This is an Accepted Manuscript of an article published by Taylor & Francis in Science and Medicine in Football on 19 January 2018, available online: http://www.tandfonline.com/10.1080/24733938.2018.1426103

The influence of physical fitness on the response to intense exercise periods during female Australian football match-play

Georgia M. Black[1], Tim J. Gabbett[2,3], Rich D. Johnston[1], Michael H. Cole[1], Geraldine Naughton[4], and Brian Dawson[5]

1. *School of Exercise Science, Australian Catholic University, Brisbane, Queensland, Australia.*
2. *Gabbett Performance Solutions, Brisbane, Queensland, Australia*
3. *University of Southern Queensland, Institute for Resilient Regions, Ipswich, Queensland, Australia*
4. *School of Exercise Science, Australian Catholic University, Melbourne, Victoria, Australia*
5. *The University of Western Australia, Crawley, Western Australia, Australia*

Address correspondence to:

Ms Georgia Black

School of Exercise Science

Australian Catholic University

1100 Nudgee Road

Brisbane, 4014 AUSTRALIA

Email: georgia.black@acu.edu.au

Abstract

Objective: To investigate the influence of physical fitness on peak periods of match-play.

Methods: Forty-three female Australian footballers from three teams wore global positioning system units in matches during one competitive season. The Yo-Yo Intermittent Recovery Test (Level 1) was conducted as an estimate of physical fitness. One-, two-, three-, four- and five-minute rolling periods were analysed in order to determine the "peak" and "subsequent" periods during match-play.

Results: Midfielders covered greater distances during peak periods than half-line players (Effect size, ES range = 0.33-0.86; likelihood ≥76%). No meaningful differences were reported between positional groups for high-speed distances during the peak periods, with the exception of half-liners covering greater distance during the 1-minute period (ES = 0.38; likelihood = 80%).Higher fitness players covered greater peak total and high-speed (ES range = 0.70-1.16; likelihood ≥94%) distances than lower fitness players, irrespective of position. Higher fitness midfielders covered greater high-speed distances during the 1 to 3-minute subsequent periods than lower fitness midfielders (ES range = 0.46-0.71; likelihood ≥81%). Half-liners with greater Yo-Yo performances covered greater relative total and low-speed (ES range = 0.47-0.70; likelihood ≥76%) distances during the subsequent periods than lower fitness players.

Conclusion: Developing physical fitness may enable greater peak and subsequent period performances and improve players' abilities to maintain higher average match intensities.

Keywords: Global positioning systems; work rate; intense periods; positional differences; transient reductions; Yo-Yo

Introduction

Understanding the demands of match-play has been central to training prescription in team sport athletes (Gabbett et al. 2009). Research commonly reports the average distances covered during matches (Dawson et al. 2004; Varley et al. 2014). However, given the stochastic nature of team sports, the fluctuations in running demands that regularly occur during match-play are less understood. The use of global positioning system (GPS) technology has allowed scientists to detect transient reductions in running performance during team sport match-play (Aughey 2010; Coutts et al. 2010; Wisbey et al. 2010). Specifically, research has recently shown female Australian football (AF) midfielders and half-line players reduce overall running intensity and high-speed distances across match halves (Black et al. 2019). Despite the importance of understanding variations in running performance over the course of a match, knowledge of peak running periods (Delaney et al. 2017a) is of equal importance to optimise player preparedness for possible match situations, such as increasing high-speed running to create space or beat an opposing player to the football.

To understand intense passages of play, studies have used rolling time scales to identify peak periods of high-intensity running throughout matches (Varley et al. 2012; Black et al. 2016). Using rolling periods, research has reported reductions in running performance following the most intense match periods in a number of team sports (Kempton et al. 2013; Black et al. 2016; Sparks et al. 2016). With the exception of one study (Black et al. 2016), 5-min peak periods for total distance have been compared with the subsequent 5-min period and the average match running intensity to measure transient reductions in physical performance (Mohr et al. 2003; Carling and Dupont 2011; Kempton et al. 2013). However, recent research investigating duration-specific peak running periods in male AF and rugby league found increases in running intensity as the duration of the rolling period decreased (Duthie et al. 2017; Delaney et al. 2017a). These findings show that 5-min epochs are not representative of true maximal match intensity in team sports (Delaney et al. 2017a, 2017b). Furthermore, although researchers have provided insight into peak exercise periods and player’s responses to within match fatigue, studies have not taken into account how physical fitness may influence this response.

Several studies of team sport athletes have identified a relationship between physical fitness and match running performance. In AF (Mooney et al. 2011) and soccer (Krustrup et al. 2005), Yo-Yo Intermittent recovery test scores have been associated with greater total- and high-speed running distances during match-play. However, female team-sport athletes consistently score lower on the Yo-Yo IR1 test (Krustrup et al. 2005; Veale et al. 2010; Deprez et al. 2015; Black et al. 2018) and cover less high-speed distance during competitive match-play (Wisbey et al. 2010; Black et al. 2018) than their male counterparts. Therefore, peak running periods, specific to female field-sport athletes, require investigation to further inform coaching practices and increase match preparedness. In addition, research is yet to investigate the influence of fitness on duration-specific peak periods in highly intermittent, running-dominant team sports, such as AF or soccer. In order to understand the influence of physical fitness on peak periods, and responses to peak periods of match-play, this study aimed to (1) identify peak periods of varying durations in female AF and (2) determine whether better performance on the Yo-Yo IR1 was associated with greater distances covered during the peak and subsequent periods in female AF match-play.

Methodology

Participants

Forty-three players (age 24.3 ± 5.5 yrs, height 167.4 ± 4.3 cm, body mass 66.5 ± 9.3 kg) from three Queensland Women's Australian Football League teams were recruited into this study. Two positional groups were analysed in this study and were further separated into high or low fitness groups based on their Yo-Yo IR1 score; midfielders (median split = 800 m; high fitness n = 11; Yo-Yo IR1 distance 950 ± 62 m, low fitness n = 11; Yo-Yo IR1 distance 670 ± 165 m) and half-line players (median split = 680 m; high fitness n = 10; Yo-Yo IR1 distance 800 ± 95 m, low fitness n = 11; Yo-Yo IR1 distance 410 ± 80 m). All participants completed two field sessions per week with their respective clubs during the preseason. However, extra individual training sessions were not accounted for and if performed, these would likely influence the physical fitness of individual players. Due to the small number of the half-backs and half-forwards these positions were pooled (Brewer et al. 2010) to represent the half-line group. Prior to data collection, participants received an information sheet outlining the risks and benefits of the study and written consent was obtained. The study was approved by the Australian Catholic University's Human Research Ethics Committee (2016-27H).

Procedures

An observational cohort study was used to investigate the influence of physical fitness on the response to intense exercise periods in female AF match-play. Physical fitness was assessed using the Yo-Yo IR1 test and match running performances were measured using GPS units worn across one competitive season. Each positional group were divided into two subsets based on their final Yo-Yo score. Each match was analysed in rolling periods in order to compare the "peak", "subsequent" and "mean" periods during match-play for players with high and low fitness.

During the final 2 weeks of preseason, players were required to complete the Yo-Yo IR1 to assess physical fitness, with the total distance covered recorded as the Yo-Yo IR1 score. Players were separated into four groups based on their positional groups and Yo-Yo IR1 performance. Specifically, following the test both the midfield and half-line players were further divided into two subsets according to their Yo-Yo IR1 performance using a median split (high/low fitness midfielders, high/low fitness half-liners). During testing, participants wore football boots and their normal training clothes; given that some players were unfamiliar with the Yo-Yo IR1 test, the first two levels were incorporated into the warm-up. The typical error of measurement for the Yo-Yo IR1 has been reported as 4.9% in female athletes (Krustrup et al. 2003).

Each player's match activity profiles were recorded for each quarter during at least four (mean ± SD: 5.1 ± 0.6; range: 4–6; total GPS files: 180) competitive matches across the 2016 competitive season. Player movement was recorded using a S5 GPS unit (S5, Optimeye, Catapult Sports, Docklands, VIC, Australia) sampling at 10 Hz worn in a customised vest positioned between the shoulder blades. These 10 Hz GPS units have reported greater validity and inter-unit reliability than 1 Hz and 5 Hz units (Johnston et al. 2014). Data were downloaded onto a laptop and analysed using software provided by the manufacturer (Sprint 5.1.7, Catapult Sports, Docklands, VIC, Australia). All matches were played at the same time of day (~1600 h). Activity profiles were determined by dividing movements into low-speed (0-4.16 $m.sec^{-1}$), and high-speed (>4.16 $m.sec^{-1}$) bands as it has been recommended that speeds of 15-16 $km.hr^{-1}$ should be used to define highspeed running in female team sport athletes (Bradley and Vescovi 2015). Only active field time was included in analyses; data were removed for the time players were rotated or interchanged off the field.

As has been previously described (Black et al. 2016), the physical performance variables were arranged into 1-min rolling periods (Varley et al. 2012). Although 5-min epochs are commonly used to identify peak match periods (Mohr et al. 2003; Sparks et al. 2016), individual files were separated into periods of five different durations (1, 2, 3, 4 and 5-min). To measure transient reductions in performance, peak periods were identified as the intervals with the maximum distance covered per minute ($m.min^{-1}$), for each match. This period was then compared with the subsequent duration interval and the average match intensity. Data were removed from the analysis if players were interchanged off the field or the match quarter ended in the subsequent period. A total of 180 match files were included in the analysis (GPS files n = 97 midfielders [45 high fitness, 52 low fitness]; GPS files n = 83 half-line players [high 49 fitness, 34 low fitness]). A sample size of 34 files per group was required to enable the detection of an ES difference of > 0.30 (Hopkins et al. 2009). However, 155 peak periods were rem oved (72 [15%] midfielders, 83 [20%] half-line players) from the analysis as players were interchanged off the field or the match quarter ended in the subsequent period.

Statistical Analyses

Cohen's effect size (ES) statistic ± 90% confidence intervals (CI) were used to determine the magnitude of differences between midfielders and half-line players. Differences between the peak, subsequent and the average match demands were calculated. Furthermore, differences between high and low fitness groups were also compared. The effect sizes were classified as substantially greater or lesser when there was a ≥ 75% likelihood of the effect being equal to or greater than the smallest worthwhile change estimated as 0.2 x between-participants SD (small ES). Effect sizes of ≤0.2, 0.21-0.6, 0.61-1.2, 1.21-2.0, and >2.0 were considered trivial, small, moderate, large, and very large, respectively (Hopkins et al. 2009). A custom Excel spreadsheet (Version 16, Microsoft, USA) was used to calculate ES, CI and likelihoods (Hopkins et al. 2009).

Results

Midfielders covered meaningfully greater distances on the Yo-Yo IR1 test than the half-line group (ES = 0.53 ± 0.63; Likelihood = likely probable, 80%). Greater average match relative total- and low-speed distances were covered by the midfielders compared with the half-line players. Table 1 illustrates the peak periods for midfield and half-line positional groups. No meaningful differences were reported between playing positions for high-speed distances during peak periods (ES ≤ 0.28; likelihood ≤65%) with the exception of the 1-min period (ES = 0.38 ± 0.36; Likelihood = likely probable, 80%). As the duration of the peak period increased, running intensity subsequently decreased (ES range = 0.37–1.31; likelihood ≥ 77%).

Insert Table 1 here

Figures 1 and 2 illustrate the differences among peak, subsequent and average running intensities for the high and low fitness players. No meaningful differences were reported between high and low fitness midfielders, irrespective of period, for low-speed distances covered (ES ≤ 0.37; likelihood ≤74%). Higher fitness midfielders covered greater high-speed distances than the lower fitness players during the subsequent 1-, 2- and 3-min periods (ES = 0.57 ± 0.61; likelihood ≥ 82%). Higher fitness half-line players covered greater relative total- (ES range = 0.89–1.22; likelihood ≥ 99%) and high-speed (ES range = 0.70–1.16; likelihood ≥ 94%) distances during all peak periods than lower fitness players. Greater relative total (ES ≥ 0.59 ± 0.70; likelihood ≥ 85%) and low-speed (ES ≥ 0.47 ± 0.74; likelihood ≥ 76%) distances were covered by the higher fitness half-liners than the lower fitness players in the subsequent 2-, 3- and 5-min periods. Higher fitness half-line players reduced high-speed running below the match average during all subsequent periods (ES ≥ 0.43 ± 0.84; likelihood ≥ 80%).

Insert Figure 1 here

Insert Figure 2 here

Discussion

This is the first study to identify true peak periods, of varying durations during female AF match-play. Moreover, this study compared the effect of physical fitness on the response to short periods of high-intensity activity. True peak periods, based on maximal distances covered per minute, were identified across a number of duration-specific periods. In contrast to male AF players (Delaney et al. 2017a), these results demonstrate that midfielders exhibit greater peak periods, irrespective of period duration, than half-line players. Additionally, greater Yo-Yo performers covered greater relative total and high-speed distances in all peak periods than low Yo-Yo performers. The current findings highlight the importance of developing physical fitness and identify intense exercise periods that players will be exposed to during match-play.

Midfielders covered greater distances, during peak periods of play than the half-line players. However, these differences were largely explained by distances covered at low-speed. Additionally, midfielders reported greater fitness levels and, similar to previous research, greater average match demands (Dawson et al. 2004) than the half-line players. Collectively, these findings suggest that players with lower fitness levels may be selected for positions that are less physically demanding. Notwithstanding, both positional groups are exposed to intense passages of play during female AF matches (Table 1). Interestingly, as the discrete period duration increased, the difference between midfield and half-line peak running intensities also increased. Moreover, in accordance with previous research (Delaney et al. 2017a), half-line players covered greater high-speed distances during the 1-min peak period than the midfielders. These findings suggest that half-line players should be exposed to shorter duration peak periods (1–2 min) during training as they may be more representative of match situations. Nevertheless, with the exception of the 1-min period, high-speed distances were comparable across positional groups, which emphasises the importance of increasing high-intensity activity during intense match stages as for female footballers, irrespective of playing position.

While fluctuations in match running intensity across female AF matches have been previously reported (Black et al. 2017a), our results highlight the most demanding fluctuations of match-play (Table 1). The greatest "peak" period of matchplay performed by an individual player consisted of 212 m covered, 122 m at low-speed and 90 m covered at highspeed. In agreement with previous research (Delaney et al. 2017a), as the period duration increased (~1 min), running intensity was reduced. Nevertheless, irrespective of the period duration, players are required to exhibit significantly greater running intensities compared with the match average during these short epochs. Therefore, the results demonstrate duration-specific running intensities that can be used to develop "worst-case scenario" training drills (Black and Gabbett 2015; Delaney et al. 2017a) specific to female footballers. While running intensities may be influenced by contextual factors such as game outcome (Lago et al. 2010), match score (Sullivan et al. 2014), opposition rank (Hulin and Gabbett 2015) and playing strategy, these were not accounted for in this study and require further research.

Higher Yo-Yo IR1 performers covered greater relative total and high-speed distances during all peak periods compared with low Yo-Yo performers, irrespective of position. These findings demonstrate that superior fitness enables female footballers to increase high-speed running during intense match periods which, although speculative, may lead to a greater ability to (1) lead for the football, (2) beat their opponent to a contest, or (3) evade their opponent by running to space to become a passing option for their teammate. Furthermore, as research has identified relationships between Yo-Yo performance, high-intensity match running and skill involvements (Mooney et al. 2011); and peak exercise periods are associated with greater skill involvements in male AF players (Black et al. 2016), superior Yo-Yo performance may increase female footballers' ability to gain possession of the football during peak periods.

Higher fitness midfielders covered greater high-speed distances during the subsequent 1-, 2- and 3-min periods compared with lower fitness midfielders. Given that the Yo-Yo IR1 is an assessment of high-intensity intermittent running ability (Krustrup et al. 2005), it is not surprising that higher Yo-Yo performers were protected from match-related fatigue (Kempton et al. 2013) following the peak match periods. While higher fitness midfielders reduced high-intensity activity below their match average during the subsequent 4- and 5-min period, high-speed distances were comparable with low fitness players. Given that higher fitness players exhibited greater peak period and match intensities, it is possible these players implemented a self-preservation strategy (Noakes et al. 2005; Tucker and Noakes 2009) during these subsequent periods and performed at the lowest intensity that the match allowed.

In contrast to the findings from mid-fielders, half-line players covered comparable high-speed distances across fitness groups during the subsequent periods (Figure 2). Differences between high and low fitness half-line players were explained by distances covered at low-speed. Although in disagreement with previous research (Kempton et al. 2013; Black et al. 2016), a possible explanation may lie within the positional requirements of the half-line players. Male AF half-line positional players complete fewer skill involvements than midfielders (Dawson et al. 2004). Therefore, it is possible that following peak periods, high-intensity running is not demanded of half-line players as the football has been cleared from the attacking/defending zones.

A limitation of this study is the relatively small number of players (three teams drawn from one state competition) included in this analysis. Also, due to the small sample size of the full-line positional group (full backs/forwards and back/forward pockets), these data were excluded from the analysis. Future research should aim to identify intense match periods in all teams competing in the national female AF competition. Additionally, there are a number of confounders, such as individual player nutrition and match recovery strategies that were not accounted for and may have influenced running performance. Furthermore, the Yo-Yo IR1 was only assessed once at the end of preseason; as such it is possible that physical fitness may have improved or declined as the season progressed. Finally, work rate does not equate to performance, therefore further research investigating the influence of peak periods on match running performance and skill efficiency in elite female AF players is warranted and remains a future challenge.

Practical applications

The assessment of high-intensity running ability is important for female AF players, as superior Yo-Yo IR1 performance is linked with greater distances covered during peak and subsequent periods, of varying durations, and average match running intensities. Players with poorly developed physical fitness should be identified early to detect individual deficiencies and allow sufficient time for improvements. Additionally, coaches should expose all players to the “worst-case scenarios” during training to increase match preparedness. Small-sided games or high-intensity interval training, using peak running intensities relative to the drill duration, could be used to develop physical fitness and adequately prepare players for competition. However, these distances and intensities should be used as a starting point with training programs progressively increased to greater intensities.

Acknowledgements

This research is supported by an Australian Government Research Training Program Scholarship.

References

Aughey RJ. 2010. Australian football player work rate: evidence of fatigue and pacing? Int J Sports Physiol Perform. 5:394-405.

Black GM, Gabbett TJ. 2015. Repeated high-intensity effort activity in elite and semi-elite rugby league match-play. Inter J Sports Physiol Perform. 10:711-717.

Black GM, Gabbett TJ, Naughton G, Cole MH, Johnston RD, Dawson B. 2019. The influence of contextual factors on running performance in female Australian football match-play. J Strength Cond Res. 33(9):2488-2495.

Black GM, Gabbett TJ, Naughton G, Cole MH, Johnston RD, Dawson B. 2018. The influence of physical qualities on activity profiles of female Australian football match-play. Inter J Sports Physiol Perform. 13(4):524-529.

Black GM, Gabbett TJ, Naughton GA, McLean BD. 2016. The effect of intense exercise periods on physical and technical performance during elite Australian football match-play: a comparison of experienced and less experienced players. J Sci Med Sport. 19:596-602.

Bradley PS, Vescovi JD. 2015. Velocity thresholds for women's soccer matches: sex specificity dictates high-speed-running and sprinting thresholds: Female athletes in motion (FAiM). Inter J Sports Physiol Perform. 10:112-116.

Brewer C, Dawson B, Heasman J, Stewart G, Cormack S. 2010. Movement pattern comparisons in elite (AFL) and sub-elite (WAFL) Australian football games using GPS. J Sci Med Sport. 13:618-623.

Carling C, Dupont G. 2011. Are declines in physical performance associated with a reduction in skill-related performance during professional soccer match-play? J Sport Sci. 29:63-71.

Coutts AJ, Quinn J, Hocking J, Castagna C, Rampinini E. 2010. Match running performance in elite Australian rules football. J Sci Med Sport. 13:543-548.

Dawson B, Hopkinson R, Appleby B, Stewart G, Roberts C. 2004. Player movement patterns and game activities in the Australian Football League. J Sci Med Sport. 7:278-291.

Delaney JA, Thornton HR, Burgess DJ, Dascombe BJ, Duthie GM. 2017a. Duration-specific running intensities of Australian football match-play. J Sci Med Sport. 20:289-294.

Delaney JA, Thornton HR, Rowell AE, Dascombe BJ, Aughey RJ, Duthie GM. 2017b. Modelling the decrement in running intensity within professional soccer players. Sci Med Football. 2:86-92.

Deprez D, Fransen J, Lenoir M, Philippaerts R, Vaeyens R. 2015. The Yo-Yo intermittent recovery test level 1 is reliable in young high-level soccer players. Biol Sport. 32:65-70.

Duthie GM, Thornton HR, Delaney JA, McMahon JT, Benton DT. 2017. Relationship between physical performance testing results and peak running intensity during professional rugby league match play. J Sci Med Sport. Epub ahead of print. doi: 10.1519/JSC.0000000000002273

Gabbett T, Jenkins D, Abernethy B. 2009. Game-based training for improving skill and physical fitness in team sport athletes. Inter J Sports Sci Coach. 4:273-283.

Hopkins W, Marshall S, Batterham A, Hanin J. 2009. Progressive statistics for studies in sports medicine and exercise science. Med Sci Sport Exerc. 41:3-13.

Hulin BT, Gabbett TJ. 2015. Activity profiles of successful and less-successful semi-elite rugby league teams. Inter J Sports Med. 36:485-489.

Johnston RJ, Watsford ML, Kelly SJ, Pine MJ, Spurrs RW. 2014. Validity and interunit reliability of 10 Hz and 15 Hz GPS units for assessing athlete movement demands. J Strength Cond Res. 28:1649-1655.

Kempton T, Sirotic AC, Cameron M, Coutts AJ. 2013. Match-related fatigue reduces physical and technical performance during elite rugby league match-play: a case study. J Sports Sci. 31:1770-1780.

Krustrup P, Mohr M, Amstrup T, Johansen J, Steensberg A, Pedersen P, Bangsbo J. 2003. The Yo-Yo intermittent recovery test: physiological response, reliability, and validity. Med Sci Sport Exerc. 35:697-705.

Krustrup P, Mohr M, Ellingsgaard H, Bangsbo J. 2005. Physical demands during an elite female soccer game: importance of training status. Med Sci Sport Exerc. 37:1242-1248.

Lago C, Casais L, Dominguez E, Sampaio J. 2010. The effects of situational variables on distance covered at various speeds in elite soccer. Euro J Sport Sci. 10:103-109.

Mohr M, Krustrup P, Bangsbo J. 2003. Match performance of high-standard soccer players with special reference to development of fatigue. J Sports Sci. 21:519-528.

Mooney M, O'Brien B, Cormack S, Coutts A, Berry J, Young W. 2011. The relationship between physical capacity and match performance in elite Australian football: a mediation approach. J Sci Med Sport. 14:447-452.

Noakes TD, St Clair Gibson A, Lambert EV. 2005. From catastrophe to complexity: A novel model of integrative central neural regulation of effort and fatigue during exercise in humans. Br J Sports Med. 39:120-124.

Sparks M, Coetzee B, Gabbett T. 2016. Variations in high-intensity running and fatigue during semi-professional soccer matches. Int J Perform Anal Sport. 16:122-132.

Sullivan C, Bilsborough JC, Cianciosi M, Hocking J, Cordy J, Coutts AJ. 2014. Match score affects activity profile and skill performance in professional Australian football players. J Sci Med Sport. 17:326-331.

Tucker R, Noakes T. 2009. The physiological regulation of pacing strategy during exercise: A critical review. Br J Sports Med. 43:e1.

Varley MC, Elias GP, Aughey RJ. 2012. Current match-analysis techniques' underestimation of intense periods of high-velocity running. Int J Sports Physiol Perform. 7:183-185.

Varley MC, Gabbett TJ, Aughey RJ. 2014. Activity profiles of professional soccer, rugby league and Australian football match play. J Sport Sci. 32:1858-1866.

Veale JP, Pearce AJ, Carlson JS. 2010. The Yo-Yo Intermittent Recovery Test (Level 1) to discriminate elite junior Australian football players. J Sci Med Sport. 13:329-331.

Wisbey B, Montgomery PG, Pyne DB, Rattray B. 2010. Quantifying movement demands of AFL football using GPS tracking. J Sci Med Sport. 13:531-536.

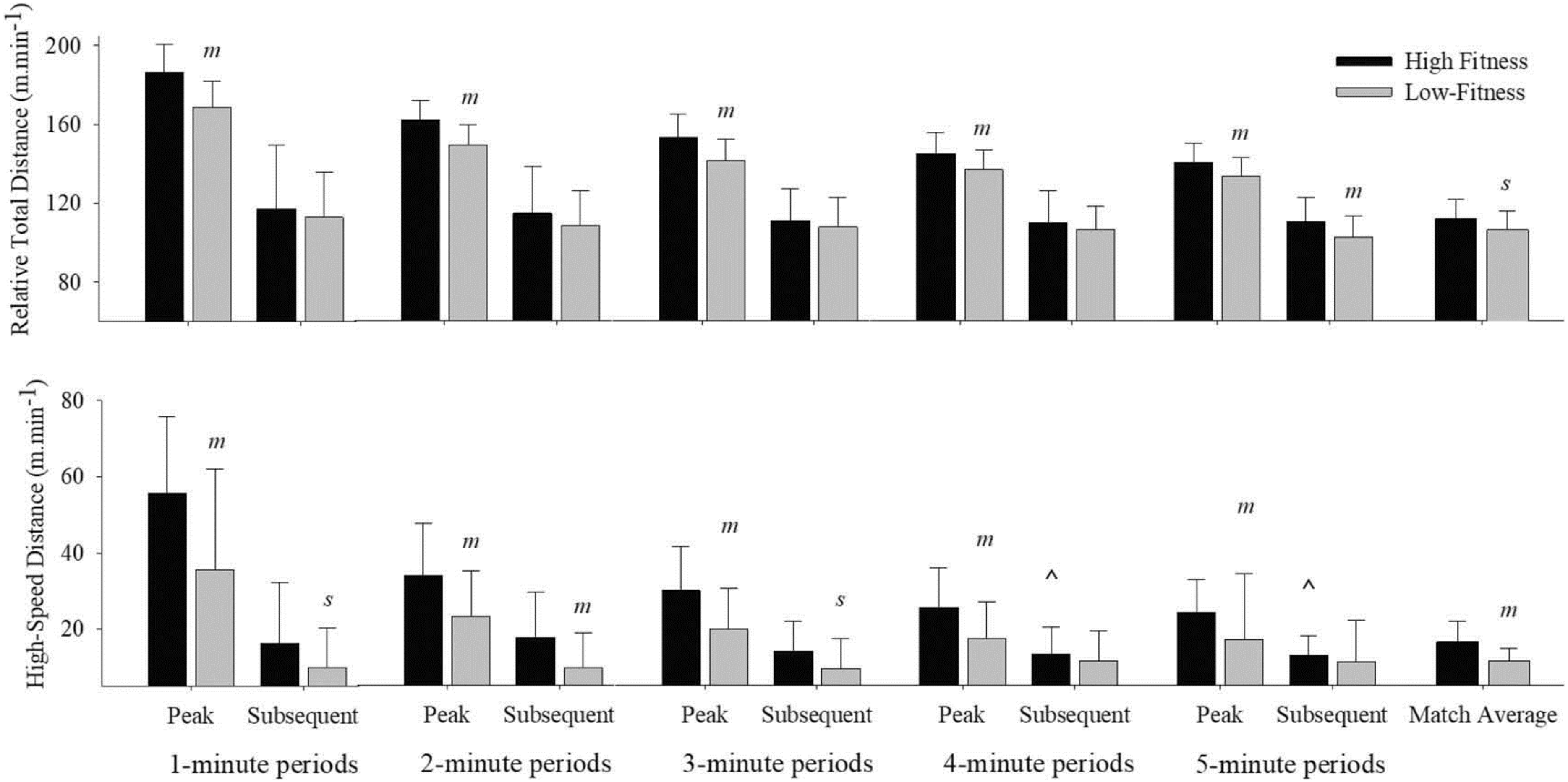

Figure 1: Duration-specific peak and subsequent periods, and match averages for the higher fitness and lower fitness midfielders.

m: a moderate effect size (ES = 0.61-1.2) difference between high and low fitness midfielders; s: a small effect size (ES = 0.21-0.60) difference between high and low fitness midfielders; ^ denotes meaningful difference (ES = 0.50–0.62) between the subsequent period and match average.

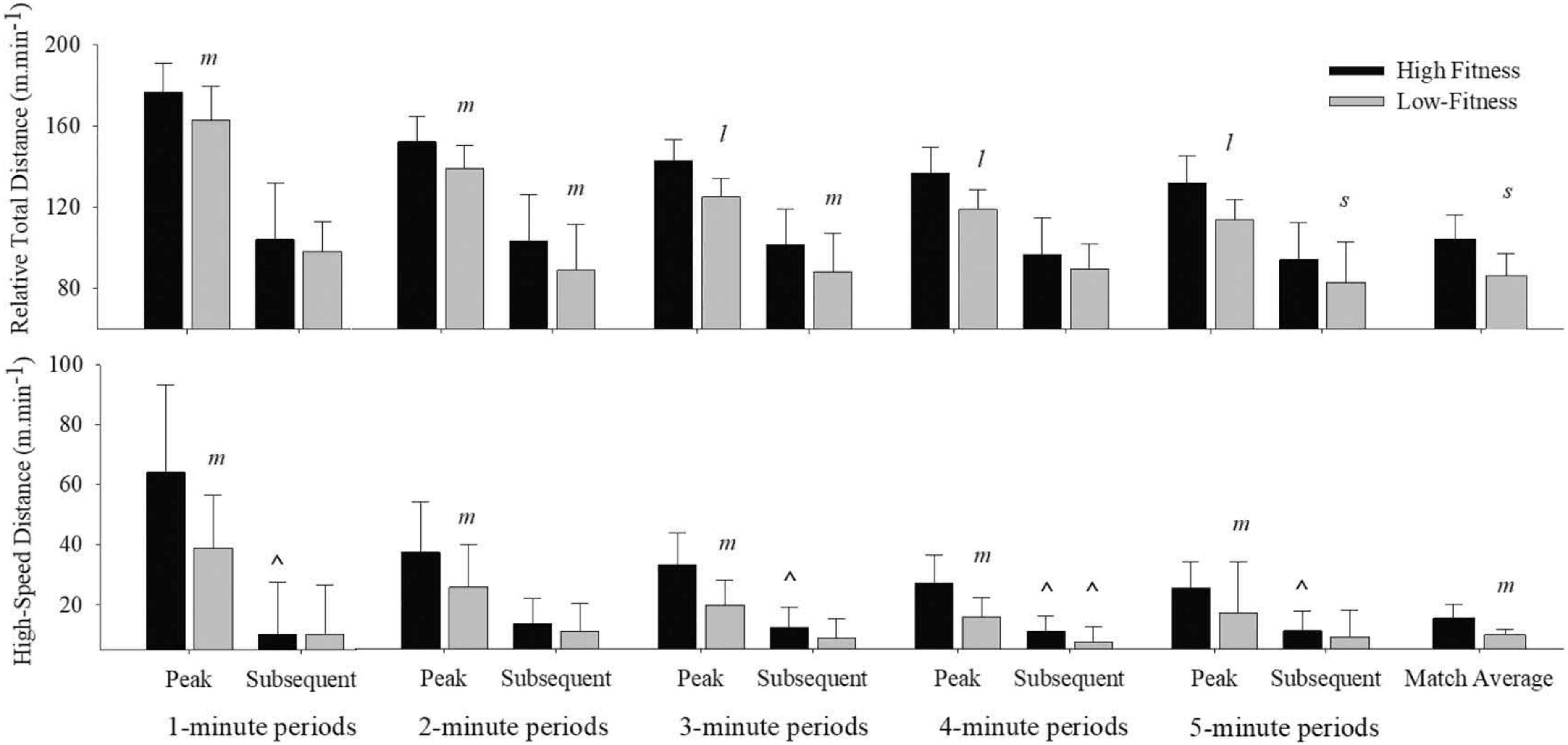

Figure 2: Duration-specific peak and subsequent periods, and match averages for the higher fitness and lower fitness half-line players.

l: a large effect size difference (ES = 1.21-2.0) between high and low fitness half-line players; m: a moderate effect size (ES = 0.61–1.2) difference between high and low fitness half-line players; s: a small effect size (ES = 0.21–0.60) difference between high and low fitness half-line players; ^ denotes meaningful difference (ES = 0.50–0.62) between the subsequent period and match average.

Table 1. Positional comparisons of running demands during competition

	Midfielders	**Half-liners**	**% difference**	**ES CI**	**Likelihood**
Average match demands					
Relative-distance (m.min^{-1})	109 (77-127)	94 (69-109)	18.7	1.06 ± 0.28	Almost certainly
Low-Speed distance (m.min^{-1})	95 (69-109)	82 (60-105)	18.7	1.15 ± 0.26	Almost certainly
High-speed distance (m.min^{-1})	14 (7-30)	13 (6-25)	19.7	0.19 ± 0.32	Trivial
1-minute Period					
Relative-distance (m.min^{-1})	178 (148-211)	173 (236-212)	3.1	0.33 ± 0.35	Possible
Low-Speed distance (m.min^{-1})	132 (59-180)	116 (61-167)	13.9	0.6 ± 0.35	Very likely
High-speed distance (m.min^{-1})	46 (0-109)	57 (0-130)	−18.9	−0.38 ± 0.36	Likely, probable
2-minute period					
Relative-distance (m.min^{-1})	156 (134-184)***	148 (120-172)***	5.7	0.64 ± 0.35	Very likely
Low-Speed distance (m.min^{-1})	127 (97-167)	114 (83-153)	11.1	0.72 ± 0.34	Almost certainly
High-speed distance (m.min^{-1})	29 (4-60)**	33 (0-66)**	13	−0.28 ± 0.37	Possible
3-minute period					
Relative-distance (m.min^{-1})	147 (125-176)*	136 (108-155)**	8.3	0.81 ± 0.35	Almost certainly
Low-Speed distance (m.min^{-1})	122 (90-149)	108 (84-128)*	13.1	0.99 ± 0.33	Almost certainly
High-speed distance (m.min^{-1})	25 (4-52)	28 (5-57)*	−10.4	−0.24 ± 0.38	Possible
4-minute period					
Relative-distance (m.min^{-1})	141 (121-167)*	130 (102-155)*	8.7	0.82 ± 0.36	Almost certainly
Low-Speed distance (m.min^{-1})	119 (93-147)	107 (83-141)*	11.2	0.87 ± 0.34	Almost certainly
High-speed distance (m.min^{-1})	22 (5-43)	23 (4-53)	3.3	−0.07 ± 0.38	Trivial
5-minute period					
Relative-distance (m.min^{-1})	137 (115-158)	125 (98-156)	9.3	0.86 ± 0.37	Almost certainly
Low-Speed distance (m.min^{-1})	116 (83-141)	103 (85-140)	12.6	0.92 ± 0.35	Almost certainly
High-speed distance (m.min^{-1})	21 (5-41)	22 (5-49)	−5.8	−0.14 ± 0.39	Trivial

Data reported as mean (range); *denotes small ES (0.43-0.47) difference from previous duration-specific period; **denotes moderate ES (0.68-0.90) difference from previous duration-specific period; ***denotes large ES (1.21-1.31) difference from previous duration-specific period