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Study of Selected Anthropometric Variables and Strength Measures to Wall Spike Skill Efficiency of Volleyball Players

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ABSTRACT

The present study was conducted on volleyball players to explore the possible ingredients of anthropometric variables and strength measures which are essential for execution of wall spike skill in volleyball game. To achieve the desired objective of this study, two hundred ten (North- East Zone) Inter- university (men) volleyball players were selected with age range from 18 to 27 years as subjects. Twenty anthropometric measurements, two strength measures were taken as independent variables and one Helman volleyball test bettery i.e., wall spike skill was taken as dependent variable of each subject. SPSS (11.5) computer software was used to analyze the data. Body weight and linear measurements, i.e., height, trunk length, upper arm length, lower leg length; body girth measurements i.e., shoulder and chest; body diameter measurements i.e., wrist, shoulder and knee; body composition variables. i.e., body density and lean body mass and arm and leg strength measure have positive and highly significant correlation with wall spike skill efficiency. The size of the multiple correlation is sufficiently large and hence regression equation developed is useful for the prediction of the wall spike skill efficiency.

KEYWORDS: Anthropometry, wall spike skill, strength measures and volleyball players

Introduction

Volleyball, which is an excellent all-around team sports, has been widely accepted as a highly competitive as well as recreational game all over the world. The reason lies in the fact that it is not difficult for a beginner to analyze the fundamental or to learn basic skills. Now, it is a game of power and tactics and is played at a faster pace and this calls sharper thinking, high standard of skills and technical application. There are very fast action and accuracy in performance to technique, and tactics, which are the demand of present game. Volleyball game may be characterized as an integrated playing action of six main skills, serve, serve-reception, set, spike, block and dig. Volleyball is game of skill and strategies. One skill is the wall spike ability to smash the ball in the desired direction, with the explosive strength and high speed.

The sports performance or any other type of human performance is not a product of one single system or aspect of human personality. On the contrary, it is the product of the total personality of the sports person. **(Tandon, 2001). De Garay(1974)** after an intensive study on anthropometric measurements of Olympic Athletes concluded that top level performance in particular event demands particular size of the body and shape, other aspects being similar. They established strong relationship between the structure of an athlete and specific task. ***Rivet(1978)*** analyzed that jumping is very significant factor in volleyball performance. He has to use his maximum power during spiking to meet the ball at highest point in order to score. Even during block jumps, the player had to jump at his maximum for a number of times to block a spiked ball. **Lamp(1954)** demonstrated positive correlations of age, weight and strength with volleyball playing ability of Junior High School boys and girls.

Various studies conducted by a number of scientists have shown significant correlations between specific sports skills and anthropometric variables and strength measures. **Tanner(1964), Gopinathan(2009), Singh(2010), Chauhan(1988, 2004, 2010), Hooda(2008) and Mohan(2009) etc.**

Methodology

Two hundred ten (North-East Zone) Inter-University men volleyball players in the age group of 18-27 years for the session 2009-10, 2010-11 and 2011-12 constituted the subjects of the study. The data of the subjects was collected 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 were collected by using **Durnin and Rehaman's Equation(1967)** and **Siri's Equation(1961)** respectively, variables for strength measurements i.e., arm strength (6Lbs Medicine ball Put), and Leg strength (vertical jump) were used. The dependent variable i.e., wall spike skill was measured by wall spike skill test of **Helman volleyball test battery(1971-73)**. To evaluate the Mean, S.D., Person Product movement method for correlation, multiple correlation, regression equation **SPSS(11.5)** computer software were used.

Results and discussion

Table -1: Correlations of linear, body diameter and girth measurements to wall spike skill efficiency of volleyball players. (N=210)

Sr. No.	Variables correlated with wall spike skill efficiency	Mean	Std. Deviation	Co-efficient of correlation 'r'
1	Wall spike skill efficiency	40.995	1.996	.506**
	Standing Height	185.184	5.554	
2	Trunk Length	59.298	3.115	.409**
3	Upper Arm Length	34.757	2.013	.398**
4	Fore Arm Length	30.084	1.604	.170*
5	Thigh Length	8.726	1.234	-.038
6	Lower Leg Length	99.693	4.674	.586**
7	Shoulder Girth	115.638	3.907	.568**
8	Chest Girth	91.729	9.093	.292**
9	Thigh Girth	55.419	7.184	.142*
10	Wrist Diameter	5.865	0.323	.245**
11	Shoulder Diameter	39.861	3.587	.516**
12	Knee Diameter	9.253	0.749	.299**

**Significant at .01 level of significance = .181
N = 210

* Significant at .05 level of significance = .138
df = 208

Table -2: Correlations of skin-fold measurements and body composition variables to wall spike skill efficiency of volleyball players.(N=210)

Sr. No.	Variables correlated with wall spike skill efficiency	Mean	Std. Deviation	Co-efficient of Correlation 'r'
13	Wall spike skill efficiency	40.995	1.996	-.357**
	Biceps	38.937	13.697	
14	Triceps	55.095	15.138	-.192**

15	Sub-scapular	93.043	35.461	-.092
16	Supra iliac	64.37	23.192	-.161*
17	Body Density	1.063	0.012	.191**
18	Fat Percentage	14.923	3.863	-.229**
19	Fat Weight	10.739	3.202	-.025
20	Lean Body Mass	61.243	5.223	.705**

Table -3: Correlations of strength measures components to wall spike skill efficiency of volleyball players.

Sr. No.	Variables correlated with wall spike skill efficiency	Mean	Std. Deviation	Co-efficient of Correlation 'r'
21	Wall spike skill efficiency	40.995	1.996	.530 **
	Explosive arm strength	12.544	0.959	
22	Explosive leg strength	57.843	6.604	.557**

It is evident from table-1 that the correlations of linear measurements i.e. height, trunk length, upper arm length, lower leg length, body girth measurements i.e., shoulder and chest girth and body diameter measurements i.e. wrist, shoulder and knee were found positive and significant at .01 level of confidence whereas correlation of fore arm length and thigh girth were found significant at .05 level of confidence only thigh length was negative correlations with wall spike skill efficiency. It suggests that these body linear measurements form good leverage system and body diameters provide good range of movements of force in the body for the execution of wall spike skill. It also shows that muscles of shoulder, chest and thigh circumferences are developed optimally for better strength through vigorous training schedule and hence suit to improve the this skill. The current evidence is very well supported by the studies of Gopinathan(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 biceps, triceps, thigh skinfolds and fat percentage were found negative and significant at .01 level, whereas supra iliac demonstrated negative and significant correlation at .05 level and among body composition variables body density and lean body mass were positive and significant correlation at .01 level of confidence with wall spike skill efficiency. The inverse relation with skill suggests that the development of subcutaneous thickness of these skin-folds contribute to improve the wall spike skill efficiency. It also implies that the lean body mass and body density are important ingredients for the wall spike skill efficiency. This occurs due to regular participation in the physical activities that consumes excess calories of energy. Similar findings were reported by Chauhan, M.S.(1988) on college women Shot putters, Hooda, B.S.(2008) on Basketball Players and De Garay.(1974) on Olympic Athletes.

It is observed from the **table- 3** that explosive arm and leg strength had significant and positive correlations at .01 level of confidence with wall spike skill efficiency. Which indicates that power to strike the ball and helps to elevate the player body to perform successful smash on specific target requires arm and leg strength. Similar findings were reported by Chauhan, M.S.(2004) on University Throwers, Tanner. (1964) on Olympic Athletes, Singh, K.(2011) on basketball players, and Lamp(1954) on Junior High School boys and girls of volleyball.

Table -4: Multiple correlation and regression equation of selected anthropometric variables and strength measures components to wall spike skill efficiency of volleyball players. (N=210)

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
Wall spike skill efficiency of volleyball players	1.Arm Strength	.631	.841**	.707	16.12
	2.Leg Strength	.040			7.39
	3.Trunk Height	.048			3.09
	4.Lower Leg Length	.052			7.15
	5.Shoulder Diameter	.079			7.35
	6.Shoulder Girth	.102			11.35
	7.Biceps Skin- Fold	-.018			4.42
	8. Lean Body Mass	.076			14.05

Beta Constant (Bo) = 3.836 S.E. of Estimate = 2.801 Pcx = (Beta Weight) x (r) x (100), Where: Beta Weight = Bx . SD of X / SD of Yc

andr = Coefficient of correlation between X and Yc.

**Significant at .01 level of significance = .307 N= 210 (df=210-9=201)

From **table- 4**, it is obvious that multiple correlation (R=0.841) of arm strength, leg strength, trunk height, lower leg length, shoulder diameter, shoulder girth, biceps skin fold and lean body mass with wall spike skill efficiency was significant at 1% level. It shows that the combined effect of these eight variables taken together contribute to improve the wall spike skill efficiency. The coefficient of multiple correlation is of sufficient size and hence these variables could be put in to the regression prediction equation of the wall spike skill efficiency.

Table- 4, further illustrates that the multiple regression analysis performed to develop equation for the prediction of wall spike skill efficiency on the basis of X_{21}, X_{22}, X_2, X_6, X_7, X_{11}, X_{13} and X_{20} anthropometric and strength measures variables. Resulted multiple regression equation in scores from is:

$$\mathbf{Y_c} = B_o + B_1.X_{21} + B_2.X_{22} + B_3.X_2 + B_4.X_6 + B_5.X_7 + B_6.X_{11} + B_7.X_{13} + B_8.X_{20}$$

$$\mathbf{Y_c} = .31 + .530.X_{21} + .557.X_{22} + .409.X_2 + .586.X_6 + .516.X_7 + .568.X_{11} + -.357.X_{13} + .705.X_{20}$$

Where $\mathbf{Y_c}$ = predicted wall spike skill efficiency of volleyball players.

X_{21} = Arm Strength X_{22} = Leg Strength

X_2 = Trunk Height X_6 = Lower Leg Length

X_7 = Shoulder Diameter X_{11} = Shoulder Girth

X_{13}= Biceps Skin Fold X_{20}= Lean body mass

R^2 = can be broken up as. **R^2 = 70.70** = 16.12+7.39+3.09+7.15+7.35+ 11.35+4.42+ 14.04

Moreover, the value of multiple coefficient of determinant (R^2= .707) suggests that 70.70 percent of variance of wall spike skill efficiency could be predicted on the basis of regression equation developed by these eight independent variables. The remaining variance of wall spike skill efficiency scores 29.30 percent are due to other factors. Hence, the developed regression equation could be put into the prediction of wall spike skill efficiency of volleyball players.

Contribution of arm strength, leg strength, trunk height, lower leg length, shoulder diameter, shoulder girth, biceps skin-fold and lean body mass individually towards multiple coefficients of determination (R^2) are 16.12,7.39, 3.09, 7.15, 7.35, 11.35, 4.42 and 14.05 percent, respectively.

The results of the present study are completely supported by other similar studies conducted by many scientists i.e., Singh, K. & Chauhan, M.S.(2010), Chauhan, M.S.(1988, 2004), De Garay(1974), Singh, K. & Singh, S.(2011), Mohan, L., & Sharma Y.P.(2009).

Conclusion:

(i) Linear measurements, i.e., standing height, trunk length, upper arm length, lower leg length and fore arm length; body girth measurements i.e., shoulder, chest and thigh girth; body diameter measurements i.e., wrist, shoulder and knee diameters; body composition variables i.e., body density and lean body mass and strength measures i.e., explosive arm and leg strength have significant correlations with wall spike skill efficiency of volleyball players.

(ii) The multiple correlation (R=.841) of explosive arm strength, explosive leg strength, trunk height, lower leg length, shoulder diameter, shoulder girth, biceps skin-fold and lean body mass taken together with wall spike skill of volleyball players is highly significant. The size of coefficient of multiple correlation is quite large and hence these variables are very important ingredients for predicting the performance of wall spike skill efficiency of volleyball players.

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