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ORIGINAL RESEARCH

Non-starters vs. starters: Comparison of in-season training load relative to match load in professional soccer players

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Abstract

Background: Sports scientists have studied in-season training periodization with elite soccer teams obtaining some calculations such as relative accumulated load. However, to the best of the authors' knowledge, there is scarce literature about training programs related to the loads imposed during matches in non-starter vs. starter players during different in-season periods. **Objective:** The main aim of the present study was to compare accumulative match and training load rates and the corresponding training/match ratio (TMr) between non-starters and starters players of an Argentine professional soccer team during two in-season periods (regular competition period vs. match congested period). **Methods:** Ten players were considered starters if they started the match and completed at least 60 min in three consecutive matches while the other 10 were classified as non-starters (most of the matches played as substitute players) over two 8-week periods. The external load of each player during typical practice sessions and official matches was monitored by GPS. Data on total distance (TD), high-intensity load rate (distance covered at speed > 14.9 km/h per minute, HILR) and high-speed load rate (distance covered at speed > 19.9 km/h per minute, HSLR), number of runs during the load rates (#HILR and #HSLR), high-intensity accelerations and decelerations (> 2.5 m/s^2, HIA; < –2.5 m/s^2, HID) and high metabolic load distance (HMLD) were monitored. An individual TMr was calculated for each external load measure. **Results:** There were no significant differences in accumulative match and training load rates between non-starters and starters. Regarding TMr, non-starters presented a lower value in HILR (–12.9%, p = .039), #HILR (–7.7%, p = .032), and HMLD (–9.8%, p = .024). **Conclusions:** The main finding of this study showed that non-starters did not present an improvement or deterioration in physical performance in the main physical metrics analysed, compared to starter players in both periods. In addition, non-starters presented lower values of TMr for high-intensity patterns during the regular period. This could be attributed to the fact that non-starting players have achieved higher performance in various physical metrics, compared to players who were substituted or completed the entire match.

Keywords: professional soccer, training performance, match performance, external load demands, high-intensity patterns

Introduction

The prescription of training loads has had a relevant value in high-performance sports. In this respect, there are a variety of studies that describe the behaviour of training loads, specifically, the quantification of training/match demands (locomotor/mechanical and physiological; Djaoui et al., 2017; Rago et al., 2020). Soccer presents physiological, metabolic, physical and physiological demands that can deteriorate the player's performance due to fatigue (Marqués-Jiménez et al., 2017). This is the main reason why global positioning system (GPS) technology has been employed in professional soccer. Besides, it provides parameters such as frequency, number of impacts, distances, speeds, accelerations and decelerations to quantify movement demands on players during training or in competition (Casamichana, Román-Quintana, Calleja-González, & Castellano, 2015). The utilization of GPS technology allows for the immediate feedback of relevant metrics, thus greatly aiding coaching staff to modify different variables in training programs related to the physical and physiological demands of the players (Casamichana, Román-Quintana, Castellano, & Calleja-González, 2015). Likewise, it is useful to provide a detailed summary of the training load (volume, intensity and frequency; Foster et al., 2001; Scott et al., 2013). In that sense, analysing cumulative load with and without match data can provide different interpretations and it is expected that starters and/or players with higher match participation will have higher cumulative load values (Oliveira et al., 2021). Therefore, to be effective, training programs in soccer keep a relation to the loads imposed during matches (i.e., relative training load; Modric et al., 2021).

Coaches require an adequate distribution of training load between the previous and the following match, to achieve a desired adaptive response and thus avoid the fatigue that may affect players' performance in competition

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(Akenhead et al., 2016; Bosquet et al., 2007). Moreover, sports scientists have studied in-season training periodization with elite soccer teams obtaining some calculations as training/match ratio (TMr; calculated by the division of the accumulated weekly load by the match load; Clemente et al., 2019; Modric et al., 2021; Oliveira et al., 2023). The TMr may also be helpful to understand the physical demands induced by competitive match play in starters and for a deeper understanding if compensatory training sessions are an adequate stimulus for non-starters (Clemente et al., 2019; Stevens et al., 2017).

In particular, non-starter players should offer a similar or superior performance during the competition, being the solution needed by coaches (Bradley et al., 2014). One of the main reasons for this choice might be due to the limited roster team. In this case, there is scarce literature that analyses the performance profile of nonstarter players. For example, Oliveira et al. (2023) concluded that non-starters obtained higher training-match rates in all variables despite lower match and training durations, suggesting that physical load had been adjusted appropriately. In contrast, Stevens et al. (2017) reported lower training-match values in terms of high-speed running for non-starters, concluding that training sessions were not adjusted according to weekly variations in match demands. In this regard, another study made in LaLiga (Spanish First Division), showed that non-starters did not present an improvement or deterioration in physical performance in the main physical metrics analysed, compared to starter players (Castillo-Rodríguez et al., 2023). However, to the best of the authors' knowledge, no previous study with professional soccer players has investigated this idea at the highest competitive level in different in-season periods. Therefore, in this context, the assessment of the training process and the competition outcome will allow for the verification of the effectiveness of training programs during the season.

Hence, the first aim of the present study was to quantify and compare the accumulative match and training load rates (per minute) between non-starter and starter players of an Argentine professional soccer team during two competitive periods (regular competition period vs. match congested periods). In addition, the second aim of the study was to determine and compare the TMr for non-starters and starters during both competitive periods. Taking into consideration that players performed most of the training sessions with the same tasks and load, the study hypothesized that non-starters would not present lower accumulative match load, but as Stevens et al. (2017) concluded, high-intensity metrics as high-speed running would be affected in non-starter players.

Methods

Participants

Twenty professional male soccer players (age 25.1 ± 4.2 years, body mass 72.8 ± 6.1 kg, height 176.5 ± 5.3 cm, sum of ten skinfold sites 59.0 ± 6.3 mm, body fat percentage 6.0% ± 1.2%; professional experience 5.6 ± 4.1 years) participated in the current study; all of them were playing for an elite Argentinian team (elite level, according to the classification by McKay et al., 2022) competing in the First Professional League (LPF) during 2023 season. The sample was composed of 4 central defenders, 4 wide defenders, 6 midfielders, 4 wingers, and 2 forwards. The eligibility criteria for participant inclusion were participating in 90% of the total number of training sessions (full session duration; Clemente et al., 2020). Collectively, players were considered starters if they started the match and completed at least 60 min in three consecutive matches while the remaining players were considered non-starters (Marín & Castellano, 2023; Nobari et al., 2020; Oliveira et al., 2023). Additionally, the exclusion criteria for the study included long-term injured player data, lack of complete data for training or match-play and goalkeepers, due to the different variations in the physical demands of outfield players (Clemente et al., 2013). Thus, 10 players (2 central defenders, 2 wide defenders, 3 midfielders, 2 wingers, and 1 forward) were considered starters (age 25.0 ± 3.6 years, body mass 73.6 ± 7.2 kg, height 177.0 ± 3.3 cm, professional experience 5.6 ± 2.8 years), while the other 10 (2 central defenders, 2 wide defenders, 3 midfielders, 2 wingers, and 1 forward) were considered non-starters (age 25.2 ± 5.1 years, body mass 72.1 ± 5.6 kg, height 176.0 ± 7.1 cm, professional experience 5.5 ± 5.4 years).

Prior to data collection, the players were evaluated using FIFA's medical protocol. None presented any ailments, or pathologies, consumed drugs or held any injuries, and no medical prescriptions were issued. The study protocol was approved by the local Institutional Review Board and drafted in accordance with the Declaration of Helsinki 2008, updated in Fortaleza, October 2013.

General procedure

Each player's GPS was monitored for external load during 84 practice sessions and 21 official matches (excluding warming-up) over two 8-week periods during the 2023 in-season period:

- first period: one official match/week (8 matches), 6 days-off and 41.5 sessions for non-starters and 36.0 for starters (February to March),
- second period: one or two official match/week (13 matches), 6 days-off and 41.9 sessions for non-starters and 32.4 for starters (April to May).

The team systematically played in a 1–4–3–3 (goalkeeper, two central defenders plus two wide defenders, one midfielder plus two offensive midfielders, one forward plus two wings) or 1–3–4–3 formation (goalkeeper, two central defenders plus one wide defender, one midfielder plus one wide defender and two offensive midfielders, one forward plus two wings). The total of matches and training sessions took place on natural grass soccer pitches with official dimensions and all external load parameters were collected at the club's official training facility. Table 1 presents the minutes per week trained and the minutes per week played, in each period for both groups.

Daily sessions were based mainly on tactical-technical tasks, configured according to the dynamics of effort attributed to the structural variables that characterized each

Table 1 Means, *SD*s, 95% confidence intervals, statistical significances of *t*-test, and effect sizes for basic sample characteristics for non-starters and starters in both periods

Variable/Period	Non-starters	Starters	*p*	Cohen's *d*
Minutes per week trained				
First	161.9 ± 15.3 [152.4, 171.4]	144.9 ± 8.0 [139.4, 154.4]	.004	1.4
Second	142.5 ± 9.4 [136.7, 148.3]	115.4 ± 6.0 [111.7, 119.1]	< .001	3.5
Minutes per week played				
First	23.3 ± 15.9 [13.4, 33.2]	77.0 ± 13.7 [68.5, 85.5]	< .001	3.6
Second	37.1 ± 25.5 [21.3, 52.9]	117.0 ± 18.4 [105.6, 128.4]	< .001	4.0
Body mass (kg)				
First	72.1 ± 5.6 [68.6, 75.6]	73.6 ± 7.2 [69.1, 78.0]	.313	0.2
Second	71.9 ± 5.8 [68.3, 75.5]	73.4 ± 7.0 [68.1, 77.7]	.302	0.2
Sum of 10 skinfolds (mm)				
First	62.1 ± 7.0 [57.7, 66.4]	60.9 ± 7.5 [56.2, 65.5]	.359	0.2
Second	58.4 ± 7.3 [53.9, 62.9]	55.9 ± 4.2 [53.3, 58.5]	.181	0.4
Body fat percentage				
First	6.0 ± 1.5 [5.1, 6.9]	5.9 ± 1.1 [5.2, 6.6]	.411	0.1
Second	5.4 ± 1.4 [4.6, 0.3]	5.0 ± 0.6 [4.6, 5.4]	.186	0.4

session. In addition, the 20 players performed the same tasks in most of the training sessions, divided into two groups. The training sessions of the selected micro-cycles were categorized using the "match day minus" format (Malone et al., 2015); for instance, match day (MD) minus 1 refers to the training session 1 day before the match (MD-1) and match day plus 1 refers to the training session 1 day after the match (MD+1).

The regular competition period consisted of 8 weeks based on 4 or 5 field training sessions. The main difference between these types of weeks was the day-off : (i) in weeks with one day-off after MD, on the second day after the match (MD+2) players participated in an aerobic and technical session; (ii) in weeks without day-off, the first day after the match (MD+1) was a recovery session for starters (it was not a monitored session: they performed stationary bike and body mobility postures), while non-starter players performed positional games. In both types of weeks, on MD-3, MD-2 and MD-1, coaches applied similar training approaches. Specifically, MD-3 and MD-2 sessions commonly consisted of a soccer session based on tactical and set-pieces. MD-1 was used for coordination & agility/reaction exercises, one possession game and offensive set-pieces. In both microcycles, there was one strength/power training session plus an injury prevention workout in the gym.

The congested period started 2 weeks after the regular one and there were two types of microcycles based on 4 field training sessions: (i) two field training sessions before each match, with MD+1 (same as in the regular period) or day-off after the second match, (ii) four field-based training sessions and one day-off after the match. In these microcycles, the same approach as in the regular period was respected for MD-1 and MD-2.

Instruments and measurements

Most of the physical parameters were assessed using portable 50-Hz GPS devices (K-AI Wearable Tech, KSport World, Fano, Italy). This technology was previously validated by Vantieghem-Nicolas et al. (2023): the inter-unit reliability was excellent to moderate depending on the variable (intra-correlation coefficients .65–.99), the coefficients of variation in the inter-trial reliability were low to very low for the radar and the GPS (all < 5.6%). Data analysis was performed using a K-Fitness software (Version 1.4.8; K-Sport, Bologna, Italy). To limit inter-unit error, each player wore the same personal device with their number throughout the season. The GPS devices were activated 15 min before the start of the match, according to the manufacturer's instructions (satellite constellation systems Galileo, GPS, BeiDou, and Glonass); using a radar Stalker Pro II Sports Radar Gun (Plano, TX, USA); with a sampling frequency of 46.875 Hz.

The following speed intensities were used to categorize motion: moderate-intensity running (14.9–19.8 km/h), high-speed running (19.9–25.2 km/h), and sprint running (> 25.2 km/h). The number of runs and the distance covered at each speed intensity were measured. The speed thresholds were equal to those reported previously by Di Salvo et al. (2009, 2013). The high-intensity acceleration and deceleration thresholds (> 2.5 m/s^2 and < –2.5 m/s^2, respectively) and definitions had been used previously by Harper et al. (2019). Load rates profile was determined as HILR (distance covered at speed > 14.9 km/h per min) and HSLR (distance covered at speed > 19.9 km/h per min), as reported by Vilamitjana et al. (2021, 2022, 2023) in previous studies. Furthermore, the high metabolic load distance (HMLD) was also considered, and this variable refers to the distance covered with a power consumption of over 20 W/kg. This cutoff value was chosen according to Manzi et al. (2014) and Osgnach et al. (2010). Hence, eight study variables were obtained from these parameters (Table 2).

The accumulated training and match load rates

The accumulated match load rate consisted of the summation of each variable during all MD played by each group (calculated per player, per minute), thus providing the 8-week loads for each dependent variable. Moreover, the accumulative training load rate was also calculated without MD data (per player, per minute). In addition, the TMr

Table 2 Definitions of study variables

Variable	Definition
Total distance (TD)	The total distance covered for the time determined for all activities combined, in meters per minute.
High-intensity load rate (HILR)	Quotient between distances covered at moderate intensity running, high-speed running, and sprint by the amount of time of each activity, in meters per minute.
High-speed running-sprints load rate (HSLR)	Quotient between distances covered at high-speed running and sprint by the amount of time of each activity, in meters per minute.
Runs in HILR (#HILR)	The numbers of runs performed at moderate intensity, high-speed running, and sprint, in number per minute.
Runs in HSLR (#HSLR)	The numbers of runs performed at high-speed running and sprinting, in number per minute.
High-intensity accelerations (HIA)	The number of accelerations performed above 2.5 m/s^2, in number per minute.
High-intensity decelerations (HID)	The number of decelerations performed below –2.5 m/s^2, in number per minute.
High metabolic load distance (HMLD)	The distance covered with a power consumption above 20 W/kg.

was calculated for each player (individualized) based on the following formula:

TMr = weekly load/match demands (in arbitrary units).

Anthropometric assessment

At the beginning of each period, all participants were measured for standing height (SECA 216, SECA, Hamburg, Germany), body mass (SECA 515, SECA, Hamburg, Germany) and ten skinfolds (biceps, triceps, subscapular, chest, mid-axillary. iliac crest, supraspinal, abdominal, midthigh and calf) using ISAK protocols (Marfell-Jones et al., 2006). A Lufkin tape (W606PM, Lufkin, TX, USA) was used to identify skinfold sites, and all skinfold thickness were taken with Harpenden callipers (HSB-BI, Baty International, Camberley, United Kingdom), with a constant pressure of 10 g/mm^2. The measurements occurred in the early morning, with participants fasting and using only their underwear. The body fat percentage was then calculated using the soccer-specific formula proposed by Santos da Fonseca et al. (2007), according to the equation previously described by Jackson and Pollock (1978).

Statistical analysis

Descriptive statistics are presented as mean ± standard deviation, and a 95% confidence interval. The normality of the different variables was tested using the Kolmogorov-Smirnov test, and confirmation of the normal distribution allowed us to use parametric statistical methods. An independent *t*-test was used for all variables. Significant results were considered at $p < .05$. Cohen's d was used as effect size: $d = 0.2$, small; $d = 0.5$, medium; $d = 0.8$, large, $d = 1.2$, very large; and $d = 2.0$, immense (Cohen, 1988; Sawilowsky, 2009). The comparative analysis was performed by statistical software R version 4.0.2 (R Foundation for Statistical Computing, Vienna, Austria).

Results

Table 1 presents the body mass, the sum of ten skinfolds and body fat percentage obtained in each period, for both groups. There were no significant differences obtained between non-starters and starters in these variables. Tables 3 and 4 present the accumulated match and training load rates for all dependent variables. There were no significant differences between non-starters and starters in all studied variables during both periods ($p > .05$). Table 5 displays the TMr values of each variable expressed as a percentage of estimated match values for non-starters and starters during both competitive periods. Non-starters presented significantly lower values for HILR (–12.9%, $p = .039$), #HILR (–7.7%, $p = .032$) and HMLD (–9.8%, $p = .024$). The effect sizes of these mean differences were $d = 0.9–1.0$. There were no other statistically significant differences (Table 5).

Discussion

The main aims of this study were to: (i) quantify and compare accumulated match and training load rates between non-starters and starters of an Argentinean professional soccer team during two competitive periods and (ii) determine and compare TMr for non-starters and starters during both competitive periods. The main findings showed that non-starters presented neither an improvement nor deterioration in the accumulated load rates analysed compared to starter players during both periods. In addition, non-starters presented lower values of TMr for high-intensity patterns such as HILR, #HILR and HMLD, during the regular period of competitions.

Taking heed of our hypothesis, we observed that non-starters presented non-significant differences in training load and match load rates during both periods when compared with starters. Such findings are similar to some studies that did not find a different external match load between starter and non-starter players, analysing similar variables to those of the present study (14 weeks, playing once a week; LaLiga Spanish First Division; Castillo-Rodríguez et al., 2023). In another research, Anderson et al. (2016) compared absolute accumulated training and match load during one annual season in the English Premier League. In contrast, they obtained higher values of running (14.4–19.7 km/h), high-speed running (19.8–25.1 km/h) and sprinting (> 25.1 km/h) for starters. The authors attributed this effect to higher match-play minutes as a possible explanation for such differences, suggesting that coaches and practitioners should be aware of this potential risk and find an appropriate method to compensate for load discrepancies, particularly in terms of high-intensity activities (Varjan et al., 2023). Therefore, weekly fitness-related adaptations in running at high speeds seem to favour the starters in a soccer team (Dalen & Lorås, 2019). In this regard, to the best of the authors' knowledge, few contributions have been

Table 3 Means, *SD*s, 95% confidence intervals, statistical significances of *t*-test, and effect sizes for accumulated match load demands for non-starters and starters in both periods

Variable/Period	Non-starters	Starters	*p*	Cohen's *d*
TD (m/min)				
First	111.3 ± 10.3 [104.9, 117.6]	110.4 ± 10.9 [103.6, 117.2]	.431	0.5
Second	110.4 ± 12.3 [105.6, 120.9]	108.4 ± 8.3 [103.3, 113.5]	.317	0.4
HILR (m/min)				
First	23.7 ± 6.9 [19.4, 28.0]	21.6 ± 5.1 [18.5, 24.7]	.229	0.3
Second	26.3 ± 8.5 [21.0, 31.6]	23.5 ± 5.4 [20.2, 26.9]	.396	0.4
HSLR (m/min)				
First	8.0 ± 2.9 [6.3, 9.8]	6.9 ± 2.0 [5.7, 8.2]	.168	0.5
Second	8.7 ± 3.3 [6.7, 10.8]	7.9 ± 1.8 [6.7, 9.0]	.475	0.3
#HILR (*n*/min)				
First	2.4 ± 0.6 [2.1, 2.8]	2.2 ± 0.4 [1.9, 2.4]	.143	0.5
Second	2.6 ± 0.8 [2.1, 3.1]	2.3 ± 0.4 [2.1, 2.6]	.317	0.5
#HSLR (*n*/min)				
First	0.7 ± 0.2 [0.6, 0.9]	0.6 ± 0.2 [0.5, 0.7]	.094	0.6
Second	0.8 ± 0.3 [0.6, 0.9]	0.7 ± 0.1 [0.6, 0.8]	.416	0.4
HIA (*n*/min)				
First	1.0 ± 0.2 [0.8, 1.1]	1.0 ± 0.1 [0.9, 1.1]	.455	0.1
Second	1.1 ± 0.3 [0.9, 1.2]	1.0 ± 0.1 [0.9, 1.1]	.426	0.4
HID (*n*/min)				
First	1.3 ± 0.5 [1.0, 1.6]	1.3 ± 0.1 [1.2, 1.4]	.434	0.1
Second	1.6 ± 0.4 [1.4, 1.9]	1.4 ± 0.2 [1.2, 1.4]	.088	0.9
HMLD (m/min)				
First	29.8 ± 7.3 [25.3, 34.4]	27.2 ± 5.0 [24.3, 30.3]	.180	0.4
Second	31.9 ± 8.0 [26.9, 36.8]	28.4 ± 5.4 [25.0, 31.8]	.271	0.5

Note. TD = total distance covered; HILR= high-intensity load rate; HSLR = high-speed running-sprints load rate; #HILR = number of runs performed in HILR; #HSLR = number of runs performed in HSSL; HIA = high-intensity accelerations; HID = high-intensity decelerations; HMLD = high metabolic load distance.

Table 4 Means, *SD*s, 95% confidence intervals, statistical significances of *t*-test, and effect sizes for accumulated training load demands for non-starters and starters in both periods

Variable /Period	Non-starters	Starters	*p*	Cohen's *d*
TD (m/min)				
First	91.7 ± 8.0 [86.8, 96.7]	95.3 ± 7.3 [90.8, 99.9]	.154	0.5
Second	81.7± 5.7 [78.2, 85.2]	81.4 ± 6.4 [77.4, 85.4]	.900	0.0
HILR (m/min)				
First	15.8 ± 3.5 [13.6, 17.9]	17.6 ± 2.0 [16.3, 18.8]	.089	0.7
Second	14.8 ± 2.4 [13.4, 16.3]	15.1 ± 2.1 [13.7, 16.4]	.763	0.1
HSLR (m/min)				
First	4.0 ± 1.5 [3.1, 5.0]	4.0 ± 0.8 [3.6, 4.5]	.499	0.0
Second	4.0 ± 1.6 [3.0, 5.0]	3.5 ± 0.9 [2.9, 4.1]	.382	0.4
#HILR (*n*/min)				
First	1.5 ± 0.4 [1.2, 1.8]	1.5 ± 0.2 [1.4, 1.6]	.477	0.0
Second	1.4 ± 0.3 [1.2, 1.6]	1.3 ± 0.1 [1.2, 1.3]	.149	0.7
#HSLR (*n*/min)				
First	0.3 ± 0.1 [0.2, 0.4]	0.4 ± 0.1 [0.3, 0.4]	.315	0.2
Second	0.3 ± 0.1 [0.2, 0.4]	0.3 ± 0 [0.3, 0.3]	.564	0.3
HIA (*n*/min)				
First	1.2 ± 0.3 [1.0, 1.4]	1.2 ± 0.2 [1.1, 1.3]	.459	0.1
Second	1.3 ± 0.4 [1.1, 1.5]	1.2 ± 0.2 [1.1, 1.3]	.444	0.4
HID (*n*/min)				
First	1.1 ± 0.4 [0.9, 1.4]	1.1 ± 0.2 [1.0, 1.2]	.277	0.3
Second	1.3 ± 0.5 [1.0, 1.6]	1.1 ± 0.3 [0.9, 1.3]	.382	0.5
HMLD (m/min)				
First	21.2 ± 4.4 [18.4, 23.9]	22.2 ± 3.5 [20.0, 24.4]	.289	0.3
Second	19.9 ± 2.9 [18.1, 21.7]	20.0 ± 2.1 [18.7, 21.2]	.976	0.0

Note. TD = total distance covered; HILR= high-intensity load rate; HSLR = high-speed running-sprints load rate; #HILR = number of runs performed in HILR; #HSLR = number of runs performed in HSSL; HIA = high-intensity accelerations; HID = high-intensity decelerations; HMLD = high metabolic load distance.

Table 5 Means, *SD*s, 95% confidence intervals, statistical significances of *t*-test, and effect sizes for training/match ratios (TMr) for non-starters and starters in both periods

Variable/Period	Non-starters	Starters	*p*	Cohen's *d*
TDr				
First	0.83 ± 0.08 [0.78, 0.88]	0.82 ± 0.09 [0.77, 0.88]	.113	0.2
Second	0.73 ± 0.08 [0.68, 0.77]	0.75 ± 0.06 [0.71, 0.79]	.204	0.3
HILRr				
First	0.70 ± 0.19 [0.58, 0.82]	0.83 ± 0.10 [0.77, 0.90]	.039	0.9
Second	0.62 ± 0.21 [0.49, 0.75]	0.66 ± 0.13 [0.58, 0.74]	.308	0.2
HSLRr				
First	0.54 ± 0.23 [0.40, 0.68]	0.61 ± 0.14 [0.52, 0.70]	.233	0.3
Second	0.54 ± 0.33 [0.34, 0.75]	0.47 ± 0.17 [0.36, 0.58]	.269	0.3
#HILRr				
First	0.62 ± 0.11 [0.55, 0.68]	0.69 ± 0.05 [0.66, 0.73]	.032	1.0
Second	0.57 ± 0.18 [0.46, 0.69]	0.55 ± 0.07 [0.50, 0.59]	.335	0.2
#HSLRr				
First	0.50 ± 0.20 [0.37, 0.62]	0.60 ± 0.11 [0.53, 0.67]	.081	0.7
Second	0.50 ± 0.32 [0.30, 0.69]	0.46 ± 0.11 [0.39, 0.53]	.373	0.2
HIAr				
First	1.27 ± 0.33 [1.06, 1.47]	1.23 ± 0.14 [1.14, 1.31]	.365	0.2
Second	1.24 ± 0.28 [1.07, 1.41]	1.20 ± 0.15 [1.10, 1.29]	.344	0.2
HIDr				
First	1.05 ± 0.74 [0.59, 1.51]	0.82 ± 0.10 [0.75, 0.88]	.175	0.6
Second	0.81 ± 0.24 [0.66, 0.96]	0.81 ± 0.16 [0.71, 0.91]	.487	0.0
HMLD				
First	0.72 ± 0.11 [0.66, 0.79]	0.82 ± 0.11 [0.76, 0.89]	.024	1.0
Second	0.65 ± 0.17 [0.55, 0.76]	0.71 ± 0.12 [0.64, 0.79]	.188	0.4

Note. TDr = TMr for total distance covered; HILRr = TMr for high-intensity load rate; HSLRr = TMr for high-speed running-sprints load rate; #HILRr = TMr for number of runs performed for HILR; #HSLR = TMr for number of runs performed in HSLR; HIAr = TMr for high-intensity accelerations; HIDr = TMr for high-intensity decelerations; HMLDr = TMr for high metabolic load distance. Means, *SD*s, and confidence intervals are presented in arbitrary units.

forthcoming from the scientific literature trying to compare professional soccer players' training load to match load measured with the same accurate tracking system in different in-season periods. For example, Stevens et al. (2017) performed a similar analysis to the current study. However, they did so by comparing accumulative weekly loads, such as the percentage of estimated match values. Individual observations were included if players played at least 60 min without warm-up. Albeit all training sessions included the warm-up activity. Nonetheless, data was monitored only for an entire year season, excluding summer, winter and training sessions during the FIFA International Match Calendar.

Regarding TMr, non-starters presented significantly lower values for high-intensity patterns such as HILR, #HILR and HMLD, compared with starters. However, there were no statistical differences between groups during the second period. In all probability, those such differences were not due to alterations in training loads, but merely due to non-starters performing higher levels of high-intensity patterns during competition (~9%–13% more, although not statistically significant). In the second period, non-starters also outperformed their counterparts in the same metrics, albeit by a smaller percentage (~10%, not statistically significant). In line with this aspect, existing published studies conclude that non-starter players introduced during matches have achieved higher performance in different physical metrics, compared to players who were substituted or completed the full match (Bradley et al., 2014; Hills et al., 2022; Padrón-Cabo et al., 2018). This phenomenon reasonably takes place from a load perspective, where non-starters need to be physically prepared to replace or substitute a starter. Furthermore, it is relevant when the roster's number of players is limited. Interestingly, Stevens et al. (2017) conducted an analysis similar to the current study, monitoring a year season in the Dutch Eredivisie League: the results showed a significative lower relative training load in non-starters compared to starters during a typical training week with one match, especially on running (–31%, > 14.4 km/h), high-speed running (–29%, > 19.8 km/h) and high-power distance (–24%, > 20 W/kg). Additionally, during typical periods with 2 matches a week, nonstarters showed even less total load, with less high-speed running (> 19.8 km/h) rates than a full match. Another research, conducted by Casamichana et al. (2022), compared four different groups of players according to the amount of time played in official matches (90 min, > 60 min, < 60 min, and 0 min; only training weeks where players had six days between successive matches and one day-off). This study revealed that players with 0 min and < 60 min groups were lower for most external loading variables in comparison to > 60 min and 90 min groups, with very little difference between the 90 min and the > 60 min groups. This finding could justify the practices used by some elite clubs that split the squad for MD+1 work based on less than < 60 min played in previous official matches (Martín-García et al., 2018). Contrary to this evidence, Lorenzo-Martínez et al. (2021) concluded that substitute players showed higher total distance and number of sprints relative to playing time than replaced and entire match players (one-year season, German Bundesliga). Moreover, Marín and Castellano (2023) observed significant differences in most of the study variables (for non-starters analysing two periodization strategies in Spanish first division Ligue). Such findings resemble other authors such as Oliveira et al. (2023) who concluded that non-starters obtained higher TMr values (despite lower match and training durations) in variables such as high-speed running (20–25 km/h), sprinting (> 25 km/h) and the number of accelerations and decelerations (> 2.0 m/s^2 and < –2.0 m/s^2). The authors suggested that the weekly physical load during a 16-week period (playing one match a week) was adjusted appropriately, adding that the type of exercises used during the compensatory training sessions (MD+1) had been appropriate for this specific group. However, more studies are needed on non-starter player performance and contextual factors that could influence the physical responses of these players (Castillo-Rodríguez et al., 2023).

Finally, there is an observation to consider about body composition in both groups of players: there were no significant differences between non-starters and starters in all measurements obtained. There is scarce literature focused on body composition and its implications on physical performance among starter and non-starter players (Clemente et al., 2024). Silvestre et al. (2006) examined the relationship between body composition (using dual-energy X-ray absorptiometry) and speed, power, and cardiorespiratory fitness measurements in male collegiate (NCAA, Division I) starters and non-starters. The authors found that total mass, fat mass, and fat percentage were correlated positively with decreases in speed performance. This result shows that an increase in total mass and fat mass is detrimental to speed. However, the relationship between body composition and performance remains unclear, especially in highly trained players who were exposed to different external training and match loads (Clemente et al., 2024).

In closing, it is a fact that both starters and non-starters had the opportunity to train with the same tasks and load magnitudes. Specifically, the most salient difference occurred on the MD+1 or MD+2 training day, where non-starting players were exposed to similar intensities to those of the matches. This kind of session could be the most suitable to compensate for the absence of competitive stimulus to synchronize the weekly training loads of all the team members (Casamichana et al., 2022). While the predominant application of compensatory training has been integrated into running-based methods (Clemente et al., 2024), a more specific approach such as positional games was implemented in the present study (for instance: 7 vs. 7 + 1 Floater (F), 9 vs. 9 + 2F + 2 goalkeepers (GK) or 10 vs. 10 + 1F + 2GK; 77,86 and 164 m^2 per player, respectively; Vilamitjana et al., 2023). For this "compensatory session", the non-starter team was complemented by a group of "sparring" partners from the second team and the games were achieved using an intermittent format of 8–10 min. This sort of tactical games was analysed in an elite Argentinean team comparing external load with competition (Vilamitjana et al., 2023). The results indicated that TD and PL performance obtained in all the formats studied was close to that of the matches. Furthermore, the high-intensity acceleration-deceleration values were significantly higher than matches in 7 vs. 7 + 1F, while 10 vs. 10 + 1F + 2GK was the only format with mean values similar or higher to matches for most variables of the study (Vilamitjana et al., 2023).

The findings herein exposed assert that it is possible to plan an integrated training load for the entire squad during the season, even if it is acknowledged that some of the team's players will not have the possibility to play frequently. As a limitation of the present study, it would be valid to mention that the sample size was small and should be increased to achieve more representative results for this category of soccer players. Consequently, correlation coefficients between both groups were not performed. Similarly, it turns out with the analysis of the data by playing positions. It is important to highlight that it has not been determined whether these results would be generalizable to other teams and competitive levels. However, we must consider that all the players belonged to the same team and this sample represents the high level of expertise in the Argentinean professional league.

Conclusions

The main findings showed that non-starters presented neither an improvement nor deterioration in the accumulated load rates analysed compared to starter players during both periods. In addition, non-starters presented lower values of TMr for high-intensity patterns such as HILR, #HILR, and HMLD, during the first period. In all probability, those differences were not due to alterations in training loads, but merely due to non-starters performing higher levels of high-intensity patterns during competition. As proposed for practical application, it is possible to profit from this data to provide useful information to coaches and performance staff to provide a better training prescription based on the weekly periodization strategy for both starter and non-starter players.

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Conflict of interest

The authors report no conflict of interest.

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