Chapter – III

METHODOLOGY

This chapter describes the selection of respondents, selection of variables, orientation to the respondents, reliability of instrument, validity and reliability of questionnaire, competence of the tester, reliability of the data, selection of tests, administering the tests, research design and statistical technique used for analyzing the data.

Selection of the respondents

The purpose of the study is to analysis of selected anthropometric, physical, physiological and psychological factors among the students with reference to their academic achievement. During the academic year 2010-2011 out of 350 sports background respondents are participated in the Inter school competition from Arts and Science discipline and Engineering discipline, 60 females studying I Year in H.H. The Rajah’s College (Autonomous), Pudukkottai and 60 from Sudharsan Engineering College, Sathyamangalam, Pudukkottai, Tamil Nadu, India were randomly selected to achieve the purpose of the study. They were selected based on their academic achievement in the XII Standard State Board Examination as average, above average, good and superior to a total of 120 respondents. The age of the respondents were ranged from 17 to 19 years. The academic achievements of the respondents in the XII standard examinations were considered as independent variables for this study. The respondents those who scored 80 to 84 percent in the XII standard examination were considered as superior achievers; respondents those who scored 75 percent to 79 percent in the
XII standard examination were considered as good achievers; respondents those who scored 70 percent to 74 percent in the XII standard examination were considered as above average achievers; respondents those who scored 65 to 69 percent in the XII standard examination were considered as average achievers.

**Selection of Variables**

Academic achievement measure the extent to which the individuals have acquired certain knowledge, skills, concept and abilities as a result of instruction received from the college. It also means that the student achieve high marks in the examination which determines respondents performance. The present study analyses the difference between the academic achievement and physical activities of the respondents from the Art & Sciences College and Engineering discipline. The time spent in physical activity does not adversely affect academic performance of the respondents. In some case, more physical education leads to improved grades and standardized test scores. Physically fit respondents tend to have better academic achievement. There are several possible mechanisms by which the physical activities could improve academic achievement, including enhanced concentration skills and classroom behavior. From the literature of the previous studies, the discussion with guide and experts in the field and considering the feasibility of the study, the researcher selected anthropometric, physical, physiological and psychological variables for the study. Hence the following variables were selected for this study.
Anthropometric Variables

1. Standing Height.
3. BMI.

Physical Variables

4. Speed.
5. Flexibility.

Physiological Variables

7. Resting Pulse Rate.
8. Respiratory Rate.

Psychological Variables

10. Trait Anxiety Inventory (TAI).
11. Aggression.
## Table – I
DESCRIPTION OF THE VARIABLES AND TEST ITEMS

<table>
<thead>
<tr>
<th>Independent Variables (Categorical Factors)</th>
<th>Academic Achievement (XII mark statement during the 2010 -2011)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Course of the study</strong></td>
<td><strong>Average achievers</strong></td>
</tr>
<tr>
<td>Arts and Science discipline</td>
<td>(I Year Female respondents studying in H.H. The Rajah’s College, PDK, TN, India)</td>
</tr>
<tr>
<td>Engineering discipline</td>
<td>(I Year Female respondents studying in Sudharsan Engineering College, PDK, TN, India)</td>
</tr>
<tr>
<td><strong>Dependent variables</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Anthropometric</strong></td>
<td></td>
</tr>
<tr>
<td>Standing Height</td>
<td>Stadiometer</td>
</tr>
<tr>
<td>Body Mass</td>
<td>Weighing Machine</td>
</tr>
<tr>
<td>Body mass Index</td>
<td>W/H²</td>
</tr>
<tr>
<td><strong>Physical</strong></td>
<td>Speed</td>
</tr>
<tr>
<td>Flexibility</td>
<td>Sit and reach scale</td>
</tr>
<tr>
<td>Muscular Endurance</td>
<td>Bent knee sit – ups</td>
</tr>
<tr>
<td><strong>Physiological</strong></td>
<td>Resting Pulse Rate</td>
</tr>
<tr>
<td>Breath Holding Time</td>
<td>Nostril clip Method</td>
</tr>
<tr>
<td>Respiratory Rate</td>
<td>Expirograph</td>
</tr>
<tr>
<td><strong>Psychological</strong></td>
<td>Trait Anxiety</td>
</tr>
<tr>
<td>Aggression</td>
<td>SAMTQ</td>
</tr>
<tr>
<td>Sports Achievement Motivation</td>
<td>SMITH AQ</td>
</tr>
</tbody>
</table>
**Orientation to the respondents**

The researcher explained the purpose of the study to the respondents and their part in the study. For the collection of data, the researcher explained the procedure of testing on selected criterion variables and gave instructions about the procedure to be adopted by them for measuring. The respondents were sufficiently motivated to perform their maximal level during the testing period.

**Instrument of Reliability**

The researcher used a list of instruments such as the clinical stopwatches, weighing machines, stadiometer and expirograph from the Department of Physical Education and Centre for Research in H.H. The Rajah’s College (Autonomous), Pudukkottai, Tamilnadu, India. The instruments were purchased from reliable and standardized companies and were considered accurate enough to serve the purpose of the study.

**Validity and Reliability of the Questionnaires**

Many researchers have used questionnaires such as Smith’s Aggression Questionnaire, Sports Achievements Motivation Test (SMAT) and Trait Anxiety Test for collecting relevant data for their research purpose.

**Competence of the Tester**

The researcher took all the measurements in this study with the assistance of coaches of the academic discipline concerned. To ensure that the researcher 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 retest method.
Reliability of the Data

Test and retest method was followed in order to establish the reliability of data by using ten respondents at random from H.H. The Rajah’s College (Autonomous), Pudukkottai, Tamilnadu, India. The same personnel under similar conditions were tested for all the dependent variables selected in the present study twice. 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 VARIABLES

<table>
<thead>
<tr>
<th>S.No</th>
<th>Variables</th>
<th>‘R’ Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Anthropometric Variables</strong></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Standing Height</td>
<td>0.93*</td>
</tr>
<tr>
<td>2.</td>
<td>Body Mass</td>
<td>0.97*</td>
</tr>
<tr>
<td>3.</td>
<td>BMI</td>
<td>0.95*</td>
</tr>
<tr>
<td></td>
<td><strong>Physical Variables</strong></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Speed</td>
<td>0.90*</td>
</tr>
<tr>
<td>5.</td>
<td>Flexibility</td>
<td>0.91*</td>
</tr>
<tr>
<td>6.</td>
<td>Muscular Endurance</td>
<td>0.90*</td>
</tr>
<tr>
<td></td>
<td><strong>Physiological Variables</strong></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Resting Pulse Rate</td>
<td>0.90*</td>
</tr>
<tr>
<td>8.</td>
<td>Breath Holding Time</td>
<td>0.88*</td>
</tr>
<tr>
<td>9.</td>
<td>Respiratory Rate</td>
<td>0.91*</td>
</tr>
<tr>
<td></td>
<td><strong>Psychological Variables</strong></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Trait Anxiety</td>
<td>0.91*</td>
</tr>
<tr>
<td>11.</td>
<td>Aggression</td>
<td>0.92*</td>
</tr>
<tr>
<td>12.</td>
<td>Sports Achievement Motivation</td>
<td>0.95*</td>
</tr>
</tbody>
</table>

*Significant at 0.05 level of confidence (Table Value require 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 respondents.
Selection of Tests

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

Table - III
SELECTION OF TESTS

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Criterion Variables</th>
<th>Test items</th>
<th>Unit of Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Standing Height</td>
<td>Stadiometer</td>
<td>In centimeters</td>
</tr>
<tr>
<td>2</td>
<td>Body Mass</td>
<td>Clinical Weighing Machine</td>
<td>In kilograms</td>
</tr>
<tr>
<td>3</td>
<td>BMI (Body mass Index)</td>
<td>W/H(^2)</td>
<td>In kg and Meters</td>
</tr>
<tr>
<td>4</td>
<td>Speed</td>
<td>50 meter Run</td>
<td>In 1/10 of seconds</td>
</tr>
<tr>
<td>5</td>
<td>Flexibility</td>
<td>Sit and Reach Scale</td>
<td>In centimeters</td>
</tr>
<tr>
<td>6</td>
<td>Muscular Endurance</td>
<td>Bent Knee Sit - Up</td>
<td>In minutes</td>
</tr>
<tr>
<td>7</td>
<td>Resting Pulse Rate</td>
<td>Bio-monitor</td>
<td>In Beats per minute</td>
</tr>
<tr>
<td>8</td>
<td>Breath Holding Time</td>
<td>Nostril clip Method</td>
<td>In seconds</td>
</tr>
<tr>
<td>9</td>
<td>Respiratory Rate</td>
<td>Expirograph</td>
<td>In rate per minute</td>
</tr>
<tr>
<td>10</td>
<td>Anxiety</td>
<td>Trait Anxiety Questionnaire</td>
<td>In scores</td>
</tr>
<tr>
<td>11</td>
<td>Aggression</td>
<td>Smith Aggressive Questionnaire</td>
<td>In scores</td>
</tr>
<tr>
<td>12</td>
<td>Sports Achievement Motivation</td>
<td>Sports Achievement Motivation Questionnaire</td>
<td>In scores</td>
</tr>
</tbody>
</table>
Administering the Tests

The data on the anthropometric and physiological variables were collected both in the morning and in the evening session. The anthropometric variables such as height, body mass and BMI and physiological variables such as resting pulse rate, breath holding time and respiratory rate were administered in the morning session from 9.00 to 10.00 a.m. After warming up in the evening session, the physical variables such as speed, flexibility and muscular endurance were administered from 4.30 p.m to 6.00 p.m on the same day. In the evening session on the same day from 6.00 p.m to 7.00 p.m psychological variables are collected by administrating the respective questionnaire for three different variables as mentioned in Table – III.

Anthropometric Variables

Standing Height

Objective

To measure the Standing height of the respondents

Equipments used

Stadiometer, scale, piece of chalk, pencil and score sheet.

Procedure

The respondents were asked to stand on the stadiometer with barefoot and at the time the measurement of the heels were kept on the platform without elevating it. The scale was brought down firmly in contact with vertex. A mark was made with chalk piece on the side of scale in the stadiometer after that the respondents stepped away from the stadiometer stand board.
Scoring

The vertical distance from the stadiometer stand board to chalk piece mark was measured. The measurement was taken to the nearest one centimeter.

Body Mass

Purpose

To measure the body mass.

Equipments Used

Clinical weighing machine, pad and pencil.

Procedure

The respondents was asked to stand with minimal movement of the hands by their side. Shoes and excess clothing were removed while measuring body mass.

Scoring

The kilograms measurement from the weighing machine was measured. The measurement was taken to the nearest one kilogram.

BMI (Body Mass Index)

Purpose

To measure the Body Mass Index.

Equipments Used

Scales or Stadiometer, was used to measure height and Weighing machine to measure weight.
Procedure

BMI is calculated from body mass (M) and Height (H), BMI = M / H (H x H), where M = body mass in kilograms and H = height in meters. The higher the score usually indicating higher levels of body fat

Scoring

The following table is used to determine the BMI rating of the individual. These classification systems were framed by World Health Organisation. The rating scale is the same for male and female. One can also use the reverse lookup BMI table for determining the ideal weight based on height.

<table>
<thead>
<tr>
<th>Classification</th>
<th>BMI (kg/m2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under Weight</td>
<td>&lt; 18.5</td>
</tr>
<tr>
<td>Normal Weight</td>
<td>18.5 – 24.9</td>
</tr>
<tr>
<td>Over Weight</td>
<td>25 – 29.9</td>
</tr>
<tr>
<td>Obesity</td>
<td>30 greater</td>
</tr>
</tbody>
</table>

Physical Variables

50 Meters Run

Purpose

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

Stopwatch, chunnam and score card.

**Procedure**

The respondent took a position behind the starting line. The starter used the command, “ready” and “go” accompanied by a downward sweep of the arm as a signal to the timer. 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 finishing line. The fractions were rounded to the next largest one tenth of a second. One trial was permitted.

**Flexibility**

**Sit and Reach Test**

**Purpose**

To assess the flexibility of the trunk.

**Equipment Used**

Sit and reach, measurement scale.

**Procedure**

The respondents were asked to line up the 15 cm apart with a line on the floor and taped the scale to the floor. After that they sat down and lined up their
heels with the near edge of the 15 cm apart and slide their seat back beyond the zero and of the measurement scale. With knees locked and heels not more than fifteen centimeters apart, stretched forward and touched the finger tips of both hands as many centimeters down the scale as possible.

**Scoring**

The highest score was recorded in nearest centimeter among the three trials.

**Muscular Endurance**

**Bent Knee Sit – ups**

**Purpose**

To measure the endurance of the abdominal muscles.

**Procedure**

From a lying position on the back, the performer flexes her knees over the yardstick while sliding her heels as closed her seat as possible. The yardstick should be held tidily under the knees until the performer is instructed to slowly slide her feet forward. At the point where the yardstick drops to the mat, the tester marks the heel line and seat line to indicate how far the feet should remain from the seat during the bent – knee sit ups exercises. The performers should interlace the finger behind the neck and perform sit – ups alternating a left elbow touch of the inside right knee and right elbow touch of the inside left knee. The exercise should be repeated as many times as possible.
**Scoring**

The total numbers of repetitions are recorded for the score. However, repetition should not be counted when fingertips do not maintain conduct behind the head, when the knees are not touched, or when the respondent pushes of the floor with the elbows.

**Physiological Variables**

**Resting Pulse Rate**

**Purpose**

The purpose was to measure the resting pulse rate of each respondent per minute.

**Equipments used**

Heart rate monitor of the Bio-monitor was used.

**Procedure**

The resting pulse rate of the respondent was monitored through the heart rate monitor of the Bio-monitor. It monitored the resting pulse rate using the method of finger plyphesmography with the help of an opto-electronic transducer on finger. Fifteen minutes before taking the pulse rate, the respondent was asked to sit and rest her comfortably in a chair. The researcher fixed opto – sensor unit to the thumb of the respondent using velcro-straps. It was fixed in such a way that the light on the opto – sensor unit was at the distal end of the finger tips and the LDR was nearer to the finger tip. The Velcro strap on the LDR side was fastened firmly while the strap on the lamp side was loosely fastened.
The PCG/pulse ON_OFF switch of the Bio-monitor was kept in the pulse position. Then the heart rate monitor was switched on by pressing the pulse push button switch. After about 30 seconds, the pulse LED indicator flashed and the beeps started and stabilized. After that, the flashes and beeps occurred rhythmically with respect to the respondents pulse.

**Scoring**

The pulse rate per minute was indicated by the three digital meters. After about a minute the digital meter showed the respondents’ pulse rate and was recorded in beats per minute.

**Breath Holding Time**

**Purpose**

The purpose was to measure the ability of the respondent to hold the breath for longer time.

**Equipment Used**

A stop watch with calibration of full a seconds, score sheet and a pencil were used to administer this test.

**Procedure**

The respondent was asked to stand at ease and inhale deeply and after that she was asked to hold the breath as long as possible. The index finger of the respondent served as an indicator to the researcher to know the start and end of the recording time. The thumb and middle finger were used to hold the nose to avoid
letting the air through the nostrils. The respondents were requested not to let the air out by opening the mouth while recording the breath holding time.

**Scoring**

The time of holding the breath was calculated using the stopwatch to the nearest full a seconds as breath holding time.

**Respiratory Rate**

**Purpose**

To measure the respondents’ number of breaths per minute.

**Equipment Used**

The apparatus Expirograph was used to measure the respiratory rate of the respondents.

**Procedure**

Respiratory rate was assessed by using the apparatus Expirograph. When the respondents became familiar with room temperature and attained normal breathing, Kymograph was switched on at a speed of 60mm/minute. Then the respondent was asked to have the breath normally for one minute. Now the recorder pen was moving up and down with marking on the graph. It was allowed to move up to 60 millimeters.

**Scoring**

There were a number of sharp edges on the graph sheet indicating the number of breaths in one minute. This reading was recorded as the respiratory rate of the respondents.
Psychological Variables

The researcher administered the questionnaire and other tests to measure the criterion variables to 120 female respondents. The purpose of the study was clearly mentioned. The researcher explained to the respondents about the uses of the question and meaning of each questions and how to fill the questionnaire. Care was taken to see that the respondents answered all the questions. The filled-in questionnaires were collected from the respondents after checking that all the items were responded. Using the scoring key the total scores obtained by each respondent were tabulated.

Procedure of Scoring

Trait Anxiety Inventory (TAI)

The inventory consists of 20 statements and the respondent has to select and tick in one of the four following columns: ‘almost never’, ‘sometimes’, ‘often’ and ‘almost always’.

The scores for each item were assigned respectively for the questions 1, 6, 7, 10, 13, 16 and 19 the scores are for almost never-4, Sometimes-3, Often-2 and almost always-1 respectively. Rest of the items are scored in the reverse way.

Aggression

Standardized Smith's questionnaire for sporting aggression was used to scale the aggressiveness. The test consists of ten questions with five levels of responses. The level changes from strongly disagree to strongly agree. The respondents were made to encircle the approximate number, which suited their
attitude. The inventory was scored with the help of the scoring key given below. The range of the score was from 10 to 50. The higher the score, the more aggressive the player is.

- Strongly disagree: 1
- Disagree: 2
- Undecided: 3
- Agree: 4
- Strongly agree: 5

**Sports Achievement Motivation Test (SAMT)**

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 the correct statement 2 marks and for incorrect zero mark is awarded. The range of the score was from 0 to 40.

**Research Design**

The experimental design used in this study is 2x4 factorial designs. The first factor was academic discipline (namely as Arts and Science & Engineering). The second factor was the different academic achievement level such as average achievers; above average achievers; good achievers and superior achievers. This design was used to find out the influence of each factor independently and also their combined influence on each of the selected criterion variables.
**Statistical Technique Used**

The present researcher consists of two categories of independent variables namely academic discipline and different academic achievements. The first independent variable relates to Arts and Science discipline and Engineering discipline and the second independent variables relate to average achievers; above average achievers; good achievers and superior achievers. The criterion variables selected for this study are standing height, body mass and BMI as anthropometric variables; 50mts run, sit and reach and bent knee sit–up as physical variables; resting pulse rate, respiratory rate and breath holding time, as physiological variable and trait anxiety, smith’s aggression and sports achievement motivation as psychological variables.

The Two Way (2x4) Analysis of variance (ANOVA) was used to evaluate the influence of the twelve criterion variables on the two categories of variables. The obtained results have three ‘F’ ratio, two for main effect; the first F – ratio for rows (referring to academic discipline) and columns (referring to academic achievement) and one for interaction (referring to the academic discipline and academic achievement).

The F- ratio for rows, test the significant difference, if any, among Arts and Science discipline and Engineering discipline female respondents irrespective of academic achievement in each dependent variables. The F – ratio for column analysis test the significant difference if any, among the respondents of academic achievement irrespective of academic discipline in each dependent variables separately. The F- ratios for interaction compare the means for Arts and Science
discipline and Engineering discipline of the selected dependent variables among the academic achievement selected for study. The obtained F ratios of column (academic achievement) were significant, Scheffe’s test was used as Post Hoc Test separately for column to find out the difference between paired mean were significant. If the obtained F ratio for interaction was significant, then simple main effect test was used as follow-up test to find out which of the mean scores for academic discipline and academic achievement were significant. Thus, Five F – ratios were computed in which the first three F – ratio analyze the scores for Arts and Science discipline and Engineering discipline at different academic achievement levels on dependent variables and the remaining two F –ratio analyze the variations in the academic achievement of respondents of Arts and Science discipline and Engineering discipline on dependent variables. Further, individual comparison among the respondents of academic achievement levels were also made for interpretation by using the Scheffe’s Post Hoc Test. In all the conditions the significant level was fixed at 0.05 levels, which was considered to be appropriate.