Chapter III

METHODOLOGY

This chapter describes the selection of subjects, selection of variables, selection of tests, procedure for scoring the questionnaire, tester competency, reliability of instruments, reliability of data, orientation to the subjects, collection of data, administration of tests and inventory, and experimental design and statistical technique for analyzing the data.

Selection of Subjects

The purpose of the present study was to analyse the selected physical, psychomotor, psychological and performance variables among men hockey players in different playing positions. To achieve the purpose of the study, 45 male hockey players were selected at random from the affiliated colleges of Madurai Kamaraj University who represented their colleges in the Intercollegiate Hockey tournament conducted by Madurai Kamaraj University, Madurai, TamilNadu, India during the year 2008-2009. The age of the subjects ranged from 17 to 22 years. The selected subjects were divided into three groups based on
their playing positions, such as defense, midfield, and forward players.

**Selection of Variables**

In all sports, speed and strength are important qualities. Generally, it requires developing performance in sports and games. Speed is a magic work in sports. The person who can run faster and throw harder and more quickly is likely to be a better athlete and win more contests. Power is an essential quality in many sports, for it represents the effective combination of strength and speed. Increase in strength or speed will increase power, and when power increases, more work can be done in less time.

Many psychological factors have direct relation with sport competitions whether success or failure. Modern man lives in a mental world in which the important skills and success based on his psychological make up. Various factors have been isolated and responsible for excellence in sports. Apart from better training, good equipment, proper atmosphere, some other factors, which play an important role at the time of competition at any level in all sports are psychological factors, such as Competition anxiety, Achievement Motivation, Aggression, Sports Stress, and Group Cohesion.
Hockey is a game of strength, speed, and skill. It is among the most difficult to master, the costliest to equip, the fastest to watch, and the most dangerous to play. It requires a combination of power, endurance and flexibility applied within a confined space over a cold, hard, and slippery surface.

There are many fundamental skills involved in Hockey such as dribbling, passing, scooping, flicking, pushing, hitting, stopping, and goal shooting which played a major role in playing hockey. Among these skills hitting, dribbling pushing, and goal shooting were only selected as performance variables for this study.

Physical, Psychomotor, psychological, and performance parameters are the ideal indicators of sports performance status of an individual. Physical variables, motor fitness and physiological parameters play an important role in almost all games and sports. Hence, the following variables were selected for this study.

**Physical Variables**

- Agility
- Speed
- Strength Endurance
- Flexibility
Psychomotor Variables

Reaction Time
Movement Time
Balance

Psychological Variables

Cognitive Anxiety
Somatic Anxiety
Self-confidence
Achievement Motivation

Performance variables

Dribbling
Pushing
Hitting
Goal shooting

Dependent Variables

Playing Ability

Selection of Tests

As per the available literatures, the following standardized tests were used to collect relevant data on the selected independent variables and they were presented in Table I.


### TABLE I

**TESTS SELECTION**

<table>
<thead>
<tr>
<th>Types of Variables</th>
<th>S. No</th>
<th>Criterion Variables</th>
<th>Test items</th>
<th>Unit of Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical Variables</strong></td>
<td>1</td>
<td>Agility</td>
<td>Shuttle Run</td>
<td>In seconds</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Speed</td>
<td>50 M Run</td>
<td>In seconds</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Strength Endurance</td>
<td>Bent Knee sit-ups</td>
<td>In numbers</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Flexibility</td>
<td>Sit &amp; Reach</td>
<td>In centimetres</td>
</tr>
<tr>
<td><strong>Psychomotor Variables</strong></td>
<td>5</td>
<td>Reaction Time</td>
<td>Reaction time test (Chronometer)</td>
<td>In seconds</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Movement Time</td>
<td>Nelson Movement time test</td>
<td>In seconds</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Balance</td>
<td>Stroke stand</td>
<td>In seconds</td>
</tr>
<tr>
<td><strong>Psychological Variables</strong></td>
<td>8</td>
<td>Cognitive Anxiety</td>
<td>CSAI –II Questionnaire</td>
<td>In numbers</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Somatic Anxiety</td>
<td>CSAI –II Questionnaire</td>
<td>In numbers</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Self-confidence</td>
<td>CSAI –II Questionnaire</td>
<td>In numbers</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>Achievement Motivation</td>
<td>SMAT Questionnaire</td>
<td>In numbers</td>
</tr>
<tr>
<td><strong>Performance Variables</strong></td>
<td>12</td>
<td>Dribbling</td>
<td>Stewart Pither’s Hockey test</td>
<td>In numbers</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>Hitting</td>
<td>Stewart Pither’s Hockey test</td>
<td>In numbers</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>Pushing</td>
<td>Stewart Pither’s Hockey test</td>
<td>In numbers</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>Goal shooting</td>
<td>Stewart Pither’s Hockey test</td>
<td>In numbers</td>
</tr>
<tr>
<td><strong>Dependent Variables</strong></td>
<td>16</td>
<td>Playing Ability</td>
<td>Judges rating</td>
<td>In numbers</td>
</tr>
</tbody>
</table>

---

**Competency of the Tester**

The investigator took all the measurements in this study with the assistance of coaches/trainers of the college team concerned. To ensure that the investigator was well versed with
the technique of conducting tests, a number of practice sessions were held in the correct testing procedure. The tester's reliability was established by test and re-test method.

**Instruments Reliability**

The stopwatches, measuring tape, chronometer, and Nelson movement timer and sit and reach box used in this study were borrowed from Alagappa University College of Physical Education, Karaikudi, TamilNadu. The instruments were purchased from reliable and standardized companies and were considered accurate enough for the purpose of the study.

**Reliability of the Data**

Test and retest method was followed in order to establish the reliability of data by using ten subjects at random. The same personnel under similar conditions tested all the independent variables selected in the present study twice for the subjects. The intra class co-efficient of correlation was used to find out the reliability of the data and the results are presented in Table II.
TABLE II
INTRA CLASS CO-EFFICIENT OF CORRELATION ON SELECTED INDEPENDENT VARIABLES

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Variables</th>
<th>'R' Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Agility</td>
<td>0.87*</td>
</tr>
<tr>
<td>2</td>
<td>Speed</td>
<td>0.86*</td>
</tr>
<tr>
<td>3</td>
<td>Strength Endurance</td>
<td>0.89*</td>
</tr>
<tr>
<td>4</td>
<td>Flexibility</td>
<td>0.93*</td>
</tr>
<tr>
<td>5</td>
<td>Reaction Time</td>
<td>0.90*</td>
</tr>
<tr>
<td>6</td>
<td>Movement Time</td>
<td>0.91*</td>
</tr>
<tr>
<td>7</td>
<td>Balance</td>
<td>0.87*</td>
</tr>
<tr>
<td>8</td>
<td>Cognitive Anxiety</td>
<td>0.92*</td>
</tr>
<tr>
<td>9</td>
<td>Somatic Anxiety</td>
<td>0.95*</td>
</tr>
<tr>
<td>10</td>
<td>Self-confidence</td>
<td>0.96*</td>
</tr>
<tr>
<td>11</td>
<td>Achievement Motivation</td>
<td>0.93*</td>
</tr>
<tr>
<td>12</td>
<td>Dribbling</td>
<td>0.86*</td>
</tr>
<tr>
<td>13</td>
<td>Hitting</td>
<td>0.87*</td>
</tr>
<tr>
<td>14</td>
<td>Pushing</td>
<td>0.85*</td>
</tr>
<tr>
<td>15</td>
<td>Goal shooting</td>
<td>0.82*</td>
</tr>
<tr>
<td>16</td>
<td>Playing Ability</td>
<td>0.91*</td>
</tr>
</tbody>
</table>

*Significant at 0.05 level of confidence.
(Table value required for significance at 0.05 level of confidence is 0.77).

Since the obtained 'R' values were much higher than the required value, the data were accepted as reliable in terms of instrument, tester, and the subjects.
Orientations to the Subjects

The investigator explained the purpose of the study to the subjects and their part in the study. For the collection of data, the investigator explained the procedure of testing on selected dependent variables and gave instructions about the procedure to be adopted by them for measuring. The subjects of all the groups were sufficiently motivated to perform their maximal level during testing periods.

Validity and Reliability of the Questionnaires

Many researchers have used these questionnaires for research. The questionnaire used by them was Competition State Anxiety Inventory (CSAI-II) and Sports Achievement Motivation Test (SMAT). There can be no better evidence to prove the validity of the questionnaire than this.

A trial run of the inventory was made to ensure the reliability of the inventory and also to establish time-limit so that the respondent gave their feeling without too much boring. Subjects were given Competition State Anxiety Inventory (CSAI-II) and Sports Achievement Motivation Test (SMAT) to assess their psychological factors. Thus, the reliability of the test was established by test and retest method and the results have been presented in Table II.
Procedure for Scoring

Competitive State Anxiety Inventory (CSAI)

The tool was constructed to find the level of cognitive anxiety, somatic anxiety, and self confidence. The inventory consisted of 27 statements about the subjects’ feeling. The response sheet was scored in accordance with the response intensity key. Three sets of responses were summated separately. Thus, the cognitive anxiety was scored by the response of 1,4,7,10,13,16,19,22 and 25 numbered questions, the somatic anxiety was scored by the response of 2,5,8,11,14,17,20,23 and 26 numbered questions, and the self confidence was scored by the response of 3,6,9,12,18,21,24 and 27 numbered questions. In each case, summated scores were obtained. Response loading was done on feeling as follows:

- Not at all - 1
- Some what - 2
- Moderately so - 3
- Very much - 4

Player performance during the game was subjectively rated by three experts on a ten points scale. The average of the three experts rating was taken as a score.
Sports Achievement Motivation Test (SMAT)

In the SAMT questionnaire there are twenty test items. Among them, for questions 1, 3, 4, 9, 10, 11, 12, 13, 15, 16, 17 and 20, the expected answer is 'a'. For the questions 2, 5, 6, 7, 8, 14, 18 and 19 the expected answer is 'b'. For correct statement 2 marks and for incorrect zero mark were awarded.

Collection of Data

The investigator administered the questionnaire and other tests to measure the criterion variables to 45 male subjects. The investigator collected the data from the subjects before their matches during their rest time. The purpose of the study was clearly mentioned. The investigator explained to the subjects about the uses of the question and meaning of each question and how to fill the questionnaire. Care was taken to see that the subjects answered all the questions. The filled-in questionnaires were collected from respondents after checking that all the items were responded. Using the scoring key the total scores obtained by each subject were tabulated.
Administration of Tests

1. Agility (4 x 10 mts Shuttle Run)

Purpose

To measure the agility of the performer in running and changing direction.

Equipment

Calibrated measuring tape, stop watch and two blocks of wood (2"x2"x 4")

Procedure

The performer started behind the starting line on the signal "go" and ran to the blocks, picked up one, returned to the starting line, and places one block behind the line; he then repeated the process with the second block, allowing some rest between the two trails. Total distance covered in one repetition was 40 meters.

Scoring

The score for each performer is the length of time required (to the nearest tenth of second) to complete the course record only the best trial.
2. Speed (50 mts Run)

Purpose

The purpose of the test was to measure the speed of an individual.

Equipment

Stopwatch, chunnam, Scorecord

Procedure

The subject took a position behind the starting line. The starter used the command, “ready” and “go”. The latter was accompanied by a downward sweep of the arm as a signal to the timer. The subject ran across the finish line. The standing start method was adopted for this purpose. The stopwatch was started on the command “Go” and stopped when the runner crossed the finish line.

Scoring

The score was the elapsed time to the nearest one tenth of a second between the starting signal and the instant the subject crossed the finished line. The fractions were rounded to the next largest one tenth of a second. One trial was permitted.
3. Strength Endurance (Sit-ups)

Purpose

To evaluate abdominal muscular strength and endurance by performing repeated sit ups.

Equipment

Stopwatch and mats.

Procedure

Subjects lay down on their backs with knees flexed, feet on floor and heels between 12 & 18 inches from the buttocks. Arms were crossed over chest with hands on opposite shoulders. One foot was held to the mat by a partner. On “Ready”, “Go” the subject curled to a sitting position, maintaining arm contact with chest. When elbows touched the thighs the sit-up is completed. The subject then uncurled to a position where the midback contacted the mat. Subjects were to complete as many sit-ups in this manner as possible in one minute and rest between sit-ups was allowed in either the up (or) down position.

Scoring

Only correctly performed sit-ups completed in one minute were counted.
4. Flexibility (Sit and Reach Test)

Purpose

The sit and reach test is designed to ensure the Flexibility of the low back and posterior thigh.

Equipment

Sit and reach box, Scorecard and pencil

Procedures

The subject was asked to remove his shoes to be tested. To begin the test, the subject sat in front of the test apparatus with feet flat against the end board. The knees were fully extended and the feet shoulder width apart. To perform the test, the subject extended the arms forward with one hand placed on top of the other. The reach was repeated 3 consecutive trails, and on the fourth trial the maximum reach was held. The distance of the maximum reach was recorded as the test score.

Scoring

Three trials were given and the distance of the maximum reach was recorded as the test score.
5. Movement time Test (The Nelson speed of movement test)

**Purpose**

To measure combine reaction and speed of movement of the hands.

**Equipment**

Nelson reaction timer, table and chair, chalk, tape and ruler.

**Procedure**

The subject sat at on the table with his hands resting on the edge of the table. The palms were facing one another with the inside border marked on the edge of the table 12 inches apart. The tester held the timer near its top so that it landed midway between the subject’s palms. The base line was positioned so it was level with the upper borders of the subject’s hands.

After the preparatory command “ready” was given, the timer was released and the subject attempted to stop it as quickly as possible by clapping the hands together. The subject had to be careful not to allow his hands to move up to down when he was clapping the hands together. Twenty trials were given.
Scoring

The score for the combined response movement was read from the timers at the point just above the upper edge of the hand after the catch. The average of the middle ten trials, after the slower and faster five trials were discarded, was recorded.

6. Balance (Stroke stand test)

Purpose

To find out the balancing ability of the subjects

Equipment

Stopwatch

Procedure

The subject stood on the dominant foot, placed the other foot flat on the medical aspect of the supporting knee and hands on the hips. At the signal, the subject now raised the heal of the supporting foot and maintained balance as long as possible without moving the ball of the supporting foot or letting its heel touch the floor.

Scoring

Three trials were given. Time was counted in seconds from the heel was raised to the time the balance was lost or the hands
were removed from the hips. The highest of the three scores was recorded to the nearest second.

**Stewart Pither's Hockey Skill Tests**

The skill testing for Hockey performance had been designed by Stewart Pithers (Tasmania State Development Officer) in the year 2002. The purpose of these tests was to help young Hockey players improve their skills and prepare them for their future in the game. This was done by isolating and testing the technical and physical ability of players in terms of accuracy and speed, and by providing them with the challenge and motivation to practice and improve. These tests also provide young players with the opportunity to check their progress, by comparing their performance against other players. Hence, these tests were used to collect the pre and post test data on Hockey skill performance variables for the present study.

**7. Stewart Pither's Dribbling Test**

**Purpose**

To measure the dribbling skill performance of hockey

**Equipment**

Cones, hockey sticks, hockey balls and stopwatch

**Procedure**
On the command, the subjects started dribbling the ball through the starting gate and dribbled to the left of the central cone, then to the right and through the second cone on the circuit. The subjects were directed to use the open stick only at all times.

**Scoring**

Two points were awarded for each gate successfully and correctly negotiated.

**8. Stewart Pither's Hitting Test**

**Purpose**

To measure the hitting skill performance of hockey

**Equipment**

Hockey sticks, hockey balls and cones

**Procedure**

The subjects were asked to hit the ball across the width of the pitch at the targets. Two options were given to the subjects in hitting the ball. One was to put the ball on the side line and hit the stationary ball and the second was to move from the spot and hit the rolling ball.
**Scoring**

The subjects got the highest score possible from six balls (24 points) was recorded. Points were allocated with one point being scored if the ball travels through the furthest cones. Two points were scored if the ball passes through the cones close to the middle cones and four points were scored for pushing the ball straight.

**9. Stewart Pither's Pushing Test**

**Purpose**

To measure the pushing ability in hockey

**Equipment**

Hockey sticks, hockey balls, cones and floor marking.

**Procedure**

The aim of this test was for the subjects to direct the ball at the target, dragging, slapping or pushing the ball. The subjects were not permitted to run with the ball before pushing. A maximum of six balls were used.

**Scoring**

The highest score possible from six balls (24 points) was recorded as the test score. One point was scored if the ball traveled through the furthest cones and two points were scored if
the ball passed through the cones close to the middle cones, and four points were scored for pushing the ball straight.

10. Steward Pither's Goal shooting Test

Purpose

To measure the hockey goal shooting ability

Equipment

Hockey sticks, hockey balls,

Procedure

The subject was asked to start by rolling the ball into the circle to the forehand (open stick) side and hitting the ball at the goal. The next ball was pushed to the left and hit with the reverse stick side only, then the next ball to the right and so on. Six balls were rolled in which three balls rolled from right side and three balls rolled from left alternatively.

Scoring

If the ball hit the back board, one point was awarded, two points were awarded if the ball hit the middle third, three points were awarded if the ball hit the top third and no point was given if the ball missed to enter the goal cage. In order to see the difference between the middle third and top third of the goal, a
coloured rope was placed in the goal net. Maximum score after six shots (18 points) was recorded as test scores.

**Playing Ability**

Playing ability was subjectively rated during the Intercollegiate Hockey Tournament organized by Madurai Kamaraj University, Madurai, TamilNadu, India by three experts with ten points scale on the selected game of Hockey. The average of the three experts rating was taken as a score.

**Statistical Technique**

The mode of analysis of data on the selected dependent variables and playing ability among the selected players of different level have been statistically analyzed by using Pearson product moment correlation, multiple correlation and multiple regression. Regression equation was found between playing ability and selected independent variables. In all the cases 0.05 level of significance was fixed to test the hypotheses.