



Anthropometric Profile in Relation to Playing Position of Elite Indian Soccer Players

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ABSTRACT

Background: Previous literature has demonstrated that each specialized playing position may have unique physical and physiological requirements. Body fat is highly related to playing position of football players.

Purpose: The purpose of the study was to examine differences among positions in body size and percent body fat of elite football players prior to the start of regular season.

Subjects: The subjects of this study were 34 (10 forwards, 10 midfielders, 10 defenders, 4 goalkeepers) normal, healthy elite football players without any orthopedic, respiratory or cardiovascular problems.

Methods: Anthropometric profiles of the subjects were determined by measuring height, weight, body mass index (BMI) and percent body fat. The prediction formula used to calculate percent body fat using BMI was: $\text{body fat \%} = (1.20 \times \text{BMI}) + (0.23 \times \text{age}) - (10.8 \times \text{gender}) - 5.4$ (R² 0.79, standard error estimate = 4.1% BF%), taking age and gender (male = 1, female = 0) into account.

Results: The results demonstrated significant differences ($p < 0.005$) in the percent body fat among the players of different playing positions. Goalkeepers possessed highest values for body fat percentage followed by defenders and forwards while midfielders had the least body fat percentage.

Conclusion: The study suggests that anthropometric characteristics differ in players of different playing positions. The differences found despite similar training protocol might be due to the physiological adaptations in the players.

Keywords: Anthropometric profile, Body mass index, Percent body fat, Playing position.

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INTRODUCTION

Soccer is the most popular and widely played sport globally.^{1,2} There is a growing interest for this sport in India as well. However, the Indian national team is currently ranked 166 of 207 according to the Fédération Internationale de Football Association (FIFA). The ranking suggests that Indian playing standards need to be improved in line with three key areas namely physical, technical, and tactical skills. The sport is characterized by short sprints, rapid acceleration or deceleration, turning, jumping, kicking, and tackling.^{3,4} The physiological demands of a given position in the team may not be linked directly to absolute fitness. The tactical role assigned to a player in that position is probably dictated by the physical capacity of that player. It is assumed that the game has developed to become faster, with more intensity and aggressive play than seen in the past. Elite soccer is a complex sport, and performance depends on a number of factors, such as physical fitness, psychological factors, player's techniques, and team tactics.

Team games are sports where body size, shape, body composition and level of fitness, all play an important part in providing distinct advantages for specific playing positions particularly at the highest level of performance where there is a high degree of player specialization.⁵ Since the physiological as well as physical characteristics are important consideration in player performance,⁶ the review focuses on the anthropometric and physiological characteristics of elite soccer players. A starting point in the search for outstanding talent is the use of profiles established for those who have been successful. These multifactorial profiles are sketched from observations on anthropometric, physiological and performance measures. Knowledge of these characteristics can provide clues as to the existence of biological prerequisites for playing at the highest standard. The degree to which physiological indices of performance capability prevail through growth and into adulthood is open to discussion. Physiological characteristics that have been reported as essential for football players are aerobic fitness, agility, muscle strength, speed, and explosive jumping

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power.⁷ One aim of body composition assessment is to differentiate and quantify different body compartments. In professional soccer, assessments are used alongside fitness measurements to determine physical preparedness for competition and to monitor the effects of training and dietary interventions on body composition status.¹¹

Excess fat mass acts as a dead weight in activities in which the body is lifted repeatedly against gravity.¹² The fat-free compartment, which includes lean muscle mass and bone mineral mass, is important for the production of speed, strength and power, and for injury prevention.^{13,14} Few descriptive studies are available that use quantitative analyses for body fat and % body fat (e.g. underwater weighing) in National Football League (NFL) players, thus providing a further need for documentation of NFL players' body size and composition. Body fat is highly related to playing position of soccer players, as previous studies have demonstrated.¹⁵ This is because of the different speed and movement demands of each position.

In the general population, differences in body composition are evident based on age,¹⁶ gender,¹⁷ physical activity,¹⁸ ethnicity,^{19,20} and disorders, such as metabolic and wasting diseases.²¹ Previous research with elite soccer players has highlighted differences in body size and composition between individuals according to playing position, although the most notable differences were found between goalkeepers and outfield players, with only minor differences reported between outfield players.²²⁻²⁴ The goalkeepers tended to be taller and heavier, with relatively more fat mass and less lean mass, than the outfield playing groups. These investigations used skin fold thickness or bioelectric impedance techniques to assess body composition, and results have yet to be confirmed using a more complex and sensitive measure, such as underwater weighing.

The database of physique and performance qualities of the players throughout the country is very important to make a national team. It is a fact that in India, there is still limited information of soccer players regarding physique and physiological profiles and performance according to the playing positions.

The purpose of this study was to find out the differences in the anthropometric characteristics of soccer players according to their respective playing positions.

SUBJECTS AND METHODS

Thirty-four healthy elite football players (10 forwards, 10 midfielders, 10 defenders, 4 goalkeepers) had furnished their consent to serve as subjects in the study. The procedure, benefits, and potential risks of study were explained to the participants before signing the

informed consent form and starting the test. The study was approved by the Institutional Ethics Committee of Faculty of Sports Medicine and Physiotherapy, Guru Nanak Dev University, Amritsar.

The inclusion criteria included for the study were: subjects agreed with the purpose of the study, subjects had no existing musculoskeletal problems, such as lower limb fracture and sprain/strain, subjects had no recent injury to lower limb, subjects had no existing neurologic problems and subjects had no existing respiratory or cardiovascular system problems. The data collection was undertaken during the period of August to December 2013 in Guru Nanak Dev University Campus, Amritsar.

Body mass was measured to the nearest 0.1 kg with an electronic scale (Atco, India). Subjects were weighed in minimal clothing with bare foot. Height was measured with a Harpenden stadiometer (Holtain Ltd., Crymych, UK) to the nearest mm. Subject was asked to stand bare foot on horizontal surface. Heel touched the ground. Counter board of Stadiometer was brought down till it touches the vertex. The height of the subjects was recorded. Body mass index (BMI) was calculated from height and weight.²⁵

Body fat percentage (BF%) of the participants was determined by anthropometric characteristics using BMI, taking age and gender (males = 1, female = 0). The prediction formula used was:

$$\text{Body fat percentage} = (1.20 \times \text{BMI}) + (0.23 \times \text{age}) - (10.8 \times \text{gender}) - 5.425.$$

Independent test was used to find out the means, standard deviation and standard error mean for the studied physiological and physical characteristics of players of different playing positions. One way analysis of variance (ANOVA) (SPSS Inc., Chicago, IL version 17) was used in order to find out the differences among different playing positions. All significant differences reported were at $p < 0.01$.

RESULTS

The anthropometric characteristics of players of different playing positions have been illustrated in Table 1. The results of this study revealed statistical significant difference ($p < 0.001$) in the anthropometric characteristics among the players of different playing positions. The results demonstrated significant differences ($p < 0.001$) in the percent body fat among the players of different playing positions (Table 2). Goalkeepers possessed highest values for body fat percentage followed by defenders and forwards while midfielders had the least body fat percentage (Table 2).

Table 1: Anthropometric profile of players at different playing positions

| | <i>Forward (n = 4)</i> <i>mean ± SD</i> | <i>Defender (n = 10)</i> <i>mean ± SD</i> | <i>Midfielder (n = 10)</i> <i>mean ± SD</i> | <i>Goalkeeper (n = 10)</i> <i>mean ± SD</i> |
|--------------|--|--|--|--|
| Age (years) | 20.5 ± 1.84 | 19.9 ± 1.29 | 20.0 ± 0.67 | 21.0 ± 1.41 |
| Weight (kgs) | 59.5 ± 3.50 | 62.3 ± 3.02 | 57.4 ± 2.79 | 71.25 ± 6.29 |
| Height (cms) | 167.6 ± 2.84 | 169.8 ± 2.57 | 168.7 ± 1.42 | 171.0 ± 5.48 |
| BMI | 21.19 ± 0.83 | 21.58 ± 0.73 | 20.16 ± 1.11 | 24.15 ± 0.68 |

Table 2: Comparison of body fat percentage of players at different playing positions

| | <i>Forward (n = 4)</i> | <i>Defender (n = 10)</i> | <i>Midfielder (n = 10)</i> | <i>Goalkeeper (n = 10)</i> |
|-----------|------------------------|--------------------------|----------------------------|----------------------------|
| Mean ± SD | 13.95 ± 1.04 | 14.27 ± 0.90 | 12.59 ± 1.37 | 17.60 ± 0.57 |

DISCUSSION

The data illustrated significant percent body fat differences among the players of different playing positions. The results supported our hypothesis that there exists significant difference in the anthropometric profile in relation to playing positions in elite Indian soccer players.

The results of this study postulated that goalkeepers possessed the highest body fat percentage compared to other playing positions. Defenders possessed the second highest body fat percentage followed by forwards. Midfielders had the least percent body fat compared to other playing positions. The findings may be because midfielders are more mobile throughout the game and covers greater distance of the ground compared to other playing positions. Goalkeepers being steady for the most part of the game justify their higher percent body fat than other playing positions.

The results of this study support the findings^{22,24} that reported significant differences in the body composition of soccer players of different playing positions, with most differences being observed between goalkeepers and the outfield players. The goalkeepers were the tallest and heaviest of the soccer players, and demonstrated greater percent body fat than the outfield players.¹¹ The results of this study also support the findings¹² that investigated body fat with respect to playing position in soccer. They found very little difference in body fat percentage among the different outfield positions, although midfielders tended to have lower body fat levels. The percentage body fat values of the present groups were found (forwards: 21.5267 ± 0.90779, defenders: 26.5500 ± 2.22153, midfielders: 17.7333 ± 1.7382, goalkeepers: 31.8700 ± 3.21269). Midfield is a position in which players need to be mobile, as they are involved in many aspects of play. They cover more ground than their defensive and offensive team mates.

The distance covered by a group of soccer players was investigated.²⁶ The team was divided into midfielders and defensive and offensive players. Midfielders covered more ground [9137 (977) m] than defenders [8523 (1175) m] and offensive players [8490 (673) m]. Thus,

present study showed the similar results that midfielders possessed lowest values for body fat percentage among all. Significant differences in age, stature, body mass and body mass index have been recently identified between elite players of different positions suggesting that players of particular size and shape may be suitable for the demands of the various playing positions. In this respect, positional role appears to have an influence on VO₂ max of an individual.

The study confirms that body fat is highly related to playing position of football players as demonstrated in previous studies. This is because of the different speed and movement demands of each position. The study demonstrated that each specialized playing position may have unique physical and physiological requirements. Knowledge of these characteristics can provide clues as to the existence of biological prerequisites for playing at the highest standard. Therefore, understanding the profile of successful players is valuable for talent identification; ensuring players are assigned to their optimal positions, and provide assistance in the design of conditioning programs.

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