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ANTHROPOMETRIC VARIABLES & HANDBALL PERFORMANCE

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ABSTRACT

A study on handball players was conducted to find out the effects of anthropometric variables on handball performance. The playing ability of the subjects was measured by the panel of three expert judges during inter-college competition on five point scale, on the basis of their all round performance. Independent anthropometric variables were age, height, weight, shoulder width, biacromion width, arm length, upper arm length, fore arm length, leg length, calf circumference, sitting height, supra iliac skin fold, thigh skin fold, sub-scapular skin fold, calf skin fold, bicep skin fold an tricep skin fold. Correlation and stepwise regression statistical procedure was applied to identify the effect of anthropometric variables on handball performance. Out of seventeen anthropometric variables fourteen variables had significant relationship with playing ability in handball, as per as combined contribution of anthropometric variables towards playing ability is concerned, only six anthropometric variables were found significant in the final equation of step-wise regression.

Keywords: Anthropometric,Handball and Competition.

INTRODUCTION:

Carter (1982) has revealed that in general, people with long legs and long arms and with relatively short and small trunks, were physically weak types in long-sustained heavy work, but they might show more endurance and speed in athletic activities. Long third class levers were noted for speed and range of action as well as for their efficiency for force. Jenson and Fisher (1997) have mentioned that "activity science" is a science, which deals with a complex analysis of various facets of human activities affecting the human organism physically, mentally and socially. Understanding of physical characteristics and the dynamics of motor fitness are becoming increasingly important to the physical educators and coaches with an increased scientific knowledge of sports. The trail and error methods, and application of guessing, become less than adequate in preparing sportsmen for top level competitions. Digiovanna (1943) investigated the relation of selected structural and functional measures to success in each of several sports. It is found that factor of body explosive power was associated with athletic success. It also indicated that these factors were of varying importance to performance ability in different sports.

After studying the physique and body composition of Olympic track and field athlete at Rome Olympic during 1960 Tanner inferred that the athlete were both born and made. The basic structure he stated must be present for the possibility of being an athlete to arise. Various other studies also suggested that different body size, shape and proportions are beneficial in different physical activities (Bran well and Ellies 1931; Krakower 1935; Cureton 1933, 1941, 1951; Kroll1954; Dupertis 1965; Hirata 1966; Malhotra et, al 1972; Kansal et. Al 1986; Sidhu et. Al 1996; Singh 2001; Kanupriya et. Al 2007).

Selection of Subjects:

A purposive sampling device was used to select the subjects for the study. The players in the teams securing first three places in inter college competitions of Panjab University Chandigarh, Punjabi University Patiala and Guru Nanak Dev University Amritsar during the year 1998 were considered. There were one hundred eight players in nine teams. In addition to these players outstanding players from other teams selected for inter-university competition by these universities were also considered as subjects.

Collection of Data:

Tools used for the collection of data:

Playing Ability: The playing ability of the subjects was measured by the panel of three expert judges during inter-college competition on five point scale, on the basis of their all round performance. The average of three judges was considered as final score.

Anthropometric measurements: The following anthropometric measurement was obtained by using appropriate methods and instruments i.e. age, height, weight, shoulder width, biacromion width, arm length, upper arm length, fore arm length, leg length, calf circumference, sitting height, supra iliac skin fold, thigh skin fold, sub-scapular skin fold, calf skin fold, bicep skin fold an tricep skin fold.

Statistical Procedure:

Stepwise regression statistical procedure was applied to identify the anthropometric variables which determine the playing ability of handball players. The results of the regression analysis were used to draw out the equations of the anthropometric variables. In table -1, descriptive analysis of different anthropometric parameters has been presented. Relationship of handball playing ability with each of anthropometric parameters in the form of Pearson’s Product Moment Coefficient of Correlation and the contribution of different anthropometric parameters towards playing ability of handball players in the form of step wise regression have also been discussed in this section.

The mean values, standard deviations and coefficients of variation of anthropometric variables have been presented in Table 4.1. It showed that age had mean 22.18, standard deviation 1.96 and coefficient of variation 8.84. Height had mean 174.31, standard deviation 5.07 and coefficient of variation 2.91. Weight had mean 65.85, standard deviation 7.10 and coefficient of variation 10.78. Shoulder width had mean 79.13, standard deviation 5.71 and coefficient of variation 7.22. Biocromion width had mean 45.08, standard deviation 3.32 and coefficient of variation 5.15. Arm length had mean 79.10, standard variations 3.43 and coefficient of variation 4.33. Upper arm length had mean 36.33, standard deviation 1.70 and coefficient of variation 4.68. Fore-arm length had mean 28.54, standard deviation 1.71 and coefficient of variation 5.99. Leg length had mean 87.24, standard deviation 3.85 and coefficient of variation 4.42. Calf circumference had mean 34.01, standard deviation 2.20 and coefficient of variation 6.47. Sitting height had mean 87.08, standard deviation 2.96 and coefficient of variation 3.40. Supra-iliac skin fold had mean 10.97, standard deviation 5.18 and coefficient of variation 47.22. Thigh skin fold had mean 8.59, standard deviation 2.96 and coefficient of variation 34.46. Sub-scapular skin fold had mean 7.27, standard deviation 2.43 and coefficient of variation 33.43. Calf skin fold had mean 7.23, standard deviation 2.55 and coefficient of variation 35.27. Bicep skin fold had mean 2.55, standard deviation 0.84 and coefficient of variation 32.94 and tricep skin fold had mean 4.03, standard deviation 1.28 and coefficient of variation 31.76.

It is, therefore, evident that the variation in age, height, weight, shoulder width, biacromion width, arm length, upper arm length, forearm length, leg length, calf circumference and sitting height ranged between 2.91 to 10.71 percent according to the values of coefficients of variation. This variation was insignificant while the variation that various skin fold variables had more than 30 per cent, was significant. This level of variation might have its impact on playing ability.

Relationship of Anthropometric Variables with Handball Playing Ability of Handball Players:

The relationship between anthropometric variables and playing ability of handball players was worked out in terms of Pearson's Product Moment correlation coefficient and the same has been presented in Table 2.

The Table showed that playing ability in handball was positively and significantly related to some of the anthropometric variables such as age (r=.287), height (r=.674), biacromion width (r=.358), arm length (r=.547), upper arm length(r=.494), leg length (r=.450), calf circumference (r=.480), sitting height (r=.578), thigh skin fold (r=.491), sub scapular skin fold (r=.280), Calf skin fold (r=.497), bicep skin fold (r=.282), tricep skin fold (r=.616) at one per cent level of confidence. Supra-iliac skin fold was significant (r=.199) at five per cent level of confidence while weight (r=.128), shoulder width (r=.093), forearm length (r=.117) were not significant variables.

It is, therefore, evident that age, height, biacromion width, arm length, upper arm length, leg length, calf circumference, sitting height and supra-iliac skin fold, thigh skin folds, sub-scapular skin fold, calf skin fold, bicep and tricep skin fold were essential parameters for the performance in handball. Table mentioned above showed that weight, shoulder width and fore arm length did not contribute to handball playing ability.

Contribution of Anthropometric Variables to Handball Playing Ability

In order to identify the anthropometric parameters determining playing ability of handball players, step-wise multiple regression analysis was done and ultimately best-fit equation was arrived at and the same is presented in Table 3. Logically, there were two types of combinations of anthropometric parameters. First of all, all the 17 parameters were tried, but there was a problem of multicollinearity of height with sitting height and leg length as height is the sum total of sitting height and leg length. These three variables cancelled the effect of each other in the final equation in this trial. In order to overcome this problem, two different sets of parameters were tried. First set included sixteen variables including sitting height and leg length and excluding height. The final equation came out to be the same as was found in case of first trial when all the seventeen parameters were tried. Therefore, another set of parameters including fifteen parameters was tried which included height and excluded sitting height and leg length. Now height itself came to be a significant contributor towards playing ability and R^2 also improved slightly. Therefore, the final equation of the 2nd set was chosen for the study.

The results of the combined contribution of anthropometrical variables, through the application of multiple regressions, have been presented in Table 3. It was observed that height had .036 regression coefficient and 18.88% contribution towards R^2 which was significant at <.05 level, calf circumference had .100 regression coefficient and 16.14% contribution towards variance which was significant at < .01 level, supra-iliac skin fold had .046 regression coefficient and 7.18% contribution towards variance which was significant at <.01 level and thigh skin fold had -.094 regression coefficient and 20.60% contribution towards variance which was significant at <.01 level. Bicep skin fold showed -.311 regression coefficient and 11.06% contribution towards variance which was significant <.01 level. The last anthropometric variable for the prediction of handball playing ability was tricep skin fold, which had -.218 regression coefficient and maximum contribution towards variance was 26.14% which was significant at <.01 level.

The combined contribution of all the anthropometric variables in the preliminary multiple regression was found 72.24 per cent of variation in the playing ability of handball players, while variables included in the final run equation, namely height, calf circumference, supra-iliac skin fold, thigh skin fold, bicep skin fold and tricep skin fold explained as high as 69.45 per cent of variation in the playing ability of handball players. This showed that nine variables other than mentioned above secured a negligible share to the tune of only 2.79 per cent of the variation. This revealed that five variables included in the final run equation were very powerful in predicting the playing ability of handball players.

The regression coefficient of height was positively significant which indicated an increase of .036 score in playing ability with an increase of one centimetre in height. The regression coefficient of calf circumference (.100) came to be positively significant which indicated that an increase of one centimetre in the existing average calf circumference of the players in the sample of the study i.e. 34.01 cm. would lead to an increase of .100 score in the playing ability of the players. The regression coefficient of supra-iliac skin fold (.046) highlighted that the performance of the handball players would be better by .046 score if an increase of one mm. in the supra-iliac skin fold would occur. This showed that existing supra-iliac skin fold still have increasing returns towards playing ability.

The trends in the case of thigh, biceps skin fold and triceps skin fold were found to be inverse. An increase of one mm. each in these parameters would contribute respective decline of .094, .311, and .218 score towards playing ability of the handball players.

Therefore, the indication of the analysis is that all the skin fold except supra-iliac skin fold needs to be controlled while height, calf circumference and supra-iliac skin fold still have their role to play towards growth of playing ability of handball players.

The equation is as under:

$$Y = -4.22+.036x_3+.100x_{11}+.46x_{13}-.094x_{14}-.311x_{17}-.218x_{18}$$

X_3 = Height

X_{11} = Calf circumference

X_{13} = Supra-iliac skin fold

X_{14} = Thigh skin fold

X_{17} = Bicep skin fold

X_{18} = Triceps skin fold

Discussion

The descriptive statistical analysis of the data as presented in Table 2 revealed that the handball playing ability of total sample of male handball players of the Punjab University, Chandigarh, Guru Nanak Dev, University, Amritsar and Punjabi University, Patiala were significantly related to the age, height, biacromion width, arm length, upper arm length, leg length, calf circumference, sitting height, supra-iliac skin fold, thigh skin fold, sub scapular skin fold, calf skin fold, bicep skin fold and tricep skin fold. Out of 17, only three anthropometrical variables weight, shoulder width and fore arm length were not significantly related to the playing ability in handball.

Table 3 showed that out of seventeen anthropometric variables only six variables were in the final equation of the step-wise regression analysis. The R^2 of the first equation was .7224 and in the final equation it was .6945 which included six significant variables i.e. height, calf circumference, supra-iliac skin fold, thigh skin fold, biceps skin fold and triceps skin fold. The remaining eleven anthropometric variables had share of R^2 .0279.

Out of seventeen anthropometric variables fourteen variables had significant relationship with playing ability in handball, as per as combined contribution of anthropometric variables towards playing ability is concerned, only six anthropometric variables were found significant in the final equation of step-wise regression. The regression equation predicting the performance of handball players indicated that regression coefficient of all six variables were significant at 0.01 level except the height which came to be significant at 0.05 level.

Height of the player had positive and highly significant correlation (.674) with playing ability amongst anthropometric variables. It showed that taller player could perform better in the game of handball. Taller players can receive the ball, pass the ball, and throw the ball in goals better than the shorter players. The pivot player must be tall to perform better in this game. PRE et. al. (1954) found that the throwers were beneficial with taller height. Kansal et. Al (1980) conducted a study on the physique of the soccer players. He also concluded that the defensive players were significantly taller and heavier and the forward line players have slightly less body fat and more of lean body mass. The calf circumference reflects well-developed gestrocenimius muscles of the foreleg, which are responsible for powerful planter flexion of the ankle joint, and results in faster acceleration and makes largest contribution to the performance of handball players. Eiban (1984) investigated that women sprinter had well developed muscle of the lower leg.

Supra-iliac skin fold variables had positive relationship with handball playing ability ($p<0.05$). It indicated that those handball players who have more adipose tissues around the supra iliac have better playing ability. But thigh skin fold, sub-scapular skin fold, calf skin fold, bicep skin fold and tricep skin fold had the negatively significant correlation at <0.01 per cent level. The handball players who have less adipose tissues at above mentioned skin fold are better playing ability.

Table 4.1

Mean values of anthropometric parameters

S.No.	Parameters	Mean	S.D.	C.V.%
2.	Age (years)	22.18	1.96	8.84
3.	Height (cm.)	174.31	5.07	2.91
4.	Weight (kg.)	65.85	7.10	10.78
5	Shoulder width (mm.)	79.13	5.71	7.22
6	Biacromion width (mm.)	45.08	2.32	5.15
7	Arm Length (cm.)	79.10	3.43	4.33
8	Upper arm length (cm.)	36.33	1.70	4.68
9	Fore arm length (cm)	28.54	1.71	5.99
10	Leg length (cm.)	87.24	3.85	4.42
11.	Calf circumference (cm.)	34.01	2.20	6.47
12.	Sitting height (cm.)	87.08	2.96	3.40
13.	Supra-iliac skin fold (mm)	10.97	5.18	47.10
14.	Thigh skin fold (mm.)	8.59	2.96	34.46
15.	Sub-scapular skin fold (mm.)	7.27	2.43	33.43
16	Calf skin fold (mm.)	7.23	2.55	35.27
17	Bicep skin fold (mm.)	2.55	0.84	32.94
18	Tricep skin fold (mm.)	4.03	1.28	31.76

Table 4.2

Correlation matrix between playing ability and anthropometric variables

S.No	Variables	Correlation	Level of Significant

2	Age	.287	<.01
3	Height (cm.)	.674	<.01
4	Weight (kg.)	.128	N.S.
5	Shoulder width (mm.)	.093	N.S.
6	Biacromion width (mm.)	.358	<.01
7	Arm Length (cm.)	.547	<.01
8	Upper arm length (cm.)	.494	<.01
9	Fore arm length (cm)	.117	N.S.
10	Leg length (cm.)	.450	<.01
11	Calf circumference (cm.)	.480	<.01
12	Sitting height (cm.)	.578	<.01
13	Supra-iliac skin fold (mm.)	.199	<.05
14	Thigh skin fold (mm.)	.491	>.01
15	Sub-scapular skin fold (mm.)	.280	<.01
16	Calf skin fold (mm.)	.497	<.01
17	Bicep skin fold (mm.)	.282	<.01
18	Tricep skin fold (mm.)	.616	<.01

Table 3

Effect of anthropometric parameters on playing ability

S.No.	Variables	Regression Coefficient	R^2 value	Contribution towards R^2	Level of significance	%Contribution towards R^2
3	Height	.036	.6945	13.11	<.05	18.88
11	Calf circumference	.100		11.21	<.01	16.14
13	supra-iliac SF	.046		4.99	<.01	7.18
14	Thigh SkinFold	-.094		14.31	<.01	20.60
17	Bicep Skinfold	-.311		7.68	<.01	11.06
18	Tricep Skinfold	-.218		18.15	<.01	26.14

(a) Intercept (a) -4.22 N.S.

R^2 = .6945 F ratio = 36.00 Level of significance = <.01

Difference in R^2 of first and final equation = .7224-.6945= .0279

The equation is under:

$Y = -4.22+.036x_3+.100x_{11}+.046x_{13}-.094x_{14}-.311x_{17}-.218x_{18}$

Where Y = Playing ability

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