Sonia Titoria
Ph.D. Scholar, Department of Exercise Physiology, Lakshmibai National Institute of Physical Education, Gwalior, Madhya Pradesh, India

Dr. Deepak Sharma
Associate Professor, Department of Exercise Physiology, Lakshmibai National Institute of Physical Education, Gwalior, Madhya Pradesh, India

Anthropometric profile development for senior Indian women soccer players

Sonia Titoria and Dr. Deepak Sharma

Abstract
Many factors are important in determining the top performance of a soccer players or a team. Some of these factors are easily measurable such as running speed, aerobic endurance and jump capacities etc. Anthropometry has been used for talent identification, for the purposes of understanding human physical variation, in anthropometry and in various attempts to correlate physical with racial and psychological traits. In order to answer these questions, the current study is being carried out. Selected variables for the study were Standing Height, Calf girth, Thigh girth, Leg length and Foot size. The profile is developed on t-scale for senior Indian women soccer players and could be used for assessing the ideal anthropometric of other players.

Keywords: Profile, anthropometric, women, soccer

Introduction
Sports today is no longer a physical activity merely performed as a means for survival it's a platform not only for individuals, teams but countries are brought together on an equal playfield. Sports events are taking place everywhere it has become a part of our culture. Sporting are organized in almost all games encouraging large participation, vast spectator and fan following and media coverage. Television and other forms of media bring these mega sporting events to our homes. That one game that is the most popular of them all is football, in terms of players and spectators. The term 'Soccer' or 'Football' which is one of the most popular events in the world is played between two teams of 11 players each. It is a game played with the ball in a rectangular field with an objective to score by maneuverings the ball into the opposing goal. The team, which scores more goals by the end of the game, wins. If there is a tie at the end of the game, either the draw is declared or the game goes into the extra time or penalty shootout, depending on the format of the competition. It is being played across all continents and had billions of fans following. During the rule of king Edward in England, from the year 1307 to 1327, a few laws were passed that would get those playing football imprisoned. That was back in those days but for now the game is played by about 240 million people across the globe. Without exceptions all the nations play football. Having phenomenal popularity, the most widespread is known as association football or soccer. Soccer has a rich history but for what is documented we know that football association was established in 1863. The game spread all over the countries in the European continent soon reaching South America and later to all the other continents. The governing body for football, FIFA (Fédération Internationale de Football Association) came to form in 1904 and was a part of the Olympics competition which was held four years later. In the first introduction of football in the Olympics United Kingdom (UK) went on to win the finals defeating Denmark 2-0, UK played a vital role to popularize the game.

Soccer stands ahead in the list of professionally played sports and is widely accepted amongst people of all ages. 'It is reported that in every sports event, top level performers require a particular body size and shape, while other aspects could be nearly similar (Tanner, 1976) [5].

Many factors are important in determining the top performance of a soccer players or a team. Soccer players have to adapt to the physical demands of the game, which are multifactorial. Players may not need to have an extraordinary capacity within any of the areas of physical performance but must possess a reasonably high level within all areas.

Corresponding Author:
Sonia Titoria
Ph.D. Scholar, Department of Exercise Physiology, Lakshmibai National Institute of Physical Education, Gwalior, Madhya Pradesh, India

Some of these factors are easily measurable such as running speed and aerobic or jump capacities (M Susana Gil *et al.*, 2007) [2].

Many studies have concluded that anthropometry plays an important role in achieving top performances, anthropometry refers to the measurement of the human individual. Anthropometry has been used for talent identification, for the purposes of understanding human physical variation, in anthropometry and in various attempts to correlate physical with racial and psychological traits. Anthropometry involves the systematic measurement of the physical properties of the human body, primarily dimensional descriptors of body size and shape (Singh Hardyal, 1991) [3].

Anthropometric measurements were central concerns of the first phase of the scientific era of measurements, which have been began in the 1860's.Current interest in anthropometric measurements focus in three areas, girth measures and body type and body composition. The assessment of such measures includes classification, prediction of growth patterns and prediction of success in motor activities as well as assessment of ability (Di Salvo V *et al.*, 2007) [1].

The existing literature in the field of football shows that standing height, body weight, arm length, leg length, waist circumference, hip circumference, thigh circumference, calf circumference, shoulder width, biacromial diameter, fore arm circumference, feet breath, palm width, chest circumference, body composition are important pre-requisites for efficient football performance, whereas excess body fat proves to be a hindrance (Zalai David *et al.*, 2015) [7].

Sports Profiling

1. Lately sports profiling has been considered as a key ingredient in order to develop the self-awareness required by the coach a professional sportsperson or an athlete. The Knowledge gained through sports profiling enables to develop once anthropometric ideal and understand in what way body measurement influences once own performance. No matter what level of performance one has with the insight of sports profiling one can enhance his/her performance to a much higher level. With the passage of time sports and games have become more demanding and even more technical, however this has also made sports more rewarding too. The presence of well trained and resourceful coaches the sportsmen are able to perform at am much higher level as before enabling them to break previously set records and performance barriers. Great coaches are expected to be experts in all allied technical expects of a particular sport. (Verma JP, 2013) [6] The study's main aim was to develop a profile on selected anthropometric variables for selected Indian women soccer players.

Methodology
Selection of Subjects
In order to achieve the aim of study, one sixty (N=160) Indian senior soccer player were selected. The subject's age ranged from 19 to 30 years old.

Selection of Anthropometric Variables
The Anthropometric Variables selected for this research study were- Standing Height, Calf girth, Thigh girth, Leg length and Foot size.

Data Collection

Table 1: Anthropometric Variables and their criterion measures

Sr. No.	Anthropometric Variables	Measuring Tool	Unit of measurement	"r" value
1	Standing Height	Stadiometer	Centimeter	0.94
2	Calf Girth	Flexible steel tape	Centimeter	0.90
3	Thigh gitrth	Flexible steel tape	Centimeter	0.92
4	Leg length	Flexible steel tape	Centimeter	0.91

The data was collected on the variables in table no. 1 for the selected soccer players. The measuring tool/ test used for measuring anthropometric variables were highly reliable "r" and valid.

Administration of Test
1. Standing Height
Purpose: To measure the height of the subjects**.**
Equipment: Stadiometer
Procedure: Height of the subject was measured by using stadiometer. Standing height is the measurement of the maximum distance from the floor to the highest point of the head, when the subject is facing directly ahead. Shoes should be off, feet together, and arms by the sides. (Refer Fig. 1) Heels, buttocks and upper back should also be in contact with the wall when the measurement is made (Singh, 2020) [4].

2. Calf Girth
Purpose- To measure the calf grith
Equipment - Steel tape
Procedure- The circumference of calf muscle was obtained in standing position. The steel tape was wrapped horizontally around the naked lower leg of the subject at the maximal budge of the calf muscle. With slight up and down movements of the steel tape keeping it in a horizontal direction, the maximal circumference entail measurement gave the value of calf muscle circumference and was measured to the nearest 0.1 cm. (Refer Fig. 1) (Singh, 2020) [4].

3. Thigh girth
Purpose: To measure the thigh grith
Equipment: Steel tape
Procedure: The circumference of thigh muscle was obtained in standing position. The steel tape was wrapped horizontally around the naked upper leg of the subject at the maximal budge of the thigh muscle. With slight up and down movements of the steel tape keeping it in a horizontal direction, the maximal circumference entail measurement gave the value of thigh muscle circumference and was measured to the nearest 0.1 cm. (Refer Fig. 1) (Singh, 2020) [4].

4. Leg length
Purpose: To measure the length of leg
Equipment: Measuring tape
Procedure: It was measured from the end of the spinal column to the floor. Also it was taken from greater trochanter to the floor. (Refer Fig. 1) (Singh, 2020) [4].

5. Foot Size
Foot Size: To measure the straight distance of foot.

Equipment's: Anthropometer Rod.

Procedure: It is the distance between the tip of the most tarsal phalange and the most posterior part of the calcaneus. The measurement will be taken with the help of Anthropometer Rod. The subject will be asked to stand in a comfortable position with feet slightly apart. Results was recorded from the reading scale of anthropometer rod in centimeter. (Refer Fig. 1)

Fig 1: Illustration of measurement of selected anthropometric variables

Statistical Analysis

Descriptive statistics like minimum score, maximum score, mean and Standard deviation were analyzed for all the parameters in Table 2. Minimum and maximum scores were converted into its standard scores by using the following transformation:-

$$Z = \frac{(x - \mu)}{\sigma} Z$$

Values were converted into its linear transformed scores by using the transformation $Z = 50 + 10 \times Z$. this way negative value of Z scores can be converted into positive scores (Verma JP, 2013) [6].

Table 2: Descriptive statistics of Anthropometric Variables

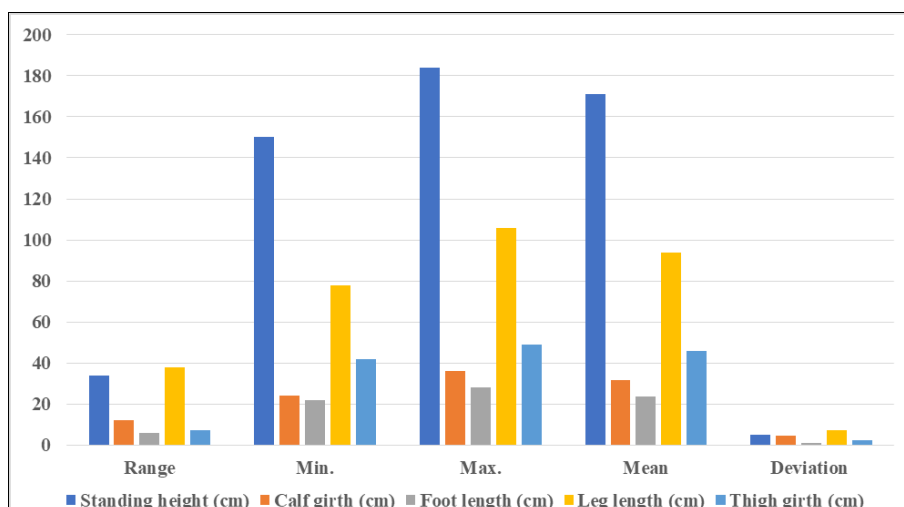| Anthropometric Variables	Range	Min.	Max.	Mean	Std. Deviation
Standing height (cm)	33.8	150.20	184	171.14	4.80
Calf girth (cm)	12	24	36	31.53	4.64
Foot length (cm)	6	22	28	23.5	1.12
Leg length (cm)	38	78	106	93.89	7.34
Thigh girth (cm)	7	42	49	45.73	2.27

Fig 2: Descriptive bar chart of selected variables of Anthropometric variable

Fig. 2 and Table No. 2. is graphically representing the minimum, maximum, mean and standard deviation of selected anthropometric variable of selected soccer players. The minimum and maximum standing heights were 150.20 cm

and 184 cm, respectively. The mean and standard deviation for standing height were 171.14 cm and 4.80 cm, respectively, with a range of 33.8 cm calculated. The minimum and maximum calf girths were 24 cm and 36 cm, respectively. Calf girth had a mean and standard deviation of 31.53 cm and 4.64 cm, respectively, with a range of 12 cm calculated. The minimum and maximum foot lengths were 22 cm and 28 cm, respectively. The mean and standard deviation for Foot length were 23.5 cm and 1.12 cm, respectively, with a 6 cm range calculated. The minimum and maximum leg lengths were 78 cm and 106 cm, respectively. Leg length had a mean and standard deviation of 93.89 cm and 7.34 cm, respectively, with a range of 38 cm calculated. The minimum and maximum thigh girths were 42 cm and 49 cm, respectively. Thigh girth had a mean and standard deviation of 45.73 cm and 2.27 cm, respectively, with a range of 7 cm calculated.

Table 3: Standard score of minimum, maximum and average of all the variables

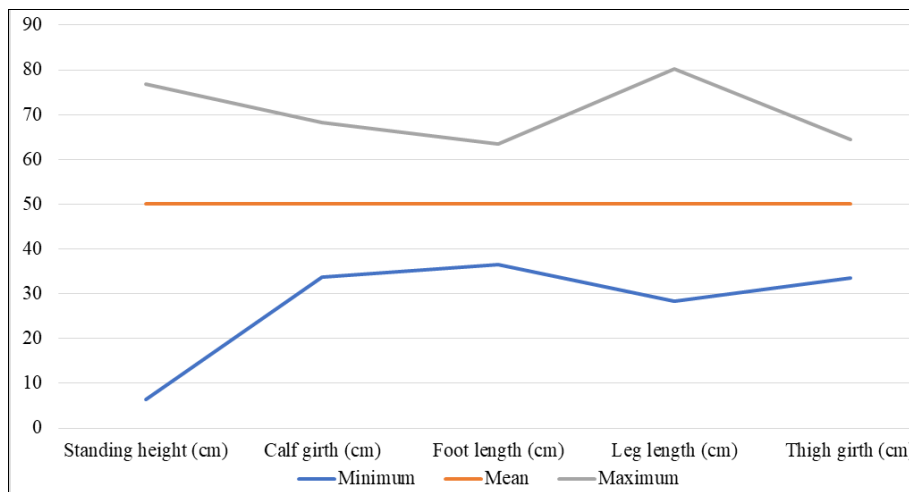| Variables	Minimum(Z)	Mean(Z)	Maximum(Z)
Standing height (cm)	-4.3625	0	2.679167
Calf girth (cm)	-1.62284	0	1.825431
Foot length (cm)	-1.33929	0	1.339286
Leg length (cm)	-2.16485	0	3.012262
Thigh girth (cm)	-1.64317	0	1.440529

Fig 3: Profile chart of selected variables of anthropometric variable

Developing Profile
The descriptive statistics (mean, standard deviation, and range) of a few chosen anthropometric variables are shown in Table 2. After descriptive statistics have been calculated, Table 3 shows the converted, standardised z-scores for the mean, maximum, and minimum values. Z-scores were determined using the method $Z=(X-MEAN)/S.D.$ Standardized scores were transformed into a Z-scale $(Z=50+10*Z)$ for the purpose of comparing various factors (Table:-4)

Table 4: Transformed standard score of minimum, maximum and average of all the variables

Variables	Minimum	Mean	Maximum
Standing height (cm)	6.375	50	76.79167
Calf girth (cm)	33.77155	50	68.25431
Foot length (cm)	36.60714	50	63.39286
Leg length (cm)	28.3515	50	80.12262
Thigh girth (cm)	33.56828	50	64.40529

The graphical range of a chosen anthropometric characteristic is shown in Figure 3. It is necessary to have the profile data for these chosen anthropometric variables in order to evaluate the effectiveness of any soccer player. After acquiring the data for the various variables, the raw score should be divided by the standard deviation to generate the standard score (z). Now, the calculated z-score is transformed into a t-scale for comparison and player selection.

Conclusion
The selected research study focused on developing profile on anthropometric variables for selected senior women soccer players on t-scale. The developed profile can be used to assess the anthropometric variable of women soccer players to determine whether, a player posses the required standing height, Calf girth, Thigh girth, Leg length and Foot size.

References
1. Di Salvo V, *et al*. Performance characteristics according to playing position in elite soccer. Int J Sports Med. 2007;28(3):222-227.
2. Susana Gil M, *et al*. Physiological and Anthropometric Characteristics of Young Soccer Players According to their Playing Position: Relevance for the Selection Process. Journal of Strength & Conditioning Research. 2007;21(2):438.
3. Singh Hardyal. Science of sports training; c1991.
4. Singh NS. Psychological and Anthropometric Profiles of National Women Soccer Players; c2020.
5. Tanner JM, *et al*. Genetic and anthropological studies of Olympic athletes; c1976.
6. Verma JP. Data analysis in management with SPSS software; c2013.
7. Zalai David, *et al*. Motor Skills, Anthropometrical Characteristics and Functional Movement in Elite Young Soccer Players. Journal of Exercise, Sport & Ortopedics. 2015;2(1):1-7.