A STUDY ON SELECTED ANTHROPOMETRIC VARIABLES AND BACK MUSCLE STRENGTH IN STATE LEVEL FOOTBALL PLAYERS OF MAHARASHTRA

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Abstract:

Football is a sport composed of many athletic components and requires different physical attributes and skills from the individual. There are different playing positions which are goal keepers, defenders, mid fielders and strikers. Purpose of the study was to evaluate the relation between different playing positions with selected anthropometric variables and back muscle strength in state level football players. Design of the study was based on cross sectional research. Sample of 106 male footballers of age group 16-25 years were included in the study and were selected from various football clubs of Maharashtra, India. In results, statistically significant differences ($p \leq 0.015-0.001$) were noted in height, weight, tibia length, femur length and total leg length between goalkeepers and defenders. Statistically significant differences ($p \leq 0.018-0.001$) were noted in height, weight, tibia length, femur length, total leg length and trunk length between goalkeepers and mid fielders. Statistically significant differences ($p \leq 0.019-0.002$) were noted in height, weight, tibia length and total leg length between goalkeepers and strikers. There was no statistically significant difference between defenders and mid fielders; and between the mid fielders and strikers.

Keywords: anthropometry, back strength, football, kinetics.

Introduction:

Football is the world's most popular form of sport, being played in every nation without exception. The most widespread code is association football or soccer. The sport has a rich history though it was formalized as we know it today by the establishment of the Football Association in 1863. The game soon spread to continental European countries and later to South America and the other continents. The world's governing body, the Federation of the International Football Association (FIFA), was set up in 1904 and the first Olympic soccer competition was held 4 years later. This competition is held every 4 years and is arguably the tournament with the most fanatical hold on its spectators and television audiences (Reilly et al., 2003).

Football is a sport composed of many athletic components and requires different physical attributes and skills from the individual. For example, a soccer player has to be able to run, sprint, dribble, pivot, cut, jump, land, and head and kick a ball. In addition, as a contact sport, tackling and collisions are frequent during matches and practices. As a player performs any of these tasks,

the whole body is submitted to internal and external forces that have to be dissipated or transferred appropriately to improve performance or to protect the different biological tissues from injury (Nyland et al., 1999; Manning et al., 2006; Landry et al., 2007). The involvement of the whole body in the process of dealing with internal and external forces during the performance of any activity defines the kinetic chain. Thus, even when describing a single component of the sport, such as kicking, the contribution of the kinetic chain to the task performance has to be considered (Schot et al., 1995).

The study was conducted with the objective to evaluate the relation between different playing positions with selected anthropometric variables and performance tests in state level football players. This study was based on cross sectional research. A total of 106 male footballers of age group 16-25 years were included in the study and were selected from various football clubs of Maharashtra, India. Ethical approval was given by institutional ethical committee.

Methodology

Method: Demographic information in the form of questionnaire was taken from each subject. The subjects were informed about the purpose of the trial and had to give their signed informed consent before being enrolled. All the anthropometric measurements were taken on each subject by following standard technique given by Lohman et al. (1988).

Kinanthropometric Measurements

The following Kinanthropometric measurements were taken:

Body weight (weighing machine): It measures the weight of the body with minimum clothes, when the bowel is empty and is taken on the weighing machine. The reading is taken from the reading scale on the machine in Kilograms.

Height (Anthropometric rod): It is the erect body length. Vertical distance is taken from the vertex to the floor. Vertex is the highest point on the head when head is in Frankfort horizontal plane. The units of height as measured are in centimetres (cm). Height and weight were measured to the nearest 0.5 cm and 0.5 kg, respectively, using a model 707 scale (Seca, Hamburg, Germany) with subjects standing bare foot and dressed in shorts or light clothing.

BMI (Derived): Body Mass Index is calculated by dividing weight in kilograms by height of the subject in subject in meters. Hence it is represented by kg/m^2 .

Length of the tibia (Anthropometric rod): It measures the distance between the tibiale and spherion. The subjects were asked to stand on a horizontal surface. The fixed cross-bar of the anthropometry rod was allowed to touch the tibiale and the moving cross-bar to the Spherion lightly and the measurement was noted in centimeters (cm).

Length of the femur (Anthropometric rod): It measures the distance between the distal lateral femoral condyle and the greater trochanter. The fixed cross-bar of the anthropometry rod was allowed to touch the greater trochanter and the moving cross-bar to the distal lateral femoral condyle lightly and the measurement was noted in centimetres (cm).

Total leg length (Anthropometric rod): It measures the distance between the anterior superior iliac spine and Spherion. The subjects were made to lie down on a table; the lower limbs were kept parallel to each other. The fixed cross-bar of the anthropometry rod was allowed to touch the anterior superior iliac spine and

the moving cross-bar to the Spherion lightly and the measurement was noted in centimetres (cm).

Trunk length (Anthropometric rod): It measures the vertical distance between the sternal notch and the sitting surface. The subjects were made to sit on a chair. The fixed cross-bar of the anthropometry rod was allowed to touch the sternal notch and the moving cross-bar to the sitting surface lightly and the measurement was noted in centimetres (cm).

Back strength Measurement (Sorenson test)

The player lied on the examining table in the prone position with the upper edge of the iliac crests aligned with the edge of the table. The lower body was fixed to the table by three straps, located around the pelvis, knees, and ankles, respectively. With the arms folded across the chest, the player was asked to isometrically maintain the upper body in a horizontal position. The time during which the patient kept the upper body straight and horizontal was recorded. In patients who experienced no difficulty in holding the position, the test was stopped after 240 seconds (Biering-Sørensen FI 1984).

Statistical analysis: Descriptive statistics (mean $\pm$ standard deviation) were determined for the directly measured and derived variables. Student's t-test was applied to compare the data between different position wise football players. All the data were determined using SPSS (Statistical Package for Social Science) version 21.0. A 5% level of probability was used to indicate statistical significance.

Results

When the anthropometric variables and back muscle performance test of goal keepers were compared with defenders, mid fielders and strikers in the state level football players of Maharashtra, there was a significant difference found between height, weight, tibia length and total leg length. In comparison between the goal keepers and defenders, highly significant differences were found in height ($p \leq 0.001$), tibia length ($p \leq 0.001$), femur length ($p \leq 0.001$) and total leg length ($p \leq 0.001$) and significant difference in weight ($p \leq 0.015$). In comparison between the goal keepers and mid fielders, highly significant differences were found in height ($p \leq 0.001$), tibia length ($p \leq 0.001$) and total leg length ($p \leq 0.001$) and significant differences in weight ($p \leq 0.012$) and femur length ($p \leq 0.006$). In comparison between the goal keepers and strikers, significant differences were found in height ($p \leq 0.002$), tibia

length ($p \leq 0.002$), weight ($p \leq 0.019$) and total leg length ($p \leq 0.007$).

When the anthropometric variables and back muscle performance test of defenders were compared with mid fielders and strikers, there was no significant

difference found between defenders and mid fielders in any of the variables.

When the anthropometric variables and back muscle performance test of midfielders were compared with strikers, there was no significant difference found in any of the variables.

Table 1: Descriptive statistics of anthropometric variables and back muscle performance test in goalkeepers and defenders in state level football players

Variables	Goalkeepers		Defenders		t-value	p-value
	Mean	S.D	Mean	S.D		
Age (years)	18.00	2.93	18.42	2.86	0.420	0.676
Height (cm)	179.36	0.06	171.61	0.06	3.622	<0.001
Weight(Kg)	69.09	8.43	62.33	7.59	2.519	<0.015
BMI(Kg/m ²)	21.42	2.23	21.16	2.59	0.300	0.765
Tibia length (cm)	44.03	2.69	40.60	2.27	4.193	<0.001
Femur length (cm)	44.39	3.89	40.80	2.37	3.746	<0.001
Total leg length (cm)	97.45	4.23	91.60	4.76	3.656	<0.001
Trunk length (cm)	57.73	3.10	55.92	3.03	1.726	0.091
Sorenson test (s)	124.27	42.83	132.30	42.28	0.529	0.599

Table 2: Descriptive statistics of anthropometric variables and back muscle performance test in goalkeepers and mid fielders in state level football players

Variables	Goalkeepers		Mid fielders		t-value	p-value
	Mean	S.D	Mean	S.D		
Age (years)	18.00	2.93	19.02	3.22	0.953	0.345
Height (cm)	179.36	0.06	169.64	0.06	4.770	<0.001
Weight(Kg)	69.09	8.43	61.02	9.36	2.593	<0.012
BMI(Kg/m ²)	21.42	2.23	21.12	2.54	0.352	0.726
Tibia length (cm)	44.03	2.69	40.26	2.06	5.049	<0.001
Femur length (cm)	44.39	3.89	41.33	2.96	2.856	<0.006
Total leg length (cm)	97.45	4.23	90.90	5.10	3.912	<0.001
Trunk length (cm)	57.73	3.10	54.91	3.45	2.454	<0.018
Sorenson test (s)	124.27	42.83	126.43	30.54	0.191	0.849

Table 3: Descriptive statistics of anthropometric variables and back muscle performance test in goalkeepers and strikers in state level football players

Variables	Goalkeepers		Strikers		t-value	p-value
	Mean	S.D	Mean	S.D		
Age (years)	18.00	2.93	18.82	2.70	0.763	0.453
Height (cm)	179.36	0.06	171.94	0.05	3.521	<0.002
Weight(Kg)	69.09	8.43	61.88	6.74	2.504	<0.019
BMI(Kg/m ²)	21.42	2.23	20.92	2.30	0.562	0.579
Tibia length (cm)	44.03	2.69	40.63	2.42	3.468	<0.002
Femur length (cm)	44.39	3.89	41.95	2.84	1.923	0.066
Total leg length (cm)	97.45	4.23	92.59	4.36	2.918	<0.007
Trunk length (cm)	57.73	3.10	56.82	3.38	0.713	0.482
Sorenson test (s)	124.27	42.83	126.70	36.86	0.160	0.874

Table 4: Descriptive statistics of anthropometric variables and back muscle performance test in defenders and mid fielders in state level football players

Variables	Defenders		Mid fielders		t-value	p-value
	Mean	S.D	Mean	S.D		
Age (years)	18.42	2.86	19.02	3.23	0.872	0.386
Height (cm)	171.61	0.06	169.64	0.06	1.391	0.168
Weight(Kg)	62.33	7.59	61.02	9.36	0.671	0.504
BMI(Kg/m ²)	21.16	2.59	21.12	2.54	0.062	0.951
Tibia length (cm)	40.60	2.27	40.26	2.06	0.687	0.494
Femur length (cm)	40.80	2.37	41.33	2.96	0.860	0.393
Total leg length (cm)	91.60	4.76	90.90	5.10	0.616	0.540
Trunk length (cm)	55.92	3.03	54.92	3.45	1.350	0.181
Sorenson test (s)	132.30	42.28	126.43	30.54	0.673	0.503

Table 5: Descriptive statistics of anthropometric variables and back muscle performance test in defenders and strikers in state level football players

Variables	Defenders		Strikers		t-value	p-value
	Mean	S.D	Mean	S.D		
Age (years)	18.42	2.86	18.82	2.70	0.492	0.625
Height (cm)	171.61	0.06	171.94	0.05	0.185	0.854
Weight(Kg)	62.33	7.59	61.88	6.74	0.209	0.835
BMI(Kg/m ²)	21.16	2.59	20.92	2.30	0.319	0.751
Tibia length (cm)	40.60	2.27	40.63	2.42	0.056	0.956
Femur length (cm)	40.80	2.37	41.95	2.84	1.542	0.129
Total leg length (cm)	91.60	4.76	92.59	4.36	0.726	0.471
Trunk length (cm)	55.92	3.03	56.82	3.38	0.981	0.331
Sorenson test (s)	132.30	42.28	126.70	36.86	0.442	0.660

Table 6: Descriptive statistics of anthropometric variables and back muscle performance test in mid fielders and strikers in state level football players

Variables	Mid fielders		Strikers		t-value	p-value
	Mean	S.D	Mean	S.D		
Age (years)	19.02	3.23	18.82	2.70	0.226	0.822
Height (cm)	169.64	0.06	171.94	0.05	1.355	0.181
Weight(Kg)	61.02	9.36	61.88	6.74	0.343	0.733
BMI(Kg/m ²)	21.12	2.54	20.92	2.30	0.279	0.781
Tibia length (cm)	40.26	2.06	40.63	2.42	0.602	0.549
Femur length (cm)	41.33	2.96	41.95	2.84	0.735	0.465
Total leg length (cm)	90.90	5.10	92.59	4.36	1.194	0.238
Trunk length (cm)	54.92	3.45	56.82	3.38	1.936	0.583
Sorenson test (s)	126.43	30.54	126.70	36.86	0.030	0.976

Discussion

In this study the mean age of mid fielders was the highest (19.02 yrs.) and of goalkeepers was the lowest (18 yrs.). It has been documented that most talented soccer players reach their peak performance between 25 and 27 years of age. However, it does not imply that this is the only age at which the highest level of performance is exhibited. There are players who play

soccer at a high level who are either younger than 25 or older than 30 years (Moghadam et al., 2012).

The mean height of goalkeepers was the highest (179.36 cm) and of mid fielders was the lowest (169.64 cm); the strikers and defenders were similar in height. For a team to be successful it is necessary to have tall goalkeepers and defenders to perform successfully in the air battles during the game. Players

with shorter height advance the ball with a high speed and their shorter height can be advantageous to defeat the center backs. Since a short height keeps the center of gravity closer to the ground, their dynamic balance is facilitated during dribbling. Tall goalkeepers can save the goal being scored by diving to a long distance and successfully stop or deflect the ball thus playing a crucial role between winning and losing a game. Defenders who are taller than strikers can be advantageous in battle with head blows when scoring a goal. Probably more height in strikers in a team makes them a target to send high flight balls. In contrast, short height in players in a team may be advantageous, when the strikers attempt to cross the opponent's defense line by dribbling through (Moghadam et al., 2012). In this way anthropometric assessment plays an important role in the different playing positions in soccer. So, during selection of players height should be considered when appointing the player any playing position that will add to their skill and talent and will enhance their game.

The mean weight of goalkeepers was the highest (69.09 kg) and of mid fielders was the lowest (61.02 kg). This shows that the goalkeepers were significantly heavier than the other players. The overweight of the goalkeepers may be attributed to the fact that they run shorter distances than other players in the game. Previous researches have shown that goalkeepers run at an average of 4 km per game while the defenders run 8 km per match and other positions run 9-12 km per match. Additionally, the goalkeepers need stronger and more muscular body to engage in air battles against the strikers (Moghadam et al., 2012).

The mean tibia length of goalkeepers was the highest (44.03 cm) and of mid fielders was the lowest (40.26 cm). The mean femur length of goalkeepers was the highest (44.39 cm) and of defenders was the lowest (40.80 cm). The mean total leg length of goalkeepers was the highest (97.45 cm) and of mid fielders was the lowest (90.90 cm). The mean trunk length of goalkeepers was the highest (57.73 cm) and of midfielders was the lowest (54.92 cm). This shows that the goalkeepers had the longest tibia, femur total leg length and trunk length in comparison to other players. Players with tall legs will have COG at a higher level in the body, which in turn assist them to reach higher height during jumping, thus this condition is advantageous in air battles to control the ball. Longer limb length of goal keepers may be associated with their high height, both of which are genetically determined (Moghadam et al., 2012).

Conclusion

The mean age of mid fielders was the highest 19.02 yrs. and of goalkeepers was the lowest 18 yrs. The mean height of goalkeepers was the highest 179.36 cm and of mid fielders was the lowest 169.64 cm. The mean weight of goalkeepers was the highest 69.09 kg and of mid fielders was the lowest 61.02 kg. The mean BMI of goalkeepers was the highest 21.42 kg/m² and of strikers were the lowest 20.92 kg/m². The mean tibia length of goalkeepers was the highest 44.03 cm and of mid fielders was the lowest 40.26 cm. The mean femur length of goalkeepers was the highest 44.39 cm and of defenders was the lowest 40.80 cm. The mean total leg length of goalkeepers was the highest 97.45 cm and of mid fielders was the lowest 90.90 cm. The mean trunk length of goalkeepers was the highest 57.73 cm and of midfielders was the lowest 54.92 cm. The Sorenson test time of defenders was the highest 132.30 s and of goalkeepers was the lowest 124.27 s.

Statistically significant differences ($p \leq 0.015-0.001$) were noted in height, weight, tibia length, femur length and total leg length between goalkeepers and defenders. Statistically significant differences ($p \leq 0.018-0.001$) were noted in height, weight, tibia length, femur length, total leg length and trunk length between goalkeepers and mid fielders. Statistically significant differences ($p \leq 0.019-0.002$) were noted in height, weight, tibia length and total leg length between goalkeepers and strikers. There was no statistically significant difference between defenders and mid fielders. There was no statistically significant difference between the mid fielders and strikers.

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