Quantification of a Professional Football Team's External Load Using a Microcycle Structure

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Abstract

Martín-García, A, Gómez Díaz, A, Bradley, PS, Morera, F, and Casamichana, D. Quantification of a professional football team's external load using a microcycle structure. *J Strength Cond Res* 32(12): 3520–3527, 2018—The aims of this study were to (a) determine the external load of a football team across playing position and relative to competition for a structured microcycle and (b) examine the loading and variation the day after competition for players with or without game time. Training and match data were obtained from 24 professional football players who belonging to the reserve squad of a Spanish La Liga club during the 2015/16 season using global positioning technology (n = 37 matches and n = 42 training weeks). Training load data were analyzed with respect to the number of days before or after a match (match day [MD] minus or plus). Training load metrics declined as competition approached (MD-4 > MD-3 > MD-2 > MD-1; $p < 0.05$; effect sizes [ES]: 0.4–3.1). On the day after competition, players without game time demonstrated greater load in a compensatory session (MD + 1C) that replicated competition compared with a recovery session (MD + 1R) completed by players with game time (MD + 1C > MD + 1R; $p < 0.05$; ES: 1.4–1.6). Acceleration and deceleration metrics during training exceeded 50% of that performed in competition for MD + 1C (80–86%), MD-4 (71–72%), MD-3 (62–69%), and MD-2 (56–61%). Full backs performed more high-speed running and sprint distance than other positions at MD-3 and MD-4 ($p < 0.05$; ES: 0.8–1.7). The coefficient of variation for weekly training sessions ranged from ~40% for MD-3 and MD-4 to ~80% for MD + 1R. The data demonstrate that the external load of a structured microcycle varied substantially based on the players training day and position. This information could be useful for applied sports scientists when trying to systematically manage load, particularly compensatory conditioning for players without game time.

Key Words soccer, training, fatigue, team sport, GPS, periodization

Introduction

Football (soccer) incorporates unpredictable movements during matches where players transition between multidirectional high-intensity efforts and low-intensity activity (9). High-intensity running during matches has increased by a third in some leagues across the past decade (6); thus, players must be robust enough to cope with such demands. One way of handling such demands could be to optimize training structure through manipulating volume and intensity of competition cycles (35). Accordingly, global positioning system (GPS) technology is widely used within football because it provides practitioners with an estimate of the external load experienced by players (4,12,27,37). Using such technology within training and competition enables coaches to not only understand the distinct game requirements of various playing positions but to also recognize the conditioning needs for the individual roles within the team (15,17,34). As midfielders (MFs) cover twice the high-intensity game distance compared with central defenders (CDs) (11), it is not surprising that research has focused on position-specific training (40). Although, limited data exist on training loads relative to match play across position, and such information could aid practitioners considering a position-specific approach (10).

One of the main objectives of staff working in elite football is the periodization of training (31,33,37). This presents itself in the form of the training day and the weekly microcycle

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(3,4,35). Although general and position-specific preparations are key, applied staff still have to strike a fine balance between loading the players enough for positive adaptation without elevating the risk of injury (22,25,26). The general consensus is that load metrics are lower in the session before competition, confirming the concept of tapering (19,23,40). However, limited data exist on the loading patterns after competition for players with game time vs. partial or no game time. This is particularly important because players with reduced game time will require a training session that replicates competition loads, whereas those players completing the game will require a recovery session instead (40,43). Therefore, more research on loading strategies the day after a game would be advantageous for coaches, as it would provide them with a practical framework.

Football conditioning has evolved substantially over the past decade because of contemporary training concepts and models (29). The structured microcycle is a weekly training unit that is dictated by the players' schedule, physical recovery status, and conditioning requirements. Although elements of the schedule are controlled, some are variable and occur in an unpredictable manner. The variability in load metrics across the microcycle has not been explored sufficiently within the literature, despite a plethora of studies quantifying competition variability (14,16). Changes in stimuli and load are important for training adaptations within the elite setting (24). Another area that has yet to be covered in detail is the contextualization of the microcycle, with most studies failing to provide any specific details of training sessions (e.g., the training session held the day before the match was referred to as match day [MD]-1 and included tactical preparation with set pieces). To the authors' knowledge, this study is one of the first to contextualize external load using a unique microcycle from one of Europe's leading football clubs. Specifically, the systematic phases of the microcycle are very unique to this club philosophy and would provide added insight to practitioners. Additional studies are also needed detailing loading patterns and training practices from various European competitions, given that the body of evidence is primarily from English Premier League clubs (1,4,35). This is relevant because differences in culture and competition demands across leagues could result in distinct loading variations in an attempt to optimize performance (e.g., styles of play, number of games, and midseason breaks). Accordingly, the aims of this study were to (a) determine the external load of a football team across playing position and relative to competition for a structured microcycle and (b) examine the loading and variation the day after competition for players with or without game time.

Methods

Experimental Approach to the Problem

Global positioning system data were collected from 37 competitive matches and 42 training weeks during the 2015–16 season. This enabled absolute and relative external training loads to be quantified across the microcycle for various playing positions. Players were excluded from further analysis if they had completed <10 training sessions and did not complete a full competitive match. Sessions were performed on a natural grass surface within a pitch dimension of 105 × 68 m. Table 1 shows the duration of each session during a typical training week and the total number of observations across playing position. The team systematically played in a 4-3-3 formation, with two full backs (FB), two central defenders (CD), one midfielder (MD), two offensive midfielders (OMF) and three forwards (FW). A total of 490 individual observations were obtained across position: CD: n=3; GPS=104, FB: n=6; GPS=145, MF: n=3; GPS=45, OMF: n=5; GPS=121 and forwards FW: n=7; GPS=90.

Subjects

Twenty-four professional outfield football players participated in this study (age; 20 ± 2 years, body mass; 70.2 ± 6.1 kg, and stature; 1.78 ± 0.64 m; all measurements mean ± *SD*). Players belonged to a reserve squad of a Spanish La Liga club that also competed in the Union of European Football Associations (UEFA) Champions League. Data arose as a condition of the players' employment, whereby they were assessed daily; thus, no authorization was required from an institutional ethics committee and this study is officially considered exempt from institutional approval (16,32,45). Nevertheless, this study conformed to the Declaration of Helsinki, and the players provided informed consent before participating.

Table 1. The duration and total number of files across different positions and sessions.*

Session	Duration (h:min)	CD	FB	MF	OMF	FW	Total files
MD + 1C	1:15 ± 0:11	9	11	2	19	5	46
MD + 1R	1:08 ± 0:07	12	18	7	5	10	52
MD-4	1:17 ± 0:09	21	29	9	24	15	98
MD-3	1:23 ± 0:11	21	29	9	24	15	98
MD-2	1:20 ± 0:10	20	29	9	25	15	98
MD-1	1:01 ± 0:12	21	29	9	24	15	98

*Data are presented across position: central defender (CD), full back (FB), midfielder (MF), offensive midfielder (OMF), forward (FW), and total number of files for all positions combined. Data are also present across training day: MD + 1C = match day +1 compensatory; MD + 1R = match day +1 recovery; MD-4 = match day-4; MD-3 = match day-3; MD-2 = match day-2; MD-1 = match day-1. Data are mean ± *SD*.

Procedures

Structured Microcycle. The microcycle was adjusted to the players' schedule, physical recovery status, and conditioning requirements. The programming of the football content was typically cyclical, but the external load was varied based on the factors above and the objectives of each seasonal phase. To optimize adaptation across the various phases of the season, staff constantly altered the structure and composition of the microcycle, so that the individual and collective performances were not impacted. Because of variations in the number of days between matches (40,43), this study only analyzed training weeks where players had 6 days between successive matches, and the training week composed of 5 training sessions that had a clear focus on an upcoming match (35). Based on the recommendations of Akenhead et al. (3), training load data were analyzed with respect to the number of days before or after a match (MD minus or plus). The training sessions that are contextualized below were composed of integrated content (e.g., tactical, technical, and physical factors were amalgamated):

MD + 1 was the session the day after competition where players split into 2 training groups. The first group included players who had completed >60 minutes of competition. The aim of this session was to regenerate from the previous match, so the recovery term was used: MD + 1R. Players conducted low-impact activity combined with regeneration exercises. The second group included players who had completed <60 minutes of competition. This group worked within a technical circuit followed by a positional game and a small-sided game (SSG) with goalkeepers (area: 30–60 m^{-2} per player). This session attempted to replicate competition loads, so the compensatory term was used: MD + 1C. MD-4 was the session 4 days before competition and aimed to develop the players' strength and power capabilities. This consisted of a gym workout followed by positional games and an SSG with goalkeepers (area: 25–50 m^{-2} per player). MD-3 was the session 3 days before competition and aimed to tactically prepare players for the next match. The structure consisted of a moderate-intensity positional game (area: 70–100 m^{-2}) and concluded with a 11 vs. 11 match (72 × 65 m). MD-2 was the session 2 days before competition. The load was focused on technical-tactical elements. The structure of the session was as follows: control and passing sequences, a positional game with a low number of players per team, and tactical exercises. MD-1 was the session before competition and was primarily geared toward activation drills replicating the tactical competition scenarios and concluded with set pieces.

External Load Variables. Activity profiles of players were monitored during each match and training session using a portable 10-Hz GPS unit (Viper Pod, 50 gr, 88 × 33 mm; Statsports Viper; Northern Ireland). Each unit was placed in a specially designed vest, inside a mini pocket positioned between the shoulder blades. Quantifying the devices' accuracy indicated a 2.5% estimation error in distance covered, with accuracy improving as the distance covered increased and the speed of movement decreased (8). To avoid interunit error, each player used the same device during the study period (13,18). On completion of each match and session, GPS data were extracted using proprietary software (Viper, Statsports). The total (TD; m), high-speed running (HSR; m > 19.8 $km \cdot h^{-1}$), and sprint distances (SPR; m > 25.2 $km \cdot h^{-1}$) were quantified. The speed thresholds used have been established based on previous studies (40,42,44). The following variables were also quantified: the number of intense accelerations/decelerations (ACC/DEC; >3 $m \cdot s^{-2}$), average metabolic power (AMP; $W \cdot kg^{-1}$), and high metabolic load distance (HMLD; m > 25.5 $W \cdot kg^{-1}$). The intensity thresholds used have been established based on previous studies (42). Average metabolic power was the energy expended by a player per second, per kg of body mass (20,36,39) and HMLD represented the distance covered by a player when their metabolic power exceeded 25.5 $W \cdot kg^{-1}$. The mean value of each training session was expressed in absolute values and relative to the mean external load registered during competitive matches: (mean training session external load × 100) ÷ mean competitive-match external load.

Statistical Analyses

All statistical analyses were conducted using SPSS for Windows 16.0 (SPSS, Inc., Chicago, USA). Homogeneity of variance was examined by conducting the Levene's test. One-way analyses of variance were used to evaluate differences in dependent variables across various periods of the microcycle and playing positions. In the event of a difference occurring, Bonferroni post hoc tests were used to identify any localized effects, or a Dunnett's T3 post hoc tests were applied when 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) (7). The coefficient of variation (CV) was quantified to assess the variation in the microcycle (5). Values are presented as mean ± *SD* unless otherwise stated. Alpha was set at $p \leq 0.05$.

Results

Absolute Training Load Analysis

Table 2 presents the absolute external load values obtained from each training sessions across playing position. When comparing the 2 training groups on the day after competition, MD + 1C demonstrated greater external loads than MD + 1R for TD, HMLD, AMP, ACC, and DEC ($p < 0.05$; ES: 1.4–1.6) but not for the distance covered in HSR or SPR ($p > 0.05$; ES: 0.1–0.2). External load in MD-4 to MD-1 declined as competition approached ($p < 0.01$) for TD (ES: 1.2–3.1), HSR (ES: 1.4–1.8), SPR (ES: 0.4–1.1), HMLD (ES: 1.5–3.0), AMP (ES: 1.5–3.0), ACC (ES: 0.7–2.3),

TABLE 2. Absolute training load metrics for professional soccer players.*

Variable	Position	MD + 1C	MD + 1R	MD-4	MD-3	MD-2	MD-1
TD (m)	CD	5,207.8 ± 618.5*,↑,♠	3,574.4 ± 1,154.4	4,769.6 ± 565.7↑,♠	5,463.4 ± 1,297*,↑,♠	4,084.8 ± 569.1	2,725.4 ± 512.3
	FB	5,383.4 ± 742.5*,↑,♠	4,227.6 ± 971.4♠	5,149.2 ± 803.5*,↑,♠	5,632.5 ± 1,162.6*,↑,♠	4,423.4 ± 680.5e	2,737.3 ± 580.7
	MF	5,412.8 ± 736.9♠	3,900.8 ± 868.9	5,510.7 ± 1,149.1*,↑,♠	5,828.5 ± 1,060.6*,↑,♠	4,207.0 ± 399.6	2,842.8 ± 376.2
	OMF	5,255.3 ± 915.5↑,♠	4,248.6 ± 971.8♠	5,472.4 ± 1,089.7↑,♠	5,726.3 ± 1,451.7↑,♠	4,327.9 ± 664.3♠	2,667.6 ± 694.6
	FW	4,727.4 ± 757.1*,♠	3,143.6 ± 1,054.8	4,874.1 ± 854.2*,↑,♠	5,407.6 ± 854*,↑,♠	3,838.9 ± 403.5♠	2,396.8 ± 687.5
	ALL	5,226.1 ± 790.2*,↑,♠	3,826.5 ± 1,068.9♠	5,123.2 ± 904.5*,↑,♠	5,602.8 ± 1,205.7*,↑,♠	4,220.6 ± 620.2♠	2,675.3 ± 601.7
HSR (m)	CD	122.6 ± 111.2	136.7 ± 112.9	216.5 ± 119.7↑,♠	154.5 ± 106.1↑,♠	57.8 ± 59.5	43.4 ± 45.7
	FB	192.9 ± 137.7	191.8 ± 141.0e,♠	371.2 ± 153.2a,c, d,e,Δ,*,↑,♠	278.4 ± 125.3a,c,↑,♠	133.7 ± 91.8a,c,e	64.6 ± 70.6
	MF	34.8 ± 2.1	84.83 ± 107.4	170.9 ± 75.9Δ,↑,♠	145.8 ± 71.2Δ,♠	51.5 ± 51.8	25.1 ± 27.4
	OMF	131.5 ± 112.8	102.7 ± 84.4	189.9 ± 102.8↑,♠	198.1 ± 100.1↑,♠	81.1 ± 58.3	49.7 ± 59.7
	FW	106.6 ± 103.7	30.2 ± 40.0	177.4 ± 130.7*,↑,♠	263.5 ± 102.9a,Δ,*,↑,♠	68.4 ± 43.4	45.9 ± 47.6
	ALL	106.7 ± 103.7♠	125.0 ± 123.3♠	245.6 ± 148.6Δ,*,↑,♠	217.7 ± 118.5Δ,*,↑,♠	87.3 ± 73.9♠	49.9 ± 56.9
SPR (m)	CD	13.7 ± 26.3	14.8 ± 24.2	53.4 ± 52.5c,♠	25.5 ± 34.2	11.3 ± 36.2	6.3 ± 15.6
	FB	41.1 ± 54.9	37.3 ± 51.1	104.6 ± 61.8a,c, d,e,*,⊕,↑,♠	55.9 ± 46.1c,d,♠	23.7 ± 37.9	13.4 ± 21.5
	MF	0.4 ± 0.5	17.6 ± 31.5	10.3 ± 10.1	17.1 ± 21.5	6.7 ± 11.7	0.0 ± 0.0
	OMF	26.3 ± 47.2	9.6 ± 19.6	27.5 ± 33.2↑	17.7 ± 21.1	4.4 ± 9.2	7.7 ± 21.3
	FW	20.7 ± 42.4	4.2 ± 9.4	38.3 ± 56.9	40.7 ± 35.4*,↑,♠	6.7 ± 8.8	5.9 ± 14.7
	ALL	25.7 ± 44.3	20.5 ± 36.5	55.9 ± 59.6Δ,*,⊕,↑,♠	34.2 ± 37.9↑,♠	12.1 ± 27.9	8.1 ± 18.4
ACC (no)	CD	157.6 ± 45.9*,↑,♠	53.5 ± 40.4	122.2 ± 31.1*,♠	115.4 ± 36.4*,♠	96.2 ± 22.7	60.4 ± 15.4
	FB	167.1 ± 58.6*,♠	88.9 ± 47.5e	135.3 ± 40.5*,♠	129.3 ± 51.2*,♠	123.6 ± 46.0e*,♠	67.3 ± 23.5e
	MF	194.5 ± 23.3	54.6 ± 35.1	148.6 ± 45.2♠	127.1 ± 38.2↑,♠	106.6 ± 38.0	68.4 ± 18.8e
	OMF	127.0 ± 54.5♠	84.0 ± 46.1	127.0 ± 28.5♠	119.2 ± 44.2♠	100.8 ± 33.3♠	54.7 ± 24.1
	FW	114.6 ± 35.5*,♠	38.2 ± 39.8	111.5 ± 36.8*,♠	96.9 ± 33.9*,♠	81.7 ± 23.0*,♠	41.9 ± 18.1
	ALL	144.2 ± 54.3*,↑,♠	65.9 ± 46.0	128.1 ± 36.5*,↑,♠	118.7 ± 43.5*,♠	104.2 ± 37.3*,♠	58.9 ± 22.4
DEC (no)	CD	150.9 ± 35.4*,!,⊕,↑,♠	42.5 ± 31.1	104.4 ± 24.3*,♠	97.8 ± 35.1*,♠	84.7 ± 23.4*,♠	56.6 ± 13.8
	FB	157.1 ± 61.4*,♠	85.9 ± 45.6e	125.8 ± 35.5a,*,♠	123.3 ± 46.2♠	119.3 ± 41.8a,e,♠	65.2 ± 22.2e
	MF	180.0 ± 7.1*,♠	58.6 ± 37.5	131.6 ± 45.5*,♠	108.2 ± 28.1	103.2 ± 41.9	66.3 ± 18.3
	OMF	119.7 ± 47.1♠	66.8 ± 42.9	116.0 ± 28.3♠	107.9 ± 58.9♠	95.9 ± 33.3♠	52.6 ± 21.8
	FW	112.4 ± 28.5*,♠	36.2 ± 41.5	100.3 ± 27.5*,♠	92.9 ± 27.7*,♠	80.3 ± 25.5*,♠	42.7 ± 18.5
	ALL	136.6 ± 49.3*,⊕,↑,♠	60.8 ± 44.0	115.4 ± 32.8*,↑,♠	108.0 ± 40.9*,♠	98.8 ± 36.5*,♠	56.9 ± 20.9

*Data are presented across position: (A) central defender (CD), (B) full back (FB), (C) midfielder (MF), (D) offensive midfielder (OMF), (E) forward (FW), and (F) for all positions combined (ALL). TD = total distance; HSR = high-speed running (>19.8 $km \cdot h^{-1}$); SPR = sprint (>25.2 $km \cdot h^{-1}$); ACC = accelerations (>3 $m \cdot s^2$); DEC = decelerations (<−3 $m \cdot s^2$). Data are mean ± *SD*.

a > CD; b > FB; c > MF; d > OMF; e > FW; $p < 0.05$.

Δ > MD + 1C; * > MD + 1R; ! > MD-4; ⊕ > MD-3; ↑ > MD-2; ♠ > MD-1; $p < 0.05$.

and DEC (ES: 0.5–2.1). Limited positional differences were evident for TD across the microcycle, with the exception of FB loading higher in MD-2 compared with FW ($p < 0.05$; ES: 1.0). Similarly, FB also covered more distance in HSR compared with other positions at MD-4, MD-3, and MD-2 ($p < 0.05$; ES: 0.8–1.3) and distance SPR at MD-4 and MD-3 ($p < 0.05$; ES: 0.9–1.7). Differences were evident between FB vs. CD and FW at MD-4 and MD-2 for the variable HMLD ($p < 0.05$; ES: 0.9–1.2). Lower values for AMP were found for FW at MD-2 compared with FB, in addition to CD and FB at MD-1 ($p < 0.05$; ES: 0.9–1.1). Full back produced more ACC than FW at MD-1 ($p < 0.01$; ES: 1.1) and DEC in MD-4, MD-2, and MD-1 compared with CD and FW ($p < 0.05$; ES: 0.7–1.1). The CV for absolute training load values was highly associated with the training session, load metric, and playing position. For instance, the CV for weekly training sessions ranged from 41 to 45% when averaged across all load metrics and positions in MD-3 and MD-4 to 79% for MD + 1R. Similarly, the CV for weekly external training load metrics when averaged across all training sessions and positions ranged from 19 to 20% for TD and AMP to >85% for the distance covered in HSR and SPR. The CV across weekly external training load metrics and sessions ranged from 49% for FB to 62% for FW.

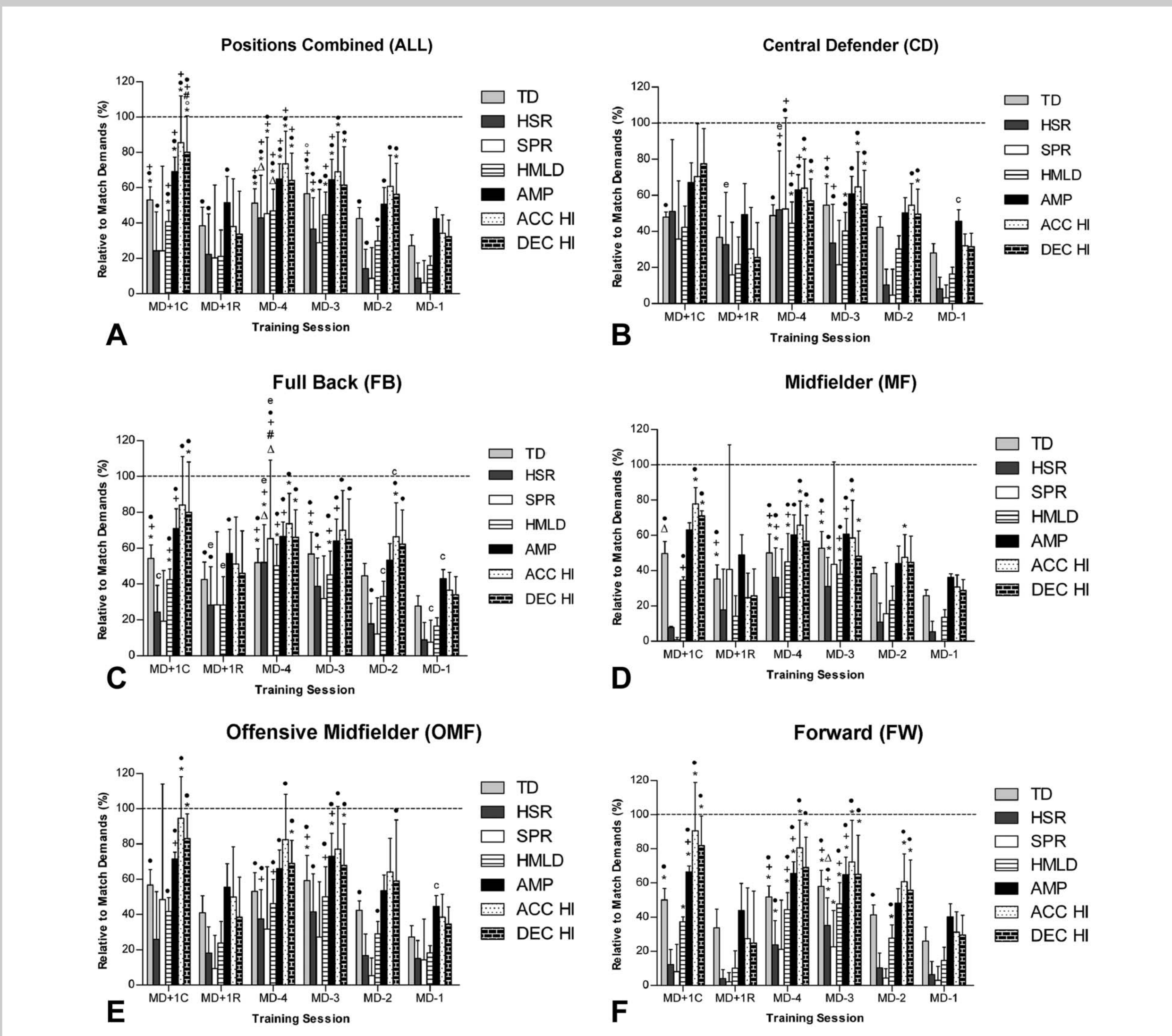

Figure 1. Training load metrics for professional players relative to competitive match play. Data are presented across position: (A) positions combined (all), (B) central defender (CD), (C) full back (FB), (D) midfielder (MF), (E) offensive midfielder (OMF), and (F) forward (FW). TD = total distance; HSR = high-speed running (>19.8 km·h^{-1}); SPR = sprint (>25.2 km·h^{-1}); HMLD = high metabolic load distance; AMP = average metabolic power; ACC = accelerations (>3 m·s^{2}); DEC = decelerations (<−3 m·s^{2}); and MD = match day. Data are mean ± *SD*. a > CD; b > FB; c > MF; d > OMF; e > FW; $p < 0.05$. Δ > MD + 1C; * > MD + 1R; ° > MD-4; # > MD-3; + > MD-2; • > MD-1; $p < 0.05$.

Relative Training Load Analysis

Figure 1A–F present the training load metrics relative to match play and across playing position. A multitude of external load metrics in MD + 1C were found to exceed 50% of match play values, and these included TD (53%), AMP (69%), ACC (86%), and DEC (80%; Figure 1A). The TD (57%) in MD-3 most resembled match values, but lower values were found for HSR (37%) and SPR (29%). The session that produced the greatest HSR (43%) and SPR (45%) distances relative to competition was MD-4 (Figure 1A). Moreover, the frequency of DEC and ACC bouts during training exceeded 50% of that performed in matches in MD + 1C (80–86%), MD-4 (71–72%), MD-3 (62–69%), and MD-2 (56–61%). Full back covered more SPR distance relative to match play at MD-4 (65%), and this was different to FW (21%; $p < 0.01$; ES: 1.1; Figure 1C, F). Similarly, FB also demonstrated the highest relative load values for HMLD (33%) at MD-2 compared with other positions (23–29%, $p < 0.05$ ES: 0.9–1.2). Differences were also evident at MD-1 for AMP between CD, FB, and OMF (43–46%) vs. MF (36%; $p < 0.01$; ES: 1.5–1.7; Figure 1B–F). The CV for training loads relative to match play was highly associated with the training session, load metric, and playing position. For instance, the CV for weekly training sessions ranged from 37 to 41% when averaged across all load metrics and positions in MD-3 and MD-4 to 82% for MD + 1R. Similarly, the CV for weekly external training load metrics when averaged across all training sessions and positions ranged from 18 to 19% for TD and AMP to >80% for HSR and SPR. The CV across weekly external training load metrics and sessions ranged from 46% for FB to 61% for FW.

Discussion

The aims of this study were to (a) determine the external load of a football team across playing position and relative to competition for a structured microcycle and (b) examine the loading and variation the day after competition for players with or without game time. A novel aspect of this study was the marked difference in load at MD + 1 between players completing the majority of the game (>60 minutes) vs. players with partial or no game time (<60 minutes). Although Stevens et al. (43) demonstrated that the load of nonstarter sessions was generally lower than regular training, this study failed to provide a practical solution. This is a pertinent point because intermittent running capacity of starters can be ~40% better than nonstarters (46); thus, strategies to maintain the physiological capacities of nonstarters would be a welcome addition to the literature. This study found players without game time undertook a training session that tried to replicate competition loads (MD + 1C), while players with game time completed a recovery session instead (MD + 1R). As a competitive match has been found to be an important stimulus for power development in starters vs. nonstarters (38), MD + 1C may offset reductions in this component, as it produced the highest ACC/DEC load of the microcycle. The elevated load for MD + 1C could be attributed to the small number of players used in this session, which results in an increase in the number of ball touches, dribbles, and duels (41). Although the SSG approach used in MD + 1C elevated TD, HMLD, AMP, ACC, and DEC (exceeds 50% of match play in all these metrics) in players with limited game time, it did not develop HSR and SPR qualities. Ade et al. (2) found that running-based drills elevated HSR and SPR compared with SSG drills, but the latter produced more ACC and DEC. Thus, future research should implement a mixed strategy of SSG and running-based drills to establish if this provides the best training stimulus for players with limited game time.

Another major finding of this study was that training loads were greatest 4 days before matches (MD-4) with selected metrics approaching competition loads. Interestingly, these studies' training time for MD-4 was ~12 minutes lower than that reported within the literature (43). Moreover, metrics such as TD, HSR, SPR, and ACC also differed substantially from those reported by others across various stages of the training week (43). This is probably because of variations in the competitive standards of players and the training methodologies used across studies. But despite these possible differences in the training methodology, this study still found that the central component of the microcycle produced the greatest load, resulting in a marked difference from MD-2 and MD-1, a finding supported by a plethora of literature (3,40,43). Varying training parameters in this way seems to be the preferred practice for attempting to optimize physiological adaptations and the performance of elite players (28,30,40). This was very evident when observing the CV for weekly training sessions, as this ranged ~40% for players when averaged across all metrics and positions in MD-3 and MD-4. Although these are the most intense sessions within the microcycle, whereby players are expected to produce repeated intense efforts, variation was still present, as the coaches constantly adjusted sessions because of the players' schedule, physical recovery status, and conditioning requirements for that week. Moreover, HSR and SPR distances are the metrics illustrating the most variability within the microcycle (>80%), which is consistent with the variability found in SSG formats (60–140%) (2) but lower than competition variability (20–30%) (14,16). The large variability in load across sessions and metrics seems to be a combination of the inherent unpredictable nature of game-based training and the strategies used by coaches to vary the stimulus for players to create training adaptations.

The tactical role of a player seems to be a powerful determinant of their match physical performance, so it is imperative that the conditioning stimulus has a positional element to it (15,17,21). In this study, the distance covered in HSR and SPR for MD-4 and MD-3 clearly demonstrated positional variation, whereby FB produced the greatest load and the lowest CV within the microcycle. This would be advantageous for FB to enable them to cope with modern game requirements because they cover a greater proportion of HSR and SPR in activities such as running the channel and overlapping than other positions (9). Moreover, HSR and SPR distance by FB has increased by ~40% in European leagues in the past decade (6), as a dual role requires them to be defensive out of possession but conduct offensive in possession actions such as overlapping to cross. Similarly, FW and OMF demonstrated ACC and DEC loads in MD-4 and MD-3 that were closest to competition values. Both of these offensive positions are expected to ACC and DEC rapidly while dribbling, running in behind, and breaking into the box, which are activities to exploit space to score and create opportunities for teammates (9). Thus, it seems that the positional stimulus at MD-4 and MD-3 is particularly preparing FB, FW, and OMF for their distinct tactical roles.

In this study, all metrics decreased progressively on the days before competition, particularly in MD-2 and MD-1. Numerous studies using an English Premier League sample have reported similar trends, particularly demonstrating that MD-1 has the lowest load (3,4,35). However, some differences do exist across studies for various training days highlighting the need to document load data from other European leagues. The consistent finding of a drop in MD-1 clearly indicates a tapering strategy, whereby coaches reduce training volume and intensity when competition approaches (40). However, most studies have failed to provide any specific context associated with each training day, and this has limited the application of such data. As this study contextualized each training day, the decline in load as competition approached was related to players moving from intense positional drills and SSG in MD-4 to low-load activation drills and set pieces in MD-1. From a positional perspective at MD-1, FW differed from CD, FB, and MF for metrics such as AMP, ACC, and DEC. Given that these data were contextualized, it was evident that the FW's activation and set piece work were geared toward finishing and efforts on goal, which are primarily technical and tactical in nature. Although activation and set piece work for CD, FB, and MF typically involved running-based activities with some attacking and defensive situations added to replicate match scenarios, future research should attempt to further contextualize match loads, so that applied staff can visualize where the load of each day comes from (e.g., 70% of ACC load in MD-3 was from SSG's) and how the tactical and technical components modulate effort and impact injuries.

In summary, this study demonstrated that (a) the compensatory session (MD + 1C) was more intense than the recovery session (MD + 1R) the day after competition, (b) loads were greatest 4 days before matches (MD-4) with selected metrics approaching competition loads, (c) the external load of the microcycle varied substantially based on the players tactical role in the team, and (d) the CV for weekly training sessions was generally large across all elements of the microcycle. This information could be useful for applied sports scientists when trying to systematically manage load, particularly compensatory conditioning for players without game time.

Practical Applications

Gaining knowledge of external training loads relative to the game is important for applied practitioners, particularly when attempting to optimize position-specific loads. For instance, applying a similar HSR load to FB and MF could potentially lead to overloading the latter position and underloading the former position. Such discrepancies in load across position could impact competition performances and increase the risk of injury. Thus, quantifying loads relative to competition demands could be an advantageous strategy that coaches use within their training periodization models. As competitive match play is an important stimulus for developing the physiological capacities of players regularly completing games, it is imperative that practical strategies are implemented to offset any reductions in the fitness of players getting limited game time. Thus, MD + 1 could be an ideal day to compensate for the reduced competition load in players with limited game time, in addition to the elevated stimulus within MD-4 and MD-3 of the microcycle.

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