Research Paper Physical Education

Motor Fitness Components and Anthropometric Measurements as a Predictior of Handball Players Skill Efficiency

* Dr. Kuldeep Singh

* Assistant Professor in Physical Education, V.V. (Post-Graduate) College, Shamli (U.P.)

ABSTRACT

The aim of this study was to correlate anthropometric dimensions and motor fitness components with skill efficiency and also to develop the regression equation for the prediction of skill efficiency. The research was conducted on Inter-University level 200 male handball players of age range from 18-25 years. Twenty one anthropometric measurements and seven motor fitness components were taken as independent variables and one skill efficiency test as dependent variables was evaluated of each subject. SPSS (11.6) computer software was used to analyze the data and it revealed that the body weight, standing height, sitting height, total arm length, leg length, hand length and hand breadth; body diameter measurements i.e., elbow and shoulder; skin-fold measurements, i.e., triceps and sub-scapular; body composition variables i.e., lean body mass and motor fitness components i.e., speed, agility, arm and leg strength were having significant relationship with skill efficiency test. The multiple correlation of seven variables taken together with skill efficiency has been found highly significant and hence the developed equation can be used in the prediction of skill efficiency.

Keywords : Motor fitness, Anthropometric measurements, Skill efficiency and Prediction.

INTRODUCTION

Handball is a very strenuous body-contact team sport that places heavy emphasis on running, jumping, passing, throwing and requires substantial strength levels to hit, block, push and hold during game actions. From this, it may be hypothesized that high levels of strength and muscular power, agility and speed are important for successful participation in elite levels of handball games. Handball is very popular and known as a speedy and skillful game. Maximum players have less body fat, narrower hips, thicker thighs, longer legs and lighter calves. From a biomechanical perspective such anthropometric variables allow for more efficient running and jumping. Many researchers i.e. Visnapuu et.al. (2007) reported that the specific hand anthropometric parameters, finger lengths and perimeters of the hand significantly correlated with the maximal handgrip strength. It,s control is necessary for the accuracy of different shots, in handball and basketball. Gopinathan and Helina (2009) determined the relationship of anthropometric and physical fitness variables with handball performance. They revealed that the anthropometric variables of height, weight, arm length, leg length, palm span and sum of four skin-folds and physical fitness variables of speed, agility, explosive power, shoulder strength, strength endurance were having significant relationship with handball performance and only flexibility was not having significant relationship with handball performance. So, the physical activities are performed by the body as a whole, but specific activities require specific body structure, fitness to perform the activity. Various studies conducted by a number of scientists have shown significant correlations between specific sports skills and anthropometric variables; and performance of basic motor skills and physical fitness of players Diez(1978), Shoundell(1968), Rodriguez (2004), Chauhan(1988,2003 & 2009) and Hooda(2008), etc.

METHODOLOGY

Two hundred male Handball players who participated in the All India (North-East) Zone Inter-University tournament between the age group of 18 to 25 years, in the sessions 2007-08, 2009-10 & 2010-11 constituted the subjects of the study. The data of the subjects were collected by using the anthropometric rod; vernier calipers, steel tape and skin-fold calipers, according to the instructions given by Weiner and Lourie (1969). Body composition variables i.e., body density, fat percentage; fat weight and lean body mass were collected by using Durnin and Rehaman's Equation (1967) and Siri's Equation (1961) respectively, variables for strength measurements; Arm Strength (6Lbs Medicine ball Put), Speed (50 yards Dash Run), Endurance (600Yards run and walk), Flexibility (Bent and Reach), Agility (Shuttle Run), Leg Strength (Standing broad jump) and Balance (Stork Stand Test) were used. The dependent variable i.e., ball controlling and passing skill efficiency was measured by Dominant hand speed pass of I.L.Zinn Team Handball Skill Battery (1981). In it the Subject stands behind the restraining line. Upon the signal "begin" the subject using the dominant hand to bounce a ball against the wall as rapidly as possible, catch the return bounce, and repeats until 10 bounces have hit the wall. All bounces must come from behind the restraining line and the subject must catch all passes with both hands, a stop watch is started as soon as the ball first contacts the wall and is stopped when the ball hit the wall on the 10th bounce. Two trials are given. Time for the better of two timed trials is the final score. Time is recorded to the nearest 1/10 of a second. SPSS (11.5) computer software was used for statistical analysis (Mean, S.D., Person Product movement method for correlation, multiple correlation, regression equation).

RESULTS & DISCUSSION

Table-1: Correlation of weight, linear and body diameter measurements to skill efficiency.

Sr. No.	Variables correlated with skill efficiency	Mean	Std. Deviation	Co-efficient of correlation 'r'
	Skill Efficiency	11.71	2.13	
1	Body Weight	67.51	6.31	-.579**
2	Height	176.13	5.72	-.664**
3	Sitting Height	87.86	4.35	-.645**
4	Total Arm Length	78.21	3.43	-.597**
5	Leg Length	93.37	5.09	-.654**
6	Hand Length	19.12	0.76	-.461**
7	Hand Breadth	8.63	0.44	-.380**
8	Elbow Diameter	6.66	0.25	-.617**
9	Shoulder Diameter	41.54	1.86	-.448**
10	Knee Diameter	9.18	0.52	-.030

****Significant at .01 level of confidence = .181 N= 200**
*** Significant at .05 level of confidence = .138 df= 198**

Table-1 clearly shows that the correlations of body weight, height, sitting height, total arm length, leg length, hand length, hand breadth, Elbow Diameter and Shoulder Diameter were inverse and significant at .01 level of confidence, whereas Knee Diameter had inverse and insignificant correlations with skill efficiency. Since time is inversely related to performance hence decrease in time indicates higher the performance. Due to this, skill efficiency correlation had inverse correlations with other variables. It suggests that optimum weight of player helps both offensive and defensive movements. Longer strides are possible with longer leg length and it will be helpful to run fast, arms length also helpful to the players in catching, passing, shooting and to do defensive and offensive actions besides the opponent's hindrance. Length and breadth of hands is useful to hold the ball firmly without slipping and jerking while executing passing and shooting. These variables also form the good leverage system and good range of movements of force in the body. The current evidence is very well supported by the studies of Gopinathan and Helina (2009) on Handball players., Hooda, B.S.(2008) on Indian Junior Male Basketball Players and Singh, K. & Chauhan (2010) on Basketball players.

Table-2 indicates that the correlations of triceps, subscapular, sum of four skin-folds and lean body mass were inverse and significant at .01 level of confidence and thigh skin-fold and fat weight had inverse and significant correlation at .05 level of confidence whereas others had insignificant correlations with skill efficiency. Since time is inversely related to performance hence decrease in time indicates higher the performance. It implies that amount of these variables are optimum and suit to develop the players skill performance. This occurs due to regular participation in the physical activity programme that consumes excess calories of energy. Hence no accumulation of excess fat and makes the body fit for efficient functioning during the execution of skill. Similar findings were reported by Rodriguez-Vicente, G. et al. (2004) on handball players, and Shondell (1972) on Volleyball players.

Table-2: Correlation of skin-fold and body composition variables to skill efficiency.

Sr. No.	Variables correlated with skill efficiency	Mean	Std. Deviation	Co-efficient of Correlation 'r'
11	Skill Efficiency	11.71	2.13	-.133
	Biceps	2.99	0.94	
12	Triceps	6.29	2.72	-.277**
13	Sub-scapular	8.83	2.52	-.341**
14	Superailliac	6.91	2.88	-.041
15	Thigh	8.12	3.31	-.139*
16	Calf	9.09	3.43	-.339
17	Sum of four Skinfolds	17.39	8.88	-.309**
18	Body Density	1.06	0.01	-.086
19	Fat Percentage	16.51	4.52	.111
20	Fat Weight	11.10	3.12	-.149*
21	Lean Body Mass	56.40	6.41	-.602**

It is observed from the table- 3 that speed, agility, arm and leg strength had significant correlations at .01 level of confidence with skill efficiency of handball players. The results reveal that for successful performance, agility and speed facilitate rapid changes in direction, sudden stops, bends, twist, falls and dives, whereas explosive arms and legs strength help the players to perform a successful throw on goal and throw the ball from longer distance with high speed at the time of initiating the fast break. Similar findings were reported by Chauhan, M.S. (1988) on college women Shot putters, Tanner, (1964) on Olympic Athletes and Diez, (1978) on Intercollegiate Women Athletes of Illinois University.

Table-3: Correlation of motor fitness components to skill efficiency.

Sr. No.	Variables correlated with skill efficiency	Mean	Std. Deviation	Co-efficient of Correlation 'r'
22	Skill Efficiency	11.71	2.13	.443**
	Speed	6.99	.47	
23	Arm Strength	870.80	28.92	-.614**
24	Endurance	220.98	19.90	-.068
25	Flexibility	15.55	3.65	.137
26	Agility	10.55	.62	.255**
27	Leg Strength	202.91	24.17	-.547**
28	Static Balance	25.99	7.55	.065

Table- 4: Multiple correlation and regression equation of selected anthropometric variables and motor fitness components to skill efficiency. (N=200, M=7)

Dependent Variable (Yc)	Selected Independent Variables (X's)	Regression Co-efficient (Bx)	Multiple Correlation (R)	Determinant of Multiple Correlation (R^2)	Percentage of each Variables
Skill efficiency (ball controlling and passing)	1.Speed	1.21	.854	.730	11.78
	2.Arm Strength	-.011			9.17
	3.Sitting Height	-.123			16.20
	4.TotalArm Length	-.093			8.93
	5.Elbow Diameter	-1.79			13.03
	6.Sub-scapular Skin-fold	-.096			3.87
	7.Lean Body Mass	-.054			9.78

Beta Constant (Bo) =12.469
S.E. of Estimate = 3.755

Pcx = (Beta Weight) x (r) x (100), Where: Beta Weight = Bx . SD of X / SD of Yc and r = Coefficient of correlation between X and Yc.

**Significant at .01 level of significance = .307 (Here: N= 200, df = 200-8=192)

Table-4 shows that multiple correlation (R=0.854) of speed, arm strength, sitting height, total arm length, elbow diameter, sub-scapular skin-fold and lean body mass with skill efficiency was significant at .01 level of confidence. It shows that the combined effect of these variables taken together contribute to improve the skill efficiency. The multiple correlation was of sufficient size and hence these variables could be put in to the regression prediction equation.

Table- 4 further illustrates that the multiple regression analysis performed to develop equation for the prediction of skill efficiency on the basis of X_{22}, X_{23}, X_3, X_4, X_8, X_{13} and X_{21} anthropometric, body composition and motor fitness variables. Resulted multiple regression equation in scores from is:

$$Y_c = B_o + B_1.X_{22} + B_2.X_{23} + B_3.X_3 + B_4.X_4 + B_5.X_8 + B_6.X_{13} + B_7.X_{21}$$

$$Y_c = .24 + 1.21.X_{22} + (-.011).X_{23} + (-.123).X_3 + (-.093).X_4 + (-1.79).X_8 + (-.096).X_{13} + (-.054).X_{21.}$$

Where Y_c = predicted skill efficiency.

X_{22} = Speed
X_{23} = Arm Strength
X_3 = Sitting Height
X_4 = Total Arm Length
X_8 = Elbow Diameter
X_{13} = Sub-scapular skin Fold
X_{21} = Lean body mass
R^2 = can be broken up as.

$R^2 = 73.00 = 11.78 + 9.17 + 16.20 + 8.93 + 13.03 + 3.87 + 9.78.$

Moreover, the value of multiple coefficient of determinant (R^2=

.7300) suggests that 73.00 percent of variance of skill efficiency could be predicted on the basis of regression equation developed by these seven variables. The remaining variance of skill efficiency scores 27.00 percent are due to other factors. Hence, the developed regression equation could be put into the prediction of skill efficiency.

Contribution of speed, arm strength, sitting height, total arm length, elbow diameter, sub-scapular skin-fold and lean body mass individually towards multiple coefficients of determination (R^2) are 11.78, 9.17, 16.20, 8.93, 13.03, 3.87 and 9.78 percent, respectively.

Similar findings were reported by Chauhan (2003) on sprinters of Haryana school boys, Singh, K. (2010) on Basketball players. and Mohan & Sharma (2009) on College Level Volleyball players of Himachal Pradesh.

CONCLUSION

(i) The weight and linear measurements, i.e., body weight, standing height, total arm length, leg length, hand length and hand breadth; body diameter, i.e., elbow and shoulder diameters; skin-fold measurements, i.e., triceps, sub-scapular, thigh and sum of four skin-folds; body composition variables i.e., lean body mass and fat weight and motor fitness components i.e., speed, agility, arm and leg strength have significant correlations with skill efficiency.

(ii) The multiple correlation (R=.854) of speed, arm strength, sitting height, total arm length, elbow diameter, sub-scapular skin-fold and lean body mass with skill efficiency of handball players. Moreover, the value of multiple coefficient of determinant (R^2= .7300) suggests that 73.00 percent of variance of ball controlling and passing speed ability skill of Handball players can be predicted on the basis of regression equation developed by these seven variables.

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