CHAPTER III

METHODOLOGY

The method adopted for the selection of the subjects, experimental variables, testers reliability, instrumental reliability, tests administration, experimental design and statistical techniques used have been mentioned below.

SELECTION OF THE SUBJECTS

The purpose of the study is to compare and analyse the selected physiological, psychological, haematological and motor fitness variables of the rural and urban school players of South India. To achieve the above purpose, the investigator selected state level school boys who had participated in Republic Day Competitions from the following states of South India (Tamil Nadu, Andhra Pradesh, Karnataka and Kerala). Twenty school players from each state were selected among these twenty, ten were from rural areas of the respective states and ten were from urban areas of the respective states. Thus the composition of the subjects is formed as shown in Table I.
Table I

Composition of the subjects selected for the study

<table>
<thead>
<tr>
<th>S.No</th>
<th>States</th>
<th>Subjects from</th>
<th>Rural</th>
<th>Urban</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tamil Nadu</td>
<td>10</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Andhra Pradesh</td>
<td>10</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Karnataka</td>
<td>10</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Kerala</td>
<td>10</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

Experimental Variables

The physiological, psychological, haematological and motor fitness variables selected for the study are listed below.

a. Physiological

i. Body Fat

ii. Vital capacity (cms)

iii. Resting Heart Rate (Minutes)

b. Psychological

i. Self Concept

ii. Anxiety

iii. Achievement Motivation
c. Haematological

i. Haemoglobin

ii. Differential count

iii. Red Blood Cells

d. Motor Fitness Variables

i. Speed

ii. Agility

iii. Endurance

TESTERS RELIABILITY

To ensure that the investigator was well versed with the techniques of conducting the tests, the investigator conducted a number of practice sessions so as to become proficient in testing procedures under the guidance of experts. The investigator trained the tester assistants and a pilot study was conducted with 10 subjects to ascertain the test-retest reliability of the investigator and also the two assistants in the selected physiological and motor variables. Qualified and trained laboratory personnel measured haematological variables.
The investigator took all the measurements with the assistance of the coaches and trained tester assistants. The physiological and haemotological variables were measured with the assistance of Indian Council for Medical Research, Chennai.

TESTERS ORIENTATION AND PILOT STUDY

The purpose of the study and method of collecting data were clearly explained to the two tester assistants who helped in this investigation. Investigator demonstrated the operation of the stopwatch and the use of other instruments. The investigator and the tester assistants conducted a pilot study on the selected variables and the test retest reliability values obtained are presented in Table II.
### Table II

**Test Retest Reliability of the Investigator and Test Assistants**

<table>
<thead>
<tr>
<th>S.No</th>
<th>Variables</th>
<th>Investigator</th>
<th>Test Assistant I</th>
<th>Test Assistant II</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Body Fat (percentage)</td>
<td>0.90</td>
<td>0.88</td>
<td>0.88</td>
</tr>
<tr>
<td>2</td>
<td>Vital Capacity (Litres)</td>
<td>0.92</td>
<td>0.90</td>
<td>0.88</td>
</tr>
<tr>
<td>3</td>
<td>Resting Heart Rate</td>
<td>0.93</td>
<td>0.87</td>
<td>0.86</td>
</tr>
<tr>
<td></td>
<td>(beats per minute)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Speed (Secs)</td>
<td>0.94</td>
<td>0.90</td>
<td>0.92</td>
</tr>
<tr>
<td>5</td>
<td>Agility (secs)</td>
<td>0.95</td>
<td>0.90</td>
<td>0.90</td>
</tr>
<tr>
<td>6</td>
<td>Endurance (in meters)</td>
<td>0.96</td>
<td>0.94</td>
<td>0.95</td>
</tr>
</tbody>
</table>

#### INSTRUMENT RELIABILITY

Body fat was determined using skin fold calipers (Lange, USA). The syringe bottles for the collection of blood samples, EDTA (for the prevention of clotting blood) cotton, spirit and other equipments utilised for this study were obtained from the Laboratory of ICMR Chennai. Hence, their reliability was accepted for the purpose of the study. Moreover the above equipments were purchased from standard companies. (SISCO, Chennai).
SUBJECTS ORIENTATION

The subjects were explained about the purpose and procedure of the tests to be administered. An informed consent was obtained from all the subjects. The subjects were active players and were healthy to undergo this study. Adequate instructions were given and the investigator if any, clarified doubts.

ADMINISTRATION OF TESTS

The method of administration and the procedures of the physiological, psychological, haematological and motor fitness tests and collection of data are detailed below:-

Physiological Variables

Body Fat

James S. Basco and William E. Custafson (1983) defined that body fat is the difference between body weight and fat free mass.

Purpose

To find out the body fat of the subjects.
Equipment

A skin fold measurement requires precise calipers that are designed to apply even under pressure throughout the time of measurement. The tester grasped the skin fold between thumb and index finger and attached the jaws of the calipers about 1 cm from the measuring site. The measurements were taken to the nearest millimeter. A Lange skin fold caliper (USA) was used.

Test Procedure

The following body parts were used to measure the skin fold thickness.

Sub - Scapula

The inferior angle of the scapula. The skin fold was measured on a 45 degrees plane parallel to the auxiliary border.

Triceps

Triceps is on the back of the upper arm midway between the acromion process and the obieron process. The skin fold was taken parallel to the long axis of the arm.
Abdomen

About one cm to the right of the umbilicus, and a horizontal fold was taken.

Supra-iliac

The skin fold of the ilium at the midaxillary line was taken. The fold was lifted following the natural line of the iliac at rest.

Vital Capacity

Purpose

To find out the vital capacity of the subjects.

Equipments

A wet Spiro meter was used to determine the lung volumes of the subjects. It consists of two metal drums, one inverted over the other. The inverted container was made air tight by sealing it in a column of water.

Procedure

As the subjects exhaled into the wet Spiro meter, the inverted drum moved up, whereas upon inhalation, the drum moved down. The up and down movement of the drum represent the volume of
air breathed. The readings are recorded from the rotating drum on a chart. A motor attached to the Spiro meter and the upward drove the drum and downward movement of the drum was recorded on the chart by a marker. The measurements were recorded to the nearest millimeter.

**Resting Heart Rate**

**Purpose**

To measure the resting heart rate

**Procedure**

To measure resting heart rate, the subjects were asked to lie in a supine position on the bench, and five minutes resting period was provided. Then the subjects were asked to get into pairs. While one subject rested, the other subject counted the pulse by slightly pressing the middle three fingers on the radial artery just above the wrist on the thumb side. The pulse rate was counted for 30 seconds and multiplied by two to get the one-minute value. The same procedure was repeated for all the subjects. All the subjects were given practice trails to count correct pulse rate.
Motor Fitness Variables

Speed – 50 Yards Dash

Purpose

To measure speed of an individual

Equipment

At least 70 yard of uncluttered, flat, safe running space and stops watch (0.01 sec)

Procedure

i. It was ensured that the athletes perform adequate stretching and warm up.

ii. The subjects were positioned behind the starting line.

iii. On the “Go” command, the subjects printed the 50 yards distance.

iv. Timer started the watch on the first movement at the starting line and stopped the watch as the subjects crossed the finishing line of 50 yards line.

v. Yobu A., (1988) stated that the scores were the elapsed time to the nearest tenth of a second.
Agility - Shuttle Run

Purpose

To measure agility

Facilities and Equipment

Two lines parallel to each other were marked on the ground 30 feet apart. Since the subject must not overrun lines it was restrained by flat blocks of wood placed on the outside of the lines, firmly pegged to the ground. Two blocks of wood two by four inches and a stopwatch were used.

Procedure

The subject stood at one of the lines with the 2 blocks at the other line. On the signal to start, the subject ran to the blocks, took one block and returned to the starting line. After placing the block behind the line the subject then returned to the second block, which was carried across the starting line on the way back. Two students were tested at the same time with two set of wooden blocks and two electronic watches. Two trials were permitted. All the subjects were in comfortable attire and ran in canvas shoes.
Scoring

The score is the elapsed time in one hundredth of second and the best score of the two trials were recorded as the score.

Endurance - 12 Minutes Cooper Test

Purpose

To measure cardiovascular endurance of an individual

Equipment

A 400 meters track and field; Chunnam; Flags; whistle and distance markers and stopwatch (0.01 sec)

Procedure

The subjects were positioned behind the line and upon the starting run / walk as many laps possible around the track in 12 minutes. The tester and tester assistants maintained the distance covered by the subjects and when the investigator gave the stop signal by blowing a whistle, the tester assistants ran immediately to the spot at which the subjects were at the moment the whistle was given. The scores were recorded in meters
Psychological Variables

Achievement Motivation

The achievement motivation was measured using Sports Achievement Motivation Questionnaire (SAMQ) constructed by Kamlesh (Appendix IV).

Administration of the Questionnaire

To enlist the cooperation of the subjects the investigator personally briefed all the subjects selected for this study. The investigator explained the purpose of the investigation and also gave a very clear idea regarding the method of answering the questions.

Sports Achievement Motivation Questionnaire consists of twenty questions. The questionnaire was handed over to the subjects and they were asked to answer all the questions without omitting any question. Before collecting the filled in questionnaires, the investigator checked whether all the statements in the questionnaire were answered.
Scoring

For every correct answer one mark was awarded and for an incorrect answer zero was awarded. Thus, the maximum marks would be twenty. The marks obtained in each test were recorded separately for analysis and interpretation.

Self Concept

Self concept questionnaire constructed by Mukta Rastogi (Appendix V) was used in this study. The questionnaire consists of twenty statements, which included both positive, and negative statements, with a response from any five answers, namely, strongly agree, agree, undecided, disagree and strongly disagree. The scale was scored with the help of the scoring key. A separate scoring method was followed for positive and negative statements.
<table>
<thead>
<tr>
<th>S.No</th>
<th>Responses</th>
<th>Scores for Positive Statements</th>
<th>Scores for Negative statements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Strongly Agree</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Agree</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Undecided</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Disagree</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Strongly Disagree</td>
<td>1</td>
<td>5</td>
</tr>
</tbody>
</table>

Self-concept scale consists of both positive and negative statements. The following are the numbers of the statement that are positive and negative.

**Positive Numbers:**

1,3,4,9,11,12,17,18,19

**Negative Numbers**

2,5,6,7,8,10,13,14,15,16, 20
Scoring

The scores obtained for both positive and negative statements were added to determine the individual score. The total scores reflected the individual’s self-concept with high scores showing higher self-concept level.

ANXIETY

C.D. Spielberger (1976) viewed that Anxiety questionnaire formulated by Speilberger was used to measure anxiety. The questionnaire consists of short descriptive statement, which includes both positive and negative statements. Each statement consists of four responses. The scale was scored with the help of scoring key.

<table>
<thead>
<tr>
<th>S.No</th>
<th>Responses</th>
<th>Scores for positive statements</th>
<th>scores for negative statements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Not at all</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>Some what</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Moderately</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Very much</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>
Anxiety scale consists of both positive and negative statement. The following are the numbers of the statement that are positive and negative.

**Positive Numbers**

4, 6, 7, 8, 10, 12, 13, 14, 15, 18, 19, 20

**Negative Numbers**

1, 2, 3, 5, 9, 11, 16, 17

The scores obtained for both positive and negative statements were added and each was treated as individual score. The total score reflected the individual’s anxiety level. The high scores showed higher anxiety level.

**Haematological Variables**

**Haemoglobin Content**

**Purpose**

To determine the haemoglobin content in the blood

**Equipment**

To determine the haemoglobin content ‘Sahli haemometer’ was used. This consists of haemometer tube, hydrochloric acid
(1:10) pipette, syringe and distilled water. The instrument was designed in accordance with the standards laid down by German Medical Association.

**Procedure**

In Sahli acid, acid haemolin method is to convert the blood into acid haemain by the addition of 1:10 hydrochloric acid. The finger tip of the subject was sterlised by solution and then the skin was pierced by Frank's needle and blood was sucked into the capillary pipette avoiding air bubbles, until the 20 cubic mark was reached. The blood was blown out completely into 2 ml of 1:10 hydrochloric acid in the haemometer tube on the stand, and was properly mixed till the liquid turned down in colour and then the tube was left undisturbed for ten minutes. Distilled water was added to this solution in a very thin steam using a dropper, until the colour of the solution in the haemometer matched with the nonfading coloured glass of the haemometer stand.

Readings were recorded at the lower meniscus of the solution from the haemoglobin scale on the tube. This indicates the haemoglobin percentage of the subject. The haemoglobin scale was
provided in grams of haemoglobin content per 100 ml of blood. The obtained result was converted into percentage by using the standard haemoglobin percentage chart.

Haemoglobin concentrations were expressed as grams deciliter.

DIFFERENTIAL COUNT

Purpose

To determine the differential count content in the blood.

Equipment

Slides, Leishman Stain, Distilled Water, Microscope.

Procedure

Take smear on the slide allow to dry. Cover the smear with Leishman stain for 2 minutes and allow it to dry. Then, pour equal amount of distilled water and washed the slide slowly after 7 to 10 minutes and make it to dry. Then, see the dried slide on the microscope and calculate the counted 100 cells.
ENUMERATION OF RED BLOOD CELLS

Purpose

To determine the red blood cells content in the blood.

Equipment

RBC Pipette, RBC Fluid, Counting Chamber.

Procedure

The number of red blood cells (RBC) were determined by suitable dilution and enumerated over a definite area.

Blood was drawn up to 0.5 mark of red blood cells pipette. The blood on the sides of the pipette was wiped off. Hayem's fluid was drawn into red blood cells pipette up to 101 mark carefully avoiding air bubbles. The contents were mixed gently taking care to avoid haemolysis. First few drops were discarded and then a small drop of mixture was placed at the edge-of the cover slip, placed on the haemocytometer, which was focused under the microscope. It was allowed undisturbed for five minutes so that the cells could settle on the haemocytometer. The number of cells in five small squares was counted.
Calculation

Number of cells in 5 small squares = X

Number of cells in a square millimeter area (25 small squares)
= X x 5

Depth (height between the cover slip and counting chamber,
= 0.1mm

Dilution factor = 200

Number of cells in 1 cu.mm = X x 5 x 10 x 200

= X x 10000

The results were expressed in millions / cu.mm of blood.

STATISTICAL ANALYSIS

Jerry R. Thomas & Jack K. Nelson (1990) viewed that to analyse the data in this study the following statistical techniques were used. 't' test and ANOVA was computed for finding the difference. The following formula was used for computing ANOVA.

\[ F = \frac{MS 	ext{ Between}}{MS 	ext{ Within}} \]
Harrison Clarke, H and David H. Clarke (1972) viewed that the significant differences obtained between the groups were analysed by Scheffe's Post Hoc Test to test if significant differences between the groups and to determine which group performed better. The Scheffe's Post Hoc test conducted using the following formula.

\[ I = \frac{S}{\sqrt{\frac{MS_{\text{within}}}{W_g}}} \]

- \( I \) = Confidence Interval Required
- \( S = \sqrt{(k-1)(F_{0.05})} \)
- \( W_g = \frac{1}{n} + \frac{1}{n} \)

Anne L. Rothstein, (1985) viewed that the collected data were further analysed using 't' ratio for comparison between rural and urban school players of South India by using the following formula.
't' = $\bar{D} / \bar{SD}$

Here $\bar{D}$ = Mean of the difference between groups

$\bar{SD}$ = Standard Error of the Mean

$\bar{D} = \sum D / N$

Here $\bar{D}$ = Mean of the different between groups

$\sum D$ = Sum of difference between scores

$N$ = Number of scores

$\bar{SD} = SD / \sqrt{N}$

Here

$SD = \sqrt{\sum D^2 - [\sum D^2 / N]}$

Here $\sum D^2$ = Square of score difference

$\sum D$ = Sum of difference between scores.