



ISSN Print: 2664-7559  
ISSN Online: 2664-7567  
IJSHPE 2023; 5(2): 17-20  
[www.physicaleducationjournal.in](http://www.physicaleducationjournal.in)  
Received: 13-05-2023  
Accepted: 21-06-2023

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## Discriminant analysis of state level volleyball players on the basis of high and low performance

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DOI: <https://doi.org/10.33545/26647559.2023.v5.i2a.75>

### Abstract

**Background:** This study aims to employ Discriminant Analysis to examine the differentiation between state-level volleyball players categorized as "High Performance" and "Low Performance,".

### Objectives of the Study:

1. To characterize the level of anthropometric, functional and volleyball skill of volleyball players on the basis of high and low performance.
2. To develop discriminate model for classifying a State level Volleyball Players into High or low – performance categories.

**Materials and methods:** In this study 72 male state-level volleyball players from various volleyball academies were selected, their age ranging between 19-25 year, all were selected by using purposive sampling. These selected subjects had been alienated into two group i.e. high and low performance group. Anthropometrical variables were measured by anthropometric kit, General volley pass playing ability, serving skill, passing skill and AAHPER serving test Numerical was measured by Brady's wall volleying test, AAHPER passing test, AAHPER set up test and AAHPER serving test respectively. Leg Explosive Power, Shoulder Strength, Agility, Abdominal strength measured Standing broad Jump, Medicine ball throw Distance, 10x4 shuttle run, Sit-ups respectively.

**Results:** Box's M test value is 1.357 is not significant it means that the assumption of homogeneity of variance/covariance matrices is not violated. Canonical correlations of function 1 is .639 indicates 40.83% (= .639) of the variation in the two different group. Wilks' Lambda value is .807 which indicates the model is good as only 65.12% in function 1 variability is not explained by the model. The value of chi-square is 15.294 shows the significance of Wilks Lambda. Group means for high and low group means are .482 and -.482 which are group centroid. (78.4%) cases were correctly classified by the model which is quite high, therefore the model can be considered as valid.

**Conclusions:** Discriminant function for the State level volleyball players on the basis of the performance (High and Low) is  $Z = -5.331 + .401 \times (\text{Set Up})$ .

**Keywords:** State level volleyball players, skill of volleyball players, basis of high and low performance

### Introduction

Discriminant Analysis has gained significant prominence in sports science and performance analysis, offering a robust method to distinguish between groups based on specific performance characteristics<sup>[1, 2]</sup>. This study aims to employ Discriminant Analysis to examine the differentiation between state-level volleyball players categorized as "High Performance" and "Low Performance," using a comprehensive set of performance metrics. By scrutinizing the distinguishing factors that contribute to the separation of these two player groups, this research contributes to the understanding of key determinants of success in volleyball and potentially offers insights into training and talent identification strategies. In competitive sports like volleyball, the identification of factors that differentiate high-performing athletes from their lower-performing counterparts is of paramount importance. Such factors can range from physical attributes, technical skills, tactical decision-making, to psychological traits. The application of Discriminant Analysis provides a structured approach to analyze a combination of these variables, enabling a more holistic assessment of player performance<sup>[3, 4]</sup>. Previous research has explored various individual and team-related factors associated with volleyball performance. Physical attributes such as strength, agility, and endurance have been considered crucial, as they directly influence the execution of volleyball skills and movements. Additionally, technical skills encompassing serving, spiking, setting, blocking, and digging contribute significantly to player effectiveness during matches<sup>[5, 6]</sup>. Moreover, tactical

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decision-making and on-court awareness are crucial aspects of successful volleyball performance. Players who exhibit effective decision-making skills, adaptability, and strategic awareness tend to have a greater impact on the outcome of matches. Psychological attributes like mental resilience, focus, and teamwork are also integral components that can differentiate high and low-performing players [7, 8]. This study seeks to explore the discriminant factors that differentiate state-level volleyball players based on their performance levels. By employing Discriminant Analysis, this research aims to contribute to the existing literature on performance analysis in sports while providing insights that could aid coaches, athletes, and sports scientists in optimizing training methods, talent identification, and overall player development [9, 10].

**Objectives of the Study**

1. To characterize the level of anthropometric, functional and volleyball skill of volleyball players on the basis of high and low performance
2. To develop discriminate model for classifying a State level Volleyball Players into High or low-performance categories.

**Materials and Methods**

72 male Volleyball players from various Volleyball academies was selected, their age ranging between 19-25 year, all were selected by using purposive sampling technique. Further as per their performance these selected subjects were classified into two categories according to their high and low performance. Various selected anthropometric variables, functional capacities, and Volleyball skills were

included in the study. High and Low Performance was independent variables and Anthropometric Variables, Functional Capacities and Volleyball Skills were dependent variables. Anthropometrical variables were measured by Anthropometric kit and General volley pass playing ability, serving skill, passing skill and AAHPER serving test Numerical was measured by Brady’s wall volleying test, AAHPER passing test, AAHPER set up test and AAHPER serving test respectively. Leg Explosive Power, Shoulder Strength, Agility, Abdominal strength measured Standing broad Jump, Medicine ball throw Distance, 10x4 shuttle run, Sit-ups respectively.

**Results, Discussion and Conclusions**

**Table 1:** Descriptive statistics for anthropometric, functional and volleyball skill variables of Low performance of State level player.

Name of Variables	Mean	SD
Height (meter)	1.8811	.05656
Weight (Kg)	76.6667	4.79285
Upper Arm length (meter)	.3553	.01134
Forearm length (meter)	.3239	.01460
Arm length (meter)	.6447	.02467
Leg length (meter)	1.0236	.04148
Calf Girth (meter)	.3692	.02347
Leg Explosive Power	1.8456	.24254
Shoulder Strength	7.9389	.78350
Agility (in sec.)	10.2469	.89502
Abdominal Strength	33.3056	5.54369
General Volley ball playing ability	36.3056	5.82516
Serving Skill	23.7222	4.28693
Passing Skill	10.4167	2.40684
Set up	12.0556	2.74585

**Table 2:** Test of Equality of group means for High and Low-performance group of State Level players

Name of Variables	Wilks’ Lambda	F	df1	df2	Sig.
Height (meter)	1.000	.007	1	72	.932
Weight (Kg)	.998	.180	1	72	.673
Upper Arm length (meter)	.980	1.450	1	72	.233
Forearm length (meter)	.983	1.265	1	72	.264
Arm length (meter)	.986	1.002	1	72	.320
Leg length (meter)	.992	.547	1	72	.462
Calf Girth (meter)	.997	.233	1	72	.631
Leg Explosive Power	.979	1.512	1	72	.223
Shoulder Strength	.929	5.481	1	72	.022
Agility (in sec.)	.985	1.132	1	72	.291
Abdominal Strength	.999	.057	1	72	.811
General Volley ball playing ability	.899	8.131	1	72	.006
Serving Skill	.937	4.880	1	72	.030
Passing Skill	1.000	.010	1	72	.919
Set up	.807	17.172	1	72	.000

Table no. 2, we are comparing the means and showing if there is any significant difference between the selected variables are there or not. As per above table we found that four variables are showing the significant difference (Shoulder Strength, General volleyball playing ability, Serving skill and set-up).

Box’s M test is not significant it means that the assumption of homogeneity of variance/covariance matrices is not violated, so researcher tried to develop the discriminant model.

**Table 3:** The Covariance matrices box’s test of Equality

Test Results		
Box's M		1.357
Approx.		1.339
F	df1	1
	df2	15552.000
	Sig.	.247

**Table 4:** Eigenvalues

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	.238 <sup>a</sup>	100.0	100.0	.639

This table shows that the value of canonical correlations of function 1 is.639. Hence here function 1 indicates 40.83%

(=.639) of the variation in the two different group is explained by the discriminant model.

**Table 5:** Wilks' Lambda

Test of Function(s)	Wilks' Lambda	Chi-square	DF	Sig.
1	.807	15.294	1	.000

The Wilks Lambda value always lies in between 0 to 1. In table 5 the score function 1 is .807. Hence the model is good as only 65.12% in function 1 variability is not explained by the model. In the same table the chi-square is calculated to show the significance of Wilks Lambda. Since the p-value is associated with its .000 which is less than .05, it may be inferred the model is good.

**Table 6:** Standardized Canonical Discriminant Function Coefficients

	Function
	1
Set up	1.000

Table 6 shows the discriminating power of the variables selected in the model. Since absolute function value of the Setup is 1, it is the most contributing predictor in the model.

**Table 7:** Unstandardized canonical discriminant function coefficients

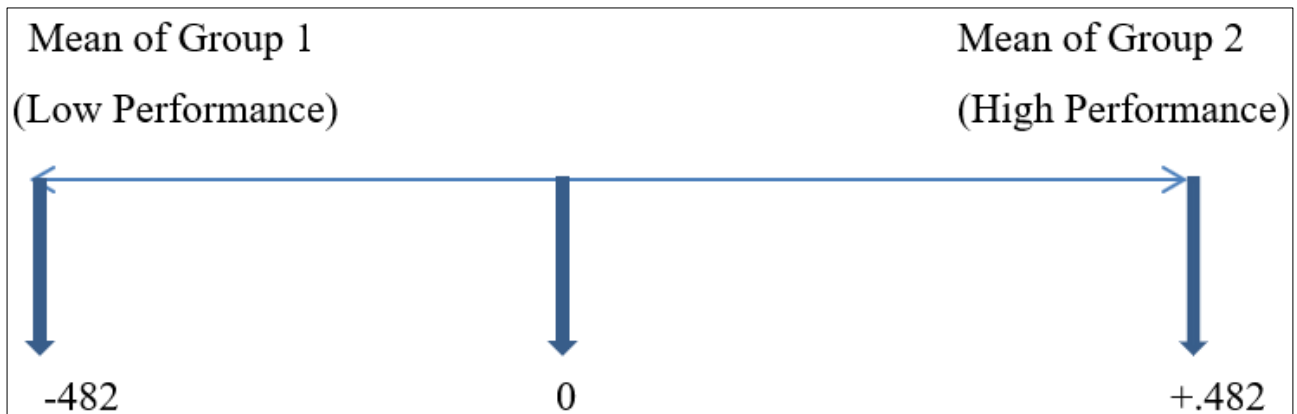
	Function
	1
Set up	.401
(Constant)	-5.331

The above table- 7 indicates that out of 15 selected independent variables, 1 independent variable was contributing as predictor's variables in discriminating the selected two groups (High and Low Performance).

**Table 8:** Functions at group centroid

Performance Category	Function
	1
High Performance	.482
Low Performance	-.482
Unstandardized canonical discriminant functions evaluated at group means	

These values represent the group means of the discriminant function scores. The aggregated mean of discriminant function scores equal zero.



Above figure shows a volleyball player is classified into high performance category if his discriminant score is more than

zero ( $Z \geq 0$ ) and in low performance if it is less than zero ( $Z < 0$ ).

**Table 9:** Classification Results

		Performance Category	Predicted Group Membership		Total
			High	Low	
Original	Count	High	23	4	27
		Low	12	35	47
	%	High	85.2	14.8	100.0
		Low	25.5	74.5	100.0

In the table no. 9, the classification matrix shows among the 74 cases, 58 (78.4%) cases were correctly classified by the model which is quite high, therefore the model can be considered as valid.

**Discussion of Findings**

The discriminant analysis revealed that set-up skill significantly impacts performance levels among state-level volleyball players. This suggests that players with proficient lifting skills are more likely to achieve higher performance levels compared to those with subpar lifting abilities. This finding aligns with previous studies that have emphasized the importance of physical conditioning and strength training in

volleyball performance. Sattler *et al.* (2015) found that players who engaged in regular strength training activities demonstrated improved vertical jump height, hitting power, and overall performance on the court. Lifting skills are known to enhance muscular strength and explosiveness, which are crucial attributes for successful volleyball players. This emphasizes the significance of lifting skill as a determinant of performance at the state level<sup>[11]</sup>.

**Conclusions**

Discriminant function for the State level volleyball players on the basis of the performance (High and Low) is  $Z = -5.331 + .401 \times (\text{Set Up})$ .

**Conflict of interest**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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