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Original article

ANALYSIS OF MOTOR ACTIVITY OF PROFESSIONAL FOOTBALL PLAYERS BY POSITIONS

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Abstract

Aim. The physical demands of football competitions are highly specific to the different positions on the field. There are many studies on the motor profiles of football players in Europe and the World. This study will give a clear picture of the state of the players in the First Professional League of Bulgaria on the issue.

Methods. A large number of data from official matches were collected using a 10-Hz GPS system. Observations were separated by playing position and GPS metrics of run work performed.

Results. The central midfielders ran the greatest total distances, and the edge defenders and forwards produced the highest rates of high-speed running, sprinting, and high-intensity acceleration distances. Central defenders achieved the lowest values for all metrics. In application to the various tactical and technical functions, the positions of athletes in soccer have a relationship to specific physical demands. The results obtained allow determining and adjusting the individual training intensity in order to secure the official football match from a conditioning point of view.

Conclusions. We did not find strong relationships between GPS metrics and the final match score, suggesting that soccer superiority is due to an overall system of conditioning, technical, tactical, and psychological skills of the individual player and the entire team.

Keywords: Soccer, professional football, positions, gps system, running.

Introduction

Soccer is one of the most complex and complicated sports because of the constant dynamics and the need to constantly dominate the opponent in every moment and aspect of the game. Competitive soccer activity is an adversarial emotion between two teams specially prepared for interaction and improvisation in their manifestations towards reaching the goal (Simeonov, 2014). The specificity of the sport is characterized by a large number of individual duels that require excellent motor, technical-tactical and psychological preparation of the competitors (Relly, 2007; Velkov, Kolev & Nedkova, 2015). The accuracy of mastering the technical-tactical skills and habits depends largely on the level of development of physical qualities (Simeonov, 2022). In recent years, there has been a tendency to select players in teams with strong anthropometric characteristics (Lovkov & Ivanov, 2020) in order to be able to achieve maximum sporting results based on these characteristics, contributing to superiority in certain football situations such as tackling, aerial duels, sprint and/or speed-power situations, etc. For the maximum success and realization of the players at elite level, they are expected to develop morphological and physiological characteristics that are suitable for football, and therefore for their playing position. Football is a game that requires bright personalities capable of submitting to collective will and creativity (Simeonov, 2015).

Two decades ago, the International Football Federation (FIFA) authorised the use of electronic performance tracking systems (GPS) in official competitions to monitor and improve the performance of players and teams. These technological advances have encouraged the detailed study of training processes that were previously difficult to quantify, making it possible to identify the stimuli applied in training and matches in order to optimise sporting performance and avoid overtraining and injury conditions (Cardinale & Varley, 2017).

Training load is important to quantify in order to identify the characteristics of the stimulus applied during the training process and to be able to divide it into extrinsic and intrinsic load. The former consists of determining the application of the stimulus to the athlete in training and/or match situations (Clemente, Praça, Bredt, van der Linden, & Serra-Olivares, 2019). The second are the parameters quantified as external load, indicating the distance travelled and the speed of the player (Strauss, Sparks & Pienaar, 2019). These variables are measurable due to the inclusion of GPS, which began its first applications on athletes in team games in 2006 (Aughey, 2011). The variables that make up intrinsic exertion are heart rate (HR) and subjective rating of perceived exertion (RPE) (Akubat, Barrett & Abt, 2014). Their relationship with external load allows to monitor workload and optimize athletic performance (Enes, et al., 2021; Medina et al., 2022).

Advances in technology in recent years have improved the measurement capacity of GPS systems in relation to high-speed movements, facilitating the analysis of distance and time data in athletes. These are variables that are important to record as they are movements that characterise sport and arise from specific actions in the game, such as avoiding an opponent or shooting at goal (Sweeting, Cormack, Morgan & Aughey, 2017). We consider them to be major factors for success in soccer (Modric, Versic, Sekulic & Liposek, 2019).

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As in other sports, football involves a number of playing positions with corresponding motor features (Mohr, Krustup & Bangsbo, 2003). Although significant correlations have been found between body weight, muscle mass, and workload profile of soccer players, the relationship between other anthropometric characteristics and workload profile has been found to be more complex (Drust, Reilly, Carter, Reilly, & Martin, 2000).

A better understanding and competency of the adaptation of players' physical performance during the football season is extremely useful for optimizing the training process as it assists coaches in setting specific goals, provides data for workload adaptation, and improves outcomes (West et al., 2021; Gadzhev, Stoilov & Tzvetkov, 2020).

In the light of the aforementioned facts, the main purpose of this study is to investigate essential motor indicators of professional football players in the "First League".

Methods

In this study, 4 official matches during 4 continuous weeks of the 2023-2024 regular season of the Bulgarian National Professional Football Championship of the First Division were recorded. Measurements of all efforts were made using GPS devices (Barin Sport Pro), which were individually distributed to each player and switched on before the start of the match. Each device was placed between the players' shoulder blades. Data was collected after each match to be analysed with a statistical program. All tests were conducted on the football field. Players were instructed to avoid handling the device once it was turned on.

A total of 10 players from PFC Levski Sofia who participate in the First League. The sample consisted of 10 field players: 2 full-backs (FB); 2 central defenders (CD); 3 central midfielders (CM); 2 wingers (W) and 1 striker (S) according to the criteria of Clemente et al. (2019). The requirements for inclusion in the study were that the players had no injuries that affected their performance, performed all planned tactical tasks, and were field players who had played a minimum of 60 minutes in the study match.

The soccer match was played at the Georgi Asparuhov stadium with a size of 105x68 meters, natural grass surface and air temperature of 13 degrees Celsius. The match was an official match of the First League of Bulgaria in the regular season of the championship.

Results

Table 1 shows the total motor activity of all players in the study team. Taking into account the recent changes and the "VAP" (video assistant referee) the playing time in the whole match is 117:25 minutes. The wingers of the team made the most sprints in the match with 19 and the midfielders the least. The centre of defence also recorded the most accelerations and de-accelerations 125/116 and 127/84. In the matches studied, the highest speed was reached by the centre forward at 32.19 km/h.

Table 1. Total running work

Position	Playing time	HR zone 3	HR zone4	HR zone5	Total 3-4-5	Total distanc	Sprints	Acceleration	Deceleration	Top speed
Full back (FB)	117:25	500	189	25	714,00	9784,00	17,00	125,00	116,00	31.95km/h
Right winger (RW)	117:25	648	92	2	724,00	11394,00	4,00	108,00	121,00	29.67km/h
Full ball (FB)	117:25	325	149	8	482,00	8890,00	12,00	63,00	83,00	29.48km/h
left winger (LW)	117:25	645	274	109	1037,00	8819,00	19,00	92,00	99,00	31.95km/h
Center back (CB)	117:25	452	118	25	595,00	10208,00	11,00	127,00	84,00	32.17km/h
Center Back (CB)	94:29	389	178	48	615,00	7635,00	19,00	81,00	86,00	31.12km/h
Striker (S)	117:25	528	169	31	728,00	9807,00	12,00	76,00	80,00	29.95km/h
Central midfielder (CM)	51:56	231	54	28	313,00	4645,00	7,00	56,00	64,00	32.19km/h
Central midfielder (CM)	94:29	655	99	0	754,00	8704,00	11,00	80,00	79,00	28.97km/h
Central midfielder (CM)	105:05	387	34	0	421,00	10162,00	4,00	75,00	115,00	25.80km/h

Figure 1 shows the running performance in zone three. With the average distance covered in this zone being 476 meters for the team. The two central midfielders covered the greatest distance: 655m and 648m. The team's left wing covered 645m in the third zone. The central striker travels the least distance 231m.



Figure 1. Total running work by position in HR zone

Figure 2 presents the Zone 4 data from the studied duels. By this metric, we see that the left and right wings travel the greatest distance, 274 meters and 178 meters, respectively. The end defenders reach 169 meters and 149 meters. One central defender runs 189 meters in zone 4. The central striker (54m) and the defensive midfielder (34m) reach the lowest figures. The team averages 135 metres travelled in zone 4.



Figure 2. Total running work by position in HR zone 4

In the most intense zone 5 (Figure 3), which is considered the highest-speed action of the players, the left and right wings reach 109 meters and 48 meters. The right defender runs 31 meters and the left defender runs 8 meters. At this pulse rate, the center forward runs 28 meters and the central defenders 25 meters. Given the positioning and lack of space in the middle of the field, the midfielders are not hit at this pulse rate.

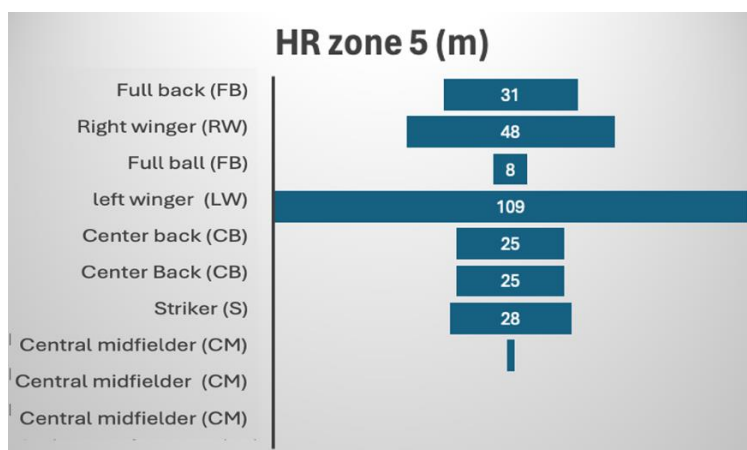


Figure 3. Total running work by position in HR zone 5

Figure 4 shows that, on average, the left wing of the team under study performs the highest intensity work with a total of 1037 meters. The central midfielders (offensive) pass for 754 meters and 724 meters respectively. Players on the wings reach: right-back - 728 meters, right-winger - 615 meters and left-back 482 meters. Central defenders have figures of 714 metres and 595 metres. Interesting is the case of the central striker reaching only 313 meters, but this is in our opinion due to the specificity of the studied duels and the small distances and the density of the defensive unit of the opposing team.

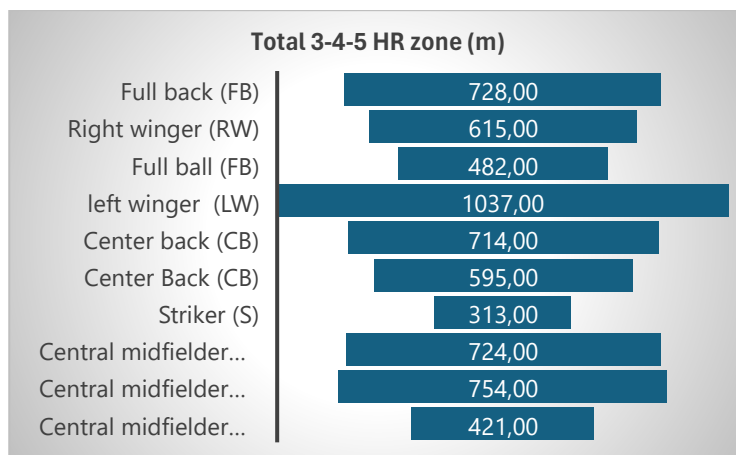


Figure 4. Total run work in 3-4-5 HR zone

Figure 5 shows the total distance travelled by the players - 90048 metres. About 9000 meters is the average distance per player on the team. With the defensive midfielder having travelled the greatest distance 11394 metres and the central striker at least 4645 metres due to his shorter playing time.

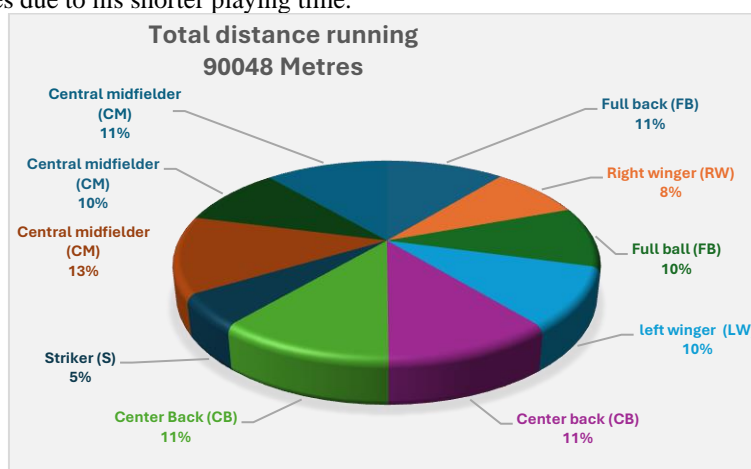


Figure 5. Total distance covered by the whole team

Figure 6 shows the 7% performance of the players in the 3-4-5 pulse rate zone. Compared to data from the 2010 World Championship (Fifa, 2011), the average high-intensity work of the teams is 10.2%, which is significantly more pronounced than the activity of the players in the Bulgarian Championship.

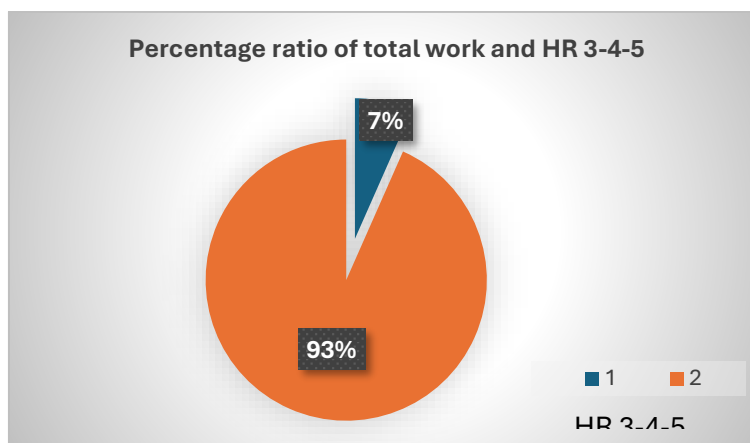


Figure 6. Relationship between total motor activity and vigorous activity in First league

Discussions

This study has limitations as the team tactics, the technical ability of the players, the importance of the match, the result that the game generates different features during the matches are not included. Therefore, for future studies, the proposed variables should be analyzed, the sample size should be increased and other professional football teams should be included in the analyses.

We can conclude that the number of sprints and distances covered at high intensity (zones 4 and 5) are differentiated and will be specific according to the characteristics of the playing position. Wings present the highest number of sprints and distance travelled at high speed compared to the other positions, and these are statistically significant differences, while central defenders show a tendency towards a high number of accelerations and de-accelerations. Stoilov and Madansky (2013) reached similar conclusions in one of the varieties of football, futsal.

Conclusions

In view of the results obtained, we can clearly conclude that the playing positions on the field have highly specialized profiles in terms of the running work performed during matches.

The preparation of the team for high-intensity running actions during the matches will contribute to more frequent and high-speed technical-tactical actions (Velkov, 2014), which prove to be essential for achieving a sporting result in football and prevailing over the opponent.

Speed-power work in the training process can be considered dominant because it occupies almost all of the pure game time and is the leading component of competitive activity (Velkov, 2014).

The speed of the players on the flanking areas is decisive for the coping skills in 1-on-1 situations in both phases of the game, especially when there are empty spaces and sparse defence.

One of the main indicators of a good midfielder appears to be distance travelled. Thus, he would be able to deal with basic tactical concepts such as: offering, covering, pressing, supporting the attack, balance, creating numerical superiority in different areas on the field, etc.

These trends are increasingly noticeable in Europe and the World. Soccer and conditioning coaches should have a broad knowledge in the area of profiling the motor abilities of soccer players in order to better and more efficiently realize the player.

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