Chapter III
METHODOLOGY

In this chapter, the selection of subjects, selection of variables, pilot study, criterion measures, reliability of data, instrument reliability, testing reliability, subject reliability, orientation of the subjects, test administration, statistical procedure have been explained.

SELECTION OF SUBJECTS

The purpose of this study was designed to study on select Anthropometric, Physical, Physiological Variables and Socio–Economic Status of urban, rural and tribal area school students. To achieve this purpose of the study 237 boys, 214 girls from urban area and, 231 boys, 217 girls from rural area, and 234 boys, 222 girls from tribal area were selected at random from various schools of Trichy District, in Tamil Nadu during the academic year 2009–2010. Their age ranged from 13 to 16 years based on their school records.

Since the subjects selected for the study belonged to different area in Trichy District of Tamil Nadu. They were considered to be as representative samples. All the subjects were day scholars attending schools from 9.30 a.m. to 4.30 p.m. The schools considered for this study were under the control of Director of School Education, Tamil Nadu.

In order to ensure full co-operation from the subjects, the scholar had a brief meeting with the respective heads of Institutions and physical education teachers. The requirements for the study were explained to all the subjects in the presence of their physical education teachers and all the subjects voluntarily agreed to undergo the prescribed tests. Physically handicapped students were not included as subjects.
SELECTION OF VARIABLES

The research scholar reviewed the various scientific literatures, pertaining to the Anthropometric, Physical, Physiological variables and Socio Economic Status from books, journals, periodicals, magazines and research papers. Taking into consideration of feasibility criteria, availability of instruments and the relevance of the variables of the present study, the following variables were selected.

**Anthropometric Variables**

1. Weight
2. Height
3. Body Mass Index
4. Percent Body Fat

**Physical variables**

1. Muscular Strength and Endurance
2. Abdominal Muscular Strength and Endurance
3. Agility
4. Explosive Leg Power
5. Speed
6. Cardio Respiratory Endurance

**Physiological Variables**

1. Peak Expiratory Flow Rate
2. Resting Pulse Rate
3. Breath Holding Time

**Socio Economic Status**

- Education of parents
- Occupation of parents
- Monthly income of parents
ANTHROPOMETRIC

Anthropometric measurements have been a part of physical education since its inception in this country. The earliest research was in the area of Anthropometry with emphasis on changes in muscle size brought about through exercise. The modern physical educator is after assigned the task of measuring Height and Weight of students. Those measures like any of the other measures taken in school could be used and not merely recorded and then ignored (Johnson and Nelson, 1988).

One of the most important tasks for physical educationists is to measure different parts and components of human body. The investigator selected Weight, Height, Body Mass Index, Percent Body Fat, to measures Anthropometric level of urban rural and tribal area school students.

A review of literature reveals maximum. Anthropometry was the first technique at measurement used in Physical Education. Anthropometry was first introduced in Physical Education by a physician, Dr. Edward Hitchcock who occupied the first chair of Physical Education created in USA in 1861 at Amherst College (Kansal, 1996).

PHYSICAL FITNESS

Since the days of the early world physical fitness has been an important objective of Physical Education. In fact, the desire to establish a scientific approach to the development of physical fitness was the primary reason for the meeting of Physical Educators in 1885 that resulted in the birth of our profession (Eugene Nixon and Cozens, 1969).

A number of studies are being conducted on physical fitness in Western Countries, but there is paucity of studies on Anthropometric, Physical, Physiological variable and Socio–Economic Status of urban, rural and tribal area school students. Therefore, the Investigator has a keen interest to investigate the Anthropometric, Physical, Physiological and Socio – Economic Status among urban, rural and tribal area school students. The Investigator selected AAHPER Youth Fitness Test to assess physical fitness of urban, rural and tribal area school students. AAHPER Youth Fitness Test consisted of six test items were measured more than seven physical
fitness components. Therefore the Investigator made a maiden effort to select this variable for this study.

**PHYSIOLOGICAL VARIABLES**

Physiology is a science that studies function in living organisms – how the various part of the body normally works and how their activities are regulated, coordinated and integrated. For maintaining the wellbeing of the organism of a whole disturbance of normal functioning is caused by disease *(Sarada Subramanyam, 2007).*

There is a closer relationship between Physical Education and Physiology than in any other field. Physical education and physiology are hand in glove with each other. Fitness and human performance are much influenced by Physiological aspects. Especially some Physiological variable are highly influencing physical fitness. Studies are scarce in Indian conditions on Peak Expiratory Flow Rate (maximum speed of expiration), Resting Pulse Rate and Breath Holding Time among the urban, rural and tribal area school students. Therefore, the present study was undertaken to study the variation among the urban, rural and tribal area school students of fitness on the selected variable. The Investigator selected Physiological variable to analysis urban, rural and tribal area school student’s Physiological capacity of the selected subjects.

**SOCIO – ECONOMIC STATUS**

It was recognized that the Socio Economic factors plays a major role in an individual’s performance and achievement in sports. The social class to which a child belongs decisively influences over all Anthropometric, Physically and physiologically in total development. This influence continues to be present throughout one’s life. In short, the importance of Socio Economic Status, as a determinant of physical fitness has been emphasized by the finding of studies made in the Western Countries. In the present study, an attempt was made to investigate whether there is a significant difference in socio economic condition among the urban, rural and tribal area school students in Trichy District, Tamil Nadu and Indian condition. So this variable was also selected for the present study. To study the Socio Economic Status of the students, the Investigator selected Kuppusamy’s Socio Economic Status Scale and
used it with some modifications to assess the socio economic status of the urban, rural and tribal area school students.

As far as the realities of the Tamil Nadu urban, rural and tribal families socio economic status is concerned, with day to day living, the parent’s education, occupation and income together helped to establish Socio Economic Status of the students. Hence, the Investigator has included the male and female parent’s education, occupation and income also in this scale.

PILOT STUDY
The investigator has conducted a pilot study for 50 urban area schools students (both Boys and Girls), 50 rural area schools students (both Boys and Girls) and 50 tribal area schools students (both Boys and Girls) in Trichy District and Tamil Nadu in order to know the practical difficulties in the administration of test, to gain additional knowledge, ideas and approaches. Based on the experience of the Pilot study individual score sheet system was introduced to record all the test results as well as individual particulars. This system minimized the time of recording and expenditure. A sense of competition was also created in the minds of school students.

CRITERION MEASURES
By chancing the literature and in consultation with professional experts the following variables were selected as the criterion measures in this study.

1. Weight was conducted to test the individual body Weight and the Weight were recorded by weighing machine in kilogram (Kg).
2. Height was conducted to test the individual body Height and the Heights were recorded by Stadiometer in centimeters and meters.
3. Body Mass Index was recorded by Weight in Kg/Height in M\(^2\).
4. Percent Body Fat was conducted to assess the level of body fatness by skinfold caliper and recorded in millimeters (to the nearest .2 mm).
5. Pull–Ups were conducted to test the muscular strength and endurance and the score were recorded by total count in number.
6. Flexed Arm Hang was conducted to test the muscular strength and endurance and the score were recorded by stop watch in one tenth of seconds.
7. Bent Knee Sit–Ups was conducted to test the Abdominal Muscular Strength and Endurance and the scores were recorded by count in number/minutes.
8. The 4 x 10 yards Shuttle Run was conducted to test the Agility and the Scores were recorded by stop watch in one tenth of seconds.
9. Standing Broad Jump was conducted to test the Explosive Leg Power and the scores were recorded by measuring tape in meters and centimeter.
10. Fifty Yard Run was conducted to test the speed by stop watch and recorded in one tenth of seconds.
11. Six hundred Yard Run/Walk test was conducted to assess the Cardio Respiratory Endurance by stop watch and recorded in one tenth of a second and minute.
12. Peak Expiratory Flow Rate was conducted to assess the person’s Peak Expiratory Flow Rate (maximum speed of expiration) by L / min.
13. Resting Pulse Rate was conducted to assess the individuals pulse rate by radial artery at wrist stop watch and recorded numbers/minute.
14. Breath Holding Time was conducted to assess the maximum breath holding by stop watch and recorded in one tenth of a second.
15. Socio Economic Status was conducted to assess the socio economic status level by modified Kuppusamy’s Socio – Economic Status Scale in points.

RELIABILITY OF DATA
The reliability of data was ensured by establishing the instrument reliability, test reliability and subject reliability.

INSTRUMENT RELIABILITY
The following instruments which were required to test the selected criterion variables such as weighing machine measuring for Weight. Stadiomete measuring Height. Skinfold caliper measuring for body fat. Stop watch for measuring pulse rate, muscular strength and endurance (girls). Abdominal Muscular Strength and Endurance, Agility, Speed, Cardio Respiratory Endurance and Breath Holding Time. Measuring tape for using some of the fold test and measuring the distance of particular test. All instrument procured from the human performance laboratory of the Department of Physical Education and Sports, Pondicherry University, and all the instruments used for this study were in good condition and purchased from reputed
and reliable companies, their calibration were tested and found to be accurate enough to serve the purpose of the study. The Socio – Economic Status questionnaire selected from Kuppusamy’s Socio – Economic status Scale. In this scale, select after discussion with physical educators, Professors and experts in the field of physical education and sports.

**TESTER RELIABILITY**

To ensure uniformity, reliability of the testing techniques and to test the competency of the testers, all the measurements were taken by the investigator. Reliability was established by the test and re-test method was administrated by the same tester to ensure consistency of result which was obtained in each test item was correlated by Pearson’s product moment correlation. Twenty subjects were used.

The correlation co-efficient obtained between the test and re-test data were significant at 0.05 level of confidence as shown in table.

**Table – 1**

**CORRELATION CO – EFFICIENT OF THE SELECTED ANTHROPOMETRIC, PHYSICAL, PHYSIOLOGICAL VARIABLES AND SOCIO – ECONOMIC STATUS**

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>VARIABLES</th>
<th>No. of Subjects</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Weight</td>
<td>20</td>
<td>0.80*</td>
</tr>
<tr>
<td>2.</td>
<td>Height</td>
<td>20</td>
<td>0.91*</td>
</tr>
<tr>
<td>3.</td>
<td>Body Mass Index</td>
<td>20</td>
<td>0.90*</td>
</tr>
<tr>
<td>4.</td>
<td>Percent of Body Fat</td>
<td>20</td>
<td>0.76*</td>
</tr>
<tr>
<td>5.</td>
<td>Muscular Strength and Endurance</td>
<td>20</td>
<td>0.98*</td>
</tr>
<tr>
<td>6.</td>
<td>Abdominal Muscular Strength and Endurance</td>
<td>20</td>
<td>0.93*</td>
</tr>
<tr>
<td>7.</td>
<td>Agility</td>
<td>20</td>
<td>0.88*</td>
</tr>
<tr>
<td>8.</td>
<td>Explosive leg power</td>
<td>20</td>
<td>0.86*</td>
</tr>
<tr>
<td>9.</td>
<td>Speed</td>
<td>20</td>
<td>0.92*</td>
</tr>
<tr>
<td>10.</td>
<td>Cardio Respiratory Endurance</td>
<td>20</td>
<td>0.83*</td>
</tr>
<tr>
<td>11.</td>
<td>Peak Expiratory Flow Rate</td>
<td>20</td>
<td>0.86*</td>
</tr>
<tr>
<td>12.</td>
<td>Resting Pulse Rate</td>
<td>20</td>
<td>0.95*</td>
</tr>
<tr>
<td>13.</td>
<td>Breath Holding time</td>
<td>20</td>
<td>0.97*</td>
</tr>
<tr>
<td>14.</td>
<td>Socio – Economic Status</td>
<td>20</td>
<td>0.76*</td>
</tr>
</tbody>
</table>

*Significant at 0.05 level of confidence.
SUBJECT RELIABILITY

The co-efficient of correlation values between the test and re-test data also indicated the subject’s reliability as the same subjects were used under similar conditions by the same tester.

ORIENTATION TO THE SUBJECTS

The subjects were to assemble in a classroom at the school. The Investigator explained the nature and purpose of the study to the subjects. All the test materials were printed into a booklet. Instructions were given on the top of each as to how to answer the questions on Socio-Economic Status information. Each questionnaire consists of Socio-Economic information on the front page.

The Investigator distributed the Socio-Economic information questionnaires to the subjects of different school students and assured them that the information gathered from them would be kept confidential. After distributing the Socio-Economic questionnaires personally in a classroom, the investigator explained every three item in the questionnaire and the students filled the questionnaire. The Investigator clarified the doubts of the students whenever the students asked. The Anthropometric Measurement, Physical fitness test score and Physiological variables measurements are also collected in separate score sheets. The Anthropometric, Physical, Physiological variables tests were conducted as per the procedure detailed in test manual. Those tests were administered on faculty wise. The Investigator scored according to the scoring methods of the respective scales. The results were tabulated, discussed and analyzed.
FIELD TEST ADMINISTRATION

1. WEIGHT

Purpose:
To measure the Weight of the subject

Sex:
Both boys and girls

Facilities and Equipment:
Weighing machine, pencil, score sheet

Description of the Test:
The subject stand on the weighing machine with bare foot and ideal clothes at the time of measuring the heels were on the weighing machine without elevating it and the body was in erect in position. After the scale vibration has stopped the reading was taken and the subjects stepped away from the weighing machine.

Scoring Procedure:
The reading was taken nearest to the one kilogram (Kansal, 1996).

Figure: 3.1: Weight
2. HEIGHT

Purpose:
To measure the Height of the subjects.

Sex:
Both boys and girls

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

Description of the Test:
The subject stand on the stadiometer with bare foot at the time of measurement the heels were on the platform without elevating it the scale was brought down firmly in contact with vertex. A mark was made with a chalk piece on the side of scale in the stadiometer. After that the subject stepped away from the stadiometer stand board.

Scoring Procedure:
The vertical distance from the stadiometer stand board to the chalk piece mark is measured. The measurement was taken to the nearest one centimeter (Kansal, 1996).

Figure: 3.2: Height
BODY MASS INDEX

**Purpose:**
To classify obesity and to assess disease risk.

**Sex:**
Both boys and girls

**Facilities and Equipment:**
A weighing Machine and Stadiometer.

**Description of the Test**
The Body Mass Index is calculated (in Kg/m$^2$) by dividing body Weight (in Kg) by the Square of Height (in m). Keep in mind that Weight S and Height S are determined without clothing.

**Scoring Procedure:**
Under Weight (less than 19) desirable (19 to 25), increased health risks (26 to 29), obese (30 to 40) and extremely obese (more than 40) (*Greenberg*).
PERCENT BODY FAT
(SKINFOLDS)

Purpose:
To measure the level of body fatness.

Description
A skinfold consists of a double layer of skin and subcutaneous fat. Measurements are usually taken on the right side of the body with the subject standing. Through extensive research, certain anatomical sites have been identified as landmarks for skinfold testing. Some of the more common sites are the abdomen, calf, scapula, suprailiac, thigh and triceps.

Instructions
The proper sequence for administering the skinfold test consists of firmly grasping the skinfold between thumb and forefinger and lifting it away; placing the caliper ½ inch above or below the skinfold; slowly releasing the pressure on the caliper trigger so that pinchers can exert full tension on the skinfold and then reading the scale.

TRICEPS SKINFOLD SITE

Definition
The point on the posterior surface of the arm, in the mid-line, at the level on the marked Mid-acromiale-radiale landmark.

Subject position
The subject assumes a relaxed standing position with the arm hanging by the side in the mid-prone position.

Location
This point is located by projecting the Mid-acromiale-radiale site perpendicularly to the long axis of the arm around to the arm, and intersecting the projected line with a vertical line in the middle of the arm when viewed from behind.
TRICEPS SKINFOLD MEASUREMENTS

Definition
The skinfold measurement taken parallel to the long axis of the arm at the Triceps skinfold site.

Subject position
The subject assumes a relaxed standing position. The right arm should be relaxed with the shoulder joint externally rotated to the mids-prone position and elbow extended by the side of the body.

Figure: 3.5: Triceps Site

Figure: 3.6: Triceps Measurement
SUBSCAPULAR SKINFOLD SITE

Definition
The site 2 cm along a line running laterally and obliquely downward from the Subscapulare landmark at a 45° angle.

Subject position
The subject assumes a relaxed standing position with the arms hanging by the sides.

Location
Use a tape measure to locate the point 2 cm from the Subscapulare in a line 45° laterally downward.

SUBSCAPULAR SKINFOLD MEASUREMENTS

Definition
The skinfold measurement taken with the fold running obliquely downwards at the Subscapular skinfold site.

Subject position
The subject assumes a relaxed standing position with the arms hanging by the sides.

Method
The line of the skinfold is determined by the natural fold lines of the skin.
Figure: 3.7: Sub Scapular Site

Figure: 3.8: Sub Scapular Measurement
ABDOMINAL SKINFOLD SITE

Definition
The point 5 cm horizontally to the right hand side of the omphalion (midpoint of the navel).

Subject position
The subject assumes a relaxed standing position with the arms hanging by the sides.

Location
The site is identified by a horizontal measure of 5 cm, to the subject’s right, from the omphalion. The skinfold taken at this site is a vertical fold.

Note: The distance of 5 cm assumes an adult Height of approximately 170 cm. Where Height differs markedly from this; the distance should be scaled for Height. For example, if the stature is 120 cm, the distance will be 5 × 120 / 170 = 3.5 cm.

ABDOMINAL SKINFOLD MEASUREMENTS

Definition
The skinfold measurement taken vertically at the Abdominal skinfold site.

Subject position
The subject assumes a relaxed standing position with the arms hanging by the sides.
Figure: 3.9: Abdominal Site

Figure: 3.10: Abdominal Measurement
Method

It is particularly important at this site that the measure is sure the initial grasp is firm and broad since often the underlying musculature is poorly developed. This may result in an underestimation of the thickness of the subcutaneous layer of tissue. (Note: Do not place the fingers or caliper inside the navel) (Michael and Tim Olds, 2006).

Validity

Skinfolds have been found to be more valid than Height –Weight ratio in estimating body fatness as determined by laboratory procedure (hydrostatic Weighting) and have a higher correlation with Percent Body Fat than most other indices for showing correlations between skinfolds and percent Body fat.

Many different combinations of skinfold measurement can be used to predict percent body fat. Jackson and Pollock, (1976) have demonstrated that skinfold fat measurement taken at various anatomical landmarks measure body fatness and are highly correlated. This finding means that if an individual tends to have a relatively high skinfold value at one site, a correspondingly high value will be found at another site. From the test administrator’s point of view, this means that measuring skinfolds at multiple sites may provide no more accurate information than what could be obtained by measuring at one or two sites. While measuring multiple sites would increase consistency of measurement, the gain in validity would be minimal (Pollock, 1976).

Age Level:

Elementary school age to adult.

Test Area:

Small room with private area.

Equipment Needed:

A skinfold caliper (e.g. Lange, Harpenden, Slim Guide, Fat – O – Meter, Ross Laboratories) is necessary for taking these measurements. The caliper should be
capable of accurate calibration and exert a constant pressure of 10 gm/sq mm throughout the measurement range.

**Scoring Procedures:**

To ensure accuracy, several readings should be taken at a particular site with the median score in millimeters (to the nearest 2 mm) recorded as the score.

**Norms:**

Normative data for skinfold measurement. Equations to convert raw skinfold data to percentage of body fat have been developed by Lohman, Boileau and Massey, (1975) *(Alan G and Lacy)*.

**FORMULA FOR CALCULATION OF BODY COMPOSITION VALUES FOR SKINFOLD ASSESSMENT PROCESS OF MALES.**

<table>
<thead>
<tr>
<th>Step 1 LOHMAN EQUATION – CALCULATION OF BODY DENSITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>BD = [1.0973 – (SUM SF X .000815)] + [(sum SF)^2 X.00000084]</td>
</tr>
<tr>
<td>Sum of SF = Triceps SF + Sub scapular SF + Abdominal SF</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STEP 2 BROZEK EQUATION – CALCULATION OF % BODY FAT FROM BODY DENSITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>% BF = (457/BD) – (414.2)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STEP 3 CALCULATION OF MINIMUM WEIGHT AT 7 % BODY FAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>MWW = ([1 – (% BF/100)] X TBW) / (.93)</td>
</tr>
</tbody>
</table>

**ALTERNATE METHOD FOR MWW**

| FAT WEIGHT (FW) = TBW x (%BF/100) |
| LEAN BODY MASS (LBM) = TBW – FW |
| MWW = (LBM) ÷ .93 |
BOILEAU EQUATION FOR CALCULATION OF BODY FAT FOR FEMALES

\[
% \text{BF} = [1.35 \times (\text{sum SF})] - [0.012 \times (\text{sum SF})^2] - 3.4
\]

\[
\text{sum OF SF} = \text{Triceps SF} + \text{Sub scapular SF}
\]

\[
\text{MWW} \ (\text{females}) = (\text{LBM}) \div 0.88.
\]

HYDRATION ASSESSMENT PROCEDURE

In an attempt to insure valid and reliable assessment of skinfold width the following general measurement techniques should be employed. These techniques are general in that they are applied to all skinfold site assessments. The subject’s skin should be dry. Measurements should not be taken immediately after a workout or when the subject is over heated. This may be an ever present problem because some of the wrestlers may be attempting to take part in rapid Weight reduction through exercise just prior to the assessment – this should not be allowed. In addition, the process requires that each wrestler pass a urine specific gravity test to determine adequate hydration level for the skinfold assessment procedure.

There is no substitute for practice and experience as an assessor. Quality in – service participation, in – depth knowledge about all aspects of the body composition assessment, careful site identification and practice will assist in the accuracy and value of this programme.

1. Palpate the site to familiarize both you and the subject with the area to be measured.
2. Elevate the double fold of skin and the subcutaneous fat with the thumb and index finger of the left hand 1 cm above or adjacent to the measurement site.
3. Become familiar with the width of the thumb and index finger as well as the perpendicular approach to site assessment prior to the elevation of each specific skinfold site.
4. The fold should be lifted in such a manner as to have two parallel sides.
5. The long axis should be parallel to the natural cleavage lines of the skin.
6. measure with caliper in right hand with scale in a position to avoid parallax error
7. measure midway between the body surface and the bulbous crest of the skinfold
8. caliper jaws are placed to measure the thickness of the skinfold perpendicular to its long axis
9. caliper pad measurement surface should be in contact with the skinfold for 2 to 4 seconds
10. Record to the nearest 2 mm and obtain (through rotation of sites) three measures with no more than a 2 mm difference between any two measurements
11. Record three measures for each of three sites for males (sub scapular, abdominal and triceps); record only sub scapular and abdominal measurements for females on the skinfold Data Worksheets.

**AAHPER YOUTH FITNESS TEST**

This test was devised by American Alliance for Health, Physical Education and Recreation (AAHPER) in Washington. AAHPER Youth Fitness Test consists of six test items and its components are used to measure the Physical Fitness of Urban Rural and Tribal area school students. *(Harrison Clarke, 1976).* The following tests were administered as given in Table–2

**TABLE - 2**

**Physical Fitness Test Items**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Name of the test Items</th>
<th>Physical fitness components</th>
<th>Sex</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a.</td>
<td>Pull-ups</td>
<td>Arm and shoulder strength</td>
<td>Boys</td>
</tr>
<tr>
<td>1b.</td>
<td>Flexed-Arm Hang</td>
<td>Arm and shoulder strength</td>
<td>Girls</td>
</tr>
<tr>
<td>2</td>
<td>Bent-Knee Sit-ups</td>
<td>Abdominal Muscular Strength and Endurance</td>
<td>Boys and Girls</td>
</tr>
<tr>
<td></td>
<td>(one minute)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Shuttle Run</td>
<td>Agility</td>
<td>Boys and Girls</td>
</tr>
<tr>
<td>4</td>
<td>Standing Broad Jump</td>
<td>Explosive Leg power</td>
<td>Boys and Girls</td>
</tr>
<tr>
<td>5</td>
<td>50-Yard Dash</td>
<td>Speed</td>
<td>Boys and Girls</td>
</tr>
<tr>
<td>6</td>
<td>600-Yard Run/Walk</td>
<td>Cardio respiratory endurance</td>
<td>Boys and Girls</td>
</tr>
</tbody>
</table>
PULL UPS (boys only)
(In Numbers)

Purpose:
The purpose of this test was to measure arm and shoulder girdle muscular strength and endurance.

Equipment’s: A wooden or metal bar approximately 1.5 inches in diameter:

(a) Test Administration: The Height of the bar should be such that when the subject hangs from it with fully extended arms, his feet do not touch the ground. The subject is asked to use an overhand grasp with the palms facing away from the body. From the hanging position, the pupil raises the body by to a full extension hang and repeats the pull ups as many times as possible. Only one trial is given unless it is obvious that the pupil has not had a fair chance. Neither swinging, nor kicking the legs nor knee raising is allowed.

Scoring: The maximum number of completed pull ups is the score which may be evaluated with the help of local norms (if available) or by comparison with other subjects tested.
Figure: 3.11 Pull Ups (Straight-Arm Hang Position)

Figure: 3.12 Pull Ups (Chinning the bar Position)
FLEXED-ARM HANG (girls only)  
(In Seconds)

A piece of pipe or the rungs of a ladder may also be and stopwatch (only for girls).

This test is almost similar to pull-ups (boys) except that the hanging-bar is adjusted at a Height equal almost to the Height of the subject. With the help of two assistants (one in front and one in back), the girl raises the body off the floor to position the chin above the bar, the elbows are flexed, chest is kept close to the bar and the subject holds this position as long as possible.

As soon as the subject takes the hanging position and the assistants helping the subject for body raising get away and do not touch the subject any more, the stopwatch is started. The stopwatch is stopped as soon as any of the following conditions is observed:
- The girl’s head tilts backwards for keeping the chin above the bar.
- The girl’s chin touches the bar.
- The girl’s chin falls below the level of bar.

Scoring: The duration of time which the girl holds the hanging position in the correct manner, recorded in seconds is the score of this test item.
Figure: 3.13. Flexed Arm Hang (Straight-Arm Hang Position)

Figure: 3.14. Flexed Arm Hang (Flexed Arm Hang Position)
BENT KNEE SIT-UPS (boys and girls)
(One Minute)

Purpose
The purpose of this test was to measure abdominal hip muscular strength and endurance.

Equipment
A mat for each subject or lying area on the floor and a stopwatch.

Test Administration
The subject is asked to lie on the back with the knees bent feet on the floor and heels not more than 12” from the buttocks. The angle at the knees should be less than 90 degree. The subject has to put the hands on the back of the neck with fingers clasped and has to place the elbows squarely on the mat. The subject’s feet are to be held by an assistant or partner to keep them in touch with the surface. The subject is asked to tighten the abdominal muscles and bring the head and elbows forwards as he or she sits-ups again.

After giving the above mentioned demonstration to the subject, a signal ‘Ready! Go’! Is given to a specific subject. At the signal ‘go’ the performer starts sit-ups and the timer starts the watch simultaneously. The performer continues performing the sit-ups at his/her best possible speed till the timer gives a stops signal after 60 seconds.

Scoring: The number of correctly performed sit-ups in 60 seconds is the score of the test. Only one effort is allowed to the subject unless the tester believes that the subject has not had a fair opportunity. The following types of sit-ups are not counted for the score:
(a) If the subject does not keep the fingers clasped behind the fingers clasped behind the neck.
(b) If the subject brings both elbows forward in starting to the sit-ups with pushing off the floor with the elbow.
(c) If the subject returns to starting position with elbows flat on the surface.
Figure: 3.15. Bent Knee Sit Ups (Bent-Knee Lying Position)

Figure: 3.16. Bent Knee Sit Ups (Curl-Up Motion Position)
SHUTTLE RUN (boys and girls)
(In seconds)

**Purpose:**
The purpose of this test was to measure speed and change of direction (agility).

**Equipment**
Two blocks of wood (2” ×2” ×4”), a stopwatch and marking powder. The subject should wear spikes or run bare foot.

**Test Administration**
Two parallel lines are marked on the floor 10 yards apart or the width of the regular volleyball court may be used for the test. The two wooden blocks are placed behind one of the lines. The subject is asked to start from behind the other line. On the signal ready? Go, the timer starts the watch and the subject runs towards the blocks, picks-up one block, runs back to the starting line, places the block behind the starting line, runs back and picks-up the second block is placed on the ground the timer stops the watch and records the time.

**Scoring**
Two trials are allowed to each subject with some rest on between the time of the better of the two trials is recorded to the nearest 10th of a second as the score of the test item.

**Important Note:** If two timers are available, it is preferable to ask two ask two subjects to run at the same time from the opposite lines. This arrangement does not only save the time but also eliminates the need to return the block after each race.
Figure: 3.17. Shuttle Run (Starting Position)

Figure: 3.18. Shuttle Run (Running Movement)
STANDING BROAD JUMP (boys and girls)
(In Meters and Centimeters)

This test measures the power of legs in jumping horizontal distance and may be applied to children of both sexes aged seven years and above.

Purpose
The purpose of this test was to measure the explosive power of leg extensor muscles.

Equipment
Floor, mat or long jump pit jump pit may be used, measuring tape, marking tape/chalk or a peg.

Test Administration
A demonstration of the standing broad jump is given to a group of subjects to be tested. The subject is then asked to stand behind the starting line with the feet parallel to each other. He is instructed to jump as farthest as possible by bending knees and swinging arms to take off for the broad hump in the forward direction. The subject is given three trials.

Scoring
The distance between the starting line and the nearest point of landing provides the score of the test. The best (maximum distance) trial is used as the final score of the test.

Comments
This is quite simple, practical, reliable and objective test of measuring athletic power of legs in jumping forward.
Figure: 3.19. Standing Broad Jump (Crouch Position)

Figure: 3.20. Standing Broad Jump (Flying Movement)

Figure: 3.21. Standing Broad (Landing on both Feet-Position)
50YARD DASH (boys and girls)
(In Seconds)

Purpose
The purpose of this test was to measure speed.

Equipment
Stopwatches (at least two) or a single stopwatch with a split second time.

Test Administration
Two lines are marked on the floor 50 yards apart. One line is used as a starting line and the other as the finish line. On the signal Ready? Go!, the subjects start running at their best to reach the finish line at their earliest. The signal ‘go’ is accompanied with the downward sweep of the starter’s arm to give the visual signal to the timer/timers who stands/stand at the finish line.

Scoring
The interval between the starting signal and the instant subject crosses the finish line is the score of the test. The time is recorded correct up to tenth of a second.

Figure: 3.22. 50 Yard Dash (Finishing Position)
600 YARD RUN-WALK
(In Minutes and Seconds)

Purpose

The purpose of this test was to measure circulatory – respiratory endurance.

Test Administration

The subject is asked to take a standing start. At the signal Ready? Go!, the subject starts running the 600 yard distance. The test is usually performed on 10-12 subjects together by pairing off before the start of the event. Walking is permitted but the performer is to cover the distance in the shortest period of time.

Scoring

The time taken to run 600 yards recorded in minutes and seconds is the score of this test item.

Figure: 3.23 600 Yards Dash (Running)
PEAK EXPIRATORY FLOW RATE

Purpose:

The peak expiratory flow rate measures how fast a person can breathe out (exhale) air. It is one of many tests that measures how well the lungs are working.

Definition: Peak expiratory flow rate is the maximal expiratory flow rate sustained by a subject for at least 10 milliseconds expressed in liter per minute (L/min) (Wright and McKerrow, 1959).

Age and sex: Age has linear relationship with PEFR by sex has no significant relation with PEFR in children when Height is considered (Nairn et al, 1960) But age has curvilinear in male and linear relationship in female of adult (Malik et al, 1980) When only age is considered, PEFR differs in both sexes (Carson, Hoey, Taylor, 1989).

Clinical interpretation of values of PEFR

Personal based value of PEFR can be compared to normal reference population and also with predicted value from regression equation (Pande, 1986; Nunn and Gregg, 1989) Diurnal variation in PEFR is a good indicator of circadian bronchial lability responsiveness. PEFR records with diurnal variation of 20% or more is a good clinical and occupational indicator of asthma (Lebowitz, 1992; Sly, 1986) PEFR variability- diurnal variation in peak flow rate expressed as the formula as follows (Hassan, Hossain, Mahmoud, 1999).

\[
\text{Daily Variability} = \frac{\text{Highest PEFR}-\text{Lowest PEFR}}{\text{Highest PEFR}} \times 100
\]

Bronchial provocation test by exercise in exercise induced asthma id diagnostic when PEFR falls 15% of personal based after exercise and reversibility of airway obstruction is evidenced by and increased in PEFR more than 20 % after an adequate dose of nebulized bronchodilator is diagnostic for asthma (Silverman, 1998) but bronchial reversibility of an increased at least 10 % in PEFR after aerosol therapy is strongly suggestive of asthma (Sly, 2000).
Self-management of bronchial asthma is advised to maintain a peak flow chart and personal based result should be interpreted in following ways

Green zone (Safe zone) - 80-100 % of personal best result
Yellow zone (zone of alert) - <80 % - > 50 % of personal best result
Red zone (zone of emergency) - <50 % of personal best result (*Cross and Nelson, 1991; Hassan et al, 1999*)

How the test is performed:
This test requires a peak expiratory flow monitor: a small handheld device with a mouth piece at one end and a scale with a moveable indicator (usually a small plastic arrow).

To perform this test:
- Breathe in as deeply as possible
- Blow in to the instruments mouthpiece as hard and fast as possible.
- Do this three times, and record the highest flow rate

How to prepare for the test:
Loosen any tight clothing that might restrict your breathing. Sit up straight or stand while performing the tests.

How the test will feel:
There is usually no discomfort rarely repeated efforts may cause some light-headiness.

Why the test is performed:
The test is commonly used to diagnose and monitor lung diseases such as:
- Asthma
- Chronic obstructive pulmonary disease (COPD)
- Rejection after a lung transplant.

Normal Results:
Normal values vary based on a person’s age, sex, and size. Peak flow measurements are most useful when a person compare the number on a given day to his or her “personal best”
Figure: 3.24. Peak Expiratory Flow Rate

Figure: 3.25. Peak Expiratory Flow Rate chart
RESTING PULSE RATE
(Per Minute)

Purpose:
To measure the resting pulse rate of each subject per minute.

Equipment
For recording the resting pulse rate, a stop watch (1/10th of a second was used.)

Administration
The pulse rates of all the subjects were recorded in a sitting position, in the evening between 4 and 5 p.m. Before taking pulse rate the subjects were asked to relax for about 30 minutes. To record the pulse rate the finger tips were placed on the radial artery at the wrist or stethoscope in such a manner that palpation was clear and the number of palpation were counted for one full minute (Jenson and Hirst, 1980).

Scoring
The number of pulse beats per minute was recorded as the scores.

Figure: 3.26. Resting Pulse Rate
BREATH HOLDING TIME
(Minutes and Seconds)

Purpose:
The purpose of this test was to measure the breath holding time.

Equipment
For recording the breath holding time a stop watch (1/10th of seconds) and Nose clip were used.

Administration
The subject was instructed to stand at ease and to inhale deeply after which he holds his breath for a length of time possibly by him. A nose clip was placed on nose to avoid letting the air through nostrils. The duration from the time of holding his breath until the movement he let air out was clocked by using the stop watch to the nearest one tenth of a second as breath holding time. The co-operation of the subject to let out the air by opening the mouth was sought to block the exact breath holding time.

Scoring
The time is recorded in seconds and the best of two trails were recorded (Mathews, 1988).
Figure: 3.27. Breadth Holding Time (Trial)

Figure: 3.28. Breadth Holding Time (Testing)
ASSESSMENT OF SOCIO-ECONOMIC STATUS

Description of the Scale

A modified Kuppuswamy’s Socio-economic Status Scale was used to assess the socio-economic status of the students. This scale measures in terms of three variables, viz., education, occupation and income. Each of these three variables is measured by means of a weighted scale. It consists of 21 component sub-divisions. Each of the three categories of socio-economic status has seven components sub-divisions in this scale.

Methods of Scoring

In this study the investigator has adopted kuppuswamy’s (Kuppuswamy, 1962) Seven point Weighted Scale for all these three variables. A detailed method of scoring on education, occupation and income is given below:

EDUCATION

The Scale for Measuring the Status Variable of Education of the Students

Male and Female Parents:

Table -3

<table>
<thead>
<tr>
<th>Items</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Doctorate Degrees / D.Sc./ Foreign Degree And training / IAS / IPS and above</td>
<td>7</td>
</tr>
<tr>
<td>2. Professional Degree / MBBS / BDS / Engineering / LLB / BL/LLM/M.phil/M.A/ M.Sc. and other Master Degrees</td>
<td>6</td>
</tr>
<tr>
<td>3. B.A / B. Sc / B. Com / and other Bachelor Degrees</td>
<td>5</td>
</tr>
<tr>
<td>4. H. Sc / Intermediate /Polytechnic/P.U.C/ I.T.I and other Diplomas</td>
<td>4</td>
</tr>
<tr>
<td>5. S.S.L.C (present X standard)</td>
<td>3</td>
</tr>
<tr>
<td>6. Primary School and Middle School completion</td>
<td>2</td>
</tr>
<tr>
<td>7. Illiterate</td>
<td>1</td>
</tr>
</tbody>
</table>

As for the first status variable, namely, the “education” of male and female parents of the students, it consists of seven component subdivisions. Each component sub-division is measured by means of weighted scale. A score of 7 is given to the
component sub-division viz., “Doctorate Degree / D. Sc / Foreign Degree and Training / I.A.S / I.P.S and above”; a score of Weighted scale 6 is given to the components sub-division viz., “Professional Degree / M.B.B.S / B.D.S / Engineering / L L B / B L / L L M / M. Phil / M.A / M. Sc and other Master Degrees”; a score of Weighted scale 5 is given to the component sub-division viz., “B.A / B. Sc / B. Com / and other Bachelor Degrees”; a score of Weighted scale 4 is given to the component sub-division viz., “H. Sc / Intermediate / Polytechnic / P U C / I T I / and other Diplomas”; a score of weight scale 3 is given to the components sub-division viz., S.S.L.C (prescent X standard), Weighted scale 2 is given to the component sub-division viz., “Primary School / Middle School completion”; and a score of Weighted scale 1 is given to the component sub-division viz., “Illiterate”. The minimum score is 2 (male and female parents together) and the maximum score is 14 (male and female parents together).

**OCCUPATION**

The Scale of Measuring the Status Variable of Occupation of the Students Male and Female Parents:

<table>
<thead>
<tr>
<th>Items</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Profession (Doctors, Engineers, Lawyers and above)</td>
<td>10</td>
</tr>
<tr>
<td>2. Semi-profession (Colleges teachers, School teachers, Bank employees, Officers, Inspectors and Managers).</td>
<td>6</td>
</tr>
<tr>
<td>3. Clerical, shop-owners, farm-owners</td>
<td>5</td>
</tr>
<tr>
<td>4. Skilled worker</td>
<td>4</td>
</tr>
<tr>
<td>5. Semi-skilled worker</td>
<td>3</td>
</tr>
<tr>
<td>6. Unskilled worker</td>
<td>2</td>
</tr>
<tr>
<td>7. Unemployed</td>
<td>1</td>
</tr>
</tbody>
</table>

In the case of second status variable, i.e. “Occupational status,” the given classification is decided on the basis of the realities of the present situation concerned. It consists of seven component sub-divisions. Each component sub-division is measured by means of weighted scale. A score of 10 is given to the component sub-division viz., “Profession” (Doctors, Engineers, Lawyers and above); a score of
Weighted scale 6 is given to the component sub-division viz., “semi-profession” (College teachers, School teachers, Bank employees, Officers, Inspectors and Managers); a Weighted scale 5 is given to the component sub-division viz., “Clerical, Shop-owners, Farm owners etc.; a score of Weighted scale 4 is given to the sub-division viz., “Skilled worker”; a score of Weighted scale 3 is given to the component sub-division viz., “Semi-skilled worker”; a score of Weighted scale 2 is given to the sub-division viz., “Unskilled worker”; a score of Weighted scale 1 is given to the component sub-division viz., “Unemployed”. The minimum score is 2 (male and female parents together), and the maximum score is 20 (male and female parents together).

**INCOME**

The Scale for Measuring the Status Variable of Income of the Students Male and Female Parents:

<table>
<thead>
<tr>
<th>Item</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Above Rs. 7000/- per month</td>
<td>12</td>
</tr>
<tr>
<td>2. Between Rs. 6001 to 7000</td>
<td>10</td>
</tr>
<tr>
<td>3. Between Rs. 5001 to 6000</td>
<td>6</td>
</tr>
<tr>
<td>4. Between Rs. 4001 to 5000</td>
<td>4</td>
</tr>
<tr>
<td>5. Between Rs. 3001 to 4000</td>
<td>3</td>
</tr>
<tr>
<td>6. Between Rs. 2001 to 3000</td>
<td>2</td>
</tr>
<tr>
<td>7. Upto Rs. 2000</td>
<td>1</td>
</tr>
</tbody>
</table>

The third status variable i.e. “Income” of the male and female parents of the students. The income range of the urban, rural and tribal family was classified on the basis of the realities of the present situation in Tamil Nadu. It is divided into seven component sub-divisions and measured by means of a weighted scale. A score of Weighted scale 12 is given to the component sub-division viz., “Above Rs. 7000 per month”; a score of 10 is given to the component sub-division viz., “Between Rs. 6001 to 7000”; a score of Weight scale 6 is given to the component sub-division viz., “Between Rs. 5001 to 6000”; a score of Weighted scale 4 is given to the sub-division viz., “Between Rs. 4001 to 5000”; a score of 3 is given to the component sub-division viz., “Between Rs. 3001 to 4000”; a score of 2 is given to the sub-division viz., “Between Rs. 2001 to 3000”; a score of 1 is given to the component sub-division viz., “Upto Rs. 2000”. The income range of the urban, rural and tribal family was classified on the basis of the realities of the present situation in Tamil Nadu. It is divided into seven component sub-divisions and measured by means of a weighted scale. A score of Weighted scale 12 is given to the component sub-division viz., “Above Rs. 7000 per month”; a score of 10 is given to the component sub-division viz., “Between Rs. 6001 to 7000”; a score of Weight scale 6 is given to the component sub-division viz., “Between Rs. 5001 to 6000”; a score of Weighted scale 4 is given to the sub-division viz., “Between Rs. 4001 to 5000”; a score of 3 is given to the component sub-division viz., “Between Rs. 3001 to 4000”; a score of 2 is given to the sub-division viz., “Between Rs. 2001 to 3000”; a score of 1 is given to the component sub-division viz., “Upto Rs. 2000”. The income range of the urban, rural and tribal family was classified on the basis of the realities of the present situation in Tamil Nadu. It is divided into seven component sub-divisions and measured by means of a weighted scale. A score of Weighted scale 12 is given to the component sub-division viz., “Above Rs. 7000 per month”; a score of 10 is given to the component sub-division viz., “Between Rs. 6001 to 7000”; a score of Weight scale 6 is given to the component sub-division viz., “Between Rs. 5001 to 6000”; a score of Weighted scale 4 is given to the sub-division viz., “Between Rs. 4001 to 5000”; a score of 3 is given to the component sub-division viz., “Between Rs. 3001 to 4000”; a score of 2 is given to the sub-division viz., “Between Rs. 2001 to 3000”; a score of 1 is given to the component sub-division viz., “Upto Rs. 2000”. The income range of the urban, rural and tribal family was classified on the basis of the realities of the present situation in Tamil Nadu. It is divided into seven component sub-divisions and measured by means of a weighted scale. A score of Weighted scale 12 is given to the component sub-division viz., “Above Rs. 7000 per month”; a score of 10 is given to the component sub-division viz., “Between Rs. 6001 to 7000”; a score of Weight scale 6 is given to the component sub-division viz., “Between Rs. 5001 to 6000”; a score of Weighted scale 4 is given to the sub-division viz., “Between Rs. 4001 to 5000”; a score of 3 is given to the component sub-division viz., “Between Rs. 3001 to 4000”; a score of 2 is given to the sub-division viz., “Between Rs. 2001 to 3000”; a score of 1 is given to the component sub-division viz., “Upto Rs. 2000”.

97
viz., “Between Rs. 3001 to 4000”; a score of Weighted scale 2 is given to the component sub-division viz., “Between Rs. 2001 to 3000”; a score of 1 is given to the sub-division viz., “Up to Rs. 2000.” The minimum score is 2 (male and female parents together), and the maximum score is 24 (male and female parents together).

High score indicates the higher Socio-Economic Status and vice-versa.

If the male and female parents come under in the same category, (in one component sub-division) then the same score is counted twice in a particular variable. If the male and female parents are of in different categories (different component sub-divisions) then the two different score are counted once in a particular variable. Socio-Economic Status composed of several aspects, among which education, occupation and income played a predominant role. As students were considered as subjects, the Education, Occupation and Income of the male and female parents were considered. Separate score was assigned for Education, Occupation and Income and the total constituted a Socio-Economic Status score and it was considered for statistical treatment.

Figure: 3.28. Socio Economic Status
STATISTICAL TECHNIQUES

The static groups design was used in the present study. In this design the static group is divided into three categories viz. urban, rural and tribal area school students. One way analysis of variance was used to find out whether there is any significance variation among urban, rural and tribal area school students on selected Anthropometric, Physical, Physiological variables and Socio – Economic Status.

The ‘F’ ratio was used to find out whether there is any significance variation on Weight, Height, Body Mass Index, Percent Body Fat, Muscular Strength and Endurance, Abdominal Muscular Strength and Endurance, Speed, Agility, Explosive Leg Power, Cardio Respiratory Endurance, Resting Pulse Rate, Breath Holding Time, Peak Respiratory Flow Rate, and Socio Economic Status. The level of significance was fixed at 0.05 level. Wherever F ratio was found to be significance, Scheffe’s test was used as post-hoc test to determine which of the paired mean difference significantly.