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Exploration study on the characteristics of selected anthropometric and motor fitness variables of successful and less successful football players

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Abstract
The purpose of the present study was to understand the selected Anthropometric and Motor Fitness variables that contributed to the classification of Football players as successful and less successful. One hundred and sixty five (165) male football players from universities comprised of 3 successful and six less successful from among those participated in the All India Inter University football tournament organised during December, 2019, were selected as subjects with an informed consent. The age of the selected subjects ranged from 18 through 25 years. The selected subjects were categorized as successful team players (N = 58) and less successful team players (N = 107) based on their team's tournament standings. The Anthropometric measurements and Motor Fitness variables were assessed utilizing calibrated instruments, standardized methods, procedures and tests. The experimental design used in this study was stratified group design involving convenient sampling. Discriminant analysis was performed to analyze the data collected using SPSS. In all cases the level of confidence was fixed at 0.05 for significance. The results show that statistically significant difference on calf girth, leg length, explosive strength and speed endurance among soccer players with different levels of achievement success. Yet, discriminant equation with inclusion 4 of 16 independent variables (Anthropometric and Motor Fitness Variables) in computing the equation as: D = – 43.504 + 0.125 (Calf girth) + 0.231 (Explosive strength) – 2.104 (Speed) + 3.023 (Speed endurance), and consequently it implies that soccer players with the potential for success can be predetermined as it is predominantly influenced by selected Anthropometric and Motor Fitness variables.

Keywords: Anthropometric, motor fitness, success in soccer, discriminant analysis

Introduction
Nowadays the evolution of human scientific knowledge is dramatic in all walks of life and it is factual in the area of games and sports. Sports performance is indeed an aspect of complex human performance, which has several dimensions. Sports researchers often accept that a top-notch feat is the result of numerous aspects, advocating a multidimensional approach in studies on talented players. Burwitz *et al*. (1994) [8] also recommend interdisciplinary performance-related sports science research. Successful sports performance is influenced by morphological and anthropometric characteristics, functional parameters and fitness. Soccer is the most popular sport, played in many countries throughout the world. The soccer skills are more complex as dribbling, kicking, juggling, and so forth are to be performed mostly by foot and other parts of the body except hands, which makes it interesting to participate and witness. Excelling in team sports like soccer at higher level demands for multidimensional characteristics.

Indeed, research in male professional Football has shown that the physical characteristics of players and the fitness demands in official competition have substantially evolved over recent decades. The capability of a sportsperson in a team game emanates from various anthropometric and motor fitness variables of the players. Contemporary science is enormously concerned in approximating the optimum anthropometric makeup of a player. So the scanning and selection of a particular player may be achieved successfully to a great extent by measuring anthropometric components. Anthropometric and motor fitness variables are dimensions of the structure of the human body taken at specific sites to give measures of girth and width. They include the body size and body proportions.

Measurements of body size include such descriptive information as height, weight and surface area, while the measures of body proportions describe relationship between height, weight, length, width and girths of various body segments. It has been observed that top athletes in some sports tend to have those proportions to biologically aid the performance (Mathews, 1973) [3]. Fitness is the capacity of an individual to perform a given task requiring muscular force. The greater the fitness, the longer a person can work and the more efficient will be his performance and his capacity for recovering from fatigue (Willgoose, 1961) [6]. It would be of interest to explore the predominant anthropometric and motor fitness variables that categorizes soccer players as successful and less successful, since there has been a very little source with regard to it. Thus, the researcher is encouraged to verify the predominance of anthropometric and motor fitness variables that determines the soccer player's level of success. This study was proposed to comprehend the selected anthropometric and motor fitness variables that contribute to the classification of soccer players as successful and less successful.

Methods and Procedures

One hundred and sixty five (165) football players from nine (9) universities who participated in the All India Inter University football tournament organised during December, 2019, were selected as subjects with an informed consent. The age of the selected subjects ranged from 18 through 25 years. The selected subjects were categorized as successful team players (N = 58) and less successful team players (N = 107) based on their team's tournament standings. The anthropometric measurements and motor fitness variables were assessed utilizing calibrated instruments, standardized methods, procedures and tests. The experimental design used in this study was stratified group design involving convenient sampling. The discriminant analysis was performed to analyze the data collected using SPSS. In all the cases level of confidence was fixed at 0.05 for significance.

Results of the Study

In order to comprehend the anthropometric and motor fitness variable that contributes to the classification of soccer players, discriminant analysis was applied. Non-standardized canonical discriminant function coefficients were used to derive the regression equation that classifies soccer team players as successful and less successful based on their anthropometric and motor fitness variables. The data on anthropometric and motor fitness variables among soccer players with different levels of achievement success is analyzed and given in Table 1. Table 1 reveals a statistically significant difference in the level of certain anthropometric (calf girth and leg length) and motor fitness (explosive strength and speed endurance) variables among soccer players with different levels of achievement success.

Table 1: ANOVA on Selected Anthropometric and Psychomotor Variables among different Levels of Successful Soccer Team Players

Different Levels of Soccer team Success						
	Successful		Less Successful			
Determinant Variables	Soccer Team		Soccer Team		F ratio	Sig.
	Players		Players			
	(N = 58)		(N = 107)			
	Mean	SD	Mean	SD		
Height	170.31	5.32	168.97	5.15	2.501	.116
Weight	64.29	5.25	63.33	5.67	1.123	.291
BMI	22.16	1.51	22.28	1.77	.196	.659
Fat percent	13.24	3.39	14.64	7.16	1.979	.161
Thigh girth	52.34	3.58	51.32	3.86	2.804	.096
Calf girth	35.81	2.32	34.95	2.35	5.051	.026
Arm length	77.09	2.93	76.24	3.00	3.055	.082
Leg length	99.64	4.26	97.95	4.25	5.936	.016
Elbow width	6.62	0.44	6.54	0.44	1.243	.267
Knee width	8.66	0.66	8.54	0.65	1.375	.243
Explosive strength	55.41	1.56	54.67	1.71	7.518	.007
Flexibility	12.81	5.11	12.65	4.92	.037	.848
Agility	12.32	0.72	12.16	0.70	2.095	.150
Speed	5.67	0.45	5.76	0.34	2.215	.139
Speed endurance	12.99	0.28	12.82	0.32	11.377	.001
Reaction time	12.91	3.56	12.61	4.32	.213	.645

Source: Primary Data.

Table 2: Test of Equality of Group Covariance Matrices Using Box's M

Group	Rank Log Box's M Approx. Determinant F	df1	df2	Sig.
Successful	4 -1.956			
Less Successful	4 -2.185 19.438 1.885	10	64884.010	.042
Pooled within-groups	4 -1.986			

Table 2 reveals the test of the multivariate normality of the data. The Rank (4) of the covariance matrix indicates that this is a 4 × 4 matrix, the number of variables in the discriminant equation. The natural log of the determinant of successful and less successful players' covariance matrices is -1.956 and -2.185 respectively.

Pooled within groups covariance matrix composed of the means of each corresponding value within the two 4 x 4 matrices of the successful and less successful players are -1.986. The Box's M value of 19.438 is a measure of multivariate normality, based on the similarities of the determinants of the covariance matrices for the successful and less successful players. The approximate F value of 1.885 reveals that the determinants from the two levels of the

dependent variable (successful and less successful players) differ considerably as the significance value is 0.042, and thereby it suggests that the obtained data is not found to be multivariate normal.

Table 3: Eigen Values and Wilks' Lambda

Function	Eigen Value	% of Variance	Cumulative %	Canonical Correlation	Test of Function	Wilk's Lambda	Chi-Square	df	Sig.
1	.220[a]	100.0	100.0	.424	1	.820	31.976	4	.000

Source: Primary Data.
a. First 1 canonical discriminant functions were used in the analysis.

The Eigen value of 0.220 is the proportion of variance explained by factor for the first (1) canonical discriminant function. The % of variance for the function 1 is 100%, and cumulative % of the function accounts for 100%. The correlation among players with different levels of achievement success for discriminant scores is high as the obtained canonical correlation of 0.424 ($p < 0.05$), which indicates that canonical discriminant function discriminates the two different levels of dependent variables (successful and less successful) well. To conduct a discriminant analysis that predicts membership into two groups based on the dependent variable categories (successful and less successful) and creating the discriminant equation with inclusion 4 of 16 independent variables (anthropometric and motor fitness) selected by stepwise procedure based on the minimization of Wilks' Lambda at each step with an F-to-enter of 1.15 and an F-toremove of 1.00. The observed chi-square value of 31.976 denotes that there is a significant difference among players' with different levels of achievement success based on the discriminant function.

Table 4: Analysis of Unstandardized Canonical Discriminant Function Coefficients

Constructs	Functions
Calf girth	.125
Explosive strength	.223
Speed	-2.104
Speed endurance	3.023
(Constant)	-43.504

Source: Primary Data.

Table 4 shows the list of coefficients and the constant of the discriminant equation. Each subject's discriminant score would be computed by entering their construct values for each of the 4 variables in the equation. The discriminant equation was as follows:

D = – 43.504 + 0.125 (Calf girth) + 0.231 (Explosive strength) – 2.104 (Speed) + 3.023 (Speed endurance)

Table 5: Classification Results

		Group	Predicted Group Membership Successful Less Successful		Total
			Team	Team	
Original	Count	Successful team	41	17	58
		Less Successful Team	35	72	107
	%	Successful Team	70.7	29.3	100.0
		Less Successful Team	32.7	67.3	100.0

Source: Primary Data.

Table 5 summarizes the number and percentage of players classified correctly and incorrectly as successful and less successful players. It is found that 41 of 58 players classified as successful soccer team players is correct, while 17 of them were incorrect as the analysis predicts them to be as less successful soccer team players. Furthermore, it is found that 72 of 107 players classified as less successful soccer team players were correct, but 35 of them were incorrect as the analysis predicts them to be as successful soccer team players. Thereby 68.5% of original grouped cases (players) were correctly classified.

Conclusions

The results of this study imply that football players with the potential for success can be predetermined as it is predominantly influenced by selected kinanthropometric and psychomotor variables. [3 findings with supportive evidence and explanation].

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