This is the accepted version of the article: Fleming A, Walker M, Armitage M, Connor M, Beato M. A Comparison of Training and Match Play External Load During a Congested In-Season Period in English League 2 Football. J Strength Cond Res. 2023 May 15. The final published version is available here: https://journals.lww.com/nsca-jscr/Abstract/9900/A_Comparison_of_Training_and_Match_Play_External.254.aspx

A comparison of training and match play external load during a congested in-season period in English League 2 Football

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ABSTRACT

This study aimed to investigate if external training load metrics differ between training days and matchday during a period of fixture congestion and to verify if external load metrics vary based on playing positions. Training and match day (MD) data were collected in a part of the competition phase of the 2020-21 season (6 weeks) in the English Football League 2 (N = 20 players, mean ± standard deviations: age = 24.4 ± 4.7 years). Global Navigation Satellite System units (Catapult S7 Vector 10Hz) were utilized to monitor external load metrics. The metrics were Duration of training, Total distance (TD), High-speed running distance (HSR), Sprinting distance (SPR), Relative intensity (m/min), Total accelerations (TotAcc) (>3 $m·s^{-2}$), and Total decelerations (TotDec) (<-3 $m·s^{-2}$). This study found that Duration, TD, Relative intensity, HSR distance, Sprint distance, TotAcc, and TotDec were different (p<0.001, *d* =

small to *moderate*) between MD and MD-2 or MD-1, however, during MD-4, only Relative intensity was significantly lower ($p<0.001$) compared with MD output. Therefore, MD-4 was the most demanding training session of the week (after the MD) and during MD-2 and MD-1 coaches decreased players' load to favor players' readiness. Moreover, this study found that MD and MD-1 resulted in statistically different values across several metrics between different playing positions (defenders < midfielders and strikers), while metrics in MD-4 and MD-2 were not statistically different, which highlights that in these sessions, players have similar external loads independently from their playing positions.

Keywords: Soccer, GPS, Fixture, Team sports, Workload

INTRODUCTION

Football is a team-sport where technical and tactical actions and physical capacities are key to success. Football is an intermittent sport comprised of short periods of high-intensity activity, interspersed with periods of low intensity activity (4). Players are required to possess good levels of aerobic fitness to cope with match durations and recovery following high-intensity actions (30). Previous research found that match load demands are position dependent, where players in some specific roles perform a higher match load (e.g., total distance) (14). For instance, wide defenders and wide midfielders usually perform higher distance at high-speed running and sprinting, which is due to tactical factors, e.g., overlapping runs and recovery runs during counter attacks (18,39). On the other hand, central areas are more populated, therefore they limit the high-intensity exposure for central midfielders (CM) as they operate in tight spaces, but instead increase mechanical loading through acceleration, deceleration and change of direction (6,39). Such research suggests that a one size fits all approach to training will not adequately prepare individual players for the physical, technical, and tactical characteristics and profiles of their position (14), meaning individualized training methods are sometimes necessary to best prepare players for match play.

In the last decade, football clubs have increased the number of sports science practitioners to collect and interpret training and match load data with the purpose of evaluating and developing current practices regarding player competition preparation strategies (21,45). Training load can be categorized as internal load and external load, both of which comprise of volume and intensity, which is manipulated to elicit a desired physical response (25). External load can be thought of as the specific training implemented by coaches, whilst the internal load is the physiological response to the external load stimulus (25). External load is generally monitored using Global Navigation Satellite System (GNSS) technology, which provides reliable and valid data regarding training load (*i.e.,* total distance, peak speed) due to its quantitative and objective nature (8,9,12). External training load analysis can be used to facilitate progressive loading and unloading strategies with the aim of improving physical performance, readiness and to mitigate injury risk and fatigue (24,43). For instance, previous research found that season-long quantification of training and match load in the English Premier League indicates that a gradual reduction in training load across the three days prior to a match is a common strategy, with proximity to the next match being a key factor in implementing that strategy (32,44).

Fixture scheduling greatly influences the training load distribution during the week (microcycle) (24,42). Two-game week formats can dramatically decrease recovery and preparation time which may manifest negative effects on both performance and injury likelihood (24). Although the comparison of the effects of fixture congestion is complicated, it is very interesting and can elucidate how periodization and coaching philosophies can affect training load distributions (43). Research regarding the effect of fixture congestion has been reported in the English Premier League, English Football League One, as well as French Ligue 1 (23,24,28), but not in the English Football League Two (EFL2). Duration of fixture congestion periods and can result in different impacts on injury rates, technical and physiological factors (15,38). Jones and colleagues, investigated the effect of short-term fixture congestion on position-specific running and external load in the EFL1 (28). External training load metrics such as low-intensity (<4.0 $m \cdot s^{-1}$), medium-intensity (4.0-5.5 $m \cdot s^{-1}$), and sprint distance (>7.0 $m \cdot s^{-1}$) were significantly different between training weeks with different days between matches (e.g., >4 vs <4 days). However, to the authors knowledge, the effect of fixture congestion in the EFL2 is yet to be investigated. The impact of fixture congestion results in a reduction in available time for training, and as such, periodization strategies and coaching philosophies are different.

The rationale for this investigation was to determine whether different external load existed between training days and match play, with a particular focus on positional and day-type metric differences, to understand coaching and periodization strategies in professional football. Therefore, the aim of this investigation was to compare the external load demands during training and match play during a period of fixture congestion on an EFL2 team. The research questions were: (i) are external load metrics different between training days and matchday? (ii) are these metrics different based on playing position during training and matchdays?

METHODS

Participants

Twenty professional male football players (mean ± SD: age = 24.4 ± 4.7 years, body mass = 77.3 ± 5.2 kg, stature =181.5 ± 5.0 cm) where enrolled in this study. Data was collected during 6-weeks of training and match days (MD) during the competition phase of the 2020-21 season (3rd mesocycle) in the EFL2. Players were assigned to one of three positions: defender (DF, n=7), midfielder (MF, n=9), and striker (ST, n=4). Goalkeepers were excluded from this study as they did not wear GNSS units. The team competed in three official competitions (EFL2, EFL Trophy and The Emirates FA Cup) during the 6-week period, totaling 11 matches, meaning that the team in the present study typically played on average every 3.6 (range 3 to 5) days. Prior written agreement was achieved between the University of Suffolk and the Football Club involved, establishing aims, objectives, and data protection policies for the players. Data analysis was performed a posteriori with the written authorization of the club. The ethics committee for the School of Health and Sports Sciences at the University of Suffolk approved the study (RDU21/013).

Design

For the purposes of comparing day type and player positional metrics the inclusion criteria for this study involved all players in the squad (i.e., starter and non-starter players) (24). Main group sessions were considered, therefore exclusion criteria related to individualized training in the form of top-up conditioning, rehabilitation, and recovery sessions. Matchplay inclusion criteria required players to have played ≥ 75 minutes (which is an arbitrary cut-off). Inclusion of substitutes who played less than this threshold could negatively skew the data with reduced physical outputs. GNSS units were utilized to monitor training and MD external load metrics. Catapult S7 Vector GNSS 10Hz units (Vector, Catapult Sports, Melbourne, Australia) were secured inside a neoprene vest, situated between the scapulae (27). Good reliability and validity of Catapult 10Hz units has been previously reported (27), *i.e.*, typical error of measurement was 1.3%, as well as extensive research into GNSS sampling rate in team sports supports the use of 10Hz units for quantifying football-specific movements (8,9,12). Players wore the same unit to avoid inter-unit error due to high variability previously reported (26). Furthermore, training and MD observations took place in wide-open spaces and open-roofed stadiums to improve satellite acquisition (11 to 14 during all testing days), average horizontal dilution of precision was 0.67 ± 0.27, GNSS units were turned on 15 minutes prior to any activity for satellite acquisition (26,31). A total of 17 training sessions took place at the Club's outdoor training facility, resulting in 271 individual player sessions being collected for further analysis (DF = 102, MF = 108, ST = 61, see Table 2). A total of 11 matches took place at both home and away grounds in three official competitions, resulting in 98 individual MD player sessions (DF = 44, MF = 36, ST = 18).

Day Type and Playing Position

Training and MD external load metrics were categorized based on MD proximity (MD plus/minus). Four different day types were analyzed in the current study such as MD-4 (n=2 sessions), MD-2 (n=4 sessions), MD-1 (n=11 sessions), MD (n=11 matches), while MD-3 was a set day off. For instance, MD-4 refers to four days before the game, MD-2 refers to two days before the game and MD-1 refers to one day before the game. The day type immediately following the match (MD+1) was excluded from analysis when classified as passive recovery days (the same was applied to MD-4 and MD-2), which was not representative of a typical training day because of the congested period analyzed in this study. For readers that are not familiar with the concept of congested period, we suggest the view of the following papers (5,24).

Data Collection

The following metrics were collected: Duration (minutes), Total distance (TD), High-speed running distance (HSR) (5.5-7 m/s), Sprinting distance (SPR) (>7.0 m/s), Relative intensity (m/min), Total accelerations (TotAcc) (>3 $m \cdot s^{-2}$) and Total decelerations (TotDec) (-<3 $m \cdot s^{-2}$) (10,24,41), which derives from velocity data (link: https://support.catapultsports.com/hc/enus/articles/360001235575-Catapult-glossary). Relative intensities were analyzed based on the distance (TD) divided by the duration of the session ($TD \cdot min^{-1}$). These external load metrics are commonly used in football by practitioners and coaches to evaluate training load and inform future training practice for players (11,45). All GNSS data was downloaded and processed by sports science practitioners post-training and matchplay using manufacturer's software (Openfield, Catapult Sports, version 1.2, Melbourne, Australia) and exported into a Microsoft Excel (Microsoft Corporation, U.S) spreadsheet for analysis. Data were exported using the default settings of the software, with no further manipulation (e.g., filters) from the sport science staff.

Statistical Analysis

All statistical analyses were performed using JASP (Amsterdam, Netherlands) software version 0.13.1 for Mac. Data were presented as mean ± standard deviation (SD). Data were assessed for normality using the Shapiro-Wilk test. Matchday type comparisons (MD, MD-4, MD-2, MD-1) were analyzed using a Friedman test (non-parametric statistical test), Kendall's W ranges were reported to interpret the size of the effect. The Kendall's W coefficient assumes the value from 0 (indicating no relationship) to 1 (indicating a perfect relationship and is interpreted as follow: ≤ 0.3 (small effect), ≤ 0.5 (moderate effect) and > 0.5 (large effect). Later a Conover's Post Hoc comparison was performed. Statistical significance was accepted at $p < 0.05$ (7). For the between positions analysis (positions: defenders, midfielders, strikers) a one-way analysis of variance (ANOVA) test was used to evaluate the differences in metrics (these results were subsequently checked against those deriving from Kruskal-Wallis Test [non-parametric ANOVA]). A homogeneity (equal variances across samples) test was performed using the Levene's test, and if a violation was found, the Brown-Forsythe correction was applied. When significant F-values were reported, post hoc analysis was performed with Bonferroni correction applied to the alpha value. Robust estimates of 95% confidence intervals (CIs) and heteroscedasticity were calculated using the bootstrapping technique (1000 randomly bootstrapped samples). Effect size was based on Cohen's *d* principle and interpreted as: trivial < 0.2; 0.2 ≤ small < 0.6; 0.6 ≤ moderate < 1.2; 1.2 ≤ large < 2.0; very large ≥ 2.0.

RESULTS

Descriptive statistics by metric distributions for day type are summarized in Table 1.

*****Please, report Table 1 here*****

Day Type

Statistically significant differences were found between day types for all metrics, including Duration ($p < 0.001$, W = 0.240, *small*), TD ($p < 0.001$, W = 0.162, *small*), Relative Intensity ($p < 0.001$, W = 0.148, *small*), HSR distance ($p < 0.001$, W = 0.086, *small*), SPR distance ($p < 0.001$, W = 0.128, *small*), TotAcc ($p < 0.001$, W = 0.362, *moderate*), TotDec ($p < 0.001$, W = 0.135, *small*). Figure 1 reports the Bonferroni post hoc analysis.

Duration

MD-4 Duration was significantly greater compared to MD ($p < 0.001$), MD-2 ($p = 0.007$) and MD-1 ($p < 0.001$). MD Duration was greater but not significantly longer compared to MD-2 but was significantly greater compared to MD-1 ($p = 0.007$). MD-2 duration was significantly greater compared to MD-1 ($p = 0.046$).

Total distance (TD)

MD TD was significantly greater compared to MD-2 ($p < 0.001$) and MD-1 ($p < 0.001$), and greater but not significant compared to MD-4 (Figure 1). MD-4 TD was significantly greater compared to MD-1 ($p = 0.002$), and greater but not significant compared to MD-2. MD-2 TD was greater but not significantly different compared to MD-1.

Relative intensity

MD Relative intensity was significantly greater compared to all other day types (Figure 1) such as MD vs. MD-4 ($p < 0.001$), MD vs. MD-2 ($p = 0.004$) and MD vs MD-1 ($p = 0.022$).

High speed running (HSR)

MD HSR distance was significantly greater compared to both MD-2 ($p = 0.015$) and MD-1 ($p < 0.001$) (Figure 1). MD-4 HSR distance was significantly greater compared to MD-2 ($p = 0.004$) and MD-1 ($p < 0.001$). MD-2 HSR distance was greater but not significant compared to MD-1.

Sprinting (SPR) distance

MD SPR distance was significantly greater compared to both MD-2 ($p = 0.004$) and MD-1 ($p < 0.001$) (Figure 1). MD-4 SPR distance was significantly greater compared to MD-2 ($p = 0.002$) and MD-1 ($p < 0.001$).

Accelerations

MD TotAcc amount was significantly greater compared to both MD-2 ($p < 0.001$) and MD-1 ($p < 0.001$), and greater but not significant compared to MD-4. MD-4 TotAcc amount was significantly greater compared to MD-2 ($p = 0.036$) and MD-1 ($p = 0.036$). MD-2 TotAcc amount was greater but not significant compared to MD-1.

Decelerations

MD TotDec amount was significantly greater compared to MD-2 ($p = 0.032$) and MD-1 ($p < 0.001$), and greater but not significant compared to MD-4 (Figure 1). The MD-4 TotDec mean value was significantly different compared to MD-1 ($p < 0.001$), but not significant compared to MD-2.

*****Please, report Figure 1 here*****

Playing Position

Descriptive statistics by metric for playing position are summarized in Table 2.

*****Please, report Table 2 here*****

MD

Statistically significant differences in several metric values were found for playing position on MD. There was a significant difference in TD between defenders ($d = -1.01$, *moderate*, $p < 0.001$) and midfielders, Relative intensity ($TD \cdot min^{-1}$) was lower for defenders compared to midfielders ($d = -1.53$, *large*, $p < 0.001$) and strikers ($d = -1.25$, *large*, $p < 0.001$), HSR distance was lower for defenders compared to midfielders ($d = -0.82$, *moderat*e, $p < 0.001$) and strikers ($d = -1.75$, *large*, $p < 0.001$), SPR distance was lower for midfielders compared to strikers ($d = -0.75$, *moderate*, $p = 0.035$), however, no statistical difference was found for playing position regarding MD Duration, TotAcc and TotDec. Table 3 reports the Bonferroni post hoc analysis and can be found in the supplementary material.

MD-4

Statistically significant differences were found in playing position on MD-4 for SPR distance between midfielders and strikers (*d* = -1.81, *large*, p = 0.048) only. No statistical difference was found for playing position regarding Duration, TD, Relative intensity, HSR, TotAcc and TotDec. Table 4 reports the Bonferroni post hoc analysis and can be found in the supplementary material.

MD-2

No statistically significant differences were found in playing position for all metrics on MD+2. Duration (F = 0.526, p = 0.595), TD (F = 0.102, p = 0.904), Relative intensity (F = 1.221, p = 0.304), HSR distance (F = 0.533, p = 0.591), SPR distance (F = 0.172, p = 0.842), TotAcc (F = 0.219, p = 0.804), TotDec (F = 0.108, p = 0.898. Table 5 reports the Bonferroni post hoc analysis and can be found in the supplementary material.

MD-1

Statistically significant differences in several metrics were found for playing position on MD-1. Statistically significant differences were found in playing position regarding Duration that was lower for defenders compared to midfielders (d = -0.54, *small*, p = 0.004) and strikers (d = -0.75, *moderate*, p < 0.001), TD was lower for defenders compared to strikers (d = -0.62, *small*, p = 0.016), TotAcc was lower for defenders and midfielders compared to strikers (d = -0.71, *moderate*, p = 0.002) and (d = -0.53, *small*, p = 0.033), respectively, TotDec was lower for defenders compared to strikers (d = -0.66, *moderate*, p = 0.007). No statistical difference was found for playing position regarding Relative intensity, HSR, and SPR. Table 6 reports the Bonferroni post hoc analysis and can be found in the supplementary material.

Discussion

In this study, day type and playing position metric values were analyzed to understand external load management during a period of fixture congestion at a football club competing in the EFL2. The first research question set out to investigate if external load metrics differed between training days and MD; this study found that, during the 6-week period analyzed, several metrics (i.e., Duration, TD, Relative intensity, HSR, SPR, TotAcc and TotDec) were significantly different between MD and MD-2, MD-1, indicating that external load decreases during the week when the next MD is approaching. On MD-4, only Relative intensity was significantly lower compared to MD outputs, while all other metric values were not significantly different, which highlights that MD-4 is the most demanding training session of the week. The second research question set out to investigate if external load metrics were different based on playing position during training days and MD. This study found that MD and MD-1 were statistically different across several metrics between playing positions, while external load metrics on MD-4 and MD-2 were not statistically different. To the authors knowledge, there are no studies reporting the quantification of external load metric distributions in the EFL2 during a period of fixture congestion, therefore, the novel insights highlighted in this paper can support coaches and practitioners to understand the physical demands of this specific league.

The training load distribution during the microcycle is a key aspect of the players' readiness for the MD, as well as training load manipulation and distribution play an important role in the long-term maintenance and development of the fitness status of the players (11,45). Coaches need to manipulate the team training load with caution because they need to train their players and offer adequate stimuli but, at the same time, they cannot overload players because they could undermine their readiness during the MD (24,42). This situation is further complicated when coaches need to manage external load in-season during a congested fixture period. In the present study, MD-4 duration was greater compared to MD ($p < 0.001$), MD-2 ($p = 0.007$) and MD-1 ($p < 0.001$). Instead, MD Duration was greater but not significantly longer compared to MD-2 but was significantly greater compared to MD-1 ($p = 0.007$, Figure 1). MD-2 Duration was significantly greater compared to MD-1 ($p = 0.046$) – a shorter duration on MD-1 was likely an attempt at reducing external load ahead of MD to promote players' readiness. These findings are in line with Malone and colleagues, (32), who noted MD-1 Duration was significantly lower compared to MD-2. A similar trend in the reduction of duration towards MD proximity exists in the Dutch Eredivisie (42). Therefore, it is possible that similar periodization strategies are used across leagues and countries in regard to duration leading up to MD. MD-4 likely had the longest significant duration of all day types as it was the furthest day from the next MD and it was used by coaches to maximize the conditioning load (volume), before reducing training load for the remainder of the training week to promote recovery, adaptations and readiness.

This study suggests that MD is the most physically demanding day during a microcycle (Figure 1), with significantly greater external load values. During MD, players perform absolute and relative distances which can be difficult to replicate during training (36). For this reason, it is paramount to consider competition demands for training periodization, as it could leave players underprepared if training is usually below game intensity (24). MD TD was significantly greater compared to MD-2 ($p < 0.001$) and MD-1 ($p < 0.001$), and greater but not significantly different compared to MD-4 (Figure 1). These findings further highlight the tapering strategy that exists as MD approaches (17). MD TD in the present study is lower than TD values in the Dutch Eredivisie (10927m) and English Championship (11000m) (35,42). Differences in TD ~ 1000 m between EFL2 and other elite football leagues suggests that the volume and Relative intensity in the EFL2 are lower compared to other professional leagues; however, they are similar to that in the EFL1, such as TD = 10041 m (39) – although this could be due to the teams' style of play analyzed in this study. It should be noted that in-season mesocycle phases can cause fluctuations in metric value distributions, for example greater TD values have been found at the beginning of the season compared to mid-and-end season (29,32). Greater TD in the pre-season and early in the competition phase can be attributed to the need to obtain physiological adaptations, while during the rest of the season, match readiness is generally the main aim. The present study gathered 6-weeks of training load and MD data during the first in-season mesocycle, which could have been influenced by its proximity to the preseason. Therefore, a season-long quantification would be necessary to provide a more comprehensive comparison to other professional leagues.

MD Relative intensity was significantly greater compared to all other day types (Figure 1). However, MD intensity in the present study was lower compared to intensities previously highlighted in the Dutch Eredivisie (120 m/min, using a local positioning measurement system) (42) and English Championship (130 m/min, using Catapult Sports™ 10 Hz OptimEye S5) teams (20), but similar to EFL1 (105 m/min, using GNSS STATSports 10 Hz Apex) (39). Therefore, it is evident that higher ranking leagues have higher intensities compared to the EFL2 although this is not consistent in all studies (e.g., EFL1) (39). Such differences could be related to physical, technical, and tactical requirements necessary for different teams and leagues. However, more research is needed regarding contextual variables in EFL2 such as game score line, home vs away, win vs lose, draw and tactical/technical variables, which could all impact Relative intensity during MD.

MD HSR distance (431m) was found to be lower compared to values noted in the Dutch Eredivisie (738 m) (42), and such values were comparable to other top-level leagues (13,34). This suggests players in top-level leagues require the capability to deliver greater HSR distances compared to the EFL2, however, variability between studies exist. HSR distance in the present study found that HSR distance was greater on MD-4 than on MD-2 and MD-1. A longer MD-4 duration in the present study may indicate a greater time opportunity for players to achieve higher HSR distances compared to the Dutch Eredivisie (42), however, it should be considered that the players analyzed on MD-4 were both starters and non-starters, therefore the HSR distance reported is very high because of the compensation external load performed by the non-starters (24). The present study highlighted a greater SPR distance on MD-4 compared to an English Premier League team (99 vs 46), but lower SPR distances for MD-2 (8 vs 28) (3). In the latest years, a lot of attention has been given to the exposure to HSR and SPR distances, which can provide a critical training stimulus to help players cope with the high-intensity demands of football (11), and also to mitigate the likelihood of non-contact injury (22,33). This is particularly important considering a reduction in HSR and SPR distances has been highlighted towards the final 10-15 minutes of the match, where injury risk is heightened due to fatigue.

This study found that MD TotAcc and MDTotDec amounts were greater compared to both MD-2 and MD-1 (Figure 1), and greater but not significant compared to MD-4. In contrast to the findings in the present study, Stevens and colleagues, (42) noted that high accelerations (>3m·s-^{2}) occurred more frequently on MD-4 compared to MD in the Dutch Eredivisie (66 vs 61). TotAcc and TotDec data from the present study was higher compared to all day types in the Dutch Eredivisie. However, these differences should be taken with caution due to the differences in validity and reliability of technologies used to monitor external load parameters in these studies (i.e., Local Positioning Measurement and GNSS). Furthermore, comparison of acceleration and deceleration data in the present study with existing literature is difficult due to different thresholds used among papers (19,42).

Extensive research has highlighted the variation that takes place in physical performance between different playing positions (1,16,18). From a microcycle distribution point of view, some differences were found between playing positions on MD, e.g., defenders reported lower TD compared with midfielders (*large*), lower Relative intensity compared to midfielders (*large*) and strikers (*large*), lower HSR distance compared to midfielders (*moderate*) and strikers (*large*). This means that on MD, player positions have different external load demands as previously reported (1,16,18). This is due to the characteristic of the positions, for instance, on MD, midfielders covered the greatest TD (Table 2) because these players are required to play between attack and defense, meaning midfielders are often involved in all phases of play (40); instead, defenders covered the lowest TD (Table 3), which is expected because of their position (2).

Some differences likely exist in this study due to the method of categorizing positions, for instance we did not analyze independently central defenders and wide defenders. Central defenders typically cover the least TD compared to all positions, meanwhile, wide defenders typically cover similar or greater TD compared to central midfielders due to their role in both attack and defense (2), performing overlapping for crossing opportunities and recovery running when opponents counter attack. The same issue could be reported for midfielders, in this study both positions covered the greatest HSR distances compared to defenders, whilst strikers covered the greatest SPR distances compared to other positions (Table 2). The midfielders player position group includes wide midfielders, who typically cover the greatest HSR and SPR distances as wide areas are largely uncongested, creating more opportunities to exploit high intensity thresholds unopposed (40) but in this study midfielder position included also central midfielders, who have less space to perform such HSR and SPT distances. This could be the motivation because in this study strikers covered greater HSR and SPR distances compared to all other positions. In contrast with that reported during MD, during MD-4 we found differences only in SPR distance between midfielders and strikers (*large*, $p = 0.048$). No statistical difference was found for playing position regarding Duration, TD, Relative intensity, HSR, TotAcc and TotDec. The same results (including SPT distance) were found during MD-2 where no significant differences were found in playing positions for all metrics. This means that during the training week (MD-4 and MD-2), coaches may plan the same external load for their players independently from their playing position. Finally, on MD-1, differences were found in playing position regarding Duration that was lower for defenders compared to midfielders (*small*) and strikers (*moderate*), TD was lower for defenders compared to strikers (*moderate*), TotAcc was lower for defenders (*moderate*) and midfielders (*small*) compared to strikers, TotDec was lower for defenders (*moderate*) compared to strikers. These findings highlight that coaches might plan external load stimuli based on their players' playing position the day before the match but not during the other training days, however, the limited playing position differences found in this study could be related to different recovery strategies that are necessary during periods of fixture congestion (23,24). For instance, central defenders and wide defenders and midfielders in the German Football League had a significant decrease in TD when there were less than 4 days between fixtures (37). Coaches' tactical strategies during training sessions could explain these findings for instance, on MD-1 defenders had the lowest TD and TotAcce demands. Moreover, these results could be due to the necessity of preserving physical performance considering players only have 2-3 days of recovery between matches in the present 6-week study. However, this study is the first of its kind in EFL2 and therefore the results should be further strengthened by replicating similar studies before drawing firm conclusions.

This study is not without limitations, this is the first that has quantified the training and match load in the EFL2, therefore it is difficult to compare our results with others. Further studies are needed to provide a comprehensive resource for coaches and practitioners to develop training methodologies and periodization strategies in EFL2. Second, this study consists of a small sample of players (only 1 team), who were analyzed for a brief period (6 weeks), therefore future studies should extend this investigation by considering more teams and different time windows and offering more exhaustive conclusions. Moreover, the variation of players' physical demands did not consider some other factors that could have affected them such as game outcomes, opponent level, etc. Lastly, this study enrolled a sample of male players, therefore these findings cannot be directly applied to female football teams of a similar level, therefore future research should investigate if in-season training and match load change between MD and training session and between positions during a period of fixture congestion in a sample of female players.

Conclusions

This study compared the in-season external training and match loads during a period of fixture congestion (6 weeks) at a football club competing in the EFL2. The results showed that several metric values (i.e., Duration, TD, Relative intensity, HSR, SPR, ToTAcc and ToTDec) were different between MD and MD-2, MD-1, indicating that periodization strategies are utilized to facilitate players' reediness and long-term training adaptations. During MD-4, TD, HSR and SPR distance were not different compared with MD outputs, which highlights that MD-4 is the most demanding training session of the week, likely due to the longer duration of the MD-4 session compared to MD (Relative intensity was much lower on MD-4). MD and MD-1 reported statistically different values in several metrics between playing positions, while metrics in MD-4 and MD-2 were not statistically different, which highlights that in these sessions, players have similar external loads independently from their playing positions. These novel insights highlighted can support coaches and practitioners to understand the physical demands of the EFL2 during periods of fixture congestion.

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Table 1. Descriptive statistics for day type analysis. Mean ± SD of training and matchplay loading for absolute and relative external load metrics.

Table 2. Descriptive statistics for playing position analysis. Mean ± SD of training and matchplay loading for absolute and relative.

Figure 1. Differences in metric distributions between day type. Absolute and Relative Duration (min), Total Distance (TD), Intensity, High-Speed Running (HSR), Sprint (SPR), Acceleration (TotAcc) and Deceleration (TotDec) values, m = metres, m/min = metres per minute, SD = standard deviation, MD = Matchday, MD-4 = Matchday minus four, MD-2 = Matchday minus two, MD-1 = Matchday minus one, * = Significant difference between MD.