

Selected Anthropometrical and Motor Skill Variables as Playing Performance Predictors in Male Volleyball Players

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ABSTRACT

The purpose of the study was to find out the most valuable variables from selected anthropometric and motor skills, which predict the playing performance of male Volleyball players. The sample consists of 102 Volleyball players between the age group 14 to 19 years who were undergoing training at various training centers of Sports Authority of India. Thirty anthropometric measurements were taken, which included longitudinal dimensions, diameters, circumferences and skin folds. Brady wall volleying, AAHPER serving, passing and set up ability tests were administered to determine the motor skills level. Playing performances was evaluated using four points rating scale, during competition. All the measurements were taken using standard equipments and techniques. IBM SPSS Statistics 20 software was used to analyse the data's. Most versatile anthropometrical and motor skills variables as predictors of the Volleyball playing performance were obtained through multiple step-wise regressions. Four models have been suggested, out of which 4th model has the highest R square value which is .478. Serving ability, calf skin fold, weight and set up ability came out as predictors for playing performance. The contribution of serving ability toward R^2 is 43% ; whereas, calf skin fold, weight, set up ability contributes 23.84%, 18.61% and 14.43%, respectively.

INTRODUCTION

Volleyball is one of the most successful, popular, competitive and recreational sports in the world. It is the fast, exciting and the actions are explosive. Yet Volleyball comprises several crucial overlapping elements whose complimentary interactions render it unique amongst rally games. Competition taps latent strength. It exhibits the best of the ability, spirit, creativity and aesthetics. With a few exceptions, Volleyball

allows all players to operate both at the net in attack and block and in the back court to defend or serve.

In Volleyball, there is a sequence of six distinct phases or elements that are repeated over and over, creating a rhythmical flow. These six elements are serve, serve reception, set, attack, block and defense. This sequence can be disrupted and terminated at any time or it can go into a cycle alternating between one team's attack and another's defense.

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Motto(1977) stated that performance depended upon inherited characteristics like height, speed and limb length. The establishment of such factors become all the more important, he further suggested that there was an optimal age for testing of various physical characteristics, as there were certain age when development reached at a stage where trend was predictable; for example, adult level of agility reached around 12-14 years with little development after that, speed of movements which depends on central nervous system functions which matures around fourteen years, with limb growth. Testing for running speed should have been continued up to 16-17 years. Power development was largely dependent upto third decades of life, but strength touched about 80% at 17 years of girls and 16 years of boys.

The height of action above net is another deciding factor for victory in modern top Volleyball. Therefore the teams, to establish their superiority in spiking and blocking above the net, continuously strive to improve upon the height of players, good jumping ability and perfect skills for spiking, blocking and serving.

METHODOLOGY

One hundred and two male Volleyball players, between 14-19 years of age, from various centres of Sports authority of India training centers, were taken as subjects. Playing performance was recorded using 4 point rating scale during competition. Age, body height, body weight, standing reach, sitting height, biacromion width, humerus bicondylar diameter, femur bicondylar diameter, ankle diameter, hand span, arm span, arm length, leg length, head circumference, chest circumference, waist circumference, gluteal circumference, thigh circumference, calf circumference, ankle circumference, arm circumference relaxed, forearm circumference, wrist circumference, sub scapular skin fold, bicep skin fold, triceps skin fold, forearm skin fold, supra iliac skin fold, thigh skin fold, calf skin fold, were taken as anthropometrical variables. Brady's wall volleying and AAHPER serving, passing and set up tests were taken to determine motor skill level of the players. Standard techniques and procedure were followed while collecting data. Mean, standard deviation, coefficient correlation and regression analysis was done to interpret the data. IBM SPSS statistics 20 software was used to analyse the data.

RESULT & DISCUSSION

Table-1 : Mean and Standard deviation of playing performance of male Volleyball players

S.No.	Variables	Mean	Standard deviation	N
1.	Playing performance	54.65	10.86	102

Table-2 : Relationship of selected anthropometrical variables with playing performance of male Volleyball players

S.No.	Variables	Unit	Mean	Standard deviation	CV%	Correlation
1.	Age	year	18.08	1.18	6.52	.192
2	Weight	kg	71.84	8.09	11.26	.346**
3	Height	Cm	184.85	7.95	4.30	.287**
4	Standing reach	Cm	244.97	11.21	4.57	.362*
5	Sitting height	Cm	92.90	3.45	3.71	.223*
6	Shoulder width	Cm	40.73	2.96	7.26	.141
7	Humerus diameter	Cm	8.23	1.33	16.16	.187
8	femur diameter	Cm	10.05	.96	9.55	.152
9	Ankle diameter	Cm	7.28	.78	10.71	.125
10	Hand span	Cm	23.75	1.37	5.76	.150
11	Arm span	Cm	190.61	19.17	10.05	.297**
12	Arm length	Cm	80.87	4.47	5.52	.338**
13	Leg length	Cm	98.16	5.88	5.99	.316**
14	Head circumference	Cm	55.21	1.50	2.71	.209*
15	Chest circumference	Cm	88.12	5.44	6.17	.212*
16	Waist circumference	Cm	77.47	5.45	7.03	.245*
17	Gluteal circumference	Cm	92.68	4.64	5.00	.233*
18	Thigh circumference	Cm	52.96	3.92	7.40	.175
19	Calf circumference	Cm	34.96	2.25	6.43	.170
20	Ankle circumference	Cm	22.89	1.92	0.08	-.030
21	Arm circumference	Cm	26.28	2.47	9.39	.132
22	Forearm circumference	Cm	25.53	2.10	8.22	.147
23	Wrist circumference	Cm	17.06	.93	5.45	.281**
24	Sub-scapula skin fold	Mm	8.75	2.63	30.05	-.035
25	Bicep a skin fold	Mm	4.00	1.14	28.50	-.066
26	Triceps skin fold	Mm	6.62	1.90	29.70	-.152
27	Fore arm skin fold	Mm	4.84	1.66	34.29	-.193
28	Supra iliac skin fold	Mm	7.58	2.76	36.41	-.014
29	Thigh skin fold	Mm	9.33	4.69	50.26	-.210*
30	Calf skin fold	Mm	6.94	2.45	35.30	-.433**

** Significant at 0.01 level of $r > 0.254$ (df=100) confidence*Significant at 0.05 level of $r > 0.195$ (df=100) confidence.

Out of 30 anthropometrical variable, 14 variables showed significant relationship with playing performance. These are weight, height, standing reach, sitting height, arm span, arm length, leg length, head

circumference, chest circumference, waist circumference, gluteal circumference, wrist circumference, thigh skin fold and calf skin fold.

Table-3: Regression models of selected anthropometric variables

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1.	.433 ^a	.188	.180	9.836	.188	23.129	1 ^a	100	.000
2.	.568 ^b	.323	.309	9.029	.135	19.693	1 ^b	99	.000

Table-4 : Regression coefficients of selected anthropometric variable in different models along with their t value and correlations

Model		Unstandardized Coefficients		Standardized Coefficients	t.	Sig (P-value)	Correlations		
		B	Std. erro	Beta			Zero order	Partia 1	Part
1	(Constant)	67.984	2.937		23.145	.000			
	calf skin fold	-1.919	.399	-.433	-4.809	.000	-.433	-.433	-.433
	(Constant)	33.115	8.307		3.986	.000			
2	calf skin fold	-1.996	.367	-.451	-5.443	.000	-.433	-.480	-.450
	Weight	.493	.111	.367	4.438	.000	.346	.407	.367

Table-5 : Contribution of anthropometric variables to the Volleyball playing performance of male Volleyball players

S. No.	Variables	Regression coefficient	R ² value	contribution towards R ²	%contribution towards R ²
2.	Weight	.367	.323	.135	41.79
30	Calf skin fold	-.451		.188	58.20

The difference in R^2 of final and first equation
 $= 0.323 - 0.188 = 0.135$

Equation to predict the playing performance
 is as under :-

$$Y = 33.115 + 0.367(x_2) - 0.451(x_3)$$

Where Y = playing performance

When the stepwise regression analysis was done, using IBM SPSS Statistics 20 software, two models have been suggested. In model 1 only calf skin fold has been come out as predictor, R^2 value of model is .188 and regression coefficient is -.451. In model 2 two variables come out as predictor of playing performance. These are calf skin fold and weight. The R^2 value of the model is .323. The

contribution of calf skin fold toward R^2 is 58.20% and weight contributes 41.79%.

Spencer et al (1980) conducted a study on the anthropometric and performance characteristics. Comparison was made between selected and non selected players. He found that selected players were heavier than non selected players.

Rawat (1989) conducted study to determine the physical, physiological and motor skill variables of men Volleyball players, which could best contribute in the playing ability of Volleyball players. He found that lean body mass is one of the best contributors for Volleyball playing ability.

Table-6 : Relationship of selected motor skill variables with playing performance of male Volleyball players.

Sr. No.	Variables	Tests	Mean	Standard deviation	CV%	Correlation
31.	General volley pass playing ability	Brady's wall volleying test	42.28	8.54	20.19	.382**
32	Serving skill	AAHPER serving test	24.80	4.93	19.87	.454**
33	Passing skill	AAHPER passing test	11.44	3.40	29.72	.406**
34	Set up ability	AAHPER set up test	8.11	2.03	25.03	.399*

** Significant at 0.01 level of $r > 0.254$
 (df=100) confidence.

* Significant at 0.05 level of $r > 0.195$
 (df=100) confidence.

The values in Table 6 indicate that all four game skills have strong positive relationship with playing performance.

Table-7 : Regression models of selected motor skill variables

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1.	.454 ^a	.206	.198	9.723	.206	26.011	1 ^a	100	.000
2.	.533 ^b	.284	.269	9.283	.078	10.721	1 ^b	99	.001

Dependent Variable : playing performance

2. Predictors in the Model : (Constant),

1. Predictors in the Model : (Constant),
serving skill

serving skill, set up ability

Table-8 : Regression coefficients of selected motor skill variables in different models along with their t value and correlations

Model		Unstandardized Coefficients		Standardized Coefficients	t.	Sig (P-value)	Correlations		
		B	Std. erro	Beta			Zero order	Partia 1	Part
1	(Constant)	29.846	4.959		6.019	.000			
	Serving	1.000	.196	.454	5.100	.000	.454	.454	.454
2	(Constant)	21.868	5.324		4.107	.000			
	Serving	.814	.196	.370	4.157	.000	.454	.386	.354
	set up	1.553	.474	.291	3.274	.001	.399	.313	.278

Table-9 : Contribution of motor skill variables to the Volleyball playing performance of male Volleyball players

S. No.	Variables	Regression coefficient	R ² value	contribution towards R ²	%contribution towards R ²
32	Serving skill	.370	0.284	.206	72.53
34	Set up ability	.291		.078	27.46

The difference in R² of final and first equation = 0.284-0.206=0.078

Equation to predict the playing performance is as under :-

$$Y = 21.868 + 3.70(x_{32}) + 0.291(x_{34})$$

Where Y = playing performance

When the stepwise regression analysis was done using IBM SPSS Statistics 20 software, two models have been suggested. In model 1, only serving skill has been come out as predictor, R^2 value of model is .206 and regression coefficient is .370. In model 2, two variable come out as predictor of playing performance, these are serving skill and set up ability. The R^2 value of the model is .284. The contribution of serving skill towards R^2 is 72.53% and set up ability contributes 27.46%.

Phipps (1982) investigated a study on high school girls to determine the relationship of three specific skill

variables to over all Volleyball performance and he found that there was a substantial relationship between selected specific-skill tests and Volleyball performance.

Rawat (1989) conducted study to determine the physical, physiological and motor skill variables of men Volleyball players, which could best contribute in the playing ability of Volleyball players. He collected data on 135 school Volleyball players (male) in 23 variables consisting of 12 physical. 7 Physiological and 4 motor skill variables. He found two motor skill variables i.e. volleying and serving were the best contributors for Volleyball playing ability.

**Table-10 : Regression models of selected anthropometric and motor skill variables
Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of The Estimate	Change Statistics	
					R Square	F Change
1.	.454 ^a	.206	.198	9.72376	.206	26.011
2.	.566 ^b	.320	.307	9.04340	.114	16.613
3.	.640 ^c	.409	.391	8.47343	.089	14.766
4.	.691 ^d	.478	.456	8.00760	.069	12.734

a. Predictors : (Constant), serving ability

b. Predictors : (Constant), serving ability, calf skin fold

c. Predictors : (Constant), serving ability, calf skin fold, weight

d. Predictors : (Constant), serving ability, calf skin fold, weight, set up ability

Table-11 : Regression coefficients of selected anthropometrical and motor skill variables in different models along with their t value.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	29.846	4.959		6.019	.000
1. Serving	1.000	.196	.454	5.100	.000
(Constant)	44.891	5.907		7.599	.000
2. Serving	.824	.187	.374	4.395	.000
calfsf	-1.536	.377	-.347	-4.076	.000
(Constant)	19.924	8.535		2.334	.022
3. Serving	.681	.180	.310	3.796	.000
calfsf	-1.666	.355	-.376	-4.697	.000
Wt	.409	.107	.305	3.843	.000
(Constant)	12.149	8.355		1.454	.149
Serving	.513	.176	.233	2.912	.004
4. calfsf	-1.616	.336	-.365	-4.815	.000
Wt	.406	.101	.303	4.031	.000
set up	1.461	.409	.274	3.568	.001

Table-12 : Combined contribution of selected anthropometrical and motor skill variables to the Volleyball playing performance of male Volleyball players

S. No.	Variables	Regression coefficient	R ² value	contribution towards R ²	%contribution towards R ²
2	Weight	.303	.478	.089	18.61
30	Calf skin fold	-.365		.114	23.84
32	Serving ability	.233		.206	43
34	Set up ability	.274		.069	14.43

The difference in R² of final and first equation = 0.478 – 0.198 = 0.280

Equation to predict the playing performance is as under :-

$$Y = 12.149 + 0.303(x_2) - 0.365(x_{30}) + 0.233(x_{32}) + 0.274(x_{34})$$

Where Y=playing performance

When step wise regression analysis was done using both selected anthropometric and motor skill variables, four models has come out. In model I serving skill come out as predictor, R^2 value of this model is .206. In second model serving skill and calf skin fold come out as predictors, R^2 value of this model is .320. In third model weight added to serving skill and calf skin fold. R^2 value of this model is .409. Fourth model is best among all four having R^2 value is .478. Weight, calf skin fold, serving ability and set up ability comes out as predictors and they contribute 18.61%, 23.84%, 43% and 14.43% respectively towards R^2 .

CONCLUSION

Based on the finding and limitations of the study, following conclusions were drawn.

Out of 30 anthropometrical variables 14 variables has significant relationship with playing performance. These are weight, height, standing reach, sitting height, arm span, arm length, leg length, head circumference, chest circumference, waist circumference, gluteal circumference, wrist circumference, thigh skin fold and calf skin fold. All four selected motor skills have significant relationship with playing performance.

Serving ability, calf skin fold, weight and set up ability come out as predictors to the playing performance of male Volleyball players. Contribution of serving ability is the highest towards playing performance which is 43% and set up ability has the lowest contribution which is 14.43%.

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