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Research article

Positional Differences in the Most Demanding Passages of Play in Football Competition

Andrés Martín-García [1]✉, David Casamichana [1,2], Antonio Gómez Díaz [1,3], Francesc Cos [1,4] and Tim J. Gabbett [5,6]

[1] FC Barcelona Sports Performance Department, Barcelona, Spain; [2] Universidad Europea del Atlántico, Santander, Spain; [3] Murcia University, San Javier University of Physical Education and Sports Science; [4] University of Physical Education and Sports Science, INEFC Barcelona, Spain; [5] Gabbett Performance Solutions, Brisbane, Australia; [6] University of Southern Queensland, Institute for Resilient Regions, Ipswich, Australia

Abstract

The aim of this investigation was to determine the position and duration specific activity of the most demanding passages of play in football players. Global positioning system data were collected from twenty-three football players across a competitive season. A total of 605 individual match files were analysed. Players were categorised based on positional groups; full-back (FB), central defender (CD), midfielder (MF), wide midfielders (WMF) and forwards (FW). The most demanding passage of a match play was analysed using a rolling average method, where maximal values were calculated for four different time durations (1', 3', 5' and 10') using distance ($m·min^{-1}$), high metabolic load distance (HMLD) and average metabolic power (AMP) as variables of interest. Using distance as the criterion variable, MF and WMF positions covered greater distance, and fewer sprinting meters (>7.0 $m·s^{-1}$, $m·min^{-1}$). With HMLD as the criterion variable, the values for WMF and MF positions were higher than the CD and FW positions. The MF and WMF positions performed more high-intensity accelerations and decelerations when the criterion variable was AMP. These results provide an understanding of the most demanding passages of play to inform training practices for specific football playing positions.

Key words: Team sports, match demands, peak intensity, global position system.

Introduction

Several studies have described the demands of football competition (Castellano et al., 2014; Di Salvo et al., 2007), serving as a benchmark for comparison with training demands (Owen et al., 2017; Stevens et al., 2017) or tasks within training (Beenham et al., 2017; Casamichana et al., 2012; Dellal et al., 2012; Giménez et al., 2017). However, training tasks designed to replicate the average demands of matches will likely result in players being underprepared for the most demanding phases of football match-play (Gabbett et al., 2016).

The most demanding phases of the match have been studied using different methodologies. Dividing the match in to predefined periods of 15 minutes (Carling and Dupont, 2011) or 5 minutes (Bradley and Noakes, 2013; Di Mascio and Bradley, 2013) has shown higher activity peaks than the match average, with intensity being higher as the duration of the studied period decreased. For example, some players reached values of close to 140 $m·min^{-1}$ for distance covered and more than 40 $m·min^{-1}$ of distance covered at high speed in 5-minute periods (Bradley and Noakes, 2013). However, the most demanding passage of match-play may not fall completely within these pre-defined blocks. Therefore, these methods underestimate the most demanding passage of match-play (Varley et al., 2012).

Alternatively, a more practical and accurate approach would be to establish the most demanding passage of match-play using the rolling method (or moving average method). This procedure has been applied to Gaelic Football (Malone et al., 2017b), Rugby League (Delaney et al., 2016), Australian Football (Delaney et al., 2017a) and European football (Delaney et al., 2017b; Lacome et al., 2017). Delaney et al. (2017b) found differences between central defenders, wide midfielders, and forwards, with central defenders covering the least distance and the lowest metabolic power, while wide midfielders performed a greater number of accelerations and decelerations. High-speed running was greatest in forwards and wide midfielders (Delaney et al., 2017b).

Distance ($m·min^{-1}$), distance covered at high speed (>5.5 $m·s^{-1}$), average metabolic power, absolute values for acceleration and deceleration, and mechanical work have all been used to characterise the most demanding passages of play (Delaney et al., 2016; Delaney et al., 2017b; Lacome et al., 2017). The inclusion of variables that integrate the activity developed at high speed and accelerating/decelerating at high-intensity could be of interest to configure these periods. In this sense, high metabolic load distance (HMLD) is of interest, since it represents the distance covered (m) by a player when their metabolic power (energy consumption per kilogram per second) is above the value of 25.5 $W·kg^{-1}$ (Tierney et al., 2016). This value of 25.5 corresponds to when a player is running at a constant speed of 5.5 $m·s^{-1}$ on grass or when they are performing significant acceleration or deceleration activity (e.g. if they are accelerating from 2 to 4 $m·s^2$ over 1 second).

To date, most football research has only quantified isolated activity variables. However, an understanding of other activities occurring within the most demanding passages of play is also important. In football the activity of the player is multidirectional, multidimensional and iterative. Consequently, a detailed description of the activity performed by players during these most demanding passage of match-play would be of interest to managers, fit-

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ness coaches and team medical staff. For example, two players could obtain the same average metabolic power (AMP; W·kg^{-1}) values over a given period of time, but the activity performed by the players could be vastly different (in one case, high intensity actions could be the result of greater high speed distance, and in another case the high intensity actions could be due to a higher number of accelerations or decelerations).

This information has significant practical application for the prescription of training, since it can serve as a benchmark when designing and evaluating the demands of the training tasks that are imposed on football players. Therefore, the purpose of this research was to identify the most demanding passage of match-play in football competition describing these periods through different variables, and determine the differences among positions through different criterion variables, and in different moving average durations.

Methods

Design

An observational, retrospective cohort study was conducted during the 2015-2016 competitive season. Global positioning system (GPS) files were collected from a professional male soccer team during match-play. Position-specific activities for the most demanding passage of match-play were established using different criterion variables, and in different moving average durations.

Subjects

Twenty-three professional football players (age: 20 ± 2 yr, mass: 70.2 ± 6.3 kg and stature: 1.78 ± 0.06 m) from the same Spanish 2nd B division team volunteered for this study. Data was collected throughout 37 competitive matches of the 2015-2016 competitive season (13 wins, 15 losses, 9 draw, final position 11th). A total of 605 individual global positioning system (GPS) files from match data of a professional male soccer team were collected. Each match was 90 min in duration, separated into two 45-min halves. Players were grouped according to their playing position, as central defenders (CD: n = 3; 95 GPS files), full backs (FB: n = 5; GPS 139 files), midfielders (MF: n = 3; GPS 101 files), wide midfielders (WMF: n = 5; GPS 110 files) and forwards (FW: n = 7; GPS 160 files). The mean (± SD) number of observations per player was 26.3 ± 12.4. A typical training week consisted of 5 field sessions. The training week typically used the following schedule: session +1: recovery from the previous game for the players who competed for more than 60 minutes and compensatory session for the players who competed less than 60 minutes in the game; session -4: strength oriented training session with SSG in reduced space; session -3: training oriented towards endurance development/maintenance; session -2: training with tasks with tactical-technical objective; and session -1: activation drills replicating the tactical profile of competition, with low conditioning load and some set piece drills. These data arose from the daily player monitoring in which player activities were routinely measured over the course of the season, thus no authorization was required from an institutional ethics committee (Lacome et al., 2017). Data arose as a condition of the players' employment whereby they were assessed daily. Nevertheless, this study conformed to the Declaration of Helsinki and players provided informed consent before participating.

Procedures

The STATSports software (Version 1.2) was then used for the computation of a moving average over each criterion variable (distance, HMLD and AMP), using four different durations (1', 3', 5' and 10'), and the maximum value for each duration was recorded. As a result, for each match, maximum values using three criterion variables were calculated for each of the 4 moving average durations. These four different durations were analysed because they correspond to the usual duration of the training drills in the team studied. Descriptive statistics and analysis were then calculated based on positions of play. These data were then averaged across all observations per position for between-group analysis.

The variables recorded were the distance covered per minute in competition (m·min^{-1}), distance covered at high speed (HSR; >5.5 m·s^{-1}, m·min^{-1}), distance covered at sprint (SPR; >7.0 m·s^{-1}, m·min^{-1}), the number of high-intensity accelerations (ACC; >3 m·s^{2}, n·min^{-1}), the number of high-intensity decelerations (DEC; <-3 m·s^{2}, n·min^{-1}), the average metabolic power (AMP: W·kg^{-1}) and the high metabolic load distance (HMLD; >25.5 W·kg^{-1}, n·min^{-1}). AMP is the energy expended by the player per second per kg for the player based on running on grass (the unit is W·kg^{-1}) and was calculated using the energetic calculations detailed previously (di Prampero et al., 2005; Osgnach et al., 2010). HMLD represents the distance covered (m) by a player when their metabolic power (energy consumption per kilogram per second) is above the value of 25.5 W·kg^{-1}.

This method allowed the computation of a number of output variables for each player, including distance (m·min^{-1}). Distance was representative of the traditional model, where accelerated running is ignored (Delaney et al., 2016). Composite variables combining multiple physical factors were also considered. The HMLD sums up high speed running distance (>4.0 m·s^{-1}) and also includes the distance covered when the player is involved in high acceleration/deceleration activities (set by the manufacturer at >2 m·s^{2} by default). HMLD represents the distance covered (m) by a player when their metabolic power (energy consumption per kilogram per second) is above the value of 25.5 W·kg^{-1}. HMLD is an estimation of energetic cost, based on the movement profile of the athlete. It is a metric calculated by the STATSports software algorithm and is considered to measure all activity above a metabolic power of 25.5 W·kg^{-1} (Dunbara et al., 2015; Osgnach et al., 2010).

The activity profile of players were monitored during each official match using a portable 10 Hz GPS unit (Viper Pod, 50 gr, 88 x 33 mm, Statsports Viper, Northern Ireland) as used in previous studies (Bowen et al., 2017; Fox et al., 2017). The accuracy of these devices has been studied recently, with 2.53 ± 6.03% estimation error in distance covered, with accuracy (%) improving as the distance covered increases and the speed of movement decreases (Beato et al., 2016). In order to avoid interunit error, each player trained with the same GPS device during the whole study period (Castellano et al., 2011; Nicolella et al., 2018). The GPS model used in this study was worn in a purpose designed vest, inside a mini pocket positioned in the centre area of the upper back, just above the shoulder blades, and thus, not affecting mobility of the upper limbs and torso.

Upon completion of each match, GPS data were extracted using proprietary software (Viper, Statsports, Ireland). A total of 605 individual match files were obtained.

The team systematically played in a 1-4-3-3 formation, with a goalkeeper, two FB, two CD, a MF, two WMF and three FW. Goalkeepers and players with less than 10 records were not included in the analysis. Only data from players who completed the full match were analysed in order to limit the effect of pacing strategies (Carling and Dupont, 2011).

Statistical analysis

The data are presented as means and standard deviations (mean ±SD). The homogeneity of variances was examined by means of the Levene's test. The presence of significant differences was determined by means of a 1-tailed repeated-measures analysis of variance, applied to each of the dependent variables in relation to the position (CD, FB, MF, WMF and FW). Whenever a significant difference was found, a post hoc Bonferroni's test were used, whereas a Dunnett's T3 post hoc test was applied when the variances were not homogeneous. Effect sizes (ES) were calculated to determine meaningful differences. Magnitudes of difference were classed as trivial (<0.2), small (>0.2–0.6), moderate (>0.6–1.2), large (>1.2– 2.0) and very large (>2.0–4.0) (Batterham and Hopkins, 2006). All the statistical analysis were performed using SPSS 16.0 (SPSS Inc., Illinois, USA) for Windows, with significance being set at $p < 0.05$.

Results

Table 1 shows the mean ± SD values of the different variables for the specific positions in the game, including the significant differences ($p < 0.05$) in the four analyzed periods of time (1´, 3´, 5´ and 10´) using distance as the criterion variable. MF and WMF positions covered greater distance and fewer meters at sprint (>7.0 $m \cdot s^{-1}$, $m \cdot min^{-1}$). In the case of HSR, FB covered the greatest distance, reaching values of 47.2 ± 24.0 $m \cdot min^{-1}$ in the 1' period.

Table 1. The most demanding passage of a match play for each position using distance (DIS; $m \cdot min^{-1}$) for four different time durations (1', 3', 5' and 10').

		Position						
Time	**Variables**	**CD**	**FB**	**MF**	**WMF**	**FW**	**AVERAGE**	**ES;p**
1 min	DIS	181.9±16.4	195.3±15.7^{a,b}	204.0±15.4^{a,b}	201.1±19.0^{a,b}	180.9±20.4	191.6±19.7	ES: 0.1-1.2; p<0.001
	HSR	35.5±24.2	47.2±24.0^{c}	29.8±22.1	35.8±19.9	37.8±21.6	38.3±23.1	ES: 0.3-0.4; p=0.004
	SPR	11.6±19.1	14.0±17.3	6.1±11.0	7.2±12.5	11.5±14.2	10.6±15.6	ES: 0.1-0.5; p=0.076
	AMP	17.2±1.7	18.9±1.6^{a,b}	18.9±1.4^{a,b}	19.1±1.9^{a,b}	17.6±2.4	18.3±1.9	ES: 0.4-1.1; p<0.001
	HMLD	59.3±17.0	70.4±17.9^{a}	65.9±16.3	69.7±16.6^{a}	61.8±17.8	65.5±17.7	ES: 0.1-0.6; p=0.003
	ACC HI	2.7±1.5	2.8±1.5	2.6±1.3	3.3±1.8	2.8±1.7	2.8±1.6	ES: 0.3-0.6; p=0.241
	DEC HI	2.8±1.6	3.7±1.5^{a}	3.4±1.5	3.8±1.9^{a}	3.5±1.6	3.5±1.6	ES: 0.1-0.6; p=0.031
	ACC+DEC HI	5.6±2.8	6.6±2.6	6.0±2.4	7.2±3.2	6.3±3.0	6.4±2.8	ES: 0.2-0.5; p=0.081
3 min	DIS	143.4±9.7	151.9±9.1^{a,b}	161.3±8.5^{a,b,e}	156.6±15.6^{a,b}	138.4±15.9	149.1±14.7	ES: 0.4-1.7; p<0.001
	HSR	11.7±8.9	19.7±9.4^{a,c,d}	12.5±7.2	15.0±7.8	17.4±8.8^{a}	15.8±9.1	ES: 0.2-0.9; p<0.001
	SPR	2.6±4.6	4.4±5.4^{c}	1.7±2.9	2.1±3.1	4.1±4.3	3.2±4.4	ES: 0.1-0.6; p=0.005
	AMP	13.3±0.9	14.4±1.1^{a,b}	14.8±0.7^{a,b}	14.6±1.5^{a,b}	13.3±1.6	14.0±1.4	ES: 0.2-1.9; p<0.001
	HMLD	30.7±8.0	39.9±9.2^{a}	37.8±6.8^{a}	38.9±9.8^{a}	36.1±9.4^{a}	36.8±9.4	ES: 0.1-1.0; p<0.001
	ACC HI	2.5±0.9	2.3±0.9	2.6±1.2	2.7±1.1	2.3±1.1	2.5±1.0	ES: 0.1-0.4; p=0.182
	DEC HI	2.6±0.8	2.7±0.9	3.1±0.7	2.9±0.8	2.7±1.2	2.7±1.0	ES: 0.3-0.7; p=0.191
	ACC+DEC HI	5.1±1.6	5.1±1.6	5.7±1.6	5.6±1.7	4.9±2.2	5.3±1.8	ES: 0.1-0.4; p=0.140
5 min	DIS	132.7±8.3	139.3±8.1^{a,b}	149.7±6.8^{a,b,e}	146.4±16.0^{a,b}	127.7±13.6	137.9±13.7	ES: 0.3-1.9; p<0.001
	HSR	8.3±4.9	14.6±6.2^{a,c,d}	9.3±5.3	11.5±5.3	13.2±6.2^{a,c}	11.8±6.1	ES: 0.2-1.1; p<0.001
	SPR	1.5±2.3	3.4±3.4^{a}	1.6±2.8	1.9±2.4	2.9±3.0	2.4±2.9	ES: 0.2-0.6; p=0.001
	AMP	12.3±0.7	13.1±0.9^{a,b}	13.8±0.6^{a,b,e}	13.6±1.5^{a,b}	12.1±1.5	12.9±1.3	ES: 0.2-1.4; p<0.001
	HMLD	25.4±4.9	32.8±6.3^{a}	31.9± 5.4^{a}	33.9±8.7^{a,b}	29.3±7.8^{a}	30.6±7.5	ES: 0.1-1.2; p<0.001
	ACC HI	2.2±0.6	2.2±0.7	2.8±0.8^{b,e}	2.7±0.9^{b}	2.1±1.1	2.4±0.9	ES: 0.1-0.7; p<0.001
	DEC HI	2.3±0.6	2.6±0.7	3.1±0.7^{a,b}	2.8±0.9^{a}	2.4±1.0	2.6±0.8	ES: 0.4-1.2; p<0.001
	ACC+DEC HI	4.5±1.1	4.9±1.4	5.9±1.5^{a,b,e}	5.5±1.6^{a}	4.5±1.9	4.9±1.6	ES: 0.3-0.8; p<0.001
10 min	DIS	122.6± 7.4	128.2±8.1^{a,b}	139.7±7.8^{a,b,e}	135.2±15.6^{a,b,e}	117.0±13.1	127.3±13.4	ES: 0.4-2.0; p<0.001
	HSR	6.4±3.3	11.3±3.9^{a,c,d}	6.8±3.1	8.9±3.9^{a}	11.2±4.3^{a,c,d}	9.3±4.3	ES: 0.0-1.3; p<0.001
	SPR	1.2±1.4	2.6±2.5^{a,c,d}	0.8±1.5	1.3±1.7	2.4±2.3^{a,c}	1.8±2.1	ES: 0.1-0.8; p<0.001
	AMP	11.3±0.7	12.1±0.9^{a,b}	12.9±0.6^{a,b,e}	12.6±1.5^{a,b}	11.0±1.4	11.9±1.3	ES: 0.3-1.6; p<0.001
	HMLD	21.9±3.6	27.7±4.9^{a,b}	27.0±4.7^{a}	28.8±7.7^{a,b}	24.7±6.1	26±6.1	ES: 0.2-1.1; p<0.001
	ACC HI	2.2±0.4	2.2±0.7	2.6±0.5^{a,b,e}	2.5±0.8^{b}	1.9±0.9	2.2±0.8	ES: 0.1-0.9; p<0.001
	DEC HI	2.2±0.5	2.5±0.6^{a,b}	2.8±0.5^{a,b}	2.6±0.7^{a,b}	2.1±0.9	2.4±0.7	ES: 0.3-0.9; p<0.001
	ACC+DEC HI	4.5±0.9	4.7±1.3	5.4±0.9^{a,b}	5.1±1.5	4.0±1.8	4.7±1.4	ES: 0.2-0.9; p<0.001

CD = central defender; FW = forward; MF = midfielder; WMF = wide midfielder; FB = full back; a > CD; b > FW; c > MF; d > WMF; e > FB; DIS = distance $\cdot min^{-1}$; HSR = high speed Running $\cdot min^{-1}$ (>5.5 $m \cdot s^{-1}$, $m \cdot min^{-1}$); SPR = sprint $\cdot min^{-1}$ (>7.0 $m \cdot s^{-1}$, $m \cdot min^{-1}$); HMLD = high metabolic load distance $\cdot min^{-1}$; AMP = average metabolic power; ACC = accelerations $\cdot min^{-1}$ (>3 $m \cdot s^{2}$, $n \cdot min^{-1}$); DEC = decelerations $\cdot min^{-1}$ (<-3 $m \cdot s^{2}$, $n \cdot min^{-1}$); HI = high intensity.

Table 2. The most demanding passage of a match play for each position using relative metabolic load distance (HMLD; m·min^{-1}) for four different time durations (1', 3', 5', and 10').

		Position						
Time	**Variables**	**CD**	**FB**	**MF**	**WMF**	**FW**	**AVERAGE**	**ES;p**
1 min	DIS	163.6±24.9	175.5±21.4	189.8±18.6^{a,b,e}	187.5±23.7^{a,b}	160.0±26.3	173.5±26.0	ES: 0.1-0.7; p<0.001
	HSR	47.2±19.3	55.9±20.2	45.2±22.6	48.3±16.4	49.4±19.9	49.9±19.8	ES: 0.3-0.5; p=0.069
	SPR	19.1±20.5	18.3±18.1	12.7±17.2	11.4±12.5	18.8±16.6	16.6±17.4	ES: 0.0-0.5; p=0.085
	AMP	16.3±2.4	18.1±2.1^{a,b}	18.5±1.8^{a,b}	17.7±2.2^{a,b}	16.5±2.8	17.5±2.5	ES: 0.2-1.0; p<0.001
	HMLD	67.7±12.8	79.7±16.0^{a,b}	77.0±13.2^{a}	79.7±11.2^{a}	72.2±14.9	75.2±14.8	ES: 0.0-0.8; p<0.001
	ACC HI	3.4±1.6	3.5±1.7	3.6±1.7	3.9±1.8	3.2±1.7	3.5±1.7	ES: 0.2-0.4; p=0.319
	DEC HI	3.0±1.7	4.0±1.6^{a,b}	3.9±1.6	3.9±1.8^{a,b}	3.1±1.4	3.6±1.7	ES: 0.1-0.6; p=0.001
	ACC+DEC HI	6.5±2.8	7.6±2.9	7.5±2.9	7.9±3.0^{b}	6.3±2.8	7.1±2.9	ES: 0.1-0.5; p=0.015
3 min	DIS	131.9±16.2	141.1±14.6^{a,b}	151.2±11.4^{a,b,e}	147.6±16.4^{a,b}	128.3±17.2	138.8±17.6	ES: 0.2-1.5; p<0.001
	HSR	18.9±9.4	24.3±9.0^{a,c}	18.2±9.5	20.8±7.1	23.7±7.9^{a,c}	21.7±8.8	ES: 0.1-0.6; p=0.001
	SPR	5.1±6.5	6.6±6.6	3.6±5.6	4.8±5.1	7.7±5.7^{c}	5.8±6.1	ES: 0.2-0.7; p=0.013
	AMP	12.7±1.5	13.9±1.4^{a,b}	14.3±1.0^{a,b}	14.3±1.7^{a,b}	12.7±1.7	13.5±1.7	ES: 0.0-0.9; p<0.001
	HMLD	36.6±6.9	44.6±7.1^{a,b}	42.4±6.3^{a}	45.3±7.6^{a,b}	40.6±7.9	41.9±7.9	ES: 0.1-1.2; p<0.001
	ACC HI	2.7±0.8	2.6±1.0	2.9±1.0^{b}	2.9±1.1^{b}	2.2±0.9	2.6±0.9	ES: 0.0-0.7; p<0.001
	DEC HI	2.5±0.9	2.9±1.0	3.1±0.9^{a}	3.1±1.0^{a,b}	2.6±0.9	2.8±0.9	ES: 0.0-0.6; p<0.001
	ACC+DEC HI	5.2±1.5	5.6±1.8	6.1±1.7^{b}	6.1±1.9^{b}	4.8±1.6	5.5±1.8	ES: 0.0-0.7; p<0.001
5 min	DIS	123.2±12.8	131.3±11.4^{a,b}	142.4±9.0^{a,b,e}	140.9± 5.3^{a,b,e}	118.2±14.9	129.9±15.9	ES: 0.1-2.0; p<0.001
	HSR	13.7±6.4	18.3±6.2^{a,c}	12.7±5.9	15.5±5.6	18.1±6.3^{a,c}	16.1±6.5	ES: 0.0-0.9; p<0.001
	SPR	4.1±4.3	4.8±4.2^{c,d}	2.4±3.3	2.5±2.7	5.1±4.3^{c,d}	4.0±3.9	ES: 0.1-0.7; p=0.001
	AMP	11.7±1.1	12.8±1.1^{a,b}	13.4±0.8^{a,b,e}	13.4±1.6^{a,b}	11.5±1.6	12.5±1.5	ES: 0.0-1.4; p<0.001
	HMLD	29.3±4.7	36.5±5.6^{a,b}	35.7±4.6^{a}	38.1±7.5^{a,b}	33.2±6.8^{a}	34.5±6.7	ES: 0.2-1.4; p<0.001
	ACC HI	2.4±0.7	2.3±0.8	2.8±0.9^{b}	2.8±1.0^{b,e}	2.2±1.1	2.5±0.9	ES: 0.0-0.6; p<0.001
	DEC HI	2.3±0.6	2.7±0.7^{a}	3.0±0.7^{a,b}	2.9±0.8^{a,b}	2.4±0.9	2.6±0.8	ES: 0.1-1.1; p<0.001
	ACC+DEC HI	4.7±1.1	5.1±1.3	5.9±1.5^{a,b}	5.8±1.7^{a,b}	4.6±1.9	5.1±1.6	ES: 0.1-0.7; p<0.001
10 min	DIS	115.6±11.9	122.9±9.1^{a,b}	135.1±9.1^{a,b,e}	132.1±13.4^{a,b,e}	110.5±14.3	121.9±14.8	ES: 0.3-2.0; p<0.001
	HSR	8.9±4.2	13.6±4.3^{a,c}	8.6±3.2	11.7±3.9^{a,c}	13.2±4.3^{a,c}	11.6±4.5	ES: 0.1-1.3; p<0.001
	SPR	2.1±2.4	3.3±2.8^{c,d}	1.2±1.4	1.7±1.7	3.6±2.7^{a,c,d}	2.6±2.5	ES: 0.1-1.0; p<0.001
	AMP	10.8±1.1	11.8±1.0^{a,b}	12.6±0.7^{a,b,e}	12.4±1.3^{a,b}	10.6±1.4	11.5±1.4	ES: 0.2-1.7; p<0.001
	HMLD	23.4±3.6	29.8±4.5^{a,b}	29.2±4.0^{a}	31.5±6.6^{a,b}	26.6±5.7^{a}	28.0±5.7	ES: 0.3-1.5; p<0.001
	ACC HI	2.3±0.5	2.2±0.7	2.8±0.6^{a,b,e}	2.6±0.8^{b}	1.9±0.9	2.3±0.8	ES: 0.3-1.1; p<0.001
	DEC HI	2.1±0.6	2.5±0.6^{b}	2.8±0.6^{a,b}	2.5±0.7^{b}	2.1±0.7	2.4±0.7	ES: 0.5-1.1; p<0.001
	ACC+DEC HI	4.5±0.9	4.7±1.2	5.6±1.0^{a,b,e}	5.1±1.5^{b}	4.0±1.7	4.7±1.4	ES: 0.4-1.1; p<0.001

CD = central defender; FW = forward; MF = midfielder; WMF = wide midfielder; FB = full back; a > CD; b > FW; c > MF; d > WMF; e > FB; DIS = distance ·min^{-1}; HSR = high speed Running ·min^{-1} (>5.5 m·s^{-1}, m·min^{-1}); SPR = sprint ·min^{-1} (>7.0 m·s^{-1}, m·min^{-1}); HMLD = high metabolic load distance ·min^{-1}; AMP = average metabolic power; ACC = accelerations ·min-1 (>3 m·s^{2}, n·min^{-1}); DEC = decelerations ·min-1 (<-3 m·s^{2}, n·min^{-1}); HI = high intensity.

Table 2 presents the mean ± SD values using HMLD as the criterion variable. In FW and WMF positions their HMLD was greater than the other positions. In the WMF and MF positions AMP was higher than the CD and FW positions in each one of the periods analyzed.

Table 3 shows the most demanding passages of play when AMP was used as the criterion variable. FB, MF and WMF positions covered the greatest distance. FB and FW positions covered more HSR distance, while the FB position ran the greatest distance at sprints. Higher accelerations and decelerations at high intensity values were performed by the MF and MFO positions in the 3' and 10' periods (ES: 0.5-1.2).

Discussion

The main findings of this study were that during the most demanding passage of match-play, physical demands are position-dependent. CD and FW reported lower locomotive demands in comparison to WMF, FB and MF, and HMLD values in WMF and FB were higher than other positions during all epochs (1´, 3´, 5´ and 10´).

Differences in the most demanding passage of play among player position have previously been observed in football (Delaney et al., 2017b) as well as in other team sports such as Rugby League (Delaney et al., 2016) and Gaelic football (Malone et al., 2017b). When distance covered was used as the criterion variable, WMF and MF covered greater distance independent of the selected duration, with values as high as 200 m·min^{-1} during 1 minute epochs. These results are similar to those obtained in professional Australian players (Delaney et al., 2016) and higher than those recorded in French professional footballers (Lacome et al., 2017). The teams studied in the previous work (Lacome et al., 2017; Delaney et al., 2017b) used the same playing system (1-3-4-3), but the classification of positions was different. Our study did not differentiate between strikers and wingers (Lacome et al., 2017), or between midfielders and wide midfielders (Delaney et al., 2017b). Despite these differences, previous studies also found that MF players cover the greatest distance whereas CD report the lowest values (Lacome et al., 2017; Delaney et al., 2017b).

One of the main original findings of this work is that the most demanding passages of play values are defined based on both the criterion variable, and other variables that may help to understand the demands of the critical moments of match-play. When the players reach their peak values in any criterion variable (e.g. in distance covered),

Table 3. **The most demanding passage of a match play for each position using relative average metabolic power (AMP; W·kg^{-1}) for four different time durations (1', 3', 5', and 10').**

		Position						
Time	**Variables**	**CD**	**FB**	**MF**	**WMF**	**FW**	**AVERAGE**	**ES;p**
1 min	DIS	172.2 ± 16.4	189.9 ± 15.6^{a,b}	200.2 ± 16.1^{a,b,e}	195.2 ± 21.2^{a,b}	175.3 ± 24.6	186.3 ± 21.3	ES: 0.3-1.7; p<0.001
	HSR	32.3 ± 22.3	46.9 ± 22.8^{a,c}	31.2 ± 19.6	37.8 ± 18.9	40.3 ± 20.2	38.9 ± 21.6	ES: 0.3-0.7; p=0.001
	SPR	8.7 ± 15.5	16.7 ± 16.9^{a,c,d}	7.6 ± 13.4	7.7 ± 10.8	12.9 ± 12.6	11.4 ± 14.6	ES: 0.3-0.6; p=0.003
	AMP	17.7 ± 1.4	19.4 ± 1.7^{a,b}	19.7 ± 1.1^{a,b}	19.6 ± 1.7^{a,b}	18.1 ± 2.2	18.9 ± 1.9	ES: 0.1-1.6; p<0.001
	HMLD	60.5 ± 14.7	73.6 ± 16.7^{a,b}	72.2 ± 15.6^{a}	72.4 ± 15.6^{a,b}	63.3 ± 17.9	68.2 ± 22.2	ES: 0.1-0.8; p<0.001
	ACC HI	3.8 ± 1.8	3.4 ± 1.6	4.1 ± 1.6	3.8 ± 1.9	3.4 ± 1.7	3.6 ± 1.7	ES: 0.2-0.4; p=0.293
	DEC HI	3.8 ± 1.6	4.3 ± 1.3	4.8 ± 1.6^{a,b}	4.8 ± 1.7^{a,b}	3.8 ± 1.6	4.2 ± 1.6	ES: 0.0-0.6; p=0.001
	ACC+DEC HI	7.5 ± 3.0	7.7 ± 2.6	8.9 ± 2.9	8.5 ± 3.0	7.2 ± 2.9	7.9 ± 2.9	ES: 0.1-0.6; p=0.034
3 min	DIS	139.4 ± 13.3	148.7 ± 9.6^{a,b}	158.5 ± 9.7^{a,b,e}	156.7 ± 12.7^{a,b,e}	136.8 ± 15.7	146.9 ± 15.1	ES: 0.2-1.6; p<0.001
	HSR	12.9 ± 9.3	19.9 ± 8.3^{a,c}	12.8 ± 6.3	17.2 ± 7.5	19.1 ± 7.4^{a,c}	16.9 ± 8.4	ES: 0.1-0.9; p<0.001
	SPR	3.3 ± 5.6	4.5 ± 5.1	1.9 ± 3.9	3.1 ± 4.5	4.9 ± 4.1^{c}	3.8 ± 4.8	ES: 0.1-0.7; p=0.025
	AMP	13.3 ± 1.2	14.6 ± 1.1^{a,b}	15.0 ± 0.7^{a,b}	15.0 ± 1.2^{a,b}	13.5 ± 1.6	14.2 ± 1.4	ES: 0.0-1.4; p<0.001
	HMLD	32.3 ± 7.6	41.1 ± 7.8^{a}	39.1 ± 6.9^{a}	42.5 ± 9.5^{a,b}	37.8 ± 8.5^{a}	38.6 ± 8.9	ES: 0.2-1.2; p<0.001
	ACC HI	2.8 ± 0.9	2.6 ± 0.9	3.4 ± 1.3^{b,e}	3.1 ± 1.1^{b}	2.5 ± 1.1	2.8 ± 1.1	ES: 0.2-0.8; p<0.001
	DEC HI	2.8 ± 0.9	3.3 ± 1.0	3.6 ± 1.0^{a,b}	3.3 ± 0.9	2.9 ± 1.2	3.1 ± 1.1	ES: 0.3-0.8; p=0.005
	ACC+DEC HI	5.6 ± 1.6	5.9 ± 1.7	7.0 ± 2.2^{a,b}	6.3 ± 1.7	5.4 ± 2.2	5.9 ± 1.9	ES: 0.4-0.7; p=0.001
5 min	DIS	130.1 ± 11.5	137.5 ± 8.8^{a,b}	147.8 ± 7.7^{a,b,e}	147.2 ± 12.4^{a,b,e}	125.9 ± 13.7	136.6 ± 14.1	ES: 0.1-1.9; p<0.001
	HSR	8.2 ± 5.4	15.2 ± 5.9^{a,c,d}	9.5 ± 4.8	11.9 ± 5.4^{a}	14.4 ± 6.1^{a,c}	12.3 ± 6.2	ES: 0.1-1.2; p<0.001
	SPR	1.9 ± 2.9	3.4 ± 3.3^{d}	1.7 ± 2.8	1.8 ± 2.2	3.2 ± 3.4	2.5 ± 3.1	ES: 0.1-0.5; p=0.004
	AMP	12.3 ± 0.9	13.3 ± 0.9^{a,b}	13.9 ± 0.6^{a,b,e}	13.9 ± 1.2^{a,b}	12.2 ± 1.5	13.1 ± 1.3	ES: 0.0-1.2; p<0.001
	HMLD	26.3 ± 4.7	34.2 ± 6.2^{a}	32.9 ± 5.9^{a}	35.8 ± 8.3^{a,b}	30.7 ± 7.4^{a}	31.9 ± 7.4	ES: 0.2-1.4; p<0.001
	ACC HI	2.6 ± 0.6	2.5 ± 0.7	3.1 ± 0.9^{b,e}	2.9 ± 0.9^{b,e}	2.3 ± 1.1	2.6 ± 0.9	ES: 0.2-0.8; p<0.001
	DEC HI	2.6 ± 0.8	2.9 ± 0.7	3.2 ± 0.7^{a,b}	3.1 ± 0.9^{a,b}	2.6 ± 1.0	2.8 ± 0.9	ES: 0.1-0.8; p=0.001
	ACC+DEC HI	5.2 ± 1.3	5.4 ± 1.3	6.3 ± 1.5^{a,b}	6.1 ± 1.6^{a,b}	4.9 ± 2.0	5.5 ± 1.6	ES: 0.1-0.8; p<0.001
10 min	DIS	120.5 ± 11.2	127.4 ± 8.5^{a,b}	138.3 ± 8.4^{a,b,e}	136.8 ± 11.3^{a,b,e}	116.5 ± 13.2	126.7 ± 13.6	ES: 0.1-1.9; p<0.001
	HSR	6.2 ± 3.4	11.7 ± 3.8^{a,c,d}	6.9 ± 3.1	9.6 ± 4.1^{a,c}	11.4 ± 3.7^{a,c}	9.5 ± 4.3	ES: 0.1-1.5; p<0.001
	SPR	1.3 ± 1.8	2.8 ± 2.5^{a,c,d}	1.1 ± 1.5	1.2 ± 1.6	2.6 ± 2.2^{a,c,d}	1.9 ± 2.1	ES: 0.1-0.8; p<0.001
	AMP	11.2 ± 0.9	12.2 ± 0.9^{a,b}	12.8 ± 0.7^{a,b,e}	12.8 ± 1.1^{a,b,e}	11.1 ± 1.3	11.9 ± 1.3	ES: 0.0-1.5; p<0.001
	HMLD	22.1 ± 3.8	28.3 ± 4.7^{a,b}	27.3 ± 4.5^{a}	30.2 ± 7.1^{a,b}	25.3 ± 5.8^{a}	26.6 ± 5.9	ES: 0.3-1.4; p<0.001
	ACC HI	2.4 ± 0.4	2.3 ± 0.6	2.7 ± 0.5^{a,b,e}	2.7 ± 0.8^{b}	2.0 ± 0.9	2.4 ± 0.8	ES: 0.0-0.8; p<0.001
	DEC HI	2.3 ± 0.5	2.7 ± 0.6^{b}	2.9 ± 0.5^{a,b}	2.7 ± 0.7^{a,b}	2.2 ± 0.9	2.5 ± 0.7	ES: 0.3-0.9; p<0.001
	ACC+DEC HI	4.7 ± 0.9	4.9 ± 1.2	5.7 ± 0.9^{a,b,e}	5.4 ± 1.4^{a,b}	4.3 ± 1.8	4.9 ± 1.4	ES: 0.2-0.9; p<0.001

CD = central defender; FW = forward; MF = midfielder; WMF = wide midfielder; FB = full back; a > CD; b > FW; c > MF; d > WMF; e > FB; DIS = distance ·min^{-1}; HSR = high speed Running ·min^{-1} (>5.5 m·s^{-1}, m·min^{-1}); SPR = sprint ·min^{-1} (>7.0 m·s^{-1}, m·min^{-1}); HMLD = high metabolic load distance ·min^{-1}; AMP = average metabolic power; ACC = accelerations ·min-1 (>3 m·s^{2}, n·min^{-1}); DEC = decelerations ·min-1 (<-3 m·s^{2}, n·min^{-1}); HI = high intensity.

they perform other activities that must be considered when designing training tasks to prepare players for the most demanding passages of play. For example, in the 3' period WMF traveled a distance of 156 m·min^{-1}, with 15 m·min^{-1} covered in HSR, while also performing 2-3 high-intensity accelerations and decelerations per minute. Designing training tasks based only on the criterion variable, may limit specifity and underestimate the actual demands of the most demanding passages of match-play.

HSR is frequently monitored by physical trainers (Akenhead and Nassis, 2016) because of its relation to the incidence of injury (Malone et al., 2017a). Although HSR was not used as a criterion variable in our study, we observed similar values to those reported by Delaney et al. (2017b) when we applied the HMLD as the criterion variable, with FB reaching values close to 50 m·min^{-1} when the applied time frame was 1 minute. Our results are in agreement with those obtained by Delaney et al. (2017b), with FB and FW performing the most HSR. However, Delaney et al. (2017b) found that the lowest amount of HSR was recorded by the CD and WMF, while in our work the MF had significantly lower values than the FB and FW. Perhaps were the non-use of HSR as the criterion variable can explain differences between the present and previous (Delaney et al., 2017b) studies. In this sense, it should be noted that the values in our study (Distance, HMLD, AMP) could be higher if we had used HSR as a criterion variable. We must take into account that absolute criteria have been used to define the actions of HSR, without considering the maximum capacities of the athlete (Sweeting et al., 2017), such as the player's peak speed (Buchheit et al., 2013).

The AMP represents a theoretical approximation of the energy cost of team sports where in addition to the speed of running, the energetic cost of accelerating and decelerating is considered (Osgnach et al., 2010). This indicator presents some controversy in the literature (Buchheit et al., 2015), although it has been presented in different studies (di Prampero et al., 2005; Osgnach et al., 2010). When AMP is used as a criterion variable, CD and FW values are significantly lower than the other positions. Delaney et al. (2017a) indicates that the CD have significantly lower values than the remaining positions. The role played by the FW according to the type of game played by the team (Fernandez-Navarro et al., 2016) and/or playing system (Bradley et al., 2011) can explain these differences and may affect the physical demands on players. The FW activity in a formation like the one used in the current team (Fernandez-Navarro et al., 2016), could reduce AMP with respect to another team where return runs and counterattacking predominates. In addition, differences in playing systems (1 vs. 2 vs. 3 FW) could explain differences in results.

AMP and HMLD variables take into account high-intensity actions performed at high and low displacement speeds. Therefore, they are variables that can reach a certain value through different mechanisms, such as small amounts of HSR and high frequencies of accelerations / decelerations, or with large amounts of HSR and a low frequency of accelerations / decelerations. In our study, we observed similar AMP values obtained by the CD and FW, with a tendency towards greater HSR and a lower frequency of accelerations / decelerations in the FW. Therefore, these measurements that summarize the energy expenditure or the player activity must always be considered with other variables at the same time in order to provide information on how the values have been obtained (Delaney et al., 2017a).

Previous studies have shown that player accelerations and decelerations during a match are positional dependent (Varley et al., 2012). Although acceleration and deceleration measurements typically have low reliability (Buchheit et al., 2013), sports scientists frequently report such activities (Akenhead and Nassis, 2016). In our study, the maximum values obtained when AMP was used as the criterion variable, were similar to when HMLD was used as the criterion variable. The frequency of high-intensity accelerations and decelerations represents smaller values in FW and CD, a finding that is consistent with that found by Delaney et al. (2017a). These results might suggest that FW and CD may require fewer accelerations and decelerations in training. However, MF and WMF were the position with the greatest acceleration and deceleration demands in this study. Given that the MF and WMF players frequently compete between opposition lines (especially the WMF), their efforts are likely to be of shorter duration, and therefore, with a higher frequency of activity changes.

In addition, as the time window increased, the intensity of all movement variables decreased in all positions and the differences among positions also increased. For example, during short duration passages (i.e. 1 min), there were no significant differences among positions for HSR and SPR when the criterion variables were distance and HMLD. However, when the duration was 10 minutes, in all cases the differences among positions were significant. It appears that reducing the time window homogenizes the physical demands imposed on players.

Some of the main limitations of this research refer to the fact that the most demanding passage of play in football competition have been studied using the criterion variables of HMLD, AMP and TD. It is likely that, if the most demanding passage of competition had been identified from the highest value of other variables (e.g. HSR), the observed results may have been different. Secondly, while differences were observed among positions for high-intensity actions within the criterion variable, these differences were typically small to moderate in magnitude, suggesting that some generic training may be warranted, even among players from contrasting positions. Finally, as different GPS devices sample at different frequencies and use different software algorithms in data processing, the accuracy of some of the variables analysed (e.g. ACC and DEC) are dependent on the device used. The accuracy of different GPS devices (Buchheit et al., 2014), should be considered when comparing different studies (Carling et al., 2012).

Conclusion

The activities that a football player performs are both stochastic and multidimensional; it is therefore necessary to consider the individual activities that comprise the most demanding passages of match-play. Our data should help coaches to design training situations that replicate and even surpass the most demanding passages of match-play, attending to positional requirements and adapting these phases to the duration of training drills.

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References

Akenhead, R. and Nassis, G.P. (2016) Training load and player monitoring in high-level football: current practice and perceptions. *International Journal of Sports Physiology and Performance* **11,** 587-593.

Batterham, A.M. and Hopkins, W.G. (2006) Making meaningful inferences about magnitudes. *International Journal of Sports Physiology and Performance* **1,** 50-57

Beato, M., Bartolini, D., Ghia, G. and Zamparo, P. (2016) Accuracy of a 10 Hz GPS Unit in Measuring Shuttle Velocity Performed at Different Speeds and Distances (5–20 M). *The Journal of Human Kinetics* **54,** 15-22.

Beenham, M., Barron, D.J., Fry, J., Hurst, H.H., Figueirdo, A. and Atkins, S. (2017) A comparison of GPS workload demands in match play and small-sided games by the positional role in youth soccer. *The Journal of Human Kinetics* **57,** 129-137.

Bowen, L., Gross, A.S., Gimpel, M. and Li, F.X. (2017) Accumulated workloads and the acute: chronic workload ratio relate to injury risk in elite youth football players. *British Journal of Sports Medicine* **51,** 452-459.

Buchheit, M., Haddad, H.A., Simpson, B.M., Palazzi, D., Bourdon, P.C., Salvo, V.D. and Mendez-Villanueva, A. (2014) Monitoring accelerations with GPS in football: time to slow down? *International Journal of Sports Physiology and Performance* **9,** 442-445.

Buchheit, M., Manouvrier, C., Cassirame, J. and Morin, J.B. (2015) Monitoring locomotor load in soccer: is metabolic power, powerful? *International Journal of Sports Medicine* **36,** 1149-1155.

Buchheit, M., Simpson, B. and Mendez-Villanueva, A. (2013) Repeated high-speed activities during youth soccer games in relation to changes in maximal sprinting and aerobic speeds. *International Journal of Sports Medicine* **34,** 40-48.

Bradley, P.S., Carling, C., Archer, D., Roberts, J., Dodds, A., Di Mascio, M., Diaz, A.G., Peart, D. and Krustrup, P. (2011) The effect of playing formation on high-intensity running and technical profiles in English FA Premier League soccer matches. *Journal of Sports Sciences* **29,** 821-830.

Bradley, P.S. and Noakes, T.D. (2013) Match running performance fluctuations in elite soccer: indicative of fatigue, pacing or situational influences? *Journal of Sports Sciences* **31,** 1627-1638.

Carling, C. and Dupont, G. (2011) Are declines in physical performance associated with a reduction in skill-related performance during professional soccer match-play? *Journal of Sports Sciences* **29,** 63-71.

Carling, C., Le Gall, F. and Dupont, G. (2012) Analysis of repeated high-intensity running performance in professional soccer. *Journal of*

Sports Sciences **30,** 325-336.
Casamichana, D., Castellano, J. and Castagna, C. (2012) Comparing the physical demands of friendly matches and small-sided games in semiprofessional soccer players. *The Journal of Strength & Conditioning Research* **26,** 837-843.
Castellano, J., Alvarez-Pastor, D. and Bradley, P.S. (2014) Evaluation of research using computerised tracking systems (Amisco® and Prozone®) to analyse physical performance in elite soccer: A systematic review. *Sports Medicine* **44,** 701-712.
Castellano, J., Casamichana, D., Calleja-González, J., San Román, J. and Ostojic, S.M. (2011) Reliability and accuracy of 10 Hz GPS devices for short-distance exercise. *Journal of Sports Science and Medicine* **10,** 233.
Delaney, J.A., Duthie, G.M., Thornton, H.R., Scott, T.J., Gay, D. and Dascombe, B.J. (2016) Acceleration-Based Running Intensities of Professional Rugby League Match Play. *International Journal of Sports Physiology and Performance* **11,** 802-809.
Delaney, J.A., Thornton, H.R., Burgess, D.J., Dascombe, B.J. and Duthie, G.M. (2017a) Duration-specific running intensities of Australian Football match-play. *Journal of Science and Medicine in Sport* **20,** 689-694.
Delaney, J.A., Thornton, H.R., Rowell, A.E., Dascombe, B.J., Aughey, R.J. and Duthie, G.M. (2017b) Modelling the decrement in running intensity within professional soccer players. *Science and Medicine in Football* **2,** 86-92.
Dellal, A., Owen, A., Wong, D.P., Krustrup, P., van Exsel, M. and Mallo, J. (2012) Technical and physical demands of small vs. large sided games in relation to playing position in elite soccer. *Human Movement Science* **31,** 957-969.
Di Mascio, M. and Bradley, P.S. (2013) Evaluation of the most intense high-intensity running period in English FA premier league soccer matches. *The Journal of Strength & Conditioning Research* **27,** 909-915.
di Prampero, P.E., Fusi, S., Sepulcri, L., Morin, J.B., Belli, A. and Antonutto, G. (2005) Sprint running: a new energetic approach. *Journal of Experimental Biology* **208,** 2809-2816.
Di Salvo, V., Baron, R., Tschan, H., Montero, F.C., Bachl, N. and Pigozzi, F. (2007) Performance characteristics according to playing position in elite soccer. *International Journal of Sports Medicine* **28,** 222-227.
Dunbara, J., Rosenb, B., Gimpelb, M. and Jehanlia, A. (2015) 11 Salivary cortisol is highly correlated with training intensity in English Premier League players. *International Research in Science and Soccer II*, 104.
Fernandez-Navarro, J., Fradua, L., Zubillaga, A., Ford, P.R. and McRobert, A.P. (2016) Attacking and defensive styles of play in soccer: analysis of Spanish and English elite teams. *Journal of Sports Sciences* **34,** 2195-2204.
Fox, R., Patterson, S.D. and Waldron, M. (2017) The relationship between heart rate recovery and temporary fatigue of kinematic and energetic indices among soccer players. *Science and Medicine in Football* **1,** 132-138.
Gabbett, T.J., Kennelly, S., Sheehan, J., Hawkins, R., Milsom, J., King, E., Whiteley, R. and Ekstrand, J. (2016) If overuse injury is a 'training load error', should undertraining be viewed the same way? *British Journal of Sports Medicine* **50,** 1017-1018.
Giménez, J.V., Del-Coso, J., Leicht, A.S. and Gomez, M.A. (2017) Comparison of the movement patterns between small-and large-side games training and competition in professional soccer players. *The Journal of Sports Medicine and Physical Fitness,* Epub ahead of print.
Lacome, M., Simpson, B.M., Cholley, Y., Lambert, P. and Buchheit, M. (2017). Small-Sided Games in Elite Soccer: Does One Size Fits All? *International Journal of Sports Physiology and Performance* **13,** 1-24.
Malone, S., Roe, M., Doran, D.A., Gabbett, T.J. and Collins, K. (2017a) High chronic training loads and exposure to bouts of maximal velocity running reduce injury risk in elite Gaelic football. *Journal of Sports Science and Medicine* **20,** 250-254.
Malone, S., Solan, B., Hughes, B. and Collins, K. (2017b) Duration specific Running performance in Elite Gaelic Football. *The Journal of Strength & Conditioning Research,* Epub ahead of print.
Nicolella, D. P., Torres-Ronda, L., Saylor, K. J. and Schelling, X. (2018) Validity and reliability of an accelerometer-based player tracking device. *PloS one* **13**, e0191823.
Osgnach, C., Poser, S., Bernardini, R., Rinaldo, R. and Di Prampero, P.E. (2010) Energy cost and metabolic power in elite soccer: a new match analysis approach. *Medicine and Science in Sports and Exercise* **42,** 170-178.
Owen, A.L., Djaoui, L., Newton, M., Malone, S. and Mendes, B. (2017) A contemporary multi-modal mechanical approach to training monitoring in elite professional soccer. *Science and Medicine in Football* **1,** 216-221.
Stevens, T.G., de Ruiter, C.J., Twisk, J.W., Savelsbergh, G.J. and Beek, P.J. (2017) Quantification of in-season training load relative to match load in professional Dutch Eredivisie football players. *Science and Medicine in Football* **1,** 117-125.
Sweeting, A.J., Cormack, S.J., Morgan, S. and Aughey, R.J. (2017) When Is a Sprint a Sprint? A Review of the Analysis of Team-Sport Athlete Activity Profile. *Frontiers in Physiology* **8,** 432.
Tierney, P.J., Young, A., Clarke, N.D. and Duncan, M.J. (2016) Match play demands of 11 versus 11 professional football using Global Positioning System tracking: Variations across common playing formations. *Human Movement Science* **49,** 1-8.
Varley, M.C., Elias, G.P. and Aughey, R.J. (2012) Current match-analysis techniques' underestimation of intense periods of high-velocity running. *International Journal of Sports Physiology and Performance* **7,** 183-185.

Key points

- Physical demands are position-dependent during the most demanding passage of match-play
- Reducing the time window homogenizes the physical demands imposed on players
- We need information about different variables to understand the actual demands of the most demanding passages of match-play

AUTHOR BIOGRAPHY

Andrés MARTÍN-GARCIA
Employment
Fitness Coach FC Barcelona
Degree
PhD student
Research interests
Training Load, Team Sports, Prevention Injury, Strength & Conditioning
E-mail: andres.martin@fcbarcelona.cat

David CASAMICHANA
Employment
Professor in Faculty of Education and Food, Universidad Europea del Atlántico. Santander, Spain.
Degree
PhD in Sport Science
Research interests
Soccer; Team analysis; Training load; Physiological development
E-mail: davidcasamichana@gmail.com

Antonio J. GÓMEZ DÍAZ
Employment
Fitness Coach FC Barcelona (1st team Football). Professor in Sport Science Murcia University
Degree
PhD, BSc
Research interest
Training Load, Team Sports, Prevention Injury, Strength & Conditioning
E-mail: antonio.gomez@fcbarcelona.cat

Francesc COS
Employment
High Performance Director FC Barcelona. Lecturer at Barcelona University
Degree
PhD, Ms, Bs, PT
Research interest
Strength & Conditioning, rehabilitation and return to play
E-mail: fcos@gencat.cat

Tim GABBETT
Employment
High Performance Consultant, Gabbett Performance Solutions
Degree
BHSc (Hons), PhD
Research interests
Training Load, Performance, Team Sports
E-mail: info@gabbettperformance.com.au

✉ **Andrés Martín García**
FC Barcelona Sports Performance Department. Av. Onze de Setembre, s/n, 08970 Sant Joan Despí, Barcelona