Chapter - III

METHODOLOGY

The purpose of this investigation was to analyse the motor and strength performances of obese and non-obese higher secondary school boys and girls.

The methods adopted for the selection of subjects, selection of dependent variables, selection of independent variables, orientation of subjects, reliability of data, procedure for test administration, experimental design and methods employed for statistical treatment of data have been described in this chapter.

Selection of subjects

The subject of study was designed to analyse the motor and strength performances of obese and non-obese higher secondary school boys and girls of seventeen to twenty years of age. The scholar selected 300 boys and 300 girls at random from obese, overweight, idealweight and underweight categories from twelve different institutions of Tirunelveli Educational District. Based on the percentage of the fat and body-weight, idealweight
was calculated. They were classified into four categories, namely obese, overweight, idealweight and underweight.

**Selection of Dependent variables**

Speed is one of the motor qualities required for any explosive sports. Agility refers to the ability of the individual to change the direction quickly. It is one of the important variables in games and sports where a player has to be agile to dodge, to penetrate, to tackle, to pass and to perform innumerable skills. Explosive power is another important variable required for each and every sports person. It is a combination of strength and speed. It helps the athlete to execute power at a greater speed.

*Strength is the basic and fundamental motor quality. Other motor* qualities like speed, agility and explosive power are closely associated with strength. Strength is classified into two types- absolute strength and relative strength. Absolute strength refers to the maximum amount of weight lifted in a single muscular contraction, irrespective of body weight whereas in relative strength the amount of weight lifted is divided by his body weight. Relative strength is needed for explosive sports. Hence relative arm strength and relative leg strength were selected as dependent variables of strength performances.
Therefor speed, agility and explosive power were selected as dependent variables as an indicator of motor performance and relative arm strength and relative leg strength were selected as an indicator of strength performance.

Selection of Independent variables

It is a known fact that boys are better than girls and men are better than women in motor and strength performance. However no study was available on motor and strength performances of boys and girls of obese, overweight, idealweight and underweight groups. Hence these variables were selected as independent variables.

Classification of Obese and Non-Obese

Obese and non-obese were classified into four categories. They were obese, overweight, idealweight and underweight.

A person having a body fat content of twenty-five percent or more of the body weight is called as obese. Overweight is applied to persons who are ten to twenty percent above desirable weight. Ideal weight is the best weight for a given individual based on his or her age, bone structure and
muscular development. Underweight is applied to persons who are ten percent below the desirable weight.

For the present study twenty-five percent or more of body weight is taken as obese.

Fifteen to twenty-five percent above the desirable weight is considered as overweight.

Five percent around desirable body weight is considered as ideal weight.

Fifteen percent and below of desirable body weight is considered as underweight.

The classification is given below:

<table>
<thead>
<tr>
<th>Categories</th>
<th>Referred in books</th>
<th>Considered for Present Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obese</td>
<td>25% or more of body weight</td>
<td>25% or more of body weight</td>
</tr>
<tr>
<td>Overweight</td>
<td>10% to 20% more of desirable body weight</td>
<td>15% to 25% more of desirable body weight</td>
</tr>
<tr>
<td>Idealweight</td>
<td>desirable body weight</td>
<td>5% above or below desirable body weight</td>
</tr>
<tr>
<td>Underweight</td>
<td>10% to 20% below of desirable body weight</td>
<td>15% to 20% below of desirable body weight</td>
</tr>
</tbody>
</table>
A sample calculation of ideal weight and conversion table used to convert skinfold into fat content are given below.

**Ideal Weight**

From the diagnostic standpoint, it would be beneficial to provide students with specific information on his/her weight especially if the student is overweight. Montoye\(^5^4\) described a simple procedure that can be used to estimate the ideal weight of adult men and women.

**Example**

A women, aged 19, was measured at four sites

<table>
<thead>
<tr>
<th>Site</th>
<th>Measurement (m.m.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biceps</td>
<td>9</td>
</tr>
<tr>
<td>Triceps</td>
<td>14</td>
</tr>
<tr>
<td>Sub-scapula</td>
<td>17</td>
</tr>
<tr>
<td>Suprailliac</td>
<td>20</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>60</strong></td>
</tr>
</tbody>
</table>

Refer to Conversion Table (Appendix - IX), to estimate the percent body fat from the total sum of skinfolds. Find the column for women, ages 16-29. Based on a sum of skinfolds of 60 m.m, the estimated percent body fat is 29.1%. The woman’s actual weight is 150 pounds. Her ideal weight is determined as follows;

**Ideal weight** 150 lbs x 29.1% / 100 = 43.65 lbs fat

150 lbs - 43.65 lbs = 106.35 lbs (lean body mass)

Then, 106.35/80% = \( x \) / 100%

Where \( x \) = ideal weight

In this example the ideal weight, \( x \), is 125 lbs. Since the woman actually weighs 150 lbs. She is 25 lbs overweight.

The same procedure was used for boys by substituting 85% instead of 80% in the denominator of the formula for ideal weight. The assumption is that a desirable level of body fat for boys is 15% while an acceptable level for women is 20%.

**Orientation of subjects**

The subjects were chosen from various higher secondary schools of different locations- Tirunelveli Town, Tirunelveli Junction, Palayamkottai, Melapalayam and N.G.O ‘A’ colony. The subjects chosen had never been exposed to this type of tests. The research scholar understood the need to get the co-operation of the boys and girls to make the tests meaningful and reliable. Hence, the scholar conducted an orientation course for the subjects.
Reliability of Data

Any research work is based upon relevant data. The data should have validity, reliability and objectivity. In order to ensure reliability and objectivity 10 subjects were selected at random and they were tested on the selected dependent variables two times at an interval of three days. The co-efficient of correlation was computed by univariate analysis and the results obtained are given below.

**TABLE 1**

**INTRACLASS RELIABILITY CO-EFFICIENTS OF SELECTED DEPENDENT VARIABLES**

<table>
<thead>
<tr>
<th>Tests</th>
<th>Reliability Co-efficient (R)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 Yards run</td>
<td>0.92*</td>
</tr>
<tr>
<td>Shuttle run</td>
<td>0.94*</td>
</tr>
<tr>
<td>Standing Broad jump</td>
<td>0.91*</td>
</tr>
<tr>
<td>Bench Press test</td>
<td>0.90*</td>
</tr>
<tr>
<td>Bench squat test</td>
<td>0.96*</td>
</tr>
</tbody>
</table>

*significant at .01 level.

The table value required for significant at .01 level of confidence is 0.77.
Test Administration

Body composition

Purpose: To find the body fat percentage

Materials used:

Skinfold Calliper
Pad and pencil

Description:

The skinfolds were measured with skinfold calliper at the site of biceps, triceps, subcapula and suprailiac. The pressure exerted on the skinfold was 10 gm/mm and it did not vary with the opening of the calliper. All the measurements were taken by the investigator himself.

a. Biceps:

The Skinfold measurement was taken in millimetres with the subject's hand hanging loosely. The skinfold was raised with the thumb and the forefinger of the left hand over the biceps muscle on the front of the subjects right upper arm half-way between the shoulder and the elbow where the skinfold runs parallel to the long axis of the arm.
Plate 1 - Skinfold Measurements

1a. Biceps
1b. Triceps
1c. Subscapular
1d. Suprailiac
b. Triceps:

With the subject standing with arms by the side and the elbow extended but relaxed, the skinfold was raised with the thumb and forefinger of the left-hand over the triceps muscle on the back of the subject's right upper arm, half way between acromion and the elbow, and was measured in millimetres.

c. Subscapula:

With the subject standing with shoulders erect but relaxed and arms by the side. The skinfold was raised with the thumb and forefinger of the left-hand lateral to the inferior angle of the right scapula and running downward and outward in the direction of the ribs. The skinfold measurement was taken in millimetres.

d. Suprailiac:

The skinfold measurement was taken in millimetres while the subject was drawing a medium breath and holding 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 suprailiac spine so that the fold runs forward and slightly downward.
These four skinfold measurements were used for estimating body density.

\[ d = \text{the sum of the four skinfolds.} \]

After estimating body density, body fat percentage was derived.

**Weight**

The purpose was to assess the weight of the subjects under study.

**Equipments:**

Weighing machine, score sheets and pencil.

**Procedure:**

The weight of the subjects was taken with a standard weighing machine. The subjects were wearing dress of less weight of the minimum possible.

**Score:**

The weight of the subjects was recorded in the nearest kilograms and then converted to pounds by multiplying with 2.205.
Motor Performance
50 Yards Run

Objective:

- To measure speed.

Equipments:

Two stop watches and 400 metres track straights.

Direction:

Two subjects ran at the same time. Both started from a standing position. The subjects ran as soon as they heard the clapper sound. As the tester closed the clapper, the timer at the finish line started the timing. The subjects ran as fast as possible to the finish line.

Scoring:

The lapsed time from the starting signal until the runner crosses the finish line was measured to the nearest tenth of a second.
Shuttle Run

Objective:

- To measure the agility of the performer in running and changing direction.

Equipment and materials:

Marking tape, stop watch and two blocks of wood of 2" X 2" X 4" size.

Directions:

The performer stood behind the starting line. On the signal "go", the performer ran to the blocks, picked up one, returned to the starting line, and placed block behind the line; he then repeated the process with second block. Some rest was permitted between the two trails. (Blocks were placed at a distance of 30 feet).

Scoring:

The score for each performance was the length of time required (to the nearest tenth of a second) to complete the course. The best time was recorded as his performance.
Plate 3 - Shuttle Run

Plate 4 - Standing Broad Jump
Standing Broad Jump

Objective:

- To measure the explosive power of the legs.

Equipment and materials:

The floor was used for this test. Marking materials, starting line, along with a tape measure to mark off increments of distance along the landing area.

Directions:

With the feet parallel to each other and behind the baseline, the performer started with knee bend position, swing the arms and jumped as far forward as possible.

Scoring:

The number of inches between the baseline and the nearest break point from the baseline was the score. Three trails were permitted and then the best trail was recorded as the score.
Strength Performance
Bench press test

Objective:

- To measure strength of arm extension in a push-up movement.

Equipment and materials:

The equipment needed for this test was a bench, a weight bar (5 or 6 feet in length) and enough weight plates to be more than sufficient for the strongest student.

Directions:

After adjusting the desired amount of weight on the bar, the student assumed a supine position on the bench and two assistants placed the bar in his hands and across the chest. With the hands approximately shoulder width apart, the performer extended the arms, pressing the bar to a "locked out" (elbow straight) position. The two assistants then removed the bar upon completion of the trail. If a second trail was taken when the performer re-adjusted the weight and then repeated the exercise.
Scoring:

The total weight of the bar-bell (including the collars) satisfactorily lifted was recorded. Only the best lift of two trails was recorded. The student's strength score was divided by his body weight to compute relative arm strength.

Safety:

The two assistants remained ready to catch the barbell at anytime during the trail.

Bench squat test

Objective:

• To measure the strength of the legs and back on lowering to and arising from a sitting position.

Equipment and materials:

An adjustable bench and fold up mats were used to get the seat level adjusted to lower patella (knee cap) level. A barbell weight plates and a thick towel to pad bar was used.
Directions:

After adjusting the desired amount of weight on the bar, two assistants placed the bar upon the shoulders (and behind the neck) of the student as he stood near the edge of the bench. With the feet a comfortable distance apart and a firm grip of the hands on the bar, the student lowered to an erect sitting position on the bench. Then, without rocking back and forth, the student returned to the standing position. After, the two assistants removed the weight. The performer re-adjusted the weights if he wants to add more weight.

General Directions:

Students were familiar with the exercises prior to testing.

On each test item, the students were allowed for two trails.

Students were warmed-up before the test.

Two set of weight were made available.

Scoring:

The total weight of the bar-bell (including the collars) satisfactorily lifted is recorded. Only the best lift of two trails was recorded. The student's
Plate 6 - Bench Squat Test
strength score was divided by his body weight to calculate relative leg strength.

Safety:

Two assistants stood at each end of the barbell were ready to catch the bar in the event that the performer overleans or starts to fall.

Additional points:

1. The performer sat at the near edge of the bench so that he would not have to rock and forth to get up.

2. The seat level of bench were adjusted to the lower patalla level before the squat was executed.

Experimental Design and Statistical Procedure

The study involves comparison of static group on selected dependent variables. Factorial design (2x4) of independent group was used in the present study. In this design, the first categorical variable was gender and it consisted of two classifications, namely obese and non-obese. It is further classified into four categories. They are obese, overweight, idealweight and underweight. The relative arm strength and relative leg strength were taken
as strength performance variables and speed, agility and explosive power were taken as motor performance variables. Thus five dependent variables were taken into consideration for the present study.

Two way analysis of variance of independent group was applied to find out

1. Whether there is any significant variation between boys and girls on selected five dependent variables,
2. Whether there is significant variation among four different weight categories on selected dependent variables, and
3. Whether there is any gender and body weight interaction.

Scheffe’s test was used as a post hoc test of significance if F ratio for column was found to be significant. ‘simple effect’ test was used as a post hoc test of significance if F ratio for interaction was found to be significant.

The data were analysed using SPSS package.

To construct norms for male and female of obese, overweight, idealweight and underweight groups Hull scale was used.