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A Comparative Study of Selected Anthropometric and Motor Fitness Variables of Football Players' Playing Positions

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Abstract

Anthropometric and fitness based analysis often lead to psychophysical assessment of an individual. Aspects related to motor fitness and Anthropometry can aid in the assessment of soccer players and classify them into highly performing and non highly performing individuals. 150 male soccer players of age group 18-25 years from different universities inclusive of those with a good performance record and vice versa in the previous years of their games were considered for this study. These players were classified on the basis of their playing positions using convenient sampling approach (Defenders - 50; Midfield – 40, Forwards – 40 and Goal keepers - 20). These variables were acquired using calibrated standard equipment with the aid of predefined test procedures. The readings obtained were analyzed and statistically assessed with a confidence level of 95% using various approaches. Significant differences were found in these classification with respect to parameters such as height, agility, speed and speed endurance among soccer players of different playing positions. Using this data, a generic equation was framed which could easily aid in the classification of a given player into highly performing and non-highly performing player.

Keywords: Motor Fitness, highly performing, non-highly performing, Anthropometric, Classification, convenient sampling, defenders, midfield, forwards, goal keeper.

Introduction

Research in various areas has seen multifold evolution in scientific knowledge, especially in recent years [1]. The approaches that were confined for pathological studies such as human behavioral analysis have been extended to occupationally exposed normal employees as well as in case of professional sportsmen such as those of basketball, table tennis and football [2,3]. As the results obtained in sports and games are factual, they are better reliable. Sports performance is a result of complex human performance, having several dimensions, but a careful and rational analysis of data can result in meaningful conclusions [4]. Such a multidimensional analysis is the need of the hour in case of sports training and rehabilitation and is gaining more importance as a potential research tool in the world of sports [5].

Sports performance depends on morphological and Anthropometric aspects. In case of soccer, skills such as dribbling, juggling and kicking are the most important facts which are greatly influenced by before mentioned aspects [6].

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A good performance in soccer definitely depends upon serious training and fitness as well. The Anthropometry aspects related to soccer player highly influences the capability of a player and this can be assessed by novel approaches developed offlate due to the advent of technology and the extension of the field of healthcare into sports. It is no surprise that the players are often selected into the team based on such Anthropometric aspects as well [7]. Also this greatly affects the position at which the player is made to play in the game. Aspects such as body proportion and size,height, weight and surface area, length, girth and width and many more are most common aspects measures under the umbrella of Anthropometry [8,9]. These aspects can be statistically analyzed to arrive at a conclusion about an individual with respect to his ability to perform and hence a better player. This is also because of the fact that the more fit a player is, better is his endurance in the game which is the primary aspect of any game. Also playing positions can affect the player to a great extent. These parameters can also help one decide on the playing position that may best suit a given player instead of undergoing a trial-and-error based approach [10].

Methods and Procedures

An investigation of selected motor fitness and Anthropometric assessment was used to classify a given

player into either of the two groups, highly performing and less-highly performing. 150 male soccer players of age group 18-25 years from different universities inclusive of those with a good performance record and vice versa in the previous years of their games were considered for this study. The selected players were classified on the basis of their playing positions based on convenient sampling approaches (*Defenders - 50; Midfield - 40; Forwards - 40; and Goal keepers - 20*). Standard predefined approaches were used to acquire data required for this test. The data thus acquired was analyzed using the SPSS tool with a 95% confidence interval in order to successfully classify the players into highly performing and non-highly performing groups.

Results

Discriminant assessment of the data collected was successfully able to provide abundant information about the capability of the player as well as the best position at which he could be put into for the game. The datasets obtained are depicted in table 1

.

Table 1
Motor fitness and Anthropometric aspects of the players

Determinant Variables	Soccer Playing Positions				F ratio	Sig
	Forwards	Midfielders	Defenders	Goalkeepers		
Height	168.92 ± 5.79	167.72 ± 4.49	170.24 ± 4.99	172.17 ± 4.73	3.920	.010
Weight	63.29 ± 4.76	62.50 ± 5.48	64.34 ± 6.07	65.14 ± 5.50	1.406	.243
BMI	22.30 ± 1.45	22.22 ± 1.71	22.27 ± 1.90	22.03 ± 1.52	.120	.948
Fat percent	14.71 ± 9.51	14.49 ± 4.14	13.80 ± 4.02	13.02 ± 3.91	.438	.726
Thigh girth	51.65 ± 3.32	51.59 ± 4.22	52.14 ± 3.81	50.50 ± 3.82	.875	.455
Calf girth	35.00 ± 1.94	35.32 ± 2.03	35.55 ± 2.96	34.83 ± 1.98	.685	.562
Arm length	76.06 ± 3.46	76.44 ± 2.59	76.70 ± 2.84	77.50 ± 3.00	1.092	.354
Leg length	98.15 ± 4.36	97.57 ± 4.41	99.16 ± 4.25	99.83 ± 3.87	1.776	.154
Elbow width	6.54 ± 0.43	6.52 ± 0.44	6.64 ± 0.47	6.52 ± 0.39	.788	.502
Knee width	8.56 ± 0.64	8.68 ± 0.66	8.61 ± 0.68	8.33 ± 0.58	1.197	.313
Explosive strength	54.67 ± 2.01	54.85 ± 1.53	54.91 ± 1.66	55.89 ± 0.68	2.411	.069
Flexibility	12.17 ± 4.80	12.37 ± 4.66	13.26 ± 5.01	13.17 ± 6.10	.537	.657
Agility	11.49 ± 0.31	11.98 ± 0.40	12.87 ± 0.50	12.59 ± 0.38	105.274	.000
Speed	5.49 ± 0.27	5.58 ± 0.28	6.00 ± 0.38	5.86 ± 0.22	27.323	.000
Speed endurance	12.56 ± 0.26	12.82 ± 0.23	13.15 ± 0.18	12.98 ± 0.03	73.493	.000
Reaction time	11.79 ± 4.12	13.51 ± 4.73	12.81 ± 3.63	13.06 ± 3.32	1.420	.239

Table 2
Test of Equality of Group Covariance Matrices

GROUP		Rank	Log Determinant	Box's M	Approx. F	df1	df2	Sig.
1	Forwards	7	-.348	218.620	2.341	84	16170.827	.000
2	Midfield	7	.107					
3	Defenders	7	-.090					
4	Goalkeepers	7	-7.410					
Pooled within-groups		7	.469					

Table 2 provides the assessment of the data using multivariate normality and the data is not found to be multivariate normal. Also the classification is successfully done into two groups namely highly performing and non-highly performing clusters. The F value signifies the fact that both these groups are much different from each other statistically as well.

Table 3
Eigen values and Wilks' Lambda

Function	Eigen value	% of Variance	Cumulative %	Canonical Correlation	Test of Function	Wilks' Lambda	Chi-square	df	Sig.
1	2.553[a]	93.5	93.5	.848	1 through 3	.238	227.856	21	.000
2	.117[a]	4.3	97.8	.324	2 through 3	.844	26.924	12	.008
3	.061[a]	2.2	100.0	.239	3	.943	9.352	5	.096

The correlation among each group is high signifying a similarity in each of the groups. Also the chi-square value hints a significant variation among different groups of players in the present analysis

Table 4
Analysis of Unstandardized Canonical Discriminant Function Coefficients

Variables	Functions		
	1	2	3
Height	.012	.244	-.080
Thigh girth	.023	-.028	-.152
Arm length	-.002	-.223	.109
Explosive strength	-.057	-.050	.520
Agility	1.568	.279	.596
Speed	.906	1.610	-1.020
Speed endurance	2.005	-2.675	-.598
(Constant)	-50.018	1.713	-9.134

Table 4 provides the coefficients and constants needed to obtain the discriminant equation mentioned as follows

D = -50.018 + 0.012 H + 0.023 TG – 0.002 AL – 0.057 ES + 1.568 A + 0.906S + 2.005 SE

Where

D = Discriminant equation
H = Height
TG = Thigh Girth
AL = Arm Length
ES = Explosive Strength
A = Agility
S = Speed
SE = Speed Endurance

Using the above equation, a discriminant score is obtained for the players at various positions and is shown from figure I – figure IV. The discriminant score of the data collected for soccer players playing in different positions is graphically illustrated in Figure I - Figure IV.

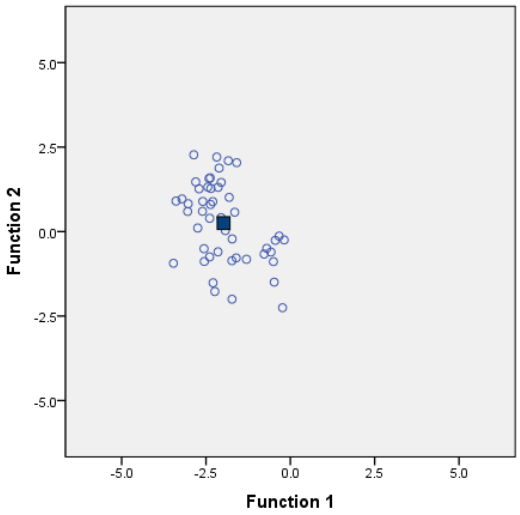

Figure I
Graphical Representation of Canonical Discriminant Function 1 of Forwards

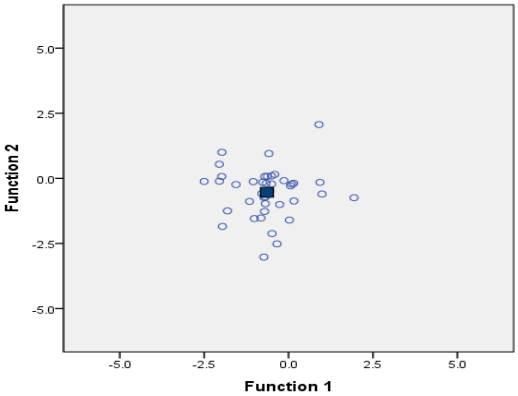

Figure II
Graphical Representation of Canonical Discriminant Function 1 of Midfielders

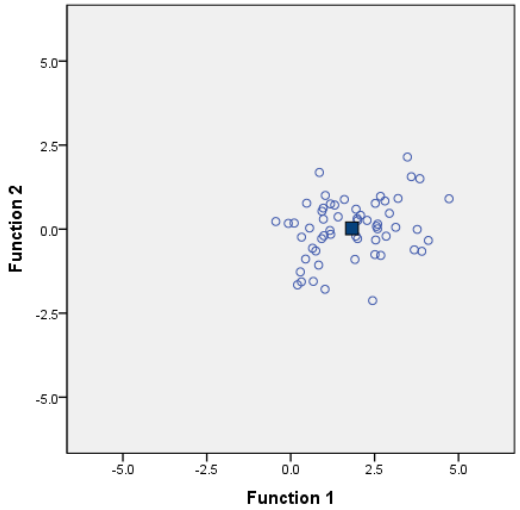

Figure III
Graphical Representation of Canonical Discriminant Function 1 of Defenders

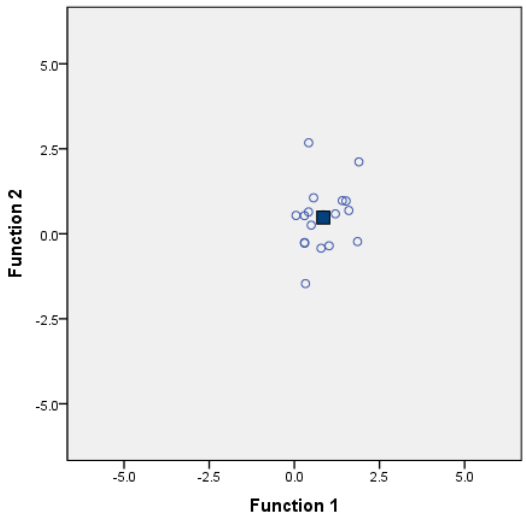

Figure IV
Graphical Representation of Canonical Discriminant Function 1 of Goalkeepers

Table 5
Classification Results

		Group	Predicted Group Membership				Total
			Forwards	Midfield	Defenders	Goalkeepers	
Original	Count	Forwards	30	10	0	0	40
		Midfield	7	30	1	2	40
		Defenders	0	6	34	10	50
		Goalkeepers	0	2	1	17	20
	%	Forwards	75.0	25.0	.0	.0	100.0
		Midfield	17.5	75	2.5	5	100.0
		Defenders	.0	12	68	20	100.0
		Goalkeepers	.0	10	5	85	100.0

Table 5 provides a detailed classification of players with respect to their positions of play. It is found that 75% of the originally grouped players were found to be correct in case of forward players

.

Conclusions

The present approach is able to precisely classify a given player into various positions of play based on the various fitness and Anthropometry variables found using difference approaches. This can help in better training and assessment of a player in real-time situations and also aid in sports rehabilitation in a much scientific manner.

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