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A comparative study on selected physiological profile of positional football players

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Abstract
The purpose of the study was to find out and compare of selected physiological profile of football players in relation to playing position. A total number of 319 male positional football players classified into four groups, were selected as subjects from different football coaching camp of Kolkata suburban area. Selected physiological profile included pre-exercise heart rate, peak expiratory flow rate and VO_2 max (predicted) were measured by standard procedures. For analysis of data, SPSS software was used. One-way ANOVA and Post hoc compare of means was used to find out the significant difference among the groups as well as to observe which group was different from the other groups. The result showed that significant difference in mean was found in resting heart rate, peak expiratory flow rate and vo_2 max (predicted) among the positional groups. Result also found that goalkeeper was higher value in pre-exercise heart rate and peak expiratory flow rate but inferior in vo_2 max in comparison to the other groups. On the other hand, midfielder was superior in vo_2 max than that the others groups. The physiological profile of footballers in respect of playing position play significant role in game performance.

Keywords: Physiology; pre-exercise heart rate; peak expiratory flow rate; vo_2 max

1. Introduction
Association football is well known as Football or Soccer, is the most popular, famous and greatest team sports on Earth. The game characterized as vigorous, high intensity, intermittent, ball and contact sports, function activities include acceleration, deceleration, jumping, cutting, pivoting, turning, heading and kicking the ball (Inklaar, 1994a).

Exercise physiology is a discipline involving the examination how the physical activity exercise or sports influences the structure and function of human body. The game performance of football is depending on several physiological factors, such as – maximum aerobic and anaerobic capacity, vo_2 kinetics, vo_2 max, running economy, heart rate, blood lactic concentration, muscle glycogen stores, muscle hypertrophy, oxygen deficit, hot cold humid environment, physical fitness and match performance. An elite football player need some important physiological characteristic for the high-level performance during game.

It is well established that the physiological system of football player is differ from other game and sports. The modern concept of football game, expert coaches concentrate on positional football play along with difference playing formation. Researchers have found that midfielder covered the longest distance and Goal keeper covered shortage distance during 90 minutes game. Similarly, the movement nature and responsibility of the players are changed according their playing position during their practices and matches. So positional physiological characteristic of footballers is now prime consideration for team selection, team practice and top performance for win the match. An elite football player always plays for a particular position during training as well as competition. As a result, he develops their physiological system along with the important physiological component on a particular position. On the other hand, coaches select football players for his team on the basis of positional physiological quality and capability of the players for team success.

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In the field of football performance, research proved that the predicted vo_2 max goalkeeper was significantly lower and midfielder was highest than other positional players. (Davis, J A *et al*., 2007, Mchatyre, Dey S K., *et al*., 2010) [3, 4].

Now the researcher intended to investigate physiological characteristic such as pre-exercise heart rate, peak expiratory flow rate and vo_2 max (predicted) of soccer player in respect of playing position to explore a new dimension in the field of competitive football.

1.1 Purpose of the study
The purpose of the present study is to find out and also compare the selected physiological profile among the different positional footballer players, such as Goalkeeper, Defender, Midfielder and Forward.

2. Materials and Methods
2.2. Subject of the Study
In the present study, a total number of 319 male positional football were selected as subjects from different football coaching camp of Kolkata suburban area with age ranging from 18 to 24 years. The subjects were selected to the following purposive sampling criteria-
a) Minimum three years training age.
b) Level of participation district, state, Kolkata club competitions and inter university.

The total number of 319 football player were classified into four positional groups as follow–
1. Goalkeeper (N=49), 2. Defender (N=100), 3. Midfielder (N=100) 4. Forward (N=70).

2.2 Physiological profile

Table 1: Criterion Measures of selected physiological profile along with Instruments and tools used.

S. No	Variables	Unit of Measurement	Instruments and tools used
1.	Pre-exercise Heart rate	beats/min	Digital Blood pressure monitor
2.	Peak expiratory flow rate	lit/min	Pocket Pick flow meter
3.	Vo_2 max (predicted)	ml/min/kg	20-meter multistage fitness test or Beep test software installed in smart phone attach with speaker.

2.3. Statistical Analysis
In the present study Statistical Package for the Social Science (SPSS, Ver.20.0) was used to analysis the collected data. Mean, Standard Deviation of selected physiological variables were used under the investigation. After that One-way ANOVA was used to find out the significant difference among the football player according to there playing position. Finally, Post Hoc Comparison of Means (Scheffe Test) was used after the one-way ANOVA to determined which group was different from the other groups.

3. Results and Discussions
In the present study physiological variables along with personal data of deferent positional football players are presented in the following tables.

3.1 Personal Data

Table 2: Descriptive statistics of personal data of footballers in respect to specific playing positions are presented in the table.

Group Variables	Goalkeeper (n= 49)	Defender (n = 100)	Midfielder (n = 100)	Forward (n = 70)
	Mean ± SD			
Age(years)	21.35±2.02	21.02±1.97	20.63±2.07	20.50±1.88
Height(cm.)	173.24±4.62	169.95±5.09	166.87±3.98	168.81±5.17
Weight (kg.)	63.67±5.69	59.74±6.34	55.18±3.61	57.44±5.42

3.2 Physiological profile

Table 3: Comparisons of physiological profile of footballers in respect to specific playing positions.

Group Variables	Goalkeeper (n= 49)	Defender (n = 100)	Midfielder (n = 100)	Forward (n = 70)	F value	P value (sig.)
Resting heart rate(beats/min)	69.45±3.42	67.92±5.49	64.30±5.56	65.47±4.52	15.536*	0.000
Peak expiratory flow rate (lit/min)	554.08±82.07	529.70±80.36	511.70±75.48	522.29±76.07	3.348*	0.019
Vo_2 max (predicted) (ml/min/kg)	42.83±5.26	47.14±4.41	50.13±4.33	47.02±3.68	31.067*	0.000

In one-way ANOVA, *= sig. when $p<0.05$, ns= not sig.

Table 3 represents that descriptive statistics and analysis of variance of selected physiological profile. Are presented in the above table. It is evident from the table that there are significant mean difference in resting heart rate, peak expiratory flow rate and vo_2 max among the positional groups.

As F-value of all three variable were found significant, post hoc multiple comparisons (Scheffe Test) was applied to find out the actual status among the group, i.e. goalkeeper, defender, midfielder and forward.

Table 4: Scheffe's F test for multiple comparison of selected physiological profile in relation to playing position.

Variable	Field Playing Position		Mean Difference
Resting heart rate	Goalkeeper	Defender	1.529^{ns}
		Midfielder	5.149^*
		Forward	3.978^*
	Defender	Midfielder	3.620^*
		Forward	2.449^*
	Midfielder	Forward	-1.171^{ns}
Peak expiratory flow rate	Goalkeeper	Defender	24.382^{ns}
		Midfielder	42.382^*
		Forward	31.796^{ns}
	Defender	Midfielder	18.000^{ns}
		Forward	7.414^{ns}
	Midfielder	Forward	-10.586^{ns}
	Goalkeeper	Defender	-4.314^*
		Midfielder	-7.305^*
		Forward	-4.189^*
	Defender	Midfielder	-2.991^*
		Forward	0.126^{ns}
	Midfielder	Forward	3.116^*

In Scheffe's test, the mean difference is significant at the 0.05 level; *= sig. (when $p<0.05$), ns= not sig.

Table 4 shows that post hoc multiple comparisons in respect of resting heart rate, peak expiratory flow rate and of vo_2 max among the four positional football players.

It is evident from the table that the mean difference in resting heart rate when goalkeeper to compare with midfielder and forward were statistically significant. Similarly, the mean difference of resting heart rate when defender to compare with midfielder and forward were statistically significant. However, there were no statistically significant difference found in resting heart rate when goalkeeper to compare with defender and also midfielder to compare with forward.

It also indicates that the mean difference of peak expiratory flow rate between goalkeeper and midfielder was statistically significant. However, there were no statistically significant difference were remained in five cases of peak expiratory flow rate.

Table also represents that the mean difference of vo_2 max when goalkeeper to compare with defender, midfielder and forward were statistically significant. Similarly, the mean difference of vo_2 max when midfielder to compare with defender and forward were statistically significant. However, there was no statistically significant difference was found of vo_2 max between defender and forward.

3.3. Discussions on Finding
1. Pre-exercise Heart rate
Heart rate is the number of times the heart beats per minute. A slow resting heart rate is characteristic of the trained individual. Heart rate is directly related with endurance-oriented games and sports. So, heart rate plays an important role for football players in relation to their specific playing position. The heart rate of midfielder group was significantly lower than that defender and goalkeeper and also lowest among the groups. On the other hand, the pre-exercise heart rate of goalkeeper was significantly high in comparison to midfielder and forward. Thomas, V. and Reilly, T. (1979) found that resting heart rate normal value of football player was 59 beats per minute. In the present study, it is evident that the pre-exercise heart rate is not same of football players, it changed in respect to their specific playing position. So, pre-exercise resting heart rate play a significant role for the midfielder to cover highest distance during a match.

2. Peak Expiratory Flow Rate
Considering the playing position, it is evident that the mean peak expiratory flow rate of goalkeeper, defender, midfielder and forward were 554.08, 529.70, 511.70 and 522.29 lit/min respectively. The peak expiratory floe rate of goalkeeper was significantly higher than midfielder. On the other hand, the peak expiratory floe rate of midfielder was significantly lower than goalkeeper. The peak expiratory floe rate is directly depending on age, physique and physical condition of football players.

3. Vo_2 max (predicted)
Maximum aerobic capacity refers as VO_2 max., is directly related to in football performance. Maximum aerobic capacity (VO_2) in adult male professional football players is reported to range between 50-75 ml/min/kg. Indeed, it is suggested that a threshold around 60 ml/min/kg is the minimum requirement to complete at an elite level (Reilly *et al*., 2000).

So, from the present study it is evident that VO_2 max of midfielder was significantly highest among the football players. Similar result has been obser by Susama, M. Gil., Javier Gil, Fatima Ruiz, Amala Irazusta, and Jon Irazusta (2007) [6]; Dey, S.K., Nabanita, K., and Partho Sarathy, D. R. (2010) [4] and Logo-Penas, C., Casais, L., Dellal, A., Roy, E., Dominguez, E. (2011) [5].Considering the playing position, it is opined that highest VO_2 max value of midfielder is advantageous because they have to cover highest distance in a match from the other positional player. Midfielder generally shortest and leanest and also possess less percentage of body fat, which are significantly related with the VO_2 max.

On the other hand, VO_2 max of goalkeeper was significantly lowest among the football players. Similar finding has also been mentioned by Susama, M. Gil., Javier Gil, Fatima Ruiz, Amala Irazusta, and Jon Irazusta (2007) [6]; Dey, S.K., Nabanita, K., and Partho Sarathy, D. R. (2010) [4]; Davis, J. A., Brewer, J., and Atkin, D. (2007) [3]. Goalkeeper are basically tallest and heaviest, possess high percentage of body fat and cover lowest distance during a match.

4. Conclusion
4.1. Personal Data
The age, height and weight of goalkeeper was higher than those of other positional football players, whereas midfielder was shortest and leanest player among the groups as per the descriptive statistics.

4.2. Physiological Profile
4.2.1. Pre-exercise heart rate
In respect of pre-exercise heart rate, goalkeeper was higher than that of midfielder and forward. Similarly, defender was also higher than that midfielder and forward in pre-exercise heart rate.

On the other hand, there were no significant difference was found in pre-exercise heart rate, when it compared in between goalkeeper and defender and also between midfielder and forward.

4.2.2. Peak expiratory flow rate
Peak expiratory flow rate, goalkeeper was superior than midfielder but there was no significant difference in between of remained groups.

4.2.3. Vo$_2$ max (predicted)
The result of vo$_2$ max shown that, goalkeeper was significantly inferior in comparison to the other groups. Midfielder was significantly superior in vo$_2$ max than that the others groups. On the other hand, there were no significant difference found in vo$_2$ max in between defender and forward.

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