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Quantifying High-Speed Running in Rugby League: An Insight into Practitioner Applications and Perceptions

Authors: *Thomas Bennett [1,2], Phil Marshall[2], Steve Barrett [3], James J. Malone [4], Chris Towlson [2]

Affiliations:

Hull F.C., Hull, UK [1]

Department of Sport, Health and Exercise Science University of Hull, Hull, UK [2]

Playermaker, London, UK [3]

School of Health and Sport Sciences, Liverpool Hope University, Liverpool, UK [4]

***Corresponding Author:**

Thomas Bennett (t.c.bennett-2020@hull.ac.uk)

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Abstract:

High-speed running (HSR) has previously been documented as a popular metric among rugby league researchers. Researchers place importance on HSR due to its inclusion in assessing the demands of training and match-play to help prescribe accurate training loads and recovery methods. However, there is currently no information available as to how important rugby league practitioners perceive HSR to be and what methods are currently used by practitioners to quantify HSR. Furthermore, practitioners' perceptions of specific benefits, barriers and motivations when selecting HSR methods is also currently limited. Therefore, the aim of this study was to provide a current insight into the practice and perceptions of rugby league practitioners when quantifying HSR. This study surveyed practitioners working in the European Super League (*n = 12*) and the Australasian National Rugby League (*n = 11*). Ranking analysis established HSR to be the most important metric for both training practice and match-play. Absolute HSR thresholds were applied by 52% of respondents (*n = 12*) with the most common being $5.5 m \cdot s^{-1}$ (*n = 9*). Individualised HSR thresholds were applied by 48% of respondents (*n = 11*) with the most common approach implementing peak sprint speed methods (*n = 9*). Absolute HSR thresholds are perceived to permit better group data comparison whereas individualized methods are perceived to permit better interpretation of HSR data. Ultimately, practitioners are motivated to implement their chosen methods with the possibility of more accurately prescribed HSR thresholds, although impracticality of specific testing procedures may act as a barrier.

Key Words: Global Positioning Systems; Training Load; Match-Play; Speed Thresholds; Maximal Aerobic Speed.

Introduction

Within rugby league, teams based in both the National Rugby League (NRL) and European Super League (ESL) quantify the training loads of both training practice and match-play to analyse external load metrics they deem important[1-3]. External load metrics such as total distance, high-speed running (HSR) and meters per minute have all been previously reported and implemented[4]. Other external load metrics used within rugby league research include accelerations and decelerations[5, 6], repeated high-intensity efforts[7, 8] and high metabolic power distance[3, 5] .

High-speed running[9-11], or 'high-intensity running' (HIR)[3, 12, 13] is an external load metric which rugby league practitioners may monitor as it often precedes pivotal match events such as try scoring [1, 3]. High-speed running has been commonly used in rugby league research to quantify the time and distance above a pre-defined running speed when monitoring training and match-play[14-17]. The introduction of these metrics originate from research conducted by Sirotic et al[18], who integrated video analysis and computer-based tracking software to quantify physical match-play activities in rugby league using absolute running thresholds adopted from soccer. This study established that higher HIR distances performed in match-play are associated with a higher playing standard when comparing elite and semi-elite players[18, 19]. Typically, during match-play, the volume of HSR performed by players can primarily be dependent on playing position, with outside backs covering the most distance (583m) when compared with adjustables (436m), wide-running forwards (418m) and hit-up forwards (235m)[20]. This is due to outside backs accelerating over greater distances on the lateral areas of the field[21], adjustables running into space to support offensive plays[16], wide-running forwards carrying the ball towards the lateral areas of the field[5] and hit-up forwards carrying the ball over shorter distances in the middle of the field[5]. However, reductions in the volume of HSR during the 2nd half of rugby league match-play has been associated with fatigue[18, 22] and the depletion of glycogen[23], supporting why this metric might be monitored. Within training, HSR is generally monitored and prescribed within traditional conditioning drills[24] in an attempt to enhance high-speed match activity[9] and minimize the risk of injury occurrence[25, 26]. However, methods used to quantify HSR, and its application among current rugby league practitioners is currently unknown[1], although similar insights have previously been documented among soccer practitioners[27].

The combined implementation of microtechnology such as global positioning systems (GPS), gyroscopes, accelerometers and magnetometers using micro-electromechanical (MEMS) devices[28] within professional rugby league clubs is now standard practice [1]. National governing bodies (such as the Rugby Football League) have taken a coordinated approach to equip constituent teams with standardised hardware to develop league-wide databases from which more accurate inferences relating to performance (such as HSR volume) can be made[28, 29]. Software advancements allow practitioners to now quantify metrics such as HSR more comprehensively by allowing multiple sets of speed classification zones to be applied[11, 30]. However, a standardized method to classify such zones remains absent[1]. Applying different methods to analyse HSR has previously been suggested to consider the absolute and relative demands of competition[11, 30], although practitioners may focus on one approach longitudinally[1]. Nevertheless, practitioners face a challenge on whether to apply an absolute or individualised approach when quantifying HSR by considering the benefits, barriers and motivations to each approach[30].

Absolute approaches apply a pre-defined HSR threshold to all players[1] (e.g., 5.0 $m \cdot s^{-1}$). Individualised approaches apply speeds relative to individual player physical fitness qualities such as peak sprint speed[11, 13], the running speed observed during the onset of the second ventilatory threshold (VT^2)[3] and maximal aerobic speed (MAS)[12]. Absolute HSR thresholds tend to be the most common amongst previous researchers[1] and have previously been suggested to be inappropriate due to erroneous interpretation of HSR data, which may stem from differences in physical qualities amongst rugby league players[1, 3]. With this in mind, practitioners may opt to implement alternative individualised approaches, although an insight into the current approaches to quantifying HSR within professional rugby league clubs is currently undefined.

Given investment from national governing bodies and subsequent compliance from professional rugby league clubs, providing an insight into the current practice when quantifying HSR may enhance future practice and research by highlighting perceived benefits, and limitations of specific HSR methods. Further insight may also identify the perceived challenges that rugby league clubs experience when structuring the monitoring process. Therefore, the aims of the current study are twofold: 1) to identify practitioners' perceptions on the importance of HSR for monitoring training load and match-play in professional rugby league, 2) to understand the current approaches rugby league practitioners implement when quantifying HSR and the environmental and situational barriers for implementing an absolute or individualised threshold.

Methods

Subjects

Practitioners utilising MEMS devices within professional, men's rugby league clubs within Europe (ESL) and Australia (NRL) were identified to participate in this study. Ethics approval (FHS341) was declared for this study after an institutional review process conducted by the local university ethics committee in the spirit of the Helsinki declaration. Twenty-eight professional rugby league teams were contacted with the survey. Twenty-three teams responded between August 2021 - October 2021 (1 practitioner from each team) resulting in a response rate of 82% with 5 practitioners deciding not to participate (18%). Of these responses, 12 teams were based in the ESL (52%) and 11 teams based in the NRL (48%). Job role of the respondents included 12 sport scientists (52%), 10 strength and conditioning coaches (44%) and 1 head of performance (4%). The participants had a mean of 6.6 ± 3.4 years' experience utilising MEMS devices. The academic qualifications held by respondents included: 3 undergraduate degrees (13%), 13 masters' degrees (57%), 1 postgraduate certificate (4%), 1 postgraduate diploma (4%) and 5 PhD's (22%).

Study Design

The practitioners identified were staff based within the performance department of each club and were emailed with an invitation to complete the survey. An advertisement for the survey was published online via Twitter[31] and LinkedIn to help identify practitioners. As per previous methods[27, 32], it was required that the survey was to be completed by the staff member who was individually responsible for managing the GPS monitoring process. A reminder email was sent one week after the initial email and if no response was received after 1 month a second email was sent. If no response was received after 2 months this participant was disregarded. The practitioners identified, agreed to participate in the survey by consenting to their information to be used as part of this study.

The survey was designed by academics and professional practitioners with experience in survey design[31-33] and athletic monitoring within professional rugby league. The survey was piloted using four professional team sport practitioners, resulting in one question being modified. The finalised survey consisted of 26 questions based on nine sections (For finalised survey, see supplementary file) (Section 1: General Information; Section 2: MEMS/GPS Information; Section 3: Metric Importance; Section 4: Defining High-Speed Running; Section 5: Absolute/Individualised Thresholds; Section 6: Testing; Section 7: Benefits; Section 8: Barriers & Motivations; Section 9: Questions). The survey included questions associated with the importance of training load metrics and questions relating to the practitioner's chosen method when quantifying HSR. Practitioners were asked to state their perceptions in relation to the benefits of the method they implement. Furthermore, practitioners had to state their perceptions in relation to the barriers and motivations they may experience when attempting to select a method to quantify HSR.

Participants were requested to respond to different question design using either multiple choice or 5-point Likert scales. The Likert scales required the participants 'level of agreement' or 'level of importance' with a score of 5 awarded to the 'highest level of agreement' or 'most important' and a score of 1 awarded to the 'lowest' or 'least'[27, 34]. Participants either selected not *important*, *slightly important*, *moderately important*, *important*, or *very important*. For further analysis, each statement was numerically coded the following scores, *not important*: 1, *slightly important*: 2, *moderately important*: 3, *important*: 4 and *very important*: 5. This scoring process was also applied to the following agreement statements: *strongly disagree*: 1, *disagree*: 2, *neutral*: 3, *agree*: 4, and *strongly agree*: 5. With reference to the 'metric importance' section, once coded, training load metrics were then ranked in order of importance for both training practice and match performance. The training load metrics ranked, consisted of total distance, meters per minute, low-speed running distance, moderate-speed running distance, high-speed running distance, very high-speed running distance, sprint distance, number/frequency of sprints, number/frequency of repeated high-intensity efforts, player load/body load/dynamic stress load, number/frequency of high-intensity accelerations, number/frequency of low intensity accelerations, number/frequency of high-intensity decelerations, number/frequency of low intensity decelerations, average metabolic power, low power distance, high power distance and maximum running speed. A maximum possible score of 115 points could be achieved per metric (23 teams multiplied by 5 points). Practitioners completed the survey by clicking on a web link to JISC online surveys software. Responses were collected using this online software and were later exported from the software for statistical analysis.

Statistical Analysis

For the training load importance section, ranking analysis was used to score and rank metric data. Descriptive statistics were implemented as percentages for the high-speed running thresholds sections. The mean and standard deviation was also applied to data collected within the benefits, barriers, and motivations sections. All statistical analysis was conducted within Microsoft Excel 2016.

Results

Importance of Training Load Metrics

Of the 18 training load metrics scored using this method, HSR distance received a total score of 104 and 102 (ranked 1st) for both training practice (Figure 1A) and match performance (Figure 1B) respectively.

********************INSERT FIGURE 1A & 1B HERE****************************

High-Speed Running Thresholds

Of the 23 practitioners who responded, 12 quantified HSR using an absolute speed threshold (52%) (Table 1), with 11 quantifying HSR using individualised speed threshold approaches (48%) (Table 2). Additionally, 2 of the 11 practitioners who used an individualised approach, implemented methods using MAS (18%), with the other 9 practitioners applying a variation of methods that incorporated individual player peak sprint speed (82%) (Table 2).

********************INSERT TABLE 1 & 2 HERE****************************

Perceived Benefits

Practitioners stated the greatest benefit for those who quantify HSR using an absolute threshold agree that it allows practitioners to 'permit positional group data comparison' (4.3 ± 0.6) (Figure 2A), whereas the greatest benefit for those who quantify HSR using individualised approaches, agree that it allows practitioners to 'permit better interpretation of high-speed running data' (4.5 ± 0.5) (Figure 2B).

********************INSERT FIGURE 2A & 2B HERE**************************

Perceived Barriers & Motivations

The greatest barrier that practitioners experience when selecting a method to quantify HSR is the 'impracticality to retest (scheduling testing for large volumes of players becomes problematic)' (3.8 ± 1.0) (Figure 3A). Likewise, the greatest motivation that practitioners consider when quantifying HSR is the 'possibility of more accurate high-speed running thresholds (leading to better interpretation)' (4.3 ± 0.6) (Figure 3B).

*******************INSERT FIGURE 3A & 3B HERE*****************************

Discussion

The main findings of this study are that (1) rugby league practitioners perceive HSR to be the most important metric for training practice and match performance, (2) as a result of this, practitioners implement different absolute and individualised methods to quantify HSR, with absolute methods perceived to permit better group data comparison and individualized methods perceived to permit better interpretation of HSR data, (3) practitioners implement their chosen methods with the possibility of quantifying more accurately prescribed HSR thresholds although, the impracticality of specific testing procedures act as a barrier.

Despite both practitioners and researchers often electing to use many external load variables to assess performance[4], of the 18 training load metrics listed for practitioners to score in order of importance in the present study, ranking analysis demonstrated HSR to be perceived as the most important metric. In addition, there was little difference between the accumulated perceived importance for HSR between training practice: (104 AU) and match performance: (102 AU). This is of relevance given that HSR has been shown to differentiate playing standard within rugby league[16], and may suggest that practitioners endeavour to prescribe training sessions to replicate important high-speed match activities. This is important, given the training loads which simulate various match intensities have been shown to improve in-season match performance[9]. This equal level of perceived importance for HSR in both training and match scenarios is consistent with the common application of HSR and HIR metrics within published rugby-league based research which incorporates GPS to quantify running demands of training and match-play. Interestingly, the ranking of training load metrics (Figure 1A and 1B) show low metabolic power distance to be the least important metric for both training practice and match-play. This may be due to rugby league based studies generally only focusing on high metabolic power distance, and its potential to be a more accurate alternative to HSR[5]. Findings here may provide support for practitioners to collect HSR data, although the reasons as to why practitioners deem the collection of HSR data and other metrics important still remains speculative. Although HSR is collectively deemed important by rugby league practitioners, the methods implemented to quantify HSR differ. For instance, a recent review documented that the majority of HSR thresholds within rugby league are absolute in nature, in comparison to individualised methods[1] (absolute methods: 84%, individualised methods: 16%). In addition, within current practice these methods appear more evenly divided (absolute methods: 52%, individualised methods: 48%), suggesting a transition towards the use of individualised methods. Moreover, the equal amount of absolute and individualised methods implemented within each league (ESL absolute methods: 50%, individualised methods: 50%; NRL absolute methods: 55%, individualised methods: 45%) may suggest a lack of consensus between practitioners on whether to apply absolute or individualised methods to quantify HSR. However, within current practice, variations in the methods used to quantify HSR exist, with a number of these not supported by previously published rugby league research, suggesting that some practitioners opt to not replicate published methods and potentially implement a justified alternative.

The absolute speed threshold of 5.0m·s^{-1} has extensively been applied as the HSR threshold within the literature for many years[6, 10, 11, 20, 21, 35-38]. However, the current study demonstrates that 5.5 m·s^{-1} is the most common absolute threshold applied within the most elite professional rugby league teams. This is of interest given that Bennett et al[1] explored current methods to quantify HSR in rugby league and established the threshold speed of 5.5 m·s^{-1} has only been documented on two occasions[17, 39]. Although this is the case, practitioners may have adopted such thresholds due to the threshold of 5.5 m·s^{-1} becoming valued amongst other sports such as soccer[27]. Akenhead et al[27] surveyed training load and player monitoring amongst high-level soccer practitioners. This study established that the distance covered above 5.5 m·s^{-1} (i.e., HSR) was the third most important metric for training practice and the most important metric during competitive soccer matches. Soccer practitioners reduced perceived importance for HSR in comparison to rugby league practitioners is somewhat surprising given that soccer players perform greater HSR distances than rugby league players[39]. That said, rugby league practitioners may have elected to use a HSR threshold which is similar to soccer practice due to its popularity and scientific coverage.

In attempt to remove methodological inconsistencies in how match activity profile data is collected, and produce broader data sets in which more accurate inferences relating to rugby league performance can be made, the Rugby Football League (National governing body for rugby league in U.K.) have produced a league wide collaboration between the ESL and a MEMs provider (i.e. Catapult Sports) to permit consistent data collection and league wide analysis[28]. However, it is unknown as to whether a similar collaboration is present within the NRL. The ESL studies published as a result of this[28, 29], have applied 5.5 $m \cdot s^{-1}$ as the HSR threshold, which practitioners may feel compelled to implement if they don't already have a justifiable approach in use. This may provide practitioners with an accessible comparison of their own data if they implement the same threshold speed, however for those practitioners who apply their own approach, this data would be incomparable. Collectively, this may have been the rationale as to why some practitioners from both the ESL and NRL apply the absolute HSR threshold of 5.5 $m \cdot s^{-1}$ within the present study. Although the focus of this current study wasn't to compare leagues, this study can reveal that practitioners in both the ESL and NRL evenly implement the same absolute HSR thresholds apart from one team, suggesting practitioner consensus for absolute HSR thresholds. However, objective evidence to suggest whether this threshold is appropriate to accurately quantify match and training loads of players fulfilling different playing positions (i.e., outside backs, adjustables, wide-running forwards, hit-up forwards) who are characterised by obvious anthropometric and physical fitness characteristics differences[37, 40, 41], is unclear. The higher absolute threshold of 7.0 $m \cdot s^{-1}$ (seen in Table 1) has never been documented as a HSR threshold within rugby league previously, although it has been documented to be the 3rd most important metric during soccer match-play[27]. It is evident some practitioners seem to value absolute thresholds, even though they have been suggested to be inappropriate due to under and over estimations of HSR data[3, 42].

The results of this study show only two practitioners working within different professional rugby league clubs utilise MAS methods to determine HSR data. The 5-minute run and the 1200m shuttle test have both been implemented by practitioners to determine MAS, however, these specific methods collated from the survey have never been documented within rugby league research[1]. This somewhat restricts the implementation of these methods by practitioners, which could be a valid reason as to why only two practitioners are currently applying these methods. MAS derived using the 5-minute run has previously been established to largely correlate with $\dot{V}O_{2max}$ ($r = 0.94$) [43]. It was last documented by Meir et al[44] to assess MAS among professional rugby league players, however, the test was last validated by Berthon et al[43] and included men with different physical fitness levels varying from sedentary subjects to sportsmen in individual or team sports and runners at local or national level. That said, the 1200m shuttle test although practical[45, 46], elicits greater metabolic cost due to accelerations, decelerations and change of directions activity[47]. Despite this test correlating with MAS scores derived from the 30:15 IFT ($r = 0.73$)[45], this test has never been validated for MAS using the criterion incremental treadmill test which may be due to the shuttle-based nature of the test and a lack of data to support the physiological responses when performing the test[45].

Interestingly, the specific percentages of MAS used in these methods differ (5-minute run: 100%, 1200m shuttle test: 90%) which may suggest that differences in method and threshold percentage may result in very different HSR thresholds if the same player were to be compared, which questions how valid these methods are to be used in practice[1]. Additionally, applying specific percentages of MAS have previously been suggested to be arbitrary in nature, less appropriate and may quantify HSR erroneously[42]. The included MAS methods of this study differ to those that have previously been reported within rugby league. Waldron et al[12] quantified HIR as 75% of MAS derived using the Mult-Stage Fitness test. Furthermore, Cummins et al[48] used a threshold speed of 5 $m \cdot s^{-1}$ to quantify HSR as this speed represented the included players MAS. However, within this study, the testing method to quantify MAS wasn't stated. Ultimately, the MAS methods outlined by practitioners in this study differ to those published previously. Due to the practicality of both field-based tests, practitioners may choose to implement them over extensive methods to quantify MAS such as an incremental treadmill test despite them not being validated.

Evidently the results of this study demonstrate quantifying HSR using peak sprint speed methods are the most popular individualised approaches in rugby league practice (82%). Predominantly, practitioners choose to conduct speed testing within training practice to quantify peak sprint speed. Moreover, peak sprint speed derived during match-play has previously been deemed to be lower than other traditional methods (40m sprint using timing gates), due to tactical and positional demand[21]. Of those practitioners conducting speed testing, the use of GPS devices to measure peak sprint speed seems to be the most favoured form of equipment, due to the practitioner's lack of access to 'traditional' timing gates, and increased access to GPS devices as part of league wide collaborations[28]. Additionally, quantifying peak sprint speed using 10HZ GPS devices has previously been validated among professional rugby union players[49]. However, no studies within rugby league have documented individualising HSR using peak sprint speed derived from GPS devices, and the traditional 40m sprint method using timing gates has only been conducted twice[11, 13]. Both Gabbett et al[11] and Dempsey et al[13] quantified HSR and HIR respectively using peak sprint speed derived over 40m using timing gates, which is a method that has been replicated by practitioners within this study. Nevertheless, it is apparent practitioners predominantly utilise GPS devices to quantify peak sprint speed, which helps reduce the chance of erroneous HSR data, with the same GPS devices being utilised to measure HSR data during training and match-play[49]. However, differences in sprint distance and threshold percentage are clearly visible (see table 2).

Interestingly, the less popular distances of 20m and 60m as reported within this study, have never been published within a rugby league-based study, which may constitute as to why they are less popular. However, it may be suggested that players would achieve a lower peak sprint speed over 20m when compared to distances over 30m[50], which would subsequently lower the HSR threshold dependant on the chosen percentage of peak sprint speed which was applied. Instructing players to sprint over 40m has been established to be a valid method of deriving peak speed[11, 13, 49], although during rugby league match-play only 17% of the total sprints where between 30m and 40m with the most common distance being players accelerating between 6m and 20m[21]. This may warrant why practitioners may use 20m sprint distance as it may be deemed more specific to the sport. However, this study establishes practitioners predominantly opt to sprint over 40m when quantifying HSR using peak sprint speed, although variations in the equipment and threshold percentage exist within practice.

Previous studies have quantified HSR by applying 50%[11] and 65%[13] of peak sprint speed respectively. However, results of this study show that currently no practitioners incorporate these published approaches, and other percentages of peak sprint speed have been applied. With the HSR threshold percentages in practice ranging from 40% to 90% (see table 2), it raises the question as to the rationale as to why practitioners implement their chosen percentage. Applying each of those percentages to a player's peak sprint speed would result in very different HSR thresholds and subsequent HSR data, which highlights how very differently HSR data is quantified using this approach, but also how differently it may be analysed and interpreted among practitioners. With the chosen threshold percentages not being supported by published rugby league studies, practitioners may have implemented their approach from other team-based sports. Reardon et al[51] implemented peak sprint speed to quantify HSR in professional rugby union, however this approach took the traditional absolute threshold of $5.0 m \cdot s^{-1}$ and calculated it as a percentage of the squad's average peak sprint speed ($8.3 m \cdot s^{-1}$). This was calculated as 60% so this was applied as the HSR threshold. A similar approach was applied in Australian Rules Football where 55% was calculated as the HSR threshold[52]. However, this approach may have been implemented by practitioners to aid in selecting the HSR threshold percentage based on average squad characteristics, although this method may be deemed an inappropriate way to individualize due to combining both an absolute speed and a group average speed. Ultimately, applying a set percentage of peak sprint speed to individualise HSR is somewhat arbitrary, and regards to speed capacity, players may begin to run at high-speed at contrasting percentages of their peak sprint speed. Although this may be a challenge that practitioners face, specific benefits, motivations, and barriers may also direct practitioners to alternative approaches.

Practitioners who apply absolute HSR thresholds perceive that the two main benefits of this approach allow them to permit better group data comparison and compare their data with published research. Grouping their data by position and comparing to published research is a logical process, especially with league wide collaborations providing a platform of league wide data for comparison[28]. However, practitioners who apply individualised thresholds perceive the two main benefits of this approach allow them to better interpret the data and more accurately design conditioning drills. Interpreting the data based on physical characteristics, allows for time and distance achieved above an individual pre-defined speed, consequently permitting practitioners to design individualised conditioning drills to enhance athletic development programming.

It is evident practitioners demand more accurately prescribed HSR thresholds, however a defined criterion measure for HSR comparison currently isn't established. For instance, practitioners may require the testing method they implement, will determine a physical fitness characteristic such as peak sprint speed or MAS accurately, which may in turn lead to better relative interpretation. As a result of this, practitioners may better attempt to monitor and enhance high-speed match activities[9] and minimise the risk of soft tissue injury occurence[25, 52]. Practitioners also require methods where the testing phase is more time efficient, whereby the specific testing method is short in duration and can be scheduled for retesting during a rugby league in-season period. However, this may reflect the perceptions of those practitioners who apply individualised methods. Moreover, practitioners require that the different approaches to quantifying HSR are supported by published research however, this study documents that a number of individualised approaches utilised by practitioners are not supported by published rugby league research which could be considered contradictory. Future research may focus on establishing the approaches mentioned within this study to provide support to those practitioners who implement them. It is clearly highlighted that the impracticality of testing is a key barrier for rugby league practitioners, which may be a reason as to why absolute methods are applied. Rugby league squads generally exceed 30 players, so implementing an indivulaised HSR approach which requires frequent testing may prove to be problematic[1, 3]. Not only would this require more staff to supervise the testing phase, but this phase could also be quite time consuming for practitioners. That said, practitioners consider these barriers to be important, to enable them to proceed with an approach which is practical enough to be administered among a large group of players frequently.

Although we acknowledge that the sample here is limited[53], we feel that the relative number of responses (82%) from professional rugby league clubs based within the ESL and NRL permit valuable insights for future practice and research within these unique high-performance environments.

Conclusion

The main finding of this study it that HSR is perceived to be the most important metric collected during rugby league training practice and match-play, although the methods to quantify HSR among practitioners are contrasting. Recent league wide collaborations and research within soccer may have established $5.5 m\cdot s^{-1}$ to be the profound absolute HSR threshold in practice, counteracting the literatures traditional absolute threshold of 5.0m·s^{-1}. Individualized HSR thresholds incorporating peak sprint speed methods and MAS methods are currently more apparent among rugby league practitioners, although none of the methods applied are supported in previously published rugby league research, questioning their validity. Absolute HSR thresholds are perceived to permit better group data comparison whereas individualized methods are perceived to permit better interpretation of HSR data. Practitioners are motivated to implement their chosen methods with the possibility of more accurately prescribed HSR thresholds, although impracticality of specific testing procedures act as a barrier. Future research should focus on establishing the validity of specific methods used to individualise HSR thresholds in rugby league, by comparing the physiological dose response of field-based tests with a criterion measure.

Practical Applications

This study establishes that HSR is perceived to be the most important metric among rugby league practitioners. It is evident that when quantifying HSR, individualised methods are currently more apparent when compared to published rugby league research. This could be a result of better relative interpretation of HSR data, due to their association with physical fitness characteristics and the testing method to quantify them being more practical. Therefore, when quantifying HSR in rugby league, practitioners should consider implementing an individualised method to better interpret HSR data by utilising a practical field-based test.

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Table 1. Represents the number of teams using each of the absolute high-speed running threshold speeds collated during the survey.

Threshold No.	Speed	No. Teams	Percentage
1	5.0 $m \cdot s^{-1}$	*n=2*	8.7%***
2	5.5 $m \cdot s^{-1}$	*n=9*	39.1%***
3	7.0 $m \cdot s^{-1}$	*n=1*	4.4%***

Key: Meters per second ($m \cdot s^{-1}$)

*** % of 23 respondents.

Table 2. Represents the number of teams implementing different peak sprint speed and maximal aerobic speed methods to quantify high-speed running.

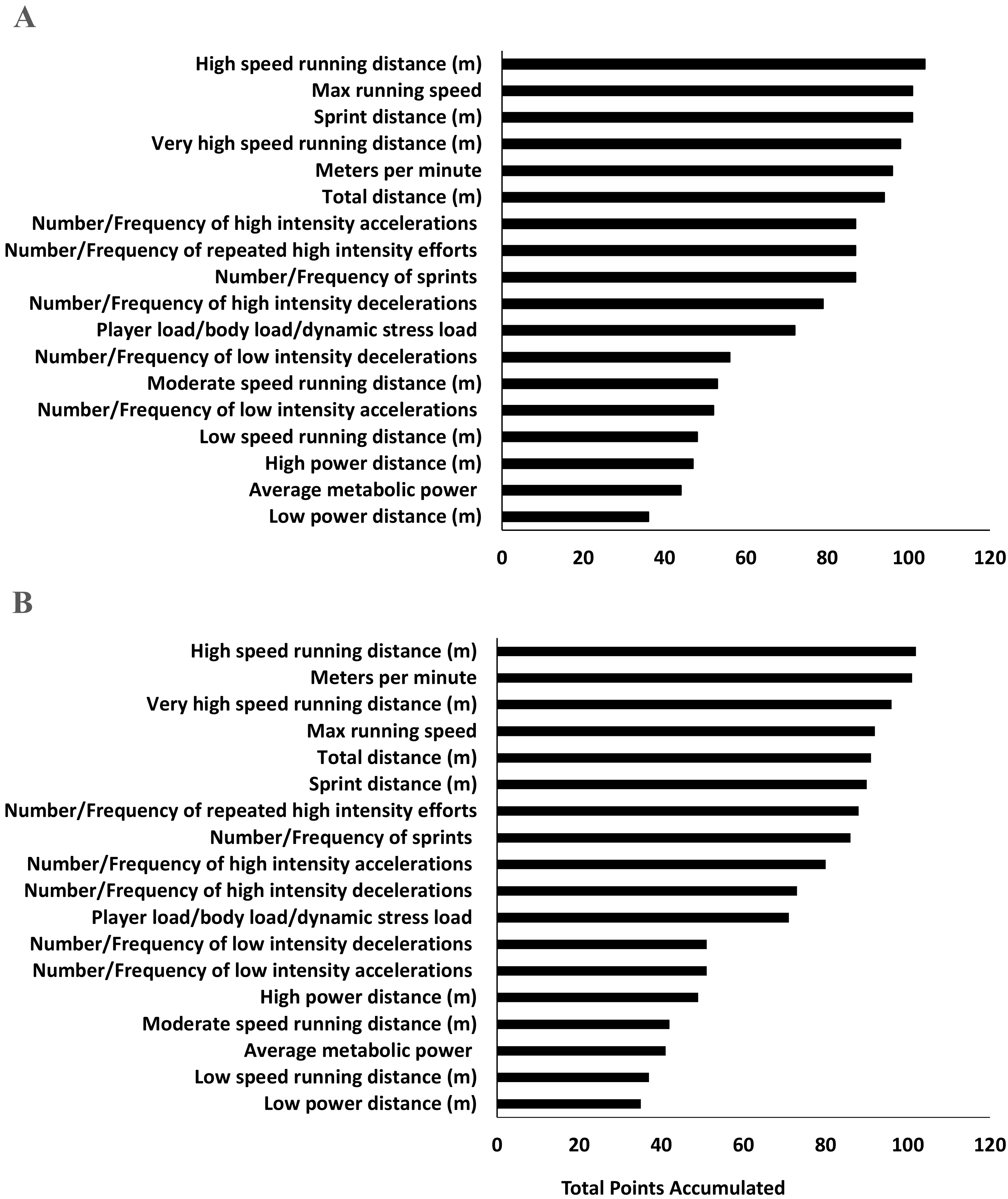
Method No.	Testing	Equipment	Distance	HSR Threshold %	No. Teams	Percentage
1	Peak Sprint Speed	Timing Gates	40m	70%*	*n=1*	4.4%***
2	Peak Sprint Speed	Timing Gates	40m	80%*	*n=1*	4.4%***
3	Peak Sprint Speed	GPS	20m	70%*	*n=1*	4.4%***
4	Peak Sprint Speed	GPS	40m	60%*	*n=1*	4.4%***
5	Peak Sprint Speed	GPS	40m	62%*	*n=1*	4.4%***
6	Peak Sprint Speed	GPS	60m	80%*	*n=1*	4.4%***
7	Peak Sprint Speed	GPS	60m	90%*	*n=1*	4.4%***
8	Match-Play **	GPS	-	40%*	*n=2*	8.7%***
9	5 Minute Run (MAS)	GPS	-	100%*	*n=1*	4.4%***
10	1200m Shuttle Test (MAS)	GPS	-	90%*	*n=1*	4.4%***

Key: High-speed running (HSR); Global positioning systems (GPS)

*% of speed in $m \cdot s^{-1}$ achieved in testing method.

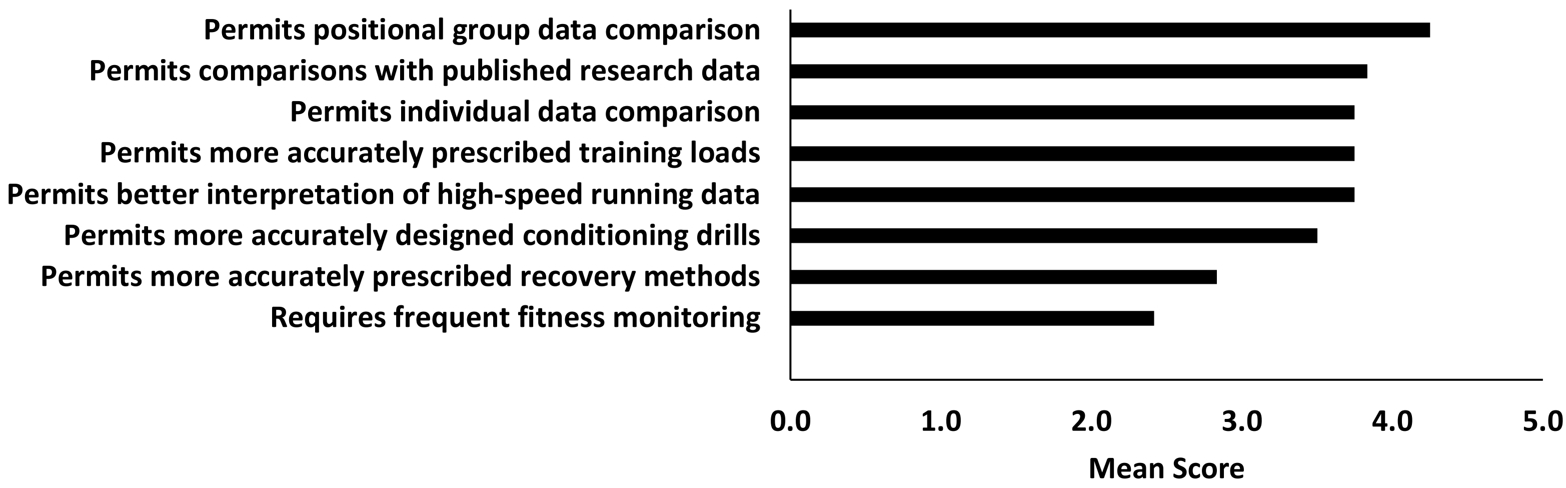
** Peak sprint speed achieved during match-play.

*** % of 23 respondents.



the total points accumulated for training load metrics on how important rugby league practitioners perceive them to be for training practice (**1A**) and match-play (**1B**).

A



B

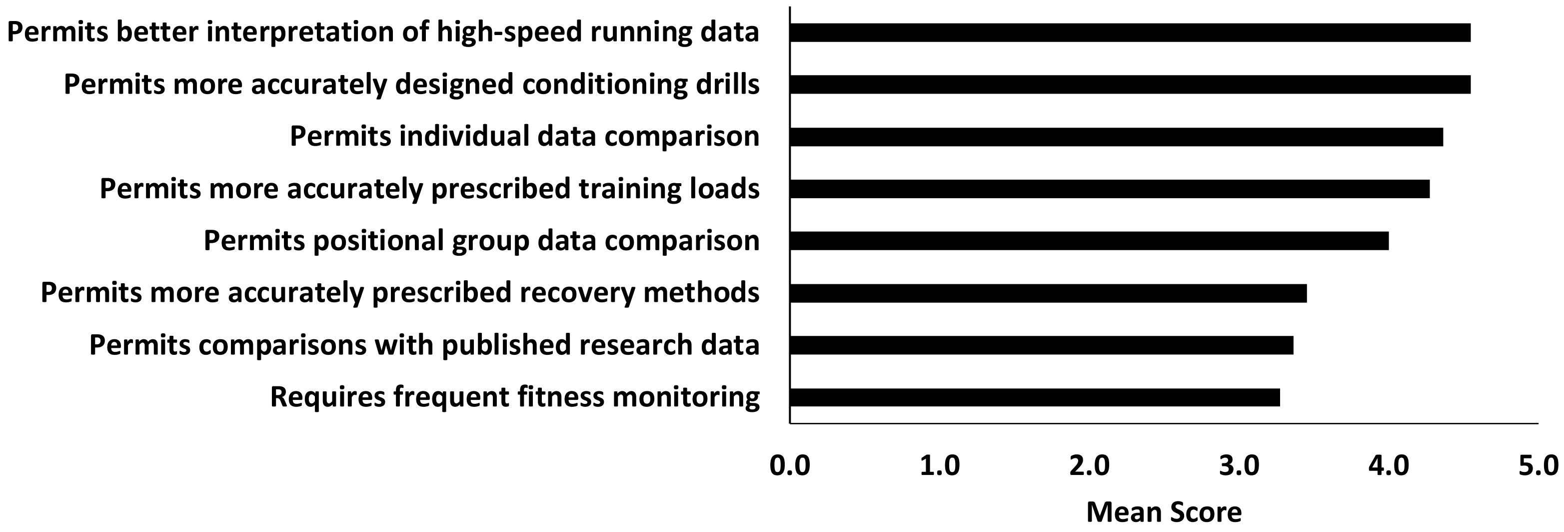
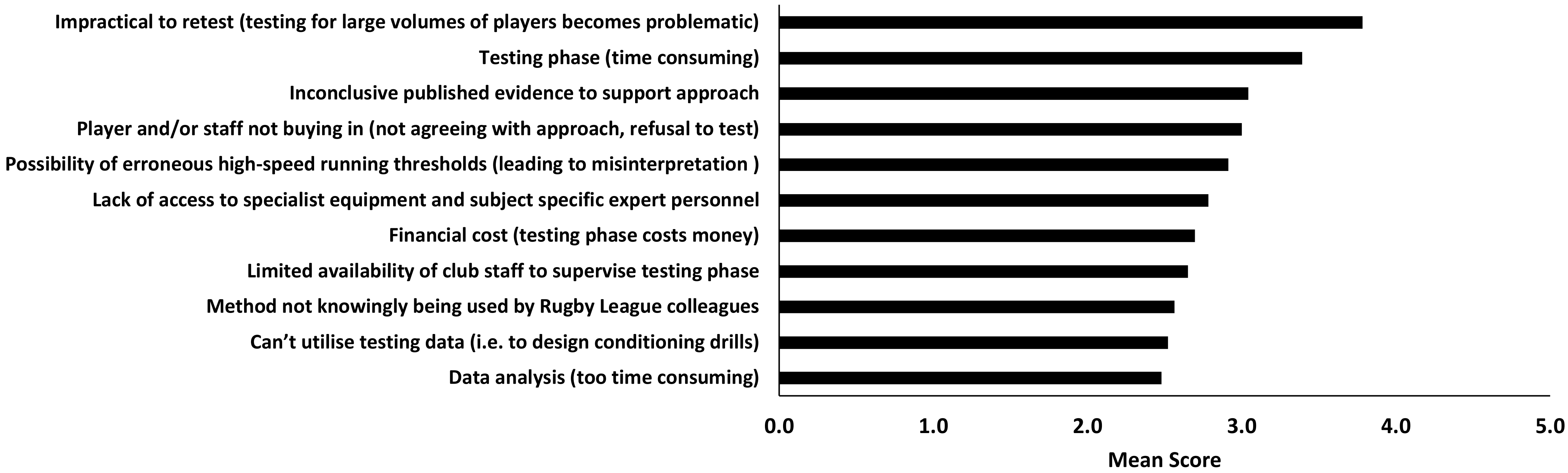


Figure 2. Represents the mean score for the perceived benefits for practitioners who selected HSR methods for absolute thresholds (**2A**) and individualised thresholds (**2B**).

A


Impractical to retest (testing for large volumes of players becomes problematic)
Testing phase (time consuming)
Inconclusive published evidence to support approach
Player and/or staff not buying in (not agreeing with approach, refusal to test)
Possibility of erroneous high-speed running thresholds (leading to misinterpretation)
Lack of access to specialist equipment and subject specific expert personnel
Financial cost (testing phase costs money)
Limited availability of club staff to supervise testing phase
Method not knowingly being used by Rugby League colleagues
Can’t utilise testing data (i.e. to design conditioning drills)
Data analysis (too time consuming)
0.0
1.0
2.0
3.0
4.0
5.0
Mean Score

B

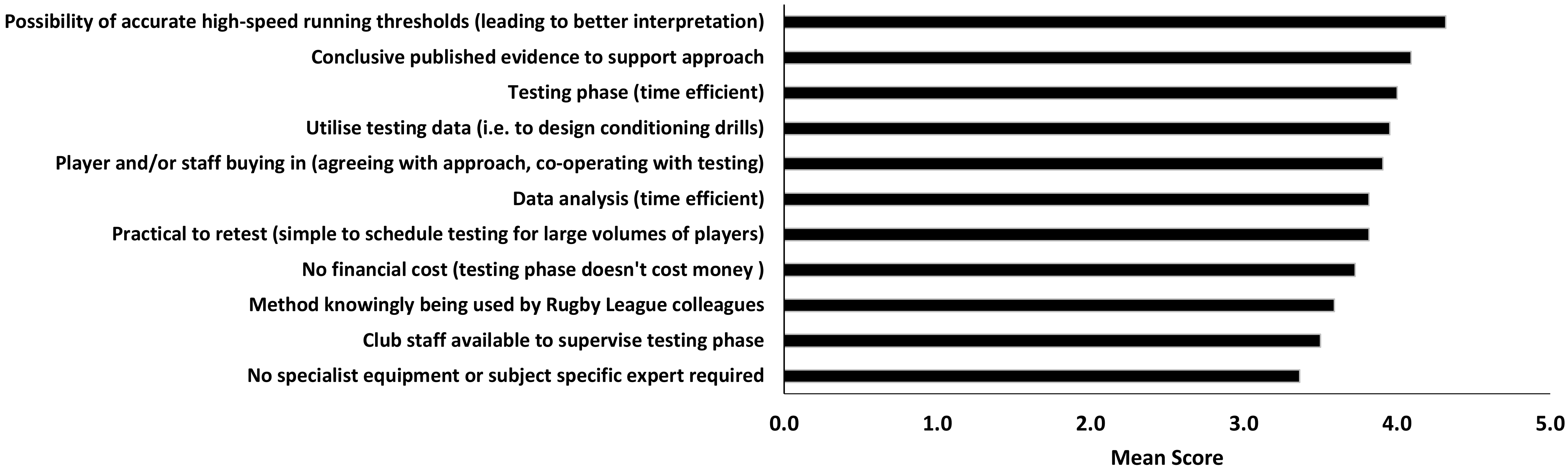


Figure 3 . Represents the mean score for the perceived barriers (**3A**) and motivations (**3B**) practitioners may experience when selecting a HSR threshold approach.