Prediction of archery performance of male archers on the basis of selected anthropometric variables

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ABSTRACT: *This study was conducted with an aim of predicting archery performance of male archers on the basis of selected anthropometric variables. To achieve the objective 100 male archers were recruited to this study. All were either national level archers or they have participated in all India Inter-varsity tournament. The independent variables selected for the study were height, weight, finger length, flexed arm biceps girth, shoulder width, arm length. Accuracy score obtained by the subjects was chosen as dependent variable for the study. To predict the archery performance regression analysis was used as statistical tool. Level of significance was set at 0.05. A prediction equation was developed with the help of selected IVs. Only 3 IV's (height, arm length, finger length) out of 6 were found significant for the development of regression equation (Ad.R^2 .892). The developed model seems quiet robust as Adjusted R square was found to be .892 which means the developed model is able to predict 89.2% of total variability in dependent variable.*

Key Words: *Archery, Accuracy, Performance, Prediction*

INTRODUCTION

Archery is as old as human civilization. One can trace the sign of archery in caves of Ajanta & Ellora. Being old sometimes become the thing of prime focus. Perhaps it was the foremost important war skill during ancient age. People used archery as the mean of their daily living and mean of survival as well. The Indian Mythology is full of archery stories. There was hardly a king without good skill of archery. In the Vedic era India has produced great archers like Arjun & Rama. This leads to dedicated love of Indians towards archery. India has achieved a high esteem in international Archery tournaments. In fact Archery is the only sports in which India has won individual Gold medal in Olympics.

With the involvement of science in sports it became possible to improve sports performance intellectually at higher pace. Presently there are several advanced techniques of statistics have been introduced which can identify the responsible variables for improving archery performance. The present study focuses on such anthropometric variable who can predict archery performance.

METHODOLOGY

100 Subjects were selected in random fashion, the training age of all the subjects was minimally exceeded 3 years. The anthropometric data were collected from subjects in laboratory. Then they were exposed to accuracy test, their data were recorded in the same way for independent and dependent variable. The subjects were asked to gather in sports lab in skin tight dress suitable for marking anthropometric measurements. Then they were called to field for measurement of accuracy performance. They should be equipped with their own bow and arrow at the time of accuracy measurement. To provide statistical authenticity to research findings multiple regression analysis was applied as statistical tool. The level of significance was set at 0.05.

ANALYSIS OF DATA

The data on various anthropometric measurements were recorded with the help of non-stretchable tape. Then the data was analysed using SPSS (Statistical package for social science) version 20. To obtain general idea regarding sample characteristics descriptive statistics were calculated.

Table-1
Descriptive Statistics

	Mean	Std. Deviation	N
ACCURACY	252.5000	7.26483	100
HEIGHT	170.5400	6.53880	100
WEIGHT	71.3200	8.37852	100
FINGER LENGTH	64.7200	5.73679	100

FLEXED ARM BICEPS GIRTH	35.8800	2.71278	100
SHOULDER WIDTH	36.4300	2.28414	100
ARM LENGTH	75.1500	6.89660	100

Mean and SD have been reported in table presented above. These two outputs are of foremost important to draw any legal conclusion regarding any population. Although these two descriptive statistics does not allow one to conclude something with firm belief but they are like stepping stone for later statistical processes.

Table-2
Correlation table

	Variable name	ACCURACY
Pearson Correlation	ACCURACY	1.000
	HEIGHT	**.766****
	WEIGHT	-.012
	FINGER LENGTH	**.247***
	FLEXED ARM BICEPS GIRTH	.004
	SHOULDER WIDTH	.022
	ARM LENGTH	**.889****
Sig. (1-tailed)	ACCURACY	.
	HEIGHT	.000
	WEIGHT	.452
	FINGER LENGTH	.007
	FLEXED ARM BICEPS GIRTH	.486
	SHOULDER WIDTH	.413
	ARM LENGTH	.000

In the above table different correlations have been reported with dependent variable. Those correlations which have been found significant at 0.05, 0.01 level of significance have been marked with *, ** respectively.

Table-3
Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.889[a]	.791	.789	3.34093
2	.901[b]	.811	.808	3.18681
3	.946[c]	.896	.892	2.38404

a. Predictors: (Constant), ARM LENGTH
b. Predictors: (Constant), ARM LENGTH, HEIGHT
c. Predictors: (Constant), ARM LENGTH, HEIGHT, FINGER LENGTH
d. Dependent Variable: ACCURACY

Table-3 indicates that on the basis of present dataset a total of 3 models have been developed. The present research study recommends using 3rd model as it has highest prediction capability. The third model is capable of predicting 89.2% of total changes in dependent variable.

Table-4
ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4131.141	1	4131.141	370.113	.000[b]
	Residual	1093.859	98	11.162		
	Total	5225.000	99			
2	Regression	4239.892	2	2119.946	208.743	.000[c]
	Residual	985.108	97	10.156		
	Total	5225.000	99			
3	Regression	4679.370	3	1559.790	274.435	.000[d]
	Residual	545.630	96	5.684		
	Total	5225.000	99			

a. Dependent Variable: ACCURACY
b. Predictors: (Constant), ARM LENGTH
c. Predictors: (Constant), ARM LENGTH, HEIGHT
d. Predictors: (Constant), ARM LENGTH, HEIGHT, FINGER LENGTH

The ANOVA table presented above shows that if the prepared model is significant at 0.05 level. Table-4 verifies that all the prepared models are significant and either model can be taken in account for prediction of archery performance.

Table-5
Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	182.110	3.674		49.566	.000
	ARM LENGTH	.937	.049	.889	19.238	.000
2	(Constant)	153.563	9.401		16.334	.000
	ARM LENGTH	.762	.071	.723	10.747	.000
	HEIGHT	.245	.075	.220	3.272	.001
3	(Constant)	120.065	7.998		15.011	.000
	ARM LENGTH	.598	.056	.567	10.639	.000
	HEIGHT	.725	.078	.652	9.273	.000
	FINGER LENGTH	-.557	.063	-.440	-8.793	.000

a. Dependent Variable: ACCURACY

Table-5 shows the unstandardized and standardized coefficients of all the three selected independent variables. Unstandardized coefficients are used for the development of prediction equations while standardized coefficients shows the actual contribution of an independent variable towards dependent variable.

FINDINGS

On the basis of present dataset the following findings were observed:

- The mean score of subjects on accuracy variable was recorded as 252.50 with SD 7.26.
- The mean score of subjects on anthropometric variable height was recorded as 170.54 with SD 6.53.
- The mean score of subjects on anthropometric variable weight was recorded as 71.32 with SD 8.37.
- The mean score of subjects on anthropometric variable finger length was recorded as 64.72 with SD 5.73.
- The mean score of subjects on anthropometric variable flexed arm biceps girth was recorded as 35.88 with SD 2.71.
- The mean score of subjects on anthropometric variable shoulder width was recorded as 36.43 with SD 2.28.
- The mean score of subjects on anthropometric variable arm length was recorded as 75.15 with SD 6.89.

CONCLUSION

In conclusion 3 regression models have been developed. This research study recommends third model for prediction of archery performance. Third model is presented below:

Archery performance of male archers = 120.065 + (Arm length in mm* .598) + (Height in cm* .725) + (Finger length in mm* -.557)

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