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Comparison of performance indicators between different football positions using the global positioning system (GPS)

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Abstract

Purpose: The purpose of this study is to compare the performance indicators between different football positions using the Global Positioning System (GPS) in Iranian Premier League football players. **Method:** This is a quasi-experimental study. To conduct this research, 18 football players who are members of a club in the Iranian Premier League were selected as the available sample, and the players were divided into 6 groups based on the game post (central back (CB), wing back (WB), central midfielder (CM), attacking midfielder (AM), winger (W), and forward (F)). Then the data related to the players' performance (total distance, distance traveled with maximum speed, duration of maximum speed, maximum speed, sprints, number of accelerations, and number of decelerations) in 6 consecutive matches Collected using Global Positioning System (GPS). Also, one-way ANOVA analysis and SPSS software were used for data analysis at a significant level ($P \leq 0.05$). **Results:** Based on the findings of the present study, between different football positions for the variables of total distance ($P \leq 0.001$), distance traveled at maximum speed ($P \leq 0.000$), duration of maximum speed ($P \leq 0.000$), maximum speed ($P \leq 0.003$), sprints ($P \leq 0.000$), number of accelerations ($P \leq 0.000$) and number of decelerations ($P \leq 0.002$) there are significant differences. **Conclusion:** There are many fundamental differences between the performance indicators of different football positions with each other it is necessary to recognize these differences and it is necessary to consider special exercises according to the physiological needs of each post.

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INTRODUCTION

Soccer is the most popular sport in the world, so it's used by men, children, and adults with different professional levels. Soccer performance depends on many factors such as technical, tactical, physical, physiological, and mental factors (Stølen et al.,2005). Extensive research is concentrated on the evaluation of body requirements quantity in Soccer matches (Bangsbo et al. 2006; Domene, 2013). Some researchers reported the physiological needs of Soccer. The energy required for a race is computed at 5700 KJ for a 75 kg man and maximum oxygen consumption is 60 ml/kg.min. Soccer requires high aerobic power. Also, starters and phosphagen energy activities are found abundantly in it (Reilly, 2003). Dominant energy in soccer is an aerobic system and movement performance without the ball is very common in this field. These movements make that person creates a position for a teammate to deceive the opponent or pursue the opponent's player. Also, movements without the ball are performed aerobically, activities that are performed directly by the ball are often aerobic systems (Sarmento et al., 2014). The activities which are associated with carrying the ball last about 30 seconds and include the most important parts of a game such as possession of the ball and attack, etc., which take less time in young players (Sarmento et al., 2014). However, these are laboratory estimations and not practical in practice in other words these can't be used directly in exercise prescription and evaluation of players. Also, today the analysis of the performance of players during competition and high-speed movement has been considered (Di Salvo et al., 2010; Bradley et al., 2009). It makes sense that it happens at high speed in the most important race (Barnes et al., 2014; Di Salvo et al., 2009). Therefore, it's necessary to have a method that directly assesses the needs of Soccer players during the game. So it has recently become customary to use a new method called the Global Positioning System (GPS) to calculate the functional and physical needs of Soccer players in the world. The Global Positioning System (GPS) is a satellite-based navigation technology that was originally developed for military purposes (Gray et al., 2010). On the other hand, the Global Positioning System (GPS), which is now regularly used in sports, has received much attention from scientists, coaches, and athletes who are

engaged in team sports (Aughey, 2011). Today, Global Positioning System (GPS) technology is used in various sports such as soccer, rugby, hockey, cricket, etc. in prestigious leagues. GPS provides you with a set of information related to activity characteristics, and by measuring movements, it objectively determines the amount of pressure and evaluates different positional loads and the intensity of training. and provides the possibility of monitoring changes in physiological needs (McLellan et al., 2011). On the other hand, the physical demands placed on athletes during soccer matches depend on significantly the position of the players (Domene, 2013). For example, previous research has concluded that, for total distance covered, central defenders and forwards covered the least distance, while central midfielders covered the most distance (Dellalet al., 2012). Also, for high-speed activities, offensive and defensive players covered the most distance for running and high-intensity running, while players active in central areas of the field have the least production (Carling, 2013). And of course, the number of accelerations produced by different positions of the players has also followed a similar pattern (Dalen et al., 2016). Therefore, football players need different functions according to their playing position, and accordingly, the type and intensity of their training should be different based on these special needs for each position. Therefore, it seems very necessary to determine the amount and intensity of performance in different positions of football for the design of practice and its privatization. Therefore, since the use of GPS can provide us with valuable information about the functional needs of football players and also determine the physiological and functional needs of football players in different positions, for the first time we intend to collect the performance indicators of Iran's elite football players by using the GPS and compared them among different football positions.

METHOD

This research is a semi-experimental type, and the statistical population of this research consists of professional football team players who present in the Premier League of Iran in 2019. The sampling was conducted as an available sample that includes 18 professional football players trained in a team of the Iranian Premier League who use GPS technology in their training and competitions. In this study, the inclusion criteria consisted of

the presence of the desired team in the first level of football in the country (the Premier League) and the desired club having GPS technology. Also, the players under investigation must not have been substituted and have been on the field for the entire duration of the game. In the following, players were classified into 6 positions, central back (CB), wing back (WB), central midfielder (CM), attacking midfielder (AM), winger (W), and forward (F) based on their positions on the football field. The mean and standard error of some of their morphological variables can be seen in Table No. 1.

Table 1: Description and comparison between groups of the morphological profile of samples

Variable	Posts	Number	Average	Standard Deviation
Body Mass Index (kg/m^2)	CB	3	22.79	1.01
	WB	4	23.63	1.24
	CM	3	22.36	1.28
	AM	3	22.59	0.90
	W	3	23.37	0.63
	F	2	21.75	1.52
	Total	18	22.85	1.12
Weight (kg)	CB	3	79.00	1.73
	WB	4	74.75	2.50
	CM	3	72.66	5.77
	AM	3	71.00	7.00
	W	3	73.33	2.30
	F	2	67.50	9.19
	Total	18	73.44	5.28
Age (years)	CB	3	28.66	1.52
	WB	4	26.25	4.42
	CM	3	31.00	4.58
	AM	3	23.00	1.00
	W	3	22.66	1.52
	F	2	27.50	0.70
	Total	18	26.44	3.98
Height (cm)	CB	3	186.33	2.08
	WB	4	178.00	2.16
	CM	3	180.33	2.08

	AM	3	177.33	7.57
	W	3	177.33	1.15
	F	2	176.00	5.65
	Total	18	179.33	4.75

In the present study, related data to players' GPS was collected in 6 consecutive matches. In this way, after the pre-season preparation, the players entered the Premier League competitions in the 2019-2019 season, and in the first 6 matches of the Premier League, they wore GPS tops during the match, the GPS information of the players was recorded at the end of the match and analyzed in this research.

These data included the following:

1) Total distance: The total distance traveled by each player during a football match (Abbott et al., 2017).
2) Distance traveled at maximum speed: The distance traveled between 100% maximum aerobic speed and 30% anaerobic speed is stored (Abbott et al., 2017).
3) Maximum speed duration: the duration of speed between 100% maximum aerobic speed and 30% anaerobic speed is saved (Malone et al., 2017).
4) Max speed: The highest speed in kilometers per hour recorded by the players during the race ((McLellan et al., 2015).
5) Sprint: Human speed is usually divided into 4 parts, which include the following: Walking (Walk) at a speed equal to 0-2 m/s, Jogging at a speed equal to 2-4 m/s, Running at a speed equivalent to 4-6 meters per second and high-speed running (Sprint) a speed equivalent to 6-7 meters per second (Dellal et al., 2012).
6) Acceleration: The number of players entering the acceleration of 2-3 m/s^2 or above 3 m/s^2 (Abbott et al., 2017).
7) Deceleration: The number of players entering the minus acceleration of 3 m/s^2 or minus 2-3 m/s^2 (Abbott et al., 2017).

To collect related data on players' performance, GPS tops produced by Catapult sports company, model EVO GPSPORTS, made in Australia, were used.

Also, to analyze the data, the normality of the data was first checked by using the Shapiro-Wilk test, and after this assumption was met, one-way

ANOVA and Tukey's post hoc test were used to determine the location of the dispute. Also, the data were analyzed by using SPSS software version 26 at a significant level (P=0.05).
In addition, in the current research, all the issues related to research ethics, including confidentiality in data retention and non-disclosure of players and club names, have been observed.

RESULTS

The data of 6 race players were measured and recorded by a GPS device in each game, and then the average of 6 races was considered for each person. The values of 7 variables examined in this research in 6 different positions are shown in Table No. 2, and also based on the variance analysis test, the difference between different football positions was investigated.
According to the findings of the present research, there is a significant difference among different football positions in all variables. You can see these results in table NO.2.

Table 2: Results of analysis of variance between different posts

Variable	Posts	Number	Average	Standard Deviation	F	Significant
Acceleration	CB	3	48.20	6.37	6.701	0.000*
	WB	4	68.70	17.57		
	CM	3	66.00	21.07		
	AM	3	65.00	16.23		
	W	3	72.10	13.58		
	F	2	105.25	29.59		
	Total	18	67.22	21.40		
Deceleration	CB	3	58.90	9.85	4.641	0.002*
	WB	4	77.50	22.99		
	CM	3	79.80	18.93		
	AM	3	55.66	11.87		
	W	3	64.10	15.18		
	F	2	94.80	25.82		
	Total	18	70.80	20.82		
Sprints	CB	3	8.22	4.40	21.046	0.000*
	WB	4	20.10	3.47		
	CM	3	10.10	2.07		

	AM	3	11.50	1.04		
	W	3	11.87	1.80		
	F	2	16.12	2.69		
	Total	18	13.11	5.05		
Distance traveled with maximum speed (m)	CB	3	192.80	98.27	16.147	0.000*
	WB	4	480.90	114.13		
	CM	3	214.40	49.51		
	AM	3	190.83	50.41		
	W	3	327.25	71.43		
	F	2	380.60	120.58		
	Total	18	296.87	141.25		
Duration of maximum speed (s)	CB	3	27.88	16.77	8.088	0.000*
	WB	4	59.66	13.80		
	CM	3	25.60	8.29		
	AM	3	5.00	2.82		
	W	3	49.00	15.18		
	F	2	54.50	15.80		
	Total	18	39.03	21.21		
Max Speed (km/h)	CB	3	26.87	3.31	4.895	0.003*
	WB	4	28.66	1.03		
	CM	3	24.00	1.00		
	AM	3	22.50	2.12		
	W	3	29.60	3.04		
	F	2	28.75	2.36		
	Total	18	27.16	3.17		
Total Distance (m)	CB	3	5855.70	492.20	4.898	0.001*
	WB	4	7749.50	1455.05		
	CM	3	8209.58	1586.57		
	AM	3	6648.53	676.09		
	W	3	7070.81	957.93		
	F	2	8127.70	1866.40		
	Total	18	7259.87	1469.32		

Note: * The mean difference is significant at the 0.05 level.

Then, Tukey's post hoc test was used for a more detailed examination and comparison of groups (posts) with each other, and the results of this

analysis can be seen in Table No. 3. According to the findings of this table, the following information can be obtained:

There is a significant difference between the total distance traveled by the central defender position and the side defender, defensive midfielder, and forward positions (P≤0.05). In this way, the middle defenders travel a much shorter distance than these three positions.

There is a significant difference (P≤0.05) between the total distance traveled in the speed zone of the middle defender position and the side defender, winger, and striker positions.

Also, there is a significant difference between the total distance traveled in the speed area of the side defender position and defensive midfielder, attacking midfielder, and winger positions (P≤0.05).

On the other hand, there is a significant difference between the total distance traveled in the speed area of the defensive midfielder and attacking midfielder positions with the forward position (P≤0.05). In this way, the shortest distance is related to the positions of the central defender and attacking midfielder, and the longest distance is related to the side defenders.

There is a significant difference (P≤0.05) between the duration of being in the speed zone of the middle defender position and the side defender and striker positions.

Also, there is a significant difference between the duration of being in the speed zone of the position of the side defender and the positions of defensive midfielder and attacking midfielder (P≤0.05).

On the other hand, there is a significant difference between the duration of being in the speed zone of the attacking midfielder position and the winger and striker positions (P≤0.05).

In this way, the shortest period time is related to the position of the attacking midfielder, and the longest period is related to the positions of the side defender and striker.

There is a significant difference (P≤0.05) between the number of accelerations of the central defender position and the winger and striker positions. Also, there is a significant difference between the number of accelerations of the attacking post and other posts (P≤0.05).

In this way, the lowest number of accelerations is related to the middle defender position, and the highest number of accelerations is related to the forward position.

On the other hand, there is a significant difference (P≤0.05) between the number of decelerations of the attacking position and the central defender, attacking midfielder, and winger positions.
In this way, the lowest number of speed reductions is related to the positions of central defender and attacking midfielder, and the highest number of speed reductions is related to the forward position.
There is a significant difference (P≤0.05) between the maximum speed of the winger position and the defensive and attacking midfielder positions.
In this way, the lowest speed is related to the positions of defensive midfielder and attacking midfielder, and the highest speed is related to the position of winger.
Also, there is a significant difference (P≤0.05) between the number of entering the speed zone of the side defender position and other positions, except the forward position (P≤0.09), and between the number of entering the speed zone of the defensive midfielder position and the forward position have a significant difference (P≤0.05).

Table 3: Comparison of different football positions based on significance level using Tukey post hoc test in variables obtained from GPS device

Post A	Post B	Total Distance	Distance traveled with maximum speed	Duration of maximum speed	Acceleration	Deceleration	Max Speed	Sprints
CB	WB	0.022*	0.000*	0.004*	0.150	0.363	1.000	0.000*
	CM	0.002*	1.000	1.000	0.360	0.179	0.765	1.000
	AM	1.000	1.000	0.783	0.937	1.000	0.504	0.576
	W	0.523	0.036*	0.214	0.045*	1.000	0.950	0.199
	F	0.015*	0.005*	0.074*	0.000*	0.009*	1.000	0.000*
WB	CB	0.022*	0.000*	0.004*	0.150	0.363	1.000	0.000*
	CM	1.000	0.000*	0.009*	1.000	1.000	0.067	0.000*
	AM	1.000	0.000*	0.001*	1.000	0.331	0.078	0.000*
	W	1.000	0.010*	1.000	1.000	1.000	1.000	0.000*
	F	1.000	0.651	1.000	0.011*	1.000	1.000	0.093
CM	CB	0.002*	1.000	1.000	0.360	0.179	0.765	1.000
	WB	1.000	0.000*	0.009*	1.000	1.000	0.067	0.000*
	AM	0.294	1.000	1.000	1.000	0.179	1.000	1.000

	W	0.711	0.147	0.245	1.000	0.827	0.021*	1.000
	F	1.000	0.019*	0.091	0.005*	1.000	0.122	0.001*
AM	CB	1.000	1.000	0.783	0.937	1.000	0.504	0.576
	WB	1.000	0.000*	0.001*	1.000	0.331	0.078	0.000*
	CM	0.294	1.000	1.000	1.000	0.179	1.000	1.000
	W	1.000	0.095	0.018*	1.000	1.000	0.031*	1.000
	F	0.691	0.014*	0.008*	0.010*	0.011*	0.107	0.078
W	CB	0.523	0.036*	0.214	0.045*	1.000	0.950	0.199
	WB	1.000	0.010*	1.000	1.000	1.000	1.000	0.000*
	CM	0.711	0.147	0.245	1.000	0.827	0.021*	1.000
	AM	1.000	0.095	0.018*	1.000	1.000	0.031*	1.000
	F	1.000	1.000	1.000	0.029*	0.044*	1.000	0.083
F	CB	0.015*	0.005*	0.074	0.000*	0.009*	1.000	0.000*
	WB	1.000	0.651	1.000	0.011*	1.000	1.000	0.093
	CM	1.000	0.019*	0.091	0.005*	1.000	0.122	0.001*
	AM	0.691	0.014*	0.008*	0.010*	0.011*	0.107	0.078
	W	1.000	1.000	1.000	0.029*	0.044*	1.000	0.083

Note: * The mean difference is significant at the 0.05 level.

DISCUSSION

The purpose of this research was to compare the performance indicators between different football positions by using the Global Positioning System (GPS) and based on the findings of this research, there is a significant difference between all the different football positions in all variables.

Football includes many different activities, such as fast and explosive running, movements without the ball and with the fastball, headers, changing the speed and direction of movement, and all kinds of jumps, tackling, shooting, and kicking, which are the source of energy supply during the competition, the device is anaerobic (Ehsani et al., 2004).

The investigations carried out on the time and distance of fast runs performed by players, the number of jumps performed in each game, and the comparison of professional and amateur players through speed tests show that among the two devices Anaerobic, the ATP-PC system plays a more important role in soccer (Aguiar et al., 2013).

It has been proven before that the aerobic power of the players in the positions of side defenders and wingers is more than other players and this

is related to the physiological requirements of their playing positions because these players during the game hit a lot of starts and have more runs (Abbott et al., 2018).

While the players who are in the position of central defender or midfielder do not need high aerobic capacity and high running, and in many minutes of the game they are physically involved with the midfielders and attackers of the opposing team, and these physical conflicts require physical strength, so therefore it is necessary for active players in these positions to follow special exercises in terms of bodybuilding (Domene, 2013).

Attackers also need high speed and acceleration to have a proper performance, and therefore, to perform their tasks, they need to work in the ATP-PC system along with the quick recovery of this to have many sprints, especially during counterattacks, and quickly reach the opponent's penalty area (Izzo and Varde'I, 2017).

There is also a consensus among different researchers that the performance of football players decreases in the second half of the match and this decrease in performance can be different in different positions (Akenhead et al., 2013; Rivilla-García et al., 2019).

Reilly et al. (2008) showed that one of the consequences of not conserving the energy of players of different positions in football games is that the muscle's ability decreases to produce force.

This disturbance is reflected in the reduction of the work rate towards the end of the game. There is evidence that shows that the reduction of muscle glycogen reserves in the thigh muscles has led to a significant reduction in the amount of work (Reilly et al., 2008).

Krustrup et al.'s (2006) study on muscle and blood metabolites during a soccer game showed that players' performance decreases during sprints during the match and immediately after the end of the game. He concluded that the low level of glycogen in individual muscle fibers explains the disturbance in running speed in the final minutes of the game and that blood lactate is a poor indicator of muscle lactate during the game (Krustrup et al., 2006).

Many teams, especially those with good ball-handling techniques manage energy better during the match by promoting a high-passing game, thus make to reduce energy consumption. But it’s necessary that the training and nutrition of the players of different positions are different from each other

so that during the matches, the players who try and run more according to their position don't confront a drop in performance in the second half and especially in the final minutes (Abbott et al., 2018).
The limitations of this study were the number of clubs and matches that were investigated, which suggests that in the future, more performance indicators should be investigated in more matches and multiple teams.

CONCLUSIONS

In general, the findings of the current research showed that there are many fundamental differences between the performance indicators of different football positions, and it is necessary to recognize these differences and perform special exercises according to the physiological needs of each position. Therefore, these results can help players and coaches to design special exercises for each position.

Ethical Approve:

the present research has received the code of ethics from the Ethics Committee of Allameh Tabataba'i University the number IR.ATU.REC.1399.085.

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