Chapter III

METHODOLOGY

In this scientific inquiry, data collection was the next sequential step after defining the problem and formulation of the hypothesis. This chapter highlights the details about the research procedure followed in conducting the study and in collection of data. This being an important part of the research study needed to be planned and carried out systematically. The detailed methodology of research design and data collection followed by researcher during investigation of the problem is presented in this chapter.

3.1. Research Methodology
The methodology of the research includes Survey observation. The purpose of this study was to standardize norms as well as have a comparison. The present research being a normative survey study, it goes through a method of survey research under descriptive one.¹ Descriptive research involves describing current events or conditions. It is concerned with conditions or relationships that exist. The most common tool of descriptive research is survey.² Descriptive statistics was used for obtaining mean and standard deviation. The percentile method was used to prepare the norms.³ A Test Battery for Health Related Physical fitness was formulated and administered. Norms of the same were established – scientifically and proper statistical design was employed for comparison.

3.2. Justification for the Physical Fitness Test Selection
The research scholar reviewed the existing standardized tests as available in valuable sources by scholars in the field of physical education and taking into consideration the varied social and cultural traditions prevalent in Nasik District. The climatic and financial conditions and other factors such as, availability of playgrounds, equipment etc. in the secondary schools formulated an ideal battery of tests to be administered to the boys, which will not cover the basic components of physical fitness but also be enjoyable to the

students and easy to administer. The following tests were administered to assess Physical Fitness. To find out the applicability of the test items on the present sample, the researcher determined the reliability. The test comprised of the following factors:

- Cardio-vascular Endurance
- Muscular Strength and Muscular Endurance
- Flexibility
- Body Composition (Body Height and Body Weight)

The above components were measured by the following test-items:

Cooper’s 9 minutes Run or Walk test ACSM’s (2005)\(^4\) it was easier to measure Cardiovascular Endurance, therefore, it was included in this study. Bent knee sit-ups test and push-ups test requires fewer resources, easy to administer in school setup and generally student knows its procedure. The most commonly method used for evaluating Muscular Strength and Endurance is one min. Push-ups and Bent-Knee Sit-Up. Literature in physical education establishes an exercise of Bent-Knee Sit-Up, if performed for one minute, can predict one’s functioning level of abdominal muscles. The leading organization AAHPERD therefore, could incorporate “Bent-Knee Sit-Ups” event as one of the test-items Miller (2002)\(^5\). Flexibility has been accepted as one of the factors as included in this study. There is no single test that can truly characterize one’s flexibility. The sit and reach test is the most widely used test for assessment of flexibility. It does not represent total body Flexibility, but it does represent hamstring, hip, and lower back Flexibility.\(^6\) It requires less resource and is easy to administer in school setup and generally student knows its procedure. The sit and reach test was used for measuring Flexibility (ACSM 2004).\(^7\) Age-height-weight tables have traditionally been used to determine underweight or overweight. However, research has shown that individuals of the same height, weight and age can vary significantly in body shape and body composition. Body Mass Index is also a good indicator of body composition. It is a rough measure of body composition that is based on the concept that a person’s weight should


be proportional to height.⁸ The most popular indices have been those of Cozens (1963), Nelson and Cozens (1934) and Mc Cloy (1954).⁹ The description of each of the above test-items of Physical Fitness is presented in table 3.1.

3.3. Human Resources Used and Tester’s Reliability

One Director of physical education as expert and three specially trained M.A. B. Ed. (Physical Education) students assisted (Appendix - D) in collecting data of Morphological measurements Physical Fitness test. This was mainly because it was difficult to conduct the whole data collection process single handed. The assistants were oriented with training in the procedures of accurate measuring and recording the scores in each list. After the specialized training all the assistants were asked to measure the performance of 30 subjects in each specified test on a trial basis. Though help was taken in this process the testers’ reliability was determined (Miller.2002).¹⁰ The statistical reliability of the tester’s coefficients was determined and it ranged between 0.88 to 0.97. All the coefficients were found statically significant at the 0.01 level. Therefore the final measurements taken with the help of these assistants were considered reliable and fully justified.

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3.4. Research Design

A properly designed research only can guide the correct act to be done and indicates the steps to be taken in sequential manner for collecting the empirical data while verifying hypothesis. The research design is hence known as a ‘blue print’ of research engine that guides the researcher in the data collection stages, which gives direction to the investigator to observed whether his research process is on the right path or not. The design of the research has been implemented considering following stages:

![Diagram of research design]

**Figure 3.1**
Research Design

3.4.1. Survey Design

The purpose of this study was to standardize norms of Health Related Physical fitness for High school Boys in the age group of 11 to 13 years in the Nasik District, state Maharashtra. The investigator applied *Cross- sectional or survey research designs* for this study. This design takes a cross- sectional sample from the overall population. In this study the *multi-stage random sample technique* was also applied. A multi-stage random sample was constructed by taking a series of simple random samples in the stages. In a multi-stage random sample, a large area, such as a country, is first divided into smaller regions such as state of Maharashtra etc. and a random sample of these

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regions is collected. In the second stage, a random sample of smaller areas such as Nasik District was taken from the region chosen in the first stage. Then, in the third stage, a random sample of even smaller areas such as Talukas is taken from within each of the areas chosen in the second stage. Hence, the investigator reviewed the Taluka-wise list of high schools in Nasik district and in order to obtain sample representative of the entire district randomly selected Rural, Tribal and Urban schools from each of 15 Talukas in Nasik district to make the study more authentic and reliable.

3.5. Population and Sampling

Population
The population was the adolescent school going boys aged 11 to 13 years. 1146 secondary schools are located in Rural, Tribal and Urban areas in Nasik district. In the age groups 11 to 13 years, approximately 60,000 boys were studied in secondary schools located in Nasik district.

Sample
Out of 1146 secondary schools, 26 Rural, 20 Tribal and 21 Urban schools were selected. From these 67 secondary schools all 11, 12 and 13 years boys were the sample of this study. In the age groups of 11, 12 and 13 years taking about 3000 boys in each age group, the number of sample for this study reached 9000 students.

Procedure of the Sample Selection
The present research is a normative survey study that goes through a method of survey research under descriptive one. Since the Nasik district has expanded its periphery, the samples for the study were widely scattered. Hence, the simple random technique was used. The data was collected taking in account Tribal, Rural and Urban schools of Nasik District. The investigator hence proposed to randomly select 3000 students from each category i.e. Tribal, Rural and Urban high schools from the age group 11 to 13 years from 15 Talukas. In order to obtain sample representative of the entire district two Tribal, Rural and Urban schools from each of 15 Talukas in Nasik district were selected randomly. To make the study more authentic and reliable, the research scholar proposed to administer the tests. Out of 9084 boys, approximately 3000 from each age group i.e. 11, 12 and 13 years were selected randomly from 67 schools from the study area. The subjects’ distribution has been presented in Table 3.1.
Table 3.1

The subject distribution for Survey Study

<table>
<thead>
<tr>
<th>Age group</th>
<th>Rural</th>
<th>Tribal</th>
<th>Urban</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>1017</td>
<td>1008</td>
<td>1001</td>
<td>3026</td>
</tr>
<tr>
<td>12</td>
<td>1036</td>
<td>1021</td>
<td>993</td>
<td>3050</td>
</tr>
<tr>
<td>13</td>
<td>1000</td>
<td>1008</td>
<td>1000</td>
<td>3008</td>
</tr>
<tr>
<td>Total</td>
<td>3053</td>
<td>3037</td>
<td>2994</td>
<td>9084</td>
</tr>
</tbody>
</table>

The data for present research study was collected by testing the male students in different Health Related Physical fitness components. The research scholar went to Nasik Corporation and obtained the list of names and addresses of different schools in Nasik district. The investigator reviewed the Taluka-wise list of high schools from statistical information of medium wise secondary school in Nasik district year 2008-09 (as shown Appendix- A). As per record of Corporation, there are near about 1200 secondary schools in Nasik district in which medium of instruction is Marathi, Hindi, English and Urdu. 60,000 boys from age group 11 to 13 years have been studying in these 1146 high schools (As shown Appendix- A). Most of the schools are co-educational with an adequate number of boys. Hence covering the proposed number of 9000 boys was really feasible. The number of schools tested in each Taluka also differed. Since some Talukas have a large number of schools whereas others have just a few schools. However, it may be noted that the students from these schools hail from the remote Rural, Tribal and also from the Urban localities. Thus the selected sample is a reliable representative of the entire Taluka.

3.6 Testing Tools Reliability

In order to ensure the reliability of the data collected, the research scholar took precautionary measures to administer the tests in a smooth and systematic manner. The subjects’ reliability was established by test Retest coefficient of the scores was obtained from said test-items during Pilot study (n=80). The scholar selected appropriate tools required for conducting the various tests which were carried to all the testing centers. The same tools were utilized for measuring performances of the subjects at every testing
center. Test-retest reliability coefficient of samples on the tools of weighing scale and stediometer were calculated 0.96 and 0.99 respectively. Whereas physical fitness test viz. 9 minute Run or Walk, Push-ups, Bent-Knee sit-ups and Sit and reach were recorded as 0.77, 0.79, 0.94 and 0.95, and respectively.

3.7 Administration of test items
The Physical Fitness Components test composed of the following test items.

Table 3.2
Physical Fitness Components and Tests

<table>
<thead>
<tr>
<th>Sr.</th>
<th>Test Item</th>
<th>To Measure</th>
<th>Equipment</th>
<th>Scoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9 Minute Run or Walk</td>
<td>Cardio vascular Endurance</td>
<td>Minimum track</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Push-ups</td>
<td>Muscular Strength</td>
<td>Mat or Flat surface</td>
<td>Number of Repetitions</td>
</tr>
<tr>
<td>3</td>
<td>One Minute Bent Knee Sit-ups</td>
<td>Muscular Endurance</td>
<td>Mat or Flat Surface</td>
<td>Number of Repetitions</td>
</tr>
<tr>
<td>4</td>
<td>Modified Sit and Reach</td>
<td>Flexibility</td>
<td>Sit and reach Box</td>
<td>Inches</td>
</tr>
<tr>
<td>5</td>
<td>Body Height</td>
<td>Standing Height</td>
<td>Meter tape</td>
<td>Centimeter</td>
</tr>
<tr>
<td>6</td>
<td>Body Weight</td>
<td>Weight</td>
<td>Weighing Machine</td>
<td>Kilogram</td>
</tr>
<tr>
<td>7</td>
<td>Body Mass Index</td>
<td>Body Composition</td>
<td>*Wt (in Kg.) / Ht(in meters)$^2$</td>
<td>Kg/m$^2$</td>
</tr>
<tr>
<td>8</td>
<td>% Body Fat</td>
<td>Body Composition</td>
<td>BFA</td>
<td>%</td>
</tr>
</tbody>
</table>

* Formula for calculating BMI

3.8 Description and Measurement of Test items.
The test items were conducted as per the standard physical battery and the procedures described in the AAHPERED health related physical fitness test. The tests used are described in detail, with their objective, equipment and the directions of the tester regarding how accurately the subjects should be tested and how they should be graded or how their performances should be recorded.
3.8.1 Body Height

**Purpose:** To measure standing length of body.

**Equipment:** Flat surface, measuring tape, marker

**Procedure:** In measuring height, the only equipment and materials necessary are flat surface against which the student stands, measuring tape or marked surface and an object to place on the student’s head that form a right angle to the wall or a black board. The measurement should be done without shoes. It has been suggested that standing with the back against a support helps the subject to stretch to his full height. The chin is tucked in slightly and head is held erect. Finally the subject bends his knee slightly when he steps away so as not to disturb the angle before the height is recorded.

**Scoring:** The height is recorded in centimeter.

3.8.2 Body Weight

**Purpose:** To measure mass of the body.

**Equipment:** Weighing machine

**Procedure:** The student to be weighed should be wearing a minimum amount of clothing and shoe removed. While it may be more accurate for the students to be weighed in the nude but, it is often not practical or desirable. The subject should be weighed at the same degree accuracy.

**Scoring:** The weight is recorded in kilogram.

3.8.3 9 minute Run or Walk

**Purpose:** To measure maximal functional capacity and endurance of cardiovascular system.

**Equipment:** 200 Meter track or flat and safe area suitable for running, scorecards, pencils and assistants.

**Age level:** The 12 minute run and/or walk are for boys for the age group 11, 12, 13 years.

**Procedure:** Students are instructed to run as far as possible in 12 minute a signal ‘Ready’ or whistle is used to begin the test. Participants continue to run or and walk until they hear the signal to stop.

**Scoring:** The distance covered during the allotted time is recorded (to the nearest 0.5 meter) as the score. Performances should be immediately recorded on a score card.
3.8.4 Push-ups

**Purpose:** To measure strength and endurance of arms and shoulders.

**Equipment:** Mat or flat surface, scorecards, pencils and assistants.

**Procedure:** Start in the push up position - with the hands and toes touching the floor, the body and legs are in a straight line, feet slightly apart, and the arms and shoulder wide apart, extended and at right angles to the body. Keeping the back and knees straight, the subject lowers the body until there is a 90-degree angle at the elbows, with the upper arms parallel to the floor and then pushes upward to the straight arm support. The exercise is continued for as many repetitions as possible without rest in 60 sec. The body must not sag or pike upward but maintain the straight line throughout the exercises.

**Scoring:** The total number of pushups completed successfully is recorded as the score.

3.8.5 Sit-ups

**Purpose:** To measure endurance of the abdominal muscles.

**Equipment:** An exercise mat or piece of a carpet and one assistant.

**Procedure:** Student lies on back with legs flexed at the knees and feet approximately 12 inches apart. The hands are placed behind the head with fingers interlaced. A partner holds the student’s ankles and keeps the feet in contact with the floor while counting each sit up. On the signal to begin, the student touches the chest both the knee and returns to the starting position. The examinee begins executing consecutive Sit-ups on the word “Go”, using the signal “Ready, Go!” At the end of 60 seconds, the test is ended with the word ‘Stop’! The score is the numbers of Sit-ups executed correctly during this time.

**Scoring:** The total number of Sit-ups successfully completed is recorded as the score. The test allows for a one minute time limit.

3.8.6 Sit and Reach

**Purpose:** To evaluate the flexibility of the lower back and hamstring muscles.

**Procedure:** This test involves sitting on the floor with legs out straight ahead. Feet (shoes off) are placed with the soles flat against the box, shoulder-wide apart. Both knees are held flat against the floor by the tester. With hands on top of each other and palms facing down, the subject reaches forward along the measuring line as far as possible. The first reach is held for at least two seconds while the distance is recorded. Make sure there
is no jerky movement and that the fingertips remain level and the legs flat. Only one trial is given.

**Scoring:** The score is recorded in inches as the distance reached by the hand.

### 3.8.7 Body Mass Index (BMI)

**Purpose:** To assess the proportion of the body

**Procedure:** Formula is used to measure body mass index. However, prior to that individual’s body weight and height are to be measured and recorded. The formula is as follows:

\[
BMI = \frac{\text{Weight (kg)}}{\text{Height (m)}^2}
\]

**Scoring:** After calculation, the score of BMI is expressed in the form of index.

### 3.9 Collection of Data

The research scholar reviewed the scholastic calendar of high school for the academic year 2008-09 and 2009-10 and accordingly worked out a tentative schedule for administering the tests in various centers in Nasik district keeping in view the school examinations, Annual functions, religious festivals, vacations etc.

- **Intimation to schools**

A detailed circular was forwarded well in advance, to the Principal/ Headmaster of the selected schools. A copy of which was provided to the physical education teachers, informing them about the investigator’s proposed study and requesting them to facilitate in administering the tests to the boys in their respective schools (as shown Appendix -C).

The relevant pro forma for the submitting the list of boys proposed to be tested, as per their age groups was prepared.

- **Age groups**

In order to facilitate the schools in enlisting the boys for the tests, the following age groups were made class wise.

- **Group 1:** 11 years (6th Std.)
- **Group 2:** 12 years (7th Std.)
- **Group 3:** 13 years (8th Std.)
Score sheet
Appropriate score sheets were duly prepared for recording the scores of each test item separately. (As shown Appendix- E)

Testing schedule
The research scholar started the work of collection of data during Feb. 2008. The six test items included in the test battery were split up into two sets and were conducted on two consecutive days as under

First day:
a) Weight   b) Height   c) Sit and reach   d) Push up

Second day:
e) 1 minute Bend knee Sit-ups f) 9 minute run or walk

Testing centre
The testing centers for administering the tests were set up within an individual institution wherever adequate numbers of boys were available.

Instrumentation
The research scholar selected the following equipment after thoroughly checking their working conditions and accuracy.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Item</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Electronic Split Time Watch</td>
<td>02 No.</td>
</tr>
<tr>
<td>2</td>
<td>Portable Weighing Machine</td>
<td>01 No.</td>
</tr>
<tr>
<td>3</td>
<td>50 Meter Tape</td>
<td>01 No.</td>
</tr>
<tr>
<td>4</td>
<td>Sit And Reach Box</td>
<td>01 No.</td>
</tr>
<tr>
<td>6</td>
<td>Whistles</td>
<td>05 No.</td>
</tr>
<tr>
<td>7</td>
<td>Whity</td>
<td>10 kg</td>
</tr>
<tr>
<td>8</td>
<td>Clapper</td>
<td>01 No.</td>
</tr>
<tr>
<td>9</td>
<td>Color Chalk</td>
<td>01 dozen</td>
</tr>
<tr>
<td>10</td>
<td>Pen</td>
<td>05 No.</td>
</tr>
</tbody>
</table>

Table 3.3
List of Equipments
➢ Equipment and ground arrangement

In order to ensure the reliability of the data collected, the research scholar took extreme care to provide standard equipment and necessary playground facilities at each testing centre. However in some schools running track was not available, so the subjects had to cover the distance (for 9 minute Run or Walk) on the road or within the available length of 100 meter of the school playground.

➢ Testing stations

Testing stations were set up at each testing centre to administer the tests systematically and within the schedule time. The number of testing stations depended on number of subjects being tested at the testing centre. The subjects were grouped age wise or class wise and each group was assigned to one testing station. Adequate numbers of officials were appointed at each station.

*The modus operandi at the testing centre was as follows:

The research scholar noted the number of boys that reported for the tests at the centre. The chief scorer then entered the names of the boys in score sheets as per the test items to be conducted for the day. Taking into consideration the number of officials available at the centre, the research scholar set up testing stations, to conduct each test item separately at each station. Mostly two stations were set up. If there were two stations, then two groups of subjects were formed. Both the tests were conducted simultaneously. On completion of the tests the group interchanged their testing stations. After completion of both tests at both the testing stations, the next two events were taken up at the next stations (viz. Sit and Reach and Pushups). The groups interchanged their places on completion of the tests at a particular station. This method was very effective. The scores were duly recorded by competent scorers at each testing station, on the specific score sheet, against the name of the subject. The research scholar personally supervised the functioning of each testing station and checked the score sheets from time to time.

On completion of the first day test items, the scholar re-checked the list of students submitted by the schools. It was noted that age groups were wrongly calculated, so the investigator re-grouped the boys and prepared fresh lists of such erring institutions, to ensure that the records of boys eligible in particular age group were duly recorded. A good number of under age and overage boys, who did not fit within any of the age