Speed Demands of Women's Rugby Sevens Match Play

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Abstract

Misseldine, ND, Blagrove, RC, and Goodwin, JE. Speed demands of women's rugby sevens match play. *J Strength Cond Res* XX(X): 000–000, 2018–The purpose of this study was to quantify the running speed demands of elite female rugby sevens match play, both absolute and relative to maximal ability, and determine the importance of maximal velocity running to performance. Individual maximal running velocity (Vmax) was established for 12 professional female rugby sevens athletes before the collection of global positioning system data during all 6 games of an international tournament. The subjective importance of each maximal velocity running effort was established using visual analogue scale ratings of video clips by coaches. Differences in velocity demands between backs and forwards were analyzed using a one-way multivariate analysis of variance, and differences in "sprint" distance using the typical-standard and female-adjusted sprint thresholds were compared using a paired-samples *t*-test. The mean peak velocity reached per game by all players was 90.6 ± 7.9% Vmax. Players covered 1,556 ± 233 m per game, with "sprinting" representing 6 ± 4% of this total distance using the typical-standard "sprint" threshold (5.6 $m \cdot s^{-1}$), but a significantly ($p < 0.001$) greater 12 ± 4% using the female-adjusted threshold (4.7 $m \cdot s^{-1}$). Despite similar total distances, backs reached significantly ($p < 0.05$) greater peak running velocity and covered more distance at sprint, >75% Vmax and >90% Vmax speeds when compared to forwards. More than half of the running efforts peaking at ≥90% Vmax were considered very influential to game outcomes. These findings suggest that maximal velocity running is important to female rugby sevens performance, and that high-speed demands are different for backs and forwards. Furthermore, the typical-standard sprint thresholds significantly underestimate the true running demands of female rugby sevens.

Key Words GPS, relative velocity, sprint

Introduction

Rugby sevens is a new Olympic sport, which made its debut at the 2016 Olympic Games; however, there is limited knowledge regarding female game demands (4,5,13,26,30,35). Speed appears to have emerged as a highly sought-after characteristic in rugby sevens athletes, but little data exist regarding the specific velocities used during female match play. An understanding of speed demands is important for the prescription of appropriate physical preparation interventions. The current knowledge base regarding running demands is limited largely to reports of distances and frequencies of running efforts within predefined velocity zones in male (12,14,15,17,23,28,29,32) and female (4,5,13,26,30,35) match play. Unfortunately, inconsistencies in the definition and division of these zones across studies make direct comparison difficult. Nonetheless, male players are reported to cover 14–19% of total distance at >5.0 $m \cdot s^{-1}$, the commonly stated threshold for "high intensity" running (15,17,28,29,32), and conduct 7 to 11 "sprint" efforts at >5.6 $m \cdot s^{-1}$ per game (17,29,32). Despite reporting similar total distances covered, the few studies in female match play have reported substantially lower speed demands, with only 6–13% of total distance covered at >5.0 $m \cdot s^{-1}$ (6,13,26,30), and 5.3–6.5 running efforts reaching above 5.6 $m \cdot s^{-1}$ (26,30). However, these studies use velocity zones originally developed from male performances, and considering potential gender differences in maximal running velocity capabilities, it is possible these thresholds underestimate the speed demands for female players. This seems likely given that average peak velocities of 6.4–7.4 $m \cdot s^{-1}$ have been reported during elite female sevens match play (13,26,30,35), which equate to approximately 85% of the peak velocities reported in elite male games (15,17,28). Furthermore, Clarke et al. (4) showed that total "high-intensity" running distances in elite

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female sevens match play were underestimated by up to 30% when using the typical-standard (male) zone (>5 m·s^{-1}) in comparison with physiologically based zones. Correspondingly, within soccer, female maximal running speed abilities have been shown to be substantially lower than those of males (22), and similar problems with using standard velocity zones for female athletes have been identified (3). It would therefore seem inappropriate to make conclusions about absolute speed demands for female sevens players based on the currently available literature using typical-standard male thresholds.

Knowledge of the velocities reached during play relative to an individual's maximal running velocity (Vmax-relative) would help to further this understanding of speed demands. One investigation in international male rugby union showed backs performed more than half their sprints above 90% of their maximum running velocity (Vmax) and reached Vmax at least once per game (9). To the author's knowledge, no studies have investigated Vmax-relative running velocities in rugby sevens. A recent study by Vescovi and Goodale (35) investigating physical demands in a female sevens tournament did report both the mean Vmax of participants during testing and the mean peak running velocity (Vpeak) reached during matches. Although the authors did not address relative velocities specifically, the reported mean Vpeak values represent 97% of the mean Vmax, which may suggest the use of (near) maximal running speeds. However, it is not known if players reach their individual Vmax specifically during match play. Furthermore, even if rugby sevens play does allow the attainment of Vmax, its presence alone does not give any indication as to its potential importance to game outcomes. To gain a more complete impression of match speed demands, it would seem helpful to understand how influential maximal running velocities are to game outcomes.

Positional differences are an additional consideration in the evaluation of speed demands. In rugby union, backs and forwards have been shown to have distinctly different speed characteristics and undergo differing running demands during match play (1,8,9,27,31). In rugby sevens, such positional differences appear to be much less pronounced, but small differences in total distances, high-speed distances and maximal velocities reached have been shown in male match play (17,28,29). The only study to have considered playing position in female match play showed no differences in any activity profiles, including maximal velocities reached and high-speed distances (13). It is therefore possible that female speed utilization may be more homogenous than that of males, but further investigation is needed to address this question.

The current knowledge base regarding running speed demands during female rugby sevens match play is limited, and understanding these demands may offer valuable insights for the prescription of speed training within an athlete's physical preparation program. The aims of the current study were to quantify the absolute and Vmax-relative running speed characteristics of elite female rugby sevens players during international match play, establish if maximal running velocities are reached, investigate the importance of maximal velocity running to game outcomes, and establish whether positional differences in speed demands exist between backs and forwards. It was hypothesized that maximal running velocities would be reached by backs and forwards during match play, and that these running efforts would be considered important to game outcomes.

Methods

Experimental Approach to the Problem

An observational, cross-sectional design was used to investigate the absolute and Vmax-relative running velocities and distances of elite female rugby sevens players during match play. Running performance data were collected from players of a National team using global positioning system (GPS) devices during 6 matches of an international sevens tournament in February 2015. Vmax-relative velocity was calculated based on individual Vmax tested before the tournament. To evaluate the importance of Vmax to rugby sevens performance, a novel approach was used in which technical coaches were asked to rate the influence of all $>$90% of Vmax efforts to game outcomes on a visual analogue scale (VAS).

Subjects

Twelve professional female rugby sevens players from the same National team, split into forwards (mean ± *SD* $n = 5$, age 27.0 ± 2.5 years, height 170.4 ± 3.3 cm, mass 69.8 ± 2.0 kg) and backs (mean ± *SD* $n = 7$, age 24.6 ± 4.7 years, height 166.7 ± 5.3 cm, mass 62.4 ± 4.4 kg), were recruited for the current study. The 7.4 kg mean difference in body mass was the only significant ($p < 0.05$) difference between groups. The benefits and risks of the study were explained to all subjects before they signed institutionally approved consent forms to participate in the study. The study was approved by the St Mary's University Ethics Committee.

Procedures

Maximal Velocity Testing. Three weeks before the tournament, 2 separate Vmax testing sessions were conducted, 7 days apart, on the same artificial grass field under similar environmental conditions (approximately 4–6° C). The first was conducted in a fresh state, and the second in a "fatigued" state, to understand whether a player's maximal running velocity potential may be lower at the end of a match, as this would alter their Vmax-relative velocity estimations during play. Running velocity and distance was measured using portable GPS units (JOHAN trackers; JOHAN Sports, Noordwijk, the Netherlands) recording at 5 Hz and TC-Timing System light gates (Brower Timing Systems, Draper, UT, USA) simultaneously. A high degree of reliability was found between the GPS and timing-gate measurements, with an average measures intraclass correlation coefficient (ICC) of 0.947 ($p < 0.001$) in the first session and 0.929

Table 1. Comparison of absolute and relative distances covered per game between forwards and backs who played full (≥70% total time) games (mean ± *SD*).*

	Forwards ($n = 12$)	Backs ($n = 19$)
Total distance (m)	1,601 ± 192	1,527 ± 256
Relative distance (m·min^{-1})	97 ± 6	98 ± 8
Distance (m) per zone		
Walk	757 ± 112	703 ± 118
Jog	468 ± 64	438 ± 109
Run	277 ± 67	234 ± 51
Sprint	60 ± 32	112 ± 69†
Female-adjusted sprint	171 ± 45‡	216 ± 88†‡
Distance (% total distance) per zone		
Walk	48 ± 3	47 ± 3
Jog	30 ± 3	29 ± 5
Run	18 ± 4	16 ± 2
Sprint	4 ± 2	8 ± 4†
Female-adjusted sprint	11 ± 3‡	14 ± 5†‡
No. of "sprint" efforts (*n*)		
Sprint	5 ± 2	6 ± 2
Female-adjusted sprint	10 ± 2	11 ± 3

*Walk <1.9 m·s^{-1}, jog = 1.9–3.9 m·s^{-1}, run = 3.9–5.6 m·s^{-1}, sprint >5.6 m·s^{-1}, female-adjusted sprint >4.7 m·s^{-1}.
†Significantly different ($p < 0.05$) to forwards.
‡Significantly different ($p < 0.001$) to sprint.

($p < 0.001$) in the second. The coefficients of variation for the first session were 5.03% (timing gates) and 5.31% (GPS), and for the second session 6.11% (timing gates) and 4.91% (GPS). Furthermore, previous research has shown acceptable validity and reliability of GPS measurement at 5 Hz (18,19,24,25,34). The same individual JOHAN tracker (mass: 63 g; size 101 × 65 × 23 mm; firmware: v0.2) was used for each player in both sessions, fitted to the upper back between their scapulae utilizing an adjustable harness worn under their playing shirt. The GPS units were switched on 10 minutes before each warm-up to ensure a satellite fix and switched off immediately after completion of the testing session.

Both sessions started with a standardized 15 minutes warm-up including running, dynamic stretching, contact and technical drills, designed to simulate pre-match warm-ups as closely as possible. A four-minute rest period then followed prior to commencement of the first sprint effort. Each participant completed 6 maximal sprint efforts over 50 m, with a 4-minute rest period between each. The distance of 50 m was selected to allow for the attainment of Vmax, based on data from male rugby players showing attainment of Vmax in 30–40 m (2,9). Global positioning system data was analyzed to provide the instantaneous Vmax for each sprint.

The second testing session utilized the same protocol, with the addition of a bout of fatiguing exercise after the warm-up. This consisted of a shortened version of the YoYo intermittent recovery test level 1, whereby players started part way through the test (level 15), thus at a faster beginning speed, but all went to volitional exhaustion, and was used to put all players in same state of volitional failure. This was followed by 3 minutes of maximal intensity partner contact-drills to simulate the contact aspects of game play, directly followed by commencement of the first sprint. A work/rest ratio of 1:0.3 was used for the contact drills based on the ratios reported in female rugby sevens research (26,30). The highest velocity achieved by each player across all trials was taken as their Vmax value.

Global Positioning System Game Analysis. Global positioning system movement data were collected for each player during all 6 games of the tournament, using the same individual JOHAN tracker as used during the Vmax testing sessions. The GPS units were switched on 10 minutes before each warm-up to ensure a satellite fix and switched off immediately after completion of the match. Data files from players who did not play during a match were excluded, as were 2 files with errors. A total of 59 data files were retained from which distances covered and velocities reached per game were analyzed for each player. Data files were split into position (back or forward) and total playing time (full or partial) per match. A full game was considered to be ≥70% of total game time, consistent with the threshold used by Ross et al. (28). For analysis of distances and velocities per game, only full game files were used. For analysis of maximal velocity importance, all files were used. Postevent analysis of the GPS movement data was completed using the JOHAN platform (JOHAN Sports), and variables were exported to Microsoft Excel 2013 for subsequent analysis.

The contribution of different running velocities were evaluated using the total distance covered in 4 velocity zones: walking (0–1.9 m·s^{-1}), jogging (1.9–3.9 m·s^{-1}), running (3.9–5.6 m·s^{-1}), and sprinting (>5.6 m·s^{-1}) (10). To address the influence of male velocity zones on "sprint" contribution in female matches and to allow a more meaningful comparison with male data, a "female-adjusted" threshold for the sprint zone was also calculated. The female-adjusted threshold represents the same % of Vmax for females in this study that the current "sprint" threshold represents for male athletes: the mean Vmax reported in male

Table 2. Comparison of Vmax-relative velocity profiles per game between forwards and backs who played full (≥70% total time) games (mean ± *SD*).

	Forwards ($n = 12$)	Backs ($n = 19$)
Vpeak ($m \cdot s^{-1}$)	6.7 ± 0.5	7.5 ± 0.7
Vpeak relative (% of Vmax)	89.1 ± 4.5	95.0 ± 7.7
Distance (m) at ≥75% Vmax	50.1 ± 16.2	86.6 ± 56.3*
Relative distance (% total) at ≥75% Vmax	3.2 ± 1.2	5.6 ± 3.4*
Distance (m) at ≥90% Vmax	5.3 ± 12.4	36.8 ± 49.2*
Relative distance (% total) at ≥90% Vmax	0.3 ± 0.8	2.4 ± 3.2*
No. of efforts (*n*) ≥90% Vmax	0.5 ± 0.5	1.3 ± 1.2

*Significantly different to forwards ($p < 0.05$).

rugby athletes is 9.2 $m \cdot s^{-1}$ (2,9,16), and the current "sprint" threshold (5.6 $m \cdot s^{-1}$) represents 61% of that mean Vmax; thus, the female-adjusted threshold (4.7 $m \cdot s^{-1}$) represents 61% of the mean Vmax recorded in this sample of female athletes. To further investigate the contribution of "sprint" efforts, the number of entries into the "sprint" zones (>5.6 $m \cdot s^{-1}$ and >4.7 $m \cdot s^{-1}$) is reported per player.

To investigate the use of maximal velocity running, the number of efforts peaking above 90% of Vmax and the distances covered at this velocity were investigated. Distances covered above 75% of Vmax were also investigated to quantify running demands at high Vmax-relative velocities. Vpeak is the single highest velocity reached by each player per game. Vmax-relative velocity is expressed as a percentage of each player's individual Vmax.

Analysis of "Maximal Velocity" Importance. Digital video recordings were made of 5 games using a Sony HDR-CX410 camera. LongoMatch video analysis software (LongoMatch 1.0.2, Fluendo, Spain) was used to cut a video segment showing the complete play for each running effort in which a player peaked at ≥90% of Vmax (as identified using the corresponding time-stamps in each GPS file). A total of 35 clips were made.

Two technical coaches separately viewed all 35 video clips and were asked to rate the influence of each ≥90% Vmax effort on the outcome of the match by marking the appropriate place along the VAS, which consisted of a horizontal line 100 mm in length, with "not influential at all" on one end and "very influential" on the other. The average measures ICC between the 2 coaches' ratings was 0.683 ($p < 0.001$). To the author's knowledge, VAS analysis has not been used in the evaluation of play importance in rugby analysis and was adapted from VAS-based research in pain and muscle soreness (11,21,33). In the absence of any normative data for use in this context, analysis ratings were grouped into 4 bands, with ratings of 0–24 mm considered to have no influence, 25–49 mm to have a small influence, 50–74 mm a moderate influence, and 75–100 mm a strong influence.

Statistical Analyses

All results were analyzed using Statistical Package for Social Science (SPSS) software (version 21, IBM Corp, New York, NY, USA). Data are presented as mean ± *SD*. A paired-samples *t*-test was used to analyze differences in Vmax measured between the fresh and fatigued states, and by those measured using GPS and timing gates. Two-way mixed (average measures) ICCs were used to establish inter-rater reliability between GPS and timing gate measures, and between coach VAS scores. A multivariate analysis of variance was used to examine any differences between backs and forwards for dependent variables (Vmax, Vpeak, distances covered per game). Where assumptions surrounding normality, outliers, equal variances, and linearity were violated, Pillai's Trace was interpreted as the test statistic. Differences in distances covered using the typical-standard and female-adjusted "sprint" thresholds were investigated using a paired-samples *t*-test. The level of significance was set to <0.05 in all tests.

Results

Maximal Velocity Testing

The mean Vmax across all players was 7.6 ± 0.4 $m \cdot s^{-1}$. There was no significant difference in Vmax between forwards ($n = 5$) and backs ($n = 7$), reaching 7.5 ± 0.4 $m \cdot s^{-1}$ and 7.8 ± 0.3 $m \cdot s^{-1}$, respectively. All players reached their Vmax between 25 and 40 m. Only the backs showed a small

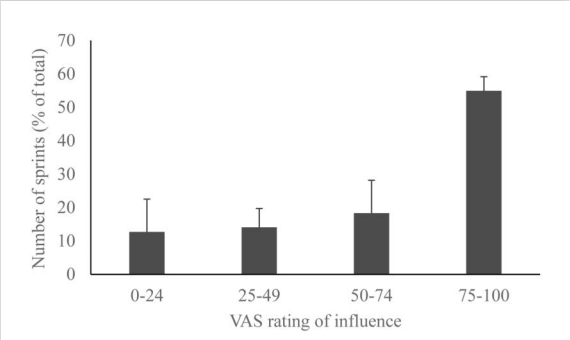

Figure 1. Frequency (% of total) of >90% Vmax sprints ($n = 35$) rated in each of 4 VAS influence categories over 5 games. VAS = visual analogue scale.

Vmax decrease of 0.3 $m \cdot s^{-1}$ ($p < 0.05$) between the first (fresh) and second (fatigued) testing sessions.

Global Positioning System Game Analysis

Players covered a mean total of 1,556 ± 233 m at a rate of 98 ± 8 $m \cdot min^{-1}$ per game, with 6 ± 4% of that distance being covered above standard "sprint" velocity (>5.6 $m \cdot s^{-1}$). However, when using the female-adjusted "sprint" threshold (>4.7 $m \cdot s^{-1}$), total "sprint" distance was doubled, representing 13 ± 4% of total distance. The mean Vpeak across all games of all players was 7.0 ± 0.7 $m \cdot s^{-1}$ and 90.6 ± 7.9% of Vmax. The total number of ≥75% Vmax efforts made on average by all players over a complete match was 36 ± 7, with speeds ≥90% Vmax being reached 7 ± 2 times.

Tables 1 and 2 provide a breakdown of the distances and velocities used by backs and forwards per game. No systematic effect was shown across dependent variables when comparing backs and forwards; however, the between-subject effects reveal significant differences at a position level for the sprint and high-speed variables. Backs covered approximately twice the distance as forwards at "sprint" velocity, despite similar total distances. They also reached higher absolute and Vmax-relative peak velocities and covered greater absolute and relative distances at >75% and >90% Vmax.

Analysis of "Maximal Velocity" Importance

More than half of the total running efforts reaching >90% of Vmax were rated between 75 and 100 on the VAS by the coaches (Figure 1) and thus considered highly influential to game outcomes.

Discussion

The current study is the first to document Vmax-relative running velocities used in female rugby sevens. It showed that typical-standard velocity zones substantially underestimate female velocity demands, but when this is accounted for, total demands are similar to male match play. Total distances identified in this study are consistent with those reported in the existing female sevens literature (4,5,13,26,30,35). The percentage of typical-standard "sprint" distance (>5.6 $m \cdot s^{-1}$) is consistent with the studies of Portillo et al. (26), Suarez-Arrones et al. (30), and Vescovi and Goodale (35), as are the number of efforts reaching this threshold. Comparing "sprint" contribution to the studies by Clarke et al. (4,5) and Goodale et al. (13) is more difficult as they investigated "high speed" running using a lower threshold (>5 $m \cdot s^{-1}$); however, the 11–14% reported by these authors fits quite closely to the 12% calculated with the "female adjusted" threshold (>4.7 $m \cdot s^{-1}$) in this study. The average peak velocity of 7.0 $m \cdot s^{-1}$ reported in this study is consistent with the 6.9–7.4 $m \cdot s^{-1}$ reported in other female rugby sevens research (13,26,35). The average Vmax value (7.6 $m \cdot s^{-1}$) attained was also identical to that reported by Vescovi et al. (35) in the only other study to have measured Vmax in female rugby sevens athletes. It would therefore seem that the overall absolute running velocities and distances presented in this study are in agreement with those reported in existing female sevens research.

Comparing these results to those reported in international male competition (15,17,28) reveal, as expected, that female players reach substantially lower Vpeak during match play, and although covering similar total distances, substantially less distance is carried out at traditional "sprint" pace (>5.6 $m \cdot s^{-1}$), and these "sprint" efforts are less frequent. However, the Vmax of female players is also substantially lower than their male counterparts, representing 83% of those reported in international male rugby sevens athletes and rugby union backs (2,9,16). The typical-standard "sprint" velocity threshold would represent 73% of female Vmax compared with only 61% of male. The results of this study showed that total sprint distance and number of sprint efforts were underestimated by approximately 50% when using this typical-standard (male) threshold compared with a female-adjusted threshold representing the same relative proportion (61%) of female's Vmax. This difference is of larger magnitude than the 30% underestimation of high-intensity running demands in female sevens athletes reported by Clarke et al. (4), who used an individual physiologically based threshold to compare with the typical-standard "high-speed" threshold (>5.0 $m \cdot s^{-1}$). These authors did not investigate actual physiological thresholds in males; however, it is possible that the typical-standard thresholds may also be an inaccurate reflection of "sprint" demands in males, especially considering it only appears to represent 61% of maximum velocity, which is not an especially fast sprint effort. Furthermore, the thresholds commonly used in rugby appear to be quite arbitrarily defined, rather than based on physiological markers (7). It should be recognized, however, that the Vmax values used to compare Vmax-relative velocities across genders in this study are based on a very limited population because of the scarcity of published data. Nonetheless, the presence of an underestimation of some magnitude for female rugby sevens players using these typical-standard male-based zones seems likely.

In further addressing the aim of quantifying "sprint" demands, use of the aforementioned female-adjusted threshold shows female "sprint" distances (approximately 13%) and frequencies (10 per game) that are considerably more similar to those reported in the international male studies (15,17,28,29,32) (10% using a slightly higher "sprint" threshold of >6.0 $m \cdot s^{-1}$, with a frequency of 8–12 sprints, and 16–19% at "high-speed" velocity of >5.0 $m \cdot s^{-1}$). Although consideration should be taken of the small number of studies and limited populations from which these data are drawn, these findings taken together as a whole suggest that male and female rugby sevens in fact have similar overall speed demands when adjusted for female specific thresholds. It would therefore seem beneficial to develop Vmax-relative velocity thresholds for performance analysis in rugby sevens to allow more valid comparisons across gender and playing level.

This is the first study to have used Vmax-relative velocities to evaluate running speed demands in rugby sevens. One of the key observations made is that the mean Vpeak reached by females during match play is approximately 90 and 95% of Vmax for forwards and backs, respectively, but that some players reach 100% in each game. This suggests that maximal velocity running does have a role within female rugby sevens. Furthermore, more than half of the maximal velocity (>90% Vmax) efforts were regarded by the coaches to be very influential to game outcomes. This subjective method of assessing speed importance is a novel approach. However, when considered in conjunction with the aforementioned frequency of Vmax efforts, it could be inferred that maximal velocity running is indeed important to female rugby sevens performance and thus also warrants attention in an athlete's physical preparation program. Additionally, exposing athletes to maximal velocity running during a training week can also offer a protective effect against injuries (20).

When considering positional differences in speed utilization, backs in this study were observed to cover greater distances at "sprint" velocity and greater distances above 75 and 90% of Vmax. These results largely agree with a study across an entire men's world series competition (54 games over 9 tournaments) showing that backs had higher Vpeaks, conducted more high-speed movements and covered more distance at $>5\ m \cdot s^{-1}$, and that these differences were more pronounced over a complete tournament (28). Interestingly, the only other study to have investigated positional differences in female sevens reported no significant difference between forwards and backs in any activity profiles, including peak velocity and distances in various velocity zones (13). However, these authors used different velocity zones, making direct comparison difficult, and did not measure Vmax-relative velocity, leaving the possibility that differences in Vmax-relative speeds may still have existed. Furthermore, the athlete population used by Goodale et al. (13) had a substantially higher world ranking than the participants in this study. Considering this in the context of other studies that have shown significant differences in high-intensity movement demands between international and development or national-level female sevens athletes (26,35) may suggest speed demands to be more homogenous between backs and forwards in higher level play. However, further investigation into the female game is clearly needed to confirm this. Moreover, whether the magnitude of positional differences observed in this study and the aforementioned male research is large enough to warrant a position-specific training focus anyway remains a pertinent question.

The aims of the current study were to quantify the running speed demands of female rugby sevens and establish the importance of maximal running velocity. It can be seen from these results that female rugby sevens players require the use of regular high-velocity efforts, of similar gender-relative magnitude to men, with velocities of close to, or reaching, Vmax. Furthermore, the majority of these maximal velocity moments are considered influential to game outcomes, confirming the importance of maximal velocity capabilities to rugby sevens athletes. Additionally, positional differences observed in high-velocity and maximal velocity demands may suggest a slightly greater importance of maximal velocity running to rugby sevens backs, compared with forwards, but further research is needed to substantiate this. One further conclusion that can be taken from this study is the advantage of using Vmax-relative velocity thresholds for the quantification of running demands. Future research could look at the development of appropriate Vmax-relative velocity thresholds that could be applied across genders and populations. Furthermore, the small sample size (12 athletes across 6 games) is a potential limitation of this study, so future research investigating Vmax across larger populations and a greater number of tournaments would be recommended.

Practical Applications

The presence and subjective importance of maximal velocity running efforts shown in this study give support for the inclusion of maximal velocity training within a female rugby sevens athlete's physical preparation program and the importance of developing high-speed running capabilities in general. This information may prove helpful to the prioritization of physical conditioning goals, especially considering the breadth of physical capabilities that must be considered in the physical preparation of a rugby sevens athlete. From a performance analysis perspective, the distinct underestimation of female running speed demands when using typical-standard velocity zones offers support for the use of Vmax-relative velocity thresholds and the development of female-specific velocity zones for the quantification of speed demands.

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