CHAPTER III
PROCEDURE
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PROCEDURE

In this chapter, the selection of subjects, selection of variables, reliability of data, design of the study, administration of the test, collection of data, procedure of rating for somatotype components and statistical techniques employed for analysing the data are described.

Selection of Subjects

In order to have an over all view of health related physical fitness of school going girls of Madhya Pradesh and to maintain uniformity, the ten urban cities were selected for collecting data on the variables of this study. One thousand one hundred female students of five to fifteen years of age undergoing school education in various schools of Madhya Pradesh were randomly selected by using random number table for each age group i.e. -5 to 15 years of age Hundred female subjects i.e. ten from each city school were randomly selected as subjects for each age group. The ten cities from which the subjects were selected were Raipur, Bilaspur, Durg, Jabalpur, Gwalior, Bhopal, Indore, Ujjain, Reewa and Sagar. Random method was used to select one school from each city. The age in completed years of the subject was taken from school health record for each age group from the randomly selected schools of Madhya Pradesh and list of students of 5 to 15 years of age was prepared. The age of the child was recorded in completed years. For analysis of the data, the age grouping was done according to the age at last birthday (Rao et al 1961 & M. Mitra et al, 2002) All the children who had completed 5 years but were less than 6 years were considered in the group of 5+ years and likewise age groups were calculated (Mitra et al 2002)

Prior to testing and administration of health related fitness tests and measurement of growth variables, the researcher had called a joint meeting of selected students, physical education teachers and principals in order to clearly explain the aims and objectives of the present study in each of the school. All the tests were practically demonstrated to the
selected subjects and their doubts were cleared. The list of randomly selected schools of Madhya Pradesh from which the samples were drawn are given in table no. 1.

**TABLE 1**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Name of Schools</th>
<th>Name of City</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Saraswati Shishu Mandir</td>
<td>Raipur</td>
</tr>
<tr>
<td>2.</td>
<td>Kendriya Vidyalaya I</td>
<td>Gwalior</td>
</tr>
<tr>
<td>3.</td>
<td>Govt. Utakristha Vidyalya</td>
<td>Bhopal</td>
</tr>
<tr>
<td>4.</td>
<td>Saraswati Shishu Mandir</td>
<td>Reowa</td>
</tr>
<tr>
<td>5.</td>
<td>B.N.S. School</td>
<td>Durg</td>
</tr>
<tr>
<td>6.</td>
<td>Guardian &amp; Guide School</td>
<td>Bilaspur</td>
</tr>
<tr>
<td>7.</td>
<td>Ghyan Ganga Academy</td>
<td>Jabalpur</td>
</tr>
<tr>
<td>8.</td>
<td>Modern School</td>
<td>Sagar</td>
</tr>
<tr>
<td>9.</td>
<td>Govt. Modern School</td>
<td>Ujjain</td>
</tr>
<tr>
<td>10.</td>
<td>Kendriya Vidyalya I</td>
<td>Indore</td>
</tr>
</tbody>
</table>

**Selection of Variables**

The Selection of variables with regard to health related physical fitness and growth were selected on the basis of review of professional literature and feasibility analysis as to what are the variables that could be taken up for investigation keeping with the availability of equipment, acceptability to the subject and legitimate time that could be devoted for tests as well as to keep the entire study unitary and integrated. The following variables were selected and they were classified into two categories, namely health related physical fitness and growth variables.

**A. Health related fitness variables:**

1. Half mile run (Cardiovascular endurance)
2. Flexed knee sit ups (Muscular endurance)
3. Modified pull ups (Muscular strength)
4. Sit and reach test (flexibility)
5. Body Composition (Sum of skinfold)
B. Growth Variables:

1. Height
2. Weight
3. Biceps Skinfold
4. Triceps Skinfold
5. Calf Skinfold
6. Subscapular Skinfold
7. Suprailliac skinfold
8. Humerus biepicondylar diameter
9. Femur biepicondylar diameter
11. Calf girth

Design of the Study

This was a status study involving cross sectional analysis of health related physical fitness and growth variables among girls of 5-15 years of age of Madhya Pradesh. In total 11 age groups consisting of 100 subjects in each age group served as subjects.

Reliability of Data

The reliability of data was ensured by establishing instrumentation reliability, tester reliability, subject reliability and reliability of tests.

Instrumentation Reliability

To measure health related physical fitness variables, instruments like stop watches, horizontal bar, flexo measure case were used and to measure growth variables, the instruments like stadiometer, weighing machine, GMP skinfold caliper, sliding caliper and flexible tape were used. All these equipment's were obtained from standard firms of India which cater to the need of various research laboratories in India and abroad. The instruments were considered highly calibrated, accurate and reliable since these are very popularly and widely used in the research work of physical education and sports by Indian sports scientists. The reliability of each of the equipment has been well established by the manufacturing industries.
Testers Reliability

Test retest method was used to establish reliability of investigator in taking the health related physical fitness variables and growth variables by computing co-efficient of correlation between the scores obtained from 20 subjects by the expert and investigator on the below given variables. The coefficient of correlation obtained between the performance values measured by the expert and investigator are presented in table-2.

Table 2

Test-reliability coefficient in health related physical fitness and growth variable

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Variables</th>
<th>Co-efficient of correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1/2 Mile run</td>
<td>.78*</td>
</tr>
<tr>
<td>2.</td>
<td>Flexed knee sit ups</td>
<td>.84*</td>
</tr>
<tr>
<td>3.</td>
<td>Modified pull ups</td>
<td>.82*</td>
</tr>
<tr>
<td>4.</td>
<td>Sit and reach test</td>
<td>.66*</td>
</tr>
<tr>
<td>5.</td>
<td>(1) Triceps skinfold</td>
<td>.88*</td>
</tr>
<tr>
<td></td>
<td>(2) Calf skinfold</td>
<td>.84*</td>
</tr>
<tr>
<td>6.</td>
<td>Height</td>
<td>.98</td>
</tr>
<tr>
<td>7.</td>
<td>Weight</td>
<td>.99</td>
</tr>
<tr>
<td>8.</td>
<td>Calf Skinfold</td>
<td>.96</td>
</tr>
<tr>
<td>9.</td>
<td>Subscapular Skinfold</td>
<td>.99</td>
</tr>
<tr>
<td>10.</td>
<td>Suprailliac Skinfold</td>
<td>.98</td>
</tr>
<tr>
<td>11.</td>
<td>Bicpicondylar diameter of Humerus</td>
<td>.94</td>
</tr>
<tr>
<td>12.</td>
<td>Biepicondylar diameter of Femur</td>
<td>.96</td>
</tr>
<tr>
<td>13.</td>
<td>Biceps girth</td>
<td>.98</td>
</tr>
<tr>
<td>14.</td>
<td>Calf girth</td>
<td>.98</td>
</tr>
</tbody>
</table>

N = 20, \( r_{.01 (18)} = .56 \)

Significant at .01 Level of confidence.
Subject Reliability

The above test retest co-efficient of correlation method also established that subjects reliability was significant at .01 level of confidence, as the same subjects were used under similar conditions by the same tester and no motivational techniques were used.

Reliability of Test

To Measure health related fitness variables, AAPHERD health related fitness were used. This test is having reliability of .68 and validity of .65 and it is widely used in research in physical education and sports in India and abroad.

Administration of Test and Collection of Data

On the day of testing, the subjects were urged to put in their best efforts. The tests were administered strictly observing the procedures specified for each test. The well trained professional persons were posted at each station to record the scores. The detailed methodology of collecting data is described below -

1. **Half mile Run**:

**Objective**: To measure the cardiovascular endurance.

**Equipment**: Track, stopwatches, paper, pencils etc.

**Procedure**: The subject was asked to stand behind the starting line inside the track. The investigator gave two commands i.e. on your mark on the signal 'On your mark' the subject came on to the starting line and on the command 'Go' the subject started running the half mile distance. Subjects were asked to keep a steady pace and complete the distance by running as fast as possible.

**Scoring**: The time taken to complete the distance of half mile run was recorded in minutes and seconds (later converted to seconds for analysis purpose) was the score of the subject.
2. **Flexed Knee sit up**:  
**Objective**: To measure the strength and endurance of abdominal muscles.  
**Equipment**: Floor mat, stop watch, paper, pencil etc.  
**Procedure**: The subjects were instructed to assume a prone lying position, having knee flexed and heels not more than 12 inches away from the buttocks, with the knee angle not less than 90 degree. The fingers were interlocked and placed behind the neck with elbows touching the floor. The feet were held tightly by a partner. The subject was asked to curl up to a sitting position and asked to touch the elbows to the knees.  
**Scoring**: One point was scored for each correct sit up the score was the maximum number of sit-ups completed in 60 seconds.

3. **Modified pull ups**:  
**Objective**: To measure arm and shoulder strength.  
**Equipment**: Modified pull-up apparatus, elastic band, mat, and pencils and scoresheets.  
**Procedure**: The students were instructed to undergo the bar holding the bar under grip with both hand. The body was made erect with whole weight of the body on the heels and shoulders. Using an underhand grip and from the down position, the student pulled up on the bar until chin was above the bar. Legs remained straight and heels on the floor throughout this upward movement. Upon completing the pull-up, the student returned to the start position.  
**Scoring**: Total number of pull ups performed by the subject.

4. **Sit and Reach test**:  
**Objective**: To measure the flexibility of the hip and back as well as the extension of the hamstring muscle.  
**Equipment**: Flexomeasure case, centimeter stick, paper, pencil etc.
Procedure: The 30 centimeter stick was fixed on the wooden box in either side. The subject were directed to sit down and to line up her heels with the front edge of the wooden box to slide her seat back beyond the zero end of the centimeter stick. She was asked to stretch forward slowly with knee locked and touch the finger tips of both hands as much forward as possible on the scale fixed on the wooden box.

Somatotype Components

The following anthropometric measurements are required for obtaining the somatotype:

**Height:**

**Instrument** – Stadiometer and anthropometer.

**Definition of the Measurement**: Erect body length from the soles of the feet to the vertex.

**Posture**: Erect standing, feet together with heels, buttocks, upper back, and rear of head in contrast with the wall scale.

**Procedure**: As the square was brought on the subjects vertex, he was instructed to take a deep breadth and to stretch up to his full height. Height was recorded to the nearest one tenth of an inch.

**Weight:**

**Instrument**: Weighing scale.

**Procedure**: Weight to the nearest half pound was recorded with the subject standing in the centre of the scale platform. Only shorts were worn by the subjects.

**Skinfold Measurements**

**Biceps**:

**Posture**: The subject stood with the arm by the side and elbow extended but relaxed.

**Procedure**: The skinfold was raised with thumb and forefinger of the left hand over the biceps muscle on the front of the right arm, half way between the acrimony and the elbow, the skinfold running parallel to the
A. Triceps Skinfold  B. Biceps Skinfold
long axis of the arm. The muscles fibers were excluded, whenever necessary, by locking the elbow joint momentarily in full extension.

**Triceps:**

**Posture:** The subject stood with the arm by the side and elbow extended but relaxed.

**Procedure:** The skinfold was raised with thumb and forefinger of the left hand over the triceps muscle on the back of the right arm, half way between the acromion and the elbow, the skinfold running parallel to the long axis of the arm. The muscles fibers were excluded, whenever necessary, by locking the elbow joint momentarily in full extension.

**Subscapular:**

**Posture:** The subject stood with shoulders erect but relaxed and arms by the sides.

**Procedure:** The skinfold was raised with the thumb and forefinger of the left hand lateral to the inferior angle of the right scapula, the skinfold running downward and outward in the direction of the ribs.

**Suprailliac:**

**Posture:** The subject stood in normal erect posture.

**Procedure:** The subject was instructed to draw in a medium breath and hold it. The skinfold was raised with the thumb and forefinger of the left hand in a position one to two inches above the right anterior superior iliac spine so that the fold run forward and slightly downward.

**Calf:**

**Posture:** The subject sat on the chair with his foot on the floor and lower leg vertical.

**Procedure:** The skinfold was raised with the thumb and forefinger of the left hand on the medial side of the right calf just above the level of the maximum calf girth, the fold running vertically.
A. Humerus Biepicondylar Diameter

B. Femur Biepicondylar Diameter
**Bone Diameters: General Instructions:**

**Instruments:** Modified sliding calipers.

**Definition of the measurement:** Bi-epicondylar diameter of the distal extremity of the humerus and femur.

**Land Marks:** The points on either epicondyle of distal extremity of the humerus or femur most lateral to the medial plane of the bone.

**Procedure:** The branches of the caliper were applied against the epicondyles in such a manner as to bisect the angle of the joint and to lie in the same plane as the limb. Firm pressure was applied and measurement was recorded to the nearest .05 centimeter. Measurements were taken on both limbs (left and right) and larger measurements were recorded.

**Humerus:**

**Posture:** The arm of the subject was raised forward to approximately the level of the shoulder and the forearm was flexed upward at a right angle to the arm.

**Procedure:** The caliper arm were applied to the epicondyles, bisecting the angle of the elbow and laying in the same plane as the arm and forearm.

**Femur:**

**Posture:** The subject sat on a chair with her feet on the floor and the lower leg vertical.

**Procedure:** The researcher took a kneeling position in front of the subject and applied the caliper branches to the epicondyles bisecting the knee angle and keeping the branches in a plane parallel to the thigh and lower leg.

**Girth Measurements**

**Biceps:**

**Posture:** The arm of the subject was horizontal. The forearm supinated and the elbow fully flexed. The subject was instructed to clench his fist and contract his biceps as strongly as possible.
A. Biceps Girth  B. Calf Girth
Procedure: The steel tape was passed around the arm approximately midway between the acromion and the elbow, at right angles to the long axis of the arm.

Calf:

Posture: The subject stood on a table with his feet six to nine inches apart and her weight equally distributed through both lower limbs.

Procedure: The steel tape was passed around the leg near the top of the calf muscle and was lowered until the greatest girth was located, at right angles to the long axis of the leg.

Procedure for Rating Somatotype Components

Endomorphy:

The measurements required for endomorphy ratings are skinfold at tricep, subscapular and supraspinale. With the following equation of Carter (1980) exact decimal ratings of endomorphy was obtained.

Corrected sum of skinfolds = (Sum of skinfold/Height) \times 170.18

1. \text{Endomorphy} = -0.7182 + 0.1451(X) - 0.00068 (X)^2 + 0.0000014 (X)^3

(Where X is the Corrected sum of triceps, subscapular and supraspinale skinfolds.)

Mesomorphy:

With the following equation of Carter (1980) exact decimal ratings of mesomorphy was obtained.

2. \text{Mesomorphy} = 0.858 \times \text{HB} + 0.601 \times \text{FB} + 0.188 \times \text{CAC} + 0.161 \times \text{CCC} - (\text{Height} \times 0.131) + 4.50

Where \text{HB} denotes Humerus biepicondylar diameter;
\text{FB} denotes Femur biepicondylar diameter
\text{CAC} denotes Corrected Arm Circumference);
\text{CCC} denotes Corrected Calf Circumference
**Ectomorphy :**

3. Ectomorph = HWR X 0.732 − 28.58

Where HWR denotes Height Weight Ratio

**Statistical Procedures**

The data was complied and tabulated for each age group separately. The statistical analysis of data was done by using ANOVA. The percentile scale was used to prepare norms on the health related physical fitness and growth variables for the girls of 5 to 15 years of age of Madhya Pradesh.