Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 13 Issue 11, November 2024

Predominance of Selected Kinanthropometric and Psychomotor Variables on Playing Positions of Soccer Players

Rachita Kiran
Department of Medical Electronics Engineering,
M S Ramaiah Institute of Technology, Bangalore. India

Abstract
The study was proposed to comprehend the selected kinanthropometric and psychomotor variables that contributes to the classification of soccer playing positions of players. One hundred and sixty five (165) football players from nine (9) universities, those participated in the All India Inter University football tournament held in Kottayam during the last week of December 2013, 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 on the basis of their playing positions (Forwards - 48; Midfield - 41; Defenders - 58; and Goal keepers - 18). The kinanthropometric measurements and psychomotor 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. The results show that statistically significant difference on height, agility, speed, and speed endurance among soccer players of different playing positions. Yet, discriminant equation with inclusion 7 of 16 independent variables (kinanthropometric and psychomotor) in computing the equation as: D = – 50.018 + 0.012 (Height) + 0.023 (Thigh girth) – 0.002 (Arm length) – 0.057 (Explosive strength) + 1.568 (Agility) + 0.906 (Speed) + 2.005 (Speed endurance), and consequently it imply that soccer players of different playing positions can be predetermined as it is predominantly influenced by selected kinanthropometric and psychomotor variables.

Keywords: **kinanthropometric, psychomotor, 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 (Regnier et al., 1993; Reilly et al., 2000). Burwitz et al. (1994) also recommend interdisciplinary performance-related sports science research. Successful sports performance is influenced by morphological and anthropometric characteristics, functional parameters (Scott, 1991; Singh et al., 2010) and fitness (Nikitushkin & Guba, 1998). Soccer is the most popular sport, played in many countries through 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 made it interesting to participate and witness. Excelling in team sports like soccer at elite level demands for multidimensional characteristics.

Indeed, research in male professional soccer has shown that the physical characteristics of players (Nevill, Holder, & Watts, 2009) and the fitness demands in official competition have substantially evolved over recent decades (Strudwick & Reilly, 2001). The capability of a sportsperson in a team game emanates from various kinanthropometric and psychomotor variables of the players. Contemporary science is enormously concerned in approximating the optimum anthropometric make-up of a player. So the scanning and selection of a particular player may be achieved successfully to a great extent by measuring anthropometric components. A group of all talented players is relatively homogeneous with regard to their performance level. As a consequence, measures of general performance characteristics are usually not sensitive enough to detect differences between elite and sub-elite players (Bangsbo & Lindquist, 1992). Yet, there are major individual differences in the physical demands of a player in part related to the position in the team. A number of studies have compared playing positions (Reilly & Thomas, 1979; Ekblom, 1986; Bangsbo et al., 1991; Bangsbo, 1994).

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 13 Issue 11, November 2024

Anthropometric 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, among 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). Physical fitness is the capacity of an individual to perform a given task requiring muscular force. The greater the physical fitness, the longer can a person work and the more efficient will be his performance and his capacity for recovering from fatigue (Willgoose, 1961).

It would be of interest to explore the predominant kinanthropometric and psychomotor variables that categorizes soccer playing positions of players, since there has been a very little research with regard to it. Thus, the researcher is encouraged to verify the predominance of kinanthropometric and psychomotor variables that determines the soccer playing positions of players. This study was proposed to comprehend the selected kinanthropometric and psychomotor variables that contributes to the classification of soccer playing positions of players.

METHODS AND PROCEDURES

One hundred and sixty five (165) football players from nine (9) universities, those participated in the All India Inter University football tournament held in Kottayam during the last week of December 2013, 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 on the basis of their playing positions (Forwards - 48; Midfield - 41; Defenders - 58; and Goal keepers - 18). The kinanthropometric measurements and psychomotor 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

So as to comprehend the kinanthropometric and psychomotor variables that contributes to the classification of soccer playing positions of players, discriminant analysis was appraised, and thereby unstandardized canonical discriminant function coefficients is used to derive the regression equation that classifies soccer team players to the categories namely: forwards, midfielders, defenders, and goalkeepers based on their kinanthropometric and psychomotor variables.

The data on kinanthropometric and psychomotor variables among soccer players of different playing positions is analyzed and given in Table 1.

Table 1 reveals a statistically significant difference in the level of certain kinanthropometric (height) and psychomotor (agility, speed, and speed endurance) variables among soccer players of different playing positions.

Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 13 Issue 11, November 2024

Table 1
ANOVA on Selected Anthropometric and Psychomotor Variables among different Playing Positions of Soccer Players

	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

Source: Primary Data

Table 2

Test of Equality of Group Covariance Matrices using Box's M

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					

Source: Primary Data

Table 2 reveals the test of the multivariate normality of the data. The Rank (7) of the covariance matrix indicates that this is a 7 x 7 x 7 x 7 matrix, the number of variables in the discriminant equation. The natural log of the determinant of forwards, midfielders, defenders, and goalkeepers covariance matrices is -0.348, 0.107, -0.090 and -7.410 respectively. Pooled within groups covariance matrix composed of the means of each corresponding

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 13 Issue 11, November 2024

value within the four 7 x 7 x 7 x 7 matrices of the forwards, midfielders, defenders, and goalkeepers are 0.469. The Box's M value of 218.620 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 2.341 reveals that the determinants from the two levels of the dependent variable (forwards, midfielders, defenders, and goalkeepers) differ considerably as the significance value is 0.000, and thereby it suggests that the obtained data is not found to be multivariate normal.

Table 3

Eigenvalues 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

Source: Primary Data
a. First 3 canonical discriminant functions were used in the analysis..

The Eigen value of 2.553 is the proportion of variance explained by factor for the first (1) canonical discriminant function. The % of variance for the function 1 is 93.5%, and cumulative % of the function accounts for 93.5%. The correlation among players with different levels of achievement success for discriminant scores is high as the obtained canonical correlation of 0.848 ($p < 0.05$), which indicates that canonical discriminant function discriminates the four different levels of dependent variables (forwards, midfielders, defenders, and goalkeepers) well.

To conduct a discriminant analysis that predicts membership into four groups based on the dependent variable categories (forwards, midfielders, defenders, and goalkeepers) and creating the discriminant equation with inclusion 7 of 16 independent variables (kinanthropometric and psychomotor) 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-to-remove of 1.00.

The observed chi-square value of 227.856 denotes that there is a significant difference among players of different playing positions based on the discriminant function.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 13 Issue 11, November 2024

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

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 variable values for each of the 7 variables in the equation. The discriminant equation was as follows:

$$D = -50.018 + 0.012\,(\text{Height}) + 0.023\,(\text{Thigh girth}) - 0.002\,(\text{Arm length}) - 0.057\,(\text{Explosive strength}) + 1.568\,(\text{Agility}) + 0.906\,(\text{Speed}) + 2.005\,(\text{Speed endurance})$$

The discriminant score of the data collected for soccer players of different playing positions is graphically illustrated in Figure 1 through 4.

Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 13 Issue 11, November 2024

Figure 1: Graphical Representation of Canonical Discriminant Function 1 of Forwards

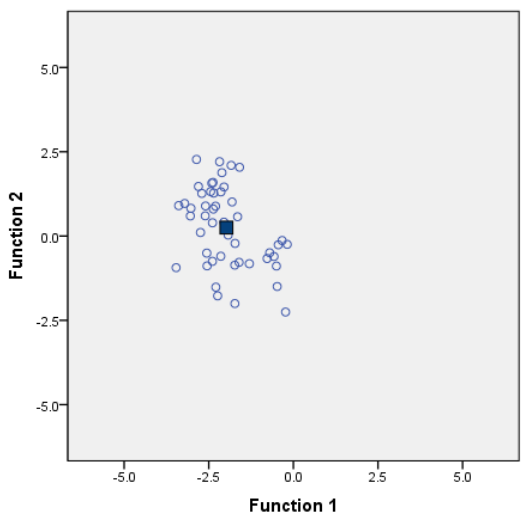


Figure 2: Graphical Representation of Canonical Discriminant Function 1 of Midfielders

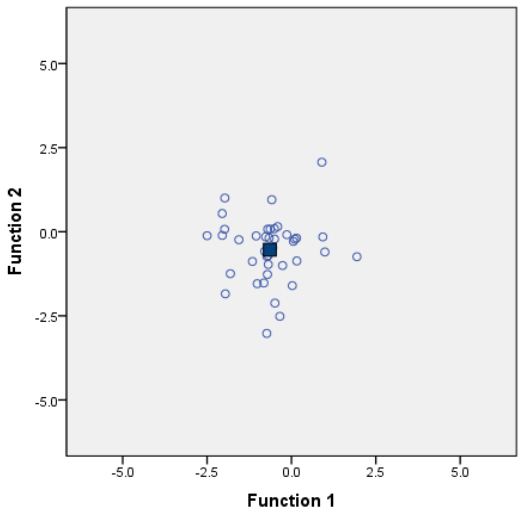


Figure 3: Graphical Representation of Canonical Discriminant Function 1 of Defenders

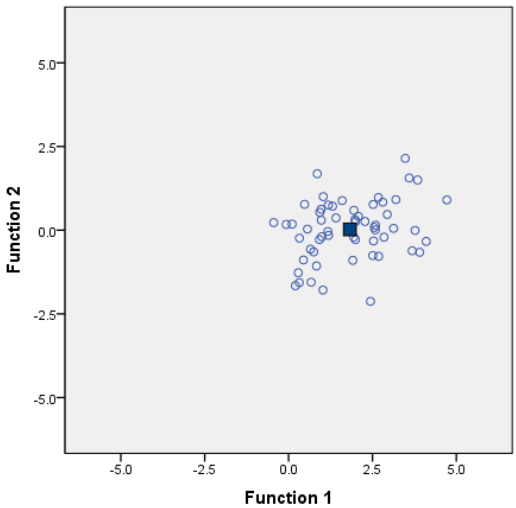
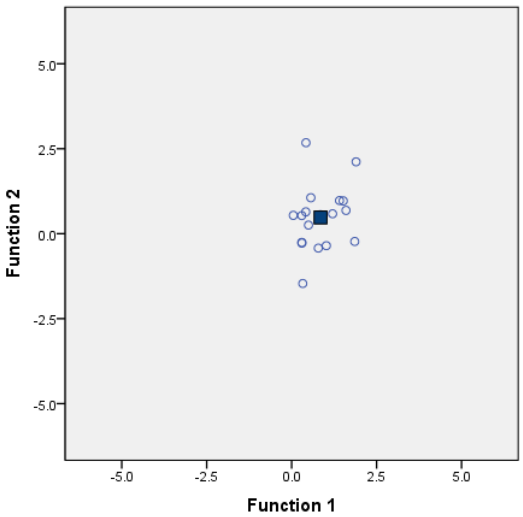


Figure 4: Graphical Representation of Canonical Discriminant Function 1 of Goalkeepers



International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 13 Issue 11, November 2024

Table 5

Classification Results

		Group	Predicted Group Membership				Total
			Forwards	Midfield	Defenders	Goalkeepers	
Original	Count	Forwards	36	12	0	0	48
		Midfield	7	30	1	3	41
		Defenders	0	6	38	14	58
		Goalkeepers	0	2	1	15	18
	%	Forwards	75.0	25.0	.0	.0	100.0
		Midfield	17.1	73.2	2.4	7.3	100.0
		Defenders	.0	10.3	65.5	24.1	100.0
		Goalkeepers	.0	11.1	5.6	83.3	100.0

Source: Primary Data
a. 72.1% of original grouped cases correctly classified.

Table 5 summarizes the number and percentage of players classified correctly and incorrectly as forwards, midfielders, defenders, and goalkeepers. It is found that 68.5% of original grouped cases (*players*) were correctly classified.

CONCLUSIONS

The results of this study imply that soccer players of different playing positions can be predetermined as it is predominantly influenced by selected kinanthropometric and psychomotor variables.

REFERENCES

1. Bangsbo, J. (1994).The physiology of soccer – with special reference to intense intermittent exercise. Acta Physiologica. Scandinavica, 151 (suppl. 619), 1-155.
2. Bangsbo, J. and Lindquist, F. (1992). Comparison of various exercise tests with endurance performance during soccer in professional players. International Journal of Sports Medicine, 13, 125-132.
3. Bangsbo, J., Norregaard, L., and Thorsoe, F. (1991). Activity profile of competition soccer. Canadian Journal of Sports Sciences 16,110-116.
4. Burwitz L., Moore P.M., Wilkinson D.M. (1994). Future directions for performance-related sports science research: An interdisciplinary approach. Journal of Sports Sciences, 12, 93-109.
5. Ekblom, B. (1986). Applied physiology of soccer. Sports Medicine, 3,50-60.
6. Mathews D.K., Close N.A. (1973). Measurements in Physical Education. 4th ed. London: W.B. Saunders Company, P.19.
7. Nevill, A., Holder, R., & Watts, A. (2009). The changing shape of "successful" professional footballers. Journal of Sports Sciences, 27, 419-426.
8. Nikitushkin V.G., Guba V.P. (1998). Methods of selection in team sports. IKAP Press: Moscow.
9. Régnier G., Salmela J.H., Russell S.J. (1993). Talent detection and development in sport. In A Handbook of Research on Sports Psychology (edited by R. Singer, M. Murphey, and L.K. Tennant), New York: Macmillan. pp. 290-313.
10. Reilly T., Williams A.M., Nevill A., Franks, A. (2000). A multidisciplinary approach to talent identification in soccer. Journal of Sports Sciences, 18, 695-702.
11. Reilly, T., and Thomas, V. (1979). Estimated energy expenditures of professional association footballers. Ergonomics 22, 541-548.
12. Scott P.A. (1991). Morphological characteristics of elite male field hockey players. J Sports Med Phys Fitness. 31(1):57-61.
13. Singh M., Singh M.K., Singh K. (2010). Anthropometric measurements, body composition and physical parameters of Indian, Pakistani and Sri Lankan field hockey players. Serbian Journal of Sports Sciences. 4(2):47-52.
14. Strudwick, T., & Reilly T. (2001). Work-rate profiles of elite premier league football players. Insight FA Coaches Association Journal, 4, 55-59.
15. Willgoose C.E. (1961). Evaluation in Health Education and Physical Education. New York: McGraw Hill Book Co. P.16.