

CHAPTER IV

RESULTS AND DISCUSSIONS

4.1 OVERVIEW

The fundamental task of scientific enquiry is to explain or predict a phenomenon. In order to explain or predict phenomena, a number of complex constructs need to be scientifically investigated. The purpose of the study was to predict hockey playing ability from selected physical fitness, physiological, psychological and performance variables of Sports Authority of India Training centre hockey players of Southern State.

To achieve the purpose of the study, the investigator selected 150 Sports Authority of India Training centre hockey players of Southern State who participated in the Inter SAI hockey competition held during 2017-2018 and 2018-2019 at Bhubaneswar of Odisha State and Kollam Kerala State. The subjects selected were in the age group between 18 to 25 years.

In this study, the hockey playing ability was predicted from 150 Sports Authority of India Training centre hockey players of Southern State with the help of selected predictor variables such as speed, agility, endurance, Blood pressure, Resting Heart Rate, Breath holding time, Aggression, Self Confidence and Motivation.

The hockey playing ability was determined by subjective rating by three experts and was used as the criterion variable. The backward selection in multiple regression method was used to determine the prediction equation (**Thomas and Nelson, 1990**).

4.2 TEST OF SIGNIFICANCE

As **Clarke and Clarke (1970)** say, “these data must be analysed in ways appropriate to the research design. Such analysis can only be appropriate to the research design through the application of pertinent statistics”.

This is the vital portion of thesis achieving the conclusion by examining the hypothesis. The procedure of testing the hypotheses was either by accepting the hypothesis or rejecting the same in accordance with the results obtained in relation to the level of confidence.

The test was usually called the test of significance since we test whether the relationship between criterion and predictor variable scores were significant or not. In this study, if the obtained r-value were greater than the table value, the null hypotheses were rejected to the effect that there existed significant relationship between criterion and predictor variables and if the obtained values were lesser than the required values, then the null hypotheses were accepted to the effect that there existed no significant relationship between the criterion variables.

4.3. LEVEL OF SIGNIFICANCE

The hockey playing ability of the Sports Authority of India Training centre hockey players of Southern State were predicted from selected physical fitness, physiological, psychological and performance variables in this study. The selected criterion variable, hockey playing ability were predicted from predictor variables, Speed, Agility, Endurance, Blood Pressure, Resting pulse rate, Breath holding time, Aggression, Self Confidence, Motivation, Dribbling, Hitting, Pushing, and Scooping. The backward selection in multiple regression method was used to determine the prediction equation (**Thomas and Nelson, 1990**). In all the cases, 0.05 level of confidence was fixed to test the significance, which was considered as appropriate.

In this study, if the obtained 'r' and F value were greater than the table value, the null hypotheses were rejected to the effect that there existed significant relationship between dependent and independent variables and if the obtained values were lesser than the required values at 0.05 level, then the null hypotheses were accepted to the effect that there existed no significant relationship among the means variables under study.

4.4. COMPUTATION OF DESCRIPTIVE STATISTICS

The descriptive statistics on selected anthropometric variables of subjects are presented in Table IV.

TABLE IV
DESCRIPTIVE STATISTICS ON SELECTED PHYSICAL FITNESS
VARIABLES OF THE SUBJECTS

S.No	Variables	Mean (M)	Standard Deviation (SD)	Range
1.	Speed (in seconds)	6.0781	.90127	4.70-8.00
2.	Agility (in seconds)	15.9251	.93193	14.34-17.82
3.	Endurance (in meters)	2496.4000	180.88626	2150 - 2900

Table IV shows the mean values, standard deviation and the range for selected physical fitness of the subjects. The mean value the speed was 6.0781 with standard deviation of $\pm .90127$, agility was 15.9251 with $\pm .93193$ and endurance was 2496.4000 with standard deviation of ± 180.88626 .

Table V shows the descriptive statistics on selected physiological variables of the subjects.

TABLE V
DESCRIPTIVE STATISTICS ON SELECTED PHYSIOLOGICAL
VARIABLES OF THE SUBJECTS

S.No	Variables	Mean (M)	Standard Deviation (SD)	Range
1	Blood Pressure	96.4420	3.46539	84.00-110
2	Resting Heart Rate (in counts / mts)	71.2667	2.87394	64.00-78.00
3	Breath Holding Time (in seconds)	37.0533	7.52873	37.00-48.00

Table V shows the physiological variables of the subjects. The mean values of the blood pressure was 96.4420 with standard deviation of ± 3.46539 , the resting heart rate was 71.2667 with standard deviation of ± 2.87394 , , the breath holding time was 37.0533 with standard deviation of ± 7.52873

Table VI shows the descriptive statistics on selected psychological variables of the subjects.

TABLE VI
DESCRIPTIVE STATISTICS ON SELECTED PSYCHOLOGICAL
VARIABLES OF THE SUBJECTS

S.No	Variables	Mean (M)	Standard Deviation (SD)	Range
1	Aggression (in scores)	87.2733	14.83959	55.00-118.00
2	Self Confidence (in scores)	18.3333	2.73105	14.00-25.00
3	Motivation (in scores)	13.4467	2.04164	10.00-17.00

Table VI shows the psychological variables of the subjects. The mean values of the aggression was 87.2733 with standard deviation of ± 14.83959 self confidence was 18.3333 with standard deviation of ± 2.73105 and motivation was 13.4467 with standard deviation of ± 2.04164 .

Table VII shows the descriptive statistics on selected performance variables of the subjects.

TABLE VII
DESCRIPTIVE STATISTICS ON SELECTED PERFORMANCE
VARIABLES OF THE SUBJECTS

S.No	Variables	Mean (M)	Standard Deviation (SD)	Range
1	Dribbling in scores	10.0733	1.61825	7.00-12.00
2	Hitting for Accuracy (in scores)	9.8867	1.92314	6.00-12.00
3	Pushing for Accuracy (in scores)	9.6267	2.09040	6.00-12.00
4	Scooping for Distance (in scores)	34.6533	7.07295	20.00-45.00
5.	Total Performance	7.5600	1.14973	5.00-9.00

Table VII shows the performance variables of the subjects. The mean values of dribbling was 10.0733 with standard deviation of ± 1.61825 , Hitting for accuracy was 9.8867 with standard deviation of ± 1.92314 , Pushing for accuracy was 9.6267 with standard deviation of ± 2.09040 , scooping for distance was 34.6533 with standard deviation of ± 7.07295 . and total performance was 7.5600 with standard deviation 1.14973.

4.5. COMPUTATION OF CORRELATION COEFFICIENT

In order to find out the relationship between the criterion variable, and predictor variables correlation coefficient was calculated and the co-efficient correlation matrix is presented in Table VIII.

TABLE VIII
CO-EFFICIENT CORRELATION AMONG PLAYING ABILITY
AND SELECTED VARIABLES

S.No	Playing Ability Vs	CORRELATION R
1	Blood Pressure	0.351*
2	Self Confidence	0.286*
3.	Pushing	0.394*
4.	Dribbling	0.216*

The required table 'r' value of 0.195 to be significant at 0.05 level.

*Significant

In Table VIII the Pearson correlation of the criterion variable (hockey playing ability) with the predictor variables are presented in the following order, namely, speed, agility, endurance, blood pressure, resting heart rate, breath holding time, , aggression, self confidence, motivation, dribbling, hitting, pushing, scooping and total performance.

The results proved that the selected psychological variables self-confidence, were significantly correlated with the hockey playing ability as the obtained 'r' values 0.286 was greater than the required table 'r' value of 0.146 to be significant at 0.05 level. And there was no significant relationship between hockey playing ability and aggression and motivation.

The results proved that selected physical variables speed, agility, and endurance were not significantly correlated with hockey playing ability as the obtained 'r' values 0.000, 0.000, and -0.000 respectively were not greater than the required table 'r' value of 0.195 to be significant at 0.05 level and hence there was no significant relationship between hockey playing ability and physical variables.

The relationship between hockey playing ability and blood pressure was significant as the obtained 'r' value 0.351 was greater than the required table 'r' value of 0.195 to be significant. The other variables, resting heart rate , breath holding time, were not significant.

The relationship between hockey playing ability and self-confidence was significant as the 'r' value of 0.286 was greater than the required table 'r' value of 0.195 to be significant. The other variables aggression and motivation were not significant.

The hockey playing ability was significantly related to the performance variables selected, namely, pushing and dribbling 'r' values 0.394, and 0.216, respectively were greater than the required table 'r' value of 0.195 to be significant.

The inter-correlation among the selected variables were also presented in Table IX.

4.6. COMPUTATION OF BACKWARD MULTIPLE REGRESSION

Table X shows the backward method of variables entered and removed among the selected physical fitness, physiological, psychological and performance variables based on the criterion variable, hockey playing ability.

TABLE IX
BACKWARD REGRESSION METHOD OF VARIABLES ENTERED
AND REMOVED

Model	Variables Entered	Variables Removed	Method
1	Dribbling, Blood Pressure, Speed, resting heart rate, Breath Holding Time, Self Confidence, Aggression, Endurance, Agility, Achievement Motivation, Hitting, pushing, scooping.	.	Enter
2		Self-confidence	Backward (criterion: Probability of F-to-remove \geq .100).
3		Dribbling	Backward (criterion: Probability of F-to-remove \geq .100).
4		Blood Pressure	Backward (criterion: Probability of F-to-remove \geq .100).
5		Pushing	Backward (criterion: Probability of F-to-remove \geq .100).

- a All requested variables entered.
- b Dependent Variable: Playing Ability

In table IX the backward regression method of removal of non significant variables based on criteria set for F to remove the predictor variables was $P > .10$ by backward regression method. The following predictor variables namely, Breath Holding Time, Speed, Agility, Scooping, Endurance, resting heart rate, Hitting, Motivation and Aggression were removed based on the above criteria.

The excluded variables' scores of beta, and 't', step by step were presented in Table X

TABLE X
THE BACKWARD REGRESSION METHOD OF EXCLUDED
VARIABLES WITH BETA AND ' t ' VALUES STEP BY STEP FOR
CRITERION VARIABLE HOCKEY PLAYING ABILITY

		Beta In	t	Sig.	Partial Corre- lation	Colline- arity Statistics
Model						Tolerance
2	Dribbling	.216	2.689	0.008	.216	.216
3	Dribbling	.219	2.768	.006	.223	.219
	Self-confidence	.187	-2.369	.019	-.192	-.187
4	Dribbling	.198	2.539	.012	.206	.197
	Self-confidence	-.206	-2.646	.009	-.214	-.205
	Blood Pressure	.206	2.635	.009	.213	.204
5	Dribbling	.221	2.858	.005	.231	.218
	Self-confidence	-.229	-2.968	.004	-.239	-.227
	Blood Pressure	.216	2.801	.006	.227	.214
	Pushing	-.183	-2.349	.020	-.191	-.179

a) Predictors **in the Model 2:** (Constant), Dribbling, and self confidence

b) Predictors **in the Model 3:** (Constant), Dribbling, Self-Confidence and Blood Pressure.

c) Predictors **in the Model 4:** (Constant), Dribbling, Self-Confidence, Blood Pressure and Pushing.

l Criterion Variable: Playing Ability

In Table X the beta, t value and its significance ($P > .10$) and also the partial correlation of eleven excluded variables, namely, breath holding time, height, agility, shooting, endurance, mean arterial blood pressure, passing, resting pulse rate, leg strength, arm girth, and handgrip strength are presented. The collinearity statistical tolerance of the predictor variables is also presented.

Table XII shows the model summary of the predictor variables based on R square, R square change with F change values.

Table XI

THE MODEL SUMMARY OF PREDICTOR VARIABLES BASED ON R SQUARE, R SQUARE CHANGE WITH F CHANGE VALUES

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df 1	Df2	Sig. F Change
1	.216	0.047	0.040	1.12641	0.047	7.233	1	148	0.008
2	.286	0.082	0.069	1.10926	0.035	5.611.001	1	147	0.019
3	.351	0.123	0.105	1.08751	0.042	.6.941	1	146	0.009
4	.394	0.155	0.132	1.07106	0.032	0.280	1	145	0.020

In Table XII the significant F change ($P < .10$) of the R square value are presented for backward regression selection method.

In model 1 for a R square change of .047 and F change of 7.233 (df1 1; df2 148) a significant F change of $P < 0.00$ was obtained with the following variables, Breath Holding Time , Blood Pressure, Speed, Self Confidence, Aggression, Endurance, Resting heart Rate, Agility, Motivation, hitting, pushing, scooping.

In model 2 for a R square change of 0.035 and F change of 5.611 (df1 1, df2 147) a significant F change of $P < 0.00$ was obtained with the following variables, Breath Holding Time , Blood Pressure, Speed, dribbling, Aggression, Endurance, Resting heart Rate, Agility, Motivation, hitting, pushing, scooping.

In model 3 for a R square change of 0.042 and F change of 6.941 (df1 1, df2 146) a significant F change of $P < 0.00$ was obtained with the following variables, Breath Holding Time , dribbling , Speed, Self Confidence, Aggression, Endurance, Resting heart Rate, Agility, Motivation, hitting, pushing, scooping.

In model 4 for a R square change of 0.032 and F change of 5.517 (df1 1, df2 145) a significant F change of $P < 0.00$ was obtained with the following variables, Breath Holding Time , Blood Pressure, Speed, Self Confidence, Aggression, Endurance, Resting heart Rate, Agility, Motivation, hitting, dribbling , scooping.

Table XIII shows the included variables beta in 't', significance level, partial correlation coefficient and the collinearity statistical tolerance for model 4.

Table XII
THE VARIABLES SELECTED FOR PREDICTION WITH BETA
AND ' t ' VALUES FOR MODEL 4 FOR HOCKEY
PLAYING ABILITY

	Variables	Beta in	T	Sig	Partial Correlation	Collinearity Statistics
Model						Tolerance
4	Dribbling	0.219	2.768	0.006	0.223	0.219
	Self-confidence	-0.206	-2.646	0.009	-0.214	-0.205
	Blood Pressure	0.206	2.635	0.009	0.213	0.204
	Pushing	-0.183	-2.349	0.020	-0.191	-0.179

Table XIII shows that the partial correlation between hockey playing ability and selected predictor variables Dribbling, Self confidence, Blood Pressure and Pushing 0.223, -0.214, 0.213 and -0.191 respectively which were significant at 0.01 level.

Table XIV shows the Analysis of Variance Table for Model 4.

Table XIII

**Showing ANOVA for Model IV – Variables Dribbling, Self-confidence,
Blood Pressure and Pushing**

Variance	Sum of Squares	Df	Mean Square	F	Sig.
Regression	30.619	4	7.665	6.673	.000*
Residual	166.341	145	1.147		
Total	196.960	149			

Table XIII shows that obtained F value for Model 4, for the selected predictor variables of dribbling, self confidence blood pressure and Pushing. The obtained F value of 6.673 was significant.

Table XIII shows the Multiple Correlation R, R Square, R Square change and significance of the selected predictor variables by backward selectors.

TABLE XIV
MULTIPLE CORRELATION, R SQUARE, R SQUARE CHANGE AND
SIGNIFICANCE OF THE SELECTED PREDICTOR VARIABLES
BY BACKWARD SELECTORS

S.N	Variables Predicted	R	R square	F change	ANOVA 'F'	Significance of 'F' change
1	Dribbling	0.216	.047	7.233	7.233	0.008
2	Self confidence	0.286	.082	5.611	6.535	0.019
3	Blood Pressure	0.351	.123	6.941	6.846	0.009
4	Pushing	0.394	.155	5.517	6.673	0.020*

In Table XIV the selected predictor variables by backward regression method, that is., model 4 from Table XIV are presented, namely, dribbling, self confidence blood pressure and Pushing. The multiple correlation R 0.394 with R square value of 0.155, F change of 5.517 and ANOVA 'F' of 6.673 with the significant F change of 0.020 are presented in the above table. The significant F change of 0.020 with the set significance level of 0.01 where all the other variables were removed from the equation (Table X).

Table XV shows the selected variables in Model 4, beta in unstandardised co-efficients, constant value and significance of each backward selected variables.

TABLE XV
BETA UNSTANDARDISED CO-EFFICIENTS, CONSTANT VALUE
AND SIGNIFICANCE OF EACH BACKWARD SELECTED
VARIABLES

S.No	Selected Variables Model 4	Unstandardized b co-efficients	Constant	Significance
	Constant		6.015	0.000
1	Dribbling	-0.157		
2	Self confidence	-0.097		
3	Blood pressure	0.072		
4	Pushing	-0.100		

In Table XV. The beta unstandardized co-efficient, constant value and significance of each backward selected variable are shown. The constant value of -6.015 was presented.

Based on the results presented, the following multiple regression formula was determined by the backward selection method from model 4 (Table XII) and the null

hypothesis were rejected at 0.10 level of significance with dribbling, self confidence, blood pressure and Pushing.

$$Y^1 = -0.157 X_1, -0.097 X_2, + 0.073 X_3 \text{ and, } -0.100X_4, + 6.015a$$

Where Y^1 = the predicted score

X_1 = Dribbling

X_2 = Self confidence

X_3 = Blood Pressure

X_4 = Pushing

a = 6.015 (constant)

The above equation were the variables with significant ratio exceeding the df of 6.015 and 0.01 level were removed as can be seen from Table X. The investigator set the significant level for retaining the variable in equation as df of 26.015 at 0.01 and all the variables that exceeded this level were removed.

4.7. DISCUSSION ON THE FINDINGS

In this study, the hockey playing ability was predicted from 150 Sports Authority of India Training centre hockey players with the help of selected predictor variables such as Speed, Agility, Endurance, Blood Pressure, Resting Heart rate, Breath holding time, Dribbling, Hitting, Pushing, Scooping Aggression, Self confidence and Motivation. The hockey playing ability was determined by

subjective rating by three experts and was used as the criterion variable. The backward selection in multiple regression method was used to determine the prediction equation (**Thomas and Nelson, 1990**).

In backward regression selection method begins with the squared multiple correlations of all the predictor variables with criterion variables. The predictor variables are deleted from the regression equation one at a time, and the last two R square due to deletion of the variable is studied, that is, each variable is treated as if it were entered last in the equation. Thus, it is possible to find out which variables adds least when entered last in the equation, and the loss in R square is compared against a criterion of meaningfulness as well as significance. Thus, when a variable does not add meaningfully or significantly to prediction it is deleted, and when no variable is deleted, the analysis is terminated.

In the present study, among the Psychological variables Self confidence only were found to be significantly correlated with hockey playing ability with correlation values of -0.239. The result of the present study was supported the studies conducted by Devaraju and Needhiraja (2012)

Among the physiological variables studied blood pressure proved to be predictors with correlation values of -0.227. The result of the present study was supported the study conducted by Natarajan and Vijayaraghavan (2011).

Among the performance variables studied Dribbling and Pushing proved to be predictors with correlation values of 0.231 and -0.191 respectively. The result of the present study was supported the study conducted by Vijayaraghavan (2011).

4.8. DISCUSSION ON HYPOTHESIS

The formulated hypothesis No. 1 It was hypothesized that the physical fitness variables, speed, agility, and endurance would be predictors for hockey playing ability.” The results of this study showed that Speed Agility and Endurance are the the predictor variables for hockey playing ability. Hence, the hypothesis was accepted for speed, Agility and endurance.

The formulated hypothesis No. 2 It was hypothesized that the physiological variables Blood Pressure, Vital capacity, Resting Heart rate and Breath Holding Time would be predictors for hockey playing ability”. The results proved Blood Pressure were found as predictors and to be accepted and in case of Resting Heart Rate and Breath Holding Time were not found to be predictors and hence the two physiological variables were rejected.

The formulated hypothesis No. 3 stated that “It was hypothesized that the psychological variables, Aggression, Self Confidence and Motivation would be predictors for hockey playing ability.” The results of this study proved that Self Confidence were only the predictor for criterion variable for hockey playing ability

and the hypothesis was partially accepted. The results proved Self confidence and were found as predictors and the hypothesis was accepted for this variable and rejected in the case of aggression and motivation.

The formulated hypothesis No. 4 It was hypothesized that the performance variables, Dribbling, Hitting, Pushing and Scooping would be predictors for hockey playing ability. Thus the hypothesis was accepted partially. The results proved Dribbling and Pushing were found as predictors and the hypothesis was partially accepted for this variable and rejected in the case of Hitting and Scooping of performance variables.

TABLE XVI

TABLE SHOWING THE RESULTS OF THE STUDY

S.No	Variables	Null Hypothesis	Research Hypothesis
	Physical Fitness Variables		
1	Speed	Rejected	Accepted
2	Agility	Rejected	Accepted
3	Endurance	Rejected	Accepted
	Physiological Variables		
4	Blood Pressure	Rejected	Accepted
5	Resting Heart rate	Accepted	Rejected
6	Breath Holding Time	Accepted	Rejected
	Psychological Variables		
7	Aggression	Accepted	Rejected
8	Motivation	Accepted	Rejected
9	Self Confidence	Rejected	Accepted
	Performance Variables		
10	Dribbling	Rejected	Accepted
11	Hitting	Accepted	Rejected
12	Pushing	Rejected	Accepted
13	Scooping	Accepted	Rejected