist to Hip Ratio (WHR) to be included, but with different cut points for different ethnic groups

(Razak et al., 2007; WHO, 2004). WC measurement is used to assess an individual's 'central' fat distribution (Klein et al., 2007; WHO, 2000; see Table 3.2).

Table 3.2: Waist circumference thresholds used to assess health risks in the general population.

At increased risk	Male	Female
Increased risk	94 cm(37 inches) or more	80 cm (31 inches) or more
Greatly increased risk	102 cm (40 inches) or more	88 cm (35 inches) or more

In the UK the WHO classification system is generally used. However, elsewhere, in certain populations these cut-points might not be appropriate (Razak et al., 2007). In addition, there has been a debate about the accuracy of BMI cutpoint of 25 for detecting 'overweight', since a large proportion of active, over lean males could fall in this category. For example, Gallagher, Heymsfield, Heo, Jebb, Murgatroyd, and Sakamoto (2000) stated that individuals with the same amount of 'total body' (e.g. surface) can have a wide range of BMI values. Others, like Rankinen, Kim, Pérusse, Deprés, and Bouchard (1999) have shown that there is a large inter-individual variation in the amount of visceral fat present in individuals with the same WC. These anomalies partially explain the lack of linear relationships between BMI and WC and morbidity and mortality statistics (Flegal et al., 2007; Pischon et al., 2008; Sharma & Kushner, 2009). Furthermore, fitness has rarely been considered in relation to BMI as a moderator of health risks. There is now increasing evidence that fitness, especially cardiorespiratory fitness, may considerably modify morbidity and mortality indices associated with higher BMIs (Sui et al., 2007). In summary, problems with the current anthropometric measurements are that their correlations with health are poor. BMI alone does not provide valuable information about quality of life, functionality, or other health indices. Therefore, weight loss, as a reduction in BMI or WC does not necessarily indicate improved health and well-being. This has implications for treatment, as relevant risk factors, co-morbidities, functional impairments and psychological functioning should also be measured before and after a treatment intervention. Despite the limitations of the classification system, it has been shown that for most sedentary, Western populations, the WHO's BMI cut points are sensitive enough to detect over-fatness (US Preventive Task Force, 2003). Therefore, in this PhD work BMI was used to detect the severity of obesity.

However, in future, despite its limitations (e.g. making clearer cut-offs for hypertension etc.) Sharma and Kushner's (2009) proposed clinical and functional staging of obesity guidelines could be adopted as an alternative to establish appropriate treatment regimes that are matched to patients' morbidity and disability to anthropometric measurements (see Table 3.3).

Table 3.3: Sharma & Kushner's proposed clinical & functional staging of obesity*

Stage	***Description***	***Management***
0	No apparent obesity-related risk factors; no physical symptoms; no psychopathology; no functional limitations and/or impairment of well-being.	Weight history; Identification of factors contributing to obesity. Lifestyle counselling to increase healthy eating and exercise behaviours.
1	Presence of obesity-related sub-clinical risk factors; mild physical symptoms; mild psychopathology; mild functional limitations and/or impairment of well-being.	Investigation for other (non-weight related) contributions to risk factors. More intense lifestyle interventions to prevent further weight gain. Monitoring risk factors and health status.
2	Presence of established obesity-related chronic disease; moderate limitations in activities of daily living and/or well-being.	Initiation of obesity treatments, including considerations of all behavioural, pharmacological and surgical treatment options. Close monitoring and management of co-morbidities as indicated.
3	Established end-organ damage such as myocardial infarction, heart failure, etc; significant psychopathology; significant functional limitations and/or impairment of well-being.	More intense obesity treatment including considerations of all behavioural, pharmacological and surgical treatment options. Aggressive management of co-morbidities as indicated.
4	Severe (potentially end stage) disabilities from obesity-related chronic diseases; severe disabling psychopathology, severe functional limitations and/or severe impairment of well-being.	Aggressive obesity management as deemed feasible. Palliative measures including pain management, occupational therapy and psychosocial support.

*Taken from Sharma and Kushner, 2009; p. 293.

3.2.2. Prevalence of obesity in the UK

3.2.2.1. Overall prevalence

Obesity has been rising steadily within the UK in both adults and children (National Heart Foundation, NHF, 2007; The NHS Information Centre, 2008a). According to the Health Survey for England (HSE: The NHS Information Centre, 2008b) data, 22.7% of men and 23.8% of women are obese and almost two thirds of all adults (i.e. approximately 31 million people) are either overweight or obese. In the UK, 0.9 % of men are classified with very severe obesity (e.g. Obesity Class III) and 2.6% of women (NHS Information Centre, 2008a & 2008b).

3.2.2.2. Age and gender

In general mean BMI and WC increases with age in both genders (The NHS Information Centre, 2008b), apart from the oldest age group (75+) (see Table 3.4).

Table 3.4: BMI status by age group in adult men and women in the UK (The NHS Information Centre, 2008a).

BMI Status	**Age Group**				**Total**
	16-34	**35-54**	**55-74**	**75+**	
Men	%	%	%	%	%
Overweight	33	47	50	50	43
Obese	**14**	**27**	**28**	**21**	**23**
Both	47	74	78	71	65
Women					
Overweight	24	33	40	40	33
Obese	**16**	**24**	**29**	**26**	**24**
Both	40	57	69	67	56

From age 35 and above the overweight status for men (74%; 78%; & 71% respectively) and for women (57%; 69% & 67% respectively) is showing alarming prevalence status. In both men and women, the highest prevalence of Class III obesity is in the 55-74 age groups: 2% and 4.1% respectively. It can be seen from the data in Table 3.4, that mean BMI levels in both genders are similar (23% for men; 24% for women). A greater proportion of men (43%) are overweight than women (33%). However, 2.6% of women are very severely obese compared to only 0.9% of men. Additionally, raised WC in women (41%) is more prevalent than in men (31%), putting women at more risk of morbidity and mortality.

3.2.2.3. Gender, socio-economic status and regional differences

According to the 2008a NHS Information Centre report and HSE (2008b) figures 18% of men aged 16 and over in London were classified as obese as opposed to 25% of men in the Yorkshire and the Humber area. The prevalence of overweight was the same in both regions (42%). Similar trends were observed in women aged 16 and over: 20% of women were classified obese in London and 24% in Yorkshire and the Humber area. The prevalence of overweight was 27% versus 32% respectively. Furthermore, overweight and obese are more common in lower socio-economic and socially disadvantaged groups, especially women (see Table 3.5) whom are the target population of this PhD.

Table 3.5: BMI status by age group in adult men and women and socio-economic status in the UK (The NHS Information Centre, 2008a).

BMI Status		**Age Group**			**Total**
	16-34	**35-54**	**55-74**	**75+**	
Men	%	%	%	%	%
Non-Manual					
Overweight	33	49	52	53	44
Obese	**14**	**26**	**25**	**18**	**21**
Both	47	75	77	71	66
Manual					
Overweight	32	45	47	46	42
Obese	**12**	**28**	**30**	**25**	**23**
Both	44	73	77	70	65
Women					
Non-Manual					
Overweight	23	33	39	39	32
Obese	**13**	**20**	**24**	**25**	**19**
Both	36	54	63	64	51
Manual					
Overweight	25	32	41	42	33
Obese	**20**	**30**	**35**	**29**	**28**
Both	45	62	76	71	61

3.2.2.4. Ethnic differences

The HSE (2008b) data shows that there are clear ethnic differences in mean BMI in the UK: Black Caribbeans (28 kg/m^2); Black Africans (28.8 kg/m^2); General population (26.8 kg/m^2); and Chinese (23.2 kg/m^2). In this study, 98 % of participants belong to the general population category, hence they were classified as clinically obese (i.e. BMI ≥30 kg/ m^2) according to WHO criteria relevant to this population.

3.2.2.5. Prevalence of overweight and obesity among adults by levels of physical activity

In Table 3.6 below it can be seen that physical activity status makes a difference to obesity classification in the general population. All values for the active population are much lower than for the insufficiently active population. Activity status was assessed by whether the individuals met or exceeded the current physical activity guidelines (Department of Health, 2004; US Department of Health & Human Services, 2002 & 2008) of 30 minutes of at least moderate intensity activity, five times a week. Those not meeting the activity guidelines were classified as insufficiently active (NHS Information Centre, 2008a; The NHS Information Centre, 2008b).

In summary, levels of obesity among men in the UK increased by 78.8% from 13.2% in 1993 to 22.7% in 2004. In women there has been a 45.1% increase from 16.4% in 1993 to 23.8% in 2004. These numbers indicate the seriousness of the obesity issue. In addition, women appear to more at risk than men and there are regional (north-south), socio-economic, and ethnic differences whereas exercise status might be a moderator.

Table 3.6: Prevalence of overweight and obesity among adults by levels of physical activity, age, and gender ((NHS Information Centre, 2008a &2008b).

BMI Status		***Age Group***			***Total***
	16-34	***35-54***	***55-74***	***75+***	
Men	%	%	%	%	%
Insufficiently Active					
Overweight	33	48	49	47	44
Obese	**16**	**29**	**29**	**22**	**25**
Both	49	77	78	69	69
Active					
Overweight	32	47	51	n/a	42
Obese	**11**	**23**	**22**	**15**	**18**
Both	44	70	74	n/a	60
Women					
Insufficiently Active					
Overweight	24	33	40	41	33
Obese	**17**	**27**	**32**	**27**	**25**
Both	41	59	71	67	58
Active					
Overweight	24	34	41	n/a	32
Obese	**12**	**19**	**18**	**n/a**	**16**
Both	36	53	59	n/a	48

3.2.3. Causes of obesity

It is well known that the causes of obesity are multi-factorial and extremely complex (Foresight, 2007). To name a few, genetics, physiology, behaviour, built environment, cultural, social and societal forces influence the development of obesity in the population. Additionally, to date there has been relatively little known about regulation of body weight, including the effects of stress, sleep deprivation, and macronutrient distribution (Ludwig, 2007). Despite acknowledging personal responsibility for weight gain, the Foresight report

(2007) postulates that in general human beings are predisposed to put on weight by their biology, which is being deregulated by the current obesogenic environment with its abundance of high fat, high sugar convenience food, coupled with increasingly sedentary lifestyle and poorly designed urban environments that acts as barrier to habitual physical activity. Therefore, any obesity interventions taking place in such an environment will face difficulties with minimising the environmental factors such as lack of urban places where one can be safely active.

3.3. Is there an obesity epidemic?

This question is really important, as on the one hand reported obesity figures are rising, on the other there is an intellectual debate going on about the presence of such an epidemic. Between the two extremes, it is difficult to reason with participants as to how much health danger their condition pose to them. Therefore, understanding this debate is key for health professionals.

In the US, Flegal (2006) eloquently argued that although obesity does have some characteristics of an epidemic, it is not because of the endemic character of over-weightness. Although there is a sustained upward trends in weight associated with affluence and economic developments, and an observed shift to the right in the entire distribution of BMI across various populations, there is uncertainty about the long-term health effects of increased BMI. With regard to the latter Allison, Fontaine, Manson, Stevens, and VanItallie (1999) stated, obesity is a major health problem worldwide, but the number of obesity-attributable deaths has not been rigorously examined. In addition, the upwards trend in weight was not observed in the US. According to the Centres for Disease Control (CDC) recent findings (Ogden, Carroll, McDowell, & Flegal, 2007) there was no change in obesity status among adults in the US between 2003-2004 and 2005-2006. Similarly, Canoy and Buchan (2007) noted that in the UK there was little change in the overweight prevalence in England (43.9% of men and 33.9% of women were overweight) between 1993 and 2004, whilst clinical obesity prevalence rose by 9.5% in men and 6.8% in women. This finding confirms that the BMI of the UK population has also shifted to the right. Canoy and Buchan (2007) identified a number of methodological problems in the current epidemiology of obesity literature. For example, there is a poor understanding of dietary habits of free-living populations; unclear consequences of long-term excess weight; poor integration of diet, feeding behaviour, and physical activity at individual level; poor understanding of lifespan metabolic health and lack of longitudinal studies at population level examining the effectiveness of lifestyle interventions.

3.4. Costs of obesity

According to the Foresight (2007) report in the UK the estimated annual costs of elevated BMI to the NHS from 2001 to 2050 will reach £7.7 billion, with NHS costs of obesity alone being projected to be £7.1 billion. Estimated future NHS costs of disease related to BMI (2007-2050) is estimated to be £3.5 billion for diabetes, £6.1 billion for CHD, and £5.5 billion for stroke respectively.

3.5. Social class

The Foresight (2007) report estimates that only Social Class I (highest; NS-SEC classes, The Office for National Statistics, 2005) female population will have clinical obesity at 15% in 2050 compared to Social Class V, for whom the prediction is 62%. The report further predicts that there is no evidence for a widening social class difference, and the gap between the remaining social classes is predicted to remain static, as it is among men. Other researchers have also shown that higher obesity rates have been consistently associated with low income and low education for women (Flegal, Carroll, Ogden, & Johnson, 2002; Wardle, Waller, & Jarvis, 2002).

Two large birth cohort studies in the UK (Hardy, Wadsworth, & Kuh, 2000; Parsons, Power, Logan, & Summerbell, 1999) also suggested that lower socio-economic status (SES) in childhood is associated with higher BMI in adulthood. Furthermore, O'Dea and Daniel (2001) have shown that stressful living conditions affect the social gradient in obesity. Similarly, Rosmond and Bjorntorp (2000) postulated that social stressors such as low SES may affect obesity through unhealthy lifestyle adoptions but also through neuroendocrine reactions to stress. Chronic stress due to low SES (living and working conditions) has been shown to prolong states of homeostatic imbalance (Baum, Garofalo & Yali, 1999). It has been hypnotised that acceptance of low SES circumstances may obscure subconscious biological arousal, and therefore self-reported conscious chronic stress responses might not correlate with biomarkers of chronic stress (Daniel et al., 2006), concluding that persons with low SES may be at higher risk of obesity and stress-related conditions, given the psychobiological and social demands of lower SES status. Therefore, SES status of participants in this PhD will be recorded.

3.6. Health consequences of obesity

Understanding the health consequences of obesity aids the understanding how exercise may or may not moderates this process. According to Jebb (2004) obesity reduces life expectancy by between 3 and 13 years in those with more severe obesity and with longer obesity status. The World Health Organisation (2000) detailed the relative risk (RR) of health problems associated with obesity with greatest risk attributed to Type 2 Diabetes

Mellitus; insulin resistance (e.g. metabolic syndrome); dyslipidaemia and sleep apnea – all rated much higher RR than 3 years. Similarly, others have also identified obesity as a risk factor for several chronic diseases, including hypertension, dyslipidaemia, diabetes, cardiovascular disease, sleep apnea, osteoarthritis, and various cancers (Must, Spadano, Coakley, Field, Colditz & Dietz, 1999). Obesity has substantial adverse effect on health and well-being. In a recent cross-sectional study, Must et al. (1999) examined 16,884 adults' graded prevalence ratio (PR aged 25-55, out of which 63% of men and 55% of women had a BMI of ≥25 kg/m^2 or above). 21% of men and 27% of women were clinically obese. They found that in general PRs increased with increasing severity of BMI and with significantly elevated PRs for many of the above listed co-morbidities.

The strongest link between clinical obesity and BMI was found with Type II diabetes mellitus and hypertension (see also Colditz, Willett, Rotnitsky, & Manson, 1995; Hanson et al., 1995). However, the influence of age, ethnicity, and fitness status has not been adequately accounted for and therefore the morbidity and mortality rates due to these risk factors are subject to debate (Andres, Muller & Sorkin, 1993; Kassirer, Angell, 1998; Stevens, Jianwen, Pamuk, Williamson, Thun, & Woods, 1998). For example, Freedman, Ron, Ballard-Barbash, Doody and Linet (2006) found that for the younger and middle aged, but not older women and men, mortality risks appeared to be directly related to BMI.

Similarly, Flegal, Graubard, Williamson, and Gail (2005) analysed data from the National Health and Examination Survey to estimate the number of annual deaths that can be attributed to obesity. Based on BMI they found a U-curve association between BMI and mortality; those underweight and of severe obesity had higher mortality rates than normal weight individuals. There was no difference found between the overweight and those of normal weight. The estimated annual number of deaths attributable to obesity was 112,000 which was extremely low compared to other figures reported previously (Mokdad, Mareks, Stroup, & Gerberding, 2004).

Furthermore, Farrell, Braun, Barlow, Cheng and Blair (2002) found that low cardiorespiratory fitness (CRF) was directly related and was an independent predictor of all-cause mortality in both men and women (also Blair et al., 1996; Blair, Kohl, Paffenbarger, Clark, Cooper, & Gibbons, 1989). Farrell et al. concluded that although obesity is an important public health problem, individuals with moderate or high CRF have significantly lower rates of all-cause mortality than normal weight individuals who are unfit, even after controlling for confounding variables such as cigarette smoking (also Barlow et al., 1995). In fact, Tremblay et al. (1991) have shown that clinically obese women's metabolic profile can be normalised by exercise and low fat diet, despite not achieving normal weight status. Although this was a longitudinal case study with four participants only, the significance of being fit was shown effectively. Therefore, an aim of the current thesis was to investigate whether an improved fitness status would be associated with a reduction in metabolic risk factors.

3.7. Obesity and metabolic health

In individuals who are not able to exercise with the frequency and intensity that has been shown to influence cardiovascular health (Myers, 2003), understanding the effects of low intensity and frequency exercise on metabolic health is vital. Metabolic health as an alternative outcome measure is key to this research, therefore, metabolic risk profiles of participants pre- and post-intervention.

The Department of Health (2004) definition of metabolic syndrome refers to a cluster of risk factors related to a state of insulin resistance, in which the body gradually becomes less able to respond to the metabolic hormone insulin. The metabolic syndrome (MetS; previously referred to as syndrome X or insulin-resistance syndrome) has emerged as an important clustering of risk factors for type 2 diabetes and cardiovascular disease and their complications (Eckel, Grundy, & Zimmet, 2005). Reaven (1988) reinvigorated the concept of metabolic clustering by describing a pathophysiological construct relating insulin resistance to metabolic abnormalities among non-obese individuals with normal oral glucose tolerance. Other investigators highlighted obesity-related metabolic clustering (especially of the abdominal, truncal, or androidtype) and its relevance to female cardiovascular risk (Bjorntorp, 1996; Lapidus, Bengtsson, & Bjorntorp, 1994).

Subsequent characterisation of MetS has been undertaken by several expert groups (Alberti & Zimmet 1998; Balkau et al., 2002; Einhorn et al., 2003; Grundy, Brewer, Cleeman, Smith, & Lenfant, 2004a) with increasing emphasis given to its abdominal obesity component (Alberti, Zimmet, & Shaw, 2005). It has been suggested that the presence of complex metabolic phenotypes in affected persons can be reliably identified by current, simplified clinical definitions (Grundy et al., 2005). A consensus worldwide definition of the MetS has recently been proposed by the International Diabetes Federation (IDF). This IDF definition (Alberti et al., 2005) was developed by a panel of experts, including those who previously had been involved in developing earlier definitions.

Bjorntorp (1991; 1996) postulated that ‘‘psychosocial pressures’’ contributed to the accumulation of visceral fat and related metabolic abnormalities through chronic hypothalamic arousal. Subsequently, psychosocial stress and lower socio-economic status with some differences in profile between the sexes (Stewart-Knox, 2005) have been shown to contribute to complex neuroendocrine perturbations inducing visceral obesity and metabolic clustering (Bjorntorp, 1991; Bjorntorp & Rosmond, 1999). In the context of the MetS, various psychosocial adversities have recently been shown to be of particular concern for women, including depression (Kinder, Carnethon, Palaniappan, King, & Fortmann, 2004), poor education (Wamala, Lynch, Horsten, Mittleman, Schenck-Gustafsson, & Orth-Gomer, 1999), social isolation (Horsten, Mittleman, Wamala, Schenck-Gustafsson, & Orth-Gomer, 1999), marital dissatisfaction (Troxel, Matthews, Gallo, & Kuller, 2005), and chronic work stress (Chandola, Brunner, & Marmot, 2006).

Lifestyle changes have been proposed as the ‘focus of treatment’ or ‘first-line clinical intervention’ in the management of the MetS (Grundy et al., 2005; Grundy, 2006a). These notably include body mass reduction, increased physical activity, and an antiatherogenic diet (The Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults, 2001; Grundy, Hansen, Smith, Cleeman, & Kahn, 2004b, 2005). Weight loss improves all aspects of the metabolic syndrome and has been considered as a primary intervention target (Foreyt, 2005). However, modest lifestyle changes, including dietary patterns (Lindstrom et al., 2006) and increased physical activity (Laaksonen et al., 2005), have been shown to substantially reduce the risk of type 2 diabetes, independent of changes in body mass, in individuals with impaired glucose tolerance. A strong emphasis has been indicated for lifestyle modifications in persons with coexisting metabolic abnormalities and high psychosocial stress, treating their overlapping risk factors for CVD (Vale, 2005).

There is evidence that both dietary and exercise behavioural interventions are effective, have complimentary roles, and work well together in the treatment of MetS components

(Sullivan, 2006). However, intensive behavioural interventions (incorporating self-selected hypocaloric dietary and exercise components) have only been efficacious in improving psychological well-being and reducing depressive symptoms in selected studies (Fontaine et al., 1999; Klem, Wing, McGuire, Seagle, & Hill, 1997; Rippe et al., 1998). Other studies among overweight and obese adults including those with MetS characteristics have shown less positive psychological findings (Hellenius, Dahlof, Aberg, Krakau, & de Faire, 1995, Kiernan, King, Stefanick, & Killen, 2001; Sorensen, Anderssen, Hjerman, Holme, & Ursin, 1999). Within the Diabetes Prevention Program study, higher levels of obesity, female sex, poor exercise self-efficacy, higher perceived stress, depression, and anxiety levels were associated with less improvement in physical activity levels (Delahanty, Conroy, & Nathan, 2006).

3.8. Obesity interventions: A review of the literature

'Most obese persons will not stay in treatment for obesity. Of those who stay in treatment, will not lose weight and of those do lose weight, most will regain it.'

Albert Stunkard (1958)

3.8.1. Introduction to obesity interventions

This review of the empirical literature will focus on the efficacy of adult obesity interventions rather than prevention programmes, and will not address pharmacological or surgical approach to treating obesity. In addition, the emphasis will be on the general effectiveness of lifestyle interventions. Despite having received considerable criticism, the main objective of most obesity treatment programmes has been weight loss (Lean, 1998; Campos, Saguy, Ernsberger, Oliver, & Gaesser, 2005).

It has been suggested that losing 10% of initial body weight in obese individuals that is maintained for at least a year, results in a significant reduction in the risk factors associated with obesity (Lean, 1998; NHLBI Obesity Education Initiative Expert Panel, 1998; Wing & O'Hill, 2001). Higgins, D'Agostino, Kannel, and Cobb (1993) found that weight loss was associated with improvements in blood pressure and cholesterol levels, but also with continuation of smoking, higher incidents of cardiovascular disease, diabetes mellitus, other diseases, and higher death rates. Leanness and stable weight (not weight cycling) were found to be beneficial to risk factors, and to the prevention of morbidity and death. This study followed 2500 men and women aged between 35 and 54 years old at baseline, for 20 years in Framingham, Massachusetts. During 20 years of further follow-up, mortality rates were highest in those whose BMI decreased and in those with the highest BMI at study entry. Similarly, Andres et al. (1993) found that the highest death rates occur in adults who either lost weight or those who gained excessive weight. Their study examined outcomes from 13 different epidemiological studies, seven from the US and four from Europe. Blair, Shaten, Brownell, Collins, and Lissner's (1993) cohort study with men (n=10529) who were 35 to 57 years old at baseline and who were in the upper 10% to 15% of risk for coronary heart disease because of smoking, high blood pressure, and elevated cholesterol level found that after seven years follow-up, greater weight variability over time (e.g. weight cycling) was associated with a greater risk for cardiovascular disease and all-cause mortality in some types of high risk men. Therefore, this review will examine whether weight loss is the most appropriate outcome measure for treatment success.

3.8.2. The role of diet and exercise in weight-management

Traditional approaches to obesity treatments generally involve either reduction of energy intake (diet) and/or expenditure (exercise, physical activity) of energy and can be self-administered or health-professional-lead (LeBow, 1981; Perri, 1992). A reduction in energy intake can lead to negative energy balance and thus weight loss, which is highly touted as the best treatment for obesity (LeBow, 1981; Wing & Jeffrey, 2003). A recent governmental briefing paper about treating adult obesity through lifestyle change (Cavill & Ells, 2010) emphasises the multi-component tailored interventions, including both exercise and diet (with a behavioural component), rather than attempting to modify either alone. Although there is evidence that both of these in conjunction works well initially, long-term data is less conclusive (Brown et al., 2009; Wooley & Garner, 1991). In the following sections, the effectiveness of lifestyle change approaches to obesity will be evaluated by reviewing evidence for diet and exercise interventions individually, then in conjunction.

3.8.3. Diet interventions: Are they effective?

A number of different types of diets have been used in obesity intervention studies including very low-calorie (VLCD), low-carbohydrate, and fat-restricted diets. Therefore, diets to reduce weight can be classified by their degree of energy restriction and by their contribution of macronutrients (Miller & Lindeman, 1997). 'VLCDs are total diet replacements with no more than 800 kilocalories per day' (Stroebe, 2008, p. 173). Pre1980s VLCDs were not deemed to be safe, as between 1977 and 1978, 58 people in the US died having followed liquid protein diets and suffered various ill health as a result (Berg, 1999 & 1995; Sours, Frattali, Brand, Feldman, 1981; Wadden, Van Itallie, & Blackburn, 1990; Wadden, Sternberg, Letizia, Stunkard, & Foster, 1989). The VLCD has one of the highest risks for sudden death syndrome of any weight loss programme (Berg, 1999; NIH, 1993 & 1992). Similarly, Wadden (1993) concluded that although there have been improvements, in randomised control trials patients treated under medical supervision using a VLCD (400-800 kcal/day) lose around 20 kg in 12-16 weeks and maintain about 50-75% of this lost weight a year on. Those on LCDs (1200 kcal/day), combined with behavioural modification lose about 8.5 kg in 20 weeks. Both VLCD and LCD were associated with long-term weight gain. Pinto, Gorin, Raynor, Tate, Fava, and Wing (2008) in their RCT study examined the relationship between weight loss and long-term weight maintenance among successful weight losers (VLCD n=24; commercial n=95; self-guided programme n=67). They randomised their participants to a face-to-face, over the Internet, or to a newsletter control condition and followed them for 18 months. At baseline the VLCD group achieved a significantly larger (24%) weight loss of their original body weight than the other two groups (17%). However, those on the VLCD regained with significantly more weight than the other two groups and after six months there were no significant differences in overall per cent weight loss between the three groups. They concluded that the large weight loss in the VLCD group was not maintained over time and other methods such as the self-guided maintenance was more effective than the VLCD. Subsequently, Wing et al. (2008) from the same study concluded that decreases in physical activity were a significant factor in weight regain in all three groups and that psychological well-being decreased in weight gainers (e.g. higher depression, disinhibition, and hunger).

Another overview study by Pi-Sunyer (1993) controversially concluded that adverse effects of VLCDs and LCDs leading to weight-loss are a greater risk of gallstone formation and cholecystitis, excessive loss of lean body mass, water and electrolyte problems, mild liver dysfunction, and elevated uric acid levels, accompanied by less serious side effects such as diarrhoea, constipation, hair loss, and cold intolerance; these were not severe enough to contraindicate the benefits of weight loss, especially short-term. Pamuk, Williamson, Serdula, Madans, and Byers (1993) in their epidemiological study of following up men (n=2453) and women (n=2739) who were 45 to 74 years old at the time of the National

Health and Nutrition Examination Survey I (1971-1975 – US Department of Health and Human Services, National Centre for Health Statistics, 1984) found that pre-existing illness may influence the association between weight loss and mortality through death from non-cardiovascular disease, but weight loss independently was also associated with increased risk of death, even after excluding deaths occurring in the first eight years.

A recent meta-analysis also showed that VLCDs were not more effective long-terms than LCDs (Tsai & Wadden, 2006). Furthermore, Wing (2004) stated that these diets are safe only if treatments are matched to patients who are then carefully monitored. Similarly, Avenell et al. (2004a & 2004b), in their systematic review of randomised controlled trials on diet and weight, also concluded that there is very little evidence for efficacy of VLCDs and LCDs. However, this review provided some support for the effectiveness of low fat diets regarding initial weight reduction in obese adults. Overall, the authors suggested that due to lack of well-designed studies the long-term value of VLCD and LCD based interventions are questionable. This was mostly true for individuals with a BMI of ≥ 40 kg m^{-2} (morbidly obese). This is an important cut-off point, as women in particular with a BMI of ≥ 40 kg m^{-2} are at increased risk of obesity-related co-morbidities (Must, Spadano, Coakley, Field, Colditz, & Dietz, 1999).

In contrast, a meta-analysis by Anderson, Konz, Frederich and Wood (2001) suggested that five years after completing a structured weight-loss program (very low energy diet; hypoenergetic balanced diet; mixed) participants maintained a weight loss of more than 3 kg (> 3%) of initial bodyweight. However, this study was limited by its inclusion criteria, as it included observational studies too, as well as the study was limited only to US population data. Observational studies pose problems, due to lack of randomisation of participants and therefore they are prone to confounding biases and lack true intervention effects (for some of the limitations of observational studies and their effect of overestimation of the efficacy of diets, see discussion below).

Therefore, these two meta-analyses produced a contradictory finding, in that individuals in VLCD and LCD conditions regained weight at the same rate during follow-up. This might be due to the fact that once patients come off the VLCD they are left to buy real food, and may return to their initial eating habits, whereas patients on LCDs have to change their habits (Stroebe, 2008). Indeed, Jeffery and Wing (1995) found that those dieters who were on the meal-replacement treatment in their original study lost 1.7 kg (Jeffery et al., 1993), but a year later regained most of the weight they had lost, and all of the advantages of such treatment disappeared. Interestingly, no weight change was found for the control group.

Most meal-replacement studies achieved good results whilst patients were receiving the packs for free (Flechtner-Mors, Ditschuneit, Johnson, Suchard, & Adler, 2000; Rothacker, 2000), but when they were asked to pay for them, they failed in their attempts to managing their weight (Wing, Jeffery, Hellerstedt, & Burton, 1996). On the whole, reviews on the efficacy of diet on weight loss have been negative. Calorie restriction might result in short-term weight reduction (5-10% of baseline weight; Perri & Fuller, 1995), but participants are unable to sustain this weight loss over time. The more time between the end of the intervention and the follow-up period the more weight the participants will have regained (Jeffrey et al., 1993; Mann, Tomiyama, Westling, Lew, Samuals, & Chatman, 2007).

Mann et al. (2007) in their comprehensive review of the long-term effects of calorie-restricting RCTs and observational studies used the GRADE system (GRADE Working Group, 2004) to evaluate the quality of evidence and strength of recommendations, concluded that diets are not effective treatment options for obesity. They defined dieting as "a specific behaviour of severely restricting one's calorie intake in order to lose weight" (p. 221). Out of 14 prospective observational studies without randomisation but with follow-ups for more than four years, one reported weight loss, and two found no effect and eight reported that dieting resulted in weight gain. Although participants lost on average 14 kg on the diets, most of this was regained at follow-up (3 kg), ranging from 29 to 64% of the participants in these studies, actually weighing more at the end of follow-up than at baseline.

If anything, these studies showed that a history of dieting was associated with future weight gain. There was little support for the efficacy of diet on weight loss in the observational studies reviewed. Furthermore, a number of problems arise when evaluating evidence from observational studies. For example, such studies do not have long long-term follow-ups, as it is difficult to follow up individuals for a long time on a waiting-list (wait-list control group). Secondly, in all of the studies (e.g. observational and RCTs), but one (Jeffery et al., 1995, RCT) diet-alone study, diet was combined with other intervention strategies including exercise.

Mann et al. (2007) also provided a number of compelling arguments that the results of observational diet studies were actually worse than reported. First, follow-up rates were often low, resulting in biased results showing that diets on obesity are more effective than they actually are, as participants who gained the most weight are the most likely to drop out from the study, whereas the ones who lost the most weight are most likely to remain in the study. In addition, researchers often exclude participants from their final analysis for a number of reasons (e.g., participants who did not lose sufficient weight during the intervention; non-completion of questionnaires or participants who had used similar diets previously).

In particular, Walsh and Flynn (1995) reported to exclude two patients who gained an extremely large amount of weight. These exclusions often make the follow-up rates artificially higher than they actually are, making the diet look more efficacious, when only a tiny proportion of participants were able to maintain the weight they've lost. A second problem is the self-report of weight. Participants generally under-report their weight by an average of 2.1 kg. This figure is even higher for participants in weight loss intervention programmes (3.7 kg). The third reason identified is that a large number of those participated have been on diets since the original diet studies ended, which also confounds follow-up findings. The fourth and most important confounding variable is the lack of clarity around which of the multi-component lifestyle approaches was most effective to tackle obesity (e.g. the effects of diet might be confounded with those of exercise, if not RCT tested).

Indeed, Mann et al. (2007) rightly pointed out that this is a major methodological flaw of most lifestyle intervention studies, if they are not RCTs. In particular, correlational studies found as reviewed in Fogelholm and Kukkoen-Harjula (2000), Wing et al. (2008), and Fogelholm (2010) that the amount of exercise is highly correlated with best weight loss maintenance. Several other studies (Grodstein et al., 1996; Klem, Wing, McGuire, Seagle, & Hill, 1997; Raynor, Phelan, Hill, & Wing, 2006) also showed that exercise is associated with successful weight loss as well as successful weight maintenance, hence supporting Mann et al.'s argument that diets appear more effective than they actually are as a result of this methodological problem associated with lifestyle and in particular diet studies, as such studies don't report exercise habits of participants. Indeed they found that nine out of the 14 observational studies did not report such data. Moreover, the five that did, after reanalysis of data, showed that those who exercised regularly maintained significantly greater weight loss than those who did not exercise.

Mann et al. (2007) concluded that long-term diet studies without control groups did not lead to sustained weight loss. Furthermore, dieting was related to weight gain over time, after controlling for weight at baseline. For example, Korkeila, Rissanen, Kapro, Sorensen, and Koskenvuo (1999) examined the long-term effects of dieting on weight gain over 6 and 15 years in a large cohort of adult Finnish twins (N=7, 729) and found that weight loss attempts were significantly related to future risk of major weight gain when controlling for most potential confounding variables (e.g. BMI, age, smoking, alcohol use, educational level, SES, marital status and energy expenditure at baseline). Another large-scale (N= 3,552) study by French and Jeffery (1994) also concluded that history of formal weight loss attempts predicted significant future weight gain. Two further large scale studies of adolescents (N=14, 972 and N=692, respectively) by Field et al. (2003) and Stice, Cameron, Killen, Hayward, and Taylor (1999) followed participants over three and four years respectively and found that dieters gained more weight than non-dieters within this period, when all major potential confounding variables were controlled.

In both studies those who had prior weight loss attempts and dieted more often had a significantly higher increase in weight and prevalence of obesity. In fact, in Stice et al.'s (1999) study of the 589 females who were not obese at baseline, 63 (11%) became obese by the end of the study. Among dieters the risk for obesity onset was three times higher than in non-dieters. Another study by Foster, Kendall, Wadden, Stunkard, and Vogt (1996) also found that 50% of their cohorts weigh more than 5 kg in comparison to baseline at five-year follow-up. The 14 observational studies reviewed by Mann et al.'s (2007) suggest that dieting at baseline is a consistent predictor of subsequent weight gain.

Finally, the main findings concerning the 7 RCT studies were that calorie restriction through dieting does not result in long-term weight loss and that participants remained obese. The most successful RCT study reviewed by Mann et al. (2007) was done by the Diabetes Prevention Research Group (2002), where within a lifestyle intervention study at three-year follow-up participants maintained a mean weight loss of 4 kg, as oppose to participants in the placebo control group, where participants gained 0.5 kg on average. However, diets might slow the gain of weight with age, which is often seen in non-dieters. The most significant aspect of this study was associated with health outcomes, as those in the lifestyle intervention group had a reduced incidence of diabetes (by 58%). However, there are methodological flaws in this study as participants exercised on average 227 minutes per week and this was not controlled for. Furthermore, it was unclear which subgroup of the cohort had these associated health benefits (e.g. those with elevated plasma glucose concentrations may benefit more). Most of the RCT studies included overweight and not just obese participants, which again questions the effectiveness of dieting to treat obesity. It was also unclear which participants were included in the follow up studies and at what point. All of the RCT studies reviewed in Mann et al.'s study (2007) did not control for potential confounding variables effectively and had other major methodological flaws, such as inclusion of hypertensives (overweight and obese), and diabetics with specific risk factors, which were not controlled for.

In summary, VLCDs and LCDs are effective in reducing weight for the period of treatment and for a short period of time thereafter. However, based on the evidence provided above, this weight loss is not without substantial health risks to patients in the long-term, even if they are somewhat effective in short-term, as both of these diets are not sustainable for life, and also slow the rate of fat oxidation, which will need to be increased (e.g. by exercise) in the maintenance phase or by converting to a very low fat habitual diet (Hill, Drougas, & Peters, 1993). However, it must be acknowledged that most who lost weight remain obese after these weight loss attempts.

Dieting (i.e. calorie restriction practices) appears to be an ineffective method to achieve long-term weight loss or obtain health benefits. Indeed, having lost weight on a diet was shown to be one of the best predictors of future weight gain (e.g., Coakley, Rimm, Colditzk, Kawachi, & Willett, 1998). It has been suggested that a high stable weight is safer than repeated weight fluctuations and as suggested above dieting might even induce increased levels of obesity. More worryingly, in particular for moderately obese women, continuous dieting has a number of negative psychological effects including increased levels of depression and anxiety, social withdrawal and personality changes (Berg, 1999; Garner & Wooley, 1993). Therefore, although calorie restriction (i.e. dieting) does indeed reduce body weight short-term, the long-term effects of such a method is equivocal. Therefore, current obesity treatment programmes should offer alternative approaches to dieting, as per Lissner, Steen, and Brownell’s (1992) suggestion who showed that dieting might only be beneficial in individuals with a BMI >35kg/m^2 or such subgroups of obese with co-morbidities. Therefore, this PhD work will adopt the non-dieting approach to weight-management and will offer a psycho-educational intensive intervention using the principles of brief cognitive behavioural therapy (Brief CBT) approach (two times a week for three weeks) to address restrictive eating behaviours and psychological problems associated with frequent dieting. This is an optional educational session and will not be assessed, but participants will be questioned about their experience through qualitative interviews of these sessions. Furthermore, the CBT therapist will evaluate her sessions and will feedback to the main investigator (EB). The aim of the current PhD is to provide participants with a weight-management initiative that focuses on health outcomes rather than weight loss per se. This project asked the question: how can we help people to be healthier at the weight they currently are?

3.8.4. Hazards of weight cycling

The aim of this section is to explore in the literature whether those with a history of weight cycling, due to dieting are less or more likely to successfully manage their weight. The hazards of weight cycling due to frequency of dieting are still not fully understood by health and medical professionals (Berg, 1999; Lahti-Koski, Mannisto, Pietinen, & Vartiainen, 2005; Van Wye, Dubin, Blair, & Di Pietro, 2007; Wing, 1992). Weight cycling, weight fluctuation, weight variation, and yo-yo dieting is defined by Van Wye et al. (2007) as '>10 pounds (4.55 kg) of weight loss three or more times' (p. 731). All of the weight loss periods were defined as intentional and all of the weight regain ones as unintentional, and had to follow a period of dieting. Other studies are less clear on definitions; for example, the number of cycles or the magnitude of weight change greatly varies across studies (NTFPTO, 1994).

The poor maintenance results of many obesity treatment studies and dieting being so widespread, the prevalence of weight cycling is assumed to be high (Brownell & Rodin, 1994). To date there is a distinct lack of studies examining the prevalence of weight cycling in obesity treatment programmes (Field, Wing, Manson, Spiegelman, & Willett, 2001; Kroke et al., 2002). Several large-scale epidemiological studies (Blair et al., 1993; Folsom, French, Zheng, Baxter, & Jeffery, 1996; Lissner et al., 1991) showed that weight cycling lead to increased mortality, independent of weight and other adverse health behaviours (e.g. smoking). On the contrary, some studies did not find weight cycling as a risk factor for cardiovascular disease (Field et al., 1999; Jeffery, Wing, & French, 1992; Petersmarck, Teitelbaum, Bond, Bianchi, Hoerr & Sowers, 1999). However, as previously stated, weight loss attempts (Coakley et al., 1998; Korkeila et al., 1999), and weight cycling (Field et al., 2001; Kroke et al., 2002) predict large weight gains in the future (Jeffery, McGuire, & French, 2002). Van Wye et al. (2007) studied healthy men (n = 797) and women (n = 141) aged 20 to 78 (BMI 23 and 21 kg/m^2 for cycling and non-cycling women and a BMI of 27 and 25 kg/m^2 for cycling and non-cycling men) over a six-year period. This was a unique study as it showed that weight cycling in normal and slightly overweight individuals does not seem to increase the risk of long-term weight gain in men, but this couldn't be ascertained for women, as those with a weight cycling history gained weight at a faster rate than those without such history. Additionally, those who had a history of weight cycling at baseline had a higher BMI, although this was not statistically tested. This was true for both genders. The average weight lost and gained at each cycle was not reported in the study, which might be too low for adverse health risks to occur in a normal weight population.

Other research by Kuller and Wing (1993) argued that the relationship between weight loss, weight cycling and health is less then clear. There are numerous methodological flaws that bias current epidemiological studies, as they do not specifically test the effects of weight cycling. Most such research found that mortality rate was higher among individuals who either lost weight or had weight cycling, but these do not separate the effects of intentional and unintentional weight loss. Kuller and Wing (1993) further argued that lifestyle factors were often not controlled for in large epidemiological studies and such data often uses self-reported weight measures. Even to date, there isn't a single purposeful clinical trial that assessed the effects of weight loss on major disease outcomes. However, experts thus far agree that weight loss programmes could potentially be hazardous (see previous discussions on dieting), and all agree that those who had a history of weight cycling have problems with faster and larger weight gains (Ciliska, 1993; Van Wye et al., 2007). Unfortunately, of those who have gained weight, most become heavier than their baseline weight (Stalonas, Perri, & Kerzner, 1984).

Field et al. (2001) assessed the prevalence of clinically significant weight loss among women and whether this was associated with smaller long-term weight gains. Their study included a total of 47,515 women without co-morbodities and pregnancy. They concluded that most women in the study who lost a clinically significant amount of weight regained most of it, but over the six years they've gained less than their peers. However, this study did not control for the effects of physical activity and used self-reported weight data. Similarly, Sorensen, Rissanen, Korkeila, and Kaprio (2005) investigated the effects of intention to lose weight and weight changes in overweight persons (BMI ≥ 25 kg/m^2) without co-morbidities (n = 2,957). In the 18-year follow-up period (from 1982 to 1999) 268 individuals died. They found that both net weight loss and weight gain over a six years period for all participants (e.g. overweight and obese) without known co-morbidities or high-risk conditions were associated with increased mortality. However, the intention to lose weight alone did not affect long-term mortality. However, those who had weight cycling over the six years period had increased mortality compared to both weight stable and intention to lose weight groups. It is now firmly established that those with weight cycling history fair worse in health outcomes than those without such history. However, as Jeffery (1996) argued none of the large scale epidemiological studies are unequivocal in their conclusion for warranting public health recommendation changes. In a subsequent study by Jeffery (French, Jeffery, & Murray, 1999), he argued that public health recommendations for weight control need to be reviewed, and more focused on persistence of weight control behaviours (e.g. weight cycling history).

As discussed above most participants involved in obesity interventions regain weight following initial weight loss. Wadden et al. (2004b) suggest that it is ‘better to have lost and regained than never to have lost at all’ (p. 151S). The argument for this statement is that when weight is lost the risk for secondary diseases are reduced (e.g., diabetes and cardiovascular disease) despite regaining weight later on. But as it can be seen from the above review, these benefits lasts only for a short period of time, and might be more detrimental to one’s health over time.

A number of explanations have been provided for the weight regain phenomenon, which is an under-researched area. Qualitative studies exploring reasons for weight gain have been retrospective in nature and have mainly focused on relapse following dietary restriction. It is widely thought, but not adequately researched, that weight gain is due to individuals’ return to inappropriate diet and physical activity habits. However, all of these reasons are based on the assumption that individuals can change their weight at will and each failure to comply with strict instruction of these weight-management programmes is their own fault (Cogan & Ernsberger, 1999; Weigle, 1990). The contribution of genetics is largely ignored in lifestyle intervention studies; even though there is strong evidence that twins are similar in their body weight whether they were reared apart or together (Bouchard et al., 1990;

Institute of Medicine, 1995; Stunkard, Harris, Pedersen, & MClearn, 1990). Furthermore, Bouchard et al. (1996) showed that studies on identical twins indicate that weight gain and the ability to lose weight after overfeeding is almost entirely determined by genetics. Other studies also imply that body weight is relatively stable after adolescence or increases slowly over the lifespan (Fox, 1973; Goodner & Ogilvie, 1974; Robinson & Watson, 1965). Some of the gains in diet-only studies might be due to changes in metabolic factors (Blackburn et al., 1989; van Baak, 1999). A reduction in leptin concentrations (Rosenbaum, Murphy, Heymsfield, Matthews, & Leibel, 2002) and an increase in ghrelin (gut peptide) (Cummings et al., 2002) have also been put forward as possible physiological mechanisms associated with weight regain. There is some evidence that weight cycling in animals and humans may lead to altered metabolic responses (e.g. reduction in daily energy requirements – Blackburn et al., 1989; Brownell, Greenwood, Stellar, & Shrager, 1986), the implications of which are that enhanced metabolic efficiency would lead to further weight gain in each new cycle of dieting (Wiegle, 1990).

In addition to physiological mechanisms there are also psychological effects of weight cycling (Foreyt, Brunner, Goodrick, Cutter, Brownell, & St. Jeor, 1995; NTFPTO, 1994). A qualitative study by Byrne, Cooper and Fairburn (2003) of 76 women (n = 28 maintained weight loss; n = 28 who did not maintain weight loss; n = 20 stable weight) showed that failure to achieve weight loss goals, dissatisfaction with weight achieved, tendency to evaluate self-worth in terms of weight and shape, lack of vigilance with regard to weight control, dichotomous thinking style (i.e. ‘black and white’ or ‘all or nothing’), and eating to regulate mood was likely to result in periods of weight gain. Similarly, a cross-sectional study by Venditti, Wing, Jakicic, Butler, and Marcus (1996) examining the relationship between weight cycling and psychological health of 120 women found that binge eating was strongly associated with the occurrence of binge eating and perceived physical health. Field, Manson, Taylor, Willett, and Colditz (2004) looked at the association of weight change, weight control practices and weight cycling among women (n = 2476) in the Nurses' Health Study II. They found also that weight cycling was associated with greater weight gain, less physical activity, and a higher prevalence of binge eating. Repeated dieting failure also may lead to low self-esteem and guilt and reinforcement of personal blame (Cogan & Ernsberger, 1999; Weigle, 1990). A possible mechanism between negative mood or emotional stress and weight regain is through loss of self-control, as negative moods and emotional stress caused a breakdown of control in obese participants, which in turn led to impaired logical reasoning and cognitive distortion resulting in inappropriate eating behaviour (e.g., Sjoberg & Persson, 1979). Finally, success in weight loss interventions is inversely related to depression (Hall, Bass, & Monroe, 1978; Scott et al., 2008).

There are also a number of environmental factors, which may contribute to the regain of weight. For example, increased density of neighbourhood fast-food outlets was associated with unhealthy lifestyles, poorer psychosocial profiles, and increased risk of obesity among older adults (Li, Harmer, Cardinal, Bosworth, & Johnson-Shelton, 2009). Prentice and Jebb (1995) also argued that modern inactive lifestyles are important in the development of obesity, but this doesn't mean that the individual is to blame (Morris, 1995). Environmental factors also effect emotional functioning, that may lead to over- or under-eating. For example, negative or positive emotional states whether the person is alone or with others might result in individuals' relapse and regain of weight (Schlundt, Sbrocco, & Bell, 1989).

In summary, individuals without weight cycling history appear to report higher general well-being, greater eating self-efficacy, lower stress levels, regardless of body weight (e.g. Foreyt et al, 1995a). Therefore, this PhD will adopt a weight history interview at baseline assessment to ascertain the history and prevalence of self-reported dieting in the recruited sample.

3.9. Benefits of non-dieting approaches to weight-management

The failure of traditional diet and exercise weight loss programmes in obtaining long-term outcomes has resulted in an alternative approach to obesity treatments. As previously discussed, dieting (e.g. calorie restriction) may lead to various short-term health effects in obese individuals, but maintaining these gains in the long-term seems elusive for most. Furthermore, it is well documented in the literature (Pavlou, Krey, & Steffee, 1989; Weigle, 1990) that even balanced calorie restrictive diets eventually will lead to chronic fatigue, impaired cognitive functioning (e.g. lack of concentration), cold intolerance, and mood disturbances. Restrictive diets are also seen as causing health problems including psychological disorders, loss of body protein, dehydration, ketosis, hypoglycaemia and hypokalaemia (Miller, 2001). Additionally, the failure of women, and in particular large women, to lose weight via diets will result in chronic dieting, and a constant self-appraisal of being fat and a failure (Ciliska, 1998). However, the evidence for the above assertions is weak and mainly based on studies which have investigated the role of starvation or individuals with eating disorders. Notwithstanding this a number of health care professionals and obesity researchers are now challenging the effectiveness of dieting as they see it as ineffective and potentially harmful (Brownell, 1993; Garner & Wooley, 1991; Miller & Lindeman, 1997; Wooley & Garner, 1991).

There appears to be various methodological problems associated with lifestyle research (e.g. Mann et al., 2007; Miller, Koceja, & Hamilton, 1997), including old research findings, use of self-selected populations, and the lack of coherence amongst obesity researchers around when obesity (i.e. excess weight) becomes a serious risk to one's health (Miller & Lindeman, 1997; Pi-Sunyer, 1993; Sharma & Kushner, 2009). Miller et al. (1997) conducted a meta-analysis of the 29 years (1965-1994) of weight loss research using diet, exercise and diet plus exercise intervention. They found that most of the studies included in the review had moderately obese middle-aged populations, with intervention lasting only a very short period of time and with inconsistent long-term follow-ups. It is also unclear what needs to be treated (Berg, 1995) excess weight or psychological aspects of eating behaviours (e.g. dieting, emotional problems, depression). There is also a lack of agreement around key outcome variables and criteria which represent effective treatment (Atkinson, 1993; Jain, 2005; Mann et al., 2007; Miller & Lindeman, 1997; Sharma & Kushner, 2009). Therefore, all of these researchers argue that weight loss should be avoided as a standard for measuring treatment success, given the widely differing populations and their reasons for losing weight (e.g. mildly to severely obese, various disease status, and fitness status).

The problem around resolving these issues is arising from a dichotomised position of researchers for or against dieting e.g. calorie restriction (Miller, 2001; Miller & Jacob, 2001; Miller & Lindeman, 1997; Miller, et al., 1997). Those who call for health behaviours to be the primary outcome measures for obesity advocate the non-dieting approach and the health at any size paradigm, as they argue that mild to moderate overweight and obesity is not unhealthy, and that dieting is ineffective and could potentially be harmful (Berg, 1999; Ciliska, 1998; Cogan & Ernsberger, 1999; Miller & Jacob, 2001; Polivy & Herman, 1992; Stroebe, 2008). The goals of such treatment are to normalise weight fluctuation and prevent weight gain by avoiding unhealthy dieting strategies, adopting healthier eating (e.g. avoiding the continuous cycles of restricting and overeating; balanced food choices) and exercise behaviours (Stroebe, 2008). The primary outcome measures are psychological well-being and reduction in the risk of weight gain. However, modest weight loss could and is expected to occur as a result of such lifestyle changes, as in Rapoport, Clark, and Wardle’s (2000) study.

One of the first non-dieting RCT studies for obese women was conducted by Ciliska (1998), where women were either allocated to a 12-week educational intervention (1 hr/ week), 12-week psycho-educational intervention (2 hr/week), or to a control condition. The psycho-educational group, which were encouraged to adopt a non-dieting or non-restraint pattern of eating, was found to improve significantly in self-esteem, restraint, and body dissatisfaction in comparison to the control group. This change happened despite a lack of weight loss or change in blood pressure. The author concluded that a non-dieting approach could be beneficial for emotional and psychological health of obese women. However, despite these short-term gains, there was a large dropout rate in the control group during the study, and subsequently in both intervention groups at six-month and one-year follow-up.

Other non-dieting approach studies also had mixed results (Goodrick, Poston, Kimball, Reeves, & Foreyt, 1998; Rapoport et al., 2000; Sbrocco, Nedegaard, Stone, & Lewis, 1999; Tanco, Linden, & Earle, 1998; Wadden et al., 2004b). Participants in all of the cited studies were women. The follow-up period was short. The studies adopted the non-dieting approach, where women were explicitly instructed not to diet, pay attention to hunger cues, stop eating when feeling full, act on environmental cues and avoid overeating in emotional states or for boredom, and increase their time spent exercising. Similar improvements in psychological well-being and quality of life were achieved in the non-dieting groups when compared to the standard behavioural weight loss groups in the above studies, with the exception of one study (Tanco et al., 1998), where the intervention group had significantly higher psychological health from the behavioural intervention and the waiting list control group. In contrast to the majority of studies there was no psychological improvement in the behavioural intervention group, probably due to the sample being morbidly obese (BMI 39.4 kg/m^2 – Stroebe, 2008).

The use of non-dieting approach in most of the aforementioned studies did not yield significant weight loss, apart from two studies (Sbrocco et al., 1999; Tanco et al., 1998), where participants in the non-dieting conditions continued to lose weight post-treatment as opposed to other treatment groups. In both studies of those in other conditions (e.g. behavioural or control) participants started to regain the lost weight. However, Wadden et al. (2004b) did not find such post-treatment effects. Lack of weight loss is often de-motivating as Levine et al. (2007) concluded in their prospective weight gain prevention study among women. Healthy women (n = 284) with an age range from 25-44, and with a BMI < 30 kg/m^2 were randomised to three groups (clinic based, correspondence course, and information-only control) to investigate the feasibility and efficacy of weight gain prevention intervention. The intervention lasted for two years with a one-year follow up. They found that most women in the study were only interested in weight loss and not weight stability. About 40% of the women were successful in preventing weight gain during the three-year study period, probably because they were less likely to be on a diet; they were less susceptible to feelings of hunger at baseline compared to those who gained weight. Interestingly, physical activity behaviour was not related to weight gain prevention in this study.

In summary, as Miller (2001) concluded, at present it ‘cannot be determined whether a non-dieting approach, that includes a health at any size philosophy, will ultimately lead to bodyweight loss and improved physical health’ (p. 720).

3.10. Health At Every Size

The Health at Every Size paradigm (HAES) is a specific non-dieting approach, which aims for individuals to accept their body size (i.e. size acceptance) and see their bodies as beautiful rather than ugly (Bacon et al., 2002; Miller, 2005 & 2001; Robinson, 1997). HAES also sees dieting as a contributing factor to abnormal eating behaviours and encourages individuals to adopt healthier eating patterns by supporting homeostatic regulation and intuitive eating patterns, when eating is based on internal cues of hunger, satiety, and appetite (e.g. Bacon, et al., 2002).

Practitioners of the HAES approach focus on self-acceptance, size-acceptance, healthier eating habits and increased physical exercise, rather than weight loss per se (Miller, 2001 & 2005; Robison, 1997). In particular, HAES suggests that large women might actually be at their genetically determined weight and metabolic functioning, as well as their history of weight cycling. Therefore, they advocate that obesity in itself is not a disease and those women without any health problems should be encouraged to maintain weight and focus on other health outcomes (e.g., body dissatisfaction, self-esteem, restraint, stress). The HAES approach assumes that ‘overweight person innately wants to eat healthy food and be active; and that once diet restrictions and barriers have been removed, the individual will develop healthier eating and activity patterns, which lead to a genetically determined healthy body weight’ (Miller & Jacob, 2001, p. 37). In this approach as in the other non-dieting approaches, quality of life and improved health is the goal of the treatment, instead of predetermined body weight (e.g. a particular BMI value).

To date there are only a handful of studies that examined the effectiveness of taking the HAES approach, and more specifically, they applied the non-dieting and self-acceptance aspects of the paradigm to treatment of overweight and obese individuals. In particular, mind, body, and lifestyle skills were focused upon (Miller & Jacob, 2001), which are the foundations of the HAES paradigm.

One of the earliest studies by Mellin, Croughan-Minihane, and Dickey (1997), which was *not* a specific HAES study, adopted the paediatric Shapedown Program to adults and called it the Solution Method. Surprisingly, most obesity researchers and policy makers, probably due to the very low sample size, lack of control group and randomisation, have largely ignored this work. The idea, if it was delivered as the study's description, could have major impact on the development of new approaches to weight-management. Interestingly, Mellin et al. (1997) acknowledge that body weight is highly variable over time, which implies that there are modifiable environmental factors that HAES doesn't seem to acknowledge explicitly, as they attribute body size mainly to genetics. Furthermore, Mellin et al.'s (1997) study is small-scale and methodologically flawed. They recruited 22 (1 man and 21 women) participants who were overweight or obese (mean BMI = 33.1 kg/m^2) with a mean age of 43.4 years for a group intervention for 18 weeks, with 6-, 12-, and 24-month follow up. Participants were classified according to their highest risk profile as medical, psychosocial, or both for balanced population-sampling purposes. Six development skills were targeted: *mind skills* (strong nurturing – need satisfaction; effective limits – management of expectations); *body skills* (body pride – body acceptance and recognition of drives to remain overweight; good health – effective self-care); *lifestyle skills* (balanced eating – regular eating habits; mastery living – physical activity and purpose of self). This developmental training scheme aimed at aiding a person to access more effectively their inherent health tendencies (e.g. genetics, temperament, reactions and coping with external stressors etc.). Although there was a high dropout rate (48%), and with the methodological flaws of the study, this seems to capture the concept of HAES. Mellin et al.'s (1997) finding shows a trend toward long-term improvement in a broad range of variables, including effective weight-management, as participants continued to lose weight at the 24-month follow-up, to the contrary of traditional weight treatment outcomes (e.g. behavioural, VLCD, LCD, and weight loss drugs), where participants regained the lost weight after the end of their treatment.

Other specific studies, testing the HAES paradigm did not yield equivocal support for all of its tenets and again had methodological limitations of working with women only, short-term follow-up and poor sample sizes. For example, Bacon et al. (2002) conducted a study (n = 78) comparing a six-month non-diet wellness intervention programme with traditional diet one. The study also provided six months of monthly after-care group support for both groups. They found that over the year-long treatment period those on the traditional weight loss programme (adherers only – attrition rate was 41%) lost weight compared to those in the non-dieting group (attrition rate was 8%) who did not. However, the non-dieting group had significantly better adherence rates, similar improvements in metabolic fitness, psychological variables and eating behaviour. A two-year follow up of these participants (Bacon, Stern, van Loan, & Keim, 2005) showed that cognitive restraint decreased in the non-dieting group and increased in the dieting one, but only 50% of those remaining in treatment were followed up. The dieting group regained the lost weight and did not sustain improvements, as opposed to the non-dieting group, where psychological improvements were sustained. However, it is really unclear from this study as to how participants' goals of weight-management were addressed and what it meant for them in the long-term.

High attrition rates affected how well individuals did in the above studies and as Bradshaw, Horwath, Katzer, and Gray (2009) found, highly educated women already engaging in some healthier lifestyle choices were less likely to be non-completers in non-dieting group programmes. They followed up 119 women with at least one cardiovascular risk factor a year after a 10-week educational programme. They concluded that all future trials of non-dieting interventions should report the effects of completion on outcomes, given that important treatment outcomes vary according to attendance. Similarly, Wardle and Griffith (2001) found that men and women of higher socio-economic status had higher levels of perceived overweight, monitored their weight status more frequently, had a lower threshold of defining themselves as overweight, and were most likely to try to lose weight.

A study by Provencher, Begin, Tremblay, Mongeau, Boivin, and Lemieux (2007) assessed the effects of HAES (non-dieting) intervention on eating behaviours and appetite ratings in 144 pre-menopausal overweight women. Women were randomly assigned to three groups (HAES, n = 48, mean BMI = 30.1 kg/m^2; Social Support, SS, n = 48, mean BMI = 30.6 kg/m^2; and control group, n = 48, mean BMI = 30.7 kg/m^2). In the four months intervention the attrition rates were 8.3% for HAES, 18.8% for SS, and 20.8% for the control group. The results showed significant changes in eating behaviour for all three groups, the HAES group had significantly larger decrease in susceptibility to external hunger cues and hunger compared to the other two groups. Changes in appetite ratings were only observed in the HAES group, indicating that the HAES (non-dieting) approach enabled women to regain their ability to recognise hunger and satiety cues more effectively. Provencher et al. (2007) argued that "developing skills to differentiate real feelings of hunger from external stimuli may be an important aspect of HAES interventions, which could be translated into lower susceptibility to hunger and appetite sensations (p. 964). The researchers used a food diary to enhance consciousness about level of hunger and satiety at each meal. Significant decrease in disinhibition (i.e. one of the subscales of the Three Factor Eating Questionnaire that looks at overconsumption of food in response to various stimuli associated with a loss of control on food intake – Stunkard & Messick, 1985) was found in all three groups as well in traditional weight loss programmes (Rapoport et al., 2000), thus suggesting that different types of techniques can be effective to tackle this eating behaviour. As oppose to Bacon et al.'s (2005 & 2002) and Sbrocco et al.'s (1999) findings cognitive dietary restraint (i.e. one of the subscales of the Three Factor Eating Questionnaire that measures conscious control of food intake with concerns about shape and weight – Stunkard & Messick, 1985) did not significantly decrease, indicating that cognitive restraint is not a homogeneous concept (Westenhoefer, Stunkard, & Pudel, 1999) but it can have rigid and flexible dimensions. In previous studies rigid restraint was related to higher BMI values (Provencher, Drapeau, Tremblay, Despres, & Lemieux, 2003; Westenhoefer et al., 1999). Participants in the SS group had a significant change in eating behaviours, but not in appetite ratings, whereas the HAES group had, indicating that educational (non-active) programme changed food perceptions, but active problem-solving changed actual behaviours. Body weight loss did not significantly differ across the three groups, all of which had a small significant decrease. The one-year follow-up results by Provencher et al. (2009) showed that situational susceptibility to disinhibition and susceptibility to hunger significantly decreased overtime in both the HAES group and the SS group. The two groups did not differ at 16 months, but both had lower scores than the control group. This suggests that short-term gains did not translated to long-term ones, as both HAES and SS did not differ.

An important message coming out of both the non-dieting and the HAES approaches is well illustrated by Ikeda, Lyons, Schwartzman, and Mitchell (2004) who collected self-reported information of 149 women's dieting experience with a BMI of 30 to 70 kg/m^2. They found that women with higher BMIs tended to start dieting before the age of 14 and dieted more frequently than women with lower BMIs. Additionally, negative memories of dieting significantly outnumbered the neutral or positive ones. The paper recommended that dieticians need to take dieting history of their clients before they decide upon an appropriate treatment, as well as focus on metabolic health risk reduction (e.g. lowering blood pressure, serum glucose, insulin, and lipid levels).

This message has not really been appropriately acknowledged in obesity treatment policy or research, probably because it goes against the traditional weight loss messages by the medical profession. Even though Sims (2001) identified a subgroup of the obese as 'obese metabolically normal' (OBMN), and warned that 'persons with OBMN and their parents may be wrongly blamed because of obesity and attempts at weight loss may be counterproductive' (p. 1499), these research findings are not promoted. The key message from Sim's (2001) and Matsuzawa's (1997) research is that it is possible that increased physical activity (e.g. fat and fit) might also play a role in OBMN. For example, Matsuzawa researched Japanese Sumo wrestlers, all of whom had gross obesity maintained by a 5,000 to 6,000 calorie diet, as their visceral adipose tissue was normal. Only after leaving the sport they developed insulin resistance. Therefore, fitness, which often is not measured or reported in large epidemiological studies, may be a key outcome measure to be aware of, as ‘there are many so-called overweight and obese people who already have healthy lifestyles and do not need “treatment” while conversely many lean persons have unhealthy lifestyles in need of improvement’ (Campos, Saguy, Ernsberger, Oliver, & Gaesser, 2005, p. 82). Therefore lifestyle, mainly physical activity not weight, should be the primary target of obesity interventions. Therefore, this PhD will focus on how individuals with clinical obesity are able to adopt a healthier lifestyle, primarily taking up or increasing their physical activity behaviours.

Findings from the non-dieting literature discussed earlier (Ciliska, 1998; Goodrick, et al., 1998; Sbrocco et al., 1999; Tanco et al., 1998) are often used by HAES advocates as justification for the HAES paradigm, yet despite some similarities, there are a number of important differences between the two approaches. HAES assumes that for all people, including men, psychological dysfunction is at the root of obesity (Miller & Jacob, 2001).

On the contrary, non-dieting approaches assume that dieting (e.g. calorie restriction) leads to eating-related negative moods, adoption of restrictive eating behaviours, feelings of failure, and weight preoccupation. HAES also assumes that weight to a large extent is determined by genetics, as opposed to the non-dieting approach, that is not. Furthermore, studies of non-dieting approaches still use weight loss as a secondary outcome measure, as they recognise that the relationship between BMI and health status currently remains unclear. Furthermore, HAES does not recognise that functional limitations restrict the frequency (e.g. how often one is able to exercise), intensity (e.g. low, moderate, high); time able to do the activity (e.g. how long one is able to move without pain or associated limitations, such as breathing problems), and type of exercise (e.g. aerobic, strength training) an individual with a BMI of ≥ 35 kg/m^2 can do.

Currently neither the non-dieting nor HAES approach can ascertain whether such treatments will lead to long-term physical and psychological health, with or without weight loss. Both non-dieting and HAES approach studies differ in specific methods adapted, but they all seek to '(1) increase awareness about dieting behaviours and their purported ill health effects, (2) identify and combat cultural notions that "thinner is better" and that body weight can be controlled by will-power, (3) help participants "stop dieting" by abandoning efforts to restrict energy intake and avoid certain foods, (4) help participants identify and eat in response to the body's "natural" hunger and satiety signals, and (5) increase self-esteem and positive body image through self-acceptance rather than weight reduction' (NTFPTO, 2000b, p. 2581). They are also ignoring men and mainly targeting women. Furthermore, these approaches do not acknowledge relative risks of obesity related co-morbidities, mortality, morbidity, functional limitations and a whole array of psychological, physical, social, and quality of life problems associated with high weight status especially in moderate to morbidly obese individuals with BMI of ≥ 35 kg/m^2 and above (Tanco, et al., 1998). There is also little support for the claim that both non-dieting approaches and HAES results in greater psychological and quality-of-life improvements compared to the traditional behavioural treatment approach (Stroebe, 2008).

In conclusion, traditional weight loss approaches are superior to both non-dieting and HAES approaches with regard to weight loss achieved, but the latter two are superior to traditional weight loss approaches in preventing weight regain over a longer period of time. In addition, the skill (e.g. use of cognitive behavioural techniques) required administering a non-dieting or an HAES approach is beyond the majority of treatment providers and health care providers (e.g. nurses, GPs, hospital doctors – Miller et al., 2001).

3.11. Weight-management: do behavioural/psychological restraints lead to self-regulation failure?

Clearly, behaviours and psychological states (e.g. emotions) are key determinants of participants' engagement in obesity research. Many people commonly believe, including those with weight problems that obesity is caused by lack of will power. Self control or self-regulation is defined by Gailliot et al. (2007) as 'the ability to control or override one's thoughts, emotions, urges, and behaviour. Self-control allows for the flexibility necessary for successful goal attainment, and it greatly facilitates adherence to morals, laws, social norm, and other rules and regulations' (p. 325). A plethora of research now identifies that good self-control plays a pivotal part in health (Hagger, Wood, Stiff, & Chatzisarantis, in press; Kahan, Polivy, & Herman, 2003; Leventhal, Leventhal, & Contrada, 1998).

In Chapter 3.18 self-regulation will also be discussed at length from the Self-Determination Theory's point of view. However, to this PhD, the notion that self-regulation is effortful (Baumeister, Heatherton, & Tice, 1994) is pertinent, as behavioural interventions require to initiate a number of competing self-regulatory restraints. For example, individuals with weight problems are constantly battling the messages of: eat less, eat different types of food that you are used to, exercise more, don't watch much TV, live a more active life with your family and so on. This raises then further questions: are these self-regulatory demands unrealistic in the treatment of obesity? How easy is it to exert self-control in weight loss studies? It might be that obesity intervention studies fail because dieting and weight loss strategies are destined to fail due to non-sustainability of behavioural restraints over a long period of time. As Baumeister and Heatherton (1996) argued that individuals' self-regulatory resources can be depleted or fatigued by self-regulatory demands. Such demands are both self-initiated (e.g. I've got to be good and not have a chocolate ice cream; I've got to exercise more; I've got to stop smoking and/or drinking) and situational demands (e.g. my doctor refuses to give me a vital heart surgery because I am obese, unless I lose weight; airlines tell me that I have to purchase two seats on the aeroplane as I am too big). Additionally, although Baumeister and Heatherton's (1996) research did not specifically mention this, environmental stresses (e.g. stigma – Puhl, Moss-Racusin, & Schwartz, 2007; Puhl & Hauer, 2009; functional limitations, quality of movement, associated pain – Larsson & Mattsson, 2001; Larsson, 2004) may magnify the situational demands on a person. Therefore, one would presume that their ability to restrain is severely impaired, which in turn will result in failing to manage one's weight. Indeed, chronic dieters were found to expend effort to override feelings of hunger when focusing on long-term weight loss goals (Heatherton & Vohs, 1998).

In a study, Vohs and Heatherton (2000) conducted three studies to test behavioural consequences of effortful eating self-regulation. Thirty-six chronic dieters were compared with non-dieters' (n = 64) on self-regulatory behaviours. In Study One, chronic dieters were exposed to situations varying in level of self-regulatory demand; then their ability to self-regulate was measured. Study Two required participants to self-regulate in the presence of good-tasting snack foods, whereas the third study asked participants to control their emotional expressions. The authors concluded that the 'ability to engage in successful regulation is limited by an underlying resource' (p. 254). Furthermore, they argued that 'the existence of chronic inhibitions, when combined with situational conditions requiring effortful self-regulation, can decrease the ability to self-regulate' (p. 254). Additionally, they stated that behavioural restraint in one domain exerted a generalised effect on behaviours in other domains. This is particularly important, as one is trying to tackle several health behaviour changes (e.g. eating and/or drinking less) increasing the likelihood of self-regulation failure. Subsequently, two studies by Muraven (Muraven, Collins, & Nienhaus, 2002; Muraven, Collins, Shiffman, & Paty, 2005) examined self-control demand and alcohol intake. In both studies it was found that when individuals planned to restrain their alcohol intake, they were more affected by self-control demands than when they did not plan to limit their alcohol intake. Trait self-control moderated these relationships. They also found that exerting self-control in non-drinking areas undermined individuals' capacity to exert self-control of drinking in daily life. There is also a link between alcohol intake and obesity in women and men (Colditz et al., 1991), as alcohol intake was associated with altered nutrient intake, as calories from alcohol were added to energy intake from other sources in men, but not in women, where alcohol intake displaced sucrose. Furthermore, Hagger, Wood, Stiff, & Chatzisarantis (2010) also explored the theoretical basis of the role of self-control in exercise.

Baumeister, Vohs, and Tice (2007) and Gailliot et al. (2007) offer a plausible explanation for the failure of individuals when they engage in a multiple-behaviour change programme (e.g. dieting, exercise). Additionally, they attempted to frame ego-depletion (i.e. failure of self-regulation due to 'energy' sources being depleted after imposing self-control – Baumeister, Bratslavsky, Muraven, & Tice, 1998) in biological terms. They found that when individuals were given glucose drinks, ego-depletion was restored, indicating a biological basis of self-control. Indeed, Dunbar (1998) found that the human brain digests 20% of the body's overall calorie intake, even though the brain consists of only 2% of the whole body's mass. Failure of self-regulation could also be due to individual differences in self-control strength or resources (Baumeister, Gailliot, DeWall, & Oaten, 2006; Tangney, Baumeister, & Boone, 2004; Nordgren, van Harreveld, & van der Pligt, 2009). For example, those with inflated impulse-control beliefs are less able to self-regulate, as they may have a tendency to overestimate their capacity to control their urges if presented unexpectedly with temptations to skip exercise or overeat at banquets (i.e. restraint bias; Nordgren et al., 2009). However, again these assumptions need further investigation, as for example, chronic dieters report deliberate overeating after breaking their diets or restrained eating periods (Polivy & Herman, 1985). Overeating in this case does not seem to relate to impulse control but rather hunger cues. It is unclear whether overeating is a cause or consequence of restrained eating, or these are reciprocally related, but tendency of overeating has become the new focus of obesity dietary interventions (van Strien, van der Laar, van Leeuwe, Lucassen, van den Hoogen, Rutten, & van Weel, 2007; Herman, van Strien, & Polivy, 2008).

In conclusion, there is a need for an integrated biopsychosocial model for health psychology (Suls & Rothman, 2004). Eating, exercise, and in general health behaviour regulation needs to be understood in a macro model of self-regulation, which is a biopsychosocial phenomenon. Indeed, Suls and Rothman (2004) argued that researchers 'need to better understand and utilize linkages among biological, psychological, social, and macrocultural variables' and adopt a 'multisystem, multilevel, and multivariate orientation among scientists, practitioners, and policymakers,' which will lead to 'transdisciplinary' solutions to complex conditions such as obesity (p. 119).

Although there are methodological issues (e.g. how to carry out self-regulation and ego-depletion experiments) within the self-regulation/self-control literature (e.g. Moller, Deci,

& Ryan, 2006), it is important to recognise that one has to deal with numerous behavioural restraints and initiate new behaviours and coping mechanisms (e.g. dealing with emotions, taking up exercise and so on). Therefore, the concept of self-regulation failure is difficult to test in laboratory conditions. However, it makes sense in terms of human experience, as habits of food preferences, eating styles, exercise behaviours, and general health habits (control of drinking, smoking, regular visits to doctors) are extremely resistant to change, requiring a great deal of mental energy and effort (Ikeda et al., 2005). It is also highly unlikely that these new behaviours will be enjoyable for the person for quite some time, especially if they are clinically obese (e.g. exercise experience might be painful – Larsson, 2004), further affecting motivation for change. This is in contrast to Mata et al.'s (2009) paper, where it was found that increased self-determination and exercise motivation facilitated improvements in eating self-regulation during weight control in women. Theoretically, there is a discrepancy between those favouring the energy strength model (Baumeister et al., 2007) and those looking at global human motivation (Moller, et al., 2007).

3.12. Behavioural interventions in weight-management

Kelly (2004) argued that 'educating overweight patients about nutrition and exercise is simply not enough; in many such persons behavioural and psychological factors must be addressed or these factors will prevent them from permanently changing behaviour' (p. 29). Several behavioural factors that have been identified to explain why it is difficult to maintain weight loss in some individuals (e.g. disinhibited eating, binge eating, eating in response to negative and positive emotions, stress – Karlsson, Hallgren, Kral, Lindroos, Sjostrom, & Sullivan, 1994; Pasman, Saris, & Westerterp-Platenga, 1999; Westenhoefer, 2001). Usually, behavioural treatment approaches are used to help participants to develop skills for behaviour change (Foster, Makris, & Bailer, 2005). Usual techniques of self-monitoring, goal-setting, and problem-solving are used in behavioural interventions to address maladaptive eating and exercise habits. According to Foster et al. (2005) behavioural therapies help patients to identify triggers that lead to maladaptive behaviours by identifying specific behavioural goals that can be measured (e.g. increase meal duration by 10 minutes). They also state that the treatment should be process-orientated, where the individual is encouraged to evaluate their goal-directed behaviours by identifying facilitators and barriers to goal-achievement. Furthermore, such therapies focus on small achievable rather than large unachievable behavioural changes, which enables therapist to address the disparity between actual and expected weight losses (Foster et al., 2005). Expected weight loss from a practitioner's point of view is around 10% of baseline weight in comparison to a minimum of 30% expected by the patient (Ames, Perri, Fox, Fallon, De Braganza, Murawski et al., 2005; Linde, Jeffrey, Finch, Ng, & Rothman, 2004; O'Neil, Smith, Foster, & Anderson, 2000).

In one of the earlier reviews of behavioural obesity interventions, Perri and Fuller (1995) reported a 75% increase over time in the initial weight loss of participants in intervention studies (1974 5% mean weight loss vs. 1990-1994 9% mean weight loss). This increase in initial weight loss appeared to be particularly related to a doubling of the treatment periods (1974 = 8.4 weeks vs. 1990-1994 = 21.5 weeks). A similar analysis of the initial effect of behavioural obesity interventions was provided by Wadden et al. (2004a). They compared behavioural RCT studies from the following time periods: 1974, 1985-1987, 1991-1995 and 1996-2002. A near quadrupling of the intervention period (from 8.4 to 31.4 weeks) was associated with a near trebling of initial weight loss (from 3.8 kg to 10.7 kg). However, the average weight loss per week remained relatively constant over the assessment period

(1974 = 0.5 kg vs. 1996-2002 = 0.4 kg). In this time period there have been some modifications to behavioural interventions including cognitive restructuring and relapse prevention. However, treatment duration was provided as the most likely explanation by the authors for the increased initial weight loss in studies conducted in more recent times.

Similarly, Shaw, O'Rourke, Del Mar, & Kenardy (2005) recently conducted a Cochrane review to examine the efficacy of psychological interventions in achieving sustained weight loss. 36 RCTs met the inclusion criteria and 3495 participants were evaluated. The studies included in this review were heterogeneous in terms of participants, interventions, outcomes, and settings. In addition, the behavioural techniques used in the interventions generally consisted of a number of different strategies. It was concluded that behavioural therapy and Cognitive Behavioural Therapy (CBT) interventions were effective weight loss therapies to enhance weight reduction. They distinguished between these two terms as both are commonly used in obesity treatments. Behavioural therapy was defined as "aims to provide the individual with coping skills to handle various cues to overeat and to manage lapses in diet and physical activity when they occur and provides motivation essential to maintain adherence to a healthier lifestyle once the initial enthusiasm for the program waned" (p. 5). In essence it aims to change harmful or unhelpful behaviours. Stimulus control, goal-setting, and self-monitoring are the key techniques used in these treatments. They stated that "when cognitive techniques added to behavioural therapy" (p. 5), then they become cognitive behaviour therapies. CBT's aim to "identify and modify aversive thinking patterns and mood states to facilitate weight loss" (p. 5). Cognitive therapies aim to help individuals to understand their current thought patterns and help it make them more realistic and helpful if they are distorted. CBT is a mixture of cognitive and behavioural therapies and takes a systematic approach to combat a problem. Brief CBT refers to "planned brief therapy in which maximum benefits are achieved with the lowest investment of the therapist's time and the lowest cost to the client" (Curwen, Palmer, & Ruddell, 2000, p.2.). Unfortunately, in published research in the context of multi-component weight loss programmes it is often not clear what psychological therapies were used and what if any specific techniques were employed.

Even though the long-term effects of behavioural treatments are similar to previously discussed effects for other traditional weight loss therapies (e.g. weight regain). However, behavioural therapies were particularly useful when used in combination with diet or exercise. Cognitive therapy, on the other hand, was found to be less effective.

Shaw et al. (2005) found that stand-alone behavioural therapy resulted in greater weight loss in studies less than 12 months in duration (2.5 kg) and studies longer than 12 months in duration (2 kg) in comparison to placebo or no-treatment control. Furthermore, when comparing behavioural therapy with diet or exercise versus studies, which only used diet and/or exercise, five studies were found to favour behavioural therapy adjunct to diet and/or exercise (significant heterogeneity between studies was present limiting the ability to pool effect sizes across studies). An important moderator was the intensity of the behavioural intervention (more behavioural strategies, more frequent clinical contact, and longer intervention duration). Again the length of treatment was an important indicator of successful treatment outcomes. For example, studies, which were less than 12 months in duration, showed that the intensive behavioural therapy resulted in an additional 2.3 kg weight loss in comparison to less intensive therapy. There was only one study in which the duration of the intervention lasted longer than 12 months. This study found a sustained (> 12 months) weight loss of 1.6 kg for the intensive group and 1.4 for the less intensive group

(Jeffery et al., 1995). It is noteworthy, though, that having 1.6 kg weight loss or even non-change in weight status is not very meaningful with regards to a clinically obese individual. Therefore, the long-term therapeutic effects of behavioural interventions in obesity-targeting weight loss remain questionable.

Similar results were obtained for comparisons between CBT with diet and/or exercise versus diet/exercise on its own in interventions. Although weight loss was observed in both conditions participants who received CBT with diet/exercise lost an additional 4.9 kg. Also, in one study, CBT was found to be more effective than behavioural therapy. At 12 months the CBT group had lost 10 kg and the behavioural group 4.3 kg (Sbrocco et al., 1999). In one study, cognitive therapy was compared with placebo condition. This study found that the participants in the treatment group gained 1.35 kg and in the no-treatment control 0.6 kg. Similarly, another study compared cognitive therapy alone with diet/exercise and cognitive therapy combined. Participants in the cognitive therapy with diet/exercise lost 1.9 kg, whereas participants in the cognitive therapy alone condition gained 0.5 kg. Although cognitive therapy appears to be ineffective the number of studies conducted makes it difficult to make clear statements on its efficacy. A problem of most behavioural obesity intervention targeting weight loss (not health) studies is that participants regain weight over time following termination of the treatment period. For the behavioural RCT obesity studies examined by Wadden et al. (2004a) a regain of 30-35% of lost weight was observed at one-year follow-up. Although weight gain slowed after the first year at five-year follow-up more than 50% of participants will have returned to their initial body weight (e.g., Wadden et al., 1989).

In summary, as discussed earlier, the duration of behavioural treatment appears to be closely associated with increased weight loss. Obesity is a chronic condition, which clearly requires long-term treatment (Perri & Corsica, 2002) and a new approach (Miller, 2001). Although intervention periods on the whole have increased in obesity treatment the duration of most programmes is still insufficient and relatively short to those of other chronic conditions. As Foster et al. (2005) argued, ‘future research might focus more on determining how these behavioural techniques can be best applied in a real-world setting’ (p. 230S).

3.13. Diet, exercise, and diet-plus-exercise interventions in weight-management

There have been a number of reviews, which have compared the efficacy of either dietary or exercise interventions or the combination of both. In one of the earlier systematic reviews on this topic, Glenny et al. (1997) concluded that a combination of diet and exercise, in the absence of behavioural treatment, was not more effective than diet or exercise alone. Another meta-analysis by Miller et al. (1997) reviewed 493 studies that were a therapeutic intervention of diet, exercise, or diet plus exercise specifically developed for weight loss. They found that a diet or diet-plus-exercise programme produced an average of 11 kg weight loss with a 6.6. ± 05 and 8.6 ± 0.8 kg maintained loss after one year, respectively. The authors concluded that a diet or diet-plus-exercise programme is most beneficial for individuals on a *short-term* basis. However, more recent systematic reviews (e.g. Curioni & Lourenco, 2005) and a meta-analytic study (e.g. Wu, Gao, Chen, & van Dam, 2009) have provided a different and more up-to-date perspective and long-term assessment of effectiveness.

A number of researchers have recently compared the efficacy of diet, exercise or diet-and-exercise interventions. For example, Avenell et al. (2004b) concluded that diet-plus-exercise interventions were associated with improved weight loss for up to 36 months in comparison to either diet or exercise alone. Additionally, Curioni and Lourenco (2005) in their systematic review of 6 RCT intervention programmes similarly concluded that diet and exercise together resulted in greater weight loss than diet-alone immediately after the intervention period (20% greater initial weight loss) and at one-year follow-up (20% greater sustained weight loss). They also suggested that these reductions were of clinical significance, leading to cardiovascular risk factor reductions in patients. Unfortunately, half of the initial weight loss was regained after one year in all conditions, suggesting that combined exercise and diet treatments do not result in better long-term maintenance of the initially lost weight. Therefore, it can be concluded that participants had difficulties in maintaining long-term the lifestyle changes associated with the intervention programmes.

Finally, a recent meta-analysis by Wu et al. (2009) comparing the long-term efficacy of diet-plus-exercise interventions versus diet-only interventions supported the findings by Curioni and Lourenco (2005). The meta-analysis included 18 studies. The mean differences between diet-plus-exercise and diet-only interventions at the end of follow-up was -0.25 and this was independent of the diet regime or type of exercise used in the studies. The pooled weight loss was 1.14 kg or 0.50 kg m^{-2} *greater* for the diet-plus-exercise interventions than the diet-only interventions. These differences were observed even after a two-year follow-up (based on data from seven trials). The weight loss at two years was 1.64 kg or 1.24 kg m^{-2} loss of initial body weight. Possible reasons for these modest decreases in weight loss are poor compliance or adherence to the programme (Dansinger, Gleason, Griffity, Selker, & Schaefer, 2005; Heshka et al. 2003) and the length of the intervention programme. Yet again, the longer the intervention time, the greater the weight loss. However, this meta-analysis also found that participants' regained weight after the initial intervention period ended.

There appears to be strong evidence that long-term a combination of diet and exercise is more effective than diet-alone. A possible explanation why a combination of diet and exercise is more effective than diet-alone treatment is that diets result in reduced energy expenditure, as eating less is associated with a decrease in thermogenesis. A reduction in body mass will both reduce resting energy expenditure and the amount of energy required to execute motor activities. This might result in suppression of thermogenesis (Dulloo, 2007) and makes it more difficult to achieve long-term weight loss in diet-only interventions. The inclusion of physical activity or exercise not only increases energy expenditure directly because of increased activity but has also been associated with an increased metabolic rate (van Baak, 1999). Physical activity or exercise has therefore the possibility to compensate the reduction in energy expenditure associated with weight loss in diet-only interventions (Wu et al., 2009).

In summary, this literature review on diet, exercise, and diet-plus-exercise treatments shows the major limitations associated with studies, regarding the long-term effectiveness of such interventions to maintain weight loss. For example, Winkler (2005) states that "the basic problem with comparative diet trials is our inability to measure what people eat. All conventional instruments depend on subjects' reports. Most trials lack independent biochemical or genetic measures of intake" (p. 199). Other problems identified by Winkler (2005) concern accurate causal relationships between the independent and dependent variables; problems with under-reporting of food intake in the obese; many researchers use correlations to show diets' effects on other risk factors, like triglycerides, which lead to misleading associations if one of them is incorrectly measured. Overall, until these methodological limitations are adequately dealt with it is very difficult to make any viable conclusions about the effect of diet, and diet plus exercise on weight loss, both short- and long-term.

3.14. Can physical activity/exercise interventions serve as gateways for changing other health behaviours such as healthy eating?

Before answering this question, it is pertinent to make a distinction between PA and exercise as it is often used inter-changeably in the exercise science literature. Caspersen, Powell, and Christenson (1985) defined physical activity as 'any bodily movement produced by skeletal muscles that result in energy expenditure. The energy expenditure can be measured in kilocalories. Physical activity in daily life can be categorised into occupational, sports, conditioning, household or other activities' (p. 126). In other words, their definition refers to habitual physical activity associated with daily living. They defined exercise as 'a subset of physical activity that is planned, structured, repetitive, and has a final or an immediate objective: the improvement or maintenance of physical fitness' (p. 126). They refer to physical fitness having a 'set of attributes that are either health- or skill-related' (p. 126). They argued that these two attributes could be measured with specific tests. This is particularly important with regards to obesity and the role of PA and exercise in this condition. Physical fitness was defined as a 'set of attributes that people have or achieve, and the ability to carry out daily tasks with vigour and alertness, without undue fatigue and with ample energy to enjoy leisure-time pursuits and to meet unforeseen emergencies' (p. 126). Many studies a) do not distinguish between these two terms; b) they are often vague regarding the description of such interventions; c) it is unclear how much of

PA or exercise one has done in a therapeutic session, which is supposed to improve a condition; and d) fitness (e.g. cardiorespiratory and muscular endurance; muscular strength, body composition; flexibility) is often not measured in obesity studies, but instead they measure self-reported total physical activity/exercise patterns. Therefore, the studies in the forthcoming section will be discussed in the light of the above statements and limitations. Dutton, Napolitano, Whiteley, and Marcus (2008; p. 216) have asked the question: is PA a gateway to diet behaviour, when conducting research testing the idea that if physical inactivity and poor diet co-occur, can then a physical activity intervention alone make a difference in eating behaviour? Predominantly Caucasian women (94.6%, n = 280, with a mean age of 47.1) were randomly allocated to three 'print based' (e.g. not actual PA, but educational) conditions: individually tailored, gender-targeted PA and a wellness/control condition. The women completed baseline, three, and 12 months' measures on physical activity and dietary behaviours. The authors put forward a number of assumptions that prompted their research that PA can act as a gateway behaviour to dietary improvements: 1) successful PA experience promotes self-efficacy and motivation which might spill over to eating behaviours; 2) realisation of health benefits of PA may prompt individuals to examine other health behaviours; and 3) individuals may adopt subsequent dietary changes in addition to their PA if they wanted to manage their weight. They found that participants in the study reported significantly lower dietary fat intake over the year, but fruit and vegetable intake did not increase. However, initial sub-analyses between baseline and three months showed a significant increase in fat intake. On the contrary to the authors' interpretation, saying that this finding shows that one health behaviour is associated with a negative change in another, it might be that participants felt able to experiment with their diet to gage how PA may or may not affect their weight status, which is probably a good thing since it indicates engagement. Alternatively, it maybe that the educational sessions did not work, as participants failed to understand the calorie expenditure related to PA. The authors concluded that the overall fat intake decrease could not be attributed to PA and some unknown aspect of the trial may have had this effect on dietary behaviour. This study had a number of serious methodological flaws, such as a) there was no actual physical activity intervention; b) all results were associations based rather than causal; c) all data collected was self-reported, poor measures of diet were used, and overall calorie intake was not measured; and d) the duration of study was too short to observe any ‘spill-over’ effects. Despite the methodological flaws, the idea that PA/Exercise alone was tested as a means to initiate overall health behaviour change is a compelling one.

It long has been acknowledged that exercise participation improves general health independent of an individual’s size, as fitness appears to be a greater determinant of disease and mortality than fatness (e.g., Barlow et al., 1995). However, exercise alone in the past was seen to be an insufficient method for weight loss and therefore was not considered a viable treatment option by clinicians. However, as Ross et al. (2000) argued, this assumption is flawed. For example, the age and BMI of participants in exercise groups in obesity intervention studies appear to be significantly lower (36.5 years; BMI 26.4 kg m^2) in comparison to participants in diet (40.0 years; BMI 34.9 kg m^2) and diet-plus-exercise (39.5 years; BMI 34.8 kg m^2) conditions (Ross et al., 2000). This is problematic and it suggests that the demographic and anthropometric characteristics of different intervention groups are not comparable and are producing spurious results. It also appears that participants in exercise-only conditions are not obese, but only marginally overweight (e.g. they don’t have functional limitations akin to those in higher BMI categories). In addition, Ross et al. argued that the exercise strategies used in obesity interventions are not strenuous enough to achieve greater weight loss. Similarly, Miller and Wadden (2004) also argued that most exercise-alone trials were based on moderate or light forms of exercise, such as walking 3-4 times a week for 20-30 minutes, and therefore did not match achieved weight losses with calorie restrictive diets. Qualitative research has shown that obese individuals find exercising difficult. There are a number of reasons for this, including functional limitations due to excess adipose tissue, physical health problems, and pain. In addition, costs of gyms, subscriptions, or personal trainers, lack of suitable facilities or exercise opportunities and the notion that exercise requires significant emotional and physical effort have also been mentioned as barriers (Thomas, Hyde, Karunarantne, Kausman, & Komesaroff, 2008). Similarly, Miller et al. (1997) refer to the Harrison's Principles of Internal Medicine, where it is stated that exercise was a good method to increase energy loss for weight reduction, but it questioned the possibility for obese individuals' ability a) to embark on an exercise regime and b) to sustain it over time. At the same time they also acknowledge that exercise plays a role in the maintenance of weight loss. Unfortunately, as previously mentioned only a very few exercise interventions measure fitness parameters. Furthermore, increased risk of orthopaedic injury is often poorly understood by those who run obesity interventions, unless is it based in a specialist clinic, where often previously sedentary individuals are closely monitored to achieve higher intensity exercise output (Miller et al., 1997). Nevertheless, since the early 1970s, studies consistently confirmed that body fatness reduction could be achieved through relatively moderate exercise without calorie restrictions, when administered over a longer period of time (Depres, Pouliot, Moorjani, & Nadeau, 1991; Tremblay, Simoneau, & Bouchard, 1994; Gwinup, 1975).

Shaw, Gennat, O'Rourke and Del Mar (2006) in a Cochrane review recently examined whether exercise RCTs in adults can reduce body weight in overweight and obesity. In their review, they've included 43 RCTs with 3476 participants. Overall, they found that exercise resulted in a small, but significant weight loss in comparison to no treatment controls. Also, exercise in combination with diet resulted in greater weight loss (an additional 1.1 kg) than diet alone. These findings are similar to earlier reviews by Miller et al. (1997) and McTigue et al. (2003). Exercise intensity was found to be a significant moderator. That is, high intensity exercise resulted in an additional 1.5 kg weight loss in comparison to low intensity exercise but only when executed without dietary changes. Shaw et al. (2006) found that although benefits of light intensity activity on body weight have been less extensively studied (Dionne, Ades, & Poehlman, 2003; Stewart & Hays, 1997; Westerterp & Meijer, 2001), walking (moderate activity) was no more effective for weight loss than light exercise such as calisthenics and stretching (Jakicic, Wing, Butler, & Robertson, 1995; Ross, Rissanen, Pedwell, Clifford, & Shragge, 1996). Additionally, Ballor and Keesey (1991) in their meta-analytic study found that effectiveness of exercise for weight loss is directly related to the initial degree of adiposity and volumes of exercise completed.

The above findings are particularly important implications for the use of exercise specifically for weight loss in obesity treatments. The content of this literature review supports the non-dieting and HAES approaches' call for the focus of obesity treatment outcome to be health and quality of life, including fitness, instead of weight maintenance/loss. Therefore, this PhD's primary outcome measures will be psychological and physical health and fitness, and the secondary outcome measure will be weight loss. In particular, Shaw et al. (2006) also found that exercise had also some beneficial effects on some physiological outcome variables even in the absence of weight loss. Exercise was associated with a decrease in diastolic blood pressure (-2 mmHg), triglycerides (-0.2 mmol/L) and fasting glucose (-0.2 mmol/L). Also, higher intensity exercise resulted in a larger reduction in fasting serum glucose (-0.3 mmol/L) in comparison to lower intensity exercise. These findings suggest that exercise has a positive effect on intermediate outcomes often associated with cardiovascular disease risk factors, whereas weight loss associated with calorie restrictions does not appear to have many long-term health benefits. However, there are further secondary benefits associated with exercise (e.g. improvement observed in metabolic risk profiles; body composition changes, improvements in flexibility, fitness, and strength – Dubbert, 2002).

Exercise or regular physical activity appears to be important for long-term weight control (Pronk & Wing, 1994; Tremblay, Doucet, & Imbeault, 1999). There is both anecdotal and empirical evidence for this assumption. For example, case studies suggested that participants who maintained weight loss without exception engaged in regular exercise (e.g., Kayman, Bruvold, & Stern, 1990). For example, in a study by Wadden, Vogt, Foster, and Anderson (1998) participants in the diet-only condition complained about the fact that they were deprived of the 'key to success (i.e., exercise)' (p. 432). Secondly, clinic and participant reports of prospective studies generally show that those who maintain weight loss regularly exercise (e.g., Hartman, Stroud, Sweet, & Saxton, 1993). Finally, as will be discussed below, studies in which participants receive diet and exercise maintain larger weight losses than those receiving only a diet intervention (e.g., Skender et al., 1996).

One unique study by Gwinup (1975) depicts the relevance of exercise for obesity treatment. He recruited 29 women and five men who failed to maintain weight loss on dietary restrictions alone. In line with the self-determinations literature and well before this theory was formed, or the non-dieting approaches, Gwinup asked his participants not to change their diet and allowed them to choose their own form of exercise. Although the dropout rate was high (62%, all women), those who remained in the study persisted with exercise and managed to increase their daily exercise to at least 30 minutes or more. Out of those who remained in the study for a year (72%) exercised more than two hours a day. This indicated that previously sedentary failed obese dieters could be physically trained within an appropriately matched exercise regime that is progressive and met the needs of the participants. Interestingly, no weight loss occurred until participants took at least 30 minutes of exercise per day, and further weight loss was significantly related to length of duration of exercise per day. The important finding here is the effects of regular exercise. At the end of the study, on average participants lost 10kgs, ranging from 4-5kg to 13.5kg by the end of the yearlong study. Given the obesity status of participants, the favourite and dominant choice of activity was walking over more vigorous activities such as jogging. The participants also felt considerably fitter. Therefore, this PhD will focus on introducing an accumulative and regular exercise programme (e.g. start at the fitness level of the participants, even if it means that they can only do 5 minutes of exercise) that is matched to the participants' needs, whilst providing choice within an appropriate structure for progression.

There is also very little discussion in the lifestyle literature about the type and amount of exercise that should be prescribed (Brownell, 1998). Also the mechanisms that links exercise to weight control are still unclear, apart from the simplistic 'calorie in – calorie out' or energy expenditure theory. It is also unclear what the relevant mechanisms are for psychological improvements such as self-esteem and mood. This PhD's physical activity component and structure development was guided by Poston, Suminski, and Foreyt's

(2000) guidelines. These suggested screening for specific health concerns (e.g. various diseases, and functional limitation, such as osteorthiritis), which guided the recruitment criteria and aims to reduce barriers to participation. Low-to moderate intensity activity will be planned, even though the above literature review states the most effective exercise intensity type for weight-management is vigorous. The aim of this PhD is to engage and provide a meaningful and eventually pleasurable physical activity experience for participants, even though it may not lead to weight loss at all or improve their health in a very short term. Safety concerns, such as pre-intervention medical screening, weight history, and number of instructors per exercise sessions were considered (see Chapter 4 Method for exact intervention details).

Finally, PA and exercise behaviour does not exist in a vacuum. Apart from personal attributes, PA and exercise takes place mainly in a public space rather than in one's home environment. Fox and Hillsdon (2007) summarized the problems associated with PA and obesity in the UK from the socio-cultural and environmental point of view. PA in its own right is as complex of a behaviour as smoking and alcohol consumption. In the UK, it is unclear what the population PA patterns and trends are at a national level (Wareham, 2007). Fox and Hillsdon (2007) stated that PA has a relevance to 'several government departments – education, transport, environment, culture and sport, and health. There has been no single department or cross-department agency with responsibility for physical activity policy and no scientific advisory group, so it (PA) has suffered from being everyone's, but no one's responsibility' (p. 115). This is also supported by an earlier discussion of Miller et al.'s (1997) argument that most agencies dealing with obesity treatment decisions lack specific subject knowledge about the value of that particular domain, in this case PA. Fox and Hillsdon (2007) argued that increasing opportunities for PA in the local and national environment is key success to the health of the nation. Indeed, Lee, Blair, and Jackson (1999) showed that one can be fat and fit at the same time, as fitness significantly reduces disease risk factors even in the case of seriously overweight and obese, which in turn will save lives and reduce health care costs. This PhD's PA intervention will take place in a local authority run facility. Unfortunately, the sports venues that were available were over 20 years old, the implications of which was conveyed in the Audit Commission's (2006) report, which surveyed all existing stock of public sector sport and recreation facilities. They found that 75% of all facilities were in need of refurbishment as they were in poor condition. There was little evidence that local authorities were building new sport and recreational facilities. It appears that the private sector plays a major role of providing such recreational spaces, which has implications for access from the lower socioeconomic groups and their health status. Yet, again they are disadvantaged because they can't afford a safer and healthier place to exercise. Indeed, there is evidence that the environment one exercises in is an important motivator (e.g. availability of parks, play grounds, cleanliness, and upkeep of neighbourhood; Ellaway, Macintyre, & Bonnefoy, 2005). For example, pedestrian safety was negatively associated with location of bus stops and crossings and poor lighting (Transport Research Board and Institute of Medicine, 2005). This PhD's exercise sessions will be taking place in a centrally located leisure centre for easy access, but will compromise on other issues, such as the overflow car park currently is poorly lit.

3.15. Weight loss maintenance

As can be seen from the above reviewed literature, individuals find it really hard to initiate, do, and maintain a health behaviour such as exercise and/or healthy eating. As Jeffery (1987) stated 'the most pressing continuing challenge is maintaining weight loss… obesity should be viewed as a chronic condition requiring long-term supportive care' (p. 20). An undesirable outcome of lifestyle based interventions for obesity is the setting up of an individual for failure, if they are not able to maintain their progress in trials. Such failures are often accompanied with feelings of guilt, anger, depression, and anger at oneself for not having the 'will-power' to overcome weight difficulties. Such negative emotions often are precursors for replace and return to previous habitual behaviours. Perri, Nezu, and Viegener (1992) identified a number of strategies that they've viewed to enhance maintenance in behavioural based weight loss trials. They suggested that 1) there should be a continued professional guidance after initial treatment (this would depend on the nature of the intervention); 2) skills training for patients to enhance their self-efficacy in managing their new behaviours and plan for challenges post treatment (e.g. action and coping planning); 3) social-influence programmes, to provide increased social support after treatment; 4) increased physical activity, where participants experience positive physical and psychological benefits, that aid long-term adherence to new behaviours; 5) multi-component interventions that combine several procedures to help the individual in treatment. In addition, Bidgood and Buckroyd (2005) suggested that in order to maintain weight loss individuals require continuous professional (e.g., counselling, dietary and exercise advice) and social support.

Despite considerable knowledge as to why treatments do or do not work, to date very few studies implement these behavioural structures into their exercise treatment protocol. Furthermore, often there is a distinct lack of behaviourally relevant post-treatment support, self-monitoring, and continued social involvement. Therefore, this PhD will ensure that participants will not be set up for failure, as all exercise based programmes will be developed in view of sustainability post treatment. Participants will be able to join the Tai Chi club on their own accord. The circuit class is being developed with collaboration with the local council and physical activity providers, so the classes will be offered at the reduced rate on the same terms (e.g. structure, broad content, and progression) for indefinite period until there is a demand for such a class. Furthermore, the aqua aerobic class is already widely available across leisure centres where participants can continue to go after the trial ends. All of the instructors work with the researcher (EB) towards sustainability, in anticipation that EB will withdraw from the scene after the 1 year follow up period. However, there are arrangements being made to enrol these classes across the leisure centre in the city, if the trial deems to be successful.

On the whole it appears that treatment of obesity is a long-term process, however the rate of recidivism is high and complete success is rare (Rossner, 1995). Through the literature review it has been established that exercise is key for maintenance of weight loss. For example, the most cited work in support of this is Kayman, et al.'s (1990) who found that a total of 92% of those participated in their trial maintained their weight loss in a treatment programme were regular exercisers. In this study they've tried to discriminate between 'relapsers', 'maintainers', and controls. They defined maintainer as someone who maintained the weight loss they've achieved within this trial over two years; a relapser was defined as someone who lost 20% of their body weight, but regained it within two years. Interestingly, they found that 76% of the maintainers described exercise as a 'weight-loss method' as oppose to 36% of relapsers. Although, this was a correlational finding, the finding is in line with many studies' that show that maintenance of weight loss enhances adherence and is motivational. Relapse prevention is a key aspect of weight maintenance, both in exercise and dieting behaviours (Brownell, 1998). For example, Dohm, Beattie, Aibel, and Striegel-Moore (2001) in a study with a large sample of successful (n = 606) and unsuccessful (n = 606) female and male dieters showed that more direct coping and more independent, autonomously driven behaviour resulted in seeking less support from program managers and were the best predictors of weight-loss maintenance. However, contrary to predictions and other empirical findings, this study did not find that frequency or intensity of exercise distinguished between those who maintained weight loss or those who regained weight. A possible reason for this finding was the self-reported intensity and frequency of physical activity and exercise behaviour in this study.

Further evidence for the effectiveness of addition of physical activity/exercise programmes in the maintenance phase comes from Fogelholm, Kukkonen-Harjula, Nenomen, and Pasanen (2000) who showed that the inclusion of a moderate intensity walking programme following a VLCD significantly improved maintenance of weight loss in premenopausal obese women. Similarly, Villanova et al. (2006) found that a specific fitness programme during the weight maintenance phase of a behavioural programme significantly improved weight loss, weight loss maintenance, and aspects of the metabolic syndrome in obese and overweight participants. Finally, Dohm et al. (2001) suggested that coping training to help dieters against dietary relapses might be an important strategy to maintain weight loss, which could also be adapted to other health behaviours, such as exercise. Ultimately, successful long-term weight-management will depend on the ability of the individual to alter their behaviour patterns, in particular in relation to diet and exercise. The question remains “Do health care professionals fail to teach weight maintenance behaviour”, as many treatment programmes do not include this element, and if they do, then professionals fail to implement them (Fairburn & Cooper, 1996; Foster & Kendall, 1994). Fairburn and Cooper (1996) also argues that weight loss expectations of participants are poorly managed, which hinders weight maintenance, as they expect to lose unrealistic amount of weight through dieting and exercise. Failure to achieve this weight loss then reinforces their view of their inability to influence their weight status (Wolfe, 1992). In fact Wolfe (1992) suggested that small weight losses are unacceptable for participants, so they give up and regain the lost weight.

In summary, what prevents weight regain is still a problem for this field of study. However, what is clear that a ‘successful outcome in the care of the obese person should not be viewed solely in terms of weight loss’ (Perri & Fuller, 1995, p. 267). Furthermore, ‘the care of the obese adult requires a perspective that acknowledges the complex, chronic natures of obesity. Since, there is “no” cure for obesity, the care of the obese person should be viewed in terms of long-term management akin to the treatment of other chronic conditions such as hypertension’ (p. 267). Finally, to conclude the findings of this literature, individuals who repeatedly failed to lose weight with one or a combination of approaches, should be offered a tailored programme. Furthermore, identification of participants who need to lose weight versus those for whom the health hazards of weight cycling outweigh the potential benefits, are crucial. Interventions for the obese should promote the development of healthy lifestyle, instead of weight loss, as fitness and not fatness is related to disease and mortality in epidemiological studies (Miller, 1999).

3.16. Overall limitations of literature reviewed on interventions

3.16.1. Overall limitations of studies

Current obesity interventions favour the calorie restrictive approach. Physical activity as a sole alternative to such approach (with behavioural therapy) has been rarely considered, despite that the use of physical activity or exercise alone might be as effective long-term as calorie restriction short-term. Exercise promotes energy expenditure, which also could lead to weight loss, but with a slower but more permanent effect. However, studies examining this are nonexistent, as those who looked at the effectiveness of exercise alone did not have long-term follow ups (e.g. five years or more). There is, however, some agreement on what constitutes short- and long-term treatment success. Six months is generally considered the time point for initial weight loss whereas trends in weight gain are examined at 1 or 2 year follow-up. However, as previously stated, 5-year follow-up data are required for a meaningful clinical outcome assessment (Jeffery et al., 2000). In addition to diet and exercise, behavioural therapy or cognitive behavioural therapy (CBT) should be added in obesity interventions to enhance healthy eating behaviours and motivation to be physically active or engagement in formal exercise.

3.16.2. Designs

Most studies used cross-sectional designs, with short-term follow-ups. Furthermore, all associations are based on correlations rather than causal relationships. Choice of outcome measures has also been problematic. Definitions of various constructs are often vague or poor. For example, exercise and PA is often used interchangeably, and habitual physical activity is almost never defined adequately. There is a lack of well designed RCTs, which would be a desired methodology to use.

3.16.3. Populations

A problem with the current state of obesity interventions' choice of population in adults is that they have generally used middle-aged, moderately obese, Caucasians (Miller et al., 1997). For example there are only a few studies, which have investigated the effects of race, age, or menopausal status (Ross et al., 2000). Most studies are favouring to target women therefore there is a definite gender bias. Sub-populations are poorly studied. For example, there is a qualitative difference of treatment engagement by different weight status within the obese categories, as well as the higher categories scoring worse (e.g. biased) on all health related indices. These population differences are rarely acknowledged in discussion and outcomes of research. Most studies use or limit the degree of obesity (e.g. BMI of 35kg/^{2} or below) due to measurement difficulties. The studies also presume that inactivity is the cause of obesity, when it could be due to having obesity. Grilo (1995) argues that most exercise interventions studies fail to calculate energy expenditure due to PA and/or exercise based on the caloric costs of the PA adjusted for body weight, the consequences of which are distorted results.

3.16.4. Instruments

There are various methodological problems present in the reviewed literature. Although, there are a variety of methods to measure PA and exercise, the majority of time studies rely mainly on self-reported exercise frequencies and intensities. There are also a limited number of studies that use more objective measurements, such as activity monitors, time-lapse photography, and respirometry chambers (Grilo, 1995). Each of these methods are subject to limitations (e.g. overestimation of frequency and intensity of exercise), even within similar methodologies (e.g. depending what kind of activity monitor was used, the results can vary greatly). Grilo (1995) argued that there is a poor correlation between measurement points regarding habitual physical activity and energy expenditure induced by a trial. As Bouchard, Despres, and Tremblay (1993) stated there is ‘no clear understanding of the role of habitual physical activity in the difference of body energy content between normal weight and overweight or obese persons is likely to emerge until this methodological deficiency is overcome’ (p. 134).

In behavioural treatment studies, there is a dearth of inconsistencies over the use of behavioural therapeutic techniques. Some used are goal-setting, self-monitoring by using keeping diaries, and stimulus control, whereas some of the cognitive techniques include identifying and modifying aversive thinking and mood states (Shaw et al., 2005; Wadden et al., 2004a), which are not always desirable (e.g. one does not want to feel permanently guilty for having a cheese cake).

3.17. Conclusion intervention studies

On the whole the treatment principles today are not much different from those 30 years ago. Standard conservative treatment includes diet, exercise and behavioural modification/CBT. Problems with many of these studies are relatively high dropout rates. In addition to this, surgical procedures (with the aim of restricting absorption) and drugs have been introduced with or instead of lifestyle-based treatment options. With regard to the latter, drugs are now available to depress appetite, increase basal metabolism, or increase energy malabsorption (Rossner, 1995). In summary, there is no clear definition what is considered to be a successful intervention. The emphasis on weight loss as the primary outcome measure has also been problematic. Although the ultimate aim of most interventions is to normalise body weight and maintain this over time this is not often achieved. In addition, there has been a move away from weight as the primary outcome measure to other health indicators including quality of life.

3.18. Motivation

3.18.1. Introduction

'There is nothing so practical as a good theory' (Lewin, 1951, p. 169).

3.18.2. Why is there a need to use theoretical frameworks in weight-management?

In modern times, countless weight-management approaches and government initiatives have failed to halt the rising obesity rates (Lean, 1998). An average 0.8 kg per year weight gain is expected without specific care to maintain existing weight (Winett, Tate, Anderson, Wojcik, & Winett, 2005). Furthermore, the evidence base for obesity interventions remains inadequate, despite substantial government and research drive (Avenell et al., 2004c). Additionally, the goals of weight-management have shifted from weight loss to avoiding weight gain, achieving moderate (about 5-10%) weight loss by a variety of different approaches, including lifestyle change, and management of other risk factors associated with weight problems (Lean, 1998). Lean also questioned what was practical and theoretically achievable weight loss, as well what was needed to improve health. However, weight-management programmes have improved exponentially since the 1970s (Wadden, Sarwer, & Berkowitz, 1999); despite this there is pessimism about how successful treatments can be (Wing & O'Hill, 2001). For example, the discovery of leptin, recent findings exploring the contribution of genetic factors to obesity, and with improved efficacy of lifestyle treatment approaches, obesity treatments rates have considerably improved (Wing, 2004). Consequently, success is defined by Wing and O'Hill (2001) as: 'intentionally losing at least 10% of initial body weight and keep it off for at least a year' (p. 323). Nearly all weight-management programmes have restrictions of calories (diet) and increased physical activity in their strategies (NTFPTO, 2000). Moreover, Bowen, Erickson, Martens, and Crockett (2009) showed that decision-makers found that 'using evidence' means simply 'using formal research findings and quantitative data' to support their position (p. 99), and does not include the use of evidence-based theoretical frameworks. Indeed, there is a distinct lack of implementation of theoretical findings in lifestyle research. Instead, what is often called evidence-based research is effectively an evaluation model (e.g. Laws, 2004), mainly due to cost-effectiveness requirements and accountability for services (Parry, 2000). Much of weight-management research is devoid of theoretical direction even now, and deemed to be descriptive, such as reporting simply comparisons of static group profiles.

Wing and Jeffrey (2003) argued that poor results in weight maintenance might be due to problems associated with psychological and behavioural adjustments to the process of weight loss rather than to the underlying physiological mechanism. Managing one's weight through lifestyle change requires motivation. Weight-management is an inherently difficult task, as it necessitates multiple behavioural adaptations in a controlling environment. For example, most individuals who participated in research-based interventions programmes were 'told' to lose weight, either by their families or doctors, which has an impact on their motivation to succeed. Furthermore, many obese patients who seek treatment often report elevated levels of depression and increased eating in response to negative emotional reactions (Wadden & Stunkard, 1985; Rodin, Schank, & Striegel-Moore, 1989), which indicates an apathetic and maybe alienated existence, where they are asked to make substantial changes to their current habits and behaviours. As Ryan and Deci (2000) would say, they lack persistence, proactive engagement, and positive tendencies, behaviours that are required for optimal functioning in the social environment. Therefore, this thesis will be guided by the self-determination theory's tenets (SDT; Deci & Ryan, 2002 & 1985a; Ryan & Deci, 2007 & 2000) in order to understand how self-regulation enhances or thwarts adherence and engagement with a yearlong weight-management programme.

3.18.3. Nature of motivation

Ryan and Deci (2000) define motivation that ‘concerns energy, direction, persistence and equifinality – all aspects of activation and intention’ (p. 69). Individuals were said to be motivated when they were *moved* to do something (Ryan & Deci, 2000). Motivation is a key to human existence and plays a central role in people’s lives regardless of their social background. As Roberts (2001) said ‘the history of motivation theory has been the search for the “right theory”’ (p. 3) to explain human motivation. However, thus far, none of the 32 general motivation frameworks can fully explain why people do what they do (Deci & Ryan, 1985a; Ford, 1992, Roberts, 2001), as individuals participate in activities for widely differing reasons. Historically, the failure of motivational theorists to recognise the capability of individuals for self-direction, autonomous decision making, and personal responsibility (Roberts, 2001) has been problematic. However, the essence of the Self-Determination Theory is exactly that, as it explores key self-regulatory processes that may drive participation (Deci & Ryan, 1985a; Ryan & Deci, 2007 & 2000). SDT views humans as active rather than reactive agents of their actions and assumes that they can reach new levels of expression and functioning, which takes place in a dialectical or cyclical manner, oscillating between impending challenges, coping responses, and new challenges (Sheldon, Williams, & Joiner, 2003). The unique aspect of SDT is the connection between inter- and intra-individual explanations of motivation, which states that even though humans are negentropic creatures within, they also have a need to integrate themselves with their environment (Ryan & Deci, 2007). However, as Sheldon et al. (2003) pointed out, it is not a linear process; people can be stuck in maladaptive functional patterns, if they are overwhelmed by their circumstances (e.g. social deprivation) or if they are not sufficiently challenged by their existence.

SDT has been widely used in sport and exercise science, as ‘it is the only major theory of human motivation that both acknowledges spontaneous, intrinsically motivated activity and pinpoints the factors that either enhance or debilitate it’ (Ryan & Deci, 2007, p. 1). Sheldon et al. (2003) define motivation ‘as the psychological forces that impel continued effort toward a goal, regardless of the (immediate) success of that effort’ (p. 45). This definition is particularly pertinent to the maintenance of regular exercise (habit formation), as goal structures associated with such behaviour are complex (e.g. body image, weight loss, preservation or improvement of health status etc). As Sheldon et al. stated ‘there is no terminal goal insight’ (p.45) and this has an effect on the continued motivation to exercise. Taken together, the definition of motivation implies that in addition to the goal of a treatment, one has to have the impetus to achieve it (Deci & Ryan, 1985a), i.e. have the energy to attain the goal. SDT furthermore assumes that people are naturally oriented towards growth, health, and enhanced self-regulation. Therefore, both the practitioners and the clients have a goal in common (e.g. health improvement). Then why don’t people do what is good for them? The problem with exercise is that it is not always a sociable activity and it requires a lot of individual effort and pre-planning. It is also difficult to vary the activities and achieve progression that result in increased fitness and feeling of well-being, especially if someone has a weight problem, as they are functionally limited, may experience pain, and probably unable to do regular physical activity with the intensity required to induce weight loss. Therefore, their impetus/energy is ‘easily eroded’ and ‘fragile’ (Sheldon et al., 2003, p. 46). Furthermore, alternative activities, such as socialising with friends, watching TV with or without family, playing games and so on are much more comfortable and pleasurable than getting out in the cold to go for a run.

Motivation is also moderated by psychological functioning. For example, if someone is distressed and lives in poor social circumstances, they might be susceptible to a variety of unhealthy behaviours (e.g. smoking, drinking) as the prevalence of unhealthy behaviours is statistically much higher amongst people in socially deprived areas. There is on average 17 years difference in 'disability free life expectancy between those at the top and those at the bottom of the economic ladder' (Marmot, 2010). For men in poor areas the gap has widened by 2%, and for women the figure is 11% over the last 10 years. Additionally, according to SDT assumptions, individuals' natural motivation toward health may be subverted when they feel that others are infringing on their freedom of choice (Sheldon et al., 2003, p. 47), meaning that if societal forces (e.g. government social services – taking obese children on 'at risk' lists) act as 'controller', they may in part spite the controller. This is an example of thwarting someone's motivation to be healthy. That is why using a theory like SDT to inform intervention studies is extremely important.

3.18.4. The theory – Self-Determination Theory (SDT)

3.18.4.1. Introduction

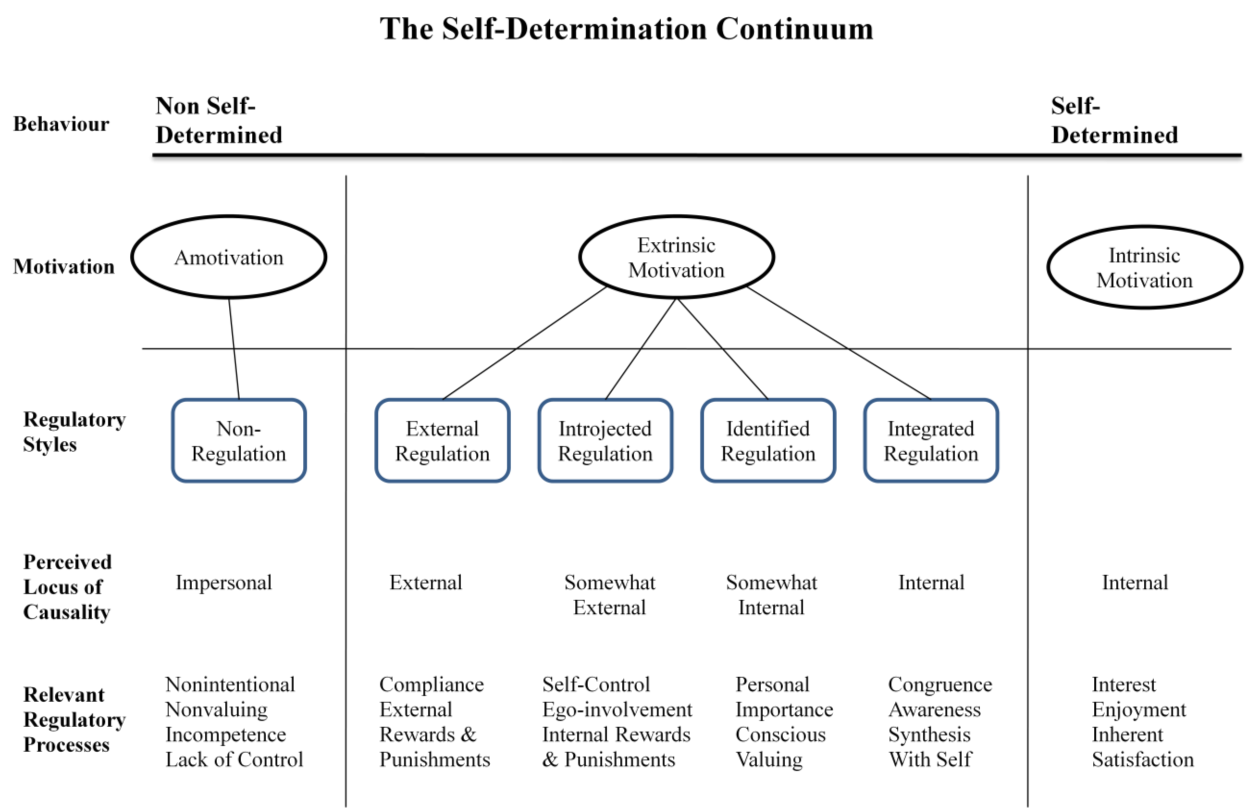
The propositions of SDT are well researched by 30 years of high-quality experimental and longitudinal data. SDT is a unifying motivational theory that takes a dialectical view of interaction between the active, integrating human nature and the social context that may thwart or nurture this tendency with relevance to all life domains (Deci & Ryan, 2002). In the history of motivational research White (1959) used the word 'effectance' or innate need for mastery in the absence of external rewards, effectively naming intrinsic motivation (IM). IM was the first building block of SDT, which was further developed and expanded upon by Deci and Ryan (1985a) and Ryan and Deci (2000 & 2007). *Intrinsic motivation* in SDT is defined as the 'inherent propensity to actively develop skills, engage challenges, and take interest in new activities even in the absence of external prompts or rewards' (Ryan & Deci, 2007, p. 2). As the theory evolved definitions of new types of motivational states emerged, such as extrinsic forms of motivation and amotivation. Ryan and Deci (2007) define *extrinsic motivation*, which concerns all instrumental behaviours, as follows: 'the behaviour is motivated by expected outcomes or contingencies not inherent in the activity itself' and *amotivation* as: 'not having either intention or energy toward action' (p. 6). The unique aspect of SDT is that it does not polarise intrinsic against extrinsic motivation, but views motivation as a continuum of behaviour that is contingent on environmental and personal influences. For example, SDT assumes that one can hold both extrinsic and intrinsic motives simultaneously, and the interaction of these influences will decide the quality of the overall motivation displayed by a person (Ryan & Connell, 1989).

Furthermore, it proposes that the extrinsic motivation behaviour can be experienced as highly autonomous or highly controlling, depending on the interplay between the person and its environment. The self-determination theory explains this complexity through four mini theories.

3.18.4.2. Brief description of the four mini theories of SDT

Figure 4.1 depicts the four mini theories of SDT. They are: Cognitive Evaluation Theory (CET; Deci, 1975; Deci & Ryan, 1985b & 1980); Organismic Integration Theory (OIT; Deci & Ryan, 1985b; Ryan & Connell, 1989); Basic Need Theory (BNT; Deci & Ryan, 2000); and the Causality Orientation Theory (COT; Deci & Ryan, 1985b).

Figure 3.1: The Self-Determination continuum showing types of motivation with their regulatory styles, loci of causality, and corresponding processes (Source: Ryan & Deci, 2000: p. 72).



3.18.4.3. Cognitive evaluation theory

Cognitive evaluation theory (CET) proposes that experience of competence and autonomy are both necessary conditions for the maintenance and enhancement of intrinsic motivation. It identifies environmental contingencies (e.g. rewards, feedback, or external motives) and links them to the adoption of intrinsically or extrinsically motivated behaviour (i.e. whether these influences are perceived as informational or motivating, controlling or amotivating.) *Informational* aspect of an event or a situation refers to an individual receiving competence and autonomy supportive feedback that in turn enhances intrinsic motivation and leads to self-determination. However, it should be noted that this is not always the case, as Ryan, Mims, and Koestner (1983) showed that positive and informational feedback can also be experienced as controlling if they are given in a pressuring climate. A *controlling* aspect refers to perceptions of pressure to act and behave in a particular way, which in turn undermines intrinsic motivation and self-determination, again depending on the interpersonal environment (Reeve & Deci, 1996). Finally, an *amotivating* orientation results in feelings of incompetence and loss of autonomy. It appears that self-determination may be more important for intrinsic motivation than perceived competence (Markland, 1999). Furthermore, these three aspects can operate both intra- and inter-individually, as internally informational events foster self-determination and intrinsic motivation, but internally controlling events will undermine both self-determination and intrinsic motivation. Similarly, externally informational events may foster or thwart self-determination and intrinsic motivation, depending on the person's internal regulation. In summary, CET is primarily concerned with the effects of specific social context on motivation, self-regulation, behaviour, and experience.

3.18.4.4. Organismic integration theory

Originally, the organismic integration (mini) theory (OIT) was explicitly formulated to explain different forms of extrinsic motivation, their development, and dynamics. However, it is now extended by research on the 'Internalisation' process. OIT aims to explore how values and motives are integrated within the self and their influence on self-regulation. For example, it systematically examines the degree to which individuals experience autonomy whilst holding extrinsic motives or engages in extrinsically motivated behaviours (e.g. doing an activity for a reward or out of guilt). It describes the process of how people integrate cultural and societal values into their self-systems. OIT also proposes that relatedness is crucial for promoting internalisation of behaviours. Ryan and Deci (2002) views *internalisation* as 'a natural process in which people work to actively transform external regulation into self-regulation, becoming more integrated [into their environment] as they do' (p. 15). Four types of self-regulation for extrinsic motivation are proposed by OIT, which differ in the degree to which they represent autonomy. They define *external regulation* as: 'the least autonomous form of extrinsic motivation' (p. 17). Behaviour is externally regulated, when one is doing an activity for a socially constructed contingency such as reward, punishment, and guilt, or external pressure (e.g. to satisfy an external demand from a doctor: be active and eat less). *Introjected regulation* is defined as when: 'external regulation has been internalized, but not, in a much deeper sense, truly accepted as one's own' (p.17). It is still a very controlling form of internalisation, when the person is still doing the activity either for ego-involvement (Ryan, 1982) and/or to avoid guilt or shame. *Identified regulation* is defined as: 'more self-determined form of extrinsic motivation, for it involves a conscious valuing of a behavioural goal or regulation, an acceptance of behaviour that is personally important' (p. 17). This form or regulation implies the person started to take ownership of the behaviour either due to feeling the benefits of their actions (e.g. feeling fitter as a result of exercise, learning new exercise skills, more socially connected), but they don't fully endorse it as yet. However, these experiences can be still relatively separated from an individual's believes and values. For example, a person still remains at risk of ceasing exercise after restoring original health parameters. *Integrated regulation* is defined as: 'most autonomous forms of extrinsically motivated behaviour' (p. 18). In this phase the behaviour is endorsed by the self, the person has taken on values and goals of the activity. This regulation shares a lot of qualities with intrinsic motivation, but the difference is that the person is still doing the activity for external reasons (e.g. remain healthy) rather for their inherent interest and enjoyment (e.g. love moving through air whilst running and listening to one's breathing). The relative autonomy continuum is not seen in SDT as a developmental one, as in a person moving in a linear fashion from one to another. SDT sees this continuum as a description of the experience that a person can take in at a particular point in time (Deci & Ryan, 1991). Indeed, Chatzisarantis, Hagger, Biddle, Smith, & Wang (2003) found support for the existence of a self-determination continuum from external regulation to identification via introjection in their meta-analysis of 21 studies using the measure of perceived locus of causality (PLOC). Furthermore, they state that "internalisation, intrinsic motivation, and amotivation constitute qualitatively distinct processes" (p. 303). In summary, OIT is different from CET, as it is mainly concerned with how individuals internalise extrinsically motivated behaviours in the context of various social influences that impact on the internalisation process.

A related concept to internalisation is *autonomy support,* as it is the best facilitator of the internalisation process. Sheldon et al. (2003) define autonomy support as a 'mode of communication and persuasion, in which the person in the persuader (or provider) role fully acknowledges and respects the selfhood of the person in the persuadee (or client) role' (p. 29). Therefore, autonomy support in health care within SDT refers to the process by which patients can be helped to make a personal choice regarding their health behaviour (Sheldon et al., 2003). Ryan and Deci (2002) see autonomy support integral to the internalisation process, which fosters self-determination, autonomous regulation and in turn, perceived competence, and increases persistence, flexibility, and vitality within a person. A plethora of research findings support the assumption that offering choice, minimising controls, giving rationale for change, listening to patients, eliciting their perspectives, encouraging patients' initiative and responsibility, acknowledging their feelings, and being non-judgemental leads to more autonomous self-regulation in individuals (e.g., Deci, Eghrari, Patrick, & Leone, 1994; Williams & Deci, 1996; Williams, Freedman, & Deci, 1998; Chatzisarantis & Hagger, 2009). Furthermore, autonomous regulation also yields greater feelings of competence (e.g., Williams & Deci, 1996; Williams et al., 1998). Non-controlling positive competence feedback also enhances autonomous motivation (Vansteenkiste & Deci, 2003; Chatzisarantis et al., 2009). There is an interaction between a degree of autonomy support provided by the health care professionals and individuals' general or trait orientation toward autonomy (Sheldon et al., 2003), as both predict autonomous motivation whilst in treatment (Williams, Rodin, Ryan, Grolnick, & Deci, 1998). Interestingly, participants' trait levels of autonomy are less easily changed, and indeed have been shown to account directly for weight loss maintained over two years in morbidly obese patients (Williams, et al. 1996). In summary, autonomy support has been shown across a wide range of settings, like education, parenting, work, health care, sport and exercise, and friendship, to increase autonomous motivation, performance, and well-being (Deci & Ryan, 2008).

3.18.4.5. Basic needs theory

Basic needs theory (BNT) is concerned with explaining an individual's need for *autonomy, competence* and *relatedness*, what Deci and Ryan (2000) termed as '*basic psychological needs'* (p. 228). *Autonomy* in SDT means a sense of volition (e.g. having a choice) and self-determination (e.g. self-endorsement) and is seen as a 'sustainable motivation' (Stone, Deci, & Ryan, 2009). It also represents a self-endorsement of one's behaviour. Individuals are said to have autonomously engaged with a task, when they possess a more internally perceived locus of causality for the activity (Ryan & Deci, 2008a). Furthermore, the concept of autonomy is different from independence (Ryan & Lynch, 1989). Soenens et al. (2007) argued that individuals could be either autonomous or controlled in their relative independence, as well as in their relative dependence.

Competence is not the same as the concept of self-efficacy (Bandura, 1997), it is a belief that one has the ability to influence important outcomes. It refers to an individual's knowing their abilities and in being able to use those abilities when it matters. Perceived competence builds through external feedback (e.g. informational; positive; administered in an autonomous environment) and the individual's inner acknowledgement of success, enjoyment, and mastery of an activity.

Relatedness refers to the experience of having supportive and satisfying social relationships. Baumeister and Leary, (1995) suggested that the concept of relatedness is the least debated part of the BNT, as there is great consensus on the fact that humans have a deep inherent motive to feel meaningfully connected with others. Ryan and Deci (2000) see the nurturance of autonomy, competence, and relatedness as essential ingredients of full internalisation.

BNT aims to capture how the environment nurtures or thwarts autonomous motivation. Deci and Ryan (2000) defined *needs* at a psychological level as ‘innate psychological nutriments that are essential for ongoing psychological growth, integrity, and well-being’ (p. 229). SDT again is unique in identifying that in all cultures and universally the satisfaction of needs is a requirement for optimal functioning (Ryan & Deci, 2007). Another unique aspect of SDT is the claim that all three needs are equally important and neglecting any of them will lead to negative functioning of the individual (Deci & Ryan, 2000). This aspect of the theory has been really important to this PhD, as the content of the intervention was guided by aiming to satisfy participants’ three basic needs: for autonomy, competence, and relatedness. For example, participants were given choices regarding their exercise classes (see Method section). They were taught exercise skills and had a brief CBT session about managing eating difficulties, and they were encouraged to build social relationships with their fellow participants through, for example, organising charity events for the group (e.g. three-mile charity walk), which helped them to build small successes in physical activity, increased communication through organisation, and fostered social relationships. However, this PhD work did not measure the three psychological needs, or test the tenets of SDT, but instead it used its components to create a more satisfying experience for those who volunteered to participate. Therefore, this aspect of the PhD may be akin to ‘theory-inspired’ rather than ‘theory-based’ intervention (Michie & Abraham, 2004) with an explicit causal pathway.

In summary, the purpose of this PhD was not to test the SDT, but to use the theory to guide (i.e. BNT and COT) the intervention design, and to test whether individual differences (i.e. a particular motivational orientation of autonomous, controlling, or impersonal) predict adherence to a lifestyle intervention programme.

3.18.4.6. Causality orientations theory

Causality Orientations Theory (COT), the least explored and empirically supported of the mini theories in SDT, assumes that a person’s overall functioning (e.g. motivation, behaviour, experience, and self-regulation) is contingent on both the social context and the person’s inner resources or regulatory style. DeCharms (1968) argued that there is an internal and external locus of causality, depending on whether a person perceives themselves as the ‘origin’ (i.e. internal locus of control) or ‘pawn’ (i.e. external locus of control) of their behaviours. SDT further expanded upon DeCharms’ work and stated that perceived causality is different from perceived locus of control, as Ryan and Connell (1989) explained that internal forces to the person ‘are experienced as “acting on” the self, in contrast to the experience of self as the origin and initiator of action’ (p. 750). COT is effectively a descriptive account of a person’s inner resources (Ryan & Deci, 2002). Deci and Ryan (1985b) identified three such orientations: *autonomous, controlled,* and *impersonal,* each of which represents relatively stable *individual differences* in one’s motivational orientation towards the social world. These three orientations are not mutually exclusive; one is said to possess each of these to an extent.

Ryan and Deci (2002) define the *autonomy orientation* as: ‘regulation of behaviour on the basis of interests and self-endorsed values; it serves to index a person’s general tendencies toward intrinsic motivation and well-integrated extrinsic motivation’; in other words, taking reflecting interest in possibilities and choices (Ryan & Deci, 2006); *controlled orientation* as: ‘orientation towards controls and directives concerning how one should behave, it relates to external and introjected regulation’; specifically behaviour is regulated on perceived or ambient contingencies, such as rewards and punishments (Ryan & Deci, 2006); and *impersonal orientation* as: ‘a focus on indicators of ineffectance and not behaving intentionally’; it relates to amotivation and lack of intentional action (p. 21). Furthermore, individuals with impersonal causality orientation are thought to have impaired or uncontrolled behavioural regulation. Ryan and Deci (2006) argue that *autonomy* simply refers to regulation by the self, and *heteronomy* is equivalent to self-regulation without endorsement from the self. Furthermore, Ryan, Kuhl, and Deci (1997) argued that autonomy is a form of self-regulation, that is "both the expression and an outcome of the more general organizational nature of animate entities – a manifestation of a central tendency toward the extension, coordination, and integration of functioning that is a common property of living things" (p. 701). They also argued that the "functional roles of autonomy include stabilizing and boosting adaptation and action, for example, by facilitating the identification and efficient expression of goals related to predominant needs and shielding such goals from competing impulses" (p. 706). Previous research showed that the strength of causality orientations in individuals were predictive of mental health (e.g. Strauss & Ryan, 1987), interpersonal (e.g. Hodgins, Liebeskind, & Schwartz, 1996), and behavioural outcomes (Neighbors, Vietor, & Knee, 2002). A study by Weinstein and Hodgins (2009) found that autonomous orientation relates to effective expression and emotion regulation, leading to positive functioning over time. Their study shows that those with autonomous motivation appraise negative emotional experiences with openness and non-defensively, as oppose to those with controlling profiles. Furthermore, when autonomy was primed, it provided similar benefits to those lacking autonomy. Therefore, this research shows that both situational (state) and dispositional (trait) autonomy orientation determines the quality of engagement with experiences.

COT is concerned with *relatively stable individual differences* that reflect how an individual's interpretation of a situation will influence their initiation, maintenance, and regulation of their behaviour. A key aspect of COT is that two different individuals can interpret the same situation as controlling or autonomous, depending on their self-regulatory style. Deci and Ryan (1985b) in their original study found that autonomy orientation was the most adaptive form, as opposed to the controlled and impersonal orientations. They stated that the concept of causality orientations has a higher-order relatedness to autonomous and controlled motivation. They developed an individual difference measure called ‘General Causality Orientation Scale’ (GCOS; Deci & Ryan, 1985b) that has been used in studies for predictive purposes, including this PhD (see Method section). Autonomy orientation has been positively related to self-actualisation and well-being. Since then several authors (e.g. Koestner, Bernieri, & Zuckerman, 1992; Williams et al., 1996) explored how causality orientation relates to aspects of personality, and well-being indicators. In general, individuals with autonomy orientation fared much better than those with controlled orientation, as they showed greater congruence between their personality and behaviours. Rose, Markland, and Parfitt (2001) developed a specific Exercise Causality Orientation Scale, which makes it a more relevant instrument specific to exercise, but lost the ‘general’ orientation aspect, which may be transferable across various domains. However, this has not been tested as yet in the literature. In summary, those with an autonomous orientation are expected to do better in health behaviour interventions than those with controlled or interpersonal orientations.

Overall, SDT provides empirically tested framework for motivation and self-regulation in the social context of one’s environment both at macro- and micro-levels (Deci & Ryan, 2008).

3.18.5. A Self-Determination approach to weight-management and exercise

As previously discussed, current obesity guidelines are evidence-inspired, rather than evidence-based (Michie & Abraham, 2004). Although the National Institute of Health and Clinical Excellence's (NICE, 2006) obesity guidance uses research evidence as base for its recommendations, it fails to identify and promote specific theory-based (not inspired) approaches for best practice. The current NICE guidelines fail to account for the complexity of health behaviours in weight-management, and it advocates a highly descriptive approach to it. As Ryan and Deci (2008a) suggested, comprehensive theories are needed (i.e. global ones) to guide the process of behaviour change, which enable transference to novel situations as both practitioners and clients embark on this journey. Additionally, lifestyle factors such as diet, physical activity, smoking, all involve behaviours that are controllable and modifiable by the individual. Therefore, why do individuals then not adhere to changes recommended by health care professionals?

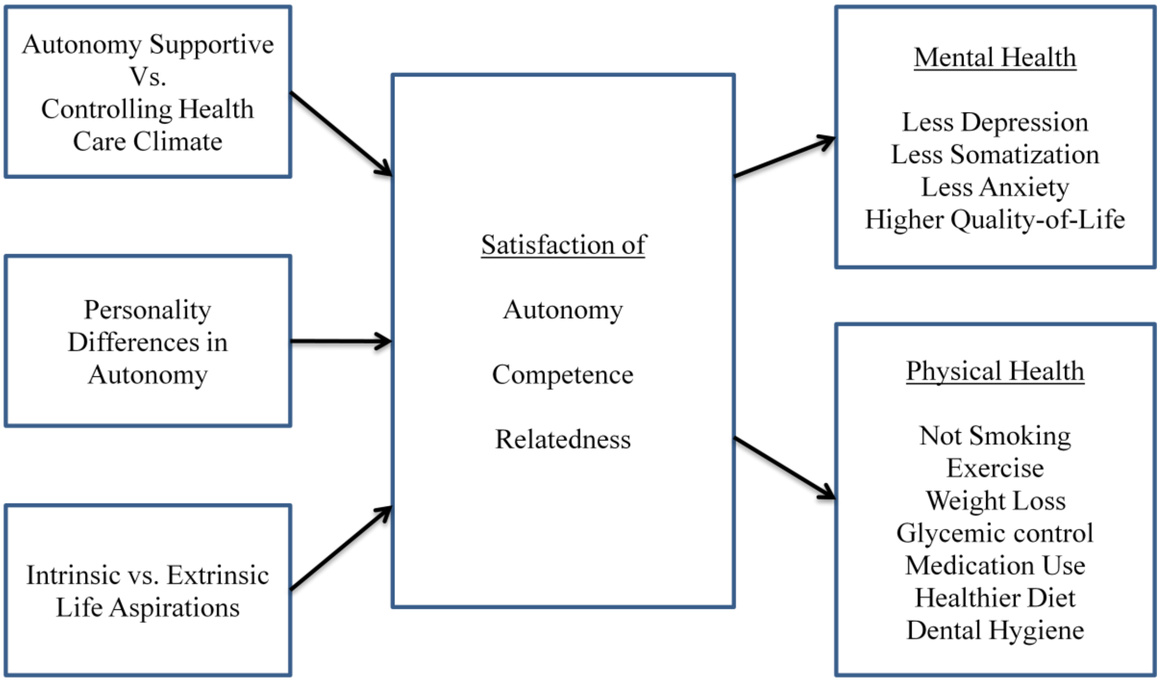
Recent work by Ryan, Patrick, Deci, and Williams (2008) and earlier work by Deci and Ryan (2000) and Ryan and Deci (2000) formulated the Self-Determination Theory's Model of Health Behaviour Change (see Figure 4.2 below), which was based on empirically informed guidelines and principles for motivating individuals to change, as well as gives an explanation of environments that practitioners can create to achieve lasting change with their clients. Each component of the model has been tested empirically and individually, but not in its entirety. According to this model, maintenance of behaviour over time requires that those participating in health-related interventions internalise values and skills for change and therefore experience self-determination. However, there is little attention paid in current weight-management guidelines to satisfying participants' basic needs for autonomy, competence, and relatedness (Williams, Deci, & Ryan, 1998). SDT is unique to presume that initiating and maintaining health behaviour change is NOT a dual task as previously debated by

Rothman (2000), but an ongoing process through which a person internalises and integrates the value of change, which sustains motivation in the long-term.

There has also been little attention paid to programme leaders' personality and management style, as those seeking weight loss programmes would more like to adopt the values and behaviours of those to whom they feel connected and in whom they trust (Fortier, Sweet, O'Sullivan, & Williams, 2007; Ryan et al., 2008). Most weight-management and lifestyle interventions studies promote controlled motivation and external regulation in individuals by trying to motivate through contingencies like monetary rewards, avoiding punishment (e.g. a person can't get weight loss surgery unless losing substantial weight before surgery or participating in a lifestyle intervention programme), or merely through authority. Uniquely, as opposed to other health behaviour theories predictions, SDT promotes integration within personality rather than behaviour change per se (Ryan & Deci, 2008a). There are no clear policy guidelines for practitioners on how to deal with setbacks, which thwarts the process of internalisation and integration. In addition, mastery, skill learning, competence building is not strategically built into intervention programmes, but may inadvertedly happen as an outcome.

To date both the effectiveness of the SDT principles and their transferability to different populations and social contexts makes this theory unique. For example, it proposes that until clients internalise responsibility for the process of change, they won't achieve long-term successes. It is also a problem for practitioners that people have varied degrees of external and internal motives for participation. To date there have only been a limited number of studies that used SDT principles in weight-management, which will be discussed below.

Figure 4.2: Self-determination theory model of health behaviour change (Ryan et al., 2008: p. 3).



Autonomous orientation in weight-management was first researched by Williams et al. (1996) who found that with 128 morbidly obese patients, in a six-month, very-low-calorie weight loss programme with a 23-month follow-up, that those who reported a more autonomous regulatory style before treatment lost more weight overall and were able to maintain their weight loss at the 23-month follow-up period in comparison to those who initially had a more controlled regulatory style. Interestingly, participants' autonomous motivation for weight loss was predicted by their autonomy orientation. Furthermore, their results indicated that health locus of control as measured by HLOC (Wallston & Wallston, 1978), was not predictive of weight loss or weight loss maintenance, as those with internal locus of control still could be controlled in regulation of their programme participation (e.g. they want to lose weight for their doctors' orders). Williams, Cagne, Ryan, and Deci (2002) published the first intervention protocol using the principles of SDT, employing an autonomy supportive approach to counselling for smoking, diet and health relative to usual care.

Subsequently, Williams et al., (2006) carried out the study, which was a six-month intervention, targeting 1006 smoking patients with elevated low-density lipoprotein cholesterol (LDL-C), for diet improvement and smoking cessation. The outcome measures were cotinine-validated smoking cessation and LDL-C validated diary recall of reduced fat intake, as well as depressive symptoms, which were assessed at six and 18 months. They found that those receiving autonomy support had significantly longer abstinence from smoking and lowered LDL-C, due to increased patient autonomy and perceived competence.

Whilst Teixeira et al., (2006) did not specifically measure causality orientation, they found that initial focus on diet was associated with short-term weight loss, as opposed to change in exercise-related factors, when the emphasis was on intrinsic sources of motivation (e.g. interest and enjoyment in exercise). The exercise intervention content and delivery was guided by SDT principles. The overarching goal of their research was to increase autonomy, intrinsic motivation, and competence levels of participants (n = 136), which in turn lead to more successful longer term weight-management, after a four-month lifestyle programme with 86% retention rate of weight loss after 12 months and 82% rate after 16 months. In a subsequent study, Palmeira et al., (2007) evaluated the interest/enjoyment, perceived competence, importance/effort, pressure/tension, and exercise motivation dimensions of the SDT concerning exercise constructs only. The importance/effort dimension was the sole predictor of long-term exercise behaviour and weight loss maintenance in this study. There is an ongoing RCT study by Silva et al. (2008), evaluating the usefulness of the self-determination theory for exercise adherence and weight control, the results of which won't be available for another two years. Similarly, Edmunds, Ntoumanis, and Duda (2007) looked at whether overweight/obese individuals who adhered more to their exercise prescriptions, had a better self-determined profile, measured by levels of autonomy support, psychological needs satisfaction, self-determined motivational regulations, than those who were poor adherers. 49 participants with a mean age of 44.9 years participated in the study. Perceived autonomy support, identified regulation, commitment to exercise, behavioural intention, and both positive and negative affects decreased over the three-month exercise-based intervention. The authors attributed these 'negative' results to the structure of the exercise prescription setting and to decreased autonomy support from the scheme. Decrease of identified (i.e. higher form of self-regulation) and increase of introjected regulation (i.e. least autonomous form of regulation) in participants was explained by lack of recognition of the benefits of exercise, or to unrealistic outcome expectations (e.g. no substantial weight loss) of individuals. Interestingly, those who had greater barrier self-efficacy, a concept akin to autonomous self-regulation, achieved greater adherence. Other researchers (e.g. Sallis, Pinski, Grossman, Patterson, & Nader, 1988; Sallis, Hovell, Hofstetter, & Barrington, 1992) also have consistently shown that barrier self-efficacy is a predictor of exercise adherence. Furthermore, adherence rates had a significant positive correlation with relatedness-need satisfaction. Edmunds et al. (2007) argued that a gradually decreasing contact with the exercise or prescription advisor affected relatedness-need satisfaction. An alternative explanation could be that this study looked at psychological profiles of individuals who wanted to manage their weight with exercise, and consequently participants wanted more guidance, and education about the role of exercise in weight-management. Relatedness-need may have increased as a direct result of goal and expectations discrepancy regarding exercise experience and weight-management. Autonomy-need satisfaction positively predicted self-determined motivation, as well as competence predicted intrinsic motivation. In summary, targeting change in one behaviour with another (i.e. weight-management with exercise), limits the theoretical assumptions that one can deduct, as the interaction between the two was not explored in this theoretical study, which may have mediated the outcome of the research. This is a persistent methodological problem within the exercise psychology/exercise science literature. From a theoretical point of view, it is a consistent finding that those who are better self-regulators, do better in many aspects of a given intervention than those who are poor self-regulators. Again Brickell and Chatzisarantis (2007) found that people who exercise for more self-determined reasons are more likely to spontaneously form implementation intentions, which in turn may lead to more self-determined behaviour, but it may be that they had autonomous self-regulation before they formed the goals. Therefore, global self-regulation per se should be a key outcome measure in any health-related interventions. Moreover, research targeting several behaviours at once, should measure whether a motivational or self-regulational transfer occurs (e.g. Hagger, Chatzisarantis, Barkoukis, Wang, & Baranowski, 2005; Hagger, Chatzisarantis, Culverhouse, & Biddle, 2003). As Hagger et al. (2003) argued, motivation underlying one's behaviour could transfer from one context to the next ("transcontextual" model of motivation). However, it is unclear as yet, whether actual self-regulation (i.e. causality orientation) allows for such transfer in motivation or something else. Nevertheless, this should be explored in future studies. One study by Mata et al. (2009) found that general self-determination and autonomous treatment motivation mediated the relationship between self-reported physical activity and eating regulation. It appears that self-regulatory power can be increased by regular exercises (e.g. interventions targeting a particular behaviour; see Baumeister, Gailliot, DeWall, & Oaten, 2006, for a review), which in one study at least produced improvements in the targeted behaviour of one's money usage (Oaten & Cheng, 2007), subsequently shown to have a 'spill-over' effect in smoking fewer cigarettes and improvements in healthy eating. The healthy eating aspect is interesting as is it more expensive than unhealthy food, and the initial target behaviour was 'saving money'.

However, self-regulatory interventions have yielded mixed results so far outside the SDT literature base. The question remains whether the qualitative change in motivation and self-regulation, from less to more autonomous, causes this effect; or alternatively, if those with already higher self-determination or self-regulation will always do better in a health behaviour change intervention.

Other research, using the Treatment Self-Regulation Questionnaire (TSRQ – Ryan & Connell, 1989) instead of GCOS as this PhD study, assessed autonomous regulation within clinical settings of various medical treatment programmes (e.g. Ryan, Plant, & O'Malley, 1995 – alcohol; Williams, Cox, Kouides, & Deci, 1999 – reduction in intensity and frequency of smoking in adolescents; Williams et al., 2002 – smoking cessation; Williams, McGregor, Borrelli, Jordan, & Stretcher, 2005 – tobacco dependence treatment; Williams, et al., 2006b – longitudinal study of smoking cessation; Williams, Rodin, Ryan, Grolnick, & Deci, 1998 – adherence to long-term medicine regiment in adult outpatients; and Williams, Freedman & Deci, 1998 – better glucose control in patients with diabetes). Consistent results of such research were that those patients who scored high on autonomous regulation had better treatment outcomes because they adhered more to medication, to diet, to cessation of smoking, and abstinence from alcohol during treatment and at subsequent follow-ups.

To date there is limited research (e.g. Williams, et al., 1996) that deliberately measures self-regulatory processes in weight-management. However, overall there is considerable evidence for SDT being a viable theory for the study of health behaviours, including weight-management and exercise. SDT when applied to weight-management studies is likely to increase our understanding of motivation for health. This PhD's work will explore self-regulatory profiles of participants before and after a yearlong exercise-based intervention.

SDT was also used in the present PhD to guide the exercise intervention. To this end, Wilson, Mack, and Grattan (2008) have examined evidence addressing the following issues: 1) quality and importance of motivation regulating exercise; 2) importance of basic needs in exercise; and 3) role of environment to maximise motivation in exercise. There is considerable support for self-determined motives irrespective of whether they are intrinsic or extrinsic to predict actual and intended adherence to exercise (Wilson & Rodgers, 2004; Wilson, Rodgers, Fraser, & Murray, 2004) as well as predict various stages of change in exercise (Landry & Solmon, 2004; Matsumoto & Takenaka, 2004; Mullan & Markland, 1997). These findings indicate that self-determined regulation is more important (at a global level) than intrinsic or extrinsic motivation alone, because autonomous disposition allows for the openness of experience in a different way from those who have a controlling disposition (Weinstein, et al., 2009). However, there is a distinct lack of studies exploring individual differences (e.g. causality orientation) in relation to exercise adherence. This PhD will explore this aspect of the theory, by measuring participants' causality orientations before and after the exercise intervention.

Studies exploring basic needs satisfaction in exercise have yielded some interesting results. For example, Markland (1999) in female exercisers found that variation in perceived competence only influenced intrinsic motivation when the women felt that their need for autonomy was not satisfied in exercise (e.g. choice). Similarly, a number of studies (McDonough & Crocker, 2007; Vlachopoulos & Michailidou, 2006; Wilson, Mack, Muon, & LeBlanc, 2007; Edmunds, Ntoumanis, & Duda, 2008) found that psychological-need fulfilment and satisfaction was associated with more self-determined regulation for exercise. At this point in time, it is unclear whether each psychological need has to be satisfied or not in the exercise contexts in order to predict autonomous regulation. Hagger, Chatzisarantis, and Harris (2006) explored the relationship between psychological-need satisfaction and motivation for dieting and exercise behaviour. They found that the overall effect of psychological-need satisfaction in the dieting sample was negative, whereas in the exercise sample it was positive. In other words, they found that global psychological-need satisfaction influenced contextual-level autonomous motives, which in turn predicted intentions via mediation of attitudes and perceived behavioural control in both exercise and diet. Their results may have been due to overall individual differences (e.g. causality orientation) within people. Those with high autonomous regulation, regardless of whether they choose to consciously or unconsciously diet or exercise would find the appropriate behavioural sequence to achieve their overall goal at both the contextual and situational levels. Interestingly, they found that diet and exercise behaviours have different routes for behavioural engagement, which might derive from the fact that exercise is an approach-oriented process (e.g. one has to take up exercise), as the diet is an avoidance-oriented process (e.g. one has to avoid over-eating – Rothman, 2000). Additionally, individuals may have a stronger experience when executing a behaviour in which they *did* engage, than in which they *did not* engage (see Baron & Ritov, 2004; Fazio, Sherman, & Herr, 1982; Gilovich, Medvec, & Chen, 1995 for related findings). Rothman (2000) also proposed that individuals might find it easier to initiate behaviour when it is motivated by a desire to reach a favourable goal-state (i.e., an approach-oriented process, becoming fit) as opposed to when it is motivated by a desire to avoid an unfavourable goal-state (i.e., an avoidance-oriented process, being fat).

SDT and its use for explaining exercise adherence was first comprehensively studied by Ryan, Frederick, Lepes, Rubio, and Sheldon (1997), who found that adherence was related to more intrinsic motives of competence and enjoyment than to extrinsic motives such as body-related reasons for participation. Prior to this, Frederick and Ryan (1993) also found that individuals engaged in sport-related activities were more intrinsically motivated and reported greater competence than those doing fitness activities, which reported less enjoyment and more external motives.

To date, autonomy support in exercise was examined only by a handful of studies in sport and exercise (Deci & Ryan, 2002) with equivocal results (Wilson & Rogers, 2004; Edmunds, Ntoumanis, & Duda, 2006). Both studies found that regardless of the sources of social support, those who perceive higher levels of social support displayed a more self-determined regulation for exercise participation. As discussed earlier, equivocal finding regarding basic-needs satisfaction, perceived autonomy support, and self-determination regulation in these two studies may be due to methodological problems associated with the nature of needs in the exercise setting (e.g. Edmunds et al., 2007), as exercise was used to enhance the effectiveness of another behaviour, namely eating-regulation in weight-management. Furthermore, autonomy support can also be channelled thorough feedback and reinforcement principle about participants' progress and in turn should foster perceived competence and adherence to exercise.

In conclusion, SDT has the potential to give insight into the individual needs of women exercise-participants to maximise exercise adherence (Ryan et al. 1997; Landry & Solmon, 2002). SDT has been used in this PhD as framework to *guide* the structure and content of a lifestyle-based intervention. However, one of limitations of this work from the theoretical point of view is that it did not measure autonomy support via a quantitative measure. There were many reasons for this, including the already considerable 'burden' on participants associated with this research, for example, the number of questionnaires assessing psychological health, and measurements of body composition to fitness and blood tests.

However, in this PhD work autonomy was fostered within the intervention set up, by building exercise competence through participation, teaching the names and postures of all standard exercise moves to enable participants to eventually join any class of their choice and knowing what to do (competence). They were provided with a meaningful rationale for participation and positive feedback on their efforts. Those who had previous exercise experience were encouraged to gradually work towards taking up those activities again, although it was recognised that this might be quite sometime in the future. Participants were also asked to take responsibility for their exercise behaviour and think about what it meant to them. It was made clear to participants from the start that the practitioner (EB) is there for providing guidance and support, but they had to find their own ways to engage with WHEEL. At times, for example, when participants doubted their ability to continue to exercise, they were reminded to reflect back to the start of WHEEL, and compare their lives, and ability to exercise to now. It was recognised when planning WHEEL that an exercise intervention for women with high status will be a difficult one and that women my feel low levels of autonomy, be emotional, have poor psychological states, have physical problems that may prevent them to participate effectively, and have poor exercise skills. One study by Adie, Duda, and Ntoumanis (2008) showed that adult sport participants with low levels of autonomy were more susceptible to feeling emotionally and physically exhausted from their sport participation. Relatedness was fostered by encouraging participants to share their stories, to plan car-sharing routes to exercise venues, and to organise whenever possible activity based outings for the group, such as walk around reservoirs, cancer charity walk, and local parks. As previous researchers suggested (Biddle & Nigg, 2000; Wilson & Rodgers, 2004) SDT provides theoretically sound insights into the reasons why people intend and continue to exercise, and allows for a meaningful interpretation of underlying motivational processes in the exercise domain.

3.18.6 Research questions and hypotheses

1. There would be significant improvements observed in participants' FITNESS (cardio-respiratory & metabolic), in both the initial intervention group (IIG) and the delayed start control group (DSCG). In particular, an improvement in $\dot{V}O_{2peak}$ normalised for body weight ($ml \cdot kg^{-1} \cdot min^{-1}$) and blood pressure after the 3 months intervention period and at 9 months follow up.
2. There would be a significant improvement in PSYCHOLOGICAL HEALTH in both the IIG and DSCG groups at 3 and at 9 months following the end of the intervention.
    a. It is hypothesised that participants' general well-being (measured by GWB schedule; Dupuy, 1977 & 1978); global self-worth (GSW), as measured by the Self Perception Profile (SPP; Messer & Harter, 1986); perceived social support, as measured by the Social Support For Exercise Scale (SSSE; Fox & Dirkin, 1992); and State Self-Esteem Scale (SSES; Heatherton & Polivy, 1991), will significantly improve.
    b. It is predicted that they will report less stress, as measured by the Perceived Stress Scale (PSS; Cohen, Kamarck, & Mermelstein, 1983) .
3. GCOS; Deci & Ryan, 1985b), Multidimensional Health Locus of Control Scales (Form C) (MHLC; Wallston, Wallston, & DeVellis, 1978)
4. Following the intervention the participants would be expected to show improvement in general well-being and overall psychological health. Specifically, participants were expected to show increased general well-being, reduced stress, improved self-esteem, and improved social support.

- Based on the intervention used in the present study participants were expected to develop greater autonomy and internal locus of control.

The qualitative aspect of this study aims to explore, through weight history interviews, the following:

- The history and prevalence of self-reported dieting.
- How dieting affected participants' weight change up to the start of the study.
- Development of their current perceived weight status.
- Physical activity history and patterns.
- Health status and difficulties with physical activity and eating behaviours.
- Motivation and goals for current weight-management trial.

The follow-up interviews at 12 months aim to explore:

- Difficulties with exercise behaviour change.
- Quality of life as a result of participation in this trial.

Chapter Four
Method

4.1. Introduction to method

In this single chapter, all methods, procedures, and instrumentation details used in the WHEEL study will be outlined. This research has taken place in the context of a multi-disciplinary team. It should be noted that some measurements taken and procedures outlined will not be addressed in future chapters (e.g. blood data, diet diaries, Bassey walking test).

4.2. Mixed methods (MM) research

4.2.1. The qualitative-quantitative debate

The qualitative–quantitative debate (e.g. Reichardt & Rallis, 1994; Guba & Lincoln, 1994) has long been a key consideration when deciding how to study a particular research phenomenon. Even though several researchers (see Guba & Lincoln, 1994) have discussed that both qualitative and quantitative methods may be used appropriately within any research paradigm, the compatibility of these methods is still questioned in medical research settings. The best argument for treating the qualitative and quantitative as methodological approaches rather than methodologies ascribed to a particular paradigm comes from Reichardt and Rallis (1994), who discussed the 'principle of underdetermination of theory by fact' issue (p. 88). This means, that 'any given set of data can be explained by many theories' (p. 88). Similarly, Guba and Lincoln (1994) stated that 'different theory windows might be equally well supported by the same set of "facts"' (p. 107). In other words, no theory has ever been finally proven and the empirically tested can lose validity, depending on the theory one used to explain the results. Therefore, in this research it is assumed that convergence of findings generated from both qualitative and quantitative points of views will provide a deeper understanding of treatment issues related to weight management. Woolley (2009) defined integration as follows: 'Quantitative and qualitative components can be considered “integrated” to the extent that these components are explicitly related to each other within a single study and in such a way as to be mutually illuminating, thereby producing findings that are greater than the sum of the parts.’ (p. 7). For example, in this way the different factors judged to be important in behavioural change (e.g., autonomy, competence and connectedness, Deci & Ryan, 1985a) and health status could be assessed in parallel using different approaches. Therefore, the design of this work included a range of both qualitative and quantitative data collection methods that were used in conjunction to provide a rich and complementary data source.

4.2.2. Mixed methods multistrand designs

There are many definitions of mixed methods (MM). Johnson and Onwuegbuzie’s (2004) definition captures the spirit of the current synthesis stage of MM investigations and gives a strong impetus to the pragmatists’ view. They defined MM research as ‘the class of research where the researcher mixes or combines quantitative and qualitative research techniques into a single study. Philosophically, it is the “third wave” or a third research movement, a movement that moves past the recent paradigm wars by offering a logical and practical alternative. In this sense, mixed research makes use of the pragmatic method and system of philosophy. Its logic of inquiry includes the use of induction (or discovery patterns), deduction (testing of theories and hypotheses), and abduction (uncovering and relying on the best set of explanations for understanding one’s results)’ (p. 17-18). A more parsimonious definition has been provided by Tashakkori and Creswell (2007); using ‘both qualitative and quantitative approaches or methods in a single study or programme of inquiry’ (p. 4). All definitions of MM agree that MM is a type of research design in which qualitative (QUAL) and quantitative (QUAN) approaches are mixed across the stages of the study. However, it is worth noting that Maxwell and Loomis (2003) concluded that, ‘The actual diversity in mixed methods studies is far greater than any typology can adequately encompass.’ (p. 244).

Table 4.1 illustrates the advancement of the pragmatist paradigm and provides an overview of the evolution of methodological approaches in the social and behavioural sciences. It is evident from the chronological table that in the 1990s researchers realised that the research question is more important than the paradigm that is supposed to underlie the method. Table 4.2 illustrates the assumptions underlying the pragmatist paradigm beliefs, which formed the methodological underpinning of this study. In fact, pragmatists argue that method must follow the question, and multiple methods should be used because every method has its limitations. Similarly, Fielding and Fielding (1986) suggested that although the diversity of data can support the convergent conclusion, this confidence in the finding will only be as good as the different kinds of errors in the data.

Multistrand designs are viewed as most complex designs within MM, because mixing the QUAL and QUAN approaches may occur both within and across the conceptualisation, methodological, analytical, and inferential stages (Teddlie & Tashakkori, 2009). Furthermore, Teddlie and Tashakkori (2009) identified five distinct multistrand designs: sequential, parallel, conversion, multi-level, and fully integrated. This PhD employed a Parallel Mixed Design (PMD – Teddlie & Tashakkori, 2009).

Table 4.1: The evolution of methodological approaches in the social & behavioural sciences (based on Tashakkori & Teddlie, 1998, p. 15).

Period I: The Mono-method or 'Purist' Era (19th Century through to 1950s)

A. The Purely Quantitative Orientation
   1. Single Data Source (QUAN)
   2. Within One Paradigm/Model, Multiple Data Sources
      a. Sequential (QUAN/QUAN)
      b. Parallel/Simultaneous (QUAN & QUAN)

B. The Purely Qualitative Orientation
   1. Single Data Source (QUAL)
   2. Within One Paradigm/Model, Multiple Data Sources
      a. Sequential (QUAL/QUAL)
      b. Parallel/Simultaneous (QUAL & QUAL)

Period II: The Emergence of Mixed Methods (1960s to 1980s)

A. Equivalent Status Design (across both paradigms/methods)
   1. Sequential (i.e. two-phase sequential studies)
      a. QUAL/QUAN
      b. QUAN/QUAL
   2. Parallel/Simultaneous
      a. QUAL + QUAN
      b. QUAN + QUAL

B. Dominant/Less Dominant Designs (across both paradigms/methods)
   1. Sequential (i.e. two-phase sequential studies)
      a. QUAL/QUAN
      b. QUAN/QUAL
   2. Parallel/Simultaneous
      a. QUAL + QUAN
      b. QUAN + QUAL

C. Designs With Multilevel Use of Approaches

Period III: The Emergence of Mixed Model Studies (1990s)

A. Single Application Within Stage of Study*
   1. Type of Inquiry – QUAL or QUAN
   2. Data Collection/Operations – QUAL or QUAN
   3. Analysis/Inferences – QUAL or QUAN

B. Multiple Applications Within Stage of Study**
   1. Type of Inquiry – QUAL and/or QUAN
   2. Data Collection/Operations – QUAL and/or QUAN
   3. Analysis/Inferences – QUAL and/or QUAN

*There must be a mixing such that <u>each</u> approach appears in at least one stage of the study.

Table 4.2: Assumptions underlying the positivist, post-positivist, pragmatist and constructivist paradigms on a continuum (based on Tashakkori & Teddlie, 1998, p. 23; and Borkoles, 1998).

	Objective ← Continuum			→ Subjective
Assumptions	Positivist	Postpositivist	Pragmatism	Constructivism
Ontology (nature of reality)	Naïve, external realism (single reality) Apprehendable reality is assumed to exist.	Critical or transcendental realism	Accept external reality. Choose explanations that best produce desired outcomes.	Relativist – interacting individuals produce and define their own definitions of situations Existence of multiple, constructed realities
Epistemology (the relationship of the knower to the known)	Objective, Dualist assumptions that findings are True – knowledge is accumulated in an objective manner (knower and known are dualism).	Modified Dualism – Findings probably, objectively "true"	Both objective and subjective points of view	Subjective point of view. Knower and known are inseparable. Knowledge is seen as a consequence of human activity - human construction.
Axiology (role of values in inquiry)	Inquiry is value-free.	Inquiry involves values, but they may be controlled.	Values play a large role in interpreting results.	Inquiry is value-laden.
Methodology	Quantitative	Primarily Quantitative	Quantitative & Qualitative	Qualitative
Logic	Deductive (a priori hypothesis) Confirmatory, Predictions to be tested and confirmed, Vigorous control	Primarily Deductive	Deductive & Inductive	Inductive (no exact hypotheses to be tested) exploratory research questions Understanding and interpretation (practical)
Causal linkages/ interpretation of results.	Real causes temporarily precedent to or simultaneous with effects.	There are some lawful, reasonably stable relationships among social phenomena. These may be known imperfectly. Causes are identifiable in a probabilistic sense that changes over time.	There may be causal relationships, but we will never be able to pin them down.	All entities simultaneously shaping each other. It's possible to distinguish causes from effects.

4.2.3. Parallel mixed design (PMD)

PMD is defined as an ‘MM project where the phase of the study (QUAN, QUAL) occurs in a parallel manner, either simultaneously or with some time lapse. These phases address related aspects of the same basic research question(s)’ (Teddlie & Tashakkori, 2009, p. 143). The type of inquiry, data collections, and analysis/ inference stages of the research mixes both qualitative and quantitative approaches in at least one stage of the study. To combine methods in such a manner infers methodological integration that is to use multiple methods to study a research problem. Furthermore, the QUAL and QUAN strands are aiming to answer related aspects of the same MM research questions; also inferences drawn from the QUAL and QUAN strands are integrated and synthesised at the end of the study (Teddlie & Tashakkori, 2009). There are three key studies that have used this design: Rao and Woolcock, 2003; Lopez and Tashakkori (2006); and Sosulski and Lawrence (2008). In all of these three studies data yielded by both strands (QUAL, QUAN) were initially analysed separately and integration only occurred at the meta-inference stage at the end of the research process. All of these studies aimed to contrast and compare the various findings in order to form a much more comprehensive view and understanding of the research phenomenon. In summary, the strength of employing this research design in this PhD is that the weaknesses self-report data obtained from questionnaires regarding health status and weight history can be attenuated by the richness of data obtained from the weight history interviews. This not only provides cross-validation, but essential meaning and descriptions of underlying processes that could not be obtained by other sources or each individual source.

4.2.4. Sampling in MM studies

For the QUAN strand the present study adopted a purposeful random sampling approach (see QUAN strand description). This was the same for the QUAL strand too, as it aimed to follow up all recruited participants (i.e. both adherers and non-adherers) at 12 months. A paper of Collins, Onwuegbuzie, and Jiao (2007) defines random purposeful sampling as ‘Selecting random cases from the sampling frame consisting of a purposefully selected sample’ (p. 272). Furthermore, Onwuegbuzie and Leech (2004) recommended a minimum sample size for experimental research design in an MM study to be 21 participants per group for one-tailed hypotheses. The present study had 31 participants in each arm of the trial (experimental and delayed control).

Table 4.3 explains the MM design decisions that were taken at every stage of the research process. The content of this table is expanded upon later in the chapter when the individual strands of the study are discussed in more detail.

Table 4.3: Structural description of goals, theories, design elements, and the meta-inference process of the PhD.

Overaching goals of research	To explore how clinically obese women respond physically and psychologically to a yearlong exercise-based lifestyle intervention programme.
Guiding theory	The Self-Determination Theory was used to enhance exercise intervention effects and to determine whether such an intervention increases regular physical activity and other health outcomes compared to a delayed start control group. Self-regulation style of participants was the outcome measure.
Design and major decision points	Multistrand MM; Parallel Mixed Design was employed. QUAN - 62 participants from a purposeful sample (clinically obese women + other criteria) were randomly allocated to either intervention or delayed start control group. QUAL - 62 participants were initially interviewed (using semi-structured format) before start of the study. All adherers were interviewed after the completion of a 1 year exercise intervention. Data was collected at 3 data points for the intervention group: 1. Baseline 2. End of intervention after 3 months 3. End of 9 month Maintenance Phase (1 year after baseline measures) Data was collected at 4 data points for the delay start control group: 4. Baseline 1 (measured at the same time as intervention group's) 5. Baseline 2 (measured at the start of the intervention for the control group) 6. End of intervention after 3 months 7. End of Maintenance Phase at 9 months (delayed control start group only)
Participants and settings	The participants were 62 clinically obese healthy women who met the selection criteria. At the time of the study all participants lived in a medium-size Northern town of England, UK.
Data collection procedures	Both QUAL and QUAN strands will be described later on in the chapter. All data collection was conducted by the lead researcher (EB).
Meta-Inference/Analytic Process	See QUAL and QUAN strands for description of data analyses.

4.2.5. Limitations of using a MM design

One of the major criticisms of using MMs is around the integration of the QUAL and QUAN elements of the study. For example, Freshwater (2007) argued that rigour of how one applies opposing paradigm's applications is problematic. However, pragmatists see QUAL and QUAN as a technique or approach that is integrated in the framework of pragmatism. Therefore, this criticism is only valid for those who work out from contradicting paradigms. However, she has a point in questioning the resolution of contradictory findings. She points out that 'MM do bring different perspectives to bear, but do they allow for competing interpretations to coexists, and therein undecidability?' (p.141). More recently, Bryman (2007) argued that 'insufficient attention has been paid to the writing up of mixed methods findings and in particular to the ways in which such findings can be integrated' (p.21). He stated that 'there is still considerable uncertainty concerning what it means to integrate findings in mixed methods research' (p.21). Indeed, Campbell, Quilty, and Dieppe (2003) raised the issue of 'quantitised' data from qualitative components of RCTs, mainly supporting or contradicting the quantitative findings. Similarly, Moffatt, White, Mackintosh, and Howell (2006) lead the way to describe six different approaches to explain discrepancies, such as where participants reported substantial benefits in a concurrent qualitative phase when there was a zero-effect size reported in the quantitative one. Another criticism is as Barbour (1999) noted, that 'only rarely is multi-method research likely to put equal emphasis on qualitative and quantitative methods' (p.39). Additionally, O'Cathain, Murphy, and Nicholl (2007) claimed that there are problems arising from researchers publishing just the quantitative or the qualitative data separately, without making any reference to the other component and how the two strands influenced the findings of each other. However, the subject specific journals still prefer to operate in their accustomed paradigm structure (either QUAN or QUAL), making it difficult for researchers to submit MM projects. All of these criticisms are valid in the context of MM research, but do not outweigh the strength of discovering mutually informative trends and themes (Sosulski & Lawrence, 2008).

4.2.6. Summary of justification for using an MMS

There are a number of arguments why the adoption of an MMS method was the most appropriate for the present thesis. First, it helps to understand the complexity of a health behaviour and the environment in which this research took place (O'Cathain et al., 2007). Secondly, it provides effective evaluation of the research undertaken (O'Cathain, 2009). Thirdly, it allows for simultaneous use of exploratory and confirmatory research questions (Teddlie & Tashakkori, 2009). Finally, the use of this design allowed for recognising in advance the implications of data derived from qualitative and quantitative investigations in this study (Bryman, 2007). This process was also important in the planning of the stages of the data collection. For example, weight history interviews took place at the same time as baseline physiological measures. However, it took a lot longer to transcribe the manuscripts from the qualitative interviews than inputting the physiology data. Therefore, there was a time delay in giving detailed feedback to participants about their physiological results until the interviews were listened to and transcribed. Combining feedback from these sources allowed a more comprehensive approach to see where the participants will need to invest in their efforts to change.

It is this PhD's aim to demonstrate that using both qualitative and quantitative approaches to research enhanced the findings of this study and led to a greater understanding of the participants' journey through an exercise intervention process.

4.3. Quantitative Strand: Exploratory Randomised Control Trial (RCT)

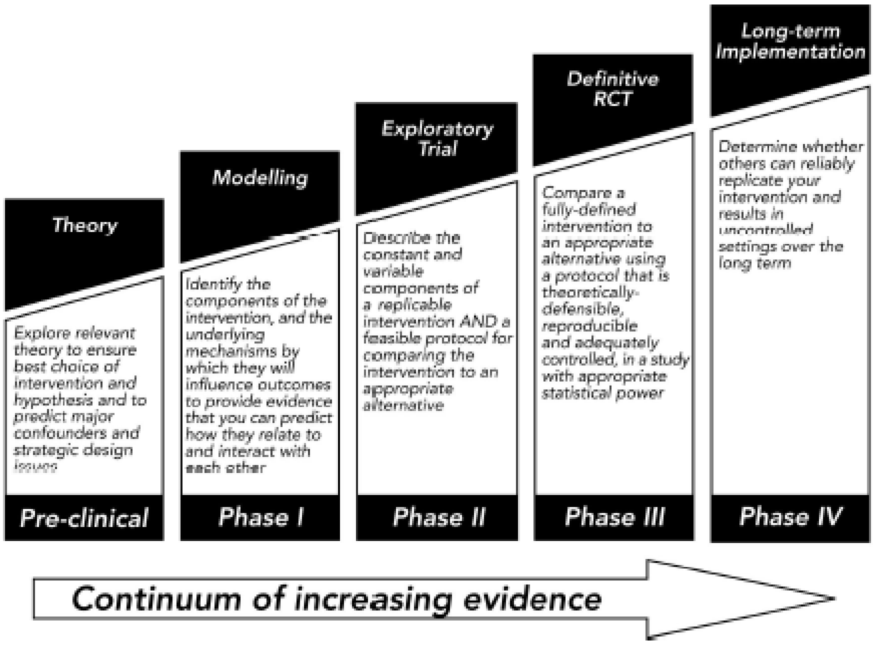
The primary aim of the QUAN strand was to determine whether a one-year-long exercise-based lifestyle intervention for clinically obese but otherwise healthy women improves health outcomes, including psychological and physical health. That is, the research tried to determine whether there were any changes over time in physical and psychological health, including fitness, psychosocial indices, and adherence to exercise. The QUAL strands' aim was to identify what aspects of the intervention participants found most useful for behaviour change, including barriers and facilitators, and how they've responded to an intensive course of lifestyle change project (e.g. adherence to sessions, sustainability, and fidelity issues). Ultimately, this is a feasibility study which will provide important information for Phase III definitive RCT studies, including sample size calculations.

The design of this study was an Exploratory RCT trial (Phase II), as it was identified by Medical Research Council (MRC, 2000) as the ideal design for complex interventions in health-related studies, since it helps to minimise bias and improves the estimate of potential benefits of the intervention. The MRC (2000) framework views complex interventions that comprise a 'number of components, which may act both independently and inter-dependently' (p. 2). For example, these components could be behaviours, and/or settings, aiming to answer questions like, 'How does the exercise intervention work? What are the 'active ingredients' (e.g. place of exercise classes, content of sessions, exercise leader etc.)? This research intended to intervene at the level of the individual.

Figure 4.1 shows the MRC framework used in this study. In the Pre-Clinical Phase (0-1) a theoretical framework was chosen (Self-Determination Theory – SDT), and implemented at 'Pre-Clinical Phase' of the framework. It was envisaged that using SDT would enhance the understanding of why an individual benefits more or less from a health-related intervention than another. Appropriate outcome measures were chosen, relevant to the concepts of self-regulation, including autonomy, competence and connectedness within SDT. The way participants respond to an intervention trial in health-related interventions has been problematic in the past as participants' self-regulation was under-researched. However, there is now sufficient evidence that participants who drop out tend to differ in very significant ways in self-regulatory terms from those who do not (Luszczynska & Schwarzer, 2005). For example, Luszczynska and Schwarzer (2005) have show that those with poor pre-intervention self-efficacy beliefs responded poorly to health-related interventions and were less able to benefit from such health initiatives. Additionally, Deci and Ryan, (2008) postulated that those who are less autonomously regulated are more likely to fair worse in intervention settings. This is particularly important as poor adherence statistics will bias and mask the outcome and usefulness of such interventions (MRC, 2000).

Phases 0-1 of the study aimed to model and identify the structure and components of the intervention, based on a systematic review of previous RCT interventions relevant to this study. The environmental (i.e. suitable place to carry out the trial), the personal (e.g. participants targeted; development of inclusion criteria, psychological and physiological measures to be taken) and intervention process, content, and design were identified prior to the start of the exploratory trial, Phase II of the MRC framework. Fidelity was monitored throughout the intervention by random observations and participant feedback sheets.

Figure 4.1: Framework for trials of complex interventions (MRC, 2000, p. 3).



The researcher was concerned about the ethical implications of withholding an opportunity for ‘desperate’ women, as 212 of them replied to the study call. After receiving advice from the University’s Research Committee and the Local Research Ethics Committee of the Teaching Hospitals, it was agreed with the supervisory team that a delayed intervention randomised control trial will be implemented. Whitehead (2004) explored whether control groups were appropriate for behaviour interventions, such as used in this PhD. A purpose of an RCT is to show that the ‘treatment or intervention’ was effective and this is not attributable to non-specific effects or confounding variables. In an RCT participants are monitored closely and there is an expectation of reciprocity and compliance, which is moderated by the amount of task they are asked to carry out and other factors such as practitioner/participant relationships. Small scale clinical trials often underestimate the effects of an intervention, hence the need for exploratory trials. Large definitive RCTs are costly and should only be attempted if an exploratory trial has been conducted (MRC, 2000) which has already established that the intervention will result in a considerable improvement of the participants' life. One major source of bias was identified before the planning of the intervention: the differential dropout rate bias. It was expected that those who did not lose weight will drop out sooner than those for whom the intervention was working. Given that the philosophy of the project was to 'improve physical and psychological health' in participants and not weight loss, the women recruited to the study were generally desperate to lose weight fast. With clinical obesity, as per previous literature, substantial weight loss was never expected through lifestyle change within the context of this study. That is why intention-to-treat analyses were also conducted throughout. Furthermore, non-specific effects such as practitioner and participant relationships were also expected to be a potential bias. For example, the researcher had a substantial interaction with participants and that may have influenced the results such as reporting better or worse outcomes. As Drossman, Whitehead, and Camilleri (1997) have shown, the higher the interaction with the research team the better results are reported. Additionally, Whitehead (2004) observed that the natural history of the disease (regression to the mean) also affected results over time. In this study, it may have been that obesity-related symptoms of fatigue, depression, and body image problems may have got better or worse regardless of the intervention.

All participants who fitted the recruitment criteria were randomised to either receive the intervention immediately or to wait three months; continue their current lifestyle and then be offered the intervention. The problems associated with this approach were that participants knowing that they would receive the intervention may have consciously or unconsciously changed their behaviour in the waiting period, thus biasing the second baseline measure. The present study did not use a credibility scale (e.g. Attitude Towards Treatment Questionnaire, Borkovec & Nau, 1972). However, as previously described, participants' goals and expectations for the intervention was comprehensively explored via qualitative interviews and questionnaires. The project was titled, advertised, and described in the context of autonomy-support framework as per the philosophical stance in SDT. The same researcher took both groups through the intervention and maintenance phases of the project. Both groups received identical exercise sessions by the same practitioners (Tai Chi and Aerobic/Aqua instructors and the dietician who was CBT trained). The amount of contact time was the same for both groups (i.e. four one-hour aerobic/circuit classes). It was hoped that the delayed start control condition was made credible to the participants. The majority (78 % of uptake) of waiting participants took up the intervention. Waiting creates a negative effect in participants' expectations, which was problematic for the implementation of SDT's philosophical stance, as participants may perceive being controlled by the researcher. Furthermore, being in a control group may have inadvertently made them less 'autonomous' in their behaviour, which might have major implications for self-regulatory processes and for intervention outcomes (note: there was no drop in GCOS Autonomy for the control group from first assessment to the start of their treatment). Nevertheless, the exploratory RCT was deemed to be the best available design. To ensure that the delayed start control group's expectations remained positive towards the intervention two principles were adhered to as per Whitehead's (2004) suggestion: 1) delayed start control groups should be credible to participants, and 2) the delayed start control group intervention should not have a significant impact on the effectiveness of the study.

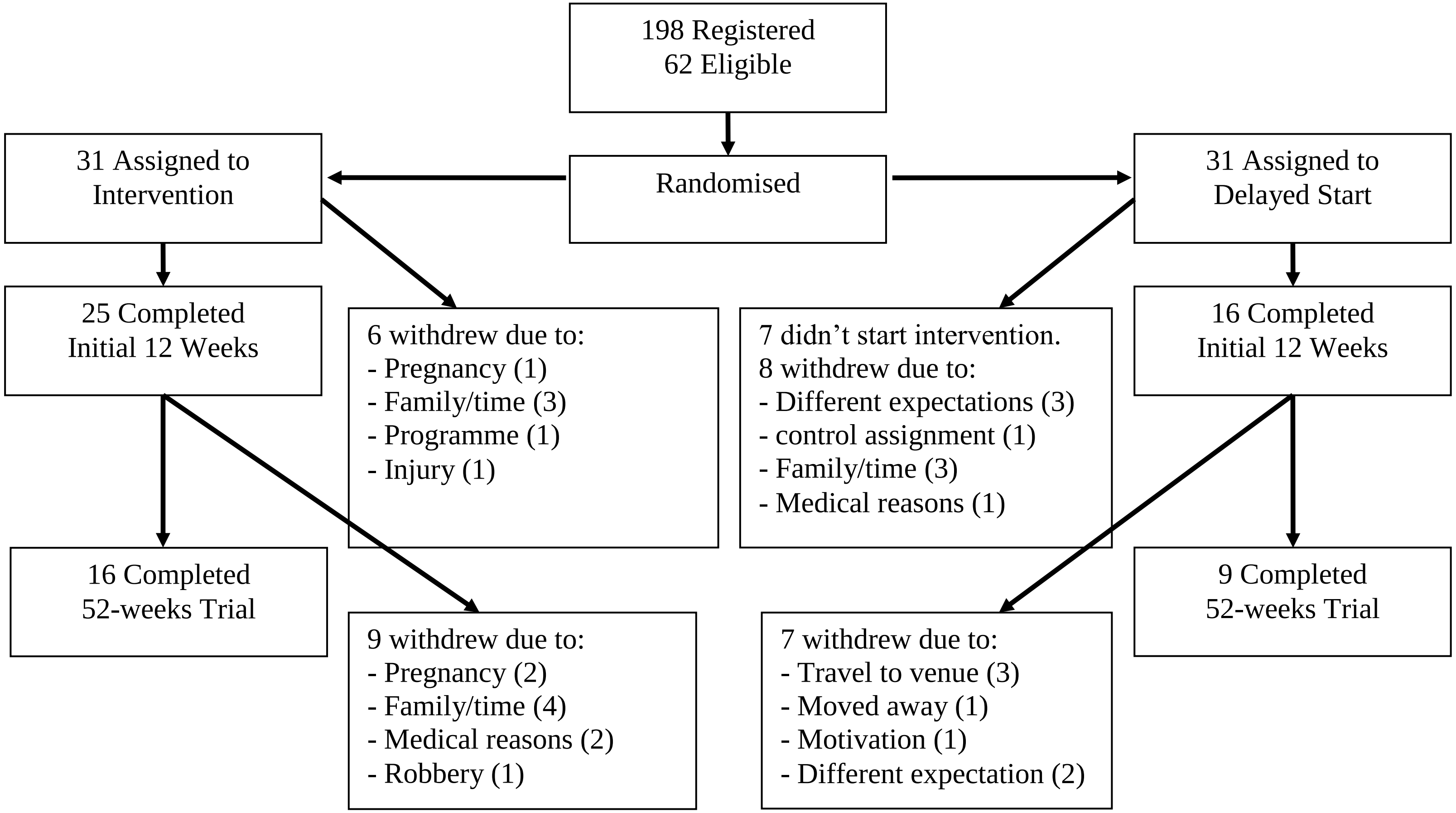
In summary, the purpose of this PhD was to determine whether a one-year-long exercise-based lifestyle intervention for clinically obese but otherwise healthy women improves health outcomes, including psychological and physical health. This research did not take the trial further to Phase III due to PhD submission constraints.

Table 4.4: Appraisal of design options for Phase II of the PhD.

	Pros	Cons
Experimental Designs		After Whitehead (2004): 4 sources of bias: 1. Investigator bias 2. Participants' expectations (placebo) 3. Ascertainment bias (inadvertent selection of an unrepresentative sample) 4. Non-specific effects, such as the quality of relationships between various professionals and participants.
Traditional RCTs	Gold standard way of investigating differences between intervention and control group. Randomised, double-blinded, parallel group, placebo controlled, multi-centred. RCTs thought to minimise biases. Employment of placebo-control groups to minimise expectation effects. Recruitment should be from multiple centres, using multiple practitioners.	It was not possible to have a double-blinded study, as the researcher designed the project and carried out the sole management of the intervention and delayed start control groups. There was no option to have multi-centres and placebo controlled study as it was a PhD study and there was no scope to recruit a 'distraction' (e.g. playing chess with friends) placebo group.
Delayed Intervention RCT	All participants will receive and may benefit from the intervention. Uses a gold standard methodology: RCT. Controls for non-specific treatment effects such as regression to the mean.	It is problematic for participants who were randomised to delayed start control not to change their 'usual' behaviour in the wait. It is not ideal for them to wait 3 months, as their condition may worsen (e.g. develop obesity-related diseases, like diabetes, hypertension etc.). Poor control for placebo effects as nobody is expected to improve whilst waiting, and in fact may deteriorate, which will bias subsequent measures, by showing a larger effect in differences between groups (immediate and delayed).

The MRC's (2000) framework (see figure 4.1) recommends using qualitative research both in the early and later stages of the RCT, first for developing an understanding for the design of the intervention and later to find out why people may or may not benefit from intervention. They postulated that using a qualitative component to the study could locate the 'active ingredients' of an intervention. Furthermore, the MRC guidelines stated that 'Qualitative studies may be used to determine which groups of participants are most likely to respond positively to the intervention, whether the intervention must be modified in different ways for the different groups, or simply not used for certain types of people' (p. 9). These arguments provide a strong rationale for the MD used the exploratory trial.

Figure 4.2: Participants randomisation and follow-up.



4.4. Participants

Newspaper and email advertisements were used to recruit participants (see also Appendix A). The final 62 participants were between 24 and 55 years of age, the mean age being 40 years (see Table 4.5 for SD's additional demographic and physiological characteristics of the sample). The sample had an average BMI of 38.6kg·m^{-2} ranging from 30-65, were free of obesity-related medical disorders, relatively free from psychological problems, and had their GPs' signed approval to participate (see also Figure 4.1). For the purpose of the study it was assumed that over-fatness was mainly the result of the participants' lifestyles, rather than their genetic make-up. The recruitment criteria were established at the planning stage of the research and only those who fitted the criteria were recruited—criteria: BMI < 30, non-pregnant women, pre-menopausal, non-smoking free of CHD, hypertension, diabetes and other known diseases, no drugs (except of hormonal contraceptives). All participants read the information sheet provided and signed the consent form before enrolment. All communications were conducted by the researcher either in person or in writing and by phone if necessary throughout the programme. Participants were also free to phone in and make individual appointments with the researcher if they wanted to.

All participants were required to fill out a Recruitment Questionnaire (see Appendix B). Participants who answered the question 'How do you rate your health?' as 'poor' were asked to clarify what they meant by poor health at the weight history interview conducted by the lead researcher (EB). Similarly, if they had indicated on the recruitment questionnaire that they were often or very often depressed, this was also followed up during the same interview. It was established that none of the participants at the time of the weight history interviews had suffered from clinical depression that was under medical control. The participants' health status was also clarified with a follow-up phone call to their GPs at the time of recruitment if they indicated that they suffered from ‘poor health’. During fitness testing, two participants showed signs of high blood pressure and borderline diabetic symptoms. The referral system which was put in place by the lead researchers in the event of any medical and/or psychological problems prior to the intervention allowed for further assessments and investigations to take place. The two women with high blood pressure were treated by the identified medical doctor (cardiologist) working with the lead researcher. The 24-hour blood pressure check proved to be non-significant for both women. At all times, if health problems were uncovered by this research participants were referred on to contact their GPs and seek help for those conditions. One woman with a BMI of 51.38 $kg \cdot m^{-2}$ suffered from serious sleep apnoea that was unnoticed by her doctor and subsequently got treated on referral. Similarly, women who had admitted to having eating disorders (e.g. binge eating, bulimia, night eating syndrome, restrictive eating – 15 out of 62; 24%) during the brief cognitive behavioural sessions were advised to seek help via their GPs. Obviously, these women could not have functioned in their everyday lives if they had full-blown eating disorders, but certainly they exhibited signs of disordered eating patterns. Additionally, one woman developed serious psychiatric problems and was treated for it by a psychiatrist to whom she was referred, whilst remaining and completing the yearlong programme. See also appendix C, D, E, F, and G for information participants provided prior to enrolment to the programme.

Table 4.5: Baseline demographic, anthropometric and metabolic components among 62 participants recruited to the WHEEL study.

Variable	Mean (SD)
Age, years	40.2 (7.7)
Weight, kg	104.3 (21.4)
BMI, kg·m^{-2}	38.6 (7.6)
Waist circumference, cm	107.9 (16.2)
Waist-Hip circumferences ratio	0.86 (0.10)
Body Fat content, %	33.7 (9.5)
$\dot{V}O_2$, ml·min^{-1}	2258.3 (356.0)
$\dot{V}O_2$, ml·kg^{-1}·min^{-1}	22.1 (3.3)
Total Cholesterol, mmol·l^{-1}	5.33 (0.88)
HDL-cholesterol, mmol·l^{-1}	1.28 (0.29)
Triglycerides, mmol·l^{-1}	1.52 (0.65)
Fasting glucose, mmol·l^{-1}	5.29 (1.1)
Systolic BP, mmHg	132.9 (17.8)
Diastolic BP, mmHg	86.8 (10.5)
IDF MetS components	2.6 (1.2)

Fasting glucose n = 58; Lipoprotein-lipids n = 55;

Blood pressure n = 54

4.5. Measurements and instruments

4.5.1 Anthropometrics

Body composition assessment was used to identify participants' health risk associated with being clinically obese (i.e. having high percentage of total body fat), especially considering intra-abdominal fat. These measures were used to promote their understanding of the health risk associated with being over-fat. The measures were also used in providing feedback to participants in their progress on the weight-management programme (Heyward & Stolarczyk, 1996). The researcher and her research assistant were trained on at least 50 clinically obese individuals prior to taking the various measurements during the WHEEL project's data collection period (see Appendix H).

Anthropometry measures the size and proportion of the human body. All measurements were taken in accordance with Lohman, Roche and Martorell's (1988) Anthropometric Standardisation Manual, with Heyward and Stolarczyk's (1996) and with Roche, Heymsfield and Lohman's (1996) recommendations. Three measures were taken at each site and the average was used in further analyses. All circumference and body diameter measurements of the limbs were taken on the right side of the body (Heyward & Stolarczyk, 1996). Circumference measurement accuracies were re-checked with 10 participants who were recalled a week later, on the same day, and at the same time to establish test-retest reliability at the assessment stage. Test-retest correlations for the circumference and body diameter measurements were between 98-99%. Only field techniques were used to measure adiposity in this study, because of the costs associated with the more sophisticated body composition measurements such as under-water weighing, Magnetic Resonance Imaging (MRI), Computed Tomography (CT) scans, and Bodpod. Furthermore, for the purpose of this study such measurements were not required.

4.5.1.1. Height

All measurements were taken at the same time of the day (e.g. either pm or am depending on testing) and by the same person (i.e. the lead researcher or the research assistant) to minimise error in measurements. All participants were asked to stand barefoot on a horizontal surface with heels together. It was checked that their back was as straight as possible with the buttock, shoulder blades and back of the head in contact with the pole of the stadiometer. Participants then were asked to 'look straight ahead' and to 'stand up tall'. Then the stadiometer's ruler was horizontally placed on their heads. Measurements were taken to the nearest millimetre using a portable, direct-reading stadiometer (Seca 217 Stadiometer; Birmingham).

4.5.1.2. Weight

Using a digital scale (Seca α 770 digital low form scale; Birmingham), participants were measured in their underwear, without shoes, to the nearest 100 g. The same scale was used to measure all participants and they were checked for calibration and buttery each time lapse before use. The scale was based on a solid supporting surface in the laboratory examination room.

4.5.1.3. Body Mass Index (BMI)

Based on height and weight participants BMI was calculated (BMI is a ratio of body weight and height squared (kg/m^2) with which body weight is measured in kilograms and the height is in meters). BMI is considered to provide the most useful population-level indicator of obesity (WHO, 1998). BMI, or Quetelet Index, is however a crude index of obesity, because it does not accurately measure body fatness (Heyward & Stolarczyk, 1996). However, it is a good enough measure to describe risk factors associated with obesity in a sedentary population (WHO, 1998). The advantage of using BMI is that it can conveniently be measured and is frequently used in obesity-related research findings. Some of the limitations associated with BMI are:

- BMI does not differentiate between different fat distributions of obese (e.g. visceral obesity), which is important in terms of assessing health risks (Garn, Leonard, & Hawthorne, 1986; Nevill, Stewart, Olds, & Holder, 2006).
- Lohman (1992) identified the potential of over-estimation of fat-free mass because of the varying amount of muscle, organs, and skeleton, as well as fat.

4.5.1.4. Circumference

Circumference measurements, just as BMI estimations, are affected by fat, muscle and skeletal mass, skeletal size being directly related to lean body mass (Heyward & Stolarczyk, 1996). All measures were taken with a metal tape measure that did not stretch with use. The following anatomical sites were measured: shoulder, arm, chest, forearm, wrist, waist and umbilicus, proximal thigh, knee, calf and ankle. Standardised procedures were closely followed when finding the measurement sites. Using a pen, participants were marked when these were located to ensure that all three measurements were taken at the same site. The average of three measurements was recorded and used for further analysis.

4.5.1.5. Waist to Hip Ratio (WHR)

WHR was calculated from circumference measurements. WHR is a ratio of the circumference of the waist to that of the hips. The WHR as well as the BMI are perceived to be good predictors of intra-abdominal fat (Després, 1993). There is a strong support for using WHR as a measure of risks associated with fatness. However, there is a decrease in accuracy of such assessment with increasing levels of obesity (Heyward & Stolarczyk, 1996). To date, research findings have been ambiguous about measuring WHR, because there is no universally standardised procedure. The WHO (1988) recommended that the site to measure waist circumference differs from The Anthropometric Standardisation Reference Manual's (Lohman, et al., 1988). For the purpose of this study the latter was adhered too. Thus, waist circumference was measured in centimetres at the narrowest part of torso, level of the 'natural' waist between ribs and iliac crest. Hip circumferences were measured at the maximum posterior extension of buttocks, by applying the tape around the abdomen at the level of greatest anterior protuberance. This ensured that overhanging fat tissue was also included. This research potentially has identified that the umbilical measures might be a better measurement site than the waist circumference when assessing abdominal fatness and associated health risks.

4.5.1.6. Skinfolds (SKF) thickness

The SKF measures were taken in a private dressing room in the presence of two researchers to minimise the embarrassment to participants. The advantage of SKF measures is that it is easy to administer at a relatively low cost. Furthermore, it is a reasonably good measure of subcutaneous and total body fat (Lohman, 1992). The sum of total SKFs in this research was used to estimate total body fat. The sites measured included chest, subscapular, suprailiac, abdominal, triceps, biceps, thigh and calf to give indication of body fatness. The same Harpenden skinfold calliper was used on all participants and all skinfolds were measured to the nearest 0.1mm.

The BMI, WHR, and the SKF estimations of body fatness are potentially problematic in obese individuals (McNeill et al., 1991; Fowler et al., 1991). It was felt that the over-fat in terms of health risk was important, but not crucial to this work. All the body composition measurements were triangulated and statistically analysed to establish which indexes were the best predictors of the metabolic profile obtained at the assessment stage of the study.

4.5.1.7. Bioelectrical Impedance Analysis (BIA)

In this study a Maltron BF-906 (Maltron International Ltd. Rayleigh, Essex, UK) body fat analyser was used to measure rapidly and non-invasively body composition. It was assumed that impedance to current flow through the body is directly related to the square of the individual’s height and indirectly related to the cross-sectional area (Heyward & Stolarczyk, 1996). The BIA measures took place at the same appointment as blood samples were taken; therefore it was easier to manage the conditions of measurement criteria (e.g. participants to fast before tests). Participants were asked to not to eat or drink within 12 hours of the test; not to exercise within 12 hours of the test, urinate within 30 minutes of the test; consume no alcohol within 48 hours of the test; and not to take diuretic medications within seven days of the test. All compliances were checked before measurements were taken. Those who had a tendency to retain water during their menstrual cycle were asked to take the test at another time, if the timing of the test coincided with that period. The same instrument was used and checked for calibration before each measurement on all participants. It was made sure that all measures were taken according to guidelines provided.

- BIA measures were taken on the right side of the body with participants lying supine on a nonconductive surface in a room with normal temperature (~22 ºC).
- At all electrode sites the skin was wiped with an alcohol pad.
- The electrodes were placed on the right hand (and wrist) and right feet (and ankle) according to Figure 4.3:

Figure 4.3: Hand and ankle measure site (maltronint.com).

- Lead wires were attached to the appropriate electrodes; black leads were attached to the hand and foot; red leads were attached to the wrist and ankle.
- Extreme care was taken that there should be no contact between the thighs and between the arms and the trunk, which is problematic in the obese.

Research has shown that hydration levels in obese women (76% to 77% fat-free body – FFB) are higher than in leaner women (73% to 74% – Segal, Wang, Gutin, Pierson, & Van Itallie, 1987). Furthermore, the fat-free body (FFB) density of obese individuals is less than 1.10 g/cc, resulting in a systematic overestimation of %Bf when two-component body composition models and equations are used. Therefore, Gray, Bray, Gemayel, and Kaplan (1989) and Weltman, Levine, Seip, and Tran's (1988) prediction equation for obese women were used to estimate body fatness.

BIA women (19-59% BF) – Gray et al. (1989)

FFM (kg) = 0.00151 (HT^2) – 0.0344 (R) + 0.140 (BW) – 0.140 (BW) – 0.158 (age) + 20.387

(FFM = fat-free mass (kg))

Anthropometry women (20-60 yr) – Weltman et al. (1988)

%BF = 0.11077 (AB C) – 0.17666 (HT) + 0.14354 (BW) + 51. 03301

(BF = body fat; HT = height (cm); R = resistance (Ω); BW = body weight (kg); AB C (cm): average abdominal circumference = {(AB_1 + AB_2)/2}, where AB_1 (cm) = abdominal circumference anteriorly midway the xyphoid process of the sternum and the umbilicus and laterally between the lower end of the ribcage and iliac rests, and AB_2 (cm) = abdominal circumference at the umbilicus level).

4.5.1.8. Limitations and sources of measurement error in anthropometrics

Heyward and Stolarczyk (1996) identified researchers' experience and skill level in measurements, participant factors, equipment used, and the prediction equation selected to estimate body composition as sources of measurement error (see also Sebo, Beer-Borst, Haller, & Bovier, 2008). It was particularly difficult to measure some obese women in this study because the underlying muscle and fat tissues were hard and compressed. Furthermore, it was difficult to locate anatomical landmarks. However, in this research great care was taken to overcome most of these errors. From this perspective, participant factors did affect skinfolds and circumference measurements, especially in the case of those participants with the highest BMI. For example, in one case the measurement tape was not long enough to measure shoulder circumference. This data was discarded when the 2-meter tape measure was insufficient during circumference measurements. Similarly, it was difficult to get accurate measurements when skinfolds were taken on the same participants.

4.5.2. Physiological measurements

4.5.2.1.Bassey et al.'s (1976) Walking Test

This walking test was used because of its suitability for frail individuals. It allowed the participants to choose the intensity of their performance in response to standard instructions. This test measures cardiac response to exercise. Before the test, participants were fitted with a heart rate monitor and chest transmitter (S610i Polar Heart Rate Monitor: Polar Electro Oy, Kempele, Finland), and their resting heart rates were recorded. Thereafter, heart rate measures were taken at the end of each lap that was completed. Additionally, each participant's blood pressure was measured by an Accoson Dekamet Mecury Sphygnomamometer, with a wide Velcro cuff (Accoson, Essex, Harlow, UK), with subjects in a seated position. Three readings were taken, with the average score recorded as the measured value, before and after the test. It was essential to use cuffs that fitted a larger than 33 cm circumference. All participants were asked to walk an indoor course three times: three laps of 100 m, at three different speeds (slow, normal, fast) ensuring that they chose their own walking speed in response to standard instructions. The researcher took great care not to interfere with the participants' choices. They were nor encouraged or discouraged whilst taking the test.

The verbal instructions of the researcher were as follows: *'Please walk rather slowly; please walk at your normal speed, neither fast nor slow; please walk rather fast, without overexerting yourself'* (see Appendix I).

The test was run progressively without rest periods. The mean of each lap walked three times was used in the final analysis. Bassey, MacDonald, and Patrick's (1982) equation for women was used that identified factors which significantly affected chosen walking speeds and heart rate. These were stature, age, and percentage of fat, but not gender, although that was not relevant to this study.

The equation used was: $fc_{4.8}$ (beat · min^{-1}) = 161 - 50.7 stature (m) + 0.223 body weight (kg) + 4.43, where fc is a standardised value at 4.8 km · h^{-1} by interpolation from points recorded at three walking speeds (i.e. fc = physical condition assessed by heart rate at a standard exercise intensity).

4.5.2.2. Cardiopulmonary exercise test

Cardiorespiratory fitness was assessed at baseline, 6 months, and 12 months using a submaximal graded exercise test on a treadmill. The modified Bruce Protocol was devised that was piloted on three clinically obese participants prior to the start of the study. All participants underwent a short habituation time to get used to the treadmill.

Participants underwent baseline maximal treadmill walking tests at the Non-Invasive Cardiology Unit, Leeds General Infirmary. The environmental conditions within the laboratory were maintained around 20°C and 40 – 60% humidity. The laboratory supervisors and technicians who determined participant scores at baseline and post-intervention were not blinded to the participants' group allocation. Participants were informed of their exercise test results at each stage of the study by the lead investigator. The exercise test stage consisted of graded treadmill walking to volitional exhaustion. A total of up to nine three-minute stages were used in which the speed and inclination were increased in an alternate fashion ranging from 2.0 mph, 0% gradient to 4.0 mph, and 16.0% gradient. Details regarding the specific speed and grade of each treadmill stage have been previously described (Lehmann, Schimd, Ammer, Schomig, & Alt, 1997) (see Appendix J).

Continuous breath by breath sampling of respiratory gases was carried out using the Medgraphics Cardio[2] Cardiopulmonary Exercise Testing System (Medical Graphics Corporation, St Paul, Minnesota, US) incorporating a flow/waveform module, oxygen and infrared (IR) carbon dioxide gas analysers and a 12-lead electrocardiograph. Based on breath by breath samples and using a rolling average of eight breaths, the following respiratory data was assessed: $\dot{V}O_2$ (oxygen consumption, $ml.min^{-1}$ and $ml.kg^{-1}.min^{-1}$), $\dot{V}CO_2$ (carbon dioxide production, $ml.min^{-1}$), RER (respiratory exchange ratio, $\dot{V}CO_2/\dot{V}O_2$, $P_{ET}co_2$ (end-tidal partial pressure of CO_2, mmHg), $\dot{V}E$ (expired volume of gas, $l.min^{-1}$ BTPS) and Vt (tidal volume, ml. BTPS).

Heart rate responses were derived from a 12-lead ECG monitored throughout exercise. Systolic and diastolic blood pressures were obtained at rest and during each stage of treadmill exercise and peak exertion from the brachial artery using a standard mercury sphygmomanometer. The peak mean arterial pressure (MAP_{peak}) was calculated as (SBP_{peak} + (2 x DBP_{peak})/3, where SBP_{peak} is peak systolic blood pressure and DBP_{peak} is peak diastolic blood pressure (Cooke, Marshall, al-Timman, Wright, Riley, & Hainsworth, 1998).

The test was ended when the participants were close to exhaustion according to the Borg scale (Rating of Perceived Exertion above 17) and/or when the increase in oxygen uptake with increasing workload was levelling off with a respiratory exchange ratio above 1.05.

Within one week of the graded exercise test, the participants re-attended the laboratory for the determination of resting and peak exercise cardiac output using CO_2 rebreathing techniques. The principle of rebreathing methods for determination of cardiac output is to cause the alveolar CO_2 level to increase until gas exchange ceases (Nichols, O'Dochartaigh, & Riley, 2002). Alveolar CO_2 tension is then assumed to be equal to that in mixed venous blood. The end tidal partial pressure of CO_2 ($P_{ET}co_2$) is used as a measure of arterial PCO_2. Cardiac output (Q) was estimated, using the indirect Fick principle, from CO_2 output and arterial and mixed venous contents, determined using appropriate CO_2 dissociation curves (Cooke et al., 1998). Three estimates of cardiac output were normally undertaken at rest. Resting estimates of cardiac output were made using the equilibrium CO_2 rebreathing method as described by Collier (1956). This method involves rebreathing from a bag containing a high initial CO_2 concentration. Following this, the participants completed a single-stage maximum workload test. The treadmill speed and incline were initially set to the level of the highest completed or nearly completed stage from the previous graded exercise protocol. The speed and incline of the treadmill were adjusted to enable the subject to sustain the exercise for at least five minutes and aim to attain a $\dot{V}O_2$ of at least 90% of the maximum attained during the graded test. At peak exercise, the exponential CO_2 rebreathing method of Defares (1958) was employed in duplicate to estimate cardiac output. Independent investigators (VanHees et al., 2000) have recommended the equilibrium method for the estimation of resting cardiac output and confirmed that automated curve-fitting for the exponential method provides reproducible and valid results at peak exercise.

Cardiac power output (CPO) was calculated from the mean cardiac output and mean arterial pressure using the following equation (Cooke et al., 1998): CPO=(Q x MAP) x K, where CPO is in Watts (W), Q is cardiac output in litres·min^{-1}, MAP is mean arterial pressure in mmHg and K is the conversion factor (2.22 x 10^{-3}). The physiological cardiac reserve is equal to the difference between CPO_{peak} and baseline resting CPO. Systolic and diastolic blood pressures were obtained at rest and during each stage of treadmill exercise and peak exertion from the brachial artery using a sphygmomanometer. The peak mean arterial pressure (MAP_{peak}) was calculated as (SBP_{peak} + (2 x DBP_{peak})/3, where SBP_{peak} is peak systolic blood pressure and DBP_{peak} is peak diastolic blood pressure (Cooke et al., 1998). Systemic vascular resistance to blood flow (SVR) was estimated as MAP_{peak}/Q_{peak} and as per convention multiplied by a factor of 80 to convert units to dynes·sec·cm^{-5}. Peak exercise arterio-venous O_2 content difference ($AVDO_{2peak}$), expressed as vol %, was calculated as ($\dot{V}O_{2peak}/Q_{peak}$) x 100.

4.5.3. Blood Sampling

Blood samples were collected after 10 min recumbence between 08.00 and 10.00 am after overnight fast and abstinence from smoking. Furthermore, the participants were told to abstain from vigorous exercise for four days prior to blood sampling. The fasting lipoprotein-lipid and glucose components were measured as routine samples at the General Infirmary at Leeds, UK. Triglycerides, total cholesterol, and HDL-cholesterol were analysed using standard enzymatic methods. The blood data will not be discussed in the present thesis.

4.5.4. Eating diaries

Eating diaries in this study were not formally assessed for treatment purposes or nutritional advice. They were used to understand psychological eating behaviour patterns during the six-weeks eating behaviour intervention run by a state-registered dietician. The method chosen was to use 24 hr, 3-Day, and 7-Day unweighed food diaries. Implementing this method made recording much easier for the participants. Eating diaries are notoriously biased for under-reporting, especially among the overweight, obese population (Heitman & Lissner, 1995; Pannermans & Westerterp, 1993; Rennie, Coward, & Jebb, 2007). Furthermore, when Bull, Wheeler, and Gatenby (1991) asked participants to reflect back on how easy or difficult it was to record food intake, they found the 24 hr recall quick and easy but failed to indicate their normal intake. Additionally, they admitted to adjusting their intake during the 7-Day recording when it became tedious. They also reported that often unscheduled snacks were omitted. A Dietary Pattern Instruction Booklet (Taylor, 1996, adapted for WHEEL by the lead researcher – see Appendix O and P) with diaries was used. Self-reported measurement of hunger and current feelings was a 100 mm unanchored visual analogue scale (VAS; Silverstone, 1975). This scale is frequently used to assess change in ratings. Moreover, it was easy to incorporate the scale in the behaviour eating diary and is an appropriate measure of ‘feelings’ including stress at specific time points.

4.5.4.1. Completion of diaries

All diary formats and completion procedures were adapted from Taylor (1996). Participants were asked to complete a separate, two-page booklet every time they had anything to eat or drink over a period of 24 hours. This procedure was repeated for the 3-Day and 7-Day records. Procedure for completion of each diary was as follows: 1) recording all food and drink consumed; 2) answering a series of questions about the time before and after eating and drinking, such as social context and location of consumption. Furthermore, feelings were recorded on a visual analogue scale (Schlundt, Hill, Sbrocco, Pope-Cordle, & Kasser, 1990) before each entry, but only during the 24 hr diary. This scale was not used in the 3-Day or 7-Day diaries, as it would have placed considerable burden on participants. A 100 mm, anchored line was used for all variables. Participants had to put a vertical stroke to mark their degree of feeling on the line. The low end of the scale was at the left extreme of the line and the high end of the scale was the right end. All participants were instructed not to change their eating behaviours whilst keeping the diaries.

4.5.4.2. Analysis of eating diaries

Resting Metabolic Rate (RMR) was measured during the exercise fitness test. This value then was used to assess the likely completeness of their 24 hr record by comparing the ratio of energy intake to RMR. None of the women were doing strenuous physical activity at the time of measurement. A ratio of less than 1.35 would be assumed to indicate that a record was unlikely to be complete. Similarly to Taylor's (1996) analysis association between meal pattern and five factors (BMI, total energy intake, lipid profile, glucose tolerance) and the presence of the internal ('feelings') and external cues was investigated. The following meal pattern information was identified from the diaries: 1) mean daily energy intake (kcal/24hr); 2) mean daily energy intake relative to RMR – an expression of energy intake relative to energy requirements in the absence of strenuous work or leisure activity; 3) median number of meals per day; each booklet was considered to represent a 'meal' providing that more than zero kcals had been consumed (meal/24hrs); 4) median length of fast between meals (hours). The visual analogue scales were analysed by measuring the position of the vertical line marked by the participant from the left hand end of the line. Words like, 'hungry, tired, depressed, bored, stressed, irritable, nervous, craving for sweet food or drink, temptation to overeat and thirst' were classified as negative feelings. 'Happy' was classified as a positive feeling. A feeling score was calculated for each participant. This was a median rating of all ratings that a participant had made for a feeling, over a 24 hr period. Additional analyses were conducted on other characteristics of the 'meal', such as number of meals in 24 hrs, description of the meal (e.g. snack), the number of other people present at each meal, and location and availability of foods considered forbidden.

4.5.5. Psychological functioning

The participants were requested to complete a battery of inventories at baseline, 12 weeks, and 52 weeks. The selection of the inventories was guided by instruments previously used in similar research, the approach adopted in the present study and the psychometric properties of the instruments. With regard to the latter, the instruments used have all been previously validated (see Appendix N).

4.5.5.1. Quality of Life – General Well-Being

Health-related quality of life has become a popular outcome measure in medicine (Wadden & Phelan, 2002). There are a number of generic instruments as well as obesity-specific measures of health-related quality of life. In their review of health-related quality of life in weight loss RCT's Maciejewski, Patrick, and Williamson (2005) found that obesity-specific measures were more sensitive to change than generic instruments. Although generic instruments could provide useful information with regard to general aspects of quality of life, condition-specific measures are better in highlighting condition-specific issues (Kolotkin, Crosby, Williams, Hartley, & Nicol, 2001). In addition, most studies have found that measures of psychological well-being or psychopathology have been associated with weight loss (Teixeira, Going, Sardinha, & Lohman, 2005). Finally, it has been suggested that instruments should measure positive well-being rather than the absence of symptoms or subjective distress (Hopton, Hunt, Shiels, & Smith, 1995). Therefore, in the present study the General Well-Being (GWB) schedule (Dupuy, 1977 & 1978) was used to assess the participants' quality of life. The GWB is an 18 item questionnaire with a past month time frame of which 14 questions relate to intensity of feelings on a six-point scale. Four questions anchored by adjectives are scored on a 10-point scale. The total GWB score is calculated by summing the scores of the 18 items and subtracting 14. A score between 0-60 reflects ‘severe distress’, 61-72 ‘moderate distress’, and 73-110 ‘positive well-being’ (Miller & Harrington, 1997). The GWB schedule consists of six subscales: emotional control and stability, energy level, relaxed vs. tense or anxious, cheerful vs. depressed mood, satisfying and interesting life, and freedom from health concern or worry. The GWB has adequate coefficients alpha (ranging between 0.82-0.95), test-retest reliability (Edwards, Yarvis, Mueller, Zingale, & Wagman, 1978; Hildebrandt & Kelber, 2005) and validity (Fazio, 1977; McDowell & Newell, 1987). The Cronbach alpha coefficient for the total score of the GWB was 0.93 and 0.94 for the pre- and post-test respectively. The alpha values for the subscales were acceptable and ranged between 0.69 and 0.84.

4.5.5.2. Stress

It has been suggested that high levels of stress or anxiety are limiting factors in the treatment of obesity (Teixeira et al., 2005). In addition, Bjorntorp (1999 & 1991) has suggested that ‘psychosocial pressures’ contributed to the accumulation of visceral fat and related metabolic abnormalities through chronic hypothalamic arousal (Metabolic syndrome). Stress, therefore, could have some significant health implications. The participants therefore completed the 14-item Perceived Stress Scale (PSS: Cohen, Kamarck, & Mermelstein, 1983). Similarly to the GWB the PSS targets a past month time frame. Participants responded to items on a 5-point Likert scale with higher scores reflecting greater perceived stress. Items are summed to obtain total score. Additionally, it has been suggested that the PSS consist of two separate factors: adaptational symptoms and coping ability (Hewitt, Flett, & Mosher, 1992). The PSS has appropriate reliability and validity (Brunner, 1997). The Cronbach alphas for the pre- and post test were 0.87 and 0.82 respectively and ranged between 0.60 and 0.84 for the two subscales.

4.5.5.3. Body image and self-esteem

Self-esteem and body image dissatisfaction are often assessed in weight loss studies. The unidimensional Rosenberg Self-Esteem Scale is generally used to assess self-esteem in participants. Although this has been shown to be a valid and reliable instrument it only assesses global self-esteem. However, the self is far more complex and it is now well established that the self is multidimensional and hierarchical in nature (Shavelson, Hubner & Stanton, 1976). Instruments which assess these multidimensional aspects of the self have been developed. Such instruments assess generally overall self-esteem with separate questions from those which assess domain-specific self-ratings (Fox, 2008 & 1997). The present study, therefore, used the Self-Perception Profile (SPP: Messer & Harter, 1986) a multidimensional measure of self-concept. The SPP consists of 50 structured alternative questions. Two statements are made per item and the participant has to indicate which is more like them. Additionally, they indicate how true this statement is for them by answering either ‘sort of true for me’ or ‘really true for me’. The SPP has 50 items and twelve factors (sociability, job competence, nurturance, athletic abilities, physical appearance, adequate provider, morality, household management, intimate relationships, intelligence, sense of humour, global self-worth) with each factor consisting of four items, except global self-worth which consisted of six items. Within each subscale half the items are worded so that the first part of the statement reflects high competence and the other half is worded so that the first part reflects low competence. The SSP has adequate reliability (alphas between 0.63 and 0.92) and validity (Messer & Harter, 1986). The reliability for the most factors was good to high (alphas between 0.70 and 0.95) except for sociability at 12 weeks (alpha = 0.64) and 1 year (alpha = 0.57) and appearance at baseline (alpha = 0.61).

This study also assessed state self-esteem. The State Self-Esteem Scale (SSES) (Heatherton & Polivy, 1991) assesses transient changes in self-esteem. It is a 20-question inventory with a 5-point Likert response scale (Not at all to Extremely) with higher scores indicating higher self-esteem. There are three self-esteem factors in the SSES: Academic performance, Social evaluation and Appearance. The SSES has sound psychometric properties with considerable concurrent and discriminant validity in different settings as well as adequate reliability (alphas between 0.80 and 0.92 – Heatherton & Polivy, 1991; Vohs, Bardone, Joiner, Abramson, & Heatherton, 1999). The present study found adequate alphas (between 0.71 and 0.92) for all three factors.

Several instruments have been used to assess body image dissatisfaction. A valid and quick method to assess dissatisfaction is to use pictograms. Therefore, body image dissatisfaction was assessed using eight pictograms of body shape (Silberstien, Striegel-Moore, Timko & Rodin, 1988). Participants were asked to rate their current size and their ideal size. The difference between these ratings was used as the body image dissatisfaction index. The validity and reliability of the use of figural stimuli for the measurement of body image dissatisfaction is well established (Thompson, 1995). Finally, participants were asked their desired and expected weight loss following the intervention.

4.5.5.4. Self-determination/locus of control

In order to assess the effectiveness of the adopted intervention philosophy the following two instruments were used:

- *The General Causality Orientation Scale* (GCOS – Deci & Ryan, 1985b): The GCOS measures autonomy, controlled, and impersonal motivational orientation. It has been hypothesised that these orientations are part of an individual personality and exist within each individual to some degree. Deci and Ryan (1985b) define these motivational orientations as follows:

> *Autonomy*: the extent to which a person is oriented toward aspects of the environment that stimulate intrinsic motivation, are optimally challenging and provide informational feedback.
>
> *Controlled*: the extent to which a person is oriented toward being controlled by rewards, deadlines, structure, ego-involvements, and the directives of others.
>
> *Impersonal*: the extent to which a person believes that attaining desired outcomes is beyond his or her control and that achievement is largely a matter of luck or fate.

This study used the 17-vignette version of the GCOS which consist of 51 items. Each vignette is followed by three types of responses: an autonomous, controlled, and impersonal. The participant responds to a vignette, which describes a typical social or achievement situation, by indicating, on a 7-point Likert-type scale, to what extent this situation is typical for them. Subscale scores are obtained by summing the individual responses on items corresponding to each subscale. Good validity and reliability has been reported for the 12-vignette version of the GCOS (Cronbach alphas of about 0.75 and test-retest coefficients of 0.74 – self-determination website). The alphas for the three scales at all three points in time were high (alphas between 0.80 and 0.94).

- *Multidimensional Health Locus of Control (MHLC) Scales (Form C)* (Wallston, Wallston, & DeVellis, 1978): the MHLC scale is a multidimensional domain-specific instrument of assessing expectancies regarding locus of control of health behaviour. It consists of 18 questions with a 6-point Likert-type response scale (Strongly Disagree to Strongly Agree). Additionally, the MHLC has three factors:

- *Internality (I)*: The extent to which people believe that their health-related behaviours are under their own control.
- *Change (C)*: Concerned with the degree to which an individual believes that chance affects their health behaviours.
- *Powerful Others (P)*: The extent to which people believe that other people control health behaviours and events in their lives. This has been subdivided in two minor subscales: doctors and other people.

Good constructs and discriminant validity as well as reliability (alphas between 0.67 and 0.77) have been reported in the development study of the MHLC (Wallston, Wallston & DeVellis, 1978; Wallston, Wallston, Kaplan, & Maides, 1976). The present study found good alphas for the I and C subscales (between 0.70 and 0.79). However, the P factor and its two subscales (Doctors and Other people) had low unsatisfactory values (alphas between 0.32 and 0.54).

4.5.5.5. Social support

Finally, this study assessed social support. Social support can be provided in a number of ways. It was felt important in the present study to assess social support for exercise. Increasing the participant's physical activity was an integral part of the intervention programme. Adopting a more physically active lifestyle can be a daunting task and would need support from significant others. Therefore the present study used the Social Support Scale for Exercise (SSSE; Fox & Dirkin, 1992). The SSSE has been specially developed for use of social support for exercise in clinical settings. It consists of four factors: listening, informational, challenge, and negative social support. The degree of social support for each factor is assessed by a single item asking participants to indicate on a 6-point Likert scale (from ‘non’ to ‘very much’) how much of this support is needed and how much is currently received. This results in a 12-item social support profile for exercise: four needed, four received and four deficit scores (need – received). In addition, total need, received, and deficit scores can be calculated. The SSSE has been shown to have good construct validity and to be sensitive to change (Anderson & Fox, 1998).

4.6. Procedure

All female participants were recruited from and around the city of Leeds, in England. The women were of Caucasian origin, apart from one who was Afro-Caribbean. A pre-trial meeting took place before randomisation so that prospective participants could ask questions regarding the project content. Furthermore, philosophy of the programme, research procedures, and processes were explained. Despite the fact that at the pre-intervention meeting the participants were told that the researcher was only a facilitator in their quest of becoming competent in managing their weight, the majority of participants enquired about a prescription diet sheet and a personal trainer provision. All participants were randomised to either the intervention or the delayed start group after the pre-intervention meeting. All participants were informed in letter and by a follow-up telephone call about their group status and when and where they would start their intervention. Participants who were randomised to the delayed start control group were naturally disappointed, but agreed to take an extra test and remained enthusiastic about the intervention. Essentially, it was explained to all participants that they needed to change their lives to accommodate what they would be learning in the programme; otherwise they were wasting their time. One participant, who was randomised to the delayed start group, put on an extra 21kgs in the three-month waiting period. She had the largest weight in the delayed control group. During the weight history interview she was asked what she thought her large weight gain was due to, and replied: ‘I thought you were going to put me on a diet and I ate myself stupid before the three-month diet period when I had to be good.’ This way of thinking about weight management was not uncommon amongst the participants. However, all participants were encouraged to seek ways of being in control about food (see Intervention). All women were asked what motivated them to apply for the programme. This was in line with the Self-Determination Theory’s assumption that motivation and goals for treatment are important for self-regulation. The women’s motivation and goals were thoroughly assessed (see Measurements Section) at baseline. After a brief motivational interview two participants were asked to leave the project because after lengthy discussions, they still had maintained that they wanted to participate in the project as an obligation to the researcher and because this project was their ‘last hope’. They wanted someone to take responsibility for their weight problems. It was important that the question, ‘Should participants be enrolled to the intervention?’ was answered as ‘yes’ by the researcher based on previous research findings. Extra care was taken that participants were not set up for yet another weight management failure. Events and circumstances that led to participants’ subsequent enrolment were also explored during the weight history interview. It was made sure that the participants set realistic weight and behavioural goals for themselves. These were discussed with each participant prior their intervention period. Understandings of treatment requirements and expectations were checked before starting the intervention. Any discrepancies were dealt with accordingly.

After the assessment the intervention group was asked to commit to a four-hour-per-week physical activity schedule of their choice (see Appendix K). They were presented with a choice of three activities that amounted to four hours of exercise per week: two circuit classes that were the combination of aerobic and resistance training per week, one aqua/aerobic class, and one Tai Chi class per week. Participants could attend to all organised classes or could pick and choose and make up their own exercise schedule as long as they did four hours of exercise per week and of these two in a structured setting. Prior to the intervention, all participants had to agree with the researcher their exercise plan for monitoring purposes. During the three months of the intervention, those who missed two consecutive sessions were contacted by telephone by the researcher to enquire the reasons for not attending. Reasons for non-attendance were recorded.

In addition to the exercise component, during the three-month intervention period they were encouraged to attend six sessions on a non-dieting, nutritional educational programme delivered using the principles of brief cognitive behavioural therapy (CBT) sessions by a state-registered dietician who was also a CBT therapist. During this period self-monitoring was also encouraged by diet diaries used during these sessions and by homework given. Participants could keep further eating and physical activity diaries (see Appendix N) if they chose to, but this was not compulsory as the intervention goal was to get participants fitter through exercise. They could also sign up to see the dietician. Participants also had an opportunity of discussing their progress with the researcher on an individual sign-up basis throughout the intervention and maintenance-phase of the research. This intervention was intensive for this 12-week period. The evaluation of the intervention was ongoing via evaluative questionnaires and follow-up interviews.

The feasibility of the data collection process was continually evaluated throughout the programme. Time and cost constraints limited the extensive follow-up data collection. It was decided after the three months of intervention that only the cardiopulmonary fitness test would be used to monitor fitness in the maintenance-phase in combination with interview and evaluative questionnaire data. Other measurements were taken at the request of individual participants. For example, if a participant felt that they needed further help with their eating habits, they continued to fill out further weekly food diaries that were subsequently discussed and evaluated with the help of a dietician. Finally, after nine months of exercise maintenance, fitness and psychological measures were taken on the remaining participants. All attempts were made to follow up dropouts.

4.7. Ethics

The Leeds Health Authority/United Teaching Hospitals' Local Research Ethics Committee gave full ethical approval for the study. All data, especially that of medical nature, was kept confidential.

4.8. Limitations of methods/design employed

The theoretical limitation of this study derives from the use of a delayed start control group as discussed previously. There is a considerable debate in the literature about the appropriateness of RCT designs for behavioural interventions (e.g. Lean, 2000; Whitehead, 2004). As Lean (2000) suggested, a single-sample study with regression analysis should be employed in obesity-related lifestyle interventions. Other limitations of RCT designs are relative and shared by other study designs. Despite the debate above, Stephenson and Imrie (1998) argued that interventions on health behaviours are often complex and demanding, hence the need for an RCT to assess the efficacy of such interventions. Therefore, the exploratory RCT was still deemed more useful in meeting the overall aim of this PhD as experimental biases needed to be minimised and efficacy of intervention to be explored, with avoidance of false conclusions.

Similarly, the researcher found that the group that received the intervention first had done markedly better in all aspects of the study than those in the delayed start control group. A number of issues are relevant here. For example, the RCT design is severely confounded by the placebo effect. That is, the delayed control group was waiting to be treated. It is inevitable that simply being accepted for treatment has altered their behaviour. Another factor was that this study measured metabolic and cardiac risk factors in participants to establish the extent to which they have changed their lifestyle. In addition, weight loss was also measured. These dependent variables are best studied in a single-sample design because of the potential confounding variables arising from the heterogeneity of the sample. Herein lays one of the most important limitations of the design employed. For obvious reasons the researcher had poor control over the lifestyle of participants. Further, lifestyle change (treatment) cannot be prescribed in a certain way; therefore the control of extraneous variable principle of experimental design is not really applicable here.

Whereas the RCT initially assumes that the intervention and control groups are comparable on variables that have a natural cycle of systematic changes, in practice, this cannot be true. Another important limitation of the study therefore would arise from the sampling method employed. Purposeful, convenience sampling did not take into account the various biases arising from the effects of the passage of time (e.g. effects of seasonal and age-related weight gain), ageing (e.g. age gap between participants was high: 24-55), being a volunteer (e.g. motivation to lose weight), and the fact that all participants were dieters before. A long observation period should have helped to establish individual patterns of such changes. However, in the framework of this study it was not a practical option. As a result, participants' weight might have fluctuated depending on these biases. For example, someone who may have recently lost weight through dieting could have entered the study when reaching a 'plateau' in his/her weight loss, which would have impeded his/her efforts to lose weight in the study.

Additionally, there were high individual differences in initial clinical obesity measured by BMI. This alone would have attenuated some participants' individual weight loss that was compounded with biological variations and societal influences (Lean, 2000).

In summary, the major limitation of the use of RCT in this study is that the 'only difference between the two groups should be the treatment, with all other elements remaining the same' (Lean, 2000, p. S5). Obviously, in this study this statement is not true, but by employing the Parallel Mixed Model Design, this limitation was somewhat attenuated by using a combination of research methods (semi-structured interviews, questionnaire data about lifestyles) to gain a wider understanding of the commonalities and differences in lifestyles within the sample. Additionally, the multi-component intervention was administered to participants that is consistent with the SIGN (2010) and NIH (1998) guidelines. This also helped to attenuate the effects of RCT and to establish inferential consistency audit (ICA). ICA is 'the degree to which the inferences and interpretations are consistent with the analysis of obtained data/information and with other inferences/conclusions made in the same study' (Tashakkori & Teddlie, 1998, p. 69). Evidently, ICA ensured the ongoing documentation of methods that allowed a regular audit of results and provided feedback on improvements of methods used.

The approach adopted in this research allowed participants to have an individualised 'intervention' package, where their own, negotiated goals and expectations were managed in a realistic manner. This intervention was based on taking into account the participants' desire for autonomy, relatedness, and competence (Deci & Ryan, 1985b) as can be seen in the next section on The Intervention.

4.9. The intervention

The intervention consisted of a 'lifestyle change' programme (Tremblay et al., 1991) designed within the framework of the Self-Determination Theory (Deci & Ryan, 1985a). The SDT (Deci & Ryan 1985a; Williams et al., 1998 & 1996; Sheldon et al., 2003) was selected as the theoretical psychological framework to maximise motivation for behavioural change. The intervention strategy emphasised relatively individual approaches to physical activity and eating behaviour, in which health professionals provided a treatment rationale, but offered choice, minimised pressure, and acknowledged participants' perspectives within the intervention process. The intervention incorporated elements of both lifestyle physical activity and structured supervised aerobic exercise. Healthy eating and weight-management psycho-educational sessions were conducted weekly throughout the intervention period. Characteristics of the Non-Dieting, Exercise-Based Weight-Management Intervention used within the WHEEL study are presented below:

Environment

- Community-based and centrally-located municipal leisure centres utilised.
- Women-only structured exercise classes, led by two female instructors.
- The exercise environment was carefully researched (e.g. entrance in and exit out of swimming pools, availability of individual changing cubicles, provision of choice of activity, opportunity to exercise and socialise with others).

Physical activity/exercise

- Participants were encouraged to increase physical activity for a minimum of four hours per week.
- Participants selected the activities they most enjoyed and individualised their physical activity and exercise programmes within overall project guidelines. Two hours of this had to be in the structured exercise classes of the programme

that offered two-circuit classes, one adapted Tai Chi class, and one aqua/aerobic class per week.

- Participants could engage in another physical activity/exercise of their choice (in agreement with the principal investigator EB) for the remaining two hours.
- All structured exercise was tailored to their individual fitness levels as ascertained from exercise-testing. Instruction in correct exercise techniques, monitoring of heart rate and ratings of perceived exertion was provided within all of the supervised group sessions.
- Initial exercise intensities and the progression of all activities were consistent with the recommendations of the American College of Sports Medicine position statements.

Healthy Eating Sessions

- A study educational booklet on healthy eating principles and the benefits of exercise was provided to all the intervention participants.
- An intensive three-week nutritional education was led by a qualified dietician and cognitive behavioural therapist. The sessions were set up to educate participants about the potentially adverse affects of dietary restriction.
- Dietary guidelines did not place specific emphasis on a prescribed restriction in caloric intake, but eating in response to physiologic hunger and fullness cues. Participants were encouraged to make healthier food choices and to break unhealthy associations between healthy food and diet food by using brief cognitive behaviour therapy techniques.
- Participants were challenged about their all-or-nothing behaviours and their feelings about food associations were explored.
- Participants were taught to read and understand food labels.

- Participants were given help and appropriate referral if they had tendencies to disordered eating.

Behaviour

- Goal-setting, problem-solving and coping skills for weight-management were employed.

Social Support

- Before treatment, participants completed an exploratory interview and participants' weight and dieting histories, eating and exercise habits, and psychological status were assessed.
- Follow-up phone calls two weeks of exercise sessions were missed. Participants were at liberty to contact the principle investigator for support at any point during the study. If the support required specialist intervention (e.g. counselling) then they were referred back to their GPs for further treatment.
- Attrition, attendance, and participant evaluations of treatment helpfulness were also monitored.

4.10. Analysis strategy

4.10.1. Results of quantitative data WHEEL study

The results of the quantitative data of the WHEEL intervention study were analysed in three ways. First, baseline data was analysed in terms of differences between the Initial Intervention Group (IIG) and Delayed Start Control Group (DSCG). Also, the data was compared with relevant norm data from the literature. Secondly, the RCT arm or the study was analysed by comparing the baseline data with the data obtained at three months. Finally, the follow-up or maintenance-aspect of the study was examined by comparing the baseline data for the IIG and DSCG (obtained at three months) with those obtained at 12 months. The level of significance was set at $P \leq 0.05$. All analysis was conducted using SPSS statistical software (version 16/17.0, SPSS Inc, Chicago).

Prior to data analysis a number of steps were undertaken to assure that the data files were correct and that the data met the assumptions underlying the different statistical procedures. Below follows a step-by-step guide to what was performed.

Step 1: Screening and cleaning of the data set: This stage incorporated the inspection of the descriptive values of each variable in the data set. In particular, the minimum, maximum, mean, and standard deviation were inspected.

Step 2: Preliminary analysis: At this stage the data was assessed for normality and checked for outliers. Using the Explore function in SPSS the following aspects of the data set were examined. First, the 5% trimmed mean was inspected. This value provides information of whether extreme scores have an influence on the mean (Fields, 2009; Tabachnick & Fidell, 2001; Pallant, 2007). In all studies the trimmed means did not show any significant deviation suggesting that there were no data points which had undue influence on the mean. The shape of the histogram for each variable, the normal Q-Q plot and detrended Q-Q plots, were inspected. That is, the histograms were inspected for the actual shape of the distribution. In the Q-Q plot the observed value is plotted against the expected value from the normal distribution and this should result in a relatively straight line. The detrended normal Q-Q plot was inspected for clustering of points. Finally, the boxplot was used (this provide information on outliers). Boxplots were in particular inspected for extreme outliers. SPSS output provides information on outliers which are either 1.5 box-lengths from the edge of the box or extreme points which are more than 3 box-lengths from the edge. On no instance were extreme points encountered in the data sets. As such no data was removed based on the inspection of the boxplots.

Step 3: Information provided for individual analysis. When regression analysis was conducted a number of assumptions were tested. In particular, multicollinearity was checked by inspecting the Tolerance and VIF values. When tolerance is < .10 or VIF > 10 there is a possibility of multicollinearity (Cohen, Cohen, West & Aiken, 2003). In none of the regression analysis conducted was there an issue with multicollinearity. All tolerance values were > .10 and all VIF values < 10. Outliers, normality, linearity, homoscedasticity, and independence of residuals were assessed by inspecting the Normal Probability Plot (P-P) of the regression standard residuals (points are at a reasonable straight line) and the scatterplot of the standard residuals. Cohen et al. (2003) have suggested that there is reason for concern when the standard residuals are more than 3.3 or less than -3.3. Outliers were also examined using Mahalanobis distances (these are checked against residual statistics) and Cook's distance (cases with a value larger than one are potentially problematic). This provides information on extreme values. The P-P plots in the present study were not problematic and the scatter plots did not indicate any problematic data points. This was supported by the Mahalanobis distances (they did not exceed critical points) or Cook's distance (all observations were < 1).

When conducting multivariate analysis of variance the homogeneity of variance of the data set was tested using Levene's test of equality of error variances. Similarly, the homogeneity of inter-correlations was tested using the Box's M statistic. Because this statistic is very sensitive, a more conservative P value was used (P < .001 – Pallant, 2007). In no instance was there a violation of these assumptions. Finally, when conducting MANOVA, Cook's distances were checked. Again, at no instance was Cook's distance > 1.

When conducting a t-test the equality of variances was assumed. In all instances the Levene’s test was used to test this assumption. Levene’s test was not significant for any of the t-tests conducted suggesting that the data sets did not violate assumptions of equality of variance.

When conducting repeated measures of analysis of variance, Levene’s statistic was used to assess equality of error variances and the Box’s M statistic to assess homogeneity of inter-correlations. In addition, Mauchly’s test of sphericity was used. In the instance of a significant effect a correction to the degrees of freedom is warranted (e.g., Greenhouse-Geisser method – Field, 2009).

For all questionnaires used the internal consistency was calculated using Cronbach alpha. Interclass correlations were calculated were relevant.

4.10.2. Baseline assessment

Demographic data from the 62 participants enrolled to the WHEEL study were summarised as frequencies and percentages. In addition, responses of 35 of the participants on the ‘How Active Are You’ questionnaire are presented (See Table 5.2). Due to the specific and homogenous constitution of the participants in the WHEEL study (clinically obese pre-menopausal females) the baseline scores obtained from the psychological instruments were compared to norm scores reported in the relevant literature. A one-sample t-test was conducted to establish whether the mean scores obtained from the clinically obese women in the WHEEL study were significantly different from those reported in the pertinent literature. Note: due to the unavailability of normative data for the Social Support Scale for Exercise no comparison was possible for this instrument. Thirdly, differences between participants randomised to the lifestyle intervention (Initial Intervention Group – IIG) and control condition (Delayed Start

Control Group – DSCG) in the physiological, metabolic, and anthropometric variables at baseline were evaluated with independent t-tests.

4.10.3. RCT phase

Changes in variables across the initial intervention stage of the study, over time and between groups, were assessed using repeated measures-analysis of variance models. The analysis evaluated the RCT (Initial Intervention Group, IIG vs. Delayed Start Control Group, DSCG) component of the study by comparing the baseline measures with the data obtained at three-month follow-up (the end of the planned lifestyle change programme sessions for IIG and start of the programme for the DSCG). Post-hoc comparisons were conducted using Fisher LSD in the instance of a significant interaction effect. In addition the effect size was calculated using partial eta squared. Cohen's (1992) suggestions for interpreting the magnitude of effect sizes were used as a guideline. These suggest that a small effect (0.10) explains 1% of the variance, a medium effect (0.30) accounts for 9% of the total variance, and a large effect (0.50) accounts for 25% of the variance. The main focus of interest was on the interaction between pre- and post-test changes in the intervention and control conditions.

Repeated measures-analysis of variance was also conducted for the psychological variables for the RCT phase of the study using the intention-to-treat method. Pre-test values for the dependent variables were carried forward to represent the values at 12-weeks post-randomisation. Full application of intention to treat requires complete outcome data for all randomised subjects (Hollis & Campbell, 1999). However, imputation of values for the missing psychological data is likely to have only a small effect on the results as there was a relatively low rate of measurement dropout (< 10%) for the psychological data (Simons-Morton, Obarzanek, & Cutler, 2006). In contrast, in view of the higher measurement dropout/non-compliance at 12 weeks, only complete case analysis was undertaken for the physiological variables. In these analyses, participants were grouped as originally randomised, regardless of the degree of intervention compliance.

4.10.4. Intention to treat analysis

It has been argued that participants who have not complied with an intervention protocol should be included in statistical analysis. The rationale for such a decision is based on the possibility that missing data can cause a bias. This could be particularly true in studies investigating weight loss. For example, if a study were to investigate the effect of two diets the following could happen: participants randomised to Diet 1 actually lose weight and therefore are more likely to stay in the study. However, participants randomised to Diet 2 don't lose weight and are more likely to drop out or try something else. In addition, the participants who stay on Diet 2 are the participants who would lose weight anyway. This would result in a bias making Diet 1 look worse than it actually is and Diet 2 better than it actually is (see Bland, 1999; Chatfield, 2002). Intention-To-Treat (ITT) analysis is a method to counteract this bias. In this method missing data is brought forward irrespective of whether the participants stay in the study or not. It states that once participants are randomised the data should be used for ITT analysis. That is, ITT requires the inclusion of all participants in the statistical analysis according to the condition determined at randomisation, thus maintaining between group balance in participant characteristics achieved through randomisation (Unnebrink & Windeler, 2001). Four arguments have been used to justify the use of ITT analysis (Dallal, 2007; Lachin, 2000):

(1) ITT simplifies the task of dealing with suspicious outcomes, i.e. it guards against conscious or unconscious attempts to influence the results of the study by excluding odd outcomes.

(2) ITT guards against bias introduced when dropping out is related to the outcome.

(3) ITT preserves the baseline comparability between treatment groups achieved by randomisation.

(4) ITT reflects the way treatments will perform in the population by ignoring adherence when the data is analysed.

4.10.5. Follow-up/maintenance phase

Repeated measures-analysis of variance was used to compare baseline scores of both groups (first measurement for the IIG and the measurements at three months for the DSCG) with the 12-month follow-up data. Post-hoc comparisons were conducted using Fisher LSD in the instance of a significant interaction effect. Finally, Pearson product moment correlations were calculated when appropriate.

4.10.6. Analyses intervention philosophy

In order to assess the influence of the adopted framework on adherence to the programme a logistic regression was run with adherence as the dependent factor and the subscales of the *GCOS* and *MHLC* as the independent factors.

To investigate the relationship between self-regulation and psychological health, Pearson product moment correlations were calculated between the *GCOS* subscales and the factors of the PSS, GWB schedule, and SPP at both baseline and 12-month follow-up.

Finally, a self-determination index was calculated based on the work by Hodgins (personal communication July 2006). The formula for the self-determination index has a positive weighting for the autonomy scale and negative weighting for the control and impersonal scales:

$$(3 \times Z \text{ autonomy}) - Z \text{ control} - (2 \times Z \text{ impersonal})$$

A paired t-test was conducted to assess whether this index changed from baseline to 12-month follow-up.

4.11. Qualitative data analysis of the WHEEL study

4.11.1. Typology of mixed method data analysis technique

At baseline all 62 participants were interviewed using semi-structured interviews (see Appendix M). In addition, 36 participants (12 drop-out and 24 adherers) were interviewed at 12-months follow-up (see Appendix M). All interviews were transcribed verbatim and analysed accordingly using QSR*NVivo. A sequential QUAN & QUAL mixed method analysis technique was used to analyse the qualitative data (Teddlie & Tashakkori, 2009). The quantitative data analysis occurred first followed by the qualitative analysis, but the two phases are inter-related. The QUAN phase was used to identify psychological and physical attributes of participants, whereas the QUAN phase was used to confirm and expand on those attributes (e.g. construct identification of weight cycling and its subcomponents, such as feeling a failure because one cannot manage their weight; validation of presence of weight cycling and its subcomponents). *Analytic induction* (Patton, 2002) was employed, which is a deductive logic as it involves a thematic analysis of data for constructs and categories of phenomena. The process is iterative as one is coding and recoding the text when modifying and refining it. The key feature of such analysis is *negative case analysis* (e.g. Berg, 2004). There was a thematic search for various themes not related to the QUAN concepts. After several *character* (e.g. holding a few words of text, such as a concept name – pain) searches for seeking associations (Richards & Richards, 1998; Bazeley & Richards, 2000), four such super-ordinate themes emerged: 1) Functional limitations during exercise (pain and knee); 2) Lack of cooking skills; 3) Fat prejudice; and 4) ‘Weight stops me’. This is in addition to the 20 super-ordinate themes derived from 344 initial themes structures. Super-ordinate themes are those that are recurrent and present in over half the sample (Smith, Flowers, & Larkin, 2009). This is similar to *variable-oriented strategies,* which is the process of finding themes that cut across cases (Huberman & Miles, 1998). The 20 themes are presented below in Table 4.5.

4.11.2. Process of data analysis

The above themes were derived by using QSR*NVivo software developed by Qualitative Research Solutions, International (QSR). Meaning generation was guided by Huberman and Miles' (1998) set of thirteen 'tactics' (p. 187). (1) Noting patterns and themes; (2) Seeing plausibility; (3) Clustering by conceptual grouping; (4) Making metaphors; (5) Integration of diverse data; (6) Counting (e.g. super-ordinate theme prevalence); (7) Making contrast and comparisons; (8) Partitioning variables – undoing themes, that no longer make sense; (9) Subsuming particulars into the general – going back and forth and recoding data; organisation of documents into nodes, sets, and trees; (10) Factoring; (11) Identifying relationships between variables; (12) Building a logical change of evidence; (13) Making conceptual coherence.

Table 4.5: Results of the qualitative data analysis.

Super-ordinate Themes	Subordinate Themes
1. Dieting	Clubs Failures Behaviours Meaning of food when dieting Dieticians advice
2. Weight Cycling	History
3. Weight Status	Perceptions of
4. Reasons for Being Big	Inactive Eating too much Traumatic life events Other (job, life)
5. Drinking	Alcohol consumption
6. Eating Behaviours	Eating in my car Hiding biscuits All or nothing Emotional Eating No breakfast Appetite Eating is relaxing Eating is a drug Binge eating It's the quickest Not eating in front of others Regulation of eating Swallowing is satisfying Facing up to food
7. Psychological states	Stress, emptiness, depression
8. Life pushes you on scales	Weighing oneself continuously
9. Meaning of weight loss	Want to be slim Desperate to lose weight Not losing weight is demotivating
10. Genetics	A lot of what I am is inherited
11.WHEEL	Goals for oneself Reasons for enrolling on WHEEL Expectations of WHEEL Previous PA/exercise experience Exercise experience in WHEEL Physical Activity (PA) change Eating behaviour change Barriers to PA/exercise Psychological change Overall lifestyle change Improvements in quality of life Study design as a barrier Study design as an enabler Evaluation of WHEEL
12. Motivation	Motivation for lifestyle change
13. Self-regulation	Poor or adequate self-regulation
14. Education	Barrier if low
15. Weight and Health	Health concerns because of weight
16. Self-perceptions	Fat legs; hiding the fat
17. Social Support	Negative Positive
20. Family	PA/Exercise Eating Social circumstances

Transparency in a PhD thesis concerning qualitative data analysis is essential. Therefore, Bringer, Johnston, and Brackenridge's (2004) paper was used to guide to how to document a computer-assisted qualitative data analysis in the thesis. This study did not use QSR*NVivo within grounded theory as Bringer et al. (2004) had done. The appropriateness of Computer-Assisted Qualitative Data Software Analysis (CAQDAS) has been debated amongst the research community (see for example, Fielding & Lee, 1991). These debates are around the influence and limitations of software use and IT skills of the researchers and how these factors deduct from the interpretation and conceptualisation of data, including exploring relationships, and document decisions (Bringer et al. 2004). The reason to use NVivo for this PhD's data analysis was the large amount of data handling required by the researcher. The timeline for analysing this QUAL data set was 1.5 years (part-time); this included transcribing documents, writing up notes, coding all the interview data, recoding of data several times and so on. In this PhD, NVivo was used for creating documents, writing memos, coding, searching, structuring categories, and identifying super-ordinate themes.

4.11.3. The electronic audit trail

<u>The Research Journal:</u> The investigator's (EB's) research journal was not kept on NVivo, but in a personal diary form. Here are a few examples of my reflections about events that happened during the yearlong study:

Entry One: PT cried today in the circuit class, partly because the instructor (not EB) asked her to go on steps, partly because something happened at work. I phoned her after the class and she couldn't stop crying during the conversation. I referred her to see a counsellor and she agreed that she would. N.B., I (EB) did not want to have a disagreement with the instructor in the class, as I have specifically requested that throughout this intervention there will be no steps used during circuit classes, because of the knee problems participants in the heavier BMI classes experience. Despite this request, the co-instructor (employed by the council) kept re-introducing steps, which was a point of contention between the instructor and me. I have to speak to my supervisors about how to handle this situation, as clearly she is keen to use steps, and no amount of information about functional limitations deter her from its use.

Entry Two: Tonight I am meeting M at his request, who is a husband of one of the heaviest participants. I specifically told him that I am not a counsellor, but he wanted to know more about how he could help his wife at home. I reluctantly agreed, but in hindsight I shouldn't have. He started off the conversation about how much he was embarrassed by the size of his wife. He found it difficult to live with her and see her slowly 'dying' in front of his eyes. He expressed a lot of fears, including not being able to have children, because of the woman's size. I stayed neutral and advised him to seek couple therapy through his GP and discuss these issues openly with each other. His feedback was that meeting with me helped him to get perspective on his wife's morbid obesity status and now he sees it as a disease rather than a defiant psychological state. Knowing that the latter was true, I sincerely hoped that they would find a solution. During a casual conversation, his wife revealed that she is on the internet all night talking to various people, and secretly binged on various food items she hid from him. Lesson to learn: this is outside your role as a researcher, do not do this again. When participants seek therapeutic relationships you have to find a finer balance of being helpful and putting yourself in such a situation.

Entry Three: Today was the first day of the aqua/aerobic session. As usual the co-instructor and I turned up at this venue well before the participants. This venue was specially chosen for having individual cubicles in which to change, which was requested by the participants, as they were not comfortable to change in front of others. I can't believe what happened in the class. I thought I've done everything I could to research the venue and the exercises. I used evidence-based exercise science principles to put together the aqua/aerobic class content and piloted it with a clinically obese person's help with the co-instructor. However, I did not expect what happened next. When the co-instructor started the class, the heaviest participants floated away. All I could see from the side of the pool was my bopping up and down. I was mortified and very distressed. Quickly we got them to hold on to the sides of the pool and changed the exercise content. This raised several issues about working in a multi-disciplinary team towards sustainability. I subsequently discussed this with my supervisors. I set up WHEEL for sustainability (see Appendix L). I did not get any funding to run this intervention, it was funded by the local council and the pool, the circuit class venue and the instructor (one and no choice in the matter) came with this deal. From the beginning I wanted the classes to be run by a council employer at a council run venue, as I wanted to make sure that in a partnership these classes would be rolled out across the city, at the end of the study if it worked. The council instructor was the constant for the participants, as my role as a researcher prohibited me from continuing with the study after its completion. However, this individual was an extremely nice and caring person, but she lacked essential understanding of the condition and had poor instructor skills, as she was not able to respond to my requests (e.g. no steps, could not manage exercise progression well, used appalling music for teaching). For example, after the intensive three-months intervention period, I went away for a conference. I missed a class and when I came back 50% of the class was missing. I phoned all those participants who missed the session and they unanimously said that the steps deterred them coming until I was back. She used my absence to 're-introduce' steps, despite my constant pleas. She kept introducing fast turns, which you can't as the weights' trajectory carries on and the participants tumble. One participant said, 'Sometimes, with the aerobics, the exercises, I used to think I wish, she'd go a bit slower' (Section 1.23, Para 49, LM). 'I do feel safe in class, that’s very important to me. I told ... a couple of months that I had only ever felt unhappy on one occasion (when the steps were introduced in my absence), and she asked me when that was, and I told her, but I said even more than feeling unhappy, I felt unsafe that night’ (Section 1.44, Para 127, JF). This clearly illustrates my point. In agreement with my supervisors, our research collaborator had a word with her, and she had not introduced steps into the class until after I left the project.

Entry four: Today I was running late to the classes as an interview overran. The participant was also heading to the classes. I was going to cycle, but I didn’t want to be late so I thought, I would ask her to give me a lift down there and I would catch the bus back. When I’ve asked her about the lift, she visibly got very upset and said no and left. I didn’t know what to make of it, as I thought we were on good terms. I didn’t think too much about it, got my bike and locked up the office, when I heard a knock. It took me about 5-8 minutes to get ready and as I was going out the door, she was standing there being very apologetic. I said not to worry, it doesn’t matter. She said, she would like to give me a lift but she needed to show me something about her car. At this point I was really curious, locked my bike away and we walked to her car. She opened a boot and there was a mini fridge, with all her supplies of chocolate and sweets. She proceeded to say that ‘nobody’ is ever allowed to enter or travel in her car. ‘Her car is her sanctuary’. That is where she does what she does between work and home on a motorway. She pulls in at petrol stations to ‘fill up’ but not with petrol. I was astonished to see and hear this, but also understanding and grateful that she kindly allowed me to be in her ‘sanctuary’. After this episode I wondered whether other people also used their car as a sanctuary and there was some evidence that this was the case in this PhD’s cohort. Qualitative evidence shows that seven others also used their car as a ‘hiding’ place. The following quote illustrates this behaviour well: ‘I didn’t know, but I noticed the first couple of days that I was stopping at the garages because I had to get petrol and stuff like that and I was getting chocolate' (Section, 1.134, Para 271, MV). This is particularly interesting, as what seems to have driven the behaviour was the chocolate rather than the need for petrol. Furthermore, consuming food in such circumstances somehow makes this extra (unscheduled) food intake 'invisible', as stated by a participant: 'Sometimes I've had chocolate at the side of me when I've been driving, and I've not realised and eaten it all, it's gone. I haven't felt anything different, I've thought, well I haven't really eaten that. Well there is nobody here to see you.' (Section 1.188, Para 389; Section 1.194, Para 402, PF). 'I try not to buy my lunches at that particular petrol station unless I really have to because that seemed to be a particular weak spot. When I do, what I try to do is limit myself to say three or four particular items. So my sandwich would be one item, a drink is another item. They also a lot of the time sell the yoghurts that I like so that's a third item. Then if I'm going to have something else I'll get either a packet of crisps or chocolate, but it's only one item. So I limit myself, I get the basics plus one thing.' (Section, 1.39, Para 80, TS).

Looking at this phenomenon in the literature, most cited work was concerning animals. There was no description of such behaviours available in humans. However, in a wider context, Elfhag and Morey (2008) found that obese patients (n = 442) with restrained eating patterns (such as these seven participants) were related to impulsiveness, lower self-discipline, negative emotions and higher responsiveness to external stimuli, which might very well be the case here. Future research will need to explore this further.

<u>Coding:</u> The coding of the document adhered to Huberman and Miles's (1998) guidance. All documents were coded and recoded several times (e.g. including overlapping coding of text, when they were relevant to other emerging themes). There were a total of 157 Code Note memos (mCN) that alluded to how the node was defined,

and analytical thinking about the node was recorded. See a screenshot example of such working in the following pages:

Figure 4.4: Coding of transcript document.

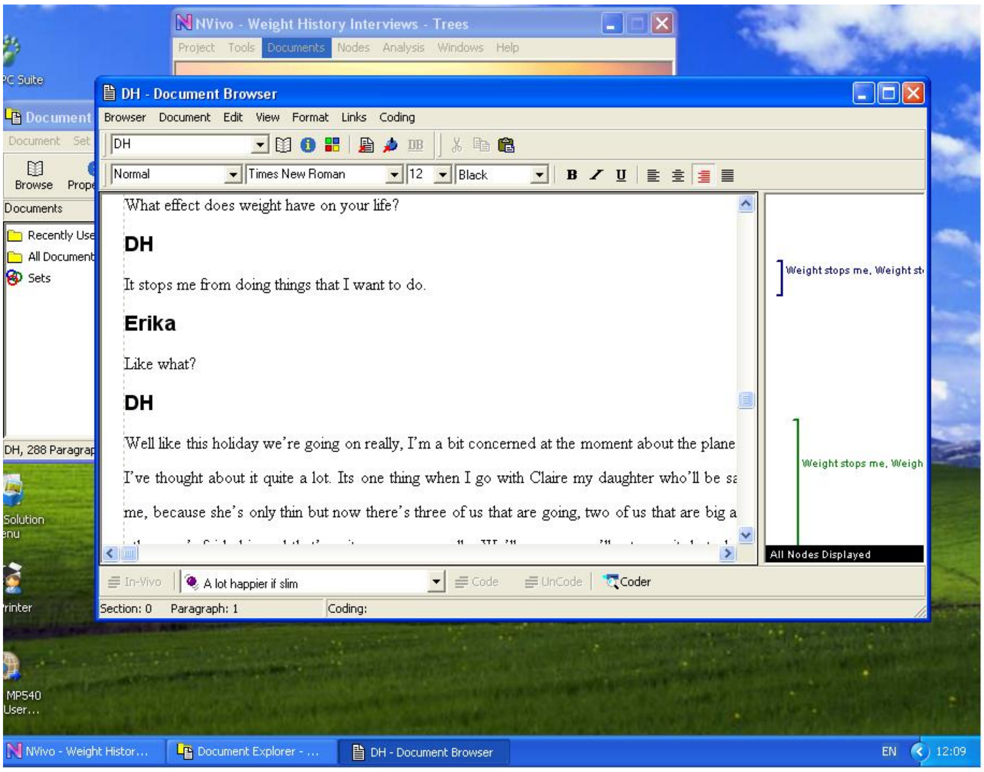


Figure 4.5: Example of an mCN.

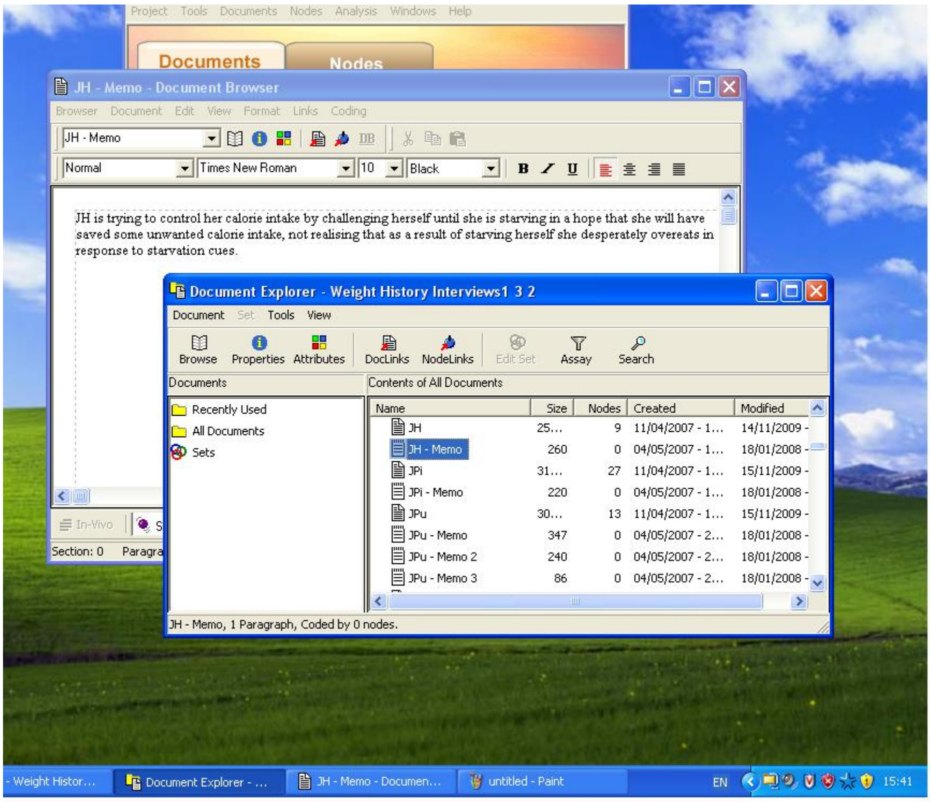


Figure 4.6: Example of a super-ordinate theme.

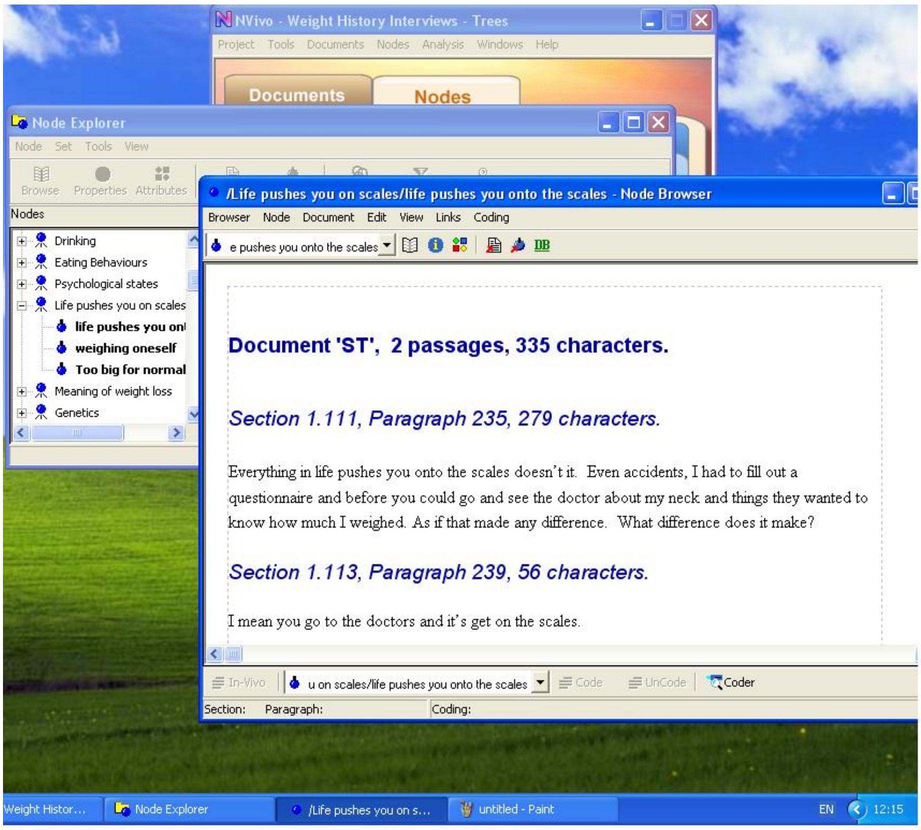


Figure 4.7: Illustration number of sets explored.

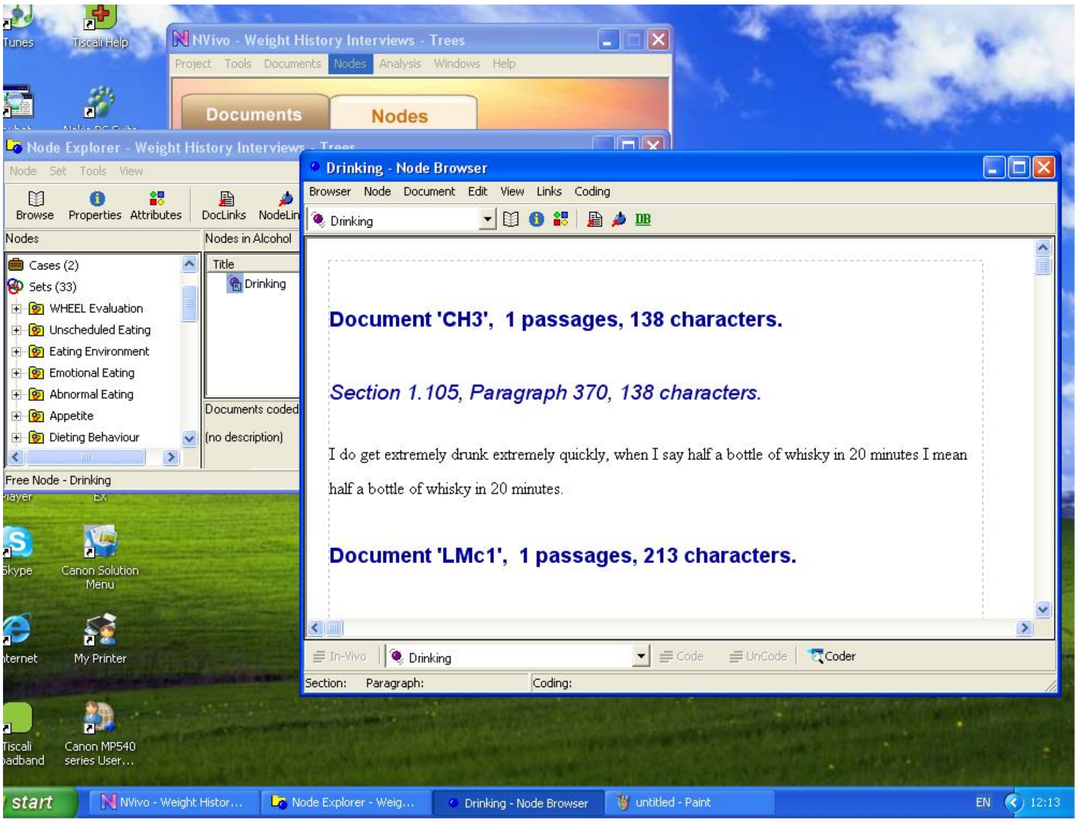


Figure 4.8: Report of the weight fluctuation node.

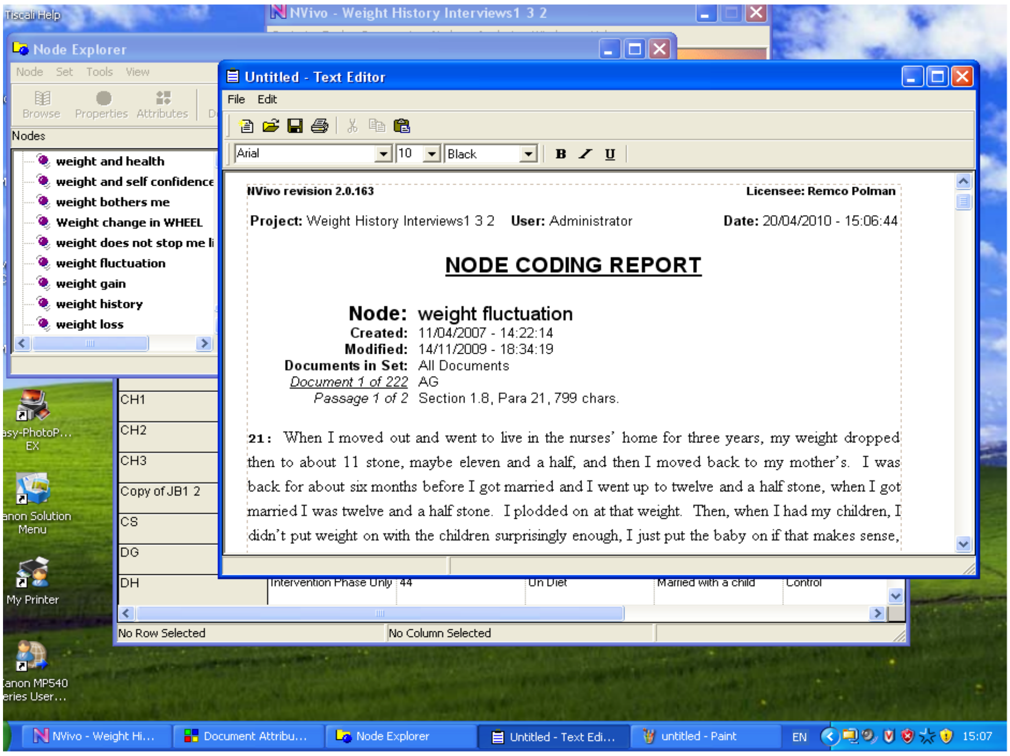
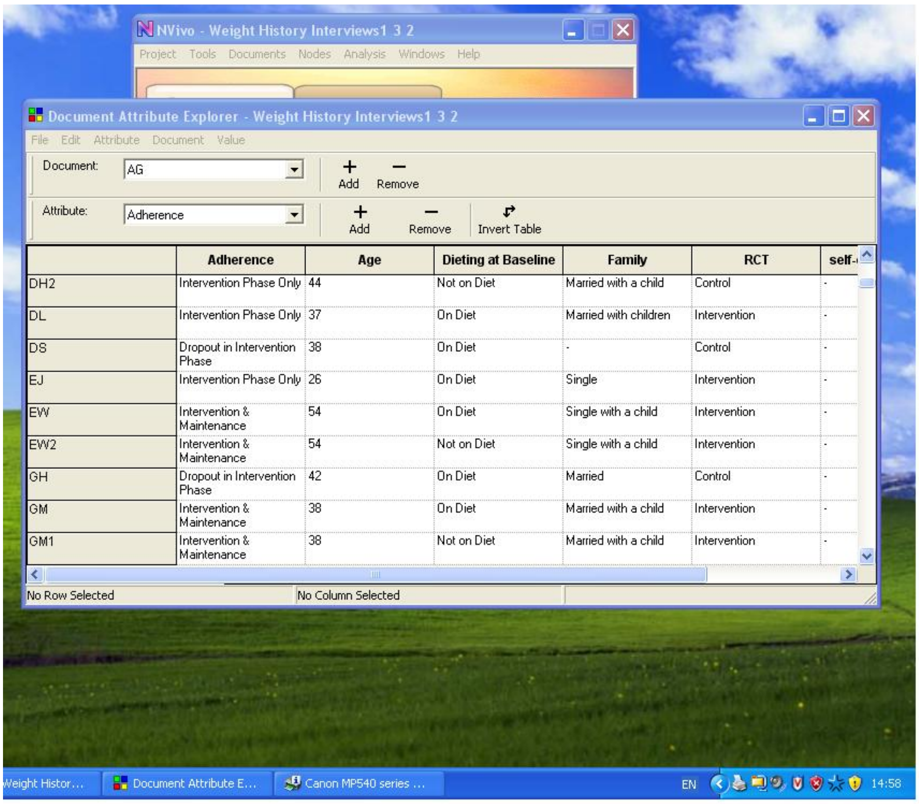


Figure 4.9: Report generated on participant attributes.



	Adherence	Age	Dieting at Baseline	Family	RCT	self-
DH2	Intervention Phase Only	44	Not on Diet	Married with a child	Control	-
DL	Intervention Phase Only	37	On Diet	Married with children	Intervention	-
DS	Dropout in Intervention Phase	38	On Diet	-	Control	-
EJ	Intervention Phase Only	26	On Diet	Single	Intervention	-
EW	Intervention & Maintenance	54	On Diet	Single with a child	Intervention	-
EW2	Intervention & Maintenance	54	Not on Diet	Single with a child	Intervention	-
GH	Dropout in Intervention Phase	42	On Diet	Married	Control	-
GM	Intervention & Maintenance	38	On Diet	Married with a child	Intervention	-
GM1	Intervention & Maintenance	38	Not on Diet	Married with a child	Intervention	-

After demonstrating how the data was analysed in NVivo, Chapter 6 will follow Miller's (2003) and Teddlie et al.'s (2009) guidance on the concept of *inference*. Teddlie et al. (2009) defined *inference* as 'conclusions and interpretations that are made on the basis of collected data in a study. As such they must be distinguished from the data from which they were derived' (p. 287). Inference is both a process and an outcome that shows how meaning was created from the relatively large amount of collected information.

Chapter Five Quantitative Results

5.1. WHEEL study: Results quantitative analysis

The result section of the quantitative data of the WHEEL study is divided into three sections. In the first section the data collected at baseline is presented in tables and figures. Section 2 and 3 shows the results of the RCT phase and the follow-up or maintenance phase of the WHEEL intervention study, respectively. Discussion of the quantitative and qualitative results is presented in Chapter 6.

5.2. Baseline measures

Demographic data from the 62 participants enrolled to the WHEEL study are summarised in table 5.1. In addition, table 5.2 reports the responses of 35 of the participants on the 'How Active Are You' questionnaire. Tables 5.3 and 5.4 compares the mean values obtained for the psychological variables for all participants recruited to the WHEEL study with relevant normative scores from the literature. Finally, table 5.5 shows the physiological, metabolic, and anthropometric variables obtained at baseline for the entire cohort and for participants randomised to the lifestyle intervention (Initial Intervention Group IIG) and control condition (Delayed Start Control Group, DSCG).

Table 5.1: Summary of the demographic data obtained from all 62 participants enrolled to the WHEEL study. Responses are reported for each section and each question in that section in terms of frequency and percentage. Data obtained from modified Health Screening Questionnaire (St Jeor, 1997).

Demographic Characteristic	Initial Intervention group and Delayed Start Control Group
Work Status	
Part-time	11 (17.7%)
Full-time	41 (66.1%)
Unemployed	6 (9.7%)
Retired	4 (6.4%)
Occupation	
Housewife	5 (8.1%)
Manual	18 (29.0%)
Admin	29 (46.8%)
Professional	9 (14.5%)
Other	1 (1.6%)
Education	
Left at 16	35 (56.5%)
Left at 18	14 (22.6%)
Graduate	11 (17.7%)
Higher Degree	2 (3.2%)
Marital Status	
Married	30 (48.4%)
Single	21 (33.9%)
Engaged	2 (3.2%)
Separated	2 (3.2%)
Divorced	6 (9.7%)
Widowed	1 (1.6%)
Family History of Obesity Related Diseases	35 (56.5%) had family history of obesity related diseases

Table 5.1: Continued.

Clinical Characteristic	Initial Intervention group and Delayed Start Control Group
Participants' own health ratings	
Poor	7 (11.3%)
Fair	22 (35.5%)
Good	32 (51.6%)
Excellent	1 (1.6%)
*All participants were declared healthy by their GPs prior to enrolment to study	
No of participants reported to suffer from the following symptoms occasionally, but they did not received medical treatment for these symptoms (palpitations, backache, dizziness, asthma, rheuma, fibroids, arthritis, ulcer, neck pain)	28 (45.2%)
*Participants that had any abnormal physiological measures were immediately referred on to their own GPs (verbal + letter to GP) or received 24hr observation at the place of testing in the Local General Infirmary	34 (43.6%) had no medical symptoms
Participants' depression frequency ratings	
Never	7 (11.3%)
Rarely	28 (45.2%)
Often	26 (41.9%)
Very often	1 (1.6%)
Medication, n (%)	
No of participants who took prescribed medications (all were checked for suitability for study)	22 (35.5%)
No of participants without medication	40 (64.5%)
Smoking Status	
Smoker	3 (4.8%)
Non-smoker	59 (95.2%)
Are you currently on a diet	
Yes	53 (85.5%)
No	9 (14.5%)

Table 5.2: Responses to the 'How Active are You? Questionnaire (N = 35).

Exercise Profiles Before Intervention	
Used to vigorous exercise	1 (1.6%)
Not used to vigorous exercise	61 (98.4%)
No of inactive participants	37 (59.7%)
No of active participants	25 (40.3%)
Exercise Type	
Gym	5 (8.1%)
Walk	12 (19.4%)
Swim	3 (4.8%)
Aerobic	4 (6.5%)
Yoga	1 (1.6)
Exercise Intensity	
Very Light	7 (11.3%)
Light	8 (12.9%)
Moderate	9 (14.5%)
Vigorous	1 (1.6%)
Exercise Time and Frequency	
5 minutes a week	1 (1.6%)
15 minutes a week	4 (6.5%)
less than 1 hr a week	15 (24.2%)
more than 1 hr a week	5 (8.1%)
7 Day Physical Activity Questionnaire: Barriers to Exercise, no of participants who found it a problem	N = 35
I don't have Time	25 (71.4%)
I don't have Energy	27 (77.1%)
I am Not the Sporty Type	14 (40.0%)
I have No Skills to Exercise	7 (20.0%)
I don't feel comfortable in the gym	21 (60.0%)
I don't Enjoy Exercise	9 (25.7%)
What benefits would you like to get from taking more physical activity?	
To feel in better shape	35 (100%)
To improve health	33 (94.3%)
To get outdoors	10 (28.6%)
To feel sense of achievement	19 (54.3%)
To control my weight	32 (91.4%)
To have fun	21 (60.0%)

Table 5.2: Continued.

How active are you?

Do you ever walk for more than 15 minutes, instead of using your car or the public transport? Yes: 19 (54.3%) No: 16 (45.7%)
If yes, how many minutes do you walk in an average week? 30: 6 (37.5%) 60: 3 (18.8%) 90: 4 (25%) 120: 2 (12.5%) 150: 3(18.8%) >180: 1 (6.3%)
Do you ever go out for a walk for more than 15 minutes, for recreation or health? Yes: 14 (40%) No: 21 (60%)
If yes, how minutes do you walk in an average week? 30 or less: 7 (50%) 60: 3 (21.4%) 120: 2 (14.3%) >180: 2 (14.3%)
Do you ever take part in any leisure activities of moderate intensity? For example, activities which leave you feeling warm and slightly out of breath? Yes: 11 (31.4%) No: 24 (68.6%)
If yes, how many minutes do you do in an average week? > 30: 5 (45.5%) 60: 4 (36.4%) 120: 1 (9.05%) 150: 1 (9.05%)
Do you ever take pare in more vigorous exercise or sports? For example, activities which leave you feeling out of breath and sweaty? Yes: 9 (25.7%) No: 26 (74.3%)
If yes, how many minutes in an average week do you do this kind of activity? 40-45: 5 (55.5%) 120: 4 (44.5%)

Table 5.3: Comparison of the mean scores obtained from the participants in the WHEEL study with relevant norms reported in the literature.

Dependent variable	Wheel Group	Norm scores	t & P
GCOS Autonomy[1]	5.03 (1.08)	5.94 (0.64)	-6.23; < .001*
GCOS Impersonal[1]	4.10 (1.40)	3.31 (0.68)	4.18; < .001*
GCOS Controlled[1]	3.65 (0.95)	3.63 (0.79)	0.13; .89
Locus of control Internal[2]	4.95 (0.93)	4.63 (0.57)	2.58; .012[†]
Locus of control Chance[2]	2.88 (0.79)	2.60 (0.85)	-4.01; < .001*
Locus of control Powerful others[2]	2.08 (0.94)	2.58 (0.79)	2.61; .012[†]
GWB total[3]	53.64 (19.34)	78.76 (15.34)	-9.63; < .001*
Emotional control and stability[4]	11.76 (3.33)	11.05 (0.6)	1.59; .12
Energy level[4]	9.96 (3.82)	10.85 (0.6)	-1.72; .09
Relaxed vs. tense or anxious[4]	16.16 (4.91)	14.95 (1.2)	1.75; .09
Cheerful vs. depressed mood[4]	13.02 (4.09)	16.90 (1.0)	-7.05; < .001*
Satisfying and interesting life[4]	9.04 (2.89)	6.05 (0.5)	7.67: < .001*
Freedom from health concern[4]	7.75 (4.17)	10.15 (0.8)	-4.28; < .001*
Perceived Stress[5]	30.55 (8.38)	18.99 (8.17)	10.23; < .001*
Adaptional symptoms[6]	16.98 (5.36)	16.51 (6.10)	0.65; .52
Coping ability[6]	6.84 (2.41)	6.19 (3.28)	1.99; .05[†]
SPP Sociability[7]	2.85 (0.72)	3.13 (0.64)	-3.03; .004*
SPP Job Competence[7]	3.02 (0.69)	2.51 (0.80)	5.58; < .001*
SPP Nurturance[7]	3.13 (0.57)	3.40 (0.47)	-3.66; .001*
SPP Athletics[7]	1.70 (0.68)	3.35 (0.51)	-18.56; < .001*
SPP Appearance[7]	1.83 (0.57)	2.81 (0.61)	-13.15; < .001*
SPP Provider[7]	2.92 (0.68)	3.14 (0.59)	-2.48; .02[†]
SPP Morality[7]	3.16 (0.61)	3.48 (0.51)	-3.94; < .001*
SPP Household[7]	2.71 (0.91)	2.90 (0.71)	-1.61; .11
SPP Intimate Relations[7]	2.64 (0.76)	3.15 (0.66)	-5.09; < .001*
SPP Intelligence[7]	2.76 (0.83)	3.23 (0.58)	-4.33; < .001*
SPP Humour[7]	3.15 (0.78)	3.24 (0.54)	-0.92; .36
SPP Global Self-Worth[7]	2.29 (0.71)	3.18 (0.55)	-9.55; < 0.001*

State self-esteem total[8]	55.00 (14.63)	69.57 (13.1)	-7.39; < 0.001*
Social[8]	20.00 (6.61)	25.67 (5.7)	-6.36; < 0.001*
Appearance[8]	11.49 (4.20)	18.93 (4.9)	-13.14; < 0.001*

(† $P \leq 0.05$; * $P \leq 0.01$)

[1]Hodgins, H.S., Koestner, R., & Duncan, N. (1996). On the compatibility of autonomy and relatedness. *Personality and Social Psychology Bulletin, 22*, 227-237. 67 Students with a mean age of 18.3 years.

[2]Wallston, K.A., Wallston, B.S., & DeVellis, R. (1978). Development of the multidimensional Health Locus of Control (MHLC) Scales. *Health Education Monographs, 6*, 160-170. Based on 115 participants with a mean age of 42 years.

[3]Miller, G.D., & Harrington, M.E. (1997). General Well-being Schedule. In S.T. St.Jeor (Ed.), Obesity assessment: Tools, methods, interpretations. A reference case: The RENO Diet-Heart Study (pp. 465-470). Based on 253 women participating in the RENO Diet-Heart Study who where classified as either normal or overweight.

[4]Cramer, S.R., Nieman, D.C., & Lee, J.W. (1991). The effects of moderate exercise training on psychological well-being and mood state in women. *Journal of Psychosomatic Research, 35*, 437-449. 35 Premenopausal women (average age 34.0, ± 1.5 years) with an average BMI of 28.1 (± 0.8).

[5]Brunner, R.L. (1997). The perceived stress scale. In S.T. St.Jeor (Ed.), Obesity assessment: Tools, methods, interpretations. A reference case: The RENO Diet-Heart Study (pp. 471-478). 162 women from RENO Diet-Heart Study, score for overweight women.

[6]Hewitt, P.L., Flett, G.L., & Mosher, S.W. (1992). The perceived stress scale: Factor structure and relation to depression symptoms in a psychiatric sample. *Journal of Psychopathology and Behavioral Assessment, 14*, 247-257. Sample 96 psychiatric patients (48 men, 48 women) with a mean age of 36.20 (sd = 10.81).

[7]Messer, B., & Harter, S. (1986). Manual for the adult self-perception profile. University of Denver. Sample B, 215 predominantly Caucasian, middle and lower class mothers with children under 3 years of age.

[8]Heatherton, T.F., & Polivy, J. (1991). Development and validation of a scale for measuring state self-esteem. *Journal of Personality and Social Psychology, 60*, 895-910. Sample 1, 428 undergraduates ranging in age between 17-57 (M = 20.3 SD = 4.3). 284 were women and 144 were men.

Finally, based on participants' GWB schedule scores they were classified as either being in 'severe distress' (0-60), 'moderate distress, (61-72) and 'positive well-being' (73-110). The table below provides the frequency count and percentage of participants in the WHEEL study for each category and the percentage obtained for overweight women (defined as being 120% of ideal body weight) in the RENO Diet Heart-Study (St Jeor, 1997).

Table 5.4: Classification of participants according to levels of distress/well-being based on total score on GWB schedule.

	WHEEL (n=55)	RENO
Severe distress	34 (61.8%)	14%
Moderate distress	11 (20.0%)	19%
Positive well-being	10 (18.2%)	67%

Note: The RENO study report data for 253 normal and over-weight women but does not explicitly report the number of women in each category.

There were no significant differences between the initial intervention group (IIG) and delayed start control group (DSCG) at baseline on any of the anthropometric, metabolic or physiological variables ($P > 0.05$).

Table 5.5: Baseline physiological, metabolic and anthropometric variables among the 62 participants recruited to WHEEL.

Dependent Variable	All participants	Initial Intervention Group (N=31)	Delayed Start Control Group (N=31)
Age, years	40.2 (7.7)	39.3 (7.8)	41.1 (7.6)
Weight, kg	104.3 (21.4)	108.4 (21.6)	99.8 (21.0)
BMI, $kg \cdot m^{-2}$	38.6 (7.6)	39.89 (7.44)	37.4 (7.7)
Waist circumference, cm	107.9 (16.2)	114.2 (14.0)	107.4 (19.8)
Waist-Hip circumferences ratio	0.86 (0.10)	0.86 (0.10)	0.85 (0.06)
Body Fat content, %	33.7 (9.5)	38.2 (9.6)	32.2 (11.7)
$\dot{V}O_2$, $ml \cdot min^{-1}$	2258.3 (356.0)	2297.1 (328.0)	2090.0 (329.0)
$\dot{V}O_2$, $ml \cdot kg^{-1} \cdot min^{-1}$	22.1 (3.3)	21.6 (3.5)	22.5 (3.2)
Total Cholesterol, $mmol \cdot l^{-1}$	5.33 (0.88)	5.42 (1.1)	5.68 (0.59)
HDL-cholesterol, $mmol \cdot l^{-1}$	1.28 (0.29)	1.15 (0.32)	1.25 (0.30)
Triglycerides, $mmol \cdot l^{-1}$	1.52 (0.65)	1.74 (0.74)	1.90 (0.68)
Fasting glucose, $mmol \cdot l^{-1}$	5.29 (1.1)	5.56 (0.97)	5.72 (1.9)
Systolic BP, mmHg	132.9 (17.8)	138.4 (17.8)	137.0 (16.0)
Diastolic BP, mmHg	86.8 (10.5)	90.6 (10.6)	87.5 (9.2)

Fasting glucose n=58; Lipoprotein-lipids n=55; Blood pressure n=54

5.3.1. RCT phase psychological data

Group data for each variable as well as the results for the IIG and DSCG separately for baseline, end of RCT phase and 12 month follow-up are presented as mean and standard deviation in Table 5.6. Table 5.7 presents the results of the on treatment analysis method using repeated measures ANOVA for the RCT phase of the WHEEL study whereas table 5.8 presents the results using the intention-to-treat principle.

Table 5.6: Baseline, End RCT phase (3 months) and 12 months data for body weight and the psychological factors for the IIG and DSCG separately.

Dependent Variable	Initial Intervention Group			Delayed Start Control Group		
	Baseline (N=29)	End RCT (N = 22)	12 Months (N = 16)	Baseline (N = 26)	End RCT (N = 26)	12 Months (N = 9)
Body weight	108.4 (21.6)	104.6 (19.2)	106.1 (23.7)	100.1 (20.7)	103.0 (20.8)	102.3 (12.7)
GCOS Autonomy	89.58 (17.23)	95.18 (14.85)	101.7 (10.51)	81.00 (18.91)	82.08 (17.89)	97.22 (8.15)
GCOS Impersonal	67.24 (23.44)	61.81 (23.16)	55.75 (19.11)	72.35 (24.32)	70.81 (24.24)	63.89 (15.37)
GCOS Controlled	64.27 (16.20)	62.14 (13.91)	62.44 (13.38)	59.46 (15.87)	59.69 (15.30)	66.67 (15.89)
Locus of control Internal	5.20 (0.87)	5.17 (0.89)	5.38 (0.67)	4.68 (0.93)	4.63 (0.90)	4.71 (0.79)
Locus of control Chance	1.81 (0.86)	1.84 (1.01)	1.67 (0.67)	2.35 (0.96)	2.28 (0.90)	2.25 (1.19)
Locus of control Powerful others	2.77 (0.77)	2.70 (0.82)	2.70 (0.82)	2.99 (0.81)	2.97 (0.60)	2.97 (0.59)
Powerful others Doctors	3.20 (1.11)	2.99 (1.01)	2.94 (0.95)	3.30 (1.06)	3.15 (0.98)	3.09 (1.00)
Powerful others Other people	2.12 (1.19)	2.31 (1.28)	2.33 (1.14)	2.54 (0.87)	2.54 (0.71)	2.57 (1.00)
GWB total	52.90 (21.11)	68.72 (19.91)	78.81 (16.43)	54.46 (17.53)	52.34 (16.16)	66.67 (14.77)
Emotional control and stability	11.48 (3.79)	13.09 (3.10)	14.68 (2.41)	12.07 (2.76)	12.12 (2.78)	13.78 (2.28)
Energy level	10.21 (4.21)	13.04 (4.77)	15.62 (3.87)	9.69 (3.39)	9.65 (3.41)	12.78 (2.59)
Relaxed vs. tense or anxious	15.62 (5.18)	19.00 (4.33)	20.63 (3.32)	16.65 (4.62)	16.07 (3.89)	18.78 (3.70)
Cheerful vs. depressed mood	12.79 (4.59)	16.00 (3.94)	17.69 (2.87)	13.26 (3.51)	12.88 (3.50)	15.44 (2.69)
Satisfying and interesting life	8.93 (3.20)	11.27 (3.02)	12.88 (2.75)	9.15 (2.56)	8.92 (2.73)	11.33 (3.16)
Freedom from health concern	7.86 (4.37)	10.31 (4.31)	11.31 (3.61)	7.61 (4.01)	6.69 (3.16)	8.56 (3.43)

Table 5.6: continued.

Dependent Variable	Initial Intervention Group			Delayed Start Control Group		
	Baseline	End RCT	12 Months	Baseline	End RCT	12 Months
Perceived stress	28.90 (9.64)	24.78 (7.36)	20.81 (7.17)	32.39 (6.39)	29.35 (6.02)	23.33 (4.24)
Adaptional symptoms	16.21 (5.87)	13.97 (4.32)	13.07 (4.79)	17.84 (4.69)	14.50 (4.09)	13.20 (3.79)
Coping ability	6.38 (2.76)	5.90 (2.23)	5.52 (2.29)	7.35 (1.87)	6.39 (1.94)	6.00 (2.10)
Body Image Dissatisfaction	3.32 (0.90)	3.20 (1.00)		3.64 (1.19)	4.00 (1.15)	
SPP Sociability	2.86 (0.78)	2.75 (0.75)	2.98 (0.76)	2.83 (0.66)	2.79 (0.68)	3.17 (0.45)
SPP Job Competence	3.12 (0.74)	3.11 (0.62)	3.34 (0.57)	2.91 (0.63)	2.89 (0.69)	3.39 (0.43)
SPP Nurturance	3.18 (0.58)	3.13 (0.66)	3.28 (0.67)	3.06 (0.56)	3.02 (0.60)	3.14 (0.66)
SPP Athletics	1.76 (0.76)	2.09 (0.82)	2.34 (0.68)	1.64 (0.59)	1.56 (0.57)	2.22 (0.63)
SPP Appearance	1.88 (0.58)	1.92 (0.59)	2.39 (0.68)	1.79 (0.56)	1.71 (0.62)	2.22 (0.62)
SPP Provider	2.92 (0.76)	2.88 (0.69)	3.04 (0.71)	2.92 (0.61)	2.88 (0.67)	2.94 (0.57)
SPP Morality	3.28 (0.60)	3.32 (0.55)	3.61 (0.39)	3.04 (0.60)	3.07 (0.53)	2.89 (0.42)
SPP Household	2.74 (0.96)	2.72 (0.95)	2.74 (1.03)	2.67 (0.88)	2.61 (0.94)	2.89 (0.85)
SPP Intimate Relations	2.64 (0.77)	2.57 (0.79)	2.70 (0.74)	2.64 (0.77)	2.69 (0.82)	2.92 (0.60)
SPP Intelligence	2.86 (0.88)	2.98 (0.74)	3.47 (0.58)	2.65 (0.77)	2.63 (0.79)	3.03 (0.44)
SPP Humour	3.00 (0.84)	2.94 (0.81)	3.09 (0.76)	3.30 (0.68)	3.26 (0.77)	3.58 (0.43)
SPP Global Self-Worth	2.25 (0.78)	2.46 (0.78)	2.71 (0.68)	2.33 (0.64)	2.20 (0.65)	2.39 (0.70)
State Self-Esteem total	55.03 (15.99)	58.90 (15.40)	65.00 (15.60)	54.96 (13.26)	55.00 (11.91)	57.92 (13.40)
Social	19.44 (6.80)	21.17 (6.86)	23.10 (6.60)	20.62 (6.43)	20.69 (6.37)	21.39 (6.46)
Appearance	11.21 (4.66)	12.10 (5.23)	15.00 (5.40)	11.81 (3.68)	11.89 (3.59)	13.27 (4.17)

Table 5.6: continued.

Dependent Variable	Initial Intervention Group			Delayed Start Control Group		
	Baseline	End RCT	12 Months	Baseline	End RCT	12 Months
SSSE Listening needed	4.86 (1.25)	4.76 (1.33)	4.79 (1.35)	4.25 (1.40)	4.25 (1.38)	4.26 (1.39)
SSSE Listening received	2.28 (1.39)	4.04 (1.51)	4.63 (1.36)	2.36 (1.19)	2.89 (1.55)	3.56 (1.51)
SSSE Listening discrepancy	2.59 (1.70)	0.64 (1.78)	0.00 (1.55)	1.89 (1.52)	1.33 (1.71)	0.67 (1.87)
SSSE Informational needed	5.17 (0.93)	4.80 (1.15)	4.75 (1.29)	4.82 (1.28)	4.74 (1.29)	4.33 (1.32)
SSSE Informational received	1.97 (1.30)	4.68 (1.18)	5.19 (0.98)	2.04 (1.32)	2.85 (1.61)	4.56 (1.42)
SSSE Informational discrepancy	3.21 (1.50)	0.12 (1.39)	-0.44 (1.36)	2.79 (1.72)	1.89 (1.76)	-.22 (1.20)
SSSE Challenge needed	4.86 (1.25)	4.80 (1.15)	4.88 (1.15)	4.89 (1.13)	4.52 (1.25)	4.22 (1.64)
SSSE Challenge received	1.90 (1.32)	4.12 (1.51)	4.94 (1.06)	2.07 (1.22)	2.63 (1.52)	4.44 (1.42)
SSSE Challenge discrepancy	2.97 (1.74)	0.68 (1.52)	-0.06 (1.39)	2.82 (1.42)	1.89 (1.63)	-.22 (1.99)
SSSE Negative needed	2.76 (1.70)	2.08 (1.26)	2.06 (1.39)	2.61 (1.60)	2.07 (1.24)	1.33 (0.50)
SSSE Negative received	3.28 (1.96)	2.48 (1.56)	1.75 (0.86)	2.75 (1.76)	2.89 (1.93)	1.67 (1.11)
SSSE Negative discrepancy	-.52 (1.55)	-.40 (1.08)	0.31 (0.94)	-.14 (1.72)	-.81 (1.42)	-.33 (1.00)

Table 5.7: Results of the on treatment repeated measures ANOVA for the RCT phase of the WHEEL intervention.

Dependent Variable	Condition $F(1,46)$	Time $F\ (1,46)$	Interaction $F(1,46)$
Body Weight	0.36; $P = .55$	0.03; $P = .87$	10.70; $P = .002$*
GCOS Autonomy	7.17; $P = .01$*; $\eta^2 = .14$	2.03; $P = .16$; $\eta^2 = .04$	0.00; $P = .96$; $\eta^2 = .00$
GCOS Impersonal	1.49; $P = .23$; $\eta^2 = .03$	6.00; $P = .02^{\dagger}$; $\eta^2 = .12$	0.34;$P = .56$; $\eta^2 = .01$
GCOS Controlled	0.27; $P = .61$; $\eta^2 = .01$	0.48; $P = .49$; $\eta^2 = .01$	0.09; $P = .76$; $\eta^2 = .00$
Locus of control Internal	4.44; $P = .04^{\dagger}$; $\eta^2 = .09$	0.09; $P = .77$; $\eta^2 = .00$	0.09; $P = .77$; $\eta^2 = .00$
Locus of control Chance	3.26; $P = .08$; $\eta^2 = .08$	1.31; $P = .26$; $\eta^2 = .03$	0.06; $P = .82$; $\eta^2 = .00$
Locus of control Powerful others	2.16; $P = .15$; $\eta^2 = .04$	1.03; $P = .31$; $\eta^2 = .02$	0.04; $P = .84$; $\eta^2 = .00$
Powerful others Doctors	1.19; $P = .28$; $\eta^2 = .03$	7.63; $P = .008$*; $\eta^2 = .14$	0.51: $P = .48$; $\eta^2 = .01$
Powerful others Other people	0.85; $P = .36$; $\eta^2 = .02$	1.13; $P = .29$; $\eta^2 = .02$	1.13; $P = .29$; $\eta^2 = .02$
GWB total	1.80; $P = .19$; $\eta^2 = .04$	30.02; $P < .001$*; $\eta^2 = .40$	50.72; $P < .001$*; $\eta^2 = .53$
Emotional control and stability	0.03; $P = .86$; $\eta^2 = .00$	16.27; $P < .001$*; $\eta^2 = .26$	14.82; $P < .001$*; $\eta^2 = .24$
Energy level	2.96; $P = .09$; $\eta^2 = .06$	21.58; $P < .001$*; $\eta^2 = .32$	22.80; $P < .001$*; $\eta^2 = .33$
Relaxed vs. tense or anxious	0.51; $P = .48$; $\eta^2 = .01$	10.01; $P = .003$*; $\eta^2 = .18$	19.48; $P = .001$*; $\eta^2 = .30$
Cheerful vs. depressed mood	1.51; $P = .23$; $\eta^2 = .03$	14.60; $P < .001$*; $\eta^2 = .24$	24.04; $P < .001$*; $\eta^2 = .34$
Satisfying and interesting life	1.55; $P = .22$; $\eta^2 = .03$	22.21; $P < .001$*; $\eta^2 = .33$	32.38; $P < .001$*; $\eta^2 = .41$
Freedom from health concern worry	2.65; $P = .11$; $\eta^2 = .05$	7.93; $P = .007$*; $\eta^2 = .15$	34.22; $P < .001$*; $\eta^2 = .43$

Table 5.7: continued.

Dependent Variable	Condition	Time	Interaction
Perceived stress	4.11; $P = .05^{\dagger}$; $\eta^2 = .08$	14.71; $P < .001$*; $\eta^2 = .24$	0.39; $P = .54$; $\eta^2 = .01$
Adaptional symptoms	3.44; $P = .07$; $\eta^2 = .07$	13.54; $P < .001$*; $\eta^2 = .24$	0.85; $P = .36$; $\eta^2 = .02$
Coping ability	1.51; $P = .23$; $\eta^2 = .03$	7.75; $P = .008$*; $\eta^2 = .14$	0.39; $P = .54$; $\eta^2 = .01$
Body Image Dissatisfaction	3.88; $P = .05^{\dagger}$; $\eta^2 = .07$	1.22; $P = .14$; $\eta^2 = .04$	8.98; $P = .004$*; $\eta^2 = .15$
SPP Sociability	0.11; $P = .74$; $\eta^2 = .00$	0.11; $P = .74$; $\eta^2 = .00$	0.28; $P = .60$; $\eta^2 = .01$
SPP Job Competence	1.21; $P = .28$; $\eta^2 = .02$	0.01; $P = .91$; $\eta^2 = .00$	0.19; $P = .67$; $\eta^2 = .00$
SPP Nurturance	0.85; $P = .36$; $\eta^2 = .01$	1.40; $P = .24$; $\eta^2 = .03$	0.18; $P = .68$; $\eta^2 = .00$
SPP Athletics	3.58; $P = .06$; $\eta^2 = .07$	3.64; $P = .06$; $\eta^2 = .07$	11.78; $P = .001$*; $\eta^2 = .19$
SPP Appearance	0.65; $P = .43$; $\eta^2 = .00$	0.14; $P = .71$; $\eta^2 = .00$	4.56; $P = .04^{\dagger}$; $\eta^2 = .08$
SPP Provider	0.02; $P = .89$; $\eta^2 = .00$	0.02; $P = .89$; $\eta^2 = .00$	0.28; $P = .60$; $\eta^2 = .01$
SPP Morality	2.16; $P = .15$; $\eta^2 = .04$	1.53; $P = .22$; $\eta^2 = .03$	0.31; $P = .58$; $\eta^2 = .01$
SPP Household	0.08; $P = .77$; $\eta^2 = .00$	0.26; $P = .61$; $\eta^2 = .01$	0.51;$P = .48$; $\eta^2 = .01$
SPP Intimate Relations	0.22; $P = .64$; $\eta^2 = .00$	0.41; $P = .53$; $\eta^2 = .01$	0.19; $P = .67$; $\eta^2 = .00$
SPP Intelligence	1.31; $P = .26$; $\eta^2 = .03$	1.72; $P = .20$; $\eta^2 = .03$	2.57; $P = .12$; $\eta^2 = .05$
SPP Humour	3.09; $P = .09$; $\eta^2 = .06$	0.01; $P = .94$; $\eta^2 = .00$	1.00; $P = .30$; $\eta^2 = .02$
SPP Global Self-Worth	0.10; $P = .76$; $\eta^2 = .00$	2.56; $P = .12$; $\eta^2 = .05$	22.59; $P < .001$*; $\eta^2 = .31$

Table 5.7: continued.

Dependent Variable	Condition	Time	Interaction
State Self-Esteem total	0.24; $P = .63$; $\eta^2 = .01$	3.34; $P = .07$; $\eta^2 = .07$	3.25; $P = .08$; $\eta^2 = .07$
Social	0.04; $P = .84$; $\eta^2 = .00$	3.27; $P = .08$; $\eta^2 = .07$	2.85; $P = .10$; $\eta^2 = .06$
Appearance	0.01; $P = .92$; $\eta^2 = .00$	1.84; $P = .18$; $\eta^2 = .04$	1.42; $P = .24$; $\eta^2 = .03$
SSSE Listening needed	2.01; $P = .16$; $\eta^2 = .04$	0.31; $P = .58$; $\eta^2 = .01$	0.31; $P = .58$; $\eta^2 = .01$
SSSE Listening received	2.19; $P = .15$; $\eta^2 = .04$	35.81; $P < .001$*; $\eta^2 = .42$	10.29; $P = .002$*; $\eta^2 = .17$
SSSE Listening discrepancy	0.00; $P = .98$; $\eta^2 = .00$	25.41; $P < .001$*; $\eta^2 = .34$	7.92; $P = .007$*; $\eta^2 = .14$
SSSE Informational needed	0.56; $P = .46$; $\eta^2 = .01$	3.33; $P = .07$; $\eta^2 = .06$	1.57; $P = .22$; $\eta^2 = .03$
SSSE Informational received	7.83; $P = .01$*; $\eta^2 = .14$	65.22; $P < .001$*; $\eta^2 = .57$	18.58; $P < .001$*; $\eta^2 = .27$
SSSE Informational discrepancy	3.75; $P = .08$; $\eta^2 = .06$	62.91; $P < .001$*; $\eta^2 = .56$	19.18; $P < .001$*; $\eta^2 = .28$
SSSE Challenge needed	0.35; $P = .56$; $\eta^2 = .01$	4.18; $P = .05^{\dagger}$; $\eta^2 = .08$	0.66; $P = .42$; $\eta^2 = .01$
SSSE Challenge received	4.77; $P = .03^{\dagger}$; $\eta^2 = .09$	78.46: $P < .001$*; $\eta^2 = .44$	12.47; $P < .001$*; $\eta^2 = .20$
SSSE Challenge discrepancy	2.22; $P = .14$; $\eta^2 = .04$	42.04; $P < .001$*; $\eta^2 = .46$	7.18; $P = .01$*; $\eta^2 = .13$
SSSE Negative needed	0.03; $P = .85$; $\eta^2 = .00$	9.63; $P = .003$*; $\eta^2 = .16$	0.11; $P = .75$; $\eta^2 = .00$
SSSE Negative received	0.07; $P = .79$; $\eta^2 = .00$	2.64; $P = .11$; $\eta^2 = .05$	6.20; $P = .02^{\dagger}$; $\eta^2 = .11$
SSSE Negative discrepancy	0.03; $P = .86$; $\eta^2 = .00$	0.85; $P = .36$; $\eta^2 = .02$	3.52; $P = .07$; $\eta^2 = .07$

(† $P \leq 0.05$; * $P \leq 0.01$)

Table 5.8: Results of the intention to treat repeated measures ANOVA for the RCT phase of the WHEEL intervention.

Dependent Variable	Condition F(1,53)	Time F (1,53)	Interaction F(1,53)
GCOS Autonomy	3.19; P = .08; η^2 = .06	2.09; P = .15; η^2 = .04	0.06; P = .80; η^2 = .00
GCOS Impersonal	0.70; P = .41; η^2 = .01	5.63; P = .02†; η^2 = .10	0.06; P = .81; η^2 = .00
GCOS Controlled	1.41; P = .24; η^2 = .03	0.43; P = .51; η^2 = .01	0.05; P = .83; η^2 = .00
Locus of control Internal	5.46; P = .02†; η^2 = .09	0.07; P = .79; η^2 = .00	0.07; P = .79; η^2 = .00
Locus of control Chance	4.61; P = .04†; η^2 = .08	1.38; P = .25; η^2 = .03	0.12; P = .73; η^2 = .00
Locus of control Powerful others	1.13; P = .29; η^2 = .02	1.09; P = .30; η^2 = .02	0.10; P = .76; η^2 = .00
Powerful others Doctors	0.23; P = .63; η^2 = .00	7.17; P = .001*; η^2 = .12	0.20: P = .66; η^2 = .00
Powerful others Other people	1.51; P = .22; η^2 = .03	0.93; P = .34; η^2 = .02	0.93; P = .34; η^2 = .02
GWB total	1.32; P = .26; η^2 = .02	15.00; P < .001*; η^2 = .22	30.03; P < .001*; η^2 = .36
Emotional control and stability	0.01; P = .98; η^2 = .00	10.94; P = .002*; η^2 = .17	9.70; P = .003*; η^2 = .16
Energy level	2.49; P = .12; η^2 = .05	13.43; P = .001*; η^2 = .20	14.44; P < .001*; η^2 = .21
Relaxed vs. tense or anxious	0.25; P = .62; η^2 = .01	5.89; P = .02†; η^2 = .10	14.24; P = .001*; η^2 = .21
Cheerful vs. depressed mood	0.81; P = .37; η^2 = .02	8.63; P = .005*; η^2 = .14	16.57; P < .001*; η^2 = .24
Satisfying and interesting life	1.20; P = .28; η^2 = .02	12.55; P = .001*; η^2 = .19	20.66; P < .001*; η^2 = .28
Freedom from health concern worry	2.75; P = .10; η^2 = .05	3.51; P = .07; η^2 = .06	25.88; P < .001*; η^2 = .33

Table 5.8: continued.

Dependent Variable	Condition	Time	Interaction
Perceived stress	3.85; P = .05†; η^2 = .07	13.85; P < .001*; η^2 = .21	0.03; P = .86; η^2 = .00
Adaptional symptoms	2.66; P = .11; η^2 = .05	12.43; P < .001*; η^2 = .19	0.24; P = .62; η^2 = .01
Coping ability	1.74; P = .19; η^2 = .03	8.23; P = .006*; η^2 = .13	0.90; P = .35; η^2 = .02
Body Image Dissatisfaction	3.65; P = .06; η^2 = .06	2.95; P = .09; η^2 = .05	9.71; P = .003*; η^2 = .15
SPP Sociability	0.09; P = .77; η^2 = .00	0.15; P = .70; η^2 = .00	0.33; P = .57; η^2 = .01
SPP Job Competence	1.79; P = .19; η^2 = .03	0.01; P = .94; η^2 = .00	0.18; P = .67; η^2 = .00
SPP Nurturance	0.50; P = .48; η^2 = .01	1.30; P = .26; η^2 = .02	0.08; P = .77; η^2 = .00
SPP Athletics	2.34; P = .13; η^2 = .04	2.25; P = .14; η^2 = .04	10.02; P = .001*; η^2 = .15
SPP Appearance	1.37; P = .25; η^2 = .02	0.02; P = .89; η^2 = .00	4.41; P = .04†; η^2 = .07
SPP Provider	0.02; P = .89; η^2 = .00	0.04; P = .84; η^2 = .00	0.30; P = .58; η^2 = .01
SPP Morality	3.50; P = .07; η^2 = .06	1.40; P = .24; η^2 = .02	0.18; P = .68; η^2 = .00
SPP Household	0.21; P = .65; η^2 = .00	0.35; P = .56; η^2 = .01	0.60;P = .44; η^2 = .01
SPP Intimate Relations	0.02; P = .90; η^2 = .00	0.48; P = .49; η^2 = .01	0.26; P = .62; η^2 = .01
SPP Intelligence	2.02; P = .16; η^2 = .04	1.28; P = .26; η^2 = .02	2.13; P = .15; η^2 = .04
SPP Humour	1.71; P = .20; η^2 = .03	0.01; P = .97; η^2 = .00	1.10; P = .30; η^2 = .02
SPP Global Self-Worth	0.23; P = .64; η^2 = .00	1.09; P = .30; η^2 = .02	19.80; P < .001*; η^2 = .26

Table 5.8: continued.

Dependent Variable	Condition	Time	Interaction
State Self-Esteem total	0.29; P = .59; η^2 = .01	2.48; P = .12; η^2 = .05	2.39; P = .13; η^2 = .04
Social	0.04; P = .84; η^2 = .00	2.47; P = .12; η^2 = .05	2.07; P = .16; η^2 = .04
Appearance	0.03; P = .86; η^2 = .00	1.44; P = .24; η^2 = .03	1.02; P = .32; η^2 = .02
SSSE Listening needed	2.71; P = .11; η^2 = .05	0.27; P = .60; η^2 = .01	0.27; P = .60; η^2 = .01
SSSE Listening received	1.93; P = .17; η^2 = .03	30.41; P < .001*; η^2 = .36	7.45; P = .009*; η^2 = .12
SSSE Listening discrepancy	0.09; P = .76; η^2 = .00	22.15; P < .001*; η^2 = .29	5.96; P = .02†; η^2 = .10
SSSE Informational needed	0.57; P = .46; η^2 = .01	3.06; P = .09; η^2 = .05	1.32; P = .26; η^2 = .02
SSSE Informational received	4.93 P = .003*; η^2 = .08	51.12; P < .001*; η^2 = .48	12.40; P = .001*; η^2 = .18
SSSE Informational discrepancy	1.71; P = .20; η^2 = .03	49.32; P < .001*; η^2 = .47	12.93; P = .001*; η^2 = .19
SSSE Challenge needed	0.07; P = .80; η^2 = .00	4.38; P = .04†; η^2 = .07	0.86; P = .36; η^2 = .02
SSSE Challenge received	2.22; P = .14; η^2 = .04	32.15: P < .001*; η^2 = .37	9.04; P = .004*; η^2 = .14
SSSE Challenge discrepancy	1.20; P = .28; η^2 = .02	36.16; P < .001*; η^2 = .40	4.84; P = .03†; η^2 = .08
SSSE Negative needed	0.12; P = .73; η^2 = .00	9.40; P = .003*; η^2 = .15	0.03; P = .88; η^2 = .00
SSSE Negative received	0.01; P = .90; η^2 = .00	2.17; P = .15; η^2 = .04	5.67; P = .02†; η^2 = .09
SSSE Negative discrepancy	0.05; P = .82; η^2 = .00	1.06; P = .31; η^2 = .02	3.73; P = .06; η^2 = .06

(† P $\leq$ 0.05; * P $\leq$ 0.01)

The post-hoc comparisons for the body weight interaction effect for the RCT showed that bodyweight in the IIG was significantly higher at the start of the study. In addition, the IIG showed a significant decrease in weight from baseline to end of the RCT phase whereas the DSCG showed a significant increase.

Participants initially randomised to intervention scored significantly higher on autonomy subscale of the *GCOS* questionnaire (Deci & Ryan, 1985a) during the RCT phase of the study. In addition, a significant decrease for the impersonal orientation was observed for both groups at the end of the RCT. Significant differences were also observed on the *MHLC* scale (Wallston, Wallston, & DeVellis, 1978). Participants in the IIG scored significantly higher on internal locus of control subscale compared with the participants in the DSCG. Participants in both groups showed a significant decrease in the 'powerful others doctors' subscale from baseline to the end of the RCT.

Significant interaction effects were found for the total score of the *GWB Schedule* (Miller & Harrington, 1997) as well as for all its subscales (see also figure 5.1a) during the RCT phase. Post-hoc comparisons showed that there were no significant differences at baseline for any of the variables except the 'Emotional Control and Stability' subscale. The IIG showed significant improvements from baseline to the end of the RCT phase for the total score of the GWB Schedule (Miller & Harrington, 1997) and all its subscales and at this point in time scored significantly higher than participants in the DSCG. Effect sizes were medium to large (between 0.24 and 0.53).

Result for the *PSS* (Cohen, Kamarck, & Mermelstein, 1983) showed that participants in the IIG scored significantly lower on perceived stress than participants in the DSCG for the RCT phase. In addition, a significant decrease was observed from baseline to end of the

RCT phase for the total perceived stress score as well as the scores for the ‘adaptional symptoms’ and ‘coping ability’ subscales indicating that participants in both groups rated their stress levels lower following the RCT phase.

Data for *body dissatisfaction* were only available for the RCT phase. The post-hoc comparisons for the significant body dissatisfaction interaction effect revealed that at both baseline and end of the RCT phase the IIG had a lower body dissatisfaction score than the DSCG. The DSCG showed a significant increase in dissatisfaction from baseline to end of the RCT phase whereas the IIG showed a non-significant decrease in body dissatisfaction.

Significant interaction effects were found for the ‘Athletic’, ‘Appearance’ and ‘Global Self-Worth (GSW)’ scales of the *SPP* (Messer & Harter, 1986) for the RCT analysis (see figures 5.1b, c, and d). The IIG showed significant improvements for all 3 subscales from baseline to end of the RCT phase and scored significantly higher than the DSCG at this stage of the study. The latter group showed a significant decrease in ‘GSW’ from baseline to end of the RCT phase. No significant differences were observed for the State Self-Esteem Inventory (Heatherton & Polivy, 1991).

Significant time main effects were found for the needed ‘Challenge’ and ‘Negative’ subscales of the Social Support Scale for Exercise (Anderson & Fox, 1997) in the RCT stage, both variables showing a significant lower value at end of the RCT phase. For receiving ‘Listening’, ‘Informational’ and ‘Challenge’ subscales of the *SSSE* post-hoc comparisons showed that the IIG increased social support from baseline to the end of RCT phase and scored significantly higher than the DSCG at phase of the study (see Figures 5.2a-d). For the received ‘Negative’ social support for exercise the IIG scored significantly higher at baseline than the DSCG but decreased ‘Negative’ support from baseline to end of the RCT phase. Post-hoc comparisons for the ‘Informational’ and ‘Challenge’ discrepancy scales showed that both conditions improved from baseline to end of the RCT phase but at this stage the IIG had a significantly lower discrepancy score than the delayed start control group. With regard to the ‘Listening’ discrepancy scale, post-hoc comparisons showed an initial difference between the two conditions, the IIG having a significantly higher score but showing a significant decrease in the ‘Listening’ discrepancy score from baseline to end of the RCT phase and the score at this stage of the study was significantly lower than that of the DSCG.

Few differences were observed between the on treatment and intention-to-treat methods of analysis (highlighted in grey in table 5.8). The ITT analyses resulted in a non-significant condition effect for the *GCOS’s* ‘Autonomy’ subscale and the *GWB Schedule’s* ‘Freedom from health concern worry’ subscales, but a significant effect for the *MHLC* ‘Chance’ scale indicating that the participants in the IIG scored significantly lower than the participants in the DSCG.

5.3.2. RCT phase physiological data

Results from the graded treadmill walking test as well as BMI are presented in table 5.9 for the forty four participants completing the test on both occasions (note, the peak exercise metabolic and hemodynamic characteristics are presented in table 5.4). Among the participants (N = 61) who underwent graded maximal exercise testing, the mean percent age-predicted maximum heart rate and peak RER attained were 93.6% ± 7.8% and 1.09 ± 0.06 respectively, indicating acceptable compliance with maximum effort. There were no significant differences between the IIG and DSCG for the peak exercise hemodynamic and metabolic measurements at baseline (see also table 5.4).

There was a modest but statistically significant decrease in BMI for the IIG compared to the DSCG during the RCT phase of the study. Repeated measures analysis of variance also showed a significantly improved $\dot{V}O_{2peak}$ normalised for body weight ($ml \cdot kg^{-1} \cdot min^{-1}$) in IIG compared with a reduction in the DSCG. In addition, Absolute $\dot{V}O_{2peak}$ significantly increased in the IIG following the intervention period but remained unchanged in the DSCG. There were no significant between group changes in peak exercise heart rate or peak RER achieved on graded exercise testing. Finally, there were significant improvements in mean arterial blood pressure in both groups.

5.4. Follow-up/maintenance phase

The results of the follow-up/maintenance analysis are displayed in table 5.10. In addition, there are graphical representations of some of the most important results in figures 5.1a-d and 5.2a-d.

Table 5.9: Pre-and post intervention anthropometric and peak exercise hemodynamic and metabolic measurements from the graded treadmill walking test for participants who completed the testing protocol on both occasions.

	Initial Intervention Group (N = 22)		Delayed Start Control Group (N = 22)		Main effect Time	Interaction effect
	Baseline	End RCT	Baseline	End RCT	P-value	P-value
BMI, $kg \cdot m^{-2}$	39.0 ± 6.4	38.3 ± 7.0	36.9 ± 7.0	37.7 ± 6.6	.78	.003*
Absolute VO_2, $ml \cdot min^{-1}$	2276 ± 359	2453 ± 382	2226 ± 331	2155 ± 319	.14	.001*
Adjusted VO_2, $ml \cdot kg^{-1} \cdot min^{-1}$	21.6 ± 3.3	23.6 ± 4.5	22.7 ± 3.1	21.6 ± 3.1	.21	.001
RER	1.09 ± 0.05	1.09 ± 0.05	1.08 ± 0.06	1.08 ± 0.05	.63	.67
Heart rate, $beats \cdot min^{-1}$	170 ± 11	172 ± 11	173 ± 14	170 ± 14	.71	.10
Systolic BP, mmHg	180.0 ± 16.5	192.3 ± 17.3	181.5 ± 31.6	192.0 ± 30.1	.001*	.76
Diastolic BP, mmHg	77.2 ± 9.7	74.3 ±10.6	78.4 ± 13.3	75.7 ± 11.0	.03[†]	.93

([†] $P \leq 0.05$; * $P \leq 0.01$)

Table 5.10: Results of the on treatment repeated measures ANOVA for the maintenance phase of the WHEEL intervention.

Dependent Variable	Condition $F(1,23)$	Time $F(1,23)$	Interaction $F(1,23)$
Body Weight	0.46; $P = 0.50$	2.24; $P = 0.15$	2.74; $P = 0.11$
GCOS Autonomy	2.32; $P = .14$; $\eta^2 = .09$	48.72; $P < .001$*; $\eta^2 = .68$	5.76; $P = .03$*; $\eta^2 = .20$
GCOS Impersonal	0.94; $P = .34$; $\eta^2 = .04$	10.75; $P = .003$*; $\eta^2 = .32$	0.00;$P = .99$; $\eta^2 = .00$
GCOS Controlled	0.26; $P = .62$; $\eta^2 = .01$	0.15; $P = .71$; $\eta^2 = .01$	1.65; $P = .21$; $\eta^2 = .07$
Locus of control Internal	6.54; $P = .02^{\dagger}$; $\eta^2 = .22$	2.55; $P = .12$; $\eta^2 = .10$	0.20; $P = .66$; $\eta^2 = .01$
Locus of control Chance	1.16; $P = .29$; $\eta^2 = .05$	4.01; $P = .05^{\dagger}$; $\eta^2 = .15$	2.04; $P = .17$; $\eta^2 = .08$
Locus of control Powerful others	1.63; $P = .21$; $\eta^2 = .03$	0.19; $P = .67$; $\eta^2 = .00$	0.19; $P = .67$; $\eta^2 = .00$
Powerful others Doctors	0.02; $P = .88$; $\eta^2 = .00$	0.82; $P = .38$; $\eta^2 = .03$	0.01; $P = .92$; $\eta^2 = .00$
Powerful others Other people	0.32; $P = .58$; $\eta^2 = .01$	1.50; $P = .23$; $\eta^2 = .06$	0.61; $P = .44$; $\eta^2 = .03$
GWB total	1.31; $P = .26$; $\eta^2 = .05$	50.88; $P < .001$*; $\eta^2 = .69$	2.40; $P = .14$; $\eta^2 = .09$
Emotional control and stability	0.21; $P = .65$; $\eta^2 = .01$	24.27; $P < .001$*; $\eta^2 = .51$	0.69; $P = .41$; $\eta^2 = .03$
Energy level	1.89; $P = .18$; $\eta^2 = .08$	35.91; $P < .001$*; $\eta^2 = .61$	1.24; $P = .28$; $\eta^2 = .05$
Relaxed vs. tense or anxious	0.35; $P = .56$; $\eta^2 = .02$	20.12; $P < .001$*; $\eta^2 = .47$	1.15; $P = .30$; $\eta^2 = .05$
Cheerful vs. depressed mood	0.97; $P = .33$; $\eta^2 = .04$	21.76; $P < .001$*; $\eta^2 = .49$	1.81; $P = .19$; $\eta^2 = .07$
Satisfying and interesting life	0.38; $P = .54$; $\eta^2 = .02$	42.91; $P < .001$*; $\eta^2 = .65$	3.73; $P = .07$; $\eta^2 = .14$
Freedom from health concern worry	2.13; $P = .16$; $\eta^2 = .09$	45.31; $P < .001$*; $\eta^2 = .66$	0.83; $P = .37$; $\eta^2 = .04$

Table 5.10: continued.

Dependent Variable	Condition	Time	Interaction
Perceived stress	0.71; P = .41; η^2 = .03	18.85; P < .001*; η^2 = .45	0.00; P = .99; η^2 = .00
Adaptional symptoms	0.60; P = .45; η^2 = .03	14.24; P < .001*; η^2 = .38	0.01; P = .93; η^2 = .00
Coping ability	0.01; P = .91; η^2 = .00	9.94; P = .005*; η^2 = .30	0.07; P = .80; η^2 = .00
SPP Sociability	0.19; P = .67; η^2 = .01	4.85; P = .04†; η^2 = .17	0.70; P = .41; η^2 = .03
SPP Job Competence	0.02; P = .91; η^2 = .00	8.86; P = .007*; η^2 = .28	0.02; P = .89; η^2 = .00
SPP Nurturance	0.20; P = .66; η^2 = .01	0.74; P = .40; η^2 = .03	0.11; P = .74; η^2 = .01
SPP Athletics	0.30; P = .59; η^2 = .01	28.67; P < .001*; η^2 = .56.	0.03; P = .86; η^2 = .00
SPP Appearance	0.26; P = .61; η^2 = .01	26.80; P < .001*; η^2 = .54	0.21; P = .65; η^2 = .01
SPP Provider	0.14; P = .71, η^2 = .01	7.84; P = .01*; η^2 = .25	0.00; P = .95; η^2 = .00
SPP Morality	16.30; P = .001*; η^2 = .42	6.36; P = .02†; η^2 = .22	0.07; P = .80; η^2 = .00
SPP Household	0.10; P = .75; η^2 = .00	10.50; P = .004*; η^2 = .31	0.08; P = .79; η^2 = .00
SPP Intimate Relations	0.83; P = .37; η^2 = .04	7.91; P = .01*; η^2 = .26	0.52; P = .48; η^2 = .02
SPP Intelligence	3.20; P = .09; η^2 = .12	21.07; P < .001*; η^2 = .48	0.21; P = .65; η^2 = .01
SPP Humour	3.43; P = .08; η^2 = .13	1.64; P = .21; η^2 = .07	0.43; P = .52; η^2 = .02
SPP Global Self-Worth	0.01; P = .94; η^2 = .00	48.40; P < .001*; η^2 = .68	0.22; P = .65; η^2 = .01

Table 5.10: continued.

Dependent Variable	Condition	Time	Interaction
State Self-Esteem total	0.00; $P = .99$; $\eta^2 = .00$	28.47; $P < .001$*; $\eta^2 = .55$	2.88; $P = .10$; $\eta^2 = .11$
Social	0.21; $P = .65$; $\eta^2 = .01$	11.78; $P = .002$*; $\eta^2 = .34$	2.52; $P = .13$; $\eta^2 = .10$
Appearance	0.11; $P = .74$; $\eta^2 = .01$	55.66; $P < .001$*; $\eta^2 = .71$	2.23; $P = .15$; $\eta^2 = .09$
SSSE Listening needed	0.60; $P = .45$; $\eta^2 = .03$	0.21; $P = .65$; $\eta^2 = .01$	0.21; $P = .65$; $\eta^2 = .01$
SSSE Listening received	0.00; $P = .97$; $\eta^2 = .00$	34.70; $P < .001$*; $\eta^2 = .60$	17.51; $P < .001$*; $\eta^2 = .43$
SSSE Listening discrepancy	0.55; $P = .46$; $\eta^2 = .03$	27.47; $P < .001$*; $\eta^2 = .54$	14.31; $P = .001$*; $\eta^2 = .38$
SSSE Informational needed	1.83; $P = .19$; $\eta^2 = .17$	0.78; $P = .39$; $\eta^2 = .03$	0.78; $P = .39$; $\eta^2 = .03$
SSSE Informational received	0.37; $P = .55$; $\eta^2 = .02$	61.83; $P < .001$*; $\eta^2 = .73$	9.15; $P = .006$*; $\eta^2 = .29$
SSSE Informational discrepancy	4.77; $P = .04^{\dagger}$; $\eta^2 = .17$	39.60; $P < .001$*; $\eta^2 = .63$	7.33; $P = .01$*; $\eta^2 = .24$
SSSE Challenge needed	1.88; $P = .18$; $\eta^2 = .08$	0.10; $P = .76$; $\eta^2 = .00$	0.10; $P = .76$; $\eta^2 = .00$
SSSE Challenge received	0.16; $P = .69$; $\eta^2 = .01$	62.07: $P < .001$*; $\eta^2 = .73$	4.09; $P = .04^{\dagger}$; $\eta^2 = .17$
SSSE Challenge discrepancy	2.51; $P = .13$; $\eta^2 = .10$	41.57; $P < .001$*; $\eta^2 = .64$	3.57; $P = .07$; $\eta^2 = .13$
SSSE Negative needed	4.94; $P = .04^{\dagger}$; $\eta^2 = .18$	3.41; $P = .08$; $\eta^2 = .13$	3.41; $P = .08$; $\eta^2 = .13$
SSSE Negative received	1.66; $P = .21$; $\eta^2 = .07$	13.51; $P = .001$*; $\eta^2 = .37$	4.78; $P = .04^{\dagger}$; $\eta^2 = .17$
SSSE Negative discrepancy	0.93; $P = .35$; $\eta^2 = .04$	9.62; $P = .005$*; $\eta^2 = .30$	1.02; $P = .32$; $\eta^2 = .04$

(† $P \leq 0.05$; * $P \leq 0.01$)

Table 5.11: Results of the intention to treat repeated measures ANOVA for the maintenance phase of the WHEEL intervention.

Dependent Variable	Condition F(1,55)	Time F (1,55)	Interaction F(1,55)
GCOS Autonomy	2.37; $P = .13$; $\eta^2 = .05$	22.35; $P < .001$*; $\eta^2 = .28$	0.09; $P = .77$; $\eta^2 = .00$
GCOS Impersonal	1.07; $P = .31$; $\eta^2 = .02$	0.75; $P = .39$; $\eta^2 = .01$	0.86;$P = .36$; $\eta^2 = .02$
GCOS Controlled	1.11; $P = .30$; $\eta^2 = .02$	0.00; $P = .95$; $\eta^2 = .00$	0.24; $P = .63$; $\eta^2 = .00$
Locus of control Internal	5.93; $P = .02^{\dagger}$; $\eta^2 = .10$	3.37; $P = .07$; $\eta^2 = .06$	0.08; $P = .78$; $\eta^2 = .00$
Locus of control Chance	5.39; $P = .02^{\dagger}$; $\eta^2 = .09$	2.04; $P = .16$; $\eta^2 = .04$	1.22; $P = .28$; $\eta^2 = .02$
Locus of control Powerful others	0.76; $P = .39$; $\eta^2 = .01$	0.36; $P = .55$; $\eta^2 = .01$	0.15; $P = .70$; $\eta^2 = .00$
Powerful others Doctors	0.05; $P = .83$; $\eta^2 = .00$	3.19; $P = .08$; $\eta^2 = .06$	1.45; $P = .23$; $\eta^2 = .03$
Powerful others Other people	1.72; $P = .20$; $\eta^2 = .03$	1.21; $P = .28$; $\eta^2 = .02$	0.59; $P = .45$; $\eta^2 = .01$
GWB total	1.85; $P = .18$; $\eta^2 = .03$	39.92; $P < .001$*; $\eta^2 = .43$	10.14; $P = .002$*; $\eta^2 = .16$
Emotional control and stability	0.00; $P = .97$; $\eta^2 = .00$	24.30; $P < .001$*; $\eta^2 = .32$	5.26; $P = .03^{\dagger}$; $\eta^2 = .09$
Energy level	3.61; $P = .06$; $\eta^2 = .06$	32.22; $P < .001$*; $\eta^2 = .38$	7.54; $P = .008$*; $\eta^2 = .13$
Relaxed vs. tense or anxious	0.38; $P = .54$; $\eta^2 = .01$	22.46; $P < .001$*; $\eta^2 = .30$	5.91; $P = .02^{\dagger}$; $\eta^2 = .10$
Cheerful vs. depressed mood	1.20; $P = .28$; $\eta^2 = .02$	25.56; $P < .001$*; $\eta^2 = .33$	8.34; $P = .006$*; $\eta^2 = .14$
Satisfying and interesting life	1.60; $P = .21$; $\eta^2 = .03$	38.22; $P < .001$*; $\eta^2 = .42$	12.72; $P = .001$*; $\eta^2 = .19$
Freedom from health concern worry	4.61; $P = .04^{\dagger}$; $\eta^2 = .08$	31.91; $P < .001$*; $\eta^2 = .38$	5.37; $P = .02^{\dagger}$; $\eta^2 = .09$

Table 5.11: Continued

Dependent Variable	Condition	Time	Interaction
Perceived stress	0.82; P = .37; η^2 = .02	20.29; P < .001*; η^2 = .28	2.40; P = .13; η^2 = .04
SPP Sociability	0.29; P = .59; η^2 = .01	4.88; P = .03†; η^2 = .08	0.19; P = .66; η^2 = .00
SPP Job Competence	2.01; P = .16; η^2 = .04	5.67; P = .02†; η^2 = .09	0.09; P = .76; η^2 = .00
SPP Nurturance	1.27; P = .27; η^2 = .02	0.20; P = .66; η^2 = .00	0.01; P = .94; η^2 = .00
SPP Athletics	3.12; P = .08; η^2 = .05	29.93; P < .001*; η^2 = .35	4.69; P = .04†; η^2 = .08
SPP Appearance	2.68; P = .11; η^2 = .05	20.34; P < .001*; η^2 = .27	2.91; P = .09; η^2 = .05
SPP Provider	0.09; P = .77, η^2 = .00	5.42; P = .02†; η^2 = .09	0.15; P = .70; η^2 = .00
SPP Morality	2.64; P = .11; η^2 = .05	4.62; P = .04†; η^2 = .08	0.06; P = .82; η^2 = .00
SPP Household	0.26; P = .61; η^2 = .01	1.77; P = .19; η^2 = .03	0.12; P = .73; η^2 = .00
SPP Intimate Relations	0.00; P = .99; η^2 = .00	6.09; P = .02†; η^2 = .10	1.49; P = .23; η^2 = .03
SPP Intelligence	2.86; P = .10; η^2 = .05	21.16; P < .001*; η^2 = .27	2.33; P = .13; η^2 = .04
SPP Humour	1.10; P = .30; η^2 = .02	3.20; P = .08; η^2 = .05	1.73; P = .19; η^2 = .03
SPP Global Self-Worth	1.06; P = .31; η^2 = .02	38.77; P < .001*; η^2 = .41	6.95; P = .01*; η^2 = .11

Table 5.11: continued.

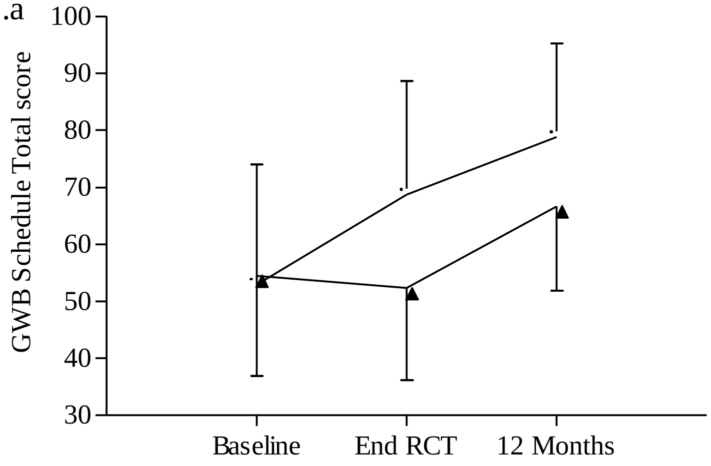
Dependent Variable	Condition	Time	Interaction
State Self-Esteem total	0.94; P = .34; η^2 = .00	24.77; P < .001*; η^2 = .32	7.40; P = .01*; η^2 = .12
Social	0.02; P = .89; η^2 = .01	16.87; P = .002*; η^2 = .24	7.84; P = .01*; η^2 = .13
Appearance	0.67; P = .42; η^2 = .01	24.41; P < .001*; η^2 = .32	3.05; P = .09; η^2 = .05
SSSE Listening needed	2.86; P = .10; η^2 = .05	0.12; P = .73; η^2 = .00	0.12; P = .73; η^2 = .00
SSSE Listening received	1.66; P = .20; η^2 = .03	34.23; P < .001*; η^2 = .38	6.10; P = .02†; η^2 = .10
SSSE Listening discrepancy	0.21; P = .63; η^2 = .00	25.14; P < .001*; η^2 = .31	4.76; P = .03†; η^2 = .08
SSSE Informational needed	0.57; P = .46; η^2 = .01	3.06; P = .09; η^2 = .05	1.32; P = .26; η^2 = .02
SSSE Informational received	3.08; P = .09; η^2 = .05	62.57; P < .001*; η^2 = .53	6.82; P = .01*; η^2 = .11
SSSE Informational discrepancy	0.79; P = .38; η^2 = .01	60.69; P < .001*; η^2 = .53	8.00; P = .01*; η^2 = .13
SSSE Challenge needed	1.88; P = .18; η^2 = .08	0.10; P = .76; η^2 = .00	0.10; P = .76; η^2 = .00
SSSE Challenge received	0.16; P = .69; η^2 = .01	62.07: P < .001*; η^2 = .73	4.09; P = .04†; η^2 = .17
SSSE Challenge discrepancy	2.51; P = .13; η^2 = .10	41.57; P < .001*; η^2 = .64	3.57; P = .07; η^2 = .13
SSSE Negative needed	0.11; P = .74; η^2 = .00	0.13; P = .72; η^2 = .00	0.13; P = .72; η^2 = .00
SSSE Negative received	1.47; P = .23; η^2 = .03	8.81; P = .004*; η^2 = .14	1.81; P = .19; η^2 = .03
SSSE Negative discrepancy	4.05; P = .06; η^2 = .07	7.97; P = .007*; η^2 = .13	1.89; P = .18; η^2 = .03

(† P ≤ 0.05; * P ≤ 0.01)

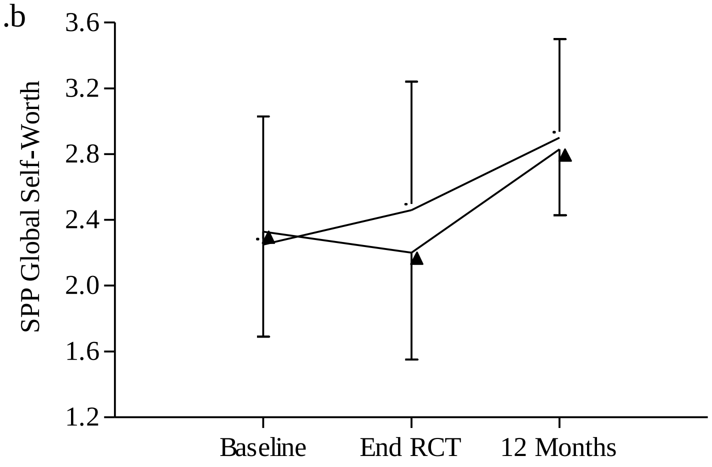
Figure 5.1a to 5.1d: Figures for the total score of the General Well Being schedule (5.1a), Global Self Worth sub-scale of the Self Perception Profile (5.1b), Athletic sub-scale of the Self Perception Profile (5.1c) and Appearance subscale of the Self Perception Profile (5.1d) for the Initial Intervention group (□) and the Delayed Start Control group (▲).

Figures 5.2.a to 5.2.d: Figures for received and needed Listening (5.2a), Informational (5.2b), Challenge (5.2c) and Negative (5.2d) support for the Social Support for Exercise Scale for the Initial Intervention group received (□), Initial Intervention group needed (■), Delayed Start Control group received (Δ) and Delayed Start Control group needed (▲).

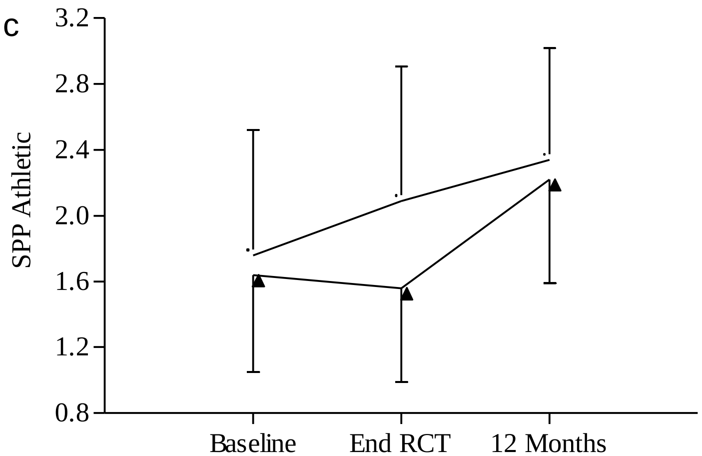
4.1.a



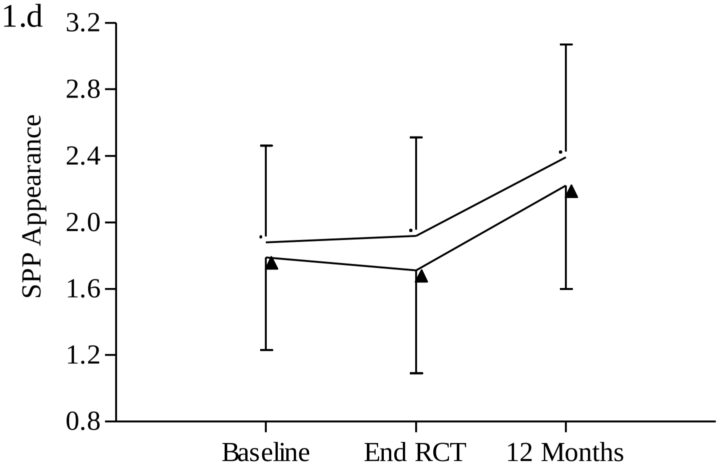
4.1.b

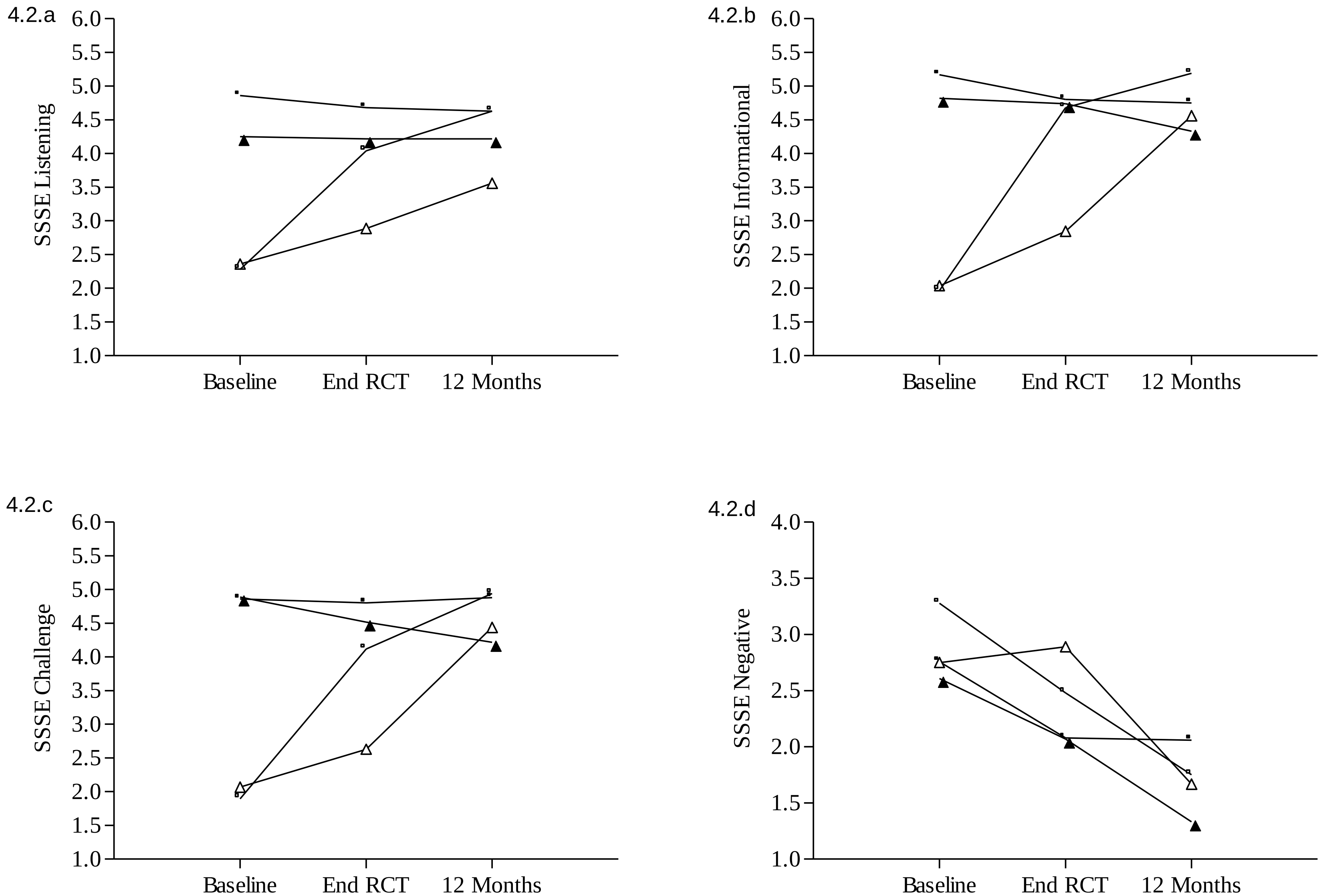


4.1.c



4.1.d




4.2.a
SSSE Listening
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
Baseline
End RCT
12 Months
4.2.b
SSSE Informational
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
Baseline
End RCT
12 Months
4.2.c
SSSE Challenge
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
Baseline
End RCT
12 Months
4.2.d
SSSE Negative
4.0
3.5
3.0
2.5
2.0
1.5
1.0
Baseline
End RCT
12 Months

No significant difference in body weight was observed for the participants in both groups when comparing the baseline with 12 months follow-up.

The WHEEL intervention significantly increased autonomy and lowered the impersonal orientation among all participants completing the 12-month intervention. Post-hoc comparisons for the significant interaction effect for the 12 month follow-up analysis indicated that participants in both conditions rated their autonomy significantly higher at 12 months in comparison to baseline. The participants in the DSCG, however, scored significantly lower at baseline than the participants in the IIG. Significant changes were also evident among the *MHLC* scale. The participants in the IIG scored significantly higher in ‘internal locus of control’ compared with the participants in the DSCG at 12 months. Participants in both groups showed a significant decrease in the ‘Chance’ Subscale from baseline to 12 month follow-up.

The significant time main effects for the *GWB Schedule* as well as for all its subscales (see also figure 5.1a) for the follow-up analysis indicated that the participants in both groups improved significantly on the GWB total and all its subscales from base line to 12 month follow-up.

Results for the *PSS* and both subscales (Adaptional symptoms and Coping ability) showed a significant decrease from baseline to 12 months follow-up indicating that participants in both groups rated their stress levels lower following the maintenance period.
The follow-up analyses showed that participants in both groups improved significantly on the majority of the 12 scales of the *SPP* from baseline to 12 months (exception being the Nurturance and Humour subscales). With regard to state self-esteem, the time main effects

indicated that both groups improved significantly for total state self-esteem and the social and appearance subscales from baseline to 12 month follow-up.

The time main effects indicates significant improvements from baseline to 12 month follow-up for both groups for received ‘Listening’, ‘Informational’, ‘Challenge’ and ‘Negative’ support as well as the discrepancy scores. However, post-hoc analysis for the ‘Listening’ and ‘Negative’ support interaction effects showed that both groups improved but that the IIG received significantly more listening support and significantly less negative’ support at the end of the maintenance period than the DSCG. The post-hoc comparison for the information and challenge interaction effects did not show any differences, both groups showing similar levels of improvement.

A number of differences were observed between the on treatment and intention to treat analysis. For example, the ITT analysis showed significant interaction for the scales of the GSW. Follow-up analysis showed that participants in the IIG showed significant improvement from baseline to post-test for relaxed vs. tense or anxious, cheerful vs. depressed mood, and satisfying and interesting life whereas the participants in the DSCG did not. Although both groups showed significant improvements for energy level and freedom from health concern worry the IIG group significantly higher improvements than the DSCG condition. Similar results were obtained for the interaction effects for the athletic and global self-worth scales of the SPP and the state self-esteem scale.

5.5. Analysis intervention strategy

The logistic regression (adhere or non-adherer as dependent variable and the GCOS and MHLC scales as predictor variables) analysis was significant (X^2 = 21.99; P = .003; Nagelkerke R^2 = .44). The impersonal (β = -.06; P = 0.04) and autonomy (β = -.12; P =

0.004) scales of the *GCOS* and the chance (β = -1.45; P = 0.01) scale of the *MHLC* were the significant predictors. This could predict group membership (adherer, non-adherer) with 75%.

The paired t-test for the self-determination index was significant (t_{54} = 3.12; P = 0.003). However, the index was more negative at 12 months (-0.77, SD = 4.97) in comparison to the baseline (-0.23, SD = 4.83).

Finally, figure 5.11 shows the correlations between the GCOS factors and the GWB schedule, PSS, and SPP at baseline and 12 month follow-up.

Table 5.12: Pearson product moment correlations between the subscales of the GCOS and the GWB schedule, PSS and SPP at baseline and 12 month follow-up.

	Impersonal Baseline N = 55	Control Baseline N = 55	Autonomy Baseline N = 55	Impersonal 12 Months N = 25	Control 12 Months N = 25	Autonomy 12 Months N = 25
General well being total	$-.30^{\dagger}$	-.06	.22	-.28	-.03	.35
Emotional control and stability	$-.33^{\dagger}$	.03	$.29^{\dagger}$	-.29	-.02	$.39^{\dagger}$
Energy level	$-.27^{\dagger}$	-.12	.21	-.09	-.11	.23
Relaxed vs. tense or anxious	-.20	-.10	.09	-.31	.14	.35
Cheerful vs. depressed mood	$-.28^{\dagger}$	-.02	.20	-.29	.11	.37
Satisfying and interesting life	$-.27^{\dagger}$	-.00	.23	-.13	-.07	.21
Freedom from health concern worry	-.20	-.05	.14	-.35	-.19	.30
Perceived stress	.43*	.11	-.48*	.32	.16	$-.49^{\dagger}$
SPP Sociability	-.48*	.06	.22	-.23	-.12	.25
SPP Job Competence	-.23	-.01	.13	-.52*	-.18	$.42^{\dagger}$
SPP Nurturance	-.11	-.12	.12	-.12	-.34	.11
SPP Athletics	-.19	.08	.14	-.12	-.39	.03
SPP Appearance	-.18	.22	.09	-.17	-.18	.29
SPP Provider	-.23	-.06	.02	$-.44^{\dagger}$	-.28	.33
SPP Morality	-.08	.01	.24	-.24	-.11	.24
SPP Household	-.26	.07	.12	$-.41^{\dagger}$	.09	$.42^{\dagger}$
SPP Intimate Relations	-.35*	.04	.22	$-.43^{\dagger}$	-.13	$.40^{\dagger}$
SPP Intelligence	-.58*	-.03	$.33^{\dagger}$	$-.47^{\dagger}$	$-.43^{\dagger}$	.21
SPP Humour	$-.27^{\dagger}$	.07	.13	-.16	.06	.15
SPP Global Self-Worth	-.39*	.20	$.26^{\dagger}$	$-.50^{\dagger}$	-.17	$.48^{\dagger}$

(† $P \leq 0.05$; * $P \leq 0.01$)

Chapter Six
Mixed Method Discussion

6.1. Discussion: The integrated QUAL & QUAN results

The outcomes of the WHEEL intervention will be considered in three separate sections. In the first section the baseline findings will be discussed. Sections 2 and 3 will consider the findings of the RCT phase and the follow-up or maintenance phase of the WHEEL study respectively.

6.2. Baseline

6.2.1. Setting the stage: Living with prejudice

Obesity is a physical condition associated with a number of debilitating physical health problems and illnesses including heart disease, stroke, cancer, diabetes, sleep disorders and joint and back pain (e.g., Bianchini, Kaaks & Vainio, 2002; Pi-Sunyer, 1993; Rabkin et al., 1997). However, obesity can have its origin in emotional and psychological issues and appears to be related to diverse negative psychological consequences (e.g., Faith, Matz & Allison, 2003). Although some studies have not found that obesity is associated with greater psyhopathology or psychological problems in comparison to the normal population (Doll, Petersen & Stewart-Brown, 2000, Fine, 1999; Stunkard & Wadden, 1992) others have found that obese individuals are more likely to have psychological, psychiatric and/or eating disorders (Becker, Margraf, Turke, Soeder, & Neumer, 2001; Fitzgibbon, Stolley & Kirschenbaum, 1993; Foster & Kendall, 1994; Hill & Williams, 1998; Rosmond, Lapidus, Marin, & Bjorntorp, 1996). Obesity, however, is a heterogeneous condition and individual variability is the norm, which might result in obese individuals perceiving their condition as distressing whereas others seem to be unaffected (Teixeira et al., 2005).

The cohort who participated in the WHEEL study had been recruited in a western country, a society in which fat prejudice is thriving (Cossrow, Jeffery, & MacGuire, 2001; Puhl & Heuer, 2009; Thomas, Hyde, Karunaratne, Herbert, & Komesaroff, 2008).

Obese women suffering have been found to suffer as a result of prejudice, stigmatisation and discrimination in many areas of life, including education, health care, employment, and housing (Puhl & Brownell, 2001). Implicit and explicit prejudices and anti-fat attitudes are prevalent in the general population and various groups of health professionals (nurses, medical students, physicians) including professionals working with obese individuals. These groups have been shown to hold negative attitudes about obese people, perceiving them as ugly, sad, lacking self-control, bad, and difficult to manage (Foster et al., 2003; Schwartz, Chambliss, Brownell, Blair, & Billington, 2003; Teachman et al., 2003). Recently, in the UK, the famous comedian Ricky Gervais said, 'If there's a woman in leggings, eating chips with fag in her mouth, sterilise her' (Long, 2010). As per Louise Carperter's interpretation, Gervais summed up what most people think of obese people: 'Fat equals thick; fat equals lack of control and overeating; fat equals poverty and bankruptcy, a potent combination of social and body hatred. Fat equals life sustained on fizzy drinks, mass-produced food and no boundaries' (Carpenter, 2010). Therefore, it is not difficult to understand that individuals with weight problems are frequent targets of weight stigma among health care providers, employers, educationists, and within their families, which has significant psychological implications for both emotional and physical well-being (Puhl, Moss-Racusin, & Schwartz, 2007).

There was evidence throughout this research confirming Puhl et al.'s findings (2007), for such prejudice experienced by participants of the WHEEL study in health care was:

> 'Everything in life pushes you onto the scales, doesn't it? Even accidents. I had to fill out a questionnaire and before you could go and see a doctor about my neck and things, they wanted to know how much I weighed. As if that made any difference?' (Section 1.111, Para 235, ST);

'Sometimes you go, and you have something wrong and you know that there is something wrong, there's something not right, you to the doctors and they just fob you off. I mean it nearly killed me, an ectopic pregnancy' (Section 1.197, Para 408, LW).

In employment:

'They just assume that because you are fat you must be thick as well' (Section 1.32, Para 65. SSi);

'I think you go so long, being put down like that, that you begin to accept it, to think that you are thick' (Section 1.34, Para 69, SSi); 'People just seem to think because you are fat, you are lazy and you overeat all the time. I notice that when I sit with some of the lads at breakfast time, they've got two bacon sandwiches and three sausage rolls – and they are like eight stone or whatever. They seem to think though that you're stupid if you are fat for some reason. It seems to connect. But they don't seem to class it as prejudice. You know like now, when you look at an application form, it doesn't say size, it's always creed, religion, disability. It's never emphasised. I know they are not allowed to advertise, like they were advertising for air stewards, they daren't say you've got to be size 12 and eight stone, because … There are other jobs such as that which they will never let you have if you're overweight' (Section 1.44, Para 132, Aha).

In general living:

'You see it's a psychological thing, if somebody sees me, a fat person, eating a big plate full, they are going to think, no wonder, why I don't eat less' (Section 1.138, Para 342, HW);

'You see if you go in a café and you see a slim girl sitting down, it's always the fat lady who has the cream bun' (Section 1.146, Para 303, PF).

In general:

> ‘If it’s crowded and it’s packed, if you’re slim you can weave in and out of people and it doesn’t matter’ (Section 1.62, Para 130, NE).

During social walking:

> ‘I do it because I’ve always had that tremendous stamina. So I never look fit, they think ,oh, she’s a fat cow. Then it’s like they can’t talk (e.g. they are out of breath when walking). Well they do sometimes, it depends what the men are like, but I like to just keep going, watching the sweat pouring off them. Which is why I don’t walk with a mixed group anymore’ (Section 1.13, Para 39, CH).

And close to home:

> ‘If I get biscuits, I’ve usually eaten them before they come home (family). Because I think, this might sound silly, but I think if I eat half a packet of biscuits and they see what’s left, they know I’ve had them. It sounds babyish, I know, but I think if I leave some, they’ll know I’ve had the rest of them. Then I’ll go and replace the whole packet (Section 1.182, Para 377, PF);

> ‘When I was older, my father would always make remarks about my body. Most recent memory was when my grandmother died. I was talking to some friends and relatives after the funeral and my father came and sat about two or three tables away but he looked across at me and said even though I was talking to other people, he said, “Isn’t your face puffy?” Criticising my body. I know he does it to my mum. It’s something that has always happened. I’d never realised that he does that. He criticises what I wear, my appearance, things like that. So I’ve become aware of that now. Because I didn’t realise I am quite critical of myself a lot of the time. And I’ve got to stop that tape and talk back to myself in my head. My father makes remarks about my body. But this morning when I was looking through this stuff I think my husband does as well a little bit and I’ve not

quite aware of it. But not like my dad. Because of what's happened to me it affected our marriage a great deal and he had some therapy as well to deal with what happened to me. It's changed our relationship a lot. It's made me more aware of who I've married and what's been repeated from the past … I think somehow it's not as bad as my dad, but just a little bit. I think my partner does influence me about my body and my weight a little bit. I think he does give me some guilt, but I can't really pinpoint it, but I think there is a little bit' (Section 1.53, Para 142, DS).

The above quotes clearly illustrate typical everyday experiences of the current cohort (86% reported prejudice) and the pervasiveness of prejudice in every aspect of their lives. Those who treat obesity—the nurses, medical doctors, dieticians, and fitness professionals—reinforce societal views of fatness in these individuals, which eventually could lead to 'learned helplessness' (Abramson, Seligman, & Teasdale, 1978), physical and psychological ill health (Puhl & Heuer, 2009; Puhl et al., 2007). As Thomas et al. (2008) state, 'Obesity is not "caused" by culture but arises within and is shaped by it' (p. 328). On the contrary, Carr, Friedman, and Jaffe (2007) found that excessive body weight is not necessarily distressing, yet the physical and interpersonal strains associated with obesity may impair one's mood.

To date there is little research that tracks the effect of such experiences in a meaningful, co-ordinated way on the health and well-being of an individual. Clearly any engagement with weight management interventions takes place in this cultural climate. Chronic stress added by 'normal' everyday living experiences, must have relevance to treatment engagement as the quotes illustrate. Often there is an emotional undertone to these experiences. The qualitative data supports the tenet that obese individuals must exert an enormous control to override their thoughts, emotions, urges, and their overall behaviour (Gailliot et al., 2007) whilst living with obesity. Self-regulation in such circumstances without a doubt is effortful (Baumeister et al., 1994) and leads to the depletion of self-regulatory resources (Baumeister & Heatherton, 1996), short- and long-term, as obesity is a chronic condition. Furthermore, the implications of such psychological states have had little or no attention in the treatment of obesity.

Indeed the quantitative data measuring perceived stress at baseline indicated that the current cohort experienced comparable stress to those reported by psychiatric patients of similar age (mean age 36.2 years – Hewitt, Flett & Mosher, 1992) but significantly higher than those reported by overweight women in the RENO Diet-Heart Study (Brunner, 1997) or those reported for two samples of college students (mean age = 23.18 and 23.67 years) and a community sample (mean age = 25.0 years) by Cohen et al. (1983) in their validation study of the Perceived Stress questionnaire. Brunner (1997) also found a negative correlation between perceived stress and age and a positive correlation with BMI. That is, older participants reported lower levels of perceived stress and higher BMI scores were associated with more stress. In the present sample no relationship was found with age ($r = 0.01$) but a low significant positive correlation was obtained with BMI ($r = 0.27$; $P = 0.04$).

High levels of stress can be particularly problematic to health. Bjorntorp (1996, 1991) has postulated that psychosocial stress contributes to the accumulation of visceral fat and related metabolic abnormalities through chronic hypothalamic arousal. Subsequently, psychosocial stress and socioeconomic handicaps, with some differences in profile between the genders (Stewart-Knox, 2005) have been shown to contribute to complex neuroendocrine perturbations inducing visceral obesity and metabolic clustering (Bjorntorp, 1993; Bjorntorp & Rosmond, 1999). Negative emotions, hostility, social anxiety, and depression appear to be particularly detrimental to women's health in comparison to men and provide possible explanations for differences in underlying disease pathways (see Stewart-Knox, 2005 for a review).

Newman, O'Connor, and Conner (2007) examined the effects of daily hassles on eating behaviour and the role of cortisol reactivity status. They found that high cortisol reactors, but not low cortical reactors, displayed significantly higher snacking behaviour, suggesting that high cortisol reactivity to stress promotes overeating. Furthermore, they found that restraint, emotional, external eating, and disinhibition were associated with significantly higher snack intake in those with high cortisol reactivity. A more recent review by Brotman, Golden, and Wittstein (2009) confirmed that psychological stress elicits measurable changes in symphathetic/parasympathetic balance and the tone of the hypothalamic-pituitary-adrenal axis, which might negatively affect the cardiovascular system both acutely—by precipitating myocardial infarction, left ventricular dysfunction, or dysrhytmia, and chronically—by accelerating the atherosclerotic process. Indeed, 13 participants from this cohort volunteered to participate to investigate peak exercise cardiac output and reserve (Carroll, Marshall, Borkoles, Ingle, Barker, & Tan, 2007). It was found that in the absence of significant weight reduction, this cohort derived modest benefits in maximal cardiorespiratory capacity and cardiac functional reserve from a three-month exercise-based intervention. Therefore, there is a good reason why inter-disciplinary teams should be managing obesity treatments in the future. As to date, there is still very little known of how fitness attenuates the effects of psychological stress in obese individuals in physiological terms and therefore its contribution to reduction in health risks.

Furthermore, stress and emotional functioning has also been linked to increased eating (Greeno & Wing, 1994). As previously discussed in the literature, restrained individuals increase their eating while stressed, whereas people who don't have to manage their weight or restrain their eating are unaffected by stress (e.g. Herman & Polivy, 1975), and furthermore, women are more likely to eat under stress than men, particularly certain foods (Grunberg & Straub, 1992). Indeed, qualitative data supports these assumptions, as 78% of this cohort reported emotional eating. Table 6.1 (see below) provides a number of examples supporting the relationship between stress and eating.

Table 6.1: Quotes indicating the relationship between stress and food consumption.

Section 1.114, Para 339, AHa	'I must admit, I had a doughnut and a cookie on the other night. I go for counselling every Monday, and I find it really takes out of me that. Even though I feel alright when I come out of there, I know I've had to sit for an hour and talk.'
Section 1.30, Para 88, CH	'I don't know if that's an excuse or not. I'll eat when I get stressed, I eat when I'm bored. I do both.'
Section 1.24, Para 59, DG	'I know all the right things to do, it's just that, I don't know, when I have a lot of stress and pressure, that's when I want to eat. Greasy things and starchy, sugary things. I don't know why.'
Section 1.44, Para 121, EW	'Once I start getting down, that's when there is only… I can eat fruit, I can anything, but I have to have the sweet stuff.'
Section 1.26, Para 76, GM	'Thin people, they don't eat, do they? Not when they are upset. A lot of skinny people don't eat when they are upset.'
Section1.187, Para 465, HW	I think it's a real emotional crutch (food). If things go well I eat, if things go badly I eat. I love food, I am not the sort of person who doesn't care about food. I like to eat, don't like to cook and don't like to prepare. I like it there in front of me. Again it's that instant gratification. I like food.'
Section 1.30, Para 76, JH	'When I used to get down I just used to eat. I used to get down about my weight and the way I looked, my self-confidence dropped because I was feeling fed up and all I wanted to do was to eat, and mainly chocolate.'
Section 1.97, Para 288, JPi	'Treats become consolations you see, when you are trying to console yourself, reward yourself for having a bad day, so if you are getting a lot of bad days, or if you have perceptions of your day being a bad day, you go home, curl up in a ball on the settee, and eat consolation food. You feel good then, you feel comfortable, feel consoled. It's changing that. Do I want to keep feeling consoled and getting fatter, less healthy… and the reward being something that's more active?'
Section, 1.62, Para 148, JW	'I definitely have a problem with food because I do turn to it when I am unhappy. I've realised that recently more than ever, because really I don't like sweet things, I am not that bothered about them, but when I'm unhappy or feel stressed I always have them and I don't really enjoy them, just have them. It's definitely a psychological thing.'
Section1.158, Para 388, JW.	'My relationship with food is more of a psychological one. I know that I eat, 80% of the time, I am eating because I feel down rather than because I feel hungry.'

In fact, these emotional eating patterns are present in patients within all weight categories, including anorexics (starving in response to emotional states), binge eaters, and bulimics (Geliebter & Aversa, 2003). Additionally, both males and females have been shown to regulate their emotions by overeating in response to a stressful environmentally stimulus.

Negative affect is often associated with eating episodes labelled as 'binges', and has been associated with loss of control (Telch & Agras, 1995). The cited quotes below illustrate that individuals act on their feelings whether they are on a 'high' or 'low'. The strengths of such urges are unknown and their influence on obesity treatment engagement has not been previously studied. Future research should explore these prior to any weight management intervention, as these findings from the weight history interviews indicate that these individuals will always struggle with self-regulation of food intake, unless it is addressed prior to the intervention in a cohort without known eating disorders.

It is also unclear how fitness may affect these urges (e.g. strength and meaning of urges), when eating due to emotional states. Furthermore, the mechanisms of such behaviour are unclear. Thus far there is an agreement on the sequence of events in emotionally motivated eating, which starts off with a stimulus event, followed by an emotion, and then a behaviour (Deci, 1996). Deci (1996) gives a possible insight how a pre-intervention work on coping with emotions could be developed. He cited a theory of Arnold's (1960) who distinguished between intuitive appraisal and reflective judgement, with the latter being most cognitively effortful. Therefore, a pre-intervention intervention could explore stimulus that elicits emotions that drives subsequent eating behaviours. For example, some were called 'fat bitch', which is a common abuse word used against obese individuals and might cause immediate anger, upset, and hurt (intuitive appraisal). However, if someone interprets this as no reflection on themselves and don't take it personally (reflective judgement), the initial hurt may well be attenuated.

Deci (1996) further argues, that 'attending the whys of specific behaviours (i.e., the cognitive antecedents of the behaviours) provides the basis of predicting when there will be an aggressive (in this case overeating) versus non-aggressive (no overeating) responses to controllable negative events (e.g. name-calling), and when there will be helpful versus non-helpful responses to uncontrollable negative events (p. 222). However, a possible limitation of this assumption is the chronic effect of such abuse. One can deflect for so long, but at some point it must be overwhelming.

It also appears that 'emotional' eating is a substitute for closeness and emotional support. For example, a participant stated her reasons for emotional eating:

> 'Because I live alone, I think in a lot of respect that's what I miss. I think It's the being alone when you go home, that's quite hard sometimes' (Section 1.60, Para 177, CH).

Ganley (1989), in his review of emotion and eating in obesity, concludes that individual differences, qualities of different emotional states prior to overeating, should be systematically studied. In addition, he argued that secrecy (e.g. hiding food, eating in cars) and the episodic quality related to the overall level of stress need to be considered. Hence, a relatively trivial daily hassle of living may have a great effect on subsequent eating behaviours. One reason that obesity treatments might fail to work is due to a lack understanding of how patients' emotional self-regulatory styles impact on their ability to benefit from treatment programmes. In general there are high-quality obesity interventions (diet, drug, physical activity) available, yet there is still very little understanding of how individuals react to the challenges presented to them by various treatments, whilst having emotional eating problems. Indeed, there is now convincing evidence showing that poor self-regulators are less likely to cope well with the demands of a health behaviour change in a variety of domains (smoking, dental flossing, weight-management – Schwarzer, 2008). Recently, researchers looking at the role of self-regulation in health behaviour change have been calling for a pre-treatment intervention to redress this balance. Indeed Schuz, Sniehotta, and Schwarzer (2007), Cochrane (2008), and Schwarzer (2009 &2008) have argued for the introduction of a pre-treatment self-efficacy enhancing intervention for those who have poor health behaviour self-efficacy perceptions, indicating that these patients need to be helped differently. Palmeira et al. (2007) found that change in weight-management self-efficacy was the strongest predictor of weight loss. Similarly, Linde et al. (2006) showed that self-efficacy beliefs prospectively predicted weight control behaviour and weight change during active treatment, but not during follow-up. These researchers' findings show that poor self-regulators have less personal, interpersonal, and environmental resources to enable them to tackle life problems effectively and with ease. They seem to falter from the start. This diminished cognitive capacity (Deveney &Pizzagalli, 2008) for engagement is also relevant to patients in obesity treatment programmes.

One example of a dysfunctional self-regulation in this context is eating in response to negative or positive emotional states and in the absence of hunger (e.g. habitual or unscheduled eating). Boredom, loneliness, anxiety, stress, depression, feelings of helplessness and hopelessness, frustration, anger, impulsiveness, tiredness, family discord, being on a diet for a long time, frustration with work, and feeling sorry for oneself all have been shown to trigger episodes of overeating that eventually lead to substantial weight gain (Courbasson, Rizea, & Weiskopf, 2008). Indeed a large percentage (59%) of participants reported eating out of boredom or habit, as conveyed in the following quotes:

'I think if I had a different job, where I wasn't so bored I would be fine. Sometimes, I eat all day at work' (Section 1.82, Para 167, TB);

'Well I get bored, I'm not really bored, I don't think I am, but I must be because I just think I'll have something to eat. I'll just go and have something, then go and have something else, then I'm off again into the kitchen' (Section 1.134, Para 271, MV);

'When I go home and shut the door, if I am bored or whatever, that's when I just go mad' (Section 1.16, Para 35, NE);

'It's like you know you are not hungry, but it's like a habit. Sitting there watching TV, you must be eating something' (Section 1.38, Para 109, AG);

'I've not been one for bingeing. I can be eating and not know I am doing it' (Section 1.61, Para, 179, AG).

The essence of some of these narratives relates to use food to 'escape from self-awareness' (Heatherton & Baumeister, 1991). Furthermore, one could view overeating, as self-defeating, as the outcomes of such behaviours are associated with poor psychological and health status (which is supported by further evidence in subsequent paragraphs). One could ask then why is it that 'individuals favour short-term benefits despite long-term costs and risks, especially under the influence of aversive emotional states and high self-awareness'? (Baumeister, & Scher, 1988; p. 3). Baumeister and Scher (1988) concluded that 'normal people do harm themselves and defeat their projects by means of poor judgements, by maladaptive responses, through unforeseen consequences of non-optimal methods, and by disregarding costs and risks in favour of immediate pleasure or relief' (p. 3). However, they have not found clear evidence for intentional, deliberate self-destructiveness among normal (non-clinical individuals). For example, it is unclear whether those with moderate to morbid obesity would be classed as 'clinical' given their functional limitations, even if they are relatively healthy. Although to explore these phenomena is not the aim of this PhD, from the QUAL data it appears that moderate to morbidly obese women without known eating disorders, also have a tendency to develop aversive self-perceptions. In future research, it would be interesting to explore whether non-clinical obese populations suffer from unrealistically high expectations of themselves and of what other people expect of them.

Even without co-morbid behaviours or disorder, emotional eating is a clinically significant issue. The findings of this study based on the weight history interviews suggest that personal and interpersonal factors (e.g. low self-esteem, poor self-regulation) played a role in emotionally driven overeating participants (Canetti, Berry, & Elizur, 2009). Therefore, it can be said that the main cause of obesity in a large number of individuals might be psychologically determined, although Allison and Heska (1993) argue against such a position. According to them there is lack of empirical support for this, as most studies based their findings on self-reported data. They only see a weak association, not causal between obesity and emotional eating. They suggest that maybe dieting leads to emotional eating, for which there is considerable evidence (Herman & Polivy, 1975; Stroebe, 2008). They also argue that there are large individual differences between emotional eaters (e.g. personality, social, and cultural factors), therefore it is difficult to come to consensus on how emotional eating affects the development of obesity. Another point they make is: 'Exposure to treatment may produce self-reports of emotional eating among obese personal that are basically artifactual (acquiescence, demand characteristics)' (p. 293). Allison and Heska (1993) posit that exposure to treatment 'may engender the belief among obese persons that they eat emotionally, even when they do not' (p. 293). This certainly was not the experience in the current project. Indeed, individuals are prompted by questions to recall their experience of overeating (e.g. both weight history interviews and eating diaries in this PhD), but emotional eating specifically has never been mentioned as such to them. In the eating behaviour diaries they were asked to recall where, when, and what they were eating and their associated feelings (e.g. how did you feel before you decided to eat, and so on).

It has been suggested that obese individuals are not able to accurately record a report on their own mental processes, and that many obese individuals are poised to accept psychological interpretations for their condition (Nisbett & Wilson, 1977; Wooley & Garner, 1991). However, the experiences of the presented intervention study, supported by the QUAN and QUAL data, suggest that obese individuals fared worst psychologically than those without weight problems. The anecdotal and observational evidence gathered by the researcher also supports these findings. Participants were visibly upset during interviews, in class, and in various social circumstances when their conditions were mentioned or commented upon. What is needed is a systematic and vigorous examination of the role of emotional eating in the development and maintenance of obesity from an inter-disciplinary point of view, as failure to address emotional eating may lead to preventing patients of all weight status to achieve their goals in treatment programmes. In the case of the obese, failure to address emotional eating caused by dieting may further reduce their self-confidence in their ability to lose weight and maintain that weight loss over time (Byrne et al., 2003; Cogan & Ernsberger, 1999; NTFPTO, 2000; Venditti et al., 1996). Weight cycling has been shown to lead to an undesirable pattern of losing and gaining weight resulting in feelings of personal failure (Cogan & Ernsberger, 1999). This in turn may result in deteriorated physical health related to the psychological and physiological effects of weight cycling (Sjoberg & Persson, 1979).

There was a strong support for chronic dieting from the QUAN and QUAL findings, as 86% of the participants reported to be on a diet at baseline. Weight cycling was also highly prevalent with 92% of participants reporting a minimum of three to a maximum of nine dieting attempts per year preceding the intervention. In terms of participants' expectations of WHEEL, most plausibly derived from their dieting experience was startling. At the base line weight history interviews, before the start of the exercise intervention, participants were asking:

> 'So we are getting something so that we've got a book that we can look at and think, well, I should be eating that, and I should be eating this, right?' (Section, 1.1.78, Para 451, LM).

It was difficult for participants to understand that there would be no diet sheets or prescriptions of particular food items. They were told that there would be educational sessions on healthy eating behaviours within a three-week brief CBT therapy trying to address eating behaviours that might contribute to the maintenance of obesity (e.g. psychological and physiological effects of weight cycling; emotional and restrained eating; tendency for bulimic and binge eating in obesity). The aim of WHEEL was not to set up participants for dieting failures, as their previous experiences clearly have done:

> 'After the diet, you just felt defeated, a failure. Because you tried to do the diet, and at first I always lose weight really well. As soon as I go on a diet, I can lose, the most I've lost in a weight in one go was on appetite suppressant pills. But they restrict your eating as well, you could only eat on this inner rim of the plate, When I think of some of the things I've done! You had this plate and it had two rings of flowers on it, and you could only eat on the inner ring one day and the on the outer ring next day' (Section 1.22, Para 61, AG);

'I was about 20, I am going back a fair few years when I went first. I know when you are desperate to succeed, you believe. They still write me letters you know, still after all this time I get letters saying we have a new promotion on blah, blah, because they know we are always going to be fat. They know that we're never going to succeed, that's what they hope. The majority of her people must fail because you can't sustain it, it's not life-changing thing, you do it for so long, then you relapse. That's what it feels like, because you've tried to do whatever this diet has told you to do, but you can't. Then you've failed and you think, oh bugger it, and off you go. Then for a couple of weeks you binge, well maybe not binge, but you just don't bother about what you are eating. Because you've been so restricted. Then when you go on the scales not only have you put back what you've lost, but you're a couple of pounds more as well. Then you think, oooh!' (Section 1.26, Para 72, AG);

'I was put on a diet when I was 6, and I've been yo-yo dieting ever since' (Section 1.8, Para 24, AHa);

'I feel if I'm not getting up every day and counting points on Weightwatchers or counting sins, because as soon as I open my eyes, in the morning all I do is write down what I'm eating and what I can have, how much it's going to cost me, I can't cope. That's how I work constantly. I go round the supermarket and I even have a calculator from Weightwatchers and I'll stand working it out. Can I eat that? That's how bad I've got over the years. I think getting rid of that and just being able to eat something and know that it was healthy rather than having a count of everything would help. Because I put myself off, when I get to 24 points and then I think I want a packet of crisps or something. And I'll eat them, and it would only put me three points over, but because I have eaten them I think I might as well have a bar of chocolate and I might as well have a biscuit now, because I’ve had that bag of crisps. It’s getting over the feeling that if I have that bag of crisps, I’ve had it, then I can forget about it. I will have to not count, not allowing for it. It’s getting over that will be problematic long-term’ (Section 0, Para 60, JD).

Listening to the majority of participants recounting such experiences of being so obsessed by food and eating, buying expensive Weightwatcher’s food and measuring products (e.g. including the calculator!) is what health care professionals in weight management have to deal with on a daily basis. Individuals with such habitual dieting behaviours will respond poorly to both diet and exercise-based interventions, unless this is addressed pre-intervention, as they will be unable to overcome their obsessive thoughts easily, as well as any new dieting advice will be interfering with such habits. Weight loss through exercise alone will not satisfy such persons’ expectations. Other participants said:

‘The day before a new diet, you say, right, I am going to start a diet now. The day before you have to eat everything you won’t be able to have’ (Section 1.138, Para 337, LMc);

‘Have you seen Slimming World? It’s a really popular diet club. I know of it, but I think they are horrible. They make you do this food red or this is green. I used to do red all of the time, and never ate carbohydrates. I knew it was unhealthy. With the protein actually lost four stone. So it’s a bit of a fear in my mind, I know, if I eat lots of potato and pasta it makes me feel full but I also feel that it’s not helping my weight. Well they tell you to eat whatever you like, so as long as you don’t mix them. You can eat as much as you like, I ate like loads of meat, tuna or chicken or ham. Then when I did it on the carbohydrates I had piles of rice but the weight didn't come off. It would if I ate protein' (Section 1.140, Para 346, HW);

'I've done the FPlan Diet, the Fibre Diet, The 1000 calorie diet, all different ones. I know you know as you get older they are not going to do any good but you try them. Before I got married I lost three and half stone, then I put it all back on and then I lost it again, I've lost it about three or four times. I mean obviously you never maintain it. So gradually it gets more and more. Each time I've put weight on I've tended to put about an extra stone on' (Section 1.42, Para 86, SM).

These accounts provide powerful information of how dieting distorts normality in beliefs and behaviours. There is a large volume of narrative text from the QUAL phase that refers to commercial dieting experiences, but the discussion of such experiences is not the aim of this PhD. Nevertheless, these extracts illustrate the complexity of problems that are associated with weight management (Miller et al., 1997; Stroebe, 2008).

Interestingly, when participants talked about their 'weight cycling' experiences a typical opening would be 'I can always remember being overweight as a child' (Section 1.14, Para 36, GH); or 'Well I've always been big. I've never been slim, I was a biggish child' (Section 0, Para 186, JD). Therefore, the contribution of genetics should also be established pre-intervention (Stunkard et al., 1990; Institute of Medicine, 1995; Cummings et al., 2002) as it will take away blame from participants (Cogan & Ernsberger, 1999), as they are likely candidates for dropping out or for weight-loss-maintenance in such interventions.

56.5% of participants believed that their struggle with weight is genetically determined 'Most of what I am is inherited, it's sort of genetic' (Section, 1.70, Para 193, DL); 'My mother was bit so I just accepted well I am like my mum (Section, 1.14, Para 36); ‘You see we grew up with my mum being overweight, and well, everybody in the family was overweight. Grandma, aunties, even my other grandma, my dad’ (Section1.26, Para 7, GM). ‘You look at my mum, you look at my mum’s family and they’ve all got the same problem. My mum is not as big as me now, but they’ve all got weight problems. It’s something they’ve all got to maintain, so it’s not just me. I’m not the only one with it. It’s running through the family (Section 1.157, Para 319, SM). Furthermore, Del Parigi, Chen, Salbe, Reiman, and Tataranni (2003) asked the question: are we addicted to food? They postulated that it may well be that human obesity is predominantly an addictive disorder, characterised by compulsive eating.

It will be important to determine prior to treatment how a person copes with overeating for any reason (e.g. emotional) or a lapse in their diet or treatment because it will influence their ability to maintain that weight loss, as they will start to revert back to old behaviours (Brownell, Marlatt, Lischtenstein, & Wilson, 1986; Fitzgibbon & Kirschenbaum, 1990; Freeman & Gil, 2004; Van Strien, 1997). Indeed, obese individuals have been shown to use mainly emotion-focused and avoidance coping strategies, meaning that they are more likely to deploy wishful thinking, venting emotions, denial, blocking and disengagement, which are examples of ineffective coping strategies (Bittinger & Smith, 2003; Paxton & Diggens, 1997; Spoor, Bekker, Van Strien, & van Heck, 2007). Therefore, the aim of these pre-treatment interventions could be to enhance the individual’s coping repertoire, including the development of problem-focused coping strategies which emphasise effective planning and increased effort towards one’s goal in order to eliminate the source of stress. Dieters who have used a number of coping strategies like distraction (performing an alternative behaviour at the time of stress rather than overeating), thinking positively about their efforts and goals achieved were able to overcome unplanned eating in stressful situations.

In summary, one can learn more effective self-regulatory behaviours by attribution training (locus of control); increasing the repertoire of coping strategies to tackle negative emotional states; and addressing treatment-related skill learning (self-efficacy) expectations. This suggests the need for more inter-disciplinary (not just multi-disciplinary) approach to tackle the alarming rise of obesity rates in the UK. Therefore, treatment commissioners should fund more complex obesity-treatment programmes that are addressing the needs of poor self-regulators before recruitment of them to any obesity-treatment programmes.

6.2.2. Socio-economic status

Demographics of this PhD cohort portray an interesting picture, reflecting what the literature review established (Flegal et al., 2002; Foresight, 2007; Wardle et al., 2002). Most women recruited for this study were from the lower SES background, only 21% had a degree and more than half of the cohort (57%) left school at 16. Most participants worked full time (66.1%), and 11% worked part-time, in mainly manual (29%) and administrative jobs (46.8%). Similarly, in their longitudinal study, Gortamaker et al. (1993) found that overweight women completed fewer years at school, were less likely to be married and had a lower socioeconomic status in comparison to average size and chronically ill cohorts. Furthermore, James, Nelson, Ralph, and Leather (1997) argued that a poorer health of people in the lower socio-economic groups in the UK is not well established, but its origins are complex. However, the higher obesity rates might be an important moderating factor. Additionally, Power, Graham, Due, Hallqvist, Joung, Kuh, and Lynch (2005) found that socio-economic status was an important influence on smoking behaviour and obesity. Factors related to disadvantaged social backgrounds reduced the probability of smoking cessation, increased the probability of risk of obesity in adulthood, particularly in women. The fact that the research-based intervention was ‘free’ was frequently mentioned during recruitment. Participants enquired about parking costs, and various venues, as costs of coming to any sessions were important to them. However, these seem to be factors which are not taken into consideration in many obesity interventions.

6.2.3. Health status at baseline

About half (54%) of participants reported good or excellent health status. One stated:

> ‘Even though I am fat and I am big, I don’t think I’m out of condition. A lot of people think because you are fat, you are not healthy. But I have no problems with anything, no’ (Section 1.280, Para 718, LM).

The main complaint was lack of energy due to inactivity:

> ‘I’ll probably find it hard (to do the exercises) because I am not used to physical activity and in all honesty, when I go home from work I like to stay home, be in for the evening, especially in the winter, so it will be novel to have to go out again’ (Section 1.35, Para 275, GH);

> ‘I am tired, I get headaches, I can’t motivate myself to do things. I’m sure it’s because I’m overweight, because it can’t be anything else. The doctor was treating me for depression and I said I’ve no reason to be depressed’ (Section 1.117, Para 319, LMc);

> ‘I get tired now, and I never used to do. Just carrying the baby upstairs as she is getting bigger. I get to the top of the steps and I’m breathless. I was never like that before. But as far as health, I think everything is okay’ (Section 1.60, Para 125, SG).

The heavier participants also complained of knee and back pains:

> ‘I am aware that I have knee pain. I haven’t told my doctor about it, I get knee pain and they creak when I bend down. I think my back is worse when I’m heavier, which I understand’ (Section 1.49, Para 132, DS);

> ‘I find that I have problems, like bending down to tie my shoe laces. I find that I cannot do things like I used to be able to do them. I get out of breath. Just the weight that I’ve put on, and my clothes and things like that’ (Section 1.28, Para 83, EW).

Although there were such health issues reported, all participants were declared fit to start the WHEEL programme by their GPs. However, a number of the baseline physiological, metabolic and anthropometric variables showed that the sample was not in great health. In particular, participants’ fitness level was below the 10% percentile for women, systolic and diastolic blood pressure were higher than normal, and triglycerides levels and total cholesterol were borderline high (ACSM, 2000) for the sample as a whole (see also chapter 6.2.4 below).

6.2.4. Physiological and metabolic outcomes: Metabolic syndrome

Due to the poor psychological (see 6.2.5) and metabolic/physiological profile of the participants enrolled to the WHEEL study, the possibility was explored that participants might suffer from the metabolic syndrome (MetS). The metabolic syndrome (previously referred to as Syndrome X, and the Insulin Resistance Syndrome), as described in chapter 3.7, has emerged as an important clustering of risk factors for Type 2 diabetes, cardiovascular disease and their complications (Eckel et al., 2005).

Of the originally recruited 62 participants, 31 met the International Diabetes Federation (IDF) metabolic syndrome criteria (detailed below). Of the IDF MetS participants, 17 were assigned to the initial intervention group and 14 in the delayed start control group.

According to the worldwide definition by IDF (Alberti et al., 2005), participants can be classified as suffering from MetS if they have the following constellation of metabolic risk factors:

- Central obesity: waist circumference ≥ 80.0 cm for Europid women.

Plus any two of the following four components:

- Raised triglyceride level: ≥ 1.7 mmol/l OR treatment for this abnormality.
- Reduced HDL cholesterol: < 1.29 mmol/l OR treatment for this abnormality.
- Raised blood pressure: systolic BP ≥ 130 or diastolic BP≥ 85 mmHg OR antihypertensive medication.
- Raised fasting plasma glucose (≥ 5.6 mmol/l) – The IDF MetS definition is inclusive of participants with or previously diagnosed Type 2 diabetes. However, Type 2 diabetics were excluded from the present study.

Table 6.2: Baseline anthropometric and metabolic characteristics among all MetS participants (n = 31) and those randomised to IIG (n = 17) and DSCG (n = 14).

Variable	**All MetS** n (%)	**IIG** n (%)	**DSCG** n (%)
Waist Circumference > 80.0cm	31 (100)	17 (100)	14 (100)
Blood Pressure > 130/85, mmHg	29 (93.5)	16 (94.1)	13 (92.9)
HDL-cholesterol < 1.29 mmol·l^{-1}	23 (74.2)	15 (88.2)	8 (57.1)
Triglycerides > 1.69 mmol·l^{-1}	17 (54.8)	7 (41.2)	10 (71.4)
Fasting glucose > 5.6 mmol·l^{-1}	12 (38.7)	7 (41.2)	5 (35.7)
IDF additional MetS components			
2 components	15 (48.4)	6 (35.3)	9 (64.3)
3 components	14 (45.2)	11 (64.7)	3 (21.4)
4 components	2 (6.5)	0	2 (14.3)
IDF MetS components, Mean (SD)	2.58 (0.62)	2.64 (0.49)	2.50 (0.76)

6.2.5. Psychological health at baseline

The relationship between obesity (BMI) and psychopathology is well documented (Wardle & Cooke, 2005). At baseline, nearly half (42%) of participants reported to have depression often or very often, and 36% of all participants were on medication related to psychological ill health. Furthermore, the comparison of the psychological baseline scores of the participants recruited to the WHEEL study with relevant scores reported in the literature indicates a poor baseline psychological profile. Participants experiencing high levels of perceived stress, low levels of general well-being (*GWB schedule*), poor self-perceptions (*SPP*), low autonomy and high impersonal orientation (*GCOS*). For example, one of the participants on anti-depressants said:

> ‘If my husband’s at home, I drag him around the shops, spending money that I have not got. If he is not at home I just do nothing. I’ll go and sit and play cards on the computer’ (Section 1.23, Para 50, LP).

Whilst two are participants commented:

> ‘I just don’t want to do anything, just want to sit there. Which is why I wanted to be in a house on my own’ (Section 1.222, Para 449, MV).

> ‘I know I have very low self-esteem. I’m always told that I have very low self-esteem and I know that’s true’ (Section, 1.60, Para 174, GT).

However, none of the participants’ psychological states prevented them from participating in WHEEL.

It should be mentioned that not all comparisons made were with female-only samples of similar age range. In addition, some of the comparisons were with obese populations whereas others were with normal weight populations. For example, Becker et al. (2001) in a cross-sectional study of 2064 young women (18-25 years) found that obese women (BMI > 30) had the highest rate of mental disorders (assessed by means of a diagnostic structured interview). Other cross-sectional studies have also shown relationships between depression and obesity in men (Rosmond et al., 1996) and adolescents (Pine, Cohen, Brook, & Coplan, 1997) and self-esteem and obesity in obese women (Hill & Williams, 1998). In particular, the obese women in this study exhibited 2 x higher rates of anxiety disorder and somatoform disorders than the normal weight women (BMI > 19 < 30). In addition, there were marked differences in affective disorder, and disorders of childhood with the obese women exhibiting a higher prevalence. The results of the present study appear to support the above findings and suggest that obesity is associated with lower levels of psychological functioning and psychopathology.

Cross-sectional and RCT studies investigating aspects of psychological functioning associated with obesity have often been limited in their use of assessment tools. Typically, psychological constructs measured include depression, global trait self-esteem, and body image disturbance (e.g., Rosen, Orosan & Reiter, 1995; Teixeira et al., 2005 & 2002). Previous intervention weight loss studies have also evaluated psychological measures specific to weight control, such as dietary restraint, disinhibition, hunger, and body dissatisfaction (e.g., Klem et al., 1998), in conjunction with measures of psychological distress (Wadden et al., 1997). The present study differed from previous studies in its choice of some psychological instruments used. However, there was good theoretical underpinning to do this (see also method section).

6.2.6. Self-regulation

Self-regulation is key to initiation, maintenance, and regulation of behaviour (Ryan & Deci, 2002). The findings obtained for the general causality orientation of participants (*GCOS)* indicates that at the start of the study participants scored relatively low in autonomy but high in impersonal motivational orientation. The autonomy scale assesses the extent to which a person is oriented toward aspects of the environment that stimulate intrinsic motivation, are optimally challenging, and provide informational feedback. Lower scores indicate that participants have poorer levels of autonomy. Also, lower scores are associated with lower levels of self-esteem, ego-development, and self-actualisation (Deci & Ryan, 1985b). Participants who scored high on autonomy made statements like:

> 'I know it's my own fault (e.g. being big), and I know there's only me that can do something about it. It doesn't matter what anybody says or does, it's just the person in here' (Section, 1.123, Para 252, SK).

The impersonal scale assesses the extent to which a person believes that attaining desired outcomes is beyond their control and that achievement is largely a matter of luck or fate. Higher scores indicate that participants believe that behaviours are outside their control and have been associated with higher levels of social anxiety, depression, and self-derogation (Deci & Ryan, 1985b). An example of such thinking is reflected in the following narratives:

> 'I think food controls me more than I control food' (Section 1.128, Para 375, AG);

> 'I think the reason I put weight on is because I'd been jilted, as well as I had this awful car crash and I was thrown out of college' (Section 1.201, Para, 449, LMc);

> 'I've just resigned myself not to do anything about it (weight). I thought I was messing about my body too much' (Section, 1.2, Para 33, AG);

> 'I have no will power. I know you want me to do it for me, which I am, but I am putting it on somebody else to make me do it. Do you know what I mean, because I can't do it for myself, I won't do it for myself. So if I can put it on somebody

else, not that I am making you think that I am doing it for you, sort of thing, but if I know I will be helping you out, then I'll do it' (Section 1.72, Para 145, MV).

The previous quote clearly illustrates that these women will struggle with owning their behaviours and taking responsibility for their actions. Indeed, the higher impersonal score for the participants in the present study was also accompanied by higher scores for the 'Internal' (the higher the score the more external the belief in locus of control) and 'Chance' subscales of the *MHLC*. In addition, they were less likely to consult significant others to help with their health issues as indicated by the lower score for the 'Powerful Others' scale. The latter finding is supported by the notion that obese people are less likely to seek medical support for health problems (Puhl & Brownell, 2001).

'Controlled orientation' refers to how a person likes being told what to do and follow orders as such. The behaviour is regulated by punishment (remaining fat) or reward (losing weight – Ryan & Deci, 2006). A typical narrative illustrating this point is from LW:

> 'I think the problem is, though, when somebody has go to the point where we are, and the desperation that we've got to, and we've tried it on our own and not managed, I know from my point of view, I want somebody to say right, I am asking you to do this, if you do exactly what I say in this length of time, this is going to solve the problem and to take the responsibility off me. I say right, I stick to that' (Section 1.20, Para 41, LW).

This quote clearly illustrates that this woman was likely to struggle in WHEEL, as the programme's aim was to help participants to find their preferred way of managing their weight. WHEEL was never a descriptive initiative, but required full participation and exploration on the participants' behalf. In line with SDT principles, WHEEL provided a structure for self-development and opportunity for learning through participation in a psycho-educational and exercise-based programme.

6.2.7. General well-being and quality of life at baseline

To date, only a limited number of studies focusing on psychological consequences of lifestyle and/or weight loss interventions have included a measure of health-related quality of life, despite its increasing use in other health domains and its acceptance as an important outcome measure in clinical trials (Sloan et al., 2003). This anomaly was highlighted in a paper by Sullivan, Karlsson, Sjostrom, and Taft (2001) who argued that health-related quality of life measures should also be used as outcome measures examining the overall psychological state of obese individuals. Therefore, this PhD work adopted this measure. The *GWB* schedule is a reliable indicator of subjective feelings of psychological well-being and distress which has been used previously in studies with obese individuals (Miller & Harrington, 1997).

The participants in the present study scored significantly lower on the total score of the *GWB* schedule than previously reported for overweight women in the RENO Diet-Heart Study (Miller & Harrington, 1997; Foreyt et al., 1995b) or for females between 16-44 years old in a validation study of the *GWB* schedule in a primary care setting (Hopton, Hunt, Shiels & Smith, 1995). However, scores for the subscales of the *GWB* were similar to those reported for 35 moderately obese, premenopausal women in an exercise intervention study by Cramer et al. (1991) or 91 slightly older (mean age 45.6 ± 1.1 years) obese women (BMI 33.1 ± 0.6 kg/m^2) in a study by Nieman, Custer, Butterworth, Utter, and Henson (2000). Participants in both studies scored higher on the ‘cheerful vs. depressed mood’ and ‘freedom from health concern’ scales but significantly lower on the ‘satisfying and interesting life’ scale. In the study by Nieman et al. (2000) a comparison was made with a sample of non-obese participants. This showed that the obese women scored significantly lower on each subscale except the ‘relaxed vs. tense or anxious’ factor. This would suggest that the data obtained at baseline for the current sample is comparable with that previously obtained for obese women. In addition, obesity appears to be associated with lower perceptions of general well-being than people in the general population. The QUAL data confirmed that participants’ quality of life seemed to be declining with weight gain, as one participant stated:

> ‘This year is the first year I can’t kneel down anymore. I can’t kneel down, there is too much weight being put on my knees if I try to kneel down. I used to get up and clean my windows, I can’t do that now. I am finding more and more things I can’t do any more. I haven’t moved and I am worn out’ (Section, 1.49, Para 145, JB).

This narrative implies also a reduction in habitual PA, as the person is forced to become more inactive through weight status. Other women’s social life was greatly affected by their weight:

> ‘I don’t go out very often at all. When I do go out, it tends to be to quiet places where there are maybe not a lot of people … Yes it (weight) affects the type of places that I go to. And I also stick to the close group of friends that I have rather than making new ones’ (Section 1.42, Para 106, JH);

> ‘It (weight) does stop me doing things. I can’t dance, and I love dancing. So if we go out and there is dancing there, I don’t dance much. Because my knees would hurt. So I might have one or two dances and then sit down when really I would like to be on the dance floor all night’ (Section 1.132, Para 269, LS).

It appears that women with weight problems change their life course and put ‘things’ on hold until they suddenly are slim, as the majority of participants alluded to the fact the weight stops them living the life they would like to live. This notion is clearly expressed in the following quote:

> ‘I’ve always said that life would start once I was slim, as though I didn’t have a life as I was fat’ (Section 1.128, Para, 262, TB).

Thus far, findings at baseline from both the QUAN and QUAL phases of this PhD research confirmed the profound effect of weight on participants’ daily life. In fact, this is reflected in the number of participants being classified as in ‘severe distress’ or ‘moderate distress’ in terms of general psychological well-being in this cohort, as their scores were very different from previously reported disturbance for overweight/obese women (Miller & Harrington, 1997). The present study found 81.8% of women being in distress whereas in the Miller and Harrington (1997) study only 33% of the participants were reported to be in the two distress categories. This may have been due to the fact the participants’ mean BMIs were in the moderate and severe categories, which are associated with accentuated effects on psychological and physical functioning.

6.2.8. Self-perceptions at baseline

The increased emphasis and value of thinness in women in western societies (Spitzer, Henderson & Zivian, 1999) has been one of the factors which has resulted in more and more women feeling dissatisfied with their body weight as well as their body image (Forbes, Adams-Curtis, Jobe, White, Revak, Zivcic-Becirevic & Pokrajac-Bullian, 2005; Schwartz & Brownell, 2004). This dissatisfaction is particularly prevalent in women because they perceive their bodies as being on display rather than men who see their body in terms of its functionality (Halliwell & Dittmar, 2003). Body dissatisfaction and image concerns are important issues because they have also been associated with psychological dysfunction (low self-esteem, depression, distorted eating, social anxiety, impaired sexual functioning), which in turn can result in medical problems (Smolak, Levine & Striegal-Moore, 1996; Silverstein & Perlik, 1995; Friedman & Brownell, 1995; Jarry & Berardi, 2004; Meekums, 2005).

Faced with such negative public opinion and difficulty to conform to standards of beauty in terms of weight and body shape it is not surprising that obese individuals have been found to have a distorted or poor self-concept and high levels of body dissatisfaction (Myers & Rosen, 1999; Harris, Waschull & Walters, 1990; Annis, Cash & Hrabosky, 2004). Annis et al., (2004) found that the greatest difference between those who have never been overweight and those who have been is significantly poorer quality of life and the negative body image for the latter group. Unfortunately, most weight-management programmes do not systematically evaluate or address body dissatisfaction (Rosen, Orosan, & Reiter, 1995). Annis et al., (2004) suggested that body image disparagement should be measured in weight-management programmes as it may help reduce maladaptive weight pre-occupation if weight were lost or regained, which is in line with both the non-dieting and HAES approaches' philosophical under-pinning (Bacon et al., 2005; Ciliska, 1990; Miller, 2001). On the other hand, it has been suggested that some degree of body dissatisfaction can be beneficial. That is, it could motivate participation in health behaviours (Heinberg, Thompson, & Matzon, 2001). There is some evidence from the weight history interviews, that putting weight on is motivating:

> 'I know when I would put on a bit of weight, when I would have gone up to a size 14, and when I went up to size 16, I thought that I was horrendously fat. I was horrified, oh Dear, I have to do something about this' (Section, 1.52, Para 115, LW).

On the contrary, Schwartz and Brownell (2004) argued that 'one potentially dangerous conclusion that could be drawn from the idea that even some body image distress is beneficial that societal discrimination and stigma is justified because they may help motivate people to change' (p. 53).

The distress regarding their bodies is clearly illustrated in the following quotes:

> 'It's like simple pleasures, even a bit of pain in the feet has become a simple pleasure, because I know there is a reason for that pain and it makes me normal and I really wanted to be normal … I said to you that time, when I got quite upset, I said I dreamed about just being average, just being normal. And just having aching feet because you've walked around town all day, whatever. It's just a normal thing to do but it actually gives me pleasure' (Section 1.50, Para 132, JB).

It appears that the majority of women in the cohort wanted to be normal, not actually knowing what normal is. There was a desire for them to be invisible, and able to do what 'normal' people do, such as buying clothes:

> 'To be able to go in any shop and say, like that, and that, and buy. You see now I have to buy whatever is that fits me. And it's always tent size dresses' (Section 1.27, Para 56, PF).

Another woman felt she needed to hide her body from her husband:

> 'I mean it's alright to say communicate to him, but I am a bit embarrassed by it (fat) even though he is my husband and he knows me really well. I don't particularly like the thought of being so open and thrusting it into his face, that I've got this problem of being a fat person. I know he knows it's there, but I feel it's a bit of an open wound, rightly or wrongly, particularly not to thrust it in his face' (Section, 1.17, Para 50, JB).

Another person said she was frightened of her own body:

'I think I'm frightened of my body in a sense. I've got to gain my confidence with my body' (Section 1.4, Para 12, DS).

Participants also compared themselves to others in terms of 'fatness' at the orientation meeting:

'When I saw people that were slimmer than me, then I didn't realise that there were people that were fatter than me. I wasn't comparing myself to other people, but I didn't realise that there were people fatter than me. It made me realise that I had a much bigger body image than I actually had' (Section, 1.197, Para 440, LMc);

'You know when we were all in that room on the first day, seeing other people that are as big as well, thinking oh I'm not the only one. There are some big people around' (Section, 1.60, Para 122, SM).

A woman just met a person she liked at the start of the WHEEL programme stated:

'I actually said to him I'll give you a ring in three months (end of intervention). I was like half joking, but serious as well. And I thought that's awful, that's like saying to him, well you know you are not good enough for me now (projection: she probably meant, she was not good enough for him), but in three months time I'll be interested. But that's because, and I said this to him as well, I can't give myself how I would want to be. Like I'd be self-conscious about my body, about lumps and bumps and everything. When I go to the car and shut the garage and he is behind me I think, God, he's seen my backside. He is not getting the REAL Me, how I would want to be' (Section, 1.56, Para 118, NE).

These narratives reflect a 'life that is on hold' until I get rid of the 'outside' as the 'real me' is not this, or lives in this body. These are just some of the typical essence of how the women in this cohort spoke about their bodies, such as, 'I am just fat all over. Fat arms, fat legs' (Section 1.25, Para, 65, GH). Furthermore, being in hot climate and away on holiday also made individuals more aware of their exposed bodies:

> I didn't feel that big. I just looked huge, you know, really big. I mean I was shattered anyway, and you don't look very good when you're in T shirt and it's all clinging to you and you are sweaty. But I was just ashamed by the way I looked and couldn't believe it' (Section 1.48, Para 97, SK);

> 'What I really get upset about is, if when we go back to Scarborough on holiday, we always meet some people we know, and I feel really embarrassed. I mean they talk to me normally and everything like that, but I feel embarrassed that when they last saw me I was about six or seven stone lighter than I am now. They must think oh goodness, she has changed, she has piled the weight on' (Section 1.187, Para 268, PH).

There is considerable evidence from the narrative interviews that body image perceptions in particular acts as one of the barriers to activity, as illustrated in the following quote:

> 'We still go on holiday and I go around the pool and everything. I am fine. But I think when you're abroad, it's different. You do feel a bit conscious but not as much as you would here. I wouldn't go down to our local swimming baths, because I know too many people down there. So yes, it stops me doing a lot like that' (Section 1.50, Para 102, SM).

The close relationship between self-esteem, health, and well-being (Wardle & Cooke, 2005) has been examined in a plethora of studies. However, most studies have used a uni-dimensional measure of self-esteem with a lack of measurement specificity, this despite the notion that the self-concept is hierarchical and multi-dimensional in nature (Shavelson, Hubner & Stonton, 1976). Additionally, there is good theoretical and conceptual evidence to suggest that self-esteem is not an enduring and stable construct (Heatherton & Polivy, 1991). This PhD study measured both state and trait self-esteem in order to address the evident deficit in the current literature. The values reported at baseline for each subscale of the Harter's Self-Perception Profile (*SPP)* were substantially lower than those reported by Messer and Harter (1986) for a sample of female homemakers (in particular the mean score for appearance, athletic and global self-worth). Similarly, the scores for state self-esteem were also lower than those previously reported in the literature both for obese females (Sbrocco, Nedegaard, Stone & Lewis, 1999) and undergraduate students (Heatherton & Polivy, 1991). A possible explanation for the low scores might be the previously mentioned obesity stigmatisation. Myers and Rosen (1999), for example, showed that exposure to stigmatisation was negatively associated with self-esteem. However, this would need further investigation.

The results of the present study also provide more detailed information on the relationship between self-esteem and obesity. Previous studies (e.g., Institute of Medicine, 1995; Teixeira et al., 2002) have mainly found that obesity is associated with lower levels of global self-esteem. However, it appears that many dimensions of the self are being affected, such as opting out from using essential skills such as driving: 'I don't drive anymore. I don't do it' (Section, 1.127, Para 268, LP) as she was too big to fit into the driving seat. 'Weight stops me to exercise on my own. It stops me going to the gym, stops me going swimming on my own. I am embarrassed to get changed in front of people that I didn't really know or whatever' (Section, 1.47, Para 132, CS). Another participant said: 'Weight stops me doing things. I find it difficult to get in and out of the car. I think it weighs me down. It doesn't make me feel full of life somehow. It makes me feel lazy. It's a bit like I can't be bothered to do things, part of me thinks that because you are carrying this weight around, that's it's more strenuous to do things, do you know what I mean?' (Section, 1.51. Para 137, DS). Currently, little information is available as to how interventions would improve these different dimensions of the self.

6.2.9. Participants' goal expectations in WHEEL

As discussed in the literature (Foster et al., 2005) one of the greatest challenges for healthcare practitioners is to address participants' or patients' actual and expected weight losses. Personal goals and expectations of WHEEL have been explored both in a QUAN and QUAL phases of this PhD. During the weight history interviews, personal goals and expectations for WHEEL were queried to check and discuss unrealistic expectations, but the nature of goals and attributions related to goals were not recorded or analysed. From the QUAN questions, this PhD cohort's 'ideal' weight loss expectations were found to be much higher (35%), than the previously reported 30% (Foster, Wadden, Vogt, & Brewer, 1997; O'Neil et al., 2000; Foster et al, 2000). Professionally, a 10% weight loss is accepted as a successful treatment outcome (Foster et al, 2005).

In this study, there was a significant correlation between higher levels of self-reported stress and higher desired weight loss score ($r = 0.33$; $P = 0.01$), indicating that those who experienced higher stress desired to lose the most weight. Interestingly, this was not the case for realistic weight loss expectations ($r = 0.07$; $P = 0.62$). Furthermore, realistic weight loss expectations were significantly correlated with internal locus of control ($r = 0.27$; $P = 0.05$), indicating that those who have higher internal locus of control expect to lose more weight during the study. Others with more realistic weight expectations said the following:

> 'I would like to achieve something from it (being in the programme) for myself. More down the lines of being able to prove to other people that you don't need to

> do these silly dieting antics. You just need to be a bit more active, doing what you do' (Section 1.96, Para, 193, SS).

Others stated: 'To get some weight off, to tone myself up a bit and give myself a bit more confidence. Give myself a pat on the back and say yes, you see, you've done it. It only needs to be a couple of pounds (weight loss), but I have done it' (Section 1.132, Para 266, SSi); 'My immediate goal is to try to get my life turned around so that I can exercise' (Section, 1.105, Para, 223, ST); 'I want to be able to run about with her (daughter) more. Play with her more, do things, more things' (Section 1.82, Para 167, VM).

Interestingly, there was also a significant positive correlation between the locus of control's doctors' subscale and realistic weight loss expectations ($r = 0.35$; $P = 0.01$), indicating that participants expected to lose more weight in a 'supervised' and 'monitored' programme, approved by their doctors. Therefore, yet again this finding indicates that a behavioural pre-intervention programme which should precede a practical one (e.g. calorie restriction and/or exercise) could readdress these issues. The WHEEL programme did attempt to do that, by making clear that weight loss was not the aim of this intervention and it was expected only as a secondary outcome to exercise behaviour change. Participants were also told that WHEEL was about healthy eating and activity behaviours (e.g. you can be healthier at any weight). In fact participants were told that they might gain weight initially, as a ceasing a dieting behaviour may result in initial weight gain as participants allow themselves not to feel guilty about consuming 'bad' food. Despite such warnings and discussions at the orientation, participants did not want to 'hear' this:

> 'I heard, in that talk last week, that some people might actually put weight on. I don't want that to happen if I can help it' (Section 1.148, Para 302, TB).

Another said:

> ‘I am hoping I won’t put weight on with it. Because I heard people mention that you could put weight on (with exercise and non-dieting) and if I stop the diet that I have been doing for the last two years, I’m worried that I’m going to pile the weight on’ (Section 1.146, Para 298, TS).

Both of these women expressed great fear of putting weight on and their narratives indicate that it would be difficult for them to change their eating behaviours through participation in a three-week brief CBT. Other participants were really focused on weight loss, as it was a pre-condition for a weight loss surgery they were waiting for:

> Well, in all honesty, I’ve got my name on the waiting list for a lap band operation. Because obviously at this size I’m getting to the point where it will affect my health’ (Section 1.24, Para 49, TS).

WHEEL specifically had a focus on non-weight related outcomes, such as improvements in metabolic markers, serum lipids, blood pressure, and glycemic index (See Carroll et al., 2007a; Carroll, Borkoles, & Polman, 2007b). One participant said:

> ‘My goal for WHEEL is health and appearance. I’ve gradually put weight on over the years, and if I continue, when I am 50 or 60 I’m going to be two stone more than I am now and that’s not good for anybody’ (Section, 1.37, Para 99, GH).

Participants were also prompted to look out for small changes during the programme such as increased energy, flexibility in movement, ability to walk more. Educational sessions addressed individual differences in ability to lose weight in response to a psycho-educational and exercise-based programme, as per Foster et al., (2005), and participants were told that: ‘not everyone who eats the same and exercise the same weighs the same’ (p. S234), therefore there is no point in comparing their individual weight losses to others in the class. Biological boundaries, such as genetics, and plateaus were discussed in these sessions, educating patients about weight loss expectations. For example, they were asked to reflect back on how long it took them to gain that weight, and therefore how realistic it was to expect that to disappear with exercise in three months to a year. Participants were asked to focus on health improvements and behaviour changes to avoid feelings of failure which accompany the cultural myth that 'you can weigh whatever you want' (p. S234).

However, this study found no association between lack of realism in weight loss goals and adherence and dieting status, as logistic regression analyses showed that desired or realistic weight loss expectations did not predict adherence (Cox & Snell: $R^2 = 0.01$) or dieting status (Cox & Snell: $R^2 = 0.02$). These findings are similar to Linde et al. (2004), who examined cross-sectional correlates of current, goal, and dream weight and their associations with weight loss in treatment. They concluded that lack of realism in the weight loss goal is not important enough to justify counselling people to accept lower weight loss goals when trying to lose weight, based on lack of significant correlations between psychological factors and weight goal expectations.

Although there were no significant correlations found between ideal weight and psychological health, the baseline severe and moderate distress scores for this cohort were significantly higher (62%; 20%) than the RENO heart study's (14%; 19%) respectively. Therefore, on the contrary to Linde et al.'s (2004) suggestions, the findings of this PhD would warrant a pre-intervention phase to address this and many other discussed thus far. Lack of effect of weight goal expectations on psychological states following the RCT phase were probably due to positive experiences during the interventions. Therefore, future research should look at how weight goal expectations affected behaviours and motivation in self-administered, either at home or over the internet or just an educational print-based intervention.

It has been long established that many women desire an unrealistic body shape (Fallon & Rozin, 1985; Tiggeman & Pennington, 1990; Cash, Morrow, Hrabovsky, & Perry, 2004). In agreement with Fallon and Rozin findings (1985) this study also found that women rated their ideal body shape significantly thinner than their current self-assessed body shape (t_{56}=18.90; $p < .001$). The mean of the current shape was 6.07 (±1.03) whereas the mean for the ideal shape was 3.74 (±0.96). These findings confirm the extent to which body dissatisfaction is present in this cohort. This was supported by the narratives:

> 'He likes me (husband). He wants me to lose weight for health reasons, but he is happy with me as I am. But I'm not. I hate myself. I sort of avoid shop windows, or if you go into shops and catch a glimpse of yourself as you go past, oh God, I do, I hate myself' (Section 1.56, Para 164, GT).

Another self-description also illustrates this point:

> 'I am really overweight, I am just like a blob and I've always been. I've no idea what being slim feels like, except it did occur to me when I went swimming on the other day, I came out of the water and felt as though I was carrying somebody else. My arms felt so heavy and I remember thinking, I bet that feeling in the water that light feeling is what being thin feels like' (Section 1.1, Para 3, JB).

Taken together, it is important to understand how low self-evaluations, weight loss expectations, and cultural context may or may not motivate participants to engage with an exercise-based weight-management programme. Further research needs to establish whether unrealistic weight loss goals aid or undermine participants' satisfaction and long-term outcomes—furthermore, how low weight loss expectations (e.g. only 10% or no weight loss at all) influence the above. The exploration of this PhD cohort's previous weight history and the integration of the demographic and psychological data at baseline confir ms Byrne et al.'s (2003) findings, in that psychological and behavioural factors present in this cohort are associated with unsuccessful weight-regainers. For example, participants in the past failed to achieve unrealistic weight goals, and when they did by VLCDs, they soon regained that lost weight and more. Furthermore, they tended to see themselves and their self-worth in terms of their body shape and weight. They also exhibited an all or nothing (dichotomous) thinking style, and the tendency to use eating to regulate their mood, the implications of which should be studied in prospective study.

6.2.10. Participants' PA/exercise behaviour at baseline

In this PhD, it was decided to use 'fitness' as a measure of health, rather than using any self-reported physical activity measure, which have generally very poor validity in this population. However, at baseline participants were asked to complete the 'How active are you?' questionnaire. Results from this (see table 5.2) showed clearly that most of the participants had an exercise profile that did not reach the recommended exercise time and intensity adequate for health benefits (ACSM, 2000). Most participants did not engage in any physical activity and from the ones who did, walking was the preferred option. The main reasons for not engaging in physical activity were lack of energy, time, and feeling uncomfortable in a gym environment. The participants almost unanimously acknowledged that physical activity would improve their health, feel in better shape and could control their weight.

Participants' exercise skills ranged from not having any at all to some very competent exercisers:

> 'In the past, I've done some really hard physical jobs, like I used to work as a cowboy abroad. I used to shepherd and physically it was extremely hard, like 14 hours a day, non-stop and I'd never lose an ounce and yet my boss who was extremely fit, worked exactly the same as me and ate more, would lose two

stones that he didn't need to lose over a six-week period. I would put it on and not lose an ounce, so this (WHEEL) be quite interesting' (Section 1.22, Para 65, CH).

Others were less skilful:

'Swimming, I do swimming, but again I've never done like speed swimming. I don't like the aqua aerobics. I tried normal aerobics and I don't know what it is, whether it's dancing or aerobics, I can't ask my top half to do something different to my feet. I've no co-ordinations sort of thing, they've all got to be doing the same thing. Although I did horse riding at one time' (Section, 1.18, Para 51, CS).

Whilst others had no exercise experience at all:

'We stroll, my husband and I stroll. We do stroll an awful lot. My husband has multiple-sclerosis which affects his walking so when we are out we stroll at his speed. He can't sustain any speed at all. So over the years I've just, without thinking about it, I've just adjusted to what he can do. But yes, we do get out in the fresh air and stroll. Neither of us have ever taken part in sport (Section 1.63, Para, 188. JF).

Interestingly, most participants joined a gym to aid their diet efforts:

'About two years ago I joined a women's-only gym. I thought to myself, I've paid £400, and if I've paid the money I will go. But I didn't go. I went the first time, this young girl showed me around, chewing gum, as they do. Now and again she'd say hello to me, but other than that you were own your own, with all these leotard women, and it was a communal changing room, communal showers, and there were all these stick-thin things, so I only went five times. Yes, then everybody at home took the mickey out of me. Because I spent £400 for five visits to the gym. But I didn't want to go where men were and I thought it would be user friendly, but it wasn't at all. I like swimming, but, the trouble is, if you go swimming everybody looks at you as if you've got two heads. It's like anything else, they do what you want them to do. Because you are looking at people's reactions. You fulfil your own plan that they're going to be like this with you' (Section, 1.14, Para 39, AG).

There are a number of important messages from the women's experiences that can be learned and used to inform any exercise-based intervention with this population: first, safety, as the choice of the gym is about being accepted by fellow women, feeling safe to try something new, under expert guidance, which they clearly did not experience previously. Secondly, 'leotard' women increased their feelings of incompetence and body anxiety (no skill and overweight body, that can't do anything) in an unknown environment. Thirdly, communal changing rooms where bodies are visible also added to the feelings of an already poor body image. Fourthly, the presence of a self-fulfilling prophecy, as they expected them to look at them, and they will indeed look and make comments. These are very important experiences to acknowledge in any exercise setting when working with people with weight problems. For example, Josselson (1996) argued that people often compare themselves with others. Therefore, stigmatised overweight people would more often than not compare themselves negatively with the socially desirable 'normal' people. These participants' experiences were clearly articulated in Bovey's (1989) description of a 'fat' woman: being fat is about knowing it. It is about a round-the-clock awareness that the fat person's body overflows the strict boundaries imposed on it by Western social and cultural norms. To be a fat woman means to carry a double burden, for women are expected to conform to a more rigorous and stereotyped aesthetic ideal than men. There is no way to hide being fat, except by staying indoors, and so most fat women exist within a tense and stressful straitjacket, unable to freely be themselves, circumscribed by social censure, aware every day in everything they do that they are being defined by their body size. It's only the on-the-telephone fat woman who can claim equality. Being fat is about experiencing hatred and contempt (p. 1.).

6.2.11. Participants' expectations of the WHEEL programme

> 'When I saw the article in the paper, it's like grasping at straws, you think there is a miracle cure out there, that someone is going to say this is what you do, and you will be thin, and normal, like everybody else' (Section, 1.150, Para 441, AG); then she said: 'When I said this is all exercise (WHEEL), at first they all laughed (entire family) and said, you know, ha, ha, they're going to kill you. But they all know that is what I need' (Section, 1.150, Para 441, AG);'

This quote sums up what most of the participants were thinking. Their common aims were to be 'normal'. The advert was asking for participants to volunteer for an exercise-based, non-dieting intervention to get healthier at whatever weight they were. It was interesting to note what participants expected of WHEEL, given they were mainly sedentary and had self-reported poor exercise skills.

These participants were interested in the non-dieting aspect of WHEEL:

> 'WHEEL is different. I just want to learn not to diet. Because it's just got to be a way of life. It's bad habit we've got into, so just getting out of it. And regular exercise as well' (Section 1.123, Para 366, AHa);

> 'Well, I think it's (WHEEL) appealed to me because I won't be dieting. Like you say, and I do know, I am obsessed with dieting me. I know I'm obsessed, honest to God, I am. Every new diet, I think I can do it all the time. When I read about this in the paper, no dieting, but exercise and healthy eating, if I don't think I am on a diet, I am hoping that I can just get through with thinking well there is everybody like me' (Section 0, Para 170, JD).

The exercise component seemed to have been something ‘new’ to try for these participants:

> ‘I just thought I’d tried everything and nothing worked and it was just for the health reasons that I felt desperate. Then I saw that this (WHEEL) was just a different approach, something new, something I hadn’t done’ (Section 1.42, Para, 103, GM).
>
> ‘I am quite interested in WHEEL because I am overweight. I am not as fit as I should be, and I know all about healthy eating’ (Section 1.4, Para 12, CH);
>
> ‘I’ve never been one for much physical activity, but I realise that to keep my weight off, which is what I want, then I have to do that. I thought this was the first step towards doing that’ (Section, 1.16, Para 46, CS).

Yet other people wanted to be feel that they were going to learn to go through a new experience with someone whom they saw were in the same boat as them:

> ‘The exercise side of it. I used to go to a gym, and I used to enjoy it, but obviously as you get bigger, you get more and more conscious. We’d go to these places where the people were very fit and very glamorous and look well and it really puts you off in that way. Whereas here, we’re all together, in different ways, aren’t we? So I think that interested me, the exercise in it. And I liked it because it was not a diet’ (Section1.12. Para 31, DG);
>
> ‘I think in there, was already a seed, there in my mind, but I had to have somebody else to help me to carry it out. I think I probably wouldn’t have done any of this unless I’d joined something where somebody would give me some reassurance and I could be with a group of people. I know everybody is different stages, but generally we are all in the same boat. You know, struggling with

whatever, for a long time. And it's not just a whim, not just that people have looked through Vogue magazine and said I want to be like stick insect, it's people who want to have a normal, healthy life. Everybody should have that. I think that's what I thought about your programme, it's just right for me at the time. I saw the advert, and I thought this is it. This will be the start for me (Section 1.90, Para, 250, DL);

'I think for the sense of everyone being in it together, everyone in the same situation. Probably the women involved were going to be at least my size. Not many woman will say, oh I need to lose half a stone. Being in the gym would feel more comfortable with women who were similar or worse shape. I think also because it based around exercise. I know in my own mind that I lose efficiently or more quickly when exercise … This is kind of focusing more on the positive rather than the negative, like you shouldn't have eaten that, why did you eat it and so on (Section 1.86, Para 206, HW).

In general all these quotes summarise the fact that exercise was a new approach to their problems, they wanted to be with people who had similar problems when they were doing exercise. Unfortunately a lot of them expected a miracle, and wanted to be told what to do rather than finding out what they can do for themselves. Additionally, they wanted to feel safe and monitored when exercising.

Completing WHEEL required a great deal of time and energy; it lacked immediate desirable results, such as big weight losses; it did not address emotional eating and psychological problems, such as depression, anger, frustration and anxiety; there was a possibility that family relationships might break down (e.g. leave husband – Borkoles, 1998) as women become more assertive, and happier with the way they were through participation; psychological problems of anxiety, anger, depression, or frustration were not addressed in a clinical sense; some participants may not be able to learn or want to learn about what driving their behaviour to sabotage their own health, and may deny to themselves and others problems they experience (e.g. after Miller, 2002). Therefore, WHEEL aimed to help participants to acquire exercise skills that they can use in 'normal' everyday classes; enable participants to foster meaningful social relationship with others in the programme, and to give them choice in a way they wanted to address their problems by providing education sessions about benefits of exercise and more adaptive eating regulations and helping them to address perceived barriers to exercise and behaviour change in general. Additionally, WHEEL aimed to increase positive experiences during and post-exercise (e.g. Miller & Miller, 2010). In summary, Brownell (1998) stated: 'successful long-term weight-management ultimately depends on the ability of patients to change their behaviour patterns, particularly with regard to diet and exercise (p. 19).

6.2.12. Conclusion baseline findings

Although it has been suggested that obese individuals have a similar mental health profile in comparison to the general population (O'Neil & Jarrell, 1992; Stunkard & Wadden, 1992) the baseline data of the current study would not support such a statement as indicated by both QUAN and QUAL findings. If anything, the data would indicate that obesity creates a psychological burden that one has to deal with either before or within any weight-management programme (National Institute of Health, 1998). Participants showed high levels of perceived stress, low levels of general well-being and self-perceptions, all of which can have negative consequences on morbidity and mortality. In addition, half of the participants met the International Diabetes Federation MetS criteria. Overall, this cohort appears to have a psychological profile that makes them highly vulnerable to drop out, such as a majority of them having unrealistic expectation, low exercise self-efficacy, low confidence in their ability to achieve, and just having generally a lot of problems associated with their size and body shape.

6.3. Finding from the RCT Phase: integration of QUAN and QUAL

6.3.1. Introduction

The narrative below provides a powerful description of the effect the WHEEL intervention had on some of the participants in terms of psychological and physical well-being and changes in behavioural patterns:

> ‘My size is no longer stopping me exercising within the group, but I wouldn’t have the will power to do it alone. I wouldn’t have the incentive to do it alone. I have begun to wonder what I would have felt like, what I would have done, if you hadn’t chosen me to come on the project. I think that might have affected me quite badly. A year ago, I looked in the mirror and my mother looked back at me, but I was not ready to be my mother. I wanted a life of my own; life after children. When mother was my age (50), she was old and her life was finished. She had no expectations beyond spending the rest of her life being a wife and housekeeper. Mine is the first generation to have a life after 50. A year ago my obese and ugly body was not able to grasp that opportunity my soul wanted so badly. Then WHEEL came along. The biggest problem I face in the beginning was accepting that as an obese person I could exercise in safety. Even now after 12 months I am still thankful that I feel safe and secure in the class, because I am still obese. Straight away the group had an outspoken rule, no Lycra. It was great relief to all of us and still is today. It was, and is important that we are not made to feel ridiculous. Exercise in itself has not brought about significant weight loss. There is sadly no magic cure to prevent me putting things into my mouth that I would be better doing without. There is nothing which switches off the thing in my brain which tells me my body it has had enough. Exercise has, however,

> given me a measurable and previously unimaginable level of fitness and confidence. I am fit and can cope with daily life at home and at work. I can tackle stairs easily and without the need for lifts and moving staircases – and I can breathe and hold a conversation when I arrive at the top. My increased confidence allows me to have a social life. I go to the pub, to the cinema, and the theatre, and I go into restaurants accepting that I will be stared at because I am obese, but confident that I will cope because I am fit in my mind as well as my body. Fitness is a state of mind as well as body, and WHEEL has given me that. The state of being obese is no longer my own personal anathema because my state of fitness, my ability to exercise to the degree I achieve, makes me special. I am fitter than many of my slimmer friends and colleagues. I can do this. I can live. I have the ability to go forward. I have the knowledge to choose. All this seems profound, but it has come from deep within – from my socks (which I can now bend and put on by myself). I can lock my bathroom door, because I can get out of the bath unaided. I can now tie my own shoe laces, and put on my own tights. I would however, still give 10 years of my life I have left to wake up size 12! These are my most personal and inner thoughts. Let no-one doubt that I can cope with my life and with my obesity because I am fitter, and I am fitter, because I can and do exercise regularly in an atmosphere of faith in myself and trust in my trainer. (Section 1.93, Para 269, JF).

This participant is particularly articulate about her experience. She has never exercised before and only in readiness to this programme she had to purchase a kit. This woman had a BMI of 47.8kg/m^2. In her own words: ‘I’ve started wearing trousers for this project and that was something very new to me. I didn’t possess trousers, I didn’t possess t-shirts, I didn’t have them at all. I found that very hard, to face the world in trousers. As well as being big, to be big and wear trousers has been something I’ve really had to work hard at. To walk into the exercise venue wearing trousers, my size, that has been a very difficult thing to face up. When I was buying the trainers I had to hold my head up and walk in to the shop. To shop for trousers, to shop for trainers. It was incredible. I told this young assistant that I wanted to buy a pair of trainers. I've never owned a pair before. I told him, that even if he just smirks, I won't be forgiving. I did get a nice comfortable pair! (Section, 1.85, Para 249, JF). Her attitude to embrace exercise and fitness has been remarkable and very inspirational for me and for others in the programme.

6.3.2. RCT phase psychological data

To date, a growing body of research has been conducted on the psychological effects of multi-component (e.g. healthy eating and exercise) weight-management interventions (e.g., Teixeira et al., 2002). Generally, using a non-dieting approach to weight-management seems to be associated with psychological benefits for obese people, especially if they don't gain weight and achieve some weight loss (Ciliska, 1998; Stroebe, 2008, Tanco et al., 1998). In agreement with these findings, the findings of the 12-week RCT phase of the exercise-based WHEEL study also showed a significant improvement in psychological functioning of participants initially randomised to the lifestyle intervention. The IIG only showed modest weight loss but despite this there was a significant improvement in psychological functioning which was indexed by increased general well-being, improved self-esteem (athletic, appearance, global self-worth), and increased social support. These improvements in psychological functioning were supported by the QUAL data. For example, one of the participants said, which summarised many experiences of being more alert and energetic:

> 'Actually, my head is a lot clearer. My mind is a lot more alert. You know some mornings you get up and you feel quite sluggish, I am up and out of bed now, and after class I'm prowling around the house doing things, so my energy levels have

shot up completely, and also my head, my mind is clearer, I can take on more things at once as well' (Section, 1.7, Para 15, MC).

Others said:

'I do feel really good after I've been (exercise sessions), you know. But that's always the case. It's like when my friend used to come and pick me up to go circuit training, I used to think I don't want to go. But there she was at the front door, peeping the horn. I always feel so good and really and really invigorated afterwards. You can have a headache before you go but get rid of it while you are there. It does have an effect on you, definitely. It changes your mood (Section 1.46, Para 93, SK);

'I am surprised really, how good I feel afterwards (after exercise). I do feel a sense of achievement really, a strange sense of satisfaction. I enjoy it, it's good. (Section, 1.8, Para 24, JW).

6.3.3. General well-being and quality of life

The exercise intervention in general was significantly associated with improvements in general well-being and quality of life. In the initial intervention group participants showed a significant improvement from baseline to end of the RCT phase in the total score of the *GWB* Schedule and all its subscales. In addition, the IIG scored significantly higher than the delayed start control group at the end of RCT phase on these variables. Cramer, Nieman, and Lee (1991) and Nieman et al. (2000) have reported similarly improved psychological well-being among mildly obese women within controlled lifestyle intervention trials. In the former study, the exercise group showed improvements after 15 weeks for the total scores of the *GWB* and the subscales 'Energy Level' and 'Freedom from Health Concern or Worry' compared with control. In the latter study, total general well-being as well as the subscales 'cheerful vs.

depressed mood' and 'satisfying and interesting life' were reported to improve in the combined lifestyle (exercise + diet) intervention group but not the exercise training alone, moderate dietary restriction alone, or control groups after 12 weeks. In that study, two additional well-being subscales ('freedom from health concern or worry' and 'relaxed vs. tense or anxious') showed trends of improvement in the combined intervention. In an exercise alone RCT study for middle-aged, postmenopausal women, Bowen et al. (2006) found that at three months participants randomised to the exercise condition perceived their mental (Brief Symptom Inventory; Derogatis & Melisaratos, 1983 and SF-36; Ware, 1996) and general health (SF-36) significantly better than participants in the control condition. In a 12-week weight loss study involving 80 women (mean age 37.4 ± 7.9 years for women in treatment group) increased physical activity, self-selected hypocaloric diet and group support, various self-report quality of life indices (physical functioning, vitality, mental health) in intervention participants improved compared to controls in moderately obese females (Rippe et al., 1998). Finally, in a 20-week multidisciplinary lifestyle intervention (diet, exercise, behaviour modification) study by Malone, Alger-Mayer and Anderson (2005) consisting of 74 females (mean age 48 ± 10 years) it was found that participants increased health-related quality of life (SF-36) and reduced depressive symptoms (Beck Depression Inventory).

In a recent review of the literature on RCT trials and health-related quality of life it was found that only nine of 34 trials (Fujioka et al., 2000; Grimm et al., 1997; Karlson, 1998; Kaukua et al., 2002; Nguyen et al., 2001; Nieman et al., 2000; Rejeski et al., 2002; Rippe et al., 1998; Shah et al., 1994) improved in one or more domains of health-related quality of life. However, six (Bacon et al., 2000; Karlson et al., 1998; Kaukua et al., 2002; Kiernan et al., 2001; McMahon et al., 2000; Painot et al., 2001) out of 11 RCTs that included an obesity-specific measure showed positive treatment effects (Maciejewski, Patrick, & Williamson, 2005). A limitation of such a review is that it compares studies with very different intervention protocols and possible outcomes. Hence, an intervention with an emphasis purely on weight loss (e.g., Skender et al., 1996) might not result in significant improvements in psychological functioning. On the other hand lifestyle interventions, like HAES, would have improved psychological well-being as one of their main outcome goals. In addition, the review made no distinction between the gender, race, or age of the different population investigated.

A possible explanation for the positive findings in the present study in comparison to studies, which did not find improved well-being or quality of life, could be due to several issues. First, the philosophy of the present study contributed to the improved well-being. SDT and non-dieting approaches were used to maximise participants' engagement in the study which might have caused the observed improvements in psychological well-being. In addition, the study actively, through education, discouraged participants from dieting (e.g. calorie restriction). Participants were asked to 'face' what it was they were really doing with food. A diet diary was used to aid this process. Participants were specifically told that it was for them to find out what they did, and there was no point in doing it if they couldn't do that. They were told they could only be helped if they were 100% honest, or they should not attempt to fill out the form at all. About 60% of the participants used the diary and made appointments to discuss their issues with the CBT therapist/nutritionist. This is how some participants found the experience:

> 'I don't want to do the diary. I avoid facing up to things. I feel bad because I do feel I'm letting you down' (Section 0, Para 2, JF);
>
> 'There is no point actually lying about anything, you wanted the true pattern of what we do and this is how I am' (Section 1.14, Para 32, JSmi);
>
> 'I just daren't. I just daren't bring it' (Section, 1.122, Para 299, LM).

Participants changed their thinking about dieting and learnt new skills to deal with cravings:

> ‘When we were at the talk on the other week, what you were saying about the craving going off after 20 minutes, I’ve really been trying to do that. Walking around the block or just trying to do something. I am going on holiday on Saturday, so I’ve been doing the packing and unpacking the case to distract myself (Section, 1.178, Para 455, JH);

> ‘Now that I’m not dieting, and I am going down the chocolate isle, it’s just all chocolate, but it doesn’t bother me. Before I would be thinking, I could just eat one of them’ (Section 1.54, Para, 161, AHa);

> ‘If there is one thing I feel, out of all this (WHEEL) it’s completely liberated. I feel liberated to make choices about what I am going to eat. I can positively choose to eat some vegetables … which I probably would associate with diet food. Stuff on diet. But because I am choosing it, because I actually think I quite like jacket potato … I am making that choice and it feels absolutely fine. I can sustain it forever’ (Section 1.40, Para, 107, JB).

These experiences are evidence for ‘normalising’ eating behaviours (Stroebe, 2008), which may in turn lead to less cognitive and psychological burden, as it took away the guilt and upset about having forbidden food.

These findings are also in line with a plethora of research, which suggests that psychological well-being and psychopathology related to obesity can be improved in the absence of significant decreases in body weight. In a study by Tanco et al. (1998) only participants within a non-dieting condition showed a significant decrease in depression, anxiety, eating-related psychopathology, and an increase in perceptions of self-control as compared to behavioural therapy and waiting list control groups. Similarly, Rapoport et al. (2000) concluded that modified CBT for weight-management, without a focus on weight loss, was efficacious in inducing modest weight reduction, as well as improving emotional well-being, lessening psychological distress, and improving dietary and exercise behaviours. Subsequently, Bacon et al. (2002) reported comparable body weight changes between obese Caucasian female participants (age 30–45 years) randomised to a restrictive diet and those to a non-dieting intervention for a six-month period. The non-dieting approach in this study produced improvements in psychological well-being (Beck Depression Inventory, Rosenberg Self-Esteem; Body Image Avoidance Questionnaire) and eating behaviour (Eating Inventory), while at the same time effectively minimised treatment attrition. One of the participants said:

> 'I don't constantly pig out as much as I did. I think I am more able to say right it's my choice. If I eat it because I want to eat, not because I've got to desperately eat it' (Section, 1.51, Para, 104, TS).

Taking up exercise also seemed to be an important aspect to achieve improved general well-being (Jakicic, 2002; Mann et al., 2007). The studies mentioned previously which showed increases in well-being all included an exercise component in their intervention. The *GWB* schedule might also be a particular useful tool for assessing well-being in obesity interventions because of its multidimensional indication of subjective feelings of well-being and distress and it allows for sensitivity to change in either a positive or negative direction (Hopton et al., 1995).

A high proportion of the participants in this study reported poor levels of psychological well-being at baseline compared with other data among overweight and obese females (Foreyt et al., 1995b). The participants in the initial intervention group showed a 29.9% increase in the *GWB* total score during the RCT phase bringing the IIG from the 'severe distress’ to the ‘moderate distress’ category. This suggests that the adopted approach in the present study was successful in improving the participants’ well-being over a relatively short period of time, as one participant stated:

> ‘I am feeling better in myself, but also I’ve found that since I’ve been going more often I’m looking forward to it more. Where, well it wasn’t really a chore twice a week, but it was like oh I’ve got to get up and go to the gym this morning, and I’m doing it more regularly, it’s oh great, I’m going up to the gym this morning and I am looking forward to it more’ (Section, 1.232. Para 590, JH).

6.3.4. Self-perceptions

Participants in the IIG showed significant improvements on ‘Appearance’, ‘Athletic’ and ‘Global Self-Worth’ scales of the *SPP* at the end of the RCT phase. These were also the factors that showed the greatest discrepancy with norm values reported previously. The results of the *SPP* in the present study indicate that self-perceptions should be assessed using instruments that acknowledge the multidimensional nature of the self (Shavelson, Hubner & Stonton, 1976). Secondly, the present study was successful in improving self-perceptions at the domain and global level over a relatively short period of time. Participants, although they were still hiding their bodies, no longer minded how their bodies moved in space:

> ‘It was so funny, because they had you jumping up and down and the fat would be going this and that way, then she’d suddenly change it and my fat was still going up and down. We were all the same and everyone was so friendly, nobody said get out of my way, or you are in my way. I was trying to stay in the deep end and then I kept losing my feet, then I’d look and there were six people doing the same thing. Nobody wanted to jump up and down out of the water. Yes, it was good’ (Section, 1.18, Para 50, AG);

> ‘There is a man at the yoga class, he’s in his late eighties and he can do this position called the plough and you get your legs right over your head. Last night was the first time I could do that. I don’t know why. Probably, some of the exercise we’ve been doing has helped. I just sat there in shock. The teacher said, are you alright, I said yes, but I’ve never been able to do that before’ (Section, 1.86, Para 240, DL).

In this study there were no differences found in state self-esteem as measured by the *State Self-Esteem Scale*. Similarly, Sbrocco et al. (1999) working with obese women in both a traditional and a choice behavioural treatment programme found no significant changes in overall state self-esteem over the 12-week treatment period. However, in this study the participants’ baseline level of state self-esteem was similar to that obtained in the validation study by Heatherton and Polivy (1991) in undergraduate students. Further research would be required to assess the sensitivity of this instrument to interventions in obese populations to detect changes in self-report state self-esteem over time.

The mechanisms to improve or influence self-esteem in relation to exercise interventions are also unclear in the literature, as well as the ‘feeling of exercise’ may have been unpleasant for some (Ekkekakis, & Lind, 2006), especially initially, as this quote illustrates:

> ‘I can’t say that I enjoy the exercise classes, because I don’t. I found that I have to force myself to go to the circuit classes. I enjoy aqua aerobics much more’ (Section 1.25, Para, 99, DH). She also said: ‘I hate sweating, I hate when I am sweating down my neck, that’s how I feel really’ (Section 1.51, P. 153, DH).

Indeed, Ekkekakis and Lind (2006) found that during exercise imposing a speed that is just 10% higher than what an overweight woman might have self-selected led to a significant decline in reported pleasure. Over time, this could diminish the enjoyment of an intrinsic motivation for physical activity, leading to decline in adherence.

Furthermore, the intensity of the exercise at this stage was far too low for many of the participants to have resulted in a great deal of overall self-esteem improvements, as Rose and Parfitt (2010) found that there is a complex interaction of psychological and physiological influences in producing an effective response to exercise.

Participants in the DSCG showed a significant increase in their body image dissatisfaction over the 12-week period. Although the IIG showed a decrease in this variable this was not significant. Several studies have reported significant decreases in body image dissatisfaction following relatively short intervention periods. For example, in the earlier-mentioned study by Rapoport et al. (2000) was reported a decrease in body image dissatisfaction following a 10-week treatment period. Similarly, in a study by Foster, Phelan, Wadden, Gill, Ermold, and Didie (2004) on 17 obese women (mean age 46.5 ± 9.7 years; BMI 34.7 ± 2.9 kg/m^2) a significant improvement in body image (as assessed by the Body Dysmorphic Disorder Examination scale), self-esteem (Rosenberg Self-Esteem Scale) and satisfaction with body weight was found after the 40-week modified cognitive behavioural treatment period. These findings persisted at 92-week follow-up despite significant weight regain (weight loss declining from 5.7% to 2.9% of initial weight). This study is key, as one of its aims was to counter negative body image and obesity-related low self-esteem. The intervention provided information on the biological basis of body weight, socio-cultural pressures to be thin, and accepting modest weight loss. The emphasis on modest weight loss in the Foster et al. study is important because it is the participants with low self-esteem and increased body image disturbance that desire to lose the most weight.

6.3.5. Social support

To change one's life-style to manage obesity cannot be achieved without on-going social support (Bidgood & Buckroyd, 2005; Williams et al., 1996a). Wing and Jeffery (1999) found that those participants recruited to their weight loss programme with three friends were much more likely to complete the 10-month treatment programme (95% vs. 76%) and to maintain their weight at 16-month follow-up (66% vs. 24%) than those recruited alone. Furthermore, long term success of weight loss intervention programmes is in part due to adopting a more physically active lifestyle (Jakicic, 2002). Increased physical activity or exercise not only increases energy expenditure but also contributes to dietary compliance (Jakicic, Wing & Winters-Hart, 2002) and improved psychological well-being (Biddle, Fox & Boutcher, 2000). Relatively few studies have investigated the role of social support for exercise or physical activity in weight loss programmes (Anderson & Fox, 1998). The present study aimed to examine the issue of social support for exercise.

The instrument used in the present study (*SSSE*, Fox & Dirkin, 1992) was specifically designed to assess social support in the adoption of exercise. This was felt to be an important source of social support to monitor because it has been shown to be a key indicator of intentions in individuals who perceive behaviour to be difficult to execute (Povey, Conner, Sparks, James, & Sheppard, 2000). The intervention was successful in that both the received level of social support increased (listening, informational, challenge) or decreased (negative) significantly for all four domains resulting in reduced discrepancy scores. In their review of predictors of weight loss, Teixeira et al. (2005 & 2002) stated that baseline social support for exercise behaviours is not a predictor of subsequent weight loss and can result in measuring inappropriate estimations of future support whereas measurement during the intervention might be more meaningful. The *SSSE* however would counter this argument because it assesses desired and received social support at a particular point in time. A large discrepancy existed at the onset of the study of what participants received in social support for exercise and what they actually needed. The need for support didn't change during the RCT phase but the received social support increased significantly. The nature of the present intervention programme, which used a multi-component, client-centred approach utilising both group-based intervention activities in conjunction with individual motivational interviews and telephone support might have partially resulted in the increased social support and decrease in discrepancy between needed and received social support for exercise. However, comparison of social support in weight loss studies is still problematic because of differences in operationalisation, measurement, and differences in intervention strategies (Verheijden, Bakx, Van Weel, Kolen, & Van Staveren, 2005).

The qualitative data provides support for increased perceived social support participants reported. Some of this more general support was provided by EB:

> 'Just finding out about things in the meetings. That was one of the things with WHEEL, you were always there. No matter how busy you are, you were always there. When I had problems, when I wasn't feeling too good with it, then you'd just say, right, get yourself here kind of thing' (Section, 1.117, Para 338, GM).

In addition, participants instinctively sought social support for the exercise from others from the beginning of the classes:

> 'I don't know if it is true, I haven't analysed this, but I think for me I noticed two groups of people. One that had been fit and OK once and perhaps had children and had then lost that fitness and then there seem to be another group of people who'd never ever reach that, never been fit, and had always had a weight problem, never felt healthy, never felt fit. I think we formed those groups in a way naturally. I think the ones who knew how it felt wanted to go back to it,

> decided to go back to it, whereas the group I tended to mix with I think possibly we had never been there, hadn't experienced being fit. It was like an alien world. Being slim, and being fit, being socially acceptable size. I certainly hadn't experienced that and I think I recognised that in other people in the programme. I don't know whether that was a real difference, but that was a perception I had' (Section, 1.12, Para 37, JB).

Furthermore, participants as they felt better, they've started to organise a number of sponsored walks that catered for everybody's needs. These were planned and executed without EB's help or prompt and on their own terms. One participant said:

> 'I loved our sponsored walk. I have never done anything like it before. I genuinely could not manage the date for the … walk-cum-picnic, but on the day itself, when the weather was bad, I was glad I couldn't go. It occurred to me then that some of the group just would not have wet weather gear. I certainly don't own or have access to that sort of clothing or footwear … On the day of the sponsored walk I had no alternative but to wear the sort of gear I exercise in, and I soon realised that my trainers were not the best footwear for that sort of walking. I have never got over a style ever before! I made the three miles at the end, but I can't say I've really enjoyed it! (Section 1.116, Para 335, JF).

6.3.6. RCT Phase physiological and metabolic data

Several randomised studies among overweight and obese women have shown that interventions, including structured aerobic exercise or lifestyle physical activity, produce significant short-term and longer-term improvements in $\dot{V}O_2max$ (Andersen et al., 1999; Dunn et al., 1999; Janssen, Fortier, Hudson, & Ross, 2002). In contrast, several short-term intensive exercise interventions (both with and without dietary counselling) have been shown to improve body composition without improving cardiorespiratory fitness in obese adults. Moreover, diet-induced weight loss among premenopausal obese women may result in adverse effects on maximal cardiorespiratory function (Ross et al., 2004; Utter, Nieman, Shannonhouse, Butterworth, & Nieman, 1998) and there remains uncertainty about the benefits of exercise-training and cardiorespiratory fitness on HRR.

The present study evaluated improvements in cardiorespiratory fitness and weight-management in a group of previously sedentary, clinically obese premenopausal women using a maximal graded walking treadmill test. The findings suggest that short-term lifestyle intervention based on the SDT and non-dieting approach significantly improved relative $\dot{V}O_{2peak}$ (normalised to body weight) among obese premenopausal women. The magnitude of the cardiorespiratory adaptive response to the lifestyle intervention was comparable with earlier reports using somewhat more prescriptive approaches to increasing physical activity among overweight and obese individuals. In the present study an approximate 9.0% increase in relative $\dot{V}O_{2peak}$ was found in the IIG compared with a 4.0% reduction in the DSCG. These findings are in general agreement with those recently reported by Jakicic, Marcus, Gallagher, Napolitano, and Lang (2003) and Potteiger, Jacobsen, Donnelly, and Hill (2003) among overweight and moderately obese sedentary women (aged 21 to 45 and 17 to 35 years respectively). Jakicic et al. (2003) showed 9%-13.4% improvement in $\dot{V}O_{2peak}$ from baseline to six months among participants randomised to moderate or vigorous intensity exercise of moderate duration. However, in contrast to the present study design, these investigators instructed all women to restrict energy intake and study groups achieved a mean 8-9% reduction in body weight after six months. Moreover, the cardiorespiratory fitness improvement in the present study is comparable with those reported in Project Active (Dunn et al., 1999), a long-term intervention trial employing psychological models of behaviour change designed primarily to increase physical activity and cardiorespiratory fitness. Six months of intensive lifestyle and structured exercise intervention resulted in adjusted mean $\dot{V}O_{2peak}$ changes of 1.58 to 3.46 ml·kg^{-1}·min^{-1}, respectively, among sedentary overweight adults. The present study found an unadjusted mean $\dot{V}O_{2peak}$ change of 3.0 ml·kg^{-1}·min^{-1} in the IIG compared with the DSCG, consistent with the significantly greater improvements associated with structured exercise-training.

The improvement in relative $\dot{V}O_{2peak}$ in the present study is considerably lower than that reported by Ross et al. (2004) in a 14-week randomised weight loss study among premenopausal, moderately obese (BMI 31.9-32.9 kg·m^{-2} across groups) women. In that study, 12 participants allocated to exercise without weight loss intervention attained a 24% increase in $\dot{V}O_{2peak}$. However, in this trial, participants performed over an hour of supervised daily treadmill exercise at an intensity of approximately 80% maximum heart rate. The participants in the IIG showed a 13.0% increase in absolute $\dot{V}O_{2peak}$ (ml·min^{-1}) compared with the DSCG. Janssen et al. (2002) have reported a 9% increase in absolute $\dot{V}O_{2peak}$ among 11 premenopausal (37.5 ± 6.0 years) obese women (BMI 36.0 ± 7.1 kg·m^{-2}) randomised to 16 weeks of exercise and dietary restriction compared with no change in those allocated to dietary intervention only. In this study, aerobic exercise was more formally prescribed progressing to 60 minutes of treadmill, stair-climbing or cycle ergometry, five days weekly at 85% of maximum heart rate. Larger increases in absolute $\dot{V}O_{2peak}$ (24 and 24%) have been shown among middle-aged obese females completing closely supervised exercise treatment with and without concomitant weight loss (Ross et al., 2004).

The present study showed that in a small cohort of sedentary, obese premenopausal participants, intensive lifestyle modification incorporating moderate-intensity supervised exercise-training can modestly improve $\dot{V}O_{2peak}$. This variable may provide a complementary index for directly quantifying overall improvements in cardiorespiratory status. Further, larger RCTs of lifestyle activity and structured exercise in addition to other interventions are required to confirm whether clinically obese patients can achieve similar improvements in functional capacity and maximal cardiorespiratory function.

6.3.7. Conclusion RCT phase

In summary, the adopted framework (SDT, non-dieting) of the present intervention study showed that significant improvements in psychological well-being and cardiorespiratory fitness can be achieved over a relatively short period of time with modest or no weight loss. In particular, participants in the initial intervention group showed moderate to large improvements in general well-being, self-perceptions, and social support as well as improved cardiorespiratory functioning.

6.4. Results of the Maintenance phase of the WHEEL Project

6.4.1. Introduction

> 'After WHEEL, I am definitely different from whom I was' (Section, 1.58, Para 118, SM).

Over the past 30 years lifestyle interventions and treatment programmes for obesity have been problematic and mostly unsuccessful in the longer-term (Lean, 2000; Mann et al., 2007; Miller, 2001). Evidence indicates that initial weight loss is followed by relapse and the majority of participants return to their pre-intervention weight within 3-5 years (Miller et al., 1997). In a recent review by Mann et al. (2007) it was found that in particular calorie-restricting diets were ineffective. They also showed that up to two thirds of participants starting a diet finally gain more weight than they lost through their diet. In addition, they established that diets do not seem to result in health improvements regardless of weight loss.

However, other studies have documented that moderate weight loss can reverse many of the metabolic disorders associated with obesity (NTFPTO, 2000; WHO, 2000). Accordingly, weight loss has typically been the primary focus of interventions (Campos et al., 2005). Moreover, traditional interventions often ignore evidence that dietary restraint and weight fluctuation may also have profound effects on psychological and physical health (Miller & Jacob, 2001). Furthermore, emphasis on weight loss and dietary restraint may promote potentially unhealthy eating behaviours and attitudes, especially among obese females (Lyons & Miller, 1999; Robison, 2005).

It has been shown that psychological and physical disorders associated with obesity can be reduced and health improved by lifestyle changes in the absence of weight loss (Miller, 1999; Gaesser, 1999). To date, traditional lifestyle intervention models with their emphasis on weight loss achieved mainly by calorie restriction have more recently been challenged by the Health at Every Size treatment paradigm (e.g., Ikeda et al., 2005; Miller, 2001; Robison, 2005) and non-dieting approaches. Such programmes advocate moving away from weight loss as being the primary focus of interventions and re-emphasise psychological and metabolic outcomes as indicators of wellness.

An important aim of the present study was to examine the long-term effects of such a non-dieting lifestyle intervention designed in the frameworks of non-dieting and SDT (Deci & Ryan, 1985a) on weight-maintenance and psychological well-being among persons recruited to the WHEEL study.

6.4.2. Psychological outcomes of the maintenance phase of the WHEEL study

The benefits of either preventing weight gain or promoting and supporting small amounts of weight loss induced by lifestyle changes appear to be crucial in the treatment of obesity-associated disorders and improved psychological functioning (Stone & Saxon, 2005). Although, referring back to Miller and Lindeman's (1997) work questioning an obese individual’s ability to embark on an exercise regime and sustaining it over time, this study proved that most moderate and severely obese individuals can adopt exercise even though they’ve never done it before. It is the way exercise knowledge and expectations are managed. As this study’s results showed, some will never be comfortable with ‘sweating’, moving bits, but most could accept that was how it was to be for a time. Furthermore, the gradual adoption is key, as clearly there are limits as how much they could do initially. Therefore, the intervention approach selected in this study was effective in helping participants adopt physical exercise and in turn eliciting significant psychological change in those participants who completed the programme.

6.4.2.1. Stress, well-being, and quality of life

At baseline, a high proportion of the participants in this study reported poor levels of psychological well-being and high perceived stress compared with other data among overweight and obese females (Foreyt et al., 1995). From baseline to 12-month follow-up participants in this study assigned to both the initial intervention condition and delayed start control condition showed significant improvements in perceived stress (and both subscales) and on the total and all subscales of the *GWB* schedule. For example, participants said:

> ‘I’ve joined a health club again (after WHEEL), so I will do an hour in morning before school. I enjoy that mentally. The only time I can turn off totally is when I’ve got time to myself, relaxing mentally on the treadmill and swimming. I can totally turn off. I can’t do that when I row because I’ve got to watch what’s happening but on the treadmill I can forget about everything’ (Section, 1.121, Para 354, CH);

> 'On Saturdays I do go dancing for an hour now. My new boyfriend is a dancer, so I am learning to dance. I've joined a class, one hour a week learning to dance' (Section, 1.44, Para 131, EW).

The average for the total score of the *GWB* schedule for those completing the programme at 12 months was 74.4 (± 16.64). This value would bring the group as a whole into the 'positive well-being' category. At the individual level 13 participants could be categorised as having 'positive well-being', five as being in 'moderate distress', and seven still in 'severe distress'. The adopted framework might be particularly efficacious among participants with psychological distress. But the inclusion of exercise and the instruments used might partially explain the positive findings of the present study in terms of psychological well-being. Similarly, the Reno Diet-Heart trial (Foreyt et al., 1995), a prospective natural history study found that increases in self-reported physical activity over four years were associated with improvements in depression and general psychological well-being in normal-weight subjects and with improvements in eating self-efficacy and well-being in obese female participants. The improvements in general psychological well-being and health perceptions noted in the present study occurred despite only small or no changes in body weight (Miller & Jacob, 2001):

> 'I feel a lot better now and I've lost some weight. I don't use my inhaler as much now. When I did the first exercise class we'd only been doing six minutes of exercise and I had to have my inhaler. Now I just do the whole hours and it doesn't bother me, unless I've got a bad cold or something, then it does, but otherwise I can manage without it' (Section 0, Para 67, AG).

Furthermore, the non-dieting treatment model assumes that if psychological dysfunction is helped, participants are more likely to be able to sustain and initiate health behaviours conducive to good long-term health including weight management. One participant said:

> 'Well I am not so bothered about losing weight. I feel better and my clothes are fitting better, I don't really care what the scales say (Section, 1.97, Para, 197, TS).

Another said:

> 'I am more aware that it (her body) can do things. That's always amazing for me, because mentally I'm very strong, I know, but obviously as my weight increased that has limited me … I am aware of how limited I was. If I compare that with what I was before, it's quite frightening to think that before I started WHEEL what I was like. You only just realise that when you see the improvement. You think oh my God, is that really like that? I don't ever again want to be like that. So that gets you more motivated again to do more, because you have seen a change. You realise how bad you really were before and you know what other opportunities there are if you do keep going. How it's going to open up for again for you' (Section 1.31, Para, 65, MC).

The following quote shows how difficult is to change weight loss expectations if it so ingrained in a person's behaviour. Nevertheless, she is no longer weighing herself and has accepted hat weight loss may not occur:

> 'Funnily enough the scales are still in the bathroom. Without batteries, even though I don't stand on them. And nobody else stands on them because there are no batteries in. It's important to me that they are still there, and when I clean the bathroom, I wipe them down and dust them, and put them back. It's important. I am not ready to do away with the scales, but they must not record anything. Because it's not important' (Section 1.241, Para 679, TS).

These notions were also supported by the previously mentioned study of Bacon et al. (2002).

6.4.2.2. Exercise, self-perceptions and self-esteem

Participants were encouraged to look out for small but significant changes in how their bodies changed during exercise. This quote summarises what many of them said:

> ‘I’ve toned up, yes, I know with my trousers that I’ve lost it round here’ (Section 1.72. Para 200, EW).

The fact that exercise helped to improve participants’ self-perceptions was a key motivator for most. In this study, self-perceptions were treated as an outcome of the intervention rather than a mediator explaining other behaviours. A number of studies (see below) have found improvements in self-esteem following participation in a weight loss programme. Most commonly these studies have used only a global measure of self-esteem (Rosenberg Self-Esteem Scale). In general, higher levels of self-esteem have been found to result in greater weight loss (Nir & Neumann, 1991) as well as longer perseverance (Nir & Neumann, 1995). For example, in the 10-week weight reduction programme (dietary, behavioural, and self-control modification based on self-care deficit theory) of 116 obese women (19–57 years) Nir and Neumann (1991) found that participants with initial low self-esteem scores (Rosenberg Self-Esteem Scale) lost significantly less weight than participants with medium and high scores (4.3 kg vs. 8.7 and 6.4 respectively). Furthermore, Nir and Neuman (1995) found that higher levels of self-esteem were associated with less weight gain during a 47-month follow-up period. The authors suggested that high self-esteem allows the adoption of reformative self-control behaviour (Nir & Neuman, 1995). Such behaviour is more easily adopted when high in the ability to delay gratification and an awareness of the implications of the weight loss programme, whilst taking responsibility for one’s own actions. Low self-esteem, it was suggested, results in preoccupation with oneself due to a lack of self-confidence and doubt, which prohibits the acquisition of reformative self-control behaviour. Similarly, Teixeira et al. (2002) conducted a four-month lifestyle behavioural weight reduction programme with 112 overweight and obese middle-aged women (mean age 47.8 ± 4.4 years; BMI 31.4 ± 3.9 kg/m^2), and they found that lower self-esteem was associated with less weight loss and was one of the factors which significantly distinguished between responders and non-responders. Body size dissatisfaction was also a strong predictor of weight loss (see Kiernan, King, Kraemer, Stefanick, & Killen, 1998 for similar results). Finally, Rapoport et al. (2000) found that both a modified-CBT and standard-CBT programme resulted in a significant reduction in body dissatisfaction and increase in self-esteem (Rosenberg Self-Esteem Scale) at one-year follow-up. A problem with the above studies is the direction of causality between self-esteem, body dissatisfaction and weight loss.

In addition, low self-esteem has been associated with dislike of oneself and doubting the accuracy and efficacy of one's attitudes and behaviour (Nir & Neumann, 1995). Attitudes and behaviours in 'low self-esteem people' are being influenced by social and psychological variables. This has been called 'plasticity' (Brockner, 1983), a susceptibility to external and social forms of influence. People high in self-esteem are more autonomous, optimistic, and have a greater ability to adapt to new situations. They are better able to deal with failure or occasional setbacks (Rosenberg, 1979). In the following quote the psychological dilemmas of participants' is well expressed:

> 'I think maybe I don't have much expectations from myself. So that if I am not doing everything, it's not so bad that I do nothing. The problem is when you are just doing a little, you think, well it's not really making much difference so why bother. It's too much effort, I'm not making the effort and doing it right, or why bother making the effort at all and just forget it. I think I have to concentrate on

> accepting half measures as being better than no measures' (Section 1.149, Para 302, TS).

Although self-regulation and self-perceptions are modifiable, it is assumed that this will take time. This assumption was supported by the findings of the present study. Most subscales of the *SPP* showed a significant improvement from baseline to 12-month follow-up. These results suggest that the intervention was successful in improving participants' self-perceptions in different domains of their lives as well as their global self-esteem.

The qualitative data also provides evidence that the participants developed improved self-perceptions led to more outgoing behaviours:

> 'We've been away to Alton Towers and I went on all the rides. That's something I wouldn't have done before. I wouldn't have fit on them!' (Section 1.129, Para 261, LP).

The same person said:

> I've worn shorts out! Going round the shops, worn shorts. Before I'd worn shorts out in the back garden, but wouldn't go out in the streets in them' (Section, 1.179, Para 273, LP).

In summary, self-perceptions, self-worth, and general psychological states are important factors of motivating health-related behaviours.

6.4.2.3. Self-regulation in WHEEL

The adopted theoretical SDT framework was successful in that all participants completing the study (irrespective of initial randomisation) perceived themselves to be more autonomous at 12 months. The autonomous causality orientation, assessed with the *GCOS* (Deci & Ryan, 1985b), relates to participants' general tendency to adjust toward autonomy support and to be more self-determined. This has been cited to increase self-awareness of needs and feelings, and, in general, experiencing a sense of choice in the regulation of their behaviour (Williams et al., 1996). A couple of examples of an autonomous motivational style from a narrative is as follows:

> 'Just sort yourself out. Nobody else is going to do it for you, are they? You've got to sort it out. It's not good sitting back and wishing that some miracle would come along and you could lose four stone, but it doesn't happen, does it? (Section, 1.82. Para, 197, DG);

> 'I'm very motivated to succeed. But it's not just about succeeding in this programme; it's about going beyond that. Because it really is going to be for the rest of my life, I just don't want it just to end and say, well done, you've done well, now that's it. I really see it as the start of something that's continuing forever' (Section, 1.112, Para, 314, DL).

The Impersonal orientation scale of the *GCOS* assesses the extent to which a person believes that attaining a desired outcome is beyond his or her control and that achievement is largely a matter of coincidence or fate. There was a significant decrease for the group as a whole at 12-month follow-up for this scale and there was also a significant decrease in the 'chance' subscale of the *MHLC* indicating that the participants considered themselves less fortuitous. Some were still thinking that someone else need to get them motivated, and it's really not much to do with them:

> 'I think I just like talking to you (EB). And I suppose I feel that if I don't do it (programme) then I'm letting you down' (Section, 1.74, Para 193, GM).

These findings are in support of previous research (Hodgins et al., 1996; Neighbors et al. 2002), in that strength of causality orientations were predictive of mental health and well-being. Indeed, in this study there was a significant positive correlation (see Table

5.10) between autonomy, emotional control, and stability, job competence, household, intimate relations, and global self-worth subscales of SPP, and negatively with perceived stress.

Furthermore, in a meta-analysis by Allison and Engel (1995) it was found that locus of control was a predictor for weight loss (ES = 0.19). In addition, health- and weight-specific locus of control was found to be a better predictor than general instrument. For example, in a study by Bryan and Tiggemann (2001) it was found that women who were on a 12-week diet improved their internality score on the Weight Locus of Control scale (Saltzer, 1982) and Dieting Beliefs Scale (Stotland & Zuroff, 1990). That is, being on a diet improved the women’s sense of control over their weight and eating behaviour. Moreover, the results indicated that those women who felt more responsible for their weight and eating behaviour at the start of the study lost the most weight. This in turn resulted in increased feelings of control. Similarly, in a study of 66 moderately obese women participating in a 10-week weight reduction programme (dietary and behavioural procedures [nutritional information, eating habits, emotional cues to eating] to lose weight and to understand their role in weight management) it was found that those participants who had a higher internal locus of control at the outset of the programme preserved longer with the programme regime (12.3 months for internals and 7.5 months for externals). In addition, participants with internal locus of control continued to be in control for an additional 29 months. However, after that the differences between internals and externals diminished (Nir & Neumann, 1995). These results also support findings of a retrospective, qualitative study by Colvin and Olsen (1983). This investigation found that in particular women who were successful in maintaining weight loss were more autonomous, self-assured, and capable of taking control of, and being responsible for their lives. Using the SDT within a weight loss obesity-treatment approach, Williams et al. (1996) reported that severely obese patients who reported more autonomous reasons for participating in a very-low-calorie, medically supervised weight loss programme attended the six-month programme more regularly, lost more weight, and maintained weight loss and improved exercise behaviour at 23-month follow-up. Thus it is hypothesised that participants high on the autonomy orientation would report more intrinsic reasons for trying to improve lifestyle behaviour, and in turn would feel more competent to change and would be more successful in long-term change.

In summary, in line with the prediction of the self-determination theory's framework, participants felt significantly more autonomous, less reliant on others and felt more in control of their condition. However, more research is required to explore the tenets of SDT in the context of lifestyle interventions.

6.4.3. Exercise capacity of participants in WHEEL

From the literature review it has been established that there is still not enough solid evidence that exercise alone is effective in maintaining a reduced body weight in obese individuals (Miller & Lindeman, 1997; Miller, 2001). Achieving more than 30 minutes of regular daily exercise, with this cohort, is always going to be a challenge, as participants had moderate to severe obesity. The motto of WHEEL was: 'Any extra PA or exercise they do is more than they've done before.' Indeed, this study's findings were confirming Mattsson, Larsson, and Rossner's (1997) who found that even five minutes indoor walking at their own pace was exhausting for obese women, as they used 56% (range 31-98%) of their VO_{2max} and experienced heavy exertion as they walked. Furthermore, the movement difficulties participants presented with were much greater than expected in this study (Larsson & Mattson, 2001). At the beginning of the interventions, on occasions, some of the heaviest individuals didn't attend a class because it was too far to walk to the venue from their car, as they couldn't park right at the entrance. They telephoned EB from the car park, to let her know why they hadn't attended. During the exercise sessions the following problems were observed, extremely poor flexibility, due to weight obstructing bending; lying on the floor was impossible for some, as they felt they were going to be 'squashed' by their weight. On one occasion, EB had to physically move one participant's belly from side to side as she insisted in trying out what it feels like doing floor exercises. This experience was just one of many that has implications for how to manage a class for individuals with such movement difficulties and disabling weight problems, but with relative general health. Other problems observed were: breathlessness, inability to squat, kneel, rising from low level, stepping on steps whilst walking up and down stairs to the venue; slow movement, inability to stretch after exercises, lifting weights, especially above head, which was confirmed by the narrative interviews. The following quotes describe general experiences of individual movement difficulties:

Knee problems:

> 'I do also worry, that, as good as you are, both you and … cannot really understand the part 'bad' knees play in being overweight, and the mind games which go with exercising them and the fear that each twinge brings. You have never been 'our' size. Shape too plays a part – simple bending is so much more difficult for apple-shaped people than pear-shaped bodies and I know we worry about the simplest, silliest things. I, for example, am so paranoid about damaging my knees, that I won't get down the floor because I believe that getting up might cause damage that will prevent me doing any exercise at all for a while, and I desperately don't want to be in that position. Generally, knees dominate most of the conversations I have with people' (Letter from a participant to EB with a BMI of 47.1 kg/m^2).

Rising from low level and general lack of muscle strength. This is particularly important as participants had difficulties to get in and out of chairs or seats, as their arms were not strong enough to push themselves up, as one participant summed it up:

> ‘I found last night, when I was on that, I don’t know what’s it called, the one where you use your body to push and pull yourself up and everything. I can do that because I’ve got very strong arms. But when it comes to the actual weights, like last night I held the red weights to start with, but then I had to go on the other ones because I found it was just like burning the muscle in my arm, and I thought this is too heavy’ (Section, 1.115, Para 236, SK).

Even though she perceived high muscular strength in her arm, she actually couldn’t work with more than a 1kg free weight in the class. Assisted pull-ups given her a ‘false’ expression of her actual strength.

Participants were encouraged to try out various exercise equipment during the ‘aerobic’ section of each circuit class, to see what they feel comfortable with. Most tested all equipment, and eventually settled to use those they preferred, as this participant experienced balance difficulties due to body size and shape:

> ‘You said before we started that we would do what’s good for us, and I’ve felt that that’s ok, that if you feel like you’ve wanted to sit down then that’s alright. There is one or two exercises that I’ve tried and don’t like for some reasons, well I know why I don’t like it, the rowing machine. I sat on it and felt really nervous sitting on that machine. I felt like I might fall off it for some reason. Because of the action, because of my stomach, I can’t get my knees near enough to go out like that. I didn’t like it at all. And the other thing is, that it probably would be good for me, but I can’t do that treadmill. It’s using the knees too much’ (Section 1.60, Para 176, GT).

Others couldn’t increase their habitual PA due to physical problems, such as difficulties to walk due to breathlessness, body shape, size and pain:

> ‘I work on the third floor. I could walk up the stairs. But I have this problem of my knees and I feel so uncomfortable with it. I do try and avoid the stairs, not just for breathlessness, but for the pain in my knees. If it was just the breathlessness then I’d persevere with it (walking). But I find it very uncomfortable, painful even. So I think that’s probably why I avoid it so much. But it’s not right to avoid it, I appreciate it that I should use the stairs’ (Section 1.39, Para 116, JB);

> ‘Like it’s hard for somebody who’s never had heavy thighs to understand that you get sore in hot weather. People just look at you stupid. I think what it is for me, I alternate my walking. How I walk is probably what stops me doing it. It’s very difficult to explain. It’s not the posture, it’s the way you walk yourself. Someone said, you waddle, you don’t walk. You waddle, so that your legs don’t rub against each other quite so much. Because I never wear tights, rarely wear them because they make me itch. But if you have tights on you have smooth surface’ (Section, 1.184, Para 425, JSmi).

There was large individual difference in what kind of activity choices participants made. In general they all liked Tai Chi and aqua aerobics, probably for being a low level intensity activity. It took the participants a while to get used to doing low- to moderate-intensity activity for a set period. Not the exercise, per se, they had to get used to, but the practicalities around exercise. For example, most participants had to be educated about the exercise context, such as type of clothes and footwear (e.g., shoes, supporting bras, kit being made from material that is breathable); how does exercise makes you feel? For example, what one does actually feel during exercise, such as to what extent is it okay to be out of breath? The purpose, and meaning of sweating?

‘I do quite like getting hot and sweaty now. I like the feeling when you finished (exercise session). Relief! I think that’s a really good feeling, so I am quite looking forward to that’ (Section 1.130, Para 374, SSi);

‘The main thing I’ve really been practising over the last week has been the deep breathing, because I think I don’t breathe properly and I think that can really do me good. I don’t know what good it does, but I feel as I am doing better. I does some good’ (Section 1.10, Para 226, JB).

Despite these difficulties, the WHEEL trial showed significant improvements in the psychological and physical health of the participants.

6.4.3.1. Habitual PA, exercise behaviour, and eating behaviour change in WHEEL: Spill-over effects

Despite participants’ movement difficulties, both QUAN and QUAL data confirmed that there was a considerable change in exercise and eating behaviours of participants. For example, habitual PA increased, and eating behaviours have changed providing evidence for ‘motivational spill-over’ supporting the findings of Hagger et al., (2005) and Hagger et al. (2006), as participants learnt techniques to manage their behavioural and physical limitations. It appears that those with high autonomous regulation orientation are more able to find appropriate behavioural sequences to achieve their overall goal at both the contextual and situational levels, regardless whether they concentrate on exercise or eating behaviours. Furthermore, as per Brickell and Chatzisarantis’s (2007) finding, it appears that those who have a general autonomous orientation might be able to form more appropriate implementation intentions and cope with relapses or setbacks in progress more efficiently. Therefore, interventions targeting a particular behaviour could potentially produce improvements in another (Baumeister, et al. 2006). This quote below is a typical representation of what had changed:

> 'Well I now park further away from the door. That's one of my little things. Try to park further away and using the stairs more. I am definitely doing that, because I was definitely one of these, if the door was there, so was the car. I also swim. I like the swimming and the Tai Chi, I really like doing that. I do the gym bits, because I need to. I've brought my trainers. First time in my life I've bought a pair of trainers!' (Section 1.106, Para 311, AG).

Others started to increase their exercise in addition to what they were doing in WHEEL:

> 'When I go and do yoga, I bike a mile there and a mile home, that's quite a good exercise. So its little things like that I've been able to introduce. And also things that are not major changes, because I am not going to keep up to major changes. Only little things. Like when I get off the bus in the morning, instead of walking slowly, I walk fast, as fast as I can to work. Then I am quite breathless when I get there, not uncomfortable, just out of breath. So they're some of the little things that I have started to do. And I've noticed my knees feel better already. I feel a lot more, I just move better' (Section, 1.92, Para 255, DL);

> 'Bending down to pick socks up off the floor, picking up the laundry, my husband will chuck his pyjamas on the bedroom floor and I can just pick them up. Instead of that being a terribly big chore, I am thinking oh look there is a sock to pick up, which means I can bend, I can have a go at bending and stretching, how nice. Oh I've got to go upstairs for that washing, damn that, means I am going to have a lovely trip upstairs. I think of reasons to go upstairs, can you believe that? No don't you go, I'll fetch it. I want to try the stairs, to see how my legs feel today' (Section, 1.54, Para 140, LP).

6.4.4. Eating behaviour

The qualitative narrative provides some good examples of how the WHEEL intervention influenced the participants' perceptions of diets as a result of participation in regular exercise. In particular WHEEL seemed to reduce the number of unscheduled eating behaviours:

> 'When I've been and I come home and think I've got to take the dog out now, it's like I don't want to watch TV and eat anymore, I want to carry on, because I've got energy and things and feel lively' (Section, 1.86, Para, 222, GM).

In addition, participants also showed changes in their eating behaviour.

> 'WHEEL is being helpful. I think going to the exercise classes, and things like that, it takes your mind off it as well. Because you are busy doing things. But then I find on the other night I've just become not bothered any more, whereas before I would sit and I would eat from sitting down in front of the TV to going to bed. I'd just have a bit of that and bit of this. I mean obviously there are days when I do feel like that, but on the whole I don't do it anymore. On the whole that's helped enormously with my weight loss. Well, obviously' (Section 1.2, Para, 8, DH).

On the whole the WHEEL programme appeared to have a positive impact on participants' eating behaviour and the attitudes and emotions associated with this:

> 'I've got a more positive attitude now. We went for a meal on the other night, with a friend. Normally I would have eaten everything. But I didn't. I said I don't want any more. And it was a really good feeling. Because in the past I used to just nibble little bits so that people didn't think I ate much. But I am just being me now. Yes, if they don't like me, tough' (Section1.80, Para 226, GT);

> 'I am not having to diet, because my whole life has been ruled around food basically. Before WHEEL I thought, oh its dinner time, and if I am only on a diet, I'm thinking I wonder what I'll be able to have today, whereas when I am not on a diet, I am thinking oh I can have this. This is the first time in my life I'd gone for a whole year without being on a diet. And I didn't put any weight on, or very little. Whereas when I'd been on diets then not dieting has had always piled on. I am also more conscious of walking and other exercise it's maintained it' (Section 1.20, Para 60, AG).

6.4.5. Social support

Verheijden et al. (2005) have recently reviewed the role of social support in lifestyle-focused weight-management interventions. These investigators suggested social support intervention research would benefit from clear definitions of social support, including clearer description of the intended mechanism of action and the actual intervention, and the inclusion of perceived social support as a study outcome. The present study investigated the social support that participants thought they needed and received for maintaining exercise behaviour. The results suggest that the need for listening, informational, and challenge support, do not change substantially over time. However, the needed negative social support decreased albeit not significantly.

The intervention strategy adopted in the present study was successful in eliciting increased listening, informational, and challenge social support for exercise and decreasing received negative support. This, in turn, resulted in reduced discrepancy scores. Again, it is difficult to compare the results of the present intervention with those reported in other studies due to differences in operationalisation, measurement, and differences in intervention strategies (Verheijden et al., 2005). For example, the instrument used in the present study was specifically adopted to assess social support in the adoption of exercise (Anderson & Fox, 1998). In this respect, the findings on social support for exercise in the present study must be viewed in the context of its multi-component, client-centred intervention approach.

6.4.6. Importance of exercise settings in behaviour change

The QUAL data yielded an important aspect of exercise experience of participants. They were told how to monitor themselves, taking their pulse, and some were fitted with heart rate monitors. They knew how hard they worked and when to ask for help, if they were not sure, as one participant described it:

> 'When we take our pulse, when I can find it, I feel I am reaching my limits on this chart that you explained to us. And I am happy for that. I am happy because when I look at the chart, I'm very close to what these limits are. I think I'm damn well trying here and it doesn't matter to me that the person next to me, who may be a stone lighter, and years younger, could achieve more. That doesn't matter to me, I'm doing my damnest, and I'm achieving. That's all it matters to me and I enjoy feeling safe … Feeling safe is an enormous part of it and I just don't feel that I would feel safe joining another class or group. That's important to me at the size I am' (Section 1.52, Para, 148, JF).

Providing alternatives were instrumental in exercise adoption:

> **'**I always appreciate the way (the instructor) has an alternative. Always. She never makes you feel that there isn't something else you can do. Last week I was having a poor week. I was worried and I was sore. I couldn't do anything with weights. There was no criticism implied or said by (the instructor) or the group. It's just the general acceptance in WHEEL that you are working to your own limits. That is lovely. Also if we've been on a particular weight for a long time we are encouraged to try another one, equally if you are struggling one night, you

can step down a weight or two without a weight or just move. That's why I feel safe, because no matter what state I am, mentally or physically, when I walk into the WHEEL class, I will achieve something after years of achieving nothing. Every class I go to is more than I would do if I was sat at home and doing nothing. Every class' (Section 1.60, Para, 172, JF);

'I felt comfortable with WHEEL, because to me exercise was always something I should do, but never really fancied it. But then I thought, right, I am on this programme going to be tested, it's a lot of work, it's being done properly, I'll give it a go' (Section, 1.13, Para, 27, MC).

6.4.7. Giving up WHEEL: reasons for dropout

A number of reasons were provided by participants who dropped out of the programme. Some of the reasons were:

Depression:

'I'd given up WHEEL. Yes, because when I first did it, originally, I knew that I was on the waiting list for the stomach stapling. Then this was like my last chance (WHEEL) to do something other than that, and then I just thought I had just blown it. That's what I felt like and because I'd convinced myself in my head, and because my husband didn't want me to do it (operation), I actually don't really talk about it. You know I felt suicidal. I am not very good with my feelings' (Section 1.56, Para 150, GM).

Costs:

'Except those first three months. I don't know whether it had anything to do with the money as well. I mean I'm not saying it's expensive, but it was like we had to kind of make the most of it (free intervention), it's like if you don't go, it doesn't cost you. If you don't go then you save money' (Section, 1.60, Para 160, GM).

Being in the control group:

> 'It was hard waiting for three months, waiting for it to start' (Section, 1.118, Para 247, NE).

Personality clashes and control group effect when the two groups merged:

> 'I think one of the reasons I stopped going to Tai Chi was the fact that certain people had been going longer than me (six months longer). My mum noticed this, when she asked us to change into partners, they were very childish, they didn't want to, it sounds so ridiculous. They didn't want to change partners' (Section 1.375, Para 838, LMc).

And lack of time:

> 'I was hoping my work would fit in with the classes and everything, but quite honestly the time I have off, I don't have any energy to do anything else. I am tending to walk a lot, and get exercise that way more than anything' (Section 1.10, Para 21, SM).

These were just some of the reasons participants alluded to. See also Chapter 7 on evaluation of WHEEL for discussion.

6.4.8. Conclusion follow-up or maintenance phase

The participants in the present study which maintained the lifestyle intervention showed improved psychological functioning at 12-months follow-up, this despite the lack of significant weight loss. The adopted framework was successful in that participants felt more autonomous and less dependent on luck or change at the end of the intervention period. This study found a significant improvement in general well-being, lower perceived stress, improved health- and self-perceptions, as well as good social support for exercise.

‘I joined WHEEL to lose weight and get healthy and fit. And that is what has happened really, isn’t it? I think everything was interesting in WHEEL. I enjoyed everything really. Everything that we went to, meetings we got all the programmes, everything was interesting, there wasn’t anything that I thought oh well that has been a waste of time coming. I enjoyed them all. It’s always been something that has been there for me to look back to’ (Section 1.54, Para 149, EW).

Chapter Seven
Programme Evaluation

7.1. WHEEL programme evaluation

Following the completion of the maintenance phase at the 12 months of the WHEEL programme participants were asked to complete two questionnaires to assess aspects of what might have changed in their lives and an evaluation of the WHEEL programme. Below follows a brief description of both assessments. In addition, information from the QUAL data are used to highlight some of the issues related to the programme and how these affected participants.

7.2. What has changed?

The narrative below provides some evidence that the WHEEL programme had profound effect on some of the participant's life:

> 'The project what you've done made me feel that it was worthwhile having a go at trying to put my life right. Because I didn't really think that I had that many options. I just felt that I was going to have an early death and that was it. I really believed that. I just think it was, for the very first time, I'd been given the opportunity to, in a really non-judgemental way, talk about what the real problems were and think of a way, a positive way forward. I don't think I ever had that before. I was always fighting off this medical profession that was always very heavy-handed about everything, and very critical. Nobody really said it's your fault. Forget about things that you've done, forget about how you've got here, and let's think about how we can move forward. You really were the catalyst for all that and I wouldn't have done any of it without the project. I think, this is going to sound really dramatic, but you saved my life really. I would have been in such a downward spiral. I was rejecting all the help, I'd learn to reject and ignore and to bat off bad feelings … I would look in the mirror and see nothing below probably nose level. I just never saw the extent of the bad stuff really; it was just a way of not being hurt all the time. Because if you see it, and feel the

rawness and the pain of what that brings you to you every day, that's a torturous way to live, yet in itself it was killing me. You really provided a safe environment to say it's okay to look at it and to feel what my body is doing by exercising. I didn't feel my legs, body and torso. All of those things were just something that stopped my head from falling on the floor; they were not part of me. I had no sense of what they were, to touch, to feel, anything. It was always discomfort that I tried, always uncomfortable. Uncomfortable to see, to live in, and to move in that body. I've tried really hard to think of mechanism to avoid facing up to it really because it was too painful. You really provided me with an environment that allowed me to do that, because I think I needed to do it. I need to recognise that I do have a body and that perhaps I need to respect it a little bit more and help it. Now I do feel like that. Sometimes I take such a pleasure in just laying in bed, I will just lift my leg up and feel the muscles and I see how it looks, maybe just exercise it a little, stretch a bit, and I think those are my feet, and that's my ankle and oh look I have thighs and hips and things. I've got this body, and I think wow. I know that I don't have to be ashamed of it. I might actually get one I quite like. What am I going to do with it? I want to do stuff with it now, now I've found it, I want to use it. So that's how I feel' (Section 1.54, Para 146, JB, BMI 65kg/m^2).

Table 7.1: Mean and standard deviation for the 18-item what has changed questionnaire.

Item	**Mean (SD) (n = 19)**
1. How do you honestly feel about yourself at the moment? (Very bad – Very good)	4.47 (1.61)
2. How pre-occupied are you with losing weight? (Very pre-occupied – Not pre-occupied at all)	4.21 (1.36)
3. How guilty do you feel, every time you eat something a little bit ‘naughty’? (Very guilty – Not guilty at all)	3.84 (2.04)
4. How often do you engage in ‘all-or-nothing’ behaviour? That is, if you can’t do it all, or do it well, you don’t think there is any point of doing it at all? (Very frequently – Very infrequently)	5.05 (1.62)
5. How tempted are you to jump on the scales to weight yourself? (Very tempted – Not tempted at all)	4.26 (2.02)
6. How energetic do you feel in general? (Very lethargic – Very energetic)	4.68 (1.34)
7. In general (apart from temporary sicknesses), how healthy do you feel at the moment? (Very unhealthy – Very healthy)	4.89 (1.56)
8. When food comes up in conversation or in something you read or see, how much do you want to eat, even if you’re not hungry? (A lot – Not much at all)	4.42 (1.71)
9. How easy do you find it to control eating your favourite fatty foods? (Not very easy – Very easy)	3.89 (1.76)
10. How often do you eat when you’re not really physically hungry? (Very often – Not often at all)	4.05 (1.58)
11. How much control do you think you have over your eating? (Very little control – A lot of control)	4.16 (1.77)
12. How do your clothes feel at the moment? (Very tight – Very loose)	4.05 (1.51)
13. How well are you sleeping at the moment? (Not well at all – Very well)	3.63 (1.77)
14. How fit do feel at the moment?(Quite unfit – Quite fit)	4.16 (1.74)
15. How comfortable are you about doing some moderate walking for exercise? How confident are you that you can continue to exercise regularly? (Not comfortable at all – Very comfortable)	5.47 (1.58)
16. When you think about exercise, do you get an extremely negative, or an extremely positive picture in your mind? (Extremely negative – Extremely positive)	5.00 (1.70)
17. How certain are you that you can continue to exercise to keep your weight down for the rest of your life? (Not very certain – Very certain)	4.32 (1.77)
18. How often do you eat more (fatty food in particular) than you’d like when you are stressed, or something negative happens to you? (Very often – Not often at all)	3.53 (2.17)

At the end of the programme participants were requested to complete a 17-item questionnaire (7-point Likert scale), which asked them to think back to the start of the WHEEL programme and asked them what has changed (See Table 7.1 above). The participants who completed this questionnaire scored above the mean for most of the questions except for items 3 (guilt), 9 (control, see also item 10 and 11), 13 (sleep), and 18 (stress and eating). The below mean scores for these items reinforces some of the observations made at baseline. In particular, it suggests that participants are still likely to engage in eating whilst stressed and have difficulty controlling their food intake, and have negative emotions following such episodes. The issue of sleep has not been dealt with before. However, it appears that obese individuals have difficulty sleeping possibly due to their excess weight. This would be an interesting topic for further study. On the whole these data suggest the need for pre-intervention interventions as suggested previously in this thesis. This might include coping interventions to deal with stress and negative emotions in a more adaptive fashion (problem-focused coping strategies) and increasing perceptions of control (e.g., develop self-efficacy).

The present study mainly dealt with improving the participants' exercise behaviour. The two items related to this scored five or above (items 15 and 16). This would provide some support that the present intervention was successful in modifying aspects of exercise behaviour in this population. The scores for questions related to body weight were above the mean (item 2: pre-occupations with weight; item 5: weighing). These results also provide tentative support that the non-dieting approach adopted in the WHEEL intervention was an appropriate choice.

Finally, the participants rated themselves above the mean for general health (item 1 and item 7), vitality (item 6) and fitness (item 14). When compared with some of the baseline data this suggests that the intervention might have been of benefit to the participants in terms of improvement of general health. Again, this observation is supported by the QUAN and QUAL data obtained in this study.

7.3. Evaluation of WHEEL

Participants were also asked to complete a WHEEL programme evaluation form (see Appendix M). Results of the quantitative questions are presented in tables 7.2, 7.3 and 7.4. In addition, the responses of the participants to a number of the open-ended questions are presented in table 7.5.

Table 7.2: Rating of the different components of the WHEEL programme (frequency for each response category and percentage).

Item	Excellent	Good	Ok	Poor	Very Poor
Healthy eating	2 (11.8%)	6 (35.3%)	6 (35.3%)	3 (17.6%)	
Circuit classes	11 (64.7%)	4 (23.5%)	2 (11.8%)		
Aqua aerobic classes	6 (35.3%)	10 (58.8%)	1 (5.9%)		
Tai Chi classes	7 (41.2%)	7 (41.2%)	3 (17.6%)		
General support from team	7 (41.2%)	5 (29.4%)	5 (29.4%)		

Table 7.2 shows that the participants were generally happy with the classes provided during the WHEEL intervention. The circuit (88.2%), aqua aerobic (94.1%) and Tai Chi (82.4%) were generally scored as excellent or good. A number of the participants rated the healthy eating sessions as poor but on the whole the participants were happy with the support provided (70.6%). These figures suggest that the participants were content with the exercise and eating component of the WHEEL study, although it has to be mentioned that the number of completed questionnaires was relatively low and that there might have been a bias towards people who liked the programme (adherers) responding.

Table 7.3: Check list of changes during WHEEL.

Item	Yes	No	Don't Know
1. Feel healthier	13 (81.3%)	2 (12.5%)	1 (6.2%)
2. Have more energy	13 (81.3%)	2 (12.5%0	1 (6.2%)
3. Less hungry	6 (37.5%)	8 (50%)	2 (12.5%)
4. Less indigestion	6 (37.5%)	4 (25.0%)	6 (37.5%)
5. Feel more comfortable	13 (81.2%)	3 (18.8%)	
6. Clothes feel less tight	11 (68.7%)	5 (31.3%)	
7. Crave fatty food less	11 (68.7%)	5 (31.3%)	
8. Enjoy food more	7 (43.8%)	8 (50.0%)	1 (6.2%)
9. Less arthritic pain	5 (31.3%)	5 (31.3%)	6 (37.4%)
10. Sleeping better	7 (43.8%)	8 (50%)	1 (6.2%)
11. Less snoring	1 (6.2%)	5 (31.3%)	10 (62.5%)
12. Less tired during the day	10 (62.6%)	6 (37.4%)	
13. Less stressed	7 (43.8%)	7 (43.8%)	2 (12.4%)
14. Breathing more easily on exertion	12 (75.0%)		4 (25.0%)
15. Feel fitter	15 (93.8%)	1 (6.2%)	
16. More careful with shopping	12 (75.0%)	4 (25.0%)	

The results presented in table 7.3 support the notion that the WHEEL intervention was successful in improving the participant's fitness and health. However, a significant number of participants did not improve in stress levels, sleep, enjoyment of food (guilt), and feelings of hunger. The response to these items is similar as those presented in table 7.1 and reinforces the idea expressed in the previous paragraphs.

The results presented in Table 7.4 suggest that the intervention was successful in improving the participants' fitness and general alertness but not in changing the participants' work/general performance or communication skills.

Table 7.4: Response to whether WHEEL affected the following (scored on a 5-point Likert scale: 1 = Considerably better, 5 = Considerably worse).

Item	**Mean (SD)**
Your fitness	1.71 (0.59)
Your alertness	2.18 (0.73)
Your performance at work and in general	2.53 (0.94)
Communication with other	2.88 (0.49)

The QUAL date also highlighted a number of aspects of WHEEL that participants struggled with. Some of these issues might depend on individual characteristics of the participants:

> ‘Healthy eating sessions I’ve never mastered. Well not as much as I could have’ (Section 0, Para 426, AHa);

> ‘I found the eating diary and the CBT classes very difficult. I didn’t enjoy that, and I am not sure what I did do for you I did accurately. I can only say to you it wasn’t because I didn’t want to impart the information, it was in which you wanted to collect it. I didn’t feel that particularly encouraging for me’ (Section 1.22, Para 58, EJ).

There was a group of younger women, who quickly got fitter and they’ve tried to push the instructor to change the content of the class, even though there have been opportunities for everybody to go at their own space. They were starting to pick on people who they didn’t think did justice for WHEEL or tried hard enough. The majority though wouldn’t have it and they then chose to leave the programme. This is what one participant said about them:

> ‘I still feel angry about some of the people who are long gone. They’re no longer with the group. I think as they wavered, they tried to influence the group and

decisions. I think we have lost one or two people who might have stuck it out if it hadn't been for them. I think if I met one of these individuals on the street, I'd find it very hard to be civil' (Section 1.156, Para 445, TS);

The various tests had to be done at various establishments, some in the hospital (e.g. fitness test), and others at university (e.g. Bassey walking test). One of the testing sessions had to be cancelled as the person who took the bloods, hadn't turned up and the session had to be re-arranged, as one participant commented:

'I found that the test got done, sometimes it didn't get done. We kept turning up for ten minutes here, or half an hour there, and it was breaking up the day, and breaking up the time with your family. Maybe somebody hadn't turned up and this or that happened. It should have been all done in one go' (Section, 1.14, Para 29, LW).

Table7.5 provides information on some of the open-ended questions relating to what worked and suggestions for improvement.

Table 7.5: Participants responses to open ended questions relating to the WHEEL project.

Why do you think WHEEL worked for you?

- The exercises (3x)
- Lose weight at own pace
- Help solve other problems than weight
- Sensible advice
- Keep motivation to attend exercise classes (group therapy)
- Get more exercise incorporated in my everyday life
- Get me out of the house at night (2x)
- Feeling fitter
- Meeting other people of similar size, so I don't feel embarrassed
- Given me the information, means and support to tackle my weight problem

What aspects of WHEEL did you enjoy most?

- Exercise classes (5x) full of fun and variety
- Group meetings
- The people (3x) camaraderie, support from peers and instructors
- The advice
- Getting fitter

What are the needs you have were met by WHEEL?

- More confidence
- Group support
- Meeting other people with the same feelings and problems
- Problems are solved
- Haven't lost weight yet but hopefully reduce my weight soon
- Not losing weight which is discouraging, need more healthy eating support
- Needed to break habit of sitting in front of the TV on a night eating
- Needed to have an exercise class to suit my needs, not for really fit people
- Got me out of sitting in front of the TV, eating better food, and drink less.
- Lost weight, got fitter, and learned about how to change my lifestyle for healthier living.

What do you think of how we can improve the programme?

- Free classes to continue, programme to stay as it is (2x)
- Health eating classes could focus more on food (recipes, alternatives)
- Timing of Tai chi (difficult time and location, would be better in city centre) More healthy eating sessions
- More aqua aerobics
- Regular meetings in small groups
- A feeling of being left behind group
- Couldn't remember the way to do circuit exercises
- Lack of privacy for aqua aerobic class (in front of other members of public + changing rooms)
- Didn't feel there was enough individual time at component sessions to give examples and explanations
- Too much info at one time to learn ways of doing exercises
- Shame not everyone is as dedicated as Erika
- More comprehensive screening questionnaire before selecting candidates
- One group instead of two, smaller number of individuals
- Gym timetable/aqua aerobic timetable (during week rather than weekend) 2x
- Difficulty attending classes at international pool
- Group to meet every 2/3 months to evaluate and support each other
- Change format for classes every 3 weeks rather than 6 weeks
- Introduction of group 2 to programme (was a big deal).

Observations made by the researcher and results from the QUAL data provide some further suggestions for improvement of WHEEL. For example, some classes like Tai Chi become too advanced too quickly. It is really difficult to cater for everybody's aches and pains and to make the skill learning experience enjoyable, as you need to progress the exercises and they are set in a tradition. Each movement has a description as to how to execute it and you can only modify it so far. Participants who didn't want to follow the programme had a choice to do more of the other two activities (circuit training and aqua aerobics).

> 'Tai Chi I love, but it is beginning to leave me behind as I refuse to 'twirl', thinking of my knees. The timing is just right for me, but I realise this class must change (be even more adapted) to attract more people if it is to survive' (Section, 193, Para 269, JF);
>
> 'The only thing I probably didn't get anything from was the Tai Chi. That wasn't for me, that sort of thing. I know other people loved it, but to me I'm not a sort of floaty person' (Section, 1.123, Para 248, LP).

Others wanted to have the educational classes to be tagged either before or after the exercise sessions as well as have a time to chat after each class:

> 'Just get-togethers, talking things, like at the classes you just didn't have time to chat' (Section, 1.15, Para 332, SC).
>
> 'Talking more about the actual exercise sessions after the exercise. Going over it, see if people had found they had problems, talking about the exercise problems more. Not necessarily one-to-one, but even as a group, looking at what we're doing and possibly a little bit more of the education brought in as part of that,

rather than have them separately elsewhere. Possibly trying to incorporate that (Section 1.88, Para 178, TS).

Participants found it really hard that the different components were all at different venues, some in town, some at a periphery, and some at the university. It was impossible, given the university's infrastructure and because of the collaborative work with the council, to have all sessions at one venue:

> 'It would have been good to have all sessions in one building, so you were say in a health centre, then you could go and meet you or whoever was running it, and then to the gym next door, and then the swimming pool. I mean I know it has not been possible' (Section, 1.369, Para 826, LMc).

Others felt that there should have been more security and lighting around the gym. Often the lights would blow, and on one occasion a participant's car was broken into and an expensive child seat was stolen. She subsequently dropped out of the programme thereafter.

> 'There should be a lot more security' (Section 0, Para 426, AHa).

Participants also did not like the fact that there was a delayed start control group. Each group had their three months of intervention alone, and then the classes were merged for a practical point of view (e.g. instructor did two instead of four classes):

> 'What we have always said that you should have not had two groups. You shouldn't have split it. There was definitely a them and us. Not many of them have carried on, have they?' (Section 1.151, Para 306, LP).

It was also daunting for them to commit for four nights a week for a good part of three months:

> 'It's very difficult. I think one of the things that I found quite daunting when I first started WHEEL, I thought no sweat, four hours of exercise a week is not a lot. But when you actually come to try and fit that in, it's basically four evenings (if you are doing it in the evenings) a week. By the time you get to wherever it is, do an hour exercise, and get back, you've basically used up the evening. So it is far more demanding to do organised exercise' (Section, 1.92, Para 192, TS).

Finally, long term maintenance may have been undermined by expectations that are overly optimistic. For example, Oettingen and Wadden (1991) reported that women who initially held exceedingly optimistic fantasies about what their life would be like if they lost weight subsequently had less success in a 12 months weight management programme. Therefore, future studies should examine what losing weight means to the participants.

7.4. Conclusion evaluation

The significant dropout from the WHEEL programme (25 [40%] completed the one-year maintenance phase) suggests that there are a number of issues that could be improved to increase adherence. Some of the dropout was associated with the research design, others with facilities and personal issues (see also Figure 4.2). On the whole, participants would prefer more support for a longer period of time. However, the underlying philosophy adopted in this intervention was rarely questioned and provided a good basis for further studies.

Chapter Eight
Epilogue

8.1. Summary of findings

Obesity is a heterogeneous, complex, and chronic condition with large individual differences. Lifestyle modification has been widely acknowledged as the primary treatment for obesity. This PhD examined the effects of a non-dieting (e.g. no calorie-restriction), exercise-based lifestyle intervention programme using the tenets of the self-determination theory (SDT) to inform intervention decisions and identify individual differences, on physical and metabolic fitness, and psychological well-being among premenopausal, clinically obese women. WHEEL focused on health outcomes rather than weight loss. Participants were given an intervention rationale for the emphasis of exercise adoption and cessation of calorie-restriction, but offered choice, and their perspective within the process of interventions was acknowledged, whilst pressure was minimised on compliance.

The findings of this mixed method, RCT feasibility study, for the QUAL component at baseline indicated that participants enrolled in WHEEL experienced societal prejudice in various aspect of their lives, such as healthcare, at home, during social interactions, and at work, with 86% experiencing at least one such episode. The QUAN findings at baseline showed that this cohort reported much higher stress levels than other comparable populations. Furthermore, those with the higher BMI experienced increased levels of stress. Participants also reported high prevalence of emotional eating practices, and dieting, as well as weight cycling periods. Only just over half of the cohort reported good to excellent health status, which was expected. Fitness level ($V0_2$max) at baseline was below the 10% percentile for women, systolic and diastolic blood pressure were higher than normal, and triglyceride levels and total cholesterol were borderline high (ACSM, 2000). Furthermore, 31 (50%) of samples met the IDF criteria for metabolic syndrome. Of these 17 (28%) were in the initial intervention group (IIG) and 14 (23%) were in the delayed start control group (DSCG). Additionally, the integrated QUAL and

QUAN results showed that the psychological health of this cohort was significantly poorer at baseline than other comparable populations on a variety of measures, such as self-reported depression, high stress, low levels of general well-being, self-esteem, poor self-perceptions, and self-regulations (e.g. low in autonomy and high in impersonal orientation). They were not inclined to consult health professionals regarding their health issues and were externally orientated. Their ideal weight loss expectations were also found to be much higher (35%) than those previously reported by other studies. Furthermore, the participants reported significantly higher discrepancies between their current and ideal body shapes.

In WHEEL, the intensive 12-week intervention phase yielded significant improvements in psychological functioning of participants in IIG, with a significant but modest weight loss. However, the biggest improvements were observed in psychological functioning, including a 29.9 % increase in general well-being (all subscales), bringing up the IIG from ‘severe’ distress to the ‘moderate’ distress category. This suggests that the adopted approach in the present study was successful in improving the participants’ well-being over a relatively short period of time. Other improvements were observed in self-esteem (athletic, appearance, and global self-worth; which showed the greatest discrepancy from norm values at baseline) and perceived social support. Self-perceptions at the domain and global level also improved over a relatively short period of time. There were no differences found in the state self-esteem scale as measured by the SSES from baseline to 12 weeks. Participants in the DSCG showed a significant increase in their body image dissatisfaction over the 12-week waiting period. Although the IIG also showed a decrease in this variable this was not significant. Overall received social support for exercise increased significantly in the IIG group. The need for support did not change during the RCT phase resulting in a decrease in the discrepancy between received and needed social support for exercise.

It was found that in the absence of significant weight reduction, this cohort derived modest benefits in maximal cardiorespiratory capacity and cardiac reserve form a three-month exercise-based intervention. Furthermore, a significant improvement was found in VO_{2peak} (normalised for body weight) of the IIG group. Approximately, 9% increase was found in relative VO_{2peak} in the IIG compared with a 4% reduction in the DSCG. The present study found unadjusted mean VO_{2peak} change of 3.0 $ml \cdot kg^{-1} \cdot min^{-1}$ in the IIG compared with the DSCG, consistent with the significantly greater improvements associated with structured exercise-training. But the improvement in relative VO_{2peak} in the present study is considerably lower than in other studies in similar populations. Participants also showed a 13% increase in absolute VO_{2peak} ($ml \cdot min^{-1}$) compared with DSCG.

In summary, within the 12-week intensive intervention period of this RCT study, intensive lifestyle modification incorporating moderate-intensity supervised exercise can modestly improve VO_{2peak} in a small cohort of sedentary, obese, pre-menopausal women, accompanied with significant improvements in psychological functioning.

In the maintenance phase, from base line to 12-month follow-up, participants assigned to both IIG and DSCG conditions showed significant improvements in psychological functioning, including perceived stress and general well-being (all subscales). The average for the total score of the GWB schedule for those completing the programme at 12 months was 74.4 (±16.64). This value would bring the group as a whole into the 'positive' well-being category. At the individual level 13 participants could be categorised as having 'positive well-being', five as being 'moderately distressed', and seven still in 'severe distress'. The adopted framework might be particularly efficacious among participants with psychological distress. Furthermore, most subscales of the SPP showed a significant improvement form baseline to 12 months. These results indicate that the intervention was successful in improving participants' self-perceptions in different domains of their lives as well as their global self-esteem. An interesting finding was that all participants completing the study (irrespective of randomisation) perceived themselves to be more autonomous at 12 months. There was also a significant decrease for the group, as a whole, at 12-month follow-up for the impersonal scale and there was also a significant decrease in the 'chance' subscale of the MHLC indicating that the participants considered themselves less fortuitous. Furthermore, there was a significant positive correlation between autonomy, emotional control, and stability, job competence, household, intimate relations, and global self-worth subscales of the SPP, and negatively with perceived stress.

In summary, in line with the prediction of the self-determination theory's framework, participants felt significantly more autonomous, less reliant on others, and felt more in control of their condition. However, more research is required to explore the tenets of SDT in the context of lifestyle interventions.

Social support results at 12 months suggest that the need for listening, informational, and challenge support did not change substantially over time. The intervention strategy adopted in the present study was successful in eliciting increased listening, informational, and challenge support for exercise and decreasing received negative support. This in turn resulted in reduced discrepancy scores.

However, there was a significant dropout from the WHEEL programme at 12 months (40% completed) suggesting that there are a number of issues that could be improved to increase adherence. Some of the dropout was associated with research design, others with facilities and personal issues. On the whole, participants would have preferred more support for a longer period of time. However, the underlying philosophy adopted in this intervention was rarely questioned and provides a good basis for further studies.

In summary, the finding that participants in the present study did not have a significant reduction in weight at 12-month follow-up does not appear to be an anomaly in comparison to other studies. However, the significantly improved psychological profile of those participants who completed the assessment at 12 months would indicate that the adopted approach was successful. This work was an RCT feasibility study and could form a basis for a definitive RCT trial.

8.2. Limitations of the study

Research designs in relation to weight loss are theoretically complex and practically problematic (Lean, 2000). Participants recruited to obesity-management trials commonly hope to achieve effective sustained weight reduction. As discussed by Ware (2003), the control arm of any obesity-related intervention presents a set of conceptual issues not seen in many areas of therapeutic development. A parallel delayed start control arm was an ethical requirement of the present study. Ideally, such patients would not embark on therapeutic/behavioural plans during the control period beyond the standard recommendations. Connelly (2002) has highlighted that in behavioural interventions the control condition is particularly important and is usually far from ‘inactive’. Accordingly, control conditions can evoke and meet either positive or negative expectancies (Crow, Gage, Hampson, Hart, Kimber, & Thomas, 1999) including the ‘resentful demoralisation’ described by Oakley (2000, p. 282) of those ‘excluded by randomisation’ in addition to other subjective effects of the control condition.

Consistent with these observations, although all randomised participants showed some reduction in perceived stress during the RCT phase of the present study, less favourable effects on intrinsic motivation, internal health locus of control, and global self-worth were evident among participants initially randomised to the delayed start control condition. Historically, such effects have been reported to lead to high dropout rates in obesity studies (Ware, 2003). The present study also showed higher levels of intervention non-compliance and study dropout in the delayed start group.

The findings from the WHEEL study may be limited specifically to the context of female obesity management. In good agreement with the intervention strategy, Delahanty et al. (2006) note that women-only exercise interventions appear to target some of the potential exercise barriers for obese women and may improve motivation and self-efficacy. Another limitation of this study could be that all but one of the participants were Caucasian; the approach may also be more appropriate for Caucasian women than those from other ethnic backgrounds (Miller & Jacob, 2001). Additional studies are needed to verify whether the lifestyle intervention strategy and findings in the present study would be similar in other ethnic groups and older female participants. A problem with most clinical trials is that the people who volunteer for this may not be representative of individuals who seek to lose weight (Byrne, 2002). However, strength of the present study was that it was run in a community setting. Many prospective studies have been conducted in university settings. Such an environment might not be conducive or typical to weight loss.

The selection of psychological instruments was guided by previous intervention studies. In the last few years obesity-specific questionnaires have been developed to assess for example quality of life. It has been suggested that specific instruments are better at detecting change over time. On the other hand, some of the obesity-specific questionnaires are only available commercially and would add unnecessary additional cost to interventions. Finally, a number of limitations will also be addressed in the next section which will be combined with future recommendations.

8.3. Future recommendations

Based on the present intervention a number of lessons have been learned. Blue and Black (2005) have recently provided guidelines for the evaluation of exercise and dietary obesity intervention studies. These will be used to consider important issues for future obesity intervention studies:

(1) *Theory connected to programme components and outcomes*.

This PhD measured causality orientation, indicating individual differences among participants based on the tenets of SDT. The various components and delivery of the interventions were designed to maximise participants' engagement with the intervention by satisfying their basic need for autonomy, connectedness, and skill-learning. In future, an adapted version of the treatment self-regulation questionnaire could be used to check level of autonomy support from practitioners. However, it is complicated in a sense that there were several practitioners working with this group (e.g. EB, Tai Chi instructor, CBT therapist, aqua instructor, circuit instructor). Autonomy support from different providers should be checked independently. Furthermore, in the light of new research on self-control, global, and specific self-efficacy for exercise and diet, ego-depletion, coping ability and basic need satisfaction should also be assessed in future studies.

(2) *Programme components and their relevance to the problem and population*.

The content of each component in WHEEL was guided by exercise prescription guidelines. There was a choice across different PA/exercise types, where participants were encouraged to learn exercise and sporting skills (e.g. Tai Chi). In each different exercise type (Tai Chi, aqua, circuit – 2 sessions, one is more strength-based; the other is more interval training type) all instructors always named the different movements and these were also posted on the walls around the circuit stations and in the hall, where the Tai Chi took place. The frequency, type, and time (four hours per week, could be accumulative, but two of these had to take place in the WHEEL class of their choice) were determined, but the intensity and how long they carried on with a particular exercise within each session were participant-driven, based on their functional limitations and health.

Functional limitations of each participant should have been assessed prior to the start of the exercise, and maybe participants should have been divided into groups depending on this assessment. Furthermore, they could have had their classes at different times. However, with a delayed start control group present this was not possible in WHEEL.

The Brief CBT therapy sessions were not compulsory, but strongly advised. This component could have been improved by providing it for the duration of the WHEEL programme instead of only three weeks. Also, it could have offered more individually tailored sessions addressing various sub-clinical eating problems, such as restrained eating, tendencies to binge, night eating problems, and so on. Cooking skills of participants and nutritional knowledge should also have been assessed (and possibly developed).

The content of the educational classes were good and well received, however, it took another night of the week, making it too time consuming for participants. This could be delivered maybe as an intensive weekend session next or before a scheduled exercise class.

(3) *Practicality and feasibility of WHEEL.*

The practicalities of the project with regards to delivery should be reconsidered. There were too many different professionals with different abilities and skills involved. For example, testing took place at many different places, with many different practitioners, which was difficult for both the participants and EB (organisation and co-ordination). There should be a dedicated team of practitioners with clearly defined roles to assess each aspect of health indices. Recently, there is a unique Obesity Treatment Centre opened in Rotherham (1st in the UK), which encompasses these recommendations, as they have both an inter-disciplinary and a multi-disciplinary team working on site, with specialist rooms for nutritional education, exercise hall with adaptive equipments, and counselling space. All tests are co-ordinated, carried out, and analysed at the centre, ready for feedback for participants.

(4) *Preference of change strategies*.

There should have been more involvement of participants with regards to choices that they made. For example, those who took the eating behaviour sessions had nowhere to continue their progress after the sessions ceased. Although they were referred back to their GPs, it was not a satisfactory solution.

(5) *Moderating and extraneous variables*.

The effect of such variables, as SES on adherence, should have been explored more. Collaboration with various research and local establishments should have been more tightly managed. Choices of venue for exercise (e.g. poor lighting in car park) should have been managed more effectively, but in this project EB had no choice as both instructor and venue were provided free by the local authority.

Although fidelity issues were addressed (e.g. EB was present throughout the project at every testing, every class etc.) the communication should have been better between the local council exercise instructor and EB. More relapse and prevention strategies should have been in place.

(6) *Recruitment, retention, intervention adherence, and relapse*.

Each component of WHEEL should have been evaluated more rigorously. Although adherence was closely monitored, there were no relapse-coping interventions. Relapse and plateau were only addressed in the educational sessions.

(7) *Dose-response/strength*.

More identification of how each particular exercise component affected muscle strengths and cardiovascular fitness. In future, components of such exercise interventions should each be tested for effectiveness and appropriateness, whilst considering functional limitations. How much, how often, and for whom, needs to be established.

(8) *Therapeutic index and safety factor*.

There were no ill effects reported from participating in WHEEL; all feedback received was constructively positive and complementary. All test results were fed back to participants. If there were problems they were addressed (e.g. with high blood pressure before exercise testing, they were put on a 24-hour blood pressure monitor before the test took place). Participants with sub-clinical eating disorder disclosures and sleep problems were referred back to their GP for specialist appointments (e.g. one participant was found to have sleep apnoea. This referral resulted from the weight history interview, where the participant disclosed that she was often found sleeping on the toilet at work and had encountered work-related problems because of that). However, participants could have benefitted if given a 'personal' progress file that had all their tests results and handouts enclosed. In the present study, feedback on tests results was given individually in a verbal form. All handouts from all of the sessions should have been also enclosed.

(9) *Process evaluation and suggestion for future process of interventions*.

See Figure 8.1 (below) for suggested outcomes measures, and treatment process.

(10) *Dependent variables*.

See first Figure 8.1 (below) for this. In addition, the present study complements the recent research focus on the role of a non-dieting weight-management approach by including other important psychological dimensions such as general well-being, and a multidimensional measure of self-esteem.

However, there is a need to measure self-control and ego-depletion. Obesity interventions take place in a complex environment. There is an urgent need to overcome the ‘policy cacophony on obesity’ (Lang & Rayner, 2007), as the directives with regards to each components and the wholeness of obesity treatment programmes are just impossible to know about and implement. Thus far nobody very few researchers and policy makers have looked at this from the participant point of view how these multiple component programmes affect their responsiveness. Future research should explore how individual components (e.g. exercise-adoption alone and eating behaviour change alone, then combined) affects ego-depletion, and therefore one’s ability to fully benefit from such a programme as WHEEL over an extended period of time. For example, a woman aged 46 years with a BMI of 48kg/m^2 who has never exercised would have to face the following obstacles to engage with the activity: What do I wear? Where do I buy my xxx-large sports bra? What is comfortable to wear when my thighs are rubbing? How do I get to the gym (wearing exercise or everyday clothes as I don’t want to undress in front of others)? Will there be others staring at me when I exercise? And so on. All of these thoughts are depleting the cognitive capacity of a person even before they started the exercise programme.

Figure 8.1: Proposed behavioural treatment model for obesity (see next page).

Behavioural Treatment Model for Obesity
THE WHEEL APPROACH
(Obesity treatment as a chronic condition)

Participant Screening

1. Personality differences (causality orientation; basic needs; self-control; perceived competence (general); specific self-efficacy (e.g., exercise, eating)
2. Body image dissatisfaction
3. Eating behaviours (prevalence and severity of emotional eating (e.g., restraint eating); weight cycling history; cooking skills; nutritional knowledge
4. Goals expectations (personal (general & specific); programme (general & specific))
5. Health perceptions and perceptions of risk
6. Functional limitations (Sharma & Kushner classification)
7. Pervious exercise behaviour
8. Coping skills (problem focused coping strategies)
9. Social support

No Issues
Enrol in intervention programme

ISSUES
Pre-Intervention Intervention
(e.g. Health care climate (i.e., autonomy support for self-regulation)

Intervention Programme
(Exercise component: physical exercise environment; exercise type, frequency, duration, intensity, scheduling; functional limitation; exercise leaders; social support)

Outcome Measures: Psychological, Fitness, & Metabolic

Maintenance: Relapse prevention, social support for participants
(Longer interventions with more intense support)

Therefore, it is hypothesised and future research should explore whether a poor self-regulator would be more overwhelmed or not by the task than an efficient self-regulator. It is presumed that someone with good self-regulation would be able to plan more effectively using a variety of resources. However, when a person is sabotaging oneself (Baumeister & Scher, 1998), can they be really helped before the reasons for that have been dealt with, such as sexual abuse?

> 'Well I think, I haven't quite got my head around this year, but I now disassociate and I am trying to be more in my body. But at the moment I am dealing with remembering what my father did to me when I was little and I've not quite remembered it yet. But I know that my sexuality is all hidden in my weight. If the weight wasn't there I might be more sexual. So I think it hides the weight' (Section 1.67, Para 177, DS).

Questions like: How do individuals with different weight status self-regulate compared to each other? Are those with high weight status poor self-regulators? Need to be asked in the future. Additionally, how do environment and the interpersonal relationships moderate participants' perceptions of control will also be an important issue for consideration in future studies.

An environment that has boundaries but is also enabling (autonomy support) by providing choices within the programme content as well as opportunities for meaningful social interactions will enhance participants' perceived competency.

(11) *Sustaining intervention effects*.

There should have been more focus on participants' acceptance of the intervention appropriateness (e.g. expectations were still there with regards to large weight loss). Obesity should be treated as a chronic condition with long-term support.

Despite these limitations, the current study provides additional support to move away from traditional weight-loss centred obesity treatment approaches towards a non-dieting, evidence-based healthy lifestyle approach to weight management among clinically obese women (Miller & Jacob, 2001). Such an approach can establish health and psychological well-being independently of weight loss (Bacon et al., 2002; Ciliska, 1998).

8.4. Sustainability of WHEEL in the community

After WHEEL, the research project finished, and EB withdrew from the field, although keeping in close touch with participants who continued to exercise, as the next phase was about rolling out WHEEL like classes across the city. One of the problems was that the council was not able to introduce charges for health-screening for prospective participants, and they had to open the class up to anyone who saw themselves 'overweight'. Therefore, new people who often came to the class were only marginally overweight and were very capable. They just wanted to join 'women-only' classes. The skill level of the WHEEL participants and their body size and shape still remained a factor in their ability to exercise. One participant eloquently described how the instructor was not able to read these differences and how it felt for her, a regular participator:

> 'Two new ladies came. Being quite fair to … (the instructor), she was appalled when I told her, she hadn't intended it. I felt that she was sort of shoving off a little bit to these ladies and the way she was demonstrating the moves far beyond anything that she would expect us to do, even in the foreseeable future. It was certainly way beyond what we were capable of doing at that stage. In trying to do it, I actually felt unsafe. I felt this is pushing me beyond the limits I am capable of

and she is not noticing it. I told her that. She was contrite and apologetic' (Section 1.44, Para 127, JF).

8.5. Life after WHEEL

Some of the following reflections sum up the participants' overall experiences: A 'thank you letter' from JB at 12 months, who also had never exercised before read:

'Within the project we each made a commitment to exercise for four hours a week in some form or other. It sounds like enormous amount, I realise, but it took many forms. We could go the organised classes, or do aqua aerobics or Tai Chi or choose something of our own if that fitted better with our lifestyles. We had lots of encouragement and lots of support and everything was tailored to our needs. Traditional classes were modified according to our fitness levels and mobility and then the main thing was that we were never made to feel anything other than special human beings who were beginning to change their lives. We learnt that as we became fitter, slowly but surely we would actually want to eat in a healthier way because our bodies would be asking for different things. So we learned that what we were eating was not motivated simply by gluttony but by need. So guess what? We didn't have to feel guilty about it anymore. No more dieting. If we needed chocolate we ate chocolate. No more denial. We learned that's what normal people did if they fancied a bit of something, they'd just have it. Wow. I hadn't realised that. This wasn't a slimming project; it was a project about getting fitter and being able to make choices about your lifestyles. Some people lost weight, some didn't. I've since joined a gym, I go swimming twice a week and I feel as though I potentially have a future I can look forward to. I came out of being able to reach to paint my toenails, get out of the chair without being in agony and with the realisation that and I know it's an old cliché, but if I can do it ... Anyone can.

Another participant's lifestyle, mental well-being, and assertiveness improved:

> 'Well I've changed my job, I do my nails. I have got more confidence now than I had before. I wouldn't have gone for interview, I wouldn't have bothered. I'd stayed at my old job forever, because it was just there. I also feel better about myself, like exercise helps with stress. I also stopped taking Prozac, which I was on before. Before you are doing the exercise even if you just feel better for a few hours afterwards, it's just alright. I mean people have said to me oh you do more than I do, even thin people, because they don't do exercise' (Section 0, Para 408, AG).

Others learnt to appreciate more the body they lived in:

> 'In the last year I have become aware of trying to love myself, in terms of not expecting somebody else to do things for me, but for inside me, I have this sort of parent inside me that talks to me, and says oh lets go and get your hair cut, like this week, I went and got my lips waxed. I mean it's a really big thing because it's something nice for me. I also go and have a massage once a month and it's something that I think of as necessary as I have such a lot of stress to deal with. So I have been making changes' (Section 1.23, Para 60, DS).

Some final words: many of the participants are still in touch with EB. Interestingly, those who stayed in touch send me letters and pictures of their achievements. A more recent one from JF reads (picture attached), who had never exercised before WHEEL:

> 'Yes, it's really me – Flying over … at 3000 feet and then a magical experience in the clouds at 5000 feet. You gave me back life I had forgotten even existed and I remain so grateful to you for that. I am thinking about what to do next – have already ticked off horse-riding, ice-skating, microlighting, country dancing,

incredibly high heels … what next I wonder? Am still thinking about climbing that mountain!

To JF: I do hope you will climb that mountain!

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Appendices

INFORMATION SHEET

This is an invitation to take part in the WHEEL (Weight, Healthy Eating, & Exercise in Leeds) Research Project at Leeds Metropolitan University. Thank you for your interest expressed in participating in this study. This programme is designed for helping you to become fit.

The study will examine several variables, including activity/exercise, diet/nutrition, eating behaviours, body weight/body composition, general health/health history and risk of diseases and will last for a year. During the study we would want to keep records of your exercise and food intake. In order to monitor how effective the exercise programme is we will do blood tests on some of the participants, but you have a choice to withdraw at any time from the study.

If you wish to join it would involve attending an orientation, answering a battery of questionnaires in your own time, blood test before and after the completion of the study, having body measurements taken to determine body composition, and adhering to an exercise plan.

This study is designed to develop a formalised exercise programme and we will not prescribe a diet for you, but will help you choose the best type of exercise for you (to match your individual lifestyle and needs).

Thank you again for your interest in the WHEEL Study. Recruitment and selection of participants will take place over a 3 month period. The study will start in January. You will be contacted if you are selected to participate in December. We look forward to hearing from you. If you have any questions please do not hesitate to contact us. Please let me remind you that you are free to leave this project whenever you wish without giving any reasons.

Kind regards,

Erika Borkoles

Appendix B: Information letter to interested participants, including participant information sheet and brief screening instrument.

Dear All,

Thank you ever so much for enquiring about the study. Please find enclosed an information sheet and a screening questionnaire.

Can you please return them as soon as possible?

This programme is comprehensive and will ask you to invest some time in your health. It is essential that you would be committed to do 4 hours of physical activity of your choice per week. If needed childcare facilities will be provided.

A few of you expressed concern about the amount of physical activity involved. The aim of the project is to help you manage your weight by becoming fitter. Successful incorporation of physical activity in your lives leads to long-term successful weight management.

Please remember that this is not a bootcamp. It is anticipated that you may be very unfit. We are not going to ask anything from you what you can't do. The whole point of the project is that help you to make a successful transition from being unfit to being fit and learn to enjoy being active.

We are currently running a circuit class for diabetics, and some of the women there were really big. When they came to the class, they started off doing exercises in a wheelchair or sitting on a bench or chair. Now, after a year they can walk without help. I consider that an achievement. But they were dedicated and kept going to the classes. That sort of attitude leads to success.

For the period of study the structured classes will be free. You will have an option of attending of a circuit class, just for overweight women (this will run twice a week Tuesdays 8-9 and Thursdays -7-8, on Fridays there will be a Tai Chi class, and on Saturday there will be an aqua aerobic class for the participants of the study. In addition, you will have a choice of coming with me and other participants for a brisk walk in the woods, or walk in your own time anywhere you like. In addition, there will be educational classes about eating behaviours, benefits of being active and so on. More specifically, you'll learn about how your body works, for example, many overweight women skip meals, especially breakfast. This is not a good idea. When your blood sugar level is low, then you naturally crave for sweet things.

Anyhow, hopefully your questions will be answered if you are asked to participate in the study. Thank you again for you interest.
Kind regards,

INFORMATION SHEET

To: Individuals interested in participating in a research study.
From: Erika Borkoles

The WHEEL (Weight, Healthy Eating, & Exercise in Leeds) programme, Leeds Metropolitan University thank you for your interest expressed in participating in our study. To achieve the aims of this study several variables will be examined, including diet/nutrition, activity/exercise, eating behaviours, body weight/body composition, general health/health history and risk of diseases. Participants of the study will be actively involved for the 1 year period. Participants are required to:

1. attend orientation
2. answer a battery of questionnaires and be interviewed in-depth
3. keep detailed 7-day food and activity records once a month
4. have blood specimens analysed twice during the study
5. have body measurements taken to determine body composition (% fat)
6. have special measurements to determine caloric needs.

The potential risks of the study are minimal, but risks of the venipuncture at the time the participants' blood is drawn include:

1. Syncope (fainting) - incidence varies with participant population; should not exceed 5% of the subjects.
2. Bleeding at the site of venipuncture with hematoma (bruise) formation. Incidence varies with the technique and experience of the researcher (who in this case is very experienced - he is the resident physiologist on the Leeds Healthy Heart Programme). It should not exceed 5%.
3. The incidence of infection from venipuncture is extremely low and has not been accurately measured.
4. Anaemia - the amount of blood being drawn should in no way substantially contribute to or create an anaemic condition in an individual.
5. Muscular injury - Supervision during all testing and exercise classes will be provided - Instructions on correct exercise techniques will be given.

This study is not a dietary intervention study in that it will not prescribe a diet for you. However, you will be guided in your search for the most suitable intervention for you, and you'll be asked to tell us about what worked or didn't work for you and why. In return for you participation you will receive a complete 'nutrition and activity profile' as well as blood lab test results. In addition, you will be contributing to an important area of research. The spaces are limited therefore enrolment for the WHEEL study will be selective and dependent on your meeting the inclusion criteria. If you have a friend who would like to participate in the study, please let them know about the enrolment procedure.

Thank you again for your interest in the WHEEL Study. Recruitment and selection of participants will take place over a 3 months period. You will be contacted if you are selected to participate. We look forward to hearing from you. If you have any questions please do not hesitate to contact us.

To help us to choose the participants according to criteria please provide us with the following information:

Your name:
Your height:
Your weight:
Date of birth:

Are you pregnant or breastfeeding?

Yes: ☐ No: ☐

How do you rate your health?

Poor: ☐ Fair: ☐ Good: ☐ Excellent: ☐

How often are you depressed?

Never:☐Rarely:☐ Often: ☐ Very often: ☐

Are you currently taking any medications?

Yes: ☐ No: ☐ If yes, describe:

Do you have any major current illnesses?

Yes: ☐ No: ☐ If yes, describe:

Have you been hospitalised for a psychological disorder within the last 5 years?

Yes: ☐ No: ☐ If yes, describe:

How much education have you had?

Left school at 16: ☐ at 18: ☐ graduated: ☐ higher degree: ☐

Are you employed:

P/T: ☐ F/T: ☐ Student:☐ Unemployed:☐Retired: ☐

How did you hear about this study? Please describe:

Appendix C: Participant invitation to take part in the WHEEL study.

WHEEL Research Project: Weight, Healthy Eating, and Exercise in Leeds

Participant Information Sheet

This is an invitation to take part in a study to help overweight women adopt a healthy life style with the aim of losing weight.

After completing an entrance form, you will be chosen on the basis of your weight and medical fitness. We will contact your General Practitioner to ask whether you are fit to exercise. We will then contact you to discuss this programme in a group with other participants. We propose to have two groups, one will start in January and the second in March.

There will be an initial assessment involving completion of questionnaires to assess your motivation and a test of your ability to exercise by walking or cycling. This will take about 4 hours. During this test we will monitor your heart rate and breathing. Following this assessment, you will be enrolled into the programme in which we will guide and encourage you to take a minimum of 4 hours exercise per week. This exercise will be varied and include walking, exercise in a gym, swimming and Thai Chi (non contact mobility exercise). All programmes have been specially adapted to suite overweight individuals and will be adapted to your ability.

This exercise and healthy eating programme will initially be for a period of 3 months. Afterwards there will be an option to continue for a full year.

After the 3 months exercise programme, we will evaluate the effect of the healthy lifestyle by repeating the evaluation tests (as above) and again after the full 12 months. Some participants will be asked for a blood test to assess the programme at the beginning and at the end (10mL about 2 teaspoons).

This programme of exercise will be free for the first 3 months only. Afterwards, you will have to pay for the formal sessions but the guidance from Ms Borkoles will be free.

This is a research programme and you are able to drop out without giving any reason at any stage if you do not wish to continue.

Erika Borkoles
Tel: Leeds (0113) 283-2600 ext 3578 (answerphone if not attended)
School of Leisure and Sport Studies
Leeds Metropolitan University
Caedmon Hall, G21,
Beckett Park Campus
Leeds
LS6 3QS

Appendix D: Consent form

WHEEL - WEIGHT, HEALTHY EATING AND EXERCISE IN LEEDS Participation Consent Form

Director:
Dr Sean Carroll,
Leedsmet

Leeds Metropolitan University
School of Leisure and Sport Studies
Caedmon Hall, Room G21
Beckett Park Campus,
Headingley,
Leeds
LS6 3QS

Phone: 0113 283 2600

Name of Participant (Upper case):...

Name of Researcher (Upper case):..................ERIKA BORKOLES............................

THIS SECTION TO BE COMPLETED BY THE PARTICIPANT

	Please cross out as necessary
Have you had an opportunity to ask questions and discuss this study?	YES / NO
Have you received satisfactory answers to all your questions?	YES / NO
Have you received enough information about the study?	YES / NO

The study has been explained to you by whom?...

Do you understand that you are free to withdraw from the study:

- At any time
- Without having to give a reason for withdrawing — YES / NO

Do you understand that:

- You will be given a fitness test before your enrolment
- We will monitor your heart rate and breathing during testing
- The interviews/focus groups will be recorded
- The interview transcriptions and other results may be used in publications
- Your identity will not be revealed at any time or in any publication — YES / NO

I agree that data from my tests can be used in future publications. — YES / NO

Do you agree to take part in this study? YES / NO

Signed (Participant):.. Date:.........................

Signed (Researcher):.. Date:.........................

Signed (Project Director):.. Date:.........................

RESEARCH ASSOCIATE: ERIKA BORKOLES	Leeds Metropolitan University	TELEPHONE: 0113 283 2600 extension: 3578	email:E.Borkoles@lmu.ac.uk

Appendix E: Form to be completed by participants' GP.

Dr's Name in Capitals……………………………………………………..

__________________________(applicant's name) has applied for joining the WHEEL (Weight, Healthy Eating and Exercise in Leeds) project's exercise classes run by Erika Borkoles at Leeds Metropolitan University. The purpose of this class is to enable women to learn exercise skills to exercise (keep fit classes) and adopt physical activity (walking the stairs, instead taking the escalator etc.) into their lifestyles. This class is designed for helping people who have been living a sedentary life. It accommodates all abilities and there is an alternative option for all movements, including using chairs if needed be.

The programme requires participants to exercise at a moderate intensity (50-69% of maximum heart rate) for at least 30 minutes. The exercise sessions include a warm up, exercise at a designated heart rate, conditioning exercises, resistance training, cool down exercises, and stretching in the context of circuit training, walking and aerobics sessions.

The exercise programme is administered by qualified personnel trained in conducting safe and progressive exercise to music programmes. All testing will be carried out by experienced and qualified medical staff.

If your patient is taking any medications cardiac or metabolic that may affect exercise response. If so please indicate the manner of the effect.

Type of medication:____
Effect: ____

Please indicate any recommendations or restrictions that are appropriate for your patient in this exercise programme. Please note again that participants will be given alternatives and modifications for each exercise depending on their skills and fitness. They can also do chair exercises, specially developed for those whose mobility is restricted.

If you know of any medical or other reason why participation in this exercise programme would be unwise, please indicate:

____
____
____

By completing this form you are not assuming any responsibility for our administration of the exercise programme. If you have any questions about the 'WHEEL' programme please call:

Erika Borkoles Tel no: 0113 283 2600 x 3578

Doctor's signature:___________________________ Date:_______________
Address:____
_______________________Tel: ________________

PRE-EXERCISE QUESTIONNAIRE
Please take 3 minutes to answer the following questions.
Just tick the appropriate box to indicate 'Yes or Not Sure'.

Name:____

Address:____
Tel:____________________

Person to be contacted in case of accident:
____
Phone nos:

HAVE YOU EVER OR DO YOU HAVE? Please tick the appropriate box.
Anyone in your family under 60 suffered Heart Disease, Stroke, raised Cholesterol or Sudden Death?

Are you NOT used to regular moderate or vigorous exercise?
Have you been hospitalised recently?
Do you have any infections or infectious diseases?
Are you pregnant?

DO YOU HAVE OR HAVE YOU HAD? Please tick the appropriate box.

gout		glandular fever		any heart condition	
stroke		rheumatic fever		heart murmur	
diabetes		dizziness or fainting		high blood pressure >140/90	
epilepsy		stomach or duodenal ulcer		palpitations or pains in the chest	
hernia		liver or kidney condition		raised cholesterol/triglycerdes	

If you ticked any of the boxes above, please give details of conditions, medications and approximate date cleared:
____
____
____
____

HAVE YOU EVER OR DO YOU HAVE? Please tick the appropriate box.

arthritis		Any pain or major injuries particularly the following areas?			
asthma		neck		back	
cramps		knees		ankles	
muscular pain					
Do you smoke?		Are you dieting or fasting?			

Are there any conditions which may be reason to modify your exercise programme?

What exercise have you been doing recently? Exercise Type:________________________________

Intensity (circle): vigorous moderate light How long:_________________ How often?_________________

Please read the following exercise advise carefully
Should you suffer any injury, illness or condition in the future. Please tell me by completing this form again.

STATEMENT

I recognize that the instructor is not able to provide me with medical advice. The information above is treated as confidential and as a guideline to the limitations of my ability to exercise. I have answered the questions to the best of my ability and understand the advice above.
Signed:____ Date:____________________

HOW ACTIVE ARE YOU?			
What is your attitude to physical activity? Please tick boxes as appropriate			How active are you? Please tick boxes as appropriate
1. 2.	Would you like to take more physical activity than you currently do at the moment? □□□yes □□□no What benefits would you like to get from taking more physical activity? □□□to feel in better shape □□□to improve my health □□□to get out of doors □□□to feel a sense of achievement □□□to control my weight □□□to have fun	1. 3.	Do you ever walk for more than 15 minutes, instead of using your car or the public transport? □□□yes □□□no If yes, how many minutes do you walk in an average week? minutes Do you ever go out for a walk for more than 15 minutes, for recreation or health? □□□yes □□□no If yes, how many minutes do you walk in an average week? minutes
3.	What prevents you from taking as much physical activity as you would like? □□□I don't have time □□□I don't have energy □□□I am not the sporty type □□□I don't feel I have the skills to exercise □□□I don't feel comfortable in the gym □□□I don't need to be more active □□□I don't enjoy exercise	3.	Do you ever take part in any leisure activities of moderate intensity? For example, activities which leave you feeling warm and slightly out of breath? □□□yes □□□no If yes, how many minutes do you walk in an average week? minutes
		4.	Finally, do you ever take part in more vigorous exercise or sports? For example, activities which leave you feeling out of breath and sweaty? □□□yes □□□no If yes, how many minutes in an average week do you do this kind of activity? minutes

Dear

Please find enclosed an information sheet and a screening questionnaire. This programme is designed to help you become healthier and will probably involve a change in your life to do about 4 hours of physical activity of your choice per week. The aim of the project is to help you manage your weight. Successful incorporation of physical activity in your lives leads to long-term successful weight management. There are lots of studies in the weight management area, which support this view and we have experience in managing exercise classes for overweight women with diabetes. We expect you to be relatively unfit and we are aiming to introduce a gentle exercise programme to you. We are not going to ask anything from you that you can't do. The whole point of the project is to help you to make a successful transition from being unfit to being fit and learn to enjoy being active. If needed childcare facilities will be provided.

For the period of study the structured classes will be free. You will have an option of attending a circuit class, just for overweight women (this will run twice a week Tuesdays 8-9 and Thursdays -7-8). On Fridays, there is a Tai Chi class, and on Saturdays there will be an aqua aerobic class for the participants of the study. As you become fitter, we will have group walks. These will initially be in the park nearby, but with agreement could be anywhere else that is convenient. IF YOU ARE ABLE TO ORGANISE A SUITABLE PHYSICAL ACTIVITY PATTERN FOR YOURSELF, YOU ARE VERY WELCOME TO DO SO. IT IS NOT COMPULSORY TO ATTEND THE CLASSES OFFERED, BUT IT IS EXPECTED THAT YOU COMPLY WITH THE REQUIREMENTS OF THE STUDY (i.e to do two of WHEEL sessions a week, plus two hours of your choice agreed with me, to make up the four hours of physical activity a week, for at least half an hour duration if you can).

The first step in the programme will be a meeting to explain out project and I will write to let you know when this will be.

Kind regards,

Erika Borkoles

Appendix H: Information blood and body composition tests + sheet for including obtained values.

BLOOD AND BODY COMPOSITION TEST

This is a standard test which is used widely for assessing the metabolic fitness and fat % of individuals.

The whole test period should last approximately 20 minutes.

The blood test itself will involve you to give 2 teaspoons (10mL) of blood. If we can't find your vein in two trials, we will not continue on with the test. The test is carried out by a very experienced physiologist.

The body composition test will involve you to have four adhesive electrodes attached to your left hand and foot with various cables going to a body composition recording machine.

In preparation for the test:

1. Do not have anything to eat 12 hours before the test.

2. You are free to drink water but please keep a record of how many cups you have had.

3. Wear a short sleeved top.

Thank You.

BODY COMPOSITION ASSESSMENT - CIRCUMFERENCES

Name:	**D.O.B:**	
Date:	**Height:**	**Weight:**

Body	1	2
Shoulders		
Chest		
Waist (bottom of rib cage & hip bone and measure half way between these0		
Minimum Waist (buttom of the rib)		
Abdomen		
Hips (buttocks)		

LEFT	1	2
Thigh		
Arm		
Forearm		
Wrist		
Knee		
Calf		
Ankle		

RIGHT	1	2
Thigh		
Arm		
Forearm		
Wrist		
Knee		
Calf		
Ankle		

BODY COMPOSITION ASSESSMENT - SKINFOLDS

Name:	**D.O.B:**	
Date:	**Height:**	**Weight:**

Body	1	2	3
Subscapular			
Suprailiac			
Abdominal			
Thigh			
Calf			

RIGHT	1	2	3
Triceps			
Biceps			

BODY COMPOSITION ASSESSMENT - BLOOD TEST

Name:	**Age:**	**Norm Sports**
Date:	**Height:**	**Weight:**
	Nationality:	

Body	Beginning	Middle	End
Menstrual Cycle			
Cups of Drink before test			
Medication - diuretics			
Exercise			
Alcohol			
Urination			
Distance Between Pads - hands			
Distance Between Pads - feet			

Values	1	2
Body Fat/%		
Body Fat/ Kg		
Total Fat/%		
BMI		
BMR Kcal		
T.Wgt Kg 062>974		
Body Resistance		
Lean /Kg		
Lean/%		
Wtr Lt./PTs		
Wtr/%		
Total Wtr/%		

Appendix I: Score sheet for Bassey walking test

BODY COMPOSITION ASSESSMENT - Walking test

Name:	**D.O.B:**	
Date:	**Height:**	**Weight:**

Slow	**Distance**	**Blood Pressure**	**HR**

Moderate	**Distance**	**Blood Pressure**	**HR**

Fast	**Distance**	**Blood Pressure**	**HR**

CARDIOPULMONARY EXERCISE TEST

This is a standard test which is used widely for assessing the exercise capacity of individuals.

The whole test period should last approximately 30 minutes and during this time you will be exercising on a treadmill for between 10 to 20 minutes depending on your fitness.

The exercise test itself will involve you walking on a treadmill. The speed of the treadmill and the steepness of the treadmill will be increased every 3 minutes. This means that the exercise workload will increase. You will be expected to keep exercising until you reach a point where you think (perceived) you cannot keep going anymore due to exhaustion or leg fatigue.

Whilst exercising you will have a rubber mouthpiece in your mouth through which we will measure the amount of air you are breathing in and out. You will also have to wear a nose clip so that all of your breathing occurs through your mouth. The nose clip can be a little uncomfortable and the rubber mouthpiece does make the back of your mouth very dry whilst at the same time you will produce lots of saliva in the front of your mouth.

During the exercise you will have your heart rate recorded continuously. This will mean that you will have some adhesive electrodes attached to your back with various cables going to a heart recording machine. You will also have your blood pressure recorded every few minutes via a cuff on your arm.

In preparation for the test:

1. Do not have anything to eat 1.5 to 2 hours before the test.
2. Come wearing or ready to change into trainers or comfortable walking shoes.
3. Wear a loose fitting top. This makes it easier to attach the electrodes.
4. Wear jogging or loose fitting trousers.

Thank You.

Dear All,

RE: WHEEL

I am writing to you concerning the start of the Exercise Programme for Group 2 and the Healthy Eating Sessions. The Healthy Eating sessions will start on…. Until…, and they will be held at …..in ….from 6.30 pm to 8pm, on Tuesdays. …is going to take the sessions. This room is on the ground floor of the building. Please bring with you your eating diaries, and all outstanding documents which you haven't given to me yet (e.g. doctor's consent etc.).

I enclosed the session outlines for you. Look forward to seeing you in the classes. If you have any problems at all, please let me know. I shall attend to all the circuit classes and the Tai Chi and Aqua Aerobic, so you can discuss with me any issues arising after the sessions.

Kind regards,

Erika

REGULAR CLASSES

MONDAYS Circuit Class - 7-8 pm at
(Please wear supportive trainers and loose clothing)

TUESDAYS Healthy Eating Sessions - - 6.30 to 8pm

WEDNESDAYS Circuit Class - 7-8 pm

Individual surgery hours with Me
10am-12pm, 2-4pm (please ring me to arrange time and appointment and let me know in advance what would you like to do (e.g. practice in the gym, or just to have a chat etc.)

FRIDAYS 4.30 - 5.30, Tai Chi Sessions

SATURDAYS: Aqua Aerobic Session SATURDAYS

The sessions are from 3.45 to 4.45 every Saturday.

Appendix L: End of 12 month letter

Dear

RE: WHEEL

I am writing to you concerning the End of the Project Evaluation. I hope that you are well and that you are able to continue with the lifestyles changes you have made so far. I would like to thank you for you co-operation and your wonderful input to the project. I would also like to invite you for a final, follow up interview to find out any recent news about you and to hear your views on how to make future similar projects more workable for you. In that context your final results will also be discussed and you will be given a hard copy of it. You can contact me on the above address and phone number. Hope to hear from you soon.

UPDATE ON CLASSES

The classes are there for you. You know that these classes are there for you as long there is a need, even though the programme has finished. The times for the classes are: Tuesdays and Thursdays 8-9pm. The class on Wednesdays (gentle class) starts at 7pm.

I hope that you are well. Kind regards,

Erika

Interview Guide Baseline

Introduction

- Welcome
- Individual consent for audio-taping the interview
- Confirmation of confidentiality agreement; participants understand that their names will not be used in any way, nor will information will be shared that reveals their identity in any way.
- Inform participants that any time during the interview the tape recorder can be turned off, and that they can withdraw from the study at any time.

Getting to know the person:

- Tell me about yourself?
  - What is the reason for you being here?
    - What concerns do you have about your weight?
    - What other concerns do you have?

Pressures from Others:

- What effect weight has on your life?
  - Tell me more about your weight problem
- Have you ever experienced prejudiced about your appearance?

  if yes,
- Tell me more about it?
- How did you feel about it?
- What is it like for you to cope with these pressures, prejudices?

Weight Loss

- How has your weight changed over the years?
  - What do you think the reason for your weight change?
- Have you ever tried to lose weight?

  if yes,
- What techniques have you used?
- Tell me more about it.
- Have you ever been concerned about your weight?

  if yes,
  - In what way?
  - What is a good thing about your weight?
  - What is a bad thing about your weight?
- Have you ever had to stop doing some activity because of your weight?

  if yes,
- Tell me more about it.

- Physical Activity Patterns:
- How do you see your progress in the programme in terms of adopting physical activity into your life?
  - What activities have you enjoyed in the past?
- What do you think you need to do to achieve the enjoyment of being physically active again?
  - What are your immediate goals?
  - What are your distant goals?

Healthy Eating:

- What is your relationship with food?
  - How do you see your progress in adopting a healthier eating pattern and habits?
  - What are your immediate goals?
  - What are your distant goals?

Health Status:

- How is your health presently?
- Do you take any medication at the present?
- how much and how often?

Moving about:

- How do you go around town or travel to work?
- How do you think you can increase your activity to and from work?
  - How do you think you can increase your activity at home?

Motivation:

- What made you decide to do something about your weight?
- How motivated are you to succeed in this programme?
  - How do you see yourself in three months time?
  - How do you see yourself in a year from now?

End:

- Thank you for participating

Interview Guide – 2^{ND} Round of Interviews

Introduction

- Welcome
- Individual consent for audio-taping the interview
- Confirmation of confidentiality agreement; participants understand that their names will not be used in any way, nor will information will be shared that reveals their identity in any way.
- Inform participants that any time during the interview the tape recorder can be turned off, and that they can withdraw from the study at any time.

How are you?

How things are going for you at the moment?
How do you honestly feel about yourself at the moment?
How do you find the programme so far?
How is your health presently?
Do you take any medication at present?
How much and how often?

Behaviour

How often do you engage in ‘all-or-nothing behaviour?
How much control do you think you have over your eating?

Motivation

What keeps you going?
How do you keep motivating yourself?

Weight Loss

How has your weight changed in the course of the programme?
What do you think the reason for your weight change?

Physical Activity:

What do you enjoy about physical activity?
What benefits or drawbacks do you experience from doing exercise?

Moving about:

How do you go around town or travel to work?
Any change in physical activity to and from work?
What about home?

END

INDIVIDUAL STYLES QUESTIONNAIRE (GCOS)

On the following pages you will find a series of vignettes. Each one describes an incident and lists three ways of responding to it. Please read each vignette and then consider the responses in turn. Think of each response option in terms of how likely it is that you would respond in that way. We all respond in a variety of ways to situations, and probably each response is at least slightly likely for you. If it is very unlikely that you would respond the way described in a given response, you would circle number 1 or 2. If it is moderately likely, you would respond in the mid range of numbers; and if it is very likely that you would respond as described, you would circle the 6 or 7. You should circle one number for each of the three responses on each vignette. Below is a sample item. The actual items begin on the next page.

THIS QUESTIONNAIRE IS VOLUNTARY. YOU DO NOT HAVE TO FILL OUT IF YOU DON'T WANT TO.

<u>EXAMPLE</u>

You are discussing politics with a friend and find yourself in sharp disagreement. It is likely that you would:

Press forward with your viewpoint and try to get him/her to understand it.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

Change the topic since you would feel unable to make your point understood.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

Try to understand your friend's position to figure out why you disagree.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

1. **You have been offered a new position in a company where you have worked for some time. The first question that is likely to come to mind is:**

a) What if I can't live up to the new responsibility?

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

b) Will I make more at this position?

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

c) I wonder if the new work will be interesting?

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

2. **You had a job interview several weeks ago. In the mail you received a form letter which states that the position has been filled. It is likely that you might think:**

a) It’s not what you know, but who you know?

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

b) I am probably not good enough for the job.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

c) Somehow they didn't see my qualifications as matching their needs.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

3. **You are a plant supervisor and have been charged with the of allotting coffee breaks to three workers who cannot all break at once. You would likely handle this by:**

a) Telling the three workers the situation and having them work with you on the schedule.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

b) Simply assigning times that each can break to avoid any problems.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

c) Find out from someone in authority what to do or do what was done in the past.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

4. **You have just received the results of a test you took and you discovered that you did very poorly. Your initial reaction is likely to be:**

a) "I can't do anything right", and feel sad.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

b) "I wonder how it is I did so poorly", and feel disappointed.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

c) "That stupid test doesn't show anything", and feel angry.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

5. **When you and your friend are making plans for Saturday evening, it is likely that you would:**

a) Leave it up to your friend; he (she) probably wouldn't want to do what you'd suggest

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

b) Each make suggestions and then decide together on something that you both feel like doing

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

c) Talk your friend into doing what you want to do.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

6. **You have been invited to a large party where you know very few people. As you look forward to the evening, you would likely expect that:**

a) You will try to fit in with whatever is happening in order to have a good time and not look bad.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

b) You'll find some people with whom you can relate.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

c) You will probably feel somewhat isolated and unnoticed.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

7. **You are asked to plan a picnic for yourself and your fellow employees. Your style for approaching this project could most likely be characterised as:**

a) Take charge: that is, you would make most of the major decisions yourself.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

b) Follow precedent: you're not really up to the task so you would do it the way it has been done before.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

c) Seek participation: get inputs from others who want to make them before you make the final plans?

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

8. **Recently a position opened up at your place of work that could have meant a promotion for you. However, a person you work with was offered the job rather than you. In evaluating the situation, you are likely to think:**

a) You didn't really expect the job; you frequently get passed over.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

b) The other person probably "did the right things" politically to get the job.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

c) You would probably take a look at factors in your own performance that led you to be passed over.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

9. **You are embarking on a new career. The most important consideration is likely to be:**

a) Whether you can do the work without getting in over your head.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

b) How interested you are in that kind of work.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

c) Whether there are good possibilities for advancement.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

10. **A woman who works for you has generally done an adequate job. However, for the past two weeks her work has not been up to par and she appears to be less actively interested in her work. Your reaction is likely to be:**

a) Tell her that her work is below what is expected and that she should start working harder.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

b) Ask her about the problem and let her know you are available to help work it out.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

c) It is hard to know what to do to get her straightened out.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

11. **Your company has promoted you to a position in a city far from your present location. As you think about the move you would probably:**

a) Feel interested in the new challenge and a little nervous at the same time.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

b) Feel excited about the higher status and salary that is involved.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

c) Feel stressed and anxious about the upcoming changes.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

12. Within your circle of friends, the one with whom you choose to spend the most time is:

a) The one with whom you spend the most time exchanging ideas and feelings.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

b) The one who is the most popular of them.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

c) The one who need you the most as a friend.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

13. **You have a school-age daughter. On parents' night the teacher tells you that your daughter is doing poorly and doesn't seem involved in the work. You are likely to:**

a) Talk over with your daughter to understand further what the problem is.

1 2 3 4 5 6 7
Very unlikely Moderately likely Very likely

b) Scold her and hope she does better.

1 2 3 4 5 6 7
Very unlikely Moderately likely Very likely

c) Make sure she does the assignments, because she should be working harder.

1 2 3 4 5 6 7
Very unlikely Moderately likely Very likely

14. **Your friend has a habit that annoys you to the point of making you angry. It is likely that you would:**

a) Point out each time you notice it, that way maybe he (she) will stop doing it.

1 2 3 4 5 6 7
Very unlikely Moderately likely Very likely

b) Try to ignore the habit because talking about it won't do any good anyway.

1 2 3 4 5 6 7
Very unlikely Moderately likely Very likely

c) Try to understand why your friend does it and why it is so upsetting for you.

1 2 3 4 5 6 7
Very unlikely Moderately likely Very likely

15. **A close (same gender) friend of yours has been moody lately, and a couple of times has become very angry with you over 'nothing'. You might:**

a) Share your observations with him/her and try to find out what is going on for him/her.

1 2 3 4 5 6 7
Very unlikely Moderately likely Very likely

b) Ignore it because there is not much you can do about it anyway.

1 2 3 4 5 6 7
Very unlikely Moderately likely Very likely

c) Tell him/her that you are willing to spend time together if and only if he/she makes more effort to control him/herself.

1 2 3 4 5 6 7
Very unlikely Moderately likely Very likely

16. **Your friend's younger sister is a freshman in college. Your friend tells you that she has been doing badly and asks you what he (she) should do about it. You advise him (her) to:**

a) Talk it over with her and try to see what is going on for her.

1 2 3 4 5 6 7
Very unlikely Moderately likely Very likely

b) Not mention it; there is nothing he (she) could do about it anyway.

1 2 3 4 5 6 7
Very unlikely Moderately likely Very likely

c) Tell her it is important for her to do well, so she should be working harder.

1 2 3 4 5 6 7
Very unlikely Moderately likely Very likely

17. **You feel that your friend is being inconsiderate. You would probably:**

a) Find an opportunity to explain why it bothers you; he (she) may not even realise how much it is bothering you.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

b) Say nothing; if your friend really cares about you he (she) would understand how you feel.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

c) Demand that your friend start being more considerate; otherwise you'll respond in kind.

1	2	3	4	5	6	7
Very unlikely			Moderately likely			Very likely

INDIVIDUAL RESPONSE FORM - 17 vignettes

NAME____

DATE____

1.	a________________	2.	a________________	3.	a________________
	b________________		b________________		b________________
	c________________		c________________		c________________
4.	a________________	5.	a________________	6.	a________________
	b________________		b________________		b________________
	c________________		c________________		c________________
7.	a________________	8.	a________________	9.	a________________
	b________________		b________________		b________________
	c________________		c________________		c________________
10.	a________________	11.	a________________	12.	a________________
	b________________		b________________		b________________
	c________________		c________________		c________________
13.	a________________	14.	a________________	15.	a________________
	b________________		b________________		b________________
	c________________		c________________		c________________
16.	a________________	17.	a________________		
	b________________		b________________		
	c________________		c________________		

ARE YOU WELL? (General Well Being Schedule)

This is a questionnaire designed to measure how you feel and how things have been going with you. There is, of course, no right answer for any statement. The answer is what you feel is true of yourself at this moment. Be sure to answer all of the items, even if you are not certain of the best answer. Again, answer these questions as they are true for your RIGHT NOW. THIS QUESTIONNAIRE IS VOLUNTARY. YOU DO NOT HAVE TO FILL OUT IF YOU DON'T WANT TO.

			Answer which best applies to you (Circle one)		
1.	During the last month, how have you been feeling in general?	1. 2. 3. 4. 5. 6.	In excellent spirits In very good spirits In good spirits I have been up and down in spirits a lot In low spirits mostly In very low spirits	[1] [2] [3] [4] [5] [6]	λ1
2.	During the past month, how much have you been bothered by nervousness or your 'nerves'?	1. 2. 3. 4. 5. 6.	Extremely so; to the point where I could not work or take care of things Very much so Quite a bit Some; enough to bother me A little bit Not at all	[1] [2] [3] [4] [5] [6]	λ2
3.	Have you been in firm control of your behaviour, thoughts, emotions or feelings?	1. 2. 3. 4. 5. 6.	Yes, definitely so Yes, for the most part Generally so Not too well No, and I am somewhat disturbed No, and I am very disturbed	[1] [2] [3] [4] [5] [6]	λ3
4.	Have you felt so sad, discouraged, hopeless, or had so many problems that you wondered if anything was worthwhile?	1. 2. 3. 4. 5. 6.	Extremely so; to the point that I have just about given up Very much so Quite a bit Some; enough to bother me A little bit Not at all	[1] [2] [3] [4] [5] [6]	λ4
5.	Have you been under or felt you were under any strain, stress, or pressure?	1. 2. 3. 4. 5. 6.	Yes, almost more than I could bear or stand Yes, quite a bit of pressure Yes, some - more than usual Yes, some - but about usual Yes, a little Not at all	[1] [2] [3] [4] [5] [6]	λ5

			Answer which best applies to you (Circle one)		
6.	How happy, satisfied, or pleased have you been with your personal life?	1. 2. 3. 4. 5. 6.	Extremely happy, could not have been more satisfied or pleased Very happy Fairly happy Satisfied; pleased Somewhat dissatisfied Very dissatisfied	[1] [2] [3] [4] [5] [6]	λ6
7.	Have you had any reason to wonder if you were losing your mind, or losing control over the way you act, talk, think, feel, or of your memory?	1. 2. 3. 4. 5. 6.	Not at all Only a little bit Some; but not enough to be concerned or worried about some and I have been a little concerned Some and I am quite concerned Yes, very much and I am very concerned	[1] [2] [3] [4] [5] [6]	λ7
8.	How anxious, worried, or upset have you been?	1. 2. 3. 4. 5. 6.	Extremely so; to the point of being sick or almost sick Very much so Quite a bit Some; enough to bother me A little bit Not at all	[1] [2] [3] [4] [5] [6]	λ8
9.	How often have you been waking up fresh and rested?	1. 2. 3. 4. 5. 6.	Every day Most every day Fairly often Less than half the time Rarely None of the time	[1] [2] [3] [4] [5] [6]	λ9
10.	How often have you been bothered by any illness, bodily disorder, pains, or fears about your health?	1. 2. 3. 4. 5. 6.	All the time Most of the time A good bit of the time Some of the time A little bit of the time None of the time	[1] [2] [3] [4] [5] [6]	λ10
11.	How often has your daily life been full of things that were interesting to you?	1. 2. 3. 4. 5. 6.	All the time Most of the time A good bit of the time Some of the time A little bit of the time None of the time	[1] [2] [3] [4] [5] [6]	λ11

			Answer which best applies to you (Circle one)		
12.	How often have you felt downhearted and sad?	1. 2. 3. 4. 5. 6.	All the time Most of the time A good bit of the time Some of the time A little bit of the time None of the time	[1] [2] [3] [4] [5] [6]	λ12
13.	How often have you been feeling emotionally stable and sure of yourself?	1. 2. 3. 4. 5. 6.	All the time Most of the time A good bit of the time Some of the time A little bit of the time None of the time	[1] [2] [3] [4] [5] [6]	λ13
14.	How often have you felt tired, worn-out, used-up, or exhausted?	1. 2. 3. 4. 5. 6.	All the time Most of the time A good bit of the time Some of the time A little bit of the time None of the time	[1] [2] [3] [4] [5] [6]	λ14

For each of the four scales below, note that the words at each end of the 0 to 10 scale describe opposite feelings. Circle any number along the bar which seems closest to how you have generally felt <u>during the past month.</u>

15.	How concerned or worried about your health have you been?	0 1 2 3 4 5 6 7 8 9 10 [0] [1] [2] [3] [4] [5] [6] [7] [8] [9] [10]			λ15
		Not at all concerned		Very concerned	
16.	How relaxed or tense have you been?	0 1 2 3 4 5 6 7 8 9 10 [0] [1] [2] [3] [4] [5] [6] [7] [8] [9] [10]			λ16
		Very relaxed		Very tense	
17.	How much energy, pep, and vitality have you felt?	0 1 2 3 4 5 6 7 8 9 10 [0] [1] [2] [3] [4] [5] [6] [7] [8] [9] [10]			λ17
		Not energy at all, listless		Very energetic, dynamic	
18.	How depressed or cheerful have you been?	0 1 2 3 4 5 6 7 8 9 10 [0] [1] [2] [3] [4] [5] [6] [7] [8] [9] [10]			λ18
		Very depressed		Very cheerful	

For each of the questions below, circle one answer which best applies to you.

			Answer which best applies to you (Circle one)		
19.	During the past year have you had severe enough personal, emotional, behaviour, or mental problems that you felt you needed help?	1. 2. 3. 4. 5.	Yes, and I did seek professional help Yes, but I did not seek professional help I have had (or have now) severe personal problems, but have not felt I needed professional help I have had very few personal problems of any serious concern I have not been bothered at all by personal problems during the past year	[1] [2] [3] [4] [5]	λ19
20.	Have you ever felt that you were going to have, or were close to having, a nervous breakdown?	1. 2. 3.	Yes, during the past year Yes, more than a year ago. No	[1] [2] [3]	λ20
21.	Have you ever had a nervous breakdown?	1. 2. 3.	Yes, during the past year Yes, more than a year ago. No	[1] [2] [3]	λ21
22.	Have you ever been a patient (or outpatient) at a mental hospital, a mental health ward of a hospital, or a mental health clinic, for any personal, emotional, behavioural, or mental disease?	1. 2. 3.	Yes, during the past year Yes, more than a year ago. No	[1] [2] [3]	λ22
23.	Have you ever seen a psychiatrist, psychologist or psychoanalyst about any personal, emotional, behavioural, or mental problems concerning yourself?	1. 2. 3.	Yes, during the past year Yes, more than a year ago. No	[1] [2] [3]	λ23
24.	Do you discuss your problems with any members of your family or with your friends?	1. 2. 3. 4. 5. 6. 7.	Yes, and it helps a lot Yes, and it helps some Yes, but it does not help at all No, I do not have anyone I can talk with about my problems No, no one cares to hear about my problems No, I do not care to talk about my problems with anyone No, I do not have any problems	[1] [2] [3] [4] [5] [6] [7]	λ24

25. Have you talked with or had any connection with any of the following about some personal, emotional, behavioural, or mental problem, worries, or 'nerves' concerning yourself during the past year?

		Consulted About Problems (Circle one)		
a.	Regular medical doctor (except for definite physical conditions or routine check-ups)	Yes [1]	No [2]	λ25
b.	Brain or nerve specialist	Yes [1]	No [2]	λ26
c.	Nurse (except for routine medical conditions)	Yes [1]	No [2]	λ27
d.	Lawyer (except for routine legal matters)	Yes [1]	No [2]	λ28
e.	Police (except for simple traffic violations)	Yes [1]	No [2]	λ29
f.	Clergy person, minister, priest, rabbi, etc.	Yes [1]	No [2]	λ30
g.	Marriage counsellor	Yes [1]	No [2]	λ31
h.	Social worker	Yes [1]	No [2]	λ32
I.	Other formal assistance Describe:______________________________	Yes [1]	No [2]	λ33

		How often have you felt or behaved this way last week? (circle one for each item)				
	During the past week:	Rarely or none of the time (less than 1 day)	Some or a little of time (1-2 days)	Occasionally or a moderate amount of time (3-4 days)	Most of all of the time (5-7 days)	
26.	I was bothered by things that usually don't bother me	[1]	[2]	[3]	[4]	λ34
27.	I did not feel like eating. My appetite was poor.	[1]	[2]	[3]	[4]	λ35
28.	I felt that I could not shake off the blues even with help	[1]	[2]	[3]	[4]	λ36
29.	I felt that I was just as good as other people	[1]	[2]	[3]	[4]	λ37
30.	I had trouble keeping my mind on what I was doing	[1]	[2]	[3]	[4]	λ38
31.	I felt depressed	[1]	[2]	[3]	[4]	λ39
32.	I felt that everything I did was an effort	[1]	[2]	[3]	[4]	λ40
33.	I felt hopeful about the future	[1]	[2]	[3]	[4]	λ41
34.	I thought my life had been a failure	[1]	[2]	[3]	[4]	λ42
35.	I felt fearful	[1]	[2]	[3]	[4]	λ43
36.	My sleep was restless	[1]	[2]	[3]	[4]	λ44
37.	I was happy	[1]	[2]	[3]	[4]	λ45
38.	I talked less than usual	[1]	[2]	[3]	[4]	λ46
39.	I felt lonely	[1]	[2]	[3]	[4]	λ47
40.	People were unfriendly	[1]	[2]	[3]	[4]	λ48
41.	I enjoyed life	[1]	[2]	[3]	[4]	λ49
42.	I had crying spells	[1]	[2]	[3]	[4]	λ50
43.	I felt sad	[1]	[2]	[3]	[4]	λ51

44.	I felt that people disliked me	[1]	[2]	[3]	[4]	λ52
45.	I could not get 'going'	[1]	[2]	[3]	[4]	λ53

ARE YOU STRESSED? (Perceived Stress Scale)

This is a questionnaire designed to measure how stressed you are. Answer these questions as they are true for your RIGHT NOW. THIS QUESTIONNAIRE IS VOLUNTARY. YOU DO NOT HAVE TO COMPLETE IT IF YOU DON'T WANT TO.

Beside each statement there is a scale which ranges from never (0) to very often (4). For each item we would like you to circle the number that represents the extent to which you disagree or agree with the statement. Please make sure that you answer every item and that you circle only one number per item. This is a measure of how stressed you are; obviously there are not right or wrong answers.

0 = Never
1 = Almost Never
2 = Sometimes
3 = Fairly Often
4 = Very Often

		N	AN	S	A	FO
1.	In the last month, how often have you been upset because something that happened unexpectedly?	0	1	2	3	4
2.	In the last month, how often have you felt that you were unable to control the important things in your life?	0	1	2	3	4
3.	In the last year, how often have you felt nervous and 'stressed'?	0	1	2	3	4
4.	In the last month, how often have you dealt successfully with irritating life hassles?	0	1	2	3	4
5.	In the last month, how often have you felt that you were effectively coping with important changes that were occurring in your life?	0	1	2	3	4
6.	In the last month, how often have you felt confident about your ability to handle your personal problems?	0	1	2	3	4
7.	In the last month, how often have you felt that things were going your way?	0	1	2	3	4
8.	In the last month, how often have you found that you could not cope with all the things that you had to do?	0	1	2	3	4
9.	In the last month, how often have you been able to control irritations in your life?	0	1	2	3	4

PLEASE TURN OVER

		N	AN	S	A	FO
10.	In the last month, how often have you felt that you were on top of things?	0	1	2	3	4
11.	In the last month, how often have you been angered because of things that happened that were outside of your control?	0	1	2	3	4
12.	In the last month, how often have you found yourself thinking about things that you have to accomplish?	0	1	2	3	4
13.	In the last month, how often have you been able to control the way you spend your time?	0	1	2	3	4
14.	In the last month, how often have you felt that difficulties were piling up so high that you could not overcome them?	0	1	2	3	4
15.	In the last month, how often have you felt that your bills were piling up so fast that you could not pay them?	0	1	2	3	4
16.	In the last month, how often have you felt that you were effectively coping with important changes that were occurring in the world?	0	1	2	3	4
17.	In the last month, how often have you felt that the things you do in life are important?	0	1	2	3	4
18.	In the last month, how often have you found yourself spending too much money?	0	1	2	3	4

WHEEL - RESEARCH QUESTIONNAIRE
We need YOUR help

This research project has been initiated by Erika Borkoles in collaboration with a team of researchers. It is concerned with helping overweight women adopt a healthy life style with the aim of losing weight.

Please be assured that your responses will remain entirely anonymous. Your return of this questionnaire will be taken as permission to use the data in our analysis.

---

1. Age: [ ] 2. Gender: M F

3. How much weight do you feel you need to loose? [ ]

4. How much weight do you think you will lose during the programme? [ ]

5. Occupation:________________________________

6. Marital Status (circle one)

Married Single Engaged Separated Divorced Widowed

THIS QUESTIONNAIRE IS VOLUNTARY. YOU DO NOT HAVE TO FILL IT OUT IF YOU DO NOT WANT TO, BUT IF YOU DO I will sincerely thank you for taking the time to answer this lengthy questionnaire. Your contribution will be used to improve exercise programmes for people like yourself who are trying to permanently lose weight"

WHAT AM I LIKE (SSP)

These are statements which allow people to describe themselves. There are no right or wrong answers since people differ a lot.

First decide which one of the two statements best describes you.

Then, go to that side of the statement and check if it is just 'sort of true' or really true" FOR YOU.

REMEMBER to CHECK only ONE of the four boxes.

	Really True for Me	Sort of True for Me	Example			Really True for Me	Sort of True for Me
1.	□	□	Some adults like the way they are leading their lives	BUT	Other adults don't like the way they are leading their lives	5	□

	Really True for Me	Sort of True for Me				Really True for Me	Sort of True for Me
1.	□	□	Some adults like the way they are leading their lives	BUT	Other adults don't like the way they are leading their lives	□	□
2.	□	□	Some adults feel that they are enjoyable to be with	BUT	Other adults often question whether they are enjoyable to be with	□	□
3.	□	□	Some adults are not satisfied with the way they do their work	BUT	Other adults are satisfied with the way they do their work	□	□
4.	□	□	Some adults see caring or nurturing others as a contribution to the future	BUT	Other adults do not gain a sense of contribution to the future through nurturing others.	□	□
5.	□	□	In games and sports some adults usually watch instead of play	BUT	Other adults usually play rather than just watch.	□	□

6.	☐	☐	Some adults are happy with the way they look.	BUT	Other adults are not happy with the way they look.	☐	☐
7.	☐	☐	Some adults feel they are not adequately supporting themselves and those who are important to them.	BUT	Other adults feel they are providing adequate support for themselves and others.	☐	☐
8.	☐	☐	Some adults live up to their own moral standard.	BUT	Other adults have trouble living up to their moral standards.	☐	☐
9.	☐	☐	Some adults are very happy being the way they are.	BUT	Other adults would like to be different.	☐	☐
10.	☐	☐	Some adults are not very organised in completing household tasks.	BUT	Other adults are organised in completing household tasks.	☐	☐
11.	☐	☐	Some adults have the ability to develop intimate relationships	BUT	Other adults do not find it easy to develop intimate relationships.	☐	☐
12.	☐	☐	When some adults don't understand something, it makes them feel stupid.	BUT	Other adults don't necessarily feel stupid when they don't understand.	☐	☐
13.	☐	☐	Some adults can really laugh at themselves	BUT	Other adults have a hard time laughing at themselves.	☐	☐
14.	☐	☐	Some adults feel uncomfortable when they have to meet new people.	BUT	Other adults like to meet new people.	☐	☐
15.	☐	☐	Some adults feel they are very good at their work.	BUT	Other adults worry about whether they can do their work.	☐	☐
16.	☐	☐	Some adults do not enjoy fostering the growth of others.	BUT	Other adults enjoy fostering the growth of others.	☐	☐
17.	☐	☐	Some adults	BUT	Other adults feel that	☐	☐

			sometimes question whether they are a worthwhile person.		they are a worthwhile person.		
18.	☐	☐	Some adults think they could do well at just about any new physical activity they haven't tried before.	BUT	Other adults are afraid they might not do well at physical activities they haven't ever tried.	☐	☐
19.	☐	☐	Some adults think that they are not very attractive or good looking.	BUT	Other adults think that they are attractive or good looking.	☐	☐
20.	☐	☐	Some adults are satisfied with how they provide for the important people in their lives.	BUT	Other adults are dissatisfied with how they provide for these people.	☐	☐
21.	☐	☐	Some adults would like to be a better person morally.	BUT	Other adults think that they are quite moral.	☐	☐
22.	☐	☐	Some adults can keep their household running smoothly.	BUT	Other adults have trouble keeping their household running smoothly.	☐	☐
23.	☐	☐	Some adults find it hard to establish intimate relationships.	BUT	Other adults do not have difficulty establishing intimate relationships.	☐	☐
24.	☐	☐	Some adults feel that they are intelligent.	BUT	Other adults question whether they are very intelligent.	☐	☐
25.	☐	☐	Some adults are disappointed with themselves.	BUT	Other adults are quite please with themselves.	☐	☐
26.	☐	☐	Some adults find it hard to act in a joking or kidding manner.	BUT	Other adults find it very easy to joke or kid around with friends and colleagues.	☐	☐
27.	☐	☐	Some adults feel at	BUT	Other adults are	☐	☐

			ease with other people.		quite shy.		
28.	□	□	Some adults are not very productive in their work.	BUT	Other adults are very productive in their work.	□	□
29.	□	□	Some adults feel that they are good at nurturing others.	BUT	Other adults are not very nurturing.	□	□
30.	□	□	Some adults do not feel that they are very good when it comes to sports.	BUT	Other adults feel they do very well at all kinds of sports.	□	□
31.	□	□	Some adults like their physical appearance the way it is.	BUT	Other adults do not like their physical appearance.	□	□
32.	□	□	Some adults feel they cannot provide for the material necessities of life.	BUT	Other adults feel they do adequately provide for the material necessities of life.	□	□
33.	□	□	Some adults are dissatisfied with themselves.	BUT	Other adults are satisfied with themselves.	□	□
34.	□	□	Some adults usually do what they know is morally right.	BUT	Other adults often don't do what they know is morally right.	□	□
35.	□	□	Some adults are not very efficient in managing activities at home.	BUT	Other adults are efficient in managing activities at home.	□	□
36.	□	□	Some people seek out close relationships.	BUT	Other persons shy away from close relationships.	□	□
37.	□	□	Some adults do not feel that they are very intellectually capable.	BUT	Other adults feel that they are intellectually capable.	□	□
38.	□	□	Some adults feel that they have a good sense of humour.	BUT	Other adults wish their sense of humour was better.	□	□
39.	□	□	Some adults are not very sociable.	BUT	Other adults are sociable.	□	□

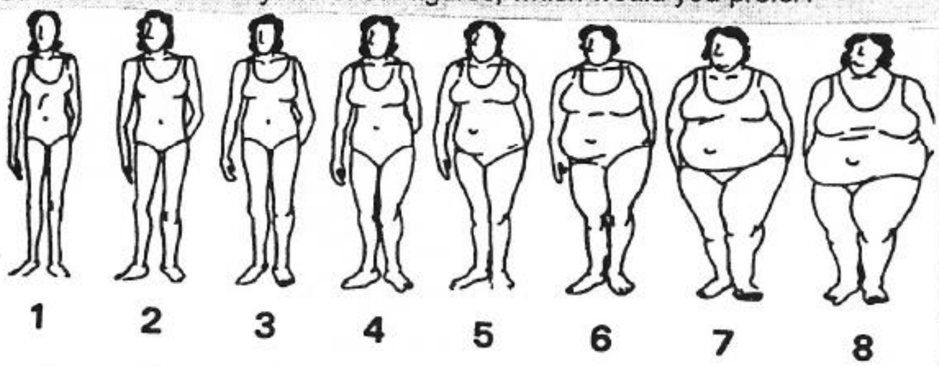
40.	☐	☐	Some adults are proud of their work.	BUT	Other adults are not very proud of what they do.	☐	☐
41.	☐	☐	Some adults like the kind of person they are.	BUT	Other adults would like to be someone else.	☐	☐
42.	☐	☐	Some adults do not enjoy nurturing others.	BUT	Other adults enjoy being nurturing.	☐	☐
43.	☐	☐	Some adults feel they are better than others their age at sport.	BUT	Other adults don't feel they can play as well.	☐	☐
44.	☐	☐	Some adults are unsatisfied with something about their face or hair.	BUT	Other adults like their face and hair the way they are.	☐	☐
45.	☐	☐	Some adults feel that they provide adequately for the needs of those who are important to them.	BUT	Other adults feel they do not provide adequately for these needs.	☐	☐
46.	☐	☐	Some adults often question the morality of their behaviour.	BUT	Other adults feel that their behaviour is usually moral.	☐	☐
47.	☐	☐	Some adults use their time efficiently at household activities.	BUT	Other adults do not use their time efficiently.	☐	☐
48	☐	☐	Some adults in close relationships have a hard time communicating openly.	BUT	Other adults in close relationships feel that it is easy to communicate openly.	☐	☐
49.	☐	☐	Some adults feel like they are just as smart as other adults.	BUT	Other adults wonder if they are as smart as other adults.	☐	☐
50.	☐	☐	Some adults feel that they are often too serious about their life.	BUT	Other adults are able to find humour in their life.	☐	☐

Using the Figures Below:

1. Which figure/physique is most like yours right now? *Enter number here* →

2. Which figure/physique do you think you will have after completing the WHEEL programme? *Enter number here* →

2. If you could look like anyone of the figures, which would you prefer? *Enter number here* →



SOCIAL SUPPORT FOR EXERCISE (SSSE)

We would like to find out how much social support you feel you have and need in your efforts to become more physically active.

Please look at the following types of support and answer the questions. (Circle ONE)

1. LISTENING SUPPORT: People who are prepared to listen to your exercise problems without judgement and who might praise your efforts and successes.

	NONE					VERY MUCH
How much of this type of support do you feel you NEED for your exercise behaviour?	1	2	3	4	5	6
How much of this type of support do you feel you RECEIVE?	1	2	3	4	5	6

2. INFORMATIONAL SUPPORT: People who know more about exercise than you and whose advice and information you trust.

	NONE					VERY MUCH
How much of this type of support do you feel you NEED for your exercise behaviour?	1	2	3	4	5	6
How much of this type of support do you feel you RECEIVE?	1	2	3	4	5	6

3. CHALLENGE SUPPORT: People who motivate and challenge you to become more active

	NONE					VERY MUCH
How much of this type of support do you feel you NEED for your exercise behaviour?	1	2	3	4	5	6
How much of this type of support do you feel you RECEIVE?	1	2	3	4	5	6

4. NEGATIVE SUPPORT: People who either unintentionally or purposely discourage or prevent you from exercising.

	NONE					VERY MUCH
How much of this type of interaction do you feel you RECEIVE regarding your exercise?	1	2	3	4	5	6
How much does it prevent you from exercising as much as you would like?	1	2	3	4	5	6

CURRENT THOUGHTS (State Self-Esteem Scale)

This is a questionnaire designed to measure what you are thinking at this moment. There is, of course, no right answer for any statement. The answer is what you feel is true of yourself at this moment. Be sure to answer all of the items, even if you are not certain of the best answer. Again, answer these question as they are true for your RIGHT NOW. THIS QUESTIONNAIRE IS VOLUNTARY. YOU DO NOT HAVE TO FILL OUT IF YOU DON'T WANT TO.

1 = NOT AT ALL
2 = A little bit
3 = Somewhat
4 = Very much
5 = Extremely

1.	I feel confident about my abilities.	1	2	3	4	5
2.	I am worried about whether I am regarded as a success or failure.	1	2	3	4	5
3.	I feel satisfied with the way my body looks right now.	1	2	3	4	5
4.	I feel frustrated or rattled about my performance.	1	2	3	4	5
5.	I feel that I am having trouble understanding things that I read.	1	2	3	4	5
6.	I feel hat others respect and admire me.	1	2	3	4	5
7.	I am dissatisfied with my weight.	1	2	3	4	5
8.	I feel self-conscious.	1	2	3	4	5
9.	I feel as smart as others.	1	2	3	4	5
10.	I feel displeased with myself.	1	2	3	4	5
11.	I feel good about myself.	1	2	3	4	5
12.	I am pleased with my appearance right now.	1	2	3	4	5
13.	I am worried about what other people think of me.	1	2	3	4	5
14.	I feel confident that I understand things.	1	2	3	4	5
15.	I feel inferior to others at this moment.	1	2	3	4	5
16.	I feel unattractive.	1	2	3	4	5
17.	I feel concerned about the impression I am making.	1	2	3	4	5
18.	I feel that I have less scholastic ability right now than others.	1	2	3	4	5
19.	I feel like I am not doing well.	1	2	3	4	5
20.	I am worried about looking foolish.	1	2	3	4	5

HEALTH THOUGHTS (Multidimensional Health Locus of Control Scale)

Each item below is a belief statement about condition with which you may agree or disagree. Beside each statement there is a scale which ranges from strongly disagree (1) to strongly agree (6). For each item we would like you to circle the number that represents the extent to which you disagree or agree with the statement. The more strongly you disagree with a statement, then the lower will be the number you circle. Please make sure that you answer every item and that you circle only one number per item. This is a measure of your personal beliefs; obviously there are not right or wrong answers.

1 = Strongly disagree
2 = Moderately disagree
3 = Slightly disagree
4 = Slightly agree
5 = Moderately agree
6 = Strongly agree

		SD	MD	D	A	MA	SA
1.	If my condition (due to being overweight) worsens, it is my own behaviour which determines how soon I feel better again.	1	2	3	4	5	6
2.	As to my condition, what will be will be.	1	2	3	4	5	6
3.	If I see my doctor regularly, I am less likely to have problems with my condition.	1	2	3	4	5	6
4.	Most things that affect my condition happen to me by chance.	1	2	3	4	5	6
5.	Whenever my condition worsens, I should consult a medically trained professional	1	2	3	4	5	6
6.	I am directly responsible for my condition getting better or worse.	1	2	3	4	5	6
7.	Other people play a big role in whether my condition improves, stays the same, or gets worse.	1	2	3	4	5	6
8.	Whatever goes wrong with my condition is my own fault.	1	2	3	4	5	6
9.	Luck plays a big part in determining how my condition improves.	1	2	3	4	5	6
10.	In order for my condition to improve, it is up to other people to see that the right things happen.	1	2	3	4	5	6
11.	Whatever improvement occurs with my condition is largely a matter of good fortune.	1	2	3	4	5	6
12.	The main thing which affects my condition is what I myself do.	1	2	3	4	5	6
13.	I deserve the credit when my condition improves and the blame when it gets worse.	1	2	3	4	5	6
14.	Following doctor's orders to the letter is the best way to keep my condition from getting any worse.	1	2	3	4	5	6

THINK BACK TO THE START OF THE PROGRAMME
WHAT HAS CHANGED?

Name: ______________________________

Please circle the number that <u>you think</u> is appropriately reflect your feelings NOW – Be honest with yourself

How do you honestly feel about yourself at the moment?

Very bad						Very good
1	2	3	4	5	6	7

How pre-occupied are you with losing weight?

Very Pre-occupied						Not pre-occupied at all
1	2	3	4	5	6	7

How guilty do you feel, every time you eat something a little bit ‘naughty’?

Very Guilty						Not guilty at all
1	2	3	4	5	6	7

How often do you engage in ‘all-or-nothing’ behaviour? That is, if you can’t do it all, or do it well, you don’t think there is any point of doing it at all?

Very Frequently						Very infrequently
1	2	3	4	5	6	7

How tempted are you to jump on the scales to weight yourself?

Very tempted						Not tempted at all
1	2	3	4	5	6	7

How energetic do you feel in general?

Very lethargic						Very energetic
1	2	3	4	5	6	7

In general (apart from temporary sicknesses), how healthy do you feel at the moment?

Very Unhealthy						Very Healthy
1	2	3	4	5	6	7

When food comes up in conversation or in something you read of see, how much do you want to eat, even if you're not hungry?

A lot						Not much at all
1	2	3	4	5	6	7

How easy do you find it to control eating your favourite fatty foods?

Not Very easy						Very easy
1	2	3	4	5	6	7

How often do you eat when you're not really physically hungry?

Very Often						Not often at all
1	2	3	4	5	6	7

How much control do you think you have over your eating?

Very Little Control						A lot of control
1	2	3	4	5	6	7

How do your clothes feel at the moment?

Very Tight						Very Loose
1	2	3	4	5	6	7

How well are you sleeping at the moment?

Not well at all						Very Well
1	2	3	4	5	6	7

How fit do you feel at the moment?

Quite unfit						Quite fit
1	2	3	4	5	6	7

How comfortable are you about doing some moderate walking for exercise?
How confident are you that you can continue to exercise regularly?

Not Comfortable at all						Very comfortable
1	2	3	4	5	6	7

When you think about exercise, do you get an extremely negative or an extremely positive picture in your mind?

Extremely Negative						Extremely positive
1	2	3	4	5	6	7

How certain are you that you can continue to exercise to keep you weight down for the rest of your life?

Not Very Certain						Very Certain
1	2	3	4	5	6	7

How often do you eat more (fatty food in particular) than you'd like when you are stress, or something negative happens to you?

Very Often						Not often at all
1	2	3	4	5	6	7

Thank you for taking the time to complete this evaluation.

How do you rate each of the following components of the WHEEL programme?

Please be honest when answering these questions.

How do you rate each of the following components of the WHEEL programme?

	Excellent	Good	OK	Poor	Very Poor
Healthy Eating Sessions					
Circuit Classes					
Aqua Aerobic Classes					
Tai Chi Classes					
General Support from the Team (be very honest here)					

What do you think how can we improve on the programme?
………………………………………………………………………………………………
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Checklist of Changes – Please tick as appropriate

	Yes	No	Don't know
Feel healthier			
Have more energy			
Less hungry			
Less indigestion			
Feel more comfortable			
Clothes feel less tight			
Crave fatty foods less			
Enjoy food more			
Less arthritic pain			
Sleeping better			
Less snoring			
Less tired during the day			
Less stressed			
Breathing more easily on exertion			
Feel fitter			
More careful with shopping			

How has your participation in the WHEEL programme affected the following: Please circle

Your fitness:

1	2	3	4	5
Considerable Better	Better	No change	Worse	Considerable Worse

Your alertness in general:

1	2	3	4	5
Considerable Better	Better	No change	Worse	Considerable Worse

Your performance at work and in general:

1	2	3	4	5
Considerable Better	Better	No change	Worse	Considerable Worse

Communication with others:

1	2	3	4	5
Considerable Better	Better	No change	Worse	Considerable Worse

PHYSICAL ACTIVITY DIARY - EXAMPLE

WEEK 1	ACTIVITY	HOW I FELT Ratings of perceived exertion	DURATION	REWARD
DAY 1	Activity 1 - walked 1/2 mile to the nearest park	Exhausted, had to stop quite a few times I was breathless after 5 minutes	18 minutes	Π I've started
DAY 2				
DAY 3				
DAY 4				
DAY 5				
DAY 6				
DAY 7	Activity 6 - walked 1/2 mile again	Felt really good, I stopped only once	14 minutes	Π Π Π Π Π I have done really well

Advice: Weight management is a lifelong 'challenge'. Be honest with yourself. This is for you to see how you are progressing. The combination of healthy eating and exercise is the best predictor of future weight maintenance and long term weight loss.

***Please use attached scale to rate your perceived exertion. Thank you.

Dietary Pattern Instruction Booklet
Developed by J. Garrow and M. Taylor (1991), adapted for WHEEL by Erika Borkoles

Please read this before you start to record what you eat and drink

PLEASE HELP US TO HELP YOU
What you don't tell us we have to guess. WE COULD GUESS INCORRECTLY. Please give us all the information that you can.

Sometimes when people are keeping records they find that they change their habits and act how they think they should, not how they normally do. We want you to tell us what you normally do. We can give you advice tailored to your lifestyle and needs. We might otherwise make suggestions that are not beneficial for you.

Appendix Q: Dietary Booklet

One week Eating Pattern Record

In order to help you to change your eating habits we need to know your normal eating and drinking pattern and how you feel when you are eating and drinking. To help us gain this information we would like you to answer the questions on the sheets provided each time you have something to eat or drink. Please answer a new set of questions for each meal or snack.

How do I answer the questions?

<u>Part 1-What is the date and time?</u>

Please give today's date and time in hours and minutes when you are about to eat or drink.

<u>Part 2-Where are you?</u>

Please briefly write down where your are e.g. at home, in the car, at a friends house.

<u>Part 3-Are you on your own?</u>

Please write down whether you are on your own or with other people.

<u>Part 4-How are you feeling?</u>

Please answer each question by ticking the appropriate box.

<u>Part 5- What time did you finish eating or drinking?</u>

Please give the time in hours and minutes when you finished eating or drinking.

Part 6-What have you eaten or had to drink?

Immediately after your meal or snack please record on the food diary page after the set of questions that you have just answered.

A. What you had

Write down everything you had - don't forget snacks, nibbles, second helpings, cups of coffee.

Record any leftovers that you didn't eat.

Give as detailed description as possible

Use one line for each food.

e.g. for a ham sandwich use a separate line for the bread, ham and margarine.

1. Food Type

e.g. 'bread' - Was it white or wholemeal?
'meat' - Was it streaky bacon or lean beef topside?
'milk' - Was it full fat, semi skimmed or skimmed?
'cheese' - Was it cheddar or edam
'margarine' - Was it low fat?

2. Brandnames

Please write down brandnames and keep any labels that give nutritional information.

3. How was the meal cooked?

e.g. Grilled or fried bacon?
Boiled or fried potatoes?

4. Was anything added?

e.g. Did you add sugar to your tea?
Did you have margarine or butter on your bread?

5. Was it a 'diet' product?

e.g. 'Lemonade' Low cal or normal

B. How much did you have?

There are several ways of helping us estimate how much food or drink you have had.

1. Look on cans and packets to see whether the weight or volume is given.
2. Use kitchen equipment like scales or a measuring jug. Chose one cup, a tablespoon and a teaspoon. Measure how much water these hold using a measuring jug. Write this value down on the front of your record book. (You may need to put several spoons of water into the jug to get enough water to measure. Write down the total volume of water, and the number of spoons that you needed.) You can then use these utensils to measure your portion sizes.

   e.g. two tablespoon of milk, two cup fulls of rice krispies, one cup full of stew.

   If you measure dry foods using a spoon it is important to say whether it is rounded, level or heaped.

3. Write down the number of sausages, fish fingers, slices of meat, rashes of bacon etc. that you ate.
4. List the ingredients if something is home-made. e.g. the number and grade of eggs in scrambled eggs, the amount of fruit etc. in a fruit cake.
5. Describe the size of a piece of food. e.g. a piece of cheese 3 inches by 4 inches by 1 inch, a slice of meat 4 inches by 3 inches cut thinly.
6. Compare the amount of potatoes that you have to a medium sized hen's egg. e.g. two egg sized potatoes.

7 Day Eating Diary

Time of day	Name of Food or Drink	Description of Food or Drink	Amount of Food or Drink	Left-overs

24 Hour Eating Diary

Date & Time of day	Name of Food or Drink	Description of Food or Drink	Amount of Food or Drink	Left-overs	Your feelings

Part 1. What is the date and time? Date:__________________ Time:________________	Part 5. What time did you finish eating or drinking? Time:________________
Part 2. Where are you?	Part 6. What have you eaten or had to drink? Please complete food diary on the attached form (24 hour Eating Diary).
Part 3. Are you on your own? - If no, how many people are with you?	Part 7. Other questions to answer after you have eaten. (Please tick the answer that applies best to you)
Part 4. How are you feeling? You can place your mark anywhere on the line. What did make you feel like that? Give yourself an honest answer, and if you want to write it on the back of this sheet. not at all hungry ⟷ extremely hungry not at all tired ⟷ extremely tired	1. Would you describe the food or drink that you have just had as: a meal □ a snack □ other (please state) □ ______________________________________ 2. Were 'forbidden food' available while you were eating? yes □ no □ I don't know □ If you answered 'yes', what 'forbidden foods' or drinks were available? ______________________________________ ______________________________________
not at all depressed ⟷ extremely depressed not at all bored ⟷ extremely bored not at all ⟷ extremely stressed	3. Had you planned to have the meal or snack that you have just had? yes □ no □ I don't know □ 4. If the meal or snack was planned did you eat or drink more than you intended to? yes □ I drank more □ I ate more □ no □ I don't know □

stressed	
not at all irritable ⟷ extremely irritable not at all nervous ⟷ extremely nervous not at all happy ⟷ extremely happy	
no craving for sweet foods or drinks ⟷ an extreme craving for sweet foods or drinks no temptation to overeat ⟷ an extreme temptation to overeat	