

Running performance across weekly microcycles in amateur soccer players

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Published online: September 30, 2025

Accepted for publication: September 15, 2025

DOI:10.7752/jpes.2025.09212

Abstract:

Soccer is a multifactorial sport requiring the integration of technical, tactical, and physical capacities to maintain performance throughout competition. Recent increases in match frequency, with players competing approximately every 4.3 days, have heightened the physiological and mechanical demands placed on athletes. Under such congested schedules, systematic workload monitoring is essential for ensuring optimal performance and reducing injury risk. The purpose of the present study was to examine the external load of amateur soccer players across two different microcycles: one comprising two matches and another comprising three matches within a single week. Ten male amateur players from Apollon Paralimniou, a third-division Greek soccer team, participated in the study. The players were aged 22±4.96 years, with a mean body height of 1.78±0.4 meters and body mass of 69.39±4.16 kg. All participants were injury-free and consistently engaged in training sessions and matches. External load was assessed using the Lagala Colli GPS transmitter. The variables analyzed included total distance covered, high-speed running, sprint distance, decelerations, and accelerations. Analysis indicated that the three-match microcycle imposed greater demands in terms of high-speed running and sprint distance, while the two-match microcycle allowed players to sustain higher volumes of accelerations and decelerations. These variations suggest that match frequency influences the distribution of locomotor activities and the overall external load profile of players. Fixture congestion appears to affect performance outputs even in amateur players. These findings highlight the importance of carefully adjusting training content and recovery strategies to manage fatigue, optimize readiness, and reduce injury risk. Practical applications are offered for coaches and sport scientists managing players under demanding competitive conditions.

Keywords: soccer performance, external load monitoring, GPS-based analysis, match congestion, running demands

Introduction

Soccer is the world's most popular sport, with over 200,000 professional players and more than 240 million amateurs actively participating (Escoda et al., 2011). It is a complex sport that requires a blend of technical skills, tactical awareness, and exceptional physical fitness to maintain high performance throughout matches. Recent changes in the modern game, including increased match frequency and demanding travel schedules for away games, have heightened the physical and logistical challenges faced by players. Professional soccer players now often compete in two or more matches per week, contributing to increased injury risk—with injury incidence rates ranging from 1.5 to 7.6 per 1,000 training hours and 12 to 35 per 1,000 match hours (Ehrmann et al., 2016; Escoda et al., 2011).

Players routinely cover between 10 and 13 kilometers per match, mostly at aerobic intensities, while anaerobic actions such as sprints, though less frequent, are critical in decisive moments like counterattacks (Reilly, Bangsbo, & Franks, 2000; Werlayne, 2016). A player performs approximately 150–250 high-intensity runs of 15–20 meters, with a sprint executed every 90 seconds lasting 2–4 seconds (Werlayne, 2016). Although sprints represent only 1–11% of the total distance, high-speed running accounts for about 8% (Komsis et al., 2022), accelerations 8.4%, and decelerations 6% (Dalen et al., 2016; Dalen et al., 2021). Especially, the total distance covered by a football player during a training session or match and is one of the most important parameters for measuring a player's workload (Ravé et al., 2020). Defenders cover an average distance of 9,962 meters, midfielders 12,045 meters, wingers 10,340 meters, and forwards 10,415 meters (Ravé et al., 2020). This highlights the positional specificity in football and can serve as a basis for specialized training programs tailored to each position. Regarding the developmental level (U19), players cover between 7 and 10 km per match (Komsis et al., 2022). The Sprint Distance refers to the total distance covered by the athlete at sprint speed. To be classified as a sprint, the athlete must exceed a speed of 25 km/h (Ravé et al., 2020). On average, one sprint is performed every 90 seconds, typically lasting between 2 and 4 seconds (Werlayne, 2016). According to the latest scientific findings, it is recommended that sprint drills should be placed at the end of a training session to

replicate the demands of a soccer match, as players tend to perform the biggest percentage of sprints in the last 15 minutes of a game, even if it increases the chances of injury (Gualtieri et al., 2023)

The High Speed Running measures the athlete's efforts at high speed, specifically within a range of 19.9 to 24.9 km/h (Ravé et al., 2020). In a study conducted during the 2010 FIFA World Cup, it was found that midfielders compared to other positions, covered greater distances at high-speed running (HSR), accounting for 10% of the total distance covered (Total Distance) (Soroka, 2018). This parameter is used to indicate the level of match fitness of the player. This is why players that are not used in the match-days, should be implemented in a high intensity interval training session (small and medium sized drills), ideally the day after the game in order to replicate the in-game conditions and stay match fit and be ready for the upcoming game (Buchheit, 2019).

Accelerations are referred to the number of accelerations performed by a player during a match or training session and is specifically measured within a range of 2.5 to 4 m/s², depending on the GPS system used (Izzo, Vanna, & Vardei, 2018). The number of accelerations per match ranges from 52 to 100, with a new movement occurring every 4 seconds (Komsis et al., 2022).

Decelerations measures the number of decelerations during a match or training session. Specifically, it is calculated within a range of -2.5 to -4 m/s² (Izzo et al., 2018). On average, decelerations account for 5-7% of the total external load of a football player during a match (Dalen et al., 2016; Dalen et al., 2021).

According to the newest studies, the threshold of speed parameters (High Speed Running, Sprints, Accelerations, Decelerations) should be individually customized in order to get the best results for each athlete (Abbott, Brickley, & Smeeton, 2018). The customization of the thresholds should be indicated through on-field tests, like 30m sprints, Yo-Yo test (Gualtieri et al., 2020; Gualtieri et al., 2023). These data highlight the necessity of a training program that enhances both aerobic and anaerobic capacities, ensuring the balanced development of both energy systems. Thus, training programs could develop both energy systems alongside strength and flexibility, with emphasis on repeated sprints and cardiorespiratory fitness (Firmansyah, Prasetya, & Ardha, 2021).

GPS technology is now widely used to monitor key variables such as high-speed running, sprint count, accelerations, and decelerations, enabling precise workload tracking to optimize performance and reduce injury risk (Akenhead & Nassis, 2016; Ravé, Granacher, & Zouhal, 2020). The GPS system measures temporal movement parameters, which are reflected in the distance covered and the number of efforts at different speeds (Akenhead & Nassis, 2016). Additionally, it tracks the number of accelerations and decelerations over short distances, where high-speed running is not feasible (Varley et al, 2017). These data have been crucial for optimizing performance and reducing injury risks across different player populations, from youth academies to professionals (Morgans et al., 2022).

Recent evidence has described weekly and seasonal variations in external load across microcycles. Effective load management has become essential in preventing injuries and maintaining peak performance levels. Research has shown that professional soccer players participate in matches approximately every 4.3 days, emphasizing the need for structured recovery and training adaptation (Kellman, 2002). In professional soccer, studies report clear tapering strategies with reduced load on match day minus one, and country-dependent differences in weekly load distribution (Clemente et al., 2019). In elite youth academies, weekly training load has been correlated with in-game running performance, stressing the importance of balancing training/game ratios (Kanaras et al., 2024). Meanwhile, in amateur contexts, GPS-based studies reveal that external load fluctuates throughout the week and by position, with tapering typically evident before competition (Miguel et al., 2022; Sánchez-Sánchez et al., 2019).

Fixture congestion presents a further challenge. Research in elite soccer shows that while total distance remains relatively stable, variables such as accelerations and decelerations are more sensitive indicators of residual fatigue (Carling et al., 2015). Recent studies examining microcycles with two versus three matches reveal distinct workload adaptations across training sessions and positions, emphasizing the influence of microcycle length on external and internal loads (Gómez-Díaz et al., 2024; Oliveira et al., 2025; Posse-Álvarez et al., 2024). These findings align with recent comparisons in semi-professional and recreational soccer, confirming that competitive level and match congestion substantially affect training demands and recovery (Chainok et al., 2025; Pillitteri et al., 2023).

Despite this growing body of research, a clear gap remains regarding workload variations across congested microcycles in amateur soccer players, who often face unique structural and resource challenges compared with professionals. Addressing this gap, the present study investigates running performance in amateur players during microcycles involving two versus three matches per week. Using GPS, total distance, sprint distance, high-speed running, accelerations, and decelerations were evaluated to provide context-specific insights into load management strategies in Greek third-division players.

The research adopts a quantitative observational design utilizing GPS tracking to capture temporal and spatial movement data during matches and training. This approach allows comparison of physical demands between different microcycles, providing insights into how amateur athletes respond to congested schedules and offering practical implications for training load management. Such information is critical for coaches aiming to optimize performance while mitigating injury risks in amateur soccer contexts.

This study's findings will contribute to improved understanding of positional and workload-specific demands in amateur soccer and assist in developing tailored training interventions reflecting real match scenarios and player capacities (Abbott, Brickley, & Smeeton, 2018; Gualtieri et al., 2023).

Material & methods

Participants

Ten amateur soccer players from Apollon Paralimniou, a team competing in the Greek Third National Division, participated in the study. Players who didn't complete the total number of team's training sessions and matches excluded from the study. Also goalkeepers were excluded from this study. There were no injuries during the research and no voluntary walkouts. All players received detailed information regarding the study objectives and provided informed consent. Ethical approval was obtained according to research guidelines. The data recording from the transmitters was conducted in accordance with the code of ethics of Aristotle University of Thessaloniki. Prior to the conduct of this study, participants completed a written consent form for participation in the research, with their personal data remaining confidential.

Table 1

Anthropometric characteristics of the participants (M ± SD)

Participants (n=10)

Age (years)	22±4.96
Bodyweight (kg)	69.39±4.16
Body Height (m)	1.78 ± 0.04

Note. n = number of participants, M= Mean, SD = standard deviation

Experimental Design and Data Collection

The study spanned two separate weekly periods during the 2023-2024 season, where data were collected for one microcycle consisting of two matches and another with three matches. Running performance data were collected using GPS technology (LagalaColli), which provided real-time tracking and recorded the following variables:

- Total Distance (TD)
- High-Speed Running (HSR) (>19.8 km/h)
- Sprint Distance (SD) (>25 km/h)
- Number of Accelerations (Acc) (>3m/s²)
- Number of Decelerations (Dec) (>-3m/s²)

GPS units were worn by each player during training sessions and official matches. Data were extracted post-session, processed through specialized software, and categorized based on the match schedule. Each GPS unit was placed on the upper back of the athletes, ensuring minimal interference with natural movement patterns while maintaining precise tracking capabilities.

Figure 1

Illustrates the GPS tracking system used for data collection, ensuring accurate monitoring of players' movement patterns and workload.



Training and Match Protocol The training structure consisted of recovery sessions, tactical drills, and endurance-based workouts. Players in both microcycles followed a structured training regimen designed to optimize recovery and maintain match fitness. The match days involved a warm-up period, full competition engagement, and post-game recovery activities. The recovery protocol included active recovery exercises, cold-water immersion therapy, and stretching routines to mitigate muscle fatigue and accelerate physiological adaptation.

During training sessions, emphasis was placed on replicating match conditions through small-sided games, sprint drills and interval running. Load distribution was monitored to ensure that players did not experience excessive fatigue, which could impact their performance in upcoming matches.

Table 2 *Weekly schedule in the microcycle with 2 games*

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Game day	Training recovery	Dayoff	Training	Training	Tactic Training	Morning training	Game day

Table 3 *Weekly schedule in the microcycle with 3 games*

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Game day	Training recovery	Training	Game day	Training recovery	Training	Morning training	Game day

Statistical analysis

Paired t-tests were conducted using SPSS 29 to determine significant differences between the two microcycles. The analysis assessed mean values and standard deviations across variables, with a significance level set at $p \leq .05$.

Results

The results showed a statistically significant difference in the variable Total Distance with $p = .001$. Although there was a small difference in the mean values for High-Speed Running distance, there was no statistically significant difference with $p = .119$. The same was observed for Sprint Distance, where a small difference in means was noted but no significant statistical difference was found with $p = .965$. The same applied to the variables of acceleration and deceleration, with insignificant differences of $p = .531$ and $p = .460$, respectively. The following tables and figures show the evaluation variables and the results of the paired t-test.

Table 4 Means and standard deviations of Evaluation Variables

	Mean	Std. Deviation
Total distance 2 weeks	39916.75	2525.39
Total distance 3 weeks	44859.29	2489.33
High Speed Running 2 weeks	2147.14	577.02
High Speed Running 3 weeks	2056.60	538.87
Total Sprint distance 2 weeks	318.42	108.85
Total Sprint distance 3 weeks	317.83	110.93

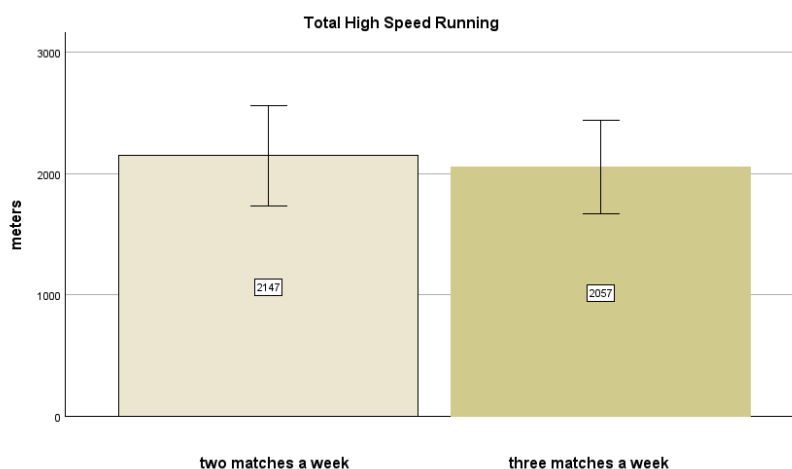
The Total Distance variable showed a statistically significant difference between the two-game microcycle and the three-game microcycle with $p = .001$, $t_{(9)} = -9.653$.

Figure 2 Total Distance in two and three weekly microcycles



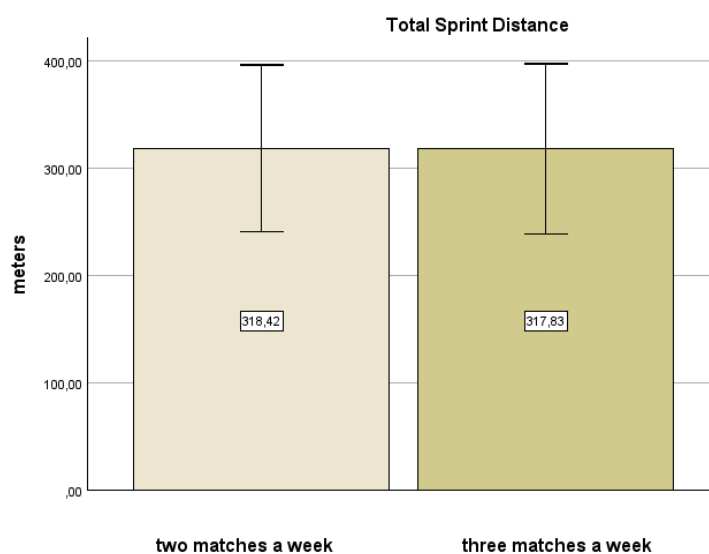
The High-Speed Running variable did not show a statistically significant difference between the two-game and three-game microcycle with $p = .119$, $t_{(9)} = 1.725$.

Figure 3 Total High-Speed Running in two weekly microcycles



The Sprint Distance variable did not show a statistically significant difference between the two-game and three-game microcycles with $p = .965$, $t(9) = 0.046$.

Figure 4 Total Sprint Distance in two and three weekly microcycles



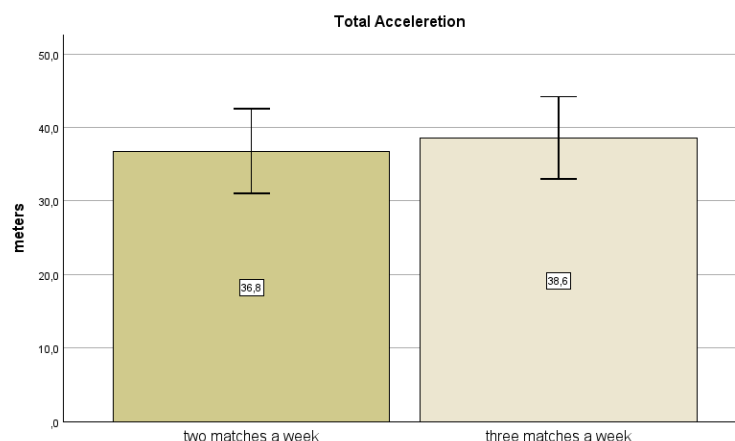
In the microcycle with two games per week (including training sessions), the average acceleration was 36.8 ± 8.07 meters, and the average deceleration was 17.2 ± 4.80 meters. In the microcycle with three games per week (including training sessions), the average acceleration was 38.6 ± 7.79 meters, and the average deceleration was 16.5 ± 4.99 meters. While no statistically significant difference was found between the two microcycles regarding accelerations with $t(9) = -0.651$ and $p = .531$, or decelerations with $t(9) = 0.460$ and $p = .656$.

Table 5 Means of acceleration and deceleration

	Mean	Std. Deviation
Total acceleration 2 weeks	36.80	8.07
Total acceleration 3 weeks	38.60	7.79
Total deceleration 2 weeks	17.20	4.80
Total deceleration 3 weeks	16.50	4.99

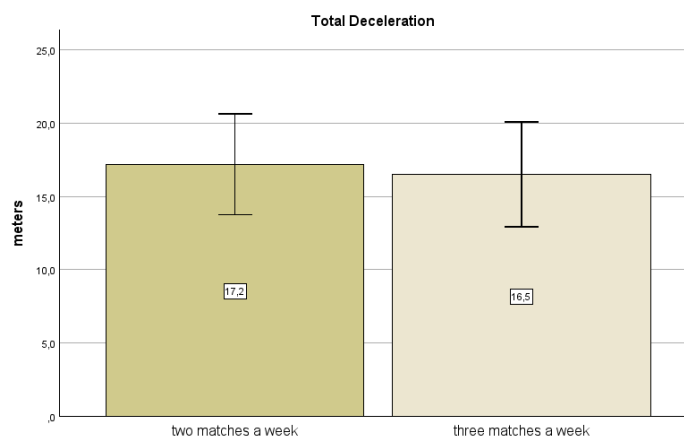
The Total Acceleration Distance variable did not show a statistically significant difference between the two microcycles with $t(9) = -0.651$ and $p = .531$.

Figure 5 Total Acceleration in two and three microcycles



The Total Deceleration Distance variable did not show a statistically significant difference between the two microcycles with $t(9) = .460$ and $p = .656$.

Figure 6 Total Deceleration in two and three microcycles



Discussion

It is evident that modern soccer is characterized by continuous competition and substantial training loads due to congested scheduling. Professional footballers, for instance, average one game every 4.3 days, with additional fatigue generated by away match travel, which has been linked to reduced performance levels (Kellman, 2002). Monitoring fluctuations in external load variables has therefore become an essential strategy for coaching staff to manage load, prevent injury, and optimize player readiness during training and match play. The purpose of this study was to compare the running performance of amateur soccer players across two distinct microcycle structures: one including two games and training sessions, and another including three games and training sessions within a week. The main findings of this study relates closely to its original objectives of assessing and comparing running performance between two- and three-match microcycles in amateur soccer players. The results highlighted no statistically significant differences in sprint distance, high-speed running, accelerations, or decelerations. However, total distance was significantly higher in the three-match microcycle, suggesting that overall workload increases linearly with match frequency. This is consistent with research by Anderson et al. (2016), who reported increased total distance in congested schedules for professional players. By contrast, Komsis et al. (2022) observed increased total distance in two-match microcycles alongside higher rates of decelerations, underlining that contextual factors such as competition level, positional role, and training methodology strongly influence responses to congestion.

The increase in total distance found in the present study (12%) occurred without a corresponding rise in injury incidence, resonating with the load fluctuation thresholds proposed by Soligard et al. (2016), who recommend limiting weekly changes in external load to within 10–15% to reduce injury risk. Similarly, Gabbett

and Ullah (2012) demonstrated that much larger fluctuations ($\geq 30\%$ increases in total distance) are strongly associated with injury occurrence. This suggests that amateur players, under appropriate monitoring and recovery strategies, can tolerate short-term increases in workload without adverse consequences.

Our findings also align with those of Gualtieri et al. (2023), who reported that consecutive matches do not significantly impact high-speed running, supporting the notion that aerobic and repeated-sprint conditioning mitigate the negative effects of fixture congestion on high-intensity outputs. The lack of significant variations in sprinting, accelerations, and decelerations echoes the conclusions of Carling et al. (2015), who argued that these variables, rather than total distance alone, are more sensitive indicators of fatigue but are often maintained under typical competitive schedules.

These results must also be interpreted within the wider body of research addressing external load and microcycle dynamics across levels of play. In elite youth athletes, Kanaras et al. (2024) demonstrated that weekly external load correlates with match running performance, with implications for training/game ratios. Similarly, Clemente et al. (2019) and Gómez-Díaz et al. (2024) documented how differences in weekly structure and fixture congestion shape professional players' loads, highlighting country-specific and methodological differences in tapering strategies. In female soccer, Posse-Álvarez et al. (2024) and Oliveira et al. (2025) found significant variations in total distance, high-speed running, and accelerations depending on microcycle length, emphasizing the importance of tailoring training to microcycle configuration.

Within the amateur context specifically, Miguel et al. (2022) and Sánchez-Sánchez et al. (2019) confirmed that loads vary daily and weekly, often tapering before competition days, with positional-specific demands playing a significant role. Our study extends these findings by focusing on congested microcycles with two versus three matches, offering novel insights regarding amateur players' adaptability under match-dense conditions. Notably, despite the increased total distance (39,916 m vs. 44,859 m between the two- and three-game weeks), sprint- and acceleration-based indicators remained stable, underscoring that amateur players may adapt well to short-term elevated workloads.

Finally, studies comparing different player populations reinforce the uniqueness of the amateur context. Morgans et al. (2022) identified marked differences in running performance between academy and senior players, while Chainok et al. (2025) observed distinct physiological responses between recreational and semi-professional players. These findings suggest that workload tolerance is heavily level-dependent, underlining the need for context-specific load management strategies, an approach supported by task-specific GPS analyses in semi-professionals (Pillitteri et al., 2023).

In summary, the present study contributes evidence that amateur soccer players can tolerate congested microcycles within controlled load fluctuation thresholds, particularly when total distance increases are kept near the 10–15% range. While no significant detriments to high-speed performance metrics were detected, ongoing monitoring remains essential to balance adaptation with the avoidance of cumulative fatigue. Future research should include larger samples across divisions to identify the thresholds at which congestion begins to impair both performance and health outcomes in amateur players.

Conclusion

In conclusion, while the core intensity components remained stable between microcycles, the increase in total distance highlights the additional physical demand imposed by congested schedules. Coaches should prioritize individualized load management, emphasize recovery protocols, and adjust training intensity based on GPS tracking data. It is recommended to implement periodized training that considers microcycle complexity and to perform regular fitness assessments to tailor sprint and high-speed running thresholds. Continuous monitoring is essential to balance performance optimization with injury prevention, particularly during congested competitive periods.

This study underlines the potential for amateur teams to maintain performance under demanding schedules, provided that load fluctuations are carefully controlled. Future research should explore longer-term effects of congested microcycles and incorporate injury surveillance to refine load management guidelines further.

The implications of this study are highly relevant for coaching staff, sports scientists, and team management within amateur soccer programs. The findings underscore the importance of carefully monitoring and managing player workload during congested match schedules, as increased total distance covered can elevate physical demands without necessarily affecting other performance aspects. This highlights a critical area for intervention to sustain player fitness and reduce injury risks, ultimately influencing team success and player availability.

From a practical business perspective, optimizing training load management enhances player longevity and performance consistency, which contributes positively to team results, fan engagement, and the club's financial stability. By employing evidence-based recovery protocols and individualized conditioning strategies, clubs can better allocate resources—such as staff time, medical support, and technology investment like GPS monitoring—to maintain competitive advantage and reduce costly injury-related absences.

The significance of this work extends to informing future research directions that could refine load management best practices, such as exploring physiological and psychological responses to congested schedules. This knowledge will further support the development of tailored interventions, maximizing player health and productivity-key factors that influence operational efficiency and long-term organizational success within amateur and semi-professional soccer environments.

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