CHAPTER III
METHOD OF STUDY
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In this chapter, the research design, sources of data, sampling procedure, selection of variables, selection of the tests, description of the tests, competency of the tests and collection of the data are described.

Research Design

The present study mainly focussed its attention on obtaining the data regarding the existing status of physical fitness and Anthropometric measures of the secondary school students. Because of the nature of the study the research scholar used the descriptive type of research method. The most commonly used method - survey method, was used despite the comparatively larger study area.

As the study was concerned with the current existing status of physical fitness and Anthropometric measures of school boys and also aimed at developing the norms for the future implementation, for achieving the objectives of the present study, the survey method of research was found to be more appropriate. This method was also selected because data could be gathered from a relatively large number of cases by direct contact and observation of the prevailing conditions.
Sources of Data

The data for the present investigation were collected by conducting the test of physical fitness and anthropometric tests on the subjects who were the students of secondary schools of three geographical regions of Nepal, namely: Tarai, Hill and Himalaya.

The study excluded the subjects from Boarding Schools and the Girls' schools. The purpose behind excluding such subjects was that, the students from Boarding schools were supposed to be from higher socio-economic strata and quite different as compared to the students of other general schools. The female subjects were excluded because the present study was restricted to male students only.

Sampling procedures

The subjects selected for the present study were from the secondary schools students of Nepal. A list of the secondary schools of different regions namely: Tarai, Hill and Himalaya were obtained from the Ministry of Education. Further the schools conducting the classes VIII, IX and X grades were listed and divided regionwise.
There were 1200 secondary schools listed in such group\(^1\). As it was impossible to cover all the aforesaid schools for the present study, proportionate stratified method of sampling was adopted.

First of all total schools of Nepal were divided into three geographical regions from where 49 districts or about 65 percent of the total seventy five districts were randomly selected in such a way that the sample districts represented all the fourteen zones.

A sample of total 3420 students was selected for the present study. The subjects for the present study were selected by the method of cluster sampling in proportion to the distribution of the National population in different regions of Nepal. The national population was found to be distributed in different regions as follows:

<table>
<thead>
<tr>
<th>TABLE - 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>REGIONWISE POPULATION DISTRIBUTION IN PERCENTAGE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Region</th>
<th>National Population 2</th>
<th>National Student population 3</th>
<th>Sample percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Tarai</td>
<td>44</td>
<td>47</td>
<td>44</td>
</tr>
<tr>
<td>2.</td>
<td>Hill</td>
<td>48</td>
<td>45</td>
<td>44</td>
</tr>
<tr>
<td>3.</td>
<td>Himalaya</td>
<td>8</td>
<td>7</td>
<td>12</td>
</tr>
</tbody>
</table>


\(^3\) Op cit
The subjects randomly selected for the present study were in proportion to the national population as shown in table-2, above. Therefore, out of 3420 subjects of VIII, IX and X grade, 44 percent (1500) from Tarai, 44 percent (1500) from Hill, and 12 percent (420) from Himalaya were selected for the study.

The analysis was based on the data collected from 49 schools of the three different regions. This has been briefly presented in the following Table-3, and a map of sample schools from different districts of Nepal is presented in appendix - D.

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Region</th>
<th>Sample School Number</th>
<th>Sample number of subjects.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Tarai</td>
<td>20</td>
<td>1500</td>
</tr>
<tr>
<td>2.</td>
<td>Hill</td>
<td>20</td>
<td>1500</td>
</tr>
<tr>
<td>3.</td>
<td>Himalaya</td>
<td>9</td>
<td>420</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>49</td>
<td>3420</td>
</tr>
</tbody>
</table>

Finally to cover the maximum districts, one half of the total strength of students from each class from Tarai and Hill was selected as the subjects. Strength of the subjects varied from school to school and class to class, therefore, to give equal representation to each group, 25 students were selected
randomly from each class as a sample. Whereas in Himalaya region total presented students of each grade of sample schools were selected as the subjects, because of less enrolment number of students in each school.

Selection of Variables

The selection of variables was done by review of the available scientific literature pertaining to the physical fitness and anthropometric characteristics. The basic physical fitness elements are Muscular strength, Muscular endurance and Cardio-respiratory endurance, so keeping in view the feasibility criteria and the relevancy of the variables to the present study, the following variables were selected.

(A) Fitness Variables:

i) Strength,
ii) Muscular endurance,
iii) Cardio-Respiratory endurance, and
iv) Speed.

(B) Anthropometric Measures:

i) Age,
ii) Height,
iii) Weight,

---

iv) Arm length,
v) Upper-Arm length,
vi) Fore-Arm length,
vii) Arm girth,
viii) Hand length,
ix) Leg length,
x) Upper-leg length,
xi) Fore-leg length,
xii) Thigh girth,
xiii) Calf girth,
xiv) Neck girth,
xv) Chest girth,
xvi) Abdominal girth, and
xvii) Arm span.

Selection of the Tests

Test for Measuring Fitness Variable:

The test selected to measure the physical fitness of the students was based on the suggestion of the expert working in the field of physical education in Nepal, and after discussion with the supervisor of the present study, the tests for measuring fitness variables were selected from the different well established group of tests having higher reliability and validity, which are following:
i) Push-ups for muscular strength,
ii) Sit-ups for Muscular endurance,
iii) Harvard Step test for Cardio-respiratory endurance, and
iv) 50-yard dash for speed.

Anthropometric Measures:

To determine the relationship between the physical fitness and Anthropometric characteristics following anthropometric measures were selected:

i) Age,
ii) Height,
iii) Weight,
iv) Arm length,
v) Upper-arm length,
vi) Fore-arm length,
vii) Arm girth,
viii) Hand length,
ix) Leg length,
x) Upper-leg length,
xi) Fore-leg length,
xii) Thigh girth,
xiii) Calf girth,
xiv) Neck girth,
xv) Chest girth,
xvi) Abdominal girth. and
xvii) Arm span.

Reasons for Selecting the Tests:

The selection of the test was done after reviewing various physical fitness test batteries, discussion with the expert working in the field of Physical Education at Nepal and a series of discussion with the supervisor of the present study. The research scholar had selected above mentioned tests due to following reasons:

i) Test items should be easy to administer,

ii) Availability of equipment and facilities to conduct the test,

iii) Test should require less equipment which should be locally available,

iv) Less expensive; it means test should be economic and cheap,

v) Test items should be more reliable and scored objectively,

vi) Test items should be easy to demonstrate and control the group,

vii) Test should not require any elaborate preparation,

viii) Test should be less time consuming and more practicable,
1x) Test should not need more assistance and specific training, and
x) Test should have established reliability and validity.

Description of the Tests

The tests for measuring fitness variables were selected from the different well established group of tests having higher reliability and validity, which are as follows:

1. Muscular Strength: Push-ups:

   It was administered to measure arm and shoulder strength following the instruction given in "Indiana Motor Fitness Tests" for high school and college men.5

   Description:

   The push-up was executed from the floor. The student lies face down on the floor with body straight, legs together and places his hands on the floor at shoulder level. He pushes up to a position in which the arm was to be

PUSH-UPS

Fig. 2-A: Initial position

Fig. 2-B: Final position
straight and the weight was to be supported entirely on hands. His body must be in a straight line from head to foot. The chest must touch the floor each time and arms must be fully extended on the return. The back must be kept straight. The entire exercise was repeated continuously as many times as possible. (Fig. 2)

Scoring:

Score was recorded in number for every correctly executed push-up.

2. Muscular Endurance: Sit-ups:

To measure the ability to continue muscular exertions of submaximal magnitude of abdominal muscle, 'sit-ups' was administered.\(^6\)

Description:

The pupil lies on his back with knee bent, feet on the floor, and heels not more than 12 inches from the buttocks. The angle at the knee should be less than 90 degrees. The pupil puts his hands on the back of his neck with fingers

\(^6\)Ibid. p 127.
clasped and places his elbows squarely on the floor. His feet was held by his partner to keep them in touch with the surface. The pupil tightens his abdominal muscles and brings his head and elbows forward as he curls up, finally making elbow touch knees. This action constitutes one 'sit-ups'. The pupil returns to the starting position with his elbows on the surface before he sit-ups again. (Fig. 3)

Scoring :

The number of correctly executed 'sit-ups' performed in sixty seconds was recorded as score.

3. Cardio-Respiratory Endurance : Harvard Step Test :

To measure the moderate contractions of large muscle groups for relatively long periods of time, which requires an adjustment of the circulatory-respiratory systems to the activity, "Harvard Step Test" was administered.\(^7\)

Description :

The subject exercises on a 20-inch bench for as long a period as possible up to five minutes. The cadence was to be

\(^7\)Ibid p 269.
SIT-UPS

Fig. 3-A: Initial position

Fig. 3-B: Final position
thirty steps per minute. The pulse count was to be made from only one minute to one minute and thirty seconds immediately after the exercise. (Fig. 4)

Scoring:

The index was calculated on the basis of following formula:

\[
\text{Index} = \frac{(\text{Duration of Exercise in seconds}) \times 100}{5.5 \times (\text{Pulse count})}
\]

4. Speed: 50-yard dash:

To measure rapidity with which successive movements of the same kind can be performed "50-yard dash" was administered.

Description:

The 50-yards distance was measured with the help of measuring tape and marking was put on starting and finishing lines. Two subjects ran at a time. The subjects took the position behind the starting line in standing position. The starter used the commands 'on your marks' and 'Go'. The latter was accompanied by a downward sweep of the starter's arm.

8 Ibid p 129.
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HARVARD STEP TEST

Fig. 4-A: Starting position

Fig. 4-B: Position 1st

Fig. 4-C: Position 2nd

Fig. 4-D: Position 3rd

Fig. 4-E: Position 4th
arm to give a visual signal to the timer who stands at the finish line.

Scoring :-

Duration of the time between the starter's signal and the instant the subject crossed the finishing line was recorded to the nearest 1/10 of a second.

Anthropometric Measures :-

Seventeen anthropometric measurements were taken on each subject. The measuring techniques were largely those described by Clarke and Clarke (1987), Mathew (1978), De Garay (1974), and Johnson and Nelson (1982) which are described as follows:

1) Age :-

Chronological age was calculated in years and months on the basis of the date of birth recorded in school admission register.

2) Height :-

The height was taken with the subject standing erect without shoes against a marked scale on a wall touching it with heel, buttocks and back. The subject was instructed to keep the heels together, heel level without tilt and to take and hold
a full breath while measurement was taken. A stiff hard board was held horizontally on his head, slightly pressing his head and touching the scale marked on wall. The subject was asked to step out and the reading indicated by the hard board was read on the scale (Fig. 5-A)

**Scoring:**

Height was recorded correctly to the nearest centimetres.

3) **Weight:**

The weight of each subject was taken with a lever tape laboratory anthropometric weighing machine. The subject, wearing short and vest only, stood at the centre of the weighing machine.

**Scoring:**

The weight was read and recorded to the nearest kilogram.

4) **Arm length:**

The arm length was measured by using calibrated stool tape. The subject stood in a side view. The arm length
ANATOMICALLY LANDMARKS

Fig. 5-A: Standing Height

Fig. 5-B

Neck Girth

Arm Girth

Thigh Girth

Calf Girth

Hand Length
was measured by putting the standard steel tape from the acromion process above the shoulder joint to the tip of the middle finger (Fig. 6-A)

Scoring:

The measurement was recorded to the nearest centimetres.

5) Upper-arm length:

The upper-arm length was measured by using calibrated steel tape. The subject stood in a side view and upper-arm length was measured by putting the standard steel tape from the acromion process above the shoulder joint to the epicondyle process of the elbow. The measurement was recorded to the nearest centimetres (Fig. 6-A)

6) Fore-arm length:

The fore-arm length was measured by using calibrated steel tape. The subject stood in a side view and forearm length was measured by putting the standard steel tape from the epicondyle process to the tip of the middle finger. The measurement was recorded to the nearest centimetres (Fig. 6-A)
7) Hand length:

The subject stood erect by keeping his arm long with his body. The measurement was taken from the styloid process of ulna to the tip of the middle finger by standard steel tape. Hand length measurement was recorded to the nearest half centimetre (Fig. 5-B)

8) Arm Girth:

For this test, the girth of the right flexed tensed upper arm was taken. The subject sat on a chair, feet flat on the floor. The arm was flexed at the shoulder to about 90 degrees and the forearm in supine position was flexed at the elbow: the muscles of the upper-arm were contracted to form as large muscles as possible. The girth was measured around the most prominent part of the upper-arm. The measurement was taken by a steel tape and recorded to the nearest centimetre (Fig. 5-B)

9) Leg Length:

To determine the leg length, the researcher faced the student, placed his hand approximately four to six inches below the student's waist on each hip and asked the student to swing his right leg back and forth slowly, and then to lift it to the
outside. By manipulation, the researcher was able to locate the spot where the greater trochanter entered the pelvic girdle. The height of the greater trochanter from the floor was measured in nearest centimetre. This procedure was followed twice with every student (Fig. 6-A)

10) Upper-leg (Thigh) length:

Thigh length of the subject was measured with an standard steel tape vertically from the most protuberant point of the patella bulge to the upper edge of the greater trochanter. The thigh length was recorded correctly to the nearest centimetre (Fig. 6-B)

11) Foreleg Length:

Foreleg length was measured vertically from the bottom outside edge of the foot in centre of the instep to a line drawn horizontally through the most protuberant part of the patella bulge coinciding with the centre of the knees bend to the buttock. The foreleg length was measured to the nearest centimetre (Fig. 6-B)

12) Thigh Girth:

Thigh girth was measured with steel measuring tape placed round the thigh horizontally with its top edge under the
fold of the buttock. The subject stood with his weight equally
distributed on both feet. The measurement was recorded to the
nearest centimetre (Fig. 5-B)

13) Calf Girth:

Calf girth was taken as the maximum circumference
of the calf in a plane at right angle to its long axis. The leg
was held dangling over a table top and the measurement tape
was in horizontal plane. The measurement was recorded to the
nearest centimetre (Fig. 5-B)

14) Neck Girth:

The subject was in a normal standing position, a
tape was brought around his neck at the level immediately below
the prominentia laryngæa. The measurement was recorded to the
nearest centimetre (Fig. 5-B)

15) Chest Girth:

For this test, the subject was in a normal standing
position, with the arms of the subject slightly lifted, the tape
was placed with both hands just below the lower angle of the
scapula and then extended towards the front with the level of
nipples. The subject, standing erect and with his arms hanging loosely at his sides, was then asked to take as deep a breath as possible, and once the maximum inspiration had been reached, the reading was made from the front. The subject was then asked to breathe out as much air as he could, and the reading was again made in front of the subject. In these measurements, the tape was always in light contact with the skin. The score recorded was the average of the girth measurements taken on full inhalation and full exhalation. (Fig. 6-B)

16) Abdominal Girth:

The subject, standing erect and with his arms hanging loosely at his sides, the tape was placed with both hands around his abdomen at the level of the umbilicus and iliac crests. The reading was made from the front of the subject. The score was recorded to the nearest centimetre (Fig. 6-B)

17) Arm Span:

For this test, the subject was in a normal standing position with back against wall, was asked to extend his both arms horizontally on the shoulder level. Distance taken from outstretched finger tips of one hand to the other was measured. The score was recorded to the nearest centimetre.
Competency of the Tests

To ensure that the investigator was well versed in the techniques of conducting the tests, the researcher had a number of practice sessions in the testing procedures under the supervision of the guide before finally collecting the data. Finally, a hundred subjects were chosen randomly and the measurements of the selected variables were taken two times by

**TABLE - 4**

**TESTER COMPETENCY FOR TEST OF THE VARIOUS VARIABLES**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Variables</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Push-ups</td>
<td>.92</td>
</tr>
<tr>
<td>2.</td>
<td>Sit-ups</td>
<td>.91</td>
</tr>
<tr>
<td>3.</td>
<td>Harvard Step Test</td>
<td>.88</td>
</tr>
<tr>
<td>4.</td>
<td>50-yards dash</td>
<td>.92</td>
</tr>
<tr>
<td>5.</td>
<td>Age</td>
<td>.99</td>
</tr>
<tr>
<td>6.</td>
<td>Standing Height</td>
<td>.95</td>
</tr>
<tr>
<td>7.</td>
<td>Body Weight</td>
<td>.96</td>
</tr>
<tr>
<td>8.</td>
<td>Arm Length</td>
<td>.95</td>
</tr>
<tr>
<td>9.</td>
<td>Upper-arm length</td>
<td>.96</td>
</tr>
<tr>
<td>10.</td>
<td>Forearm length</td>
<td>.94</td>
</tr>
<tr>
<td>11.</td>
<td>Hand length</td>
<td>.96</td>
</tr>
<tr>
<td>12.</td>
<td>Arm Girth</td>
<td>.92</td>
</tr>
<tr>
<td>13.</td>
<td>Leg length</td>
<td>.93</td>
</tr>
<tr>
<td>14.</td>
<td>Upper-leg (Thigh) length</td>
<td>.95</td>
</tr>
<tr>
<td>15.</td>
<td>Foreleg length</td>
<td>.94</td>
</tr>
<tr>
<td>16.</td>
<td>Thigh girth</td>
<td>.92</td>
</tr>
<tr>
<td>17.</td>
<td>Calf girth</td>
<td>.93</td>
</tr>
<tr>
<td>18.</td>
<td>Neck girth</td>
<td>.94</td>
</tr>
<tr>
<td>19.</td>
<td>Chest girth</td>
<td>.91</td>
</tr>
<tr>
<td>20.</td>
<td>Abdominal girth</td>
<td>.90</td>
</tr>
<tr>
<td>21.</td>
<td>Arm span</td>
<td>.97</td>
</tr>
</tbody>
</table>
the researcher, of the said group. To ensure the accuracy of measurement the coefficient of correlation of measurements between two scores were calculated and are presented in Table-4.

From test-retest coefficient of correlation (Table-4), it is evident that the tester's reliability was significantly high, establishing the competency of the scholar to administer the test.

**Collection of Data**

In data collection procedures the researcher first consulted the Ministry of Education and Culture in order to obtain information about the total number of schools existing in the country. A booklet about the information on the secondary school was acquired where detailed information about the location, standards and type of schools was given. Further the schools conducting the classes VIII, IX and X grade were listed and divided regionwise.

As mentioned in the sampling procedures earlier, the researcher selected 49 schools from three regions (Table-3) and visited personally each selected school for data collection. The researcher visited the school of Tarai regions in summer
because of the all weather road facility, and the Hill region in winter because in summer the road and transport mostly get blocked due to rain and landslides. The Himalaya region was visited during spring because in summer roads and transport get blocked due to rain and landslides, in winter travelling is difficult because of snowfall, minus degree temperatures and winter vacation.

The researcher visited each selected school personally and introduced himself to the Headmaster of the schools and explained his aim of the visit. The researcher had a discussion with the physical education teachers and concerned teachers with the permission of headmasters.

As mentioned earlier, (page- 88) to give equal representation to each group, 25 students were selected at random from each class as a sample from the Tarai and Hill region, whereas all the present boy students from Himalaya region were selected for the study in presence of school teachers. Thus the data collected from the different regions are presented in the Table No.5.

The research scholar had an informal discussion before the collection of data with the selected students of the respective schools in presence of the school physical education teachers or subject teachers. The researcher explained and demonstrated the
various test items to the subjects so that they were well acquainted with the procedures of various tests. All the subjects were allowed two trials so that the learning effect could be minimised before finally collecting data. After the explanation, demonstration and trials of test items the subjects were evaluated to their physical fitness by the investigator with the help of other teachers of the respective school.

**TABLE - 5**

TOTAL NUMBER OF SUBJECTS FROM DIFFERENT REGIONS

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Region</th>
<th>Number of subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Tarai</td>
<td>1500</td>
</tr>
<tr>
<td>2.</td>
<td>Hill</td>
<td>1500</td>
</tr>
<tr>
<td>3.</td>
<td>Himalaya</td>
<td>420</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>3420</td>
</tr>
</tbody>
</table>

The subjects were given half an hour rest after the administration of physical fitness test, and then anthropometric measures were taken and recorded with the help of school teachers. The age of the students was recorded from the school admission file in years and months. Height and weight was recorded to the nearest centimetres and nearest half kilogram respectively. In the same way, all the body segment measures were recorded to nearest centimetres.