Chapter III

METHODOLOGY

3.1 INTRODUCTION

The purpose of the study was to analyse the level of physical activity and exercise intervention programme among adolescents. The manner of handling the various details of experiment is extremely important to the success of research. Research methodology involves the systematic procedures by which the researcher starts from the initial identification of the problem to its final conclusion.

This chapter describes the procedures followed in the selection of subjects, selection of variables, selection of tests, competency of the tests, reliability of the instruments, reliability of the data, orientation to the subjects, training program, collection of data, administration of tests, experimental design and the method adopted for statistical treatment of data have been explained.

3.2 SELECTION OF SUBJECTS

To achieve the purpose of the first part of the study, 300 boys 14-17 years old adolescents were selected from Sankar
Higher Secondary School, Sankar Nagar, Tirunelveli, Tamilnadu and their level of physical activity was measured by Physical Activity Questionnaire (Pate et al., 1999). Based on the survey the selected subjects were classified as follows and the results have been presented in table 3.1.

**A. Inactive.** Watch television, read, or do homework after school, ride to school, no sports activities after school hours.

**B. Occasionally active.** Prefer sedentary (mostly in resting position) activities, but sometimes play outside.

**C. Moderately active.** Take opportunities to become involved in physical activity when available and enjoy it.

**D. Active.** Take initiative to participate in physical exercise and prefer this to sedentary activities. At least three times a week involved in vigorous exercise.

**E. Very active.** Participate regularly in sport after school hours, use great deal of energy. Dislike sedentary activities.
<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Category</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Inactive</td>
<td>92</td>
<td>30.67</td>
</tr>
<tr>
<td>2</td>
<td>Occasionally active</td>
<td>41</td>
<td>13.67</td>
</tr>
<tr>
<td>3</td>
<td>Moderately active</td>
<td>75</td>
<td>25.00</td>
</tr>
<tr>
<td>4</td>
<td>Active</td>
<td>54</td>
<td>18.00</td>
</tr>
<tr>
<td>5</td>
<td>Very active</td>
<td>38</td>
<td>12.67</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td>300</td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

From the above table, 50 male students were selected randomly from the categories of occasionally and moderately active and they were (simple random sample) assigned in to two groups of twenty five (n=25) each at random, such as experimental group I and control group. The group I (n=25) underwent exercise intervention programme for a duration of 12 weeks and the number of sessions per week is confined to three days, in addition to the regular schedule and group II (n=25) acted as control, who is asked to refrain from any special training except their leisure time pursuit.

Members of these groups will consist of healthy boys. Prior to enrollment in the study, participants were informed of all possible risks involved in this study, and signed an informed consent form previously.
3.3 SELECTION OF VARIABLES

Dependent Variables

Physical fitness (PF) and physical activity (PA) are considered to be important supportive elements for the maintenance and enhancement of health and quality of life, and hence for the improvement of the holistic development of a child. Low levels of PA and PF are associated with various health-risk factors whilst higher levels of PA are associated with enduring health and vitality.

The literature indicates that there is a decline in the levels of PA among boys and girls during their teenage years and into early adulthood. Engelbrecht (2001) reported in this regard that 73.3% of girls between the ages of 13-15-years-old in the North-West Province of South Africa had low activity levels, and significant decreases of activity levels with increasing age up to 15 years were also found in the group. It was also indicated by researchers that there was a relationship between PA levels during childhood and adulthood. Kriska (2000) and Prinsloo and Pienaar (2005) indicated that greater domestic responsibilities of children from low socio economic environments contributed to higher levels of energy expenditure and hence higher levels of PA among them. In addition, children from rural environments
usually walked to school, mainly because of financial constraints. In this regard, significantly higher levels of physical activity were reported among children in rural environments who walked to school compared to those using other forms of transport. Considering the differences in level of physical activity in respect of gender, socio economic status, it seems feasible to suggest that the following variables were selected as dependent variables for this study.

1. Aerobic capacity
2. Abdominal strength and endurance
3. Trunk strength and flexibility
4. Upper body strength and endurance
5. Lower back flexibility
6. Grip strength
7. Explosive Power

**Independent Variables**

Sallis and Patrick (1994:307) and Winnick (2005:406) proposed physical activity guidelines for adolescents which required them to perform activities of a moderate intensity for at least 30 minutes daily. These guidelines also stated that they
should perform continuous exercise at a moderate to high intensity level at least three times a week.

Meredith and Welk (1999:53) proposed a health-promoting level of activity where children should be active for 45 minutes, three times a week, and adolescents twice a week for 30 minutes. According to these researchers, no distinction should be made between moderate and high intensity activities in order to encourage children to participate in a more active lifestyle. They stated that children and adolescents had to learn that physical activity are important for everyone and that it is not limited to top athletes only. Furthermore, that not only high-intensity activity could provide health-promoting advantages but moderate physical activity as well.

Keeping the above concept, exercise intervention programme was selected as independent variable for this study.

3.4 SELECTION OF TESTS

As per the available literature (Meredith & Welk, 1999) the following standardized test were used to collect the relevant data on the selected dependent variables and they were presented in Table 3.2.
TABLE 3.2
TEST SELECTION

<table>
<thead>
<tr>
<th>Criterion variables</th>
<th>Test Items</th>
<th>Units of Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerobic capacity</td>
<td>PACER Test</td>
<td>No. of laps completed</td>
</tr>
<tr>
<td>Abdominal strength and endurance</td>
<td>Curl ups</td>
<td>Number of Sit-ups</td>
</tr>
<tr>
<td>Trunk strength and flexibility</td>
<td>Trunk Lift Test</td>
<td>In centimetres</td>
</tr>
<tr>
<td>Upper body strength and endurance</td>
<td>Push-ups Test</td>
<td>Number of Push-ups</td>
</tr>
<tr>
<td>Lower back flexibility</td>
<td>Modified sit-and-reach test</td>
<td>In centimetres</td>
</tr>
<tr>
<td>Grip strength</td>
<td>Grip Dynamometer</td>
<td>In kilograms</td>
</tr>
<tr>
<td>Explosive power</td>
<td>Standing Broad Jump</td>
<td>In centimetres</td>
</tr>
</tbody>
</table>

3.5 COMPETENCY OF THE TESTER

All measurement in this study was taken by the investigator with assistance of faculty from Dept. of Physical Education and Sports, Manonmaniam Sundaranar University, Tirunelveli, Tamilnadu, India. To ensure that the investigator and his assistance were well versed with the techniques of conducting tests, they had a number of practice sessions in the correct testing procedure. The tester’s reliability was established by test and re-test method.

3.6 RELIABILITY OF THE INSTRUMENTS

Instruments used for this study were measuring tapes, sit and reach box, grip dynamometer and stop watches availed from Dept. of Physical Education and Sports, Manonmaniam
Sundaranar University, Tirunelveli, Tamilnadu, India. The equipments were purchased from reliable and standardized companies and were considered accurate enough to serve for the purpose of the study.

3.7 RELIABILITY OF THE DATA

Test and retest method was followed in order to establish the reliability of the data by using ten subjects at random. All the variables selected in the present study were tested twice for the subjects by the same personnel under similar conditions. The intra class co-efficient correlation was used to find out the reliability of the data as suggested by Johnson and Nelson and the results are presented in Table 3.3.

TABLE 3.3
INTRA CLASS CO-EFFICIENT OF CORRELATION ON SELECTED DEPENDENT VARIABLES

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Criterion Variables</th>
<th>Correlation Coefficient ‘R’</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aerobic capacity</td>
<td>0.86*</td>
</tr>
<tr>
<td>2</td>
<td>Abdominal strength and endurance</td>
<td>0.84*</td>
</tr>
<tr>
<td>3</td>
<td>Trunk strength and flexibility</td>
<td>0.95*</td>
</tr>
<tr>
<td>4</td>
<td>Upper body strength and endurance</td>
<td>0.90*</td>
</tr>
<tr>
<td>5</td>
<td>Lower back flexibility</td>
<td>0.94*</td>
</tr>
<tr>
<td>6</td>
<td>Grip strength</td>
<td>0.91*</td>
</tr>
<tr>
<td>7</td>
<td>Explosive power</td>
<td>0.90*</td>
</tr>
</tbody>
</table>

* Significant at 0.05 level of confidence.
(Table value required for significance at 0.01 level of confidence is 0.77).

Since the obtained ‘R’ values are much higher than the required value, the data are accepted as reliable in terms of instrument, tester and the subjects.

3.8 ORIENTATION TO THE SUBJECTS

The investigator explained the purpose of the study participated and their part in the study. For the collection of the data, the investigator explained the procedure of testing on selected dependent variables and gave instructions about the procedure to be adopted by them five sessions were spent to familiarize the participants with the technique involved to training perfectly further the control group was specially oriented, advised and controlled to avoid the special practice of any of the specific training programme till the end of the experimental period.

3.9 PILOT STUDY

Prior to the formal study sessions, a pilot study was conducted to validate research procedure and the initial capacity of the participants to fix the load and also to design the training programme. For the purpose, twelve participants (n=10) were selected at random.
The selected subjects underwent exercise intervention programme for five sessions under the watchful eyes of the investigator. The initial loads of the participants were fixed and the training programme was designed separately based on the performance in the pilot study.

While constructing the training programmes the basic principles of sports training (progression of over load and specificity) were followed during construction of training programme the individual differences were also considered.

3.10 TRAINING PROGRAMME

The selected participants were randomly (simple random sample) assigned to one of two groups of twenty five (n=25) each, such as experimental group I and control group. The experimental group (n=25) underwent exercise intervention for a duration of 12 weeks and the number of sessions per week is confined to three days, in addition to the regular schedule and group II (n=12) acted as control, who is asked to refrain from any special training except their leisure time pursuit.

The duration of training session in all days was between half an hour to one hour approximately which include warming up and limbering down. All the subjects involved in this study were carefully monitored throughout the training programme to
be away from injuries. They were questioned about their health status throughout the training programme. None of them reported with any injuries. However, muscle soreness appeared in the earlier period of the training programme and it was reduced in due course. The detailed training schedule was presented in the appendix.

3.11 ADMINISTRATION OF TESTS

**PACER:** This test measures *aerobic capacity* and is determined by a 20m multi-stage shuttle run, with a progressive increase in pace. When a participant can no longer complete a lap within the required time, he is stopped and the number of completed 20m laps are recorded.

![PACER Diagram](image)

**Curl-ups:** This test measures *abdominal strength and endurance*. The objective is to do as many curl-ups as possible at a predetermined rate of one curl-up every three seconds. An age-appropriate measuring strip was used to ensure the correct execution of the curl-ups. The score was the number of correct curl-ups performed.


**Trunk lift**: This test measures *trunk extensor strength and flexibility*. The objective is to raise the torso as high as possible from the floor from a prone position, while keeping the eyes on an object in line with the eyes on the floor. This position is held while the distance from the floor to the chin is measured in centimeters.

**Push-ups**: This test measures *upper body strength and endurance*. The participant has to do as many push-ups (where the torso must touch the floor with each pushup) as possible at a predetermined rate of approximately 20 push-ups per minute or one every three seconds. The total number of push-ups is recorded.

**Left and right hand grip strength**: This was measured by the hand grip dynamometer (Wood, 1997). The dynamometer was held in each hand separately, parallel with the leg and the participant had to squeeze it as hard as possible, after which the score was recorded in kilogram. The average performance was recorded as final score.

**Standing long jump**: The participant stood feet slightly apart (toes behind a starting line) and jumped forward as far as possible. Two trials were given and the farthest distance was
measured in centimeter from the starting line to the heel of the foot nearest to this line (Wood, 1997).

*Modified sit-and-reach*: This test measured the **flexibility** of the lower back and hamstrings by means of a standard box and metre stick (Docherty, 1996). The participant sat with both feet against the standard box and with the hands on top of each other with a straight back against a wall. The distance was measured from the starting line to the tip of the fingertips (cm). The participant was then asked to reach as far as possible and hold the position for three seconds. The distance was measured and deducted from the first measurement.

### 3.14 STATISTICAL TECHNIQUE

No attempt was made to equate the groups in any manner. Hence, to make adjustments for difference in the initial means and test the adjusted posttest means for significant differences, the analysis of covariance (ANCOVA) was used (Broota, 1989). Independent *t* test was used to find out the significant improvement between pre and post tests on selected variables. All of the statistical analysis tests were computed at 0.05 level of significance (*P*<0.05).
3.15 JUSTIFICATIONS FOR USING ONE-WAY ANCOVA

One-way univariate analysis of covariance (ANCOVA) was used to determine how each dependent variable was influenced by independent variables while controlling for a covariate (pre-test) (Hari, Anderson, Tatham, and Black., 1998). Analysis of covariance adjusts the mean of each dependent variable to what they would be if all groups started out equally on the covariate. In this study, pretest scores of selected variables have been shown to correlate with the posttest scores, thus they were considered as appropriate covariates.

3.16 ASSUMPTIONS FOR ANCOVA

A preliminary analysis was conducted to determine whether the prerequisite assumptions of ANCOVA were met before preceding the univariate analysis. Thus, the assumption of equality of variance (homogeneity), and the homogeneity of regression slopes were examined.

Levene’s test of equality of error variances on selected variables was calculated and presented in table 3.4.
TABLE 3.4
LEVENE’S TEST OF EQUALITY OF ERROR VARIANCES ON SELECTED VARIABLES AMONG GROUPS

<table>
<thead>
<tr>
<th>Variables</th>
<th>F-Ratio</th>
<th>df1</th>
<th>df2</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerobic capacity</td>
<td>0.121</td>
<td>1</td>
<td>48</td>
<td>0.886</td>
</tr>
<tr>
<td>Abdominal strength and endurance</td>
<td>2.01</td>
<td>1</td>
<td>48</td>
<td>0.150</td>
</tr>
<tr>
<td>Trunk strength and flexibility</td>
<td>1.01</td>
<td>1</td>
<td>48</td>
<td>0.320</td>
</tr>
<tr>
<td>Upper body strength and endurance</td>
<td>0.881</td>
<td>1</td>
<td>48</td>
<td>0.424</td>
</tr>
<tr>
<td>Lower back flexibility</td>
<td>0.332</td>
<td>1</td>
<td>48</td>
<td>0.567</td>
</tr>
<tr>
<td>Grip strength</td>
<td>2.50</td>
<td>1</td>
<td>48</td>
<td>0.120</td>
</tr>
<tr>
<td>Explosive power</td>
<td>2.32</td>
<td>1</td>
<td>48</td>
<td>0.135</td>
</tr>
</tbody>
</table>

(The table value required for 0.05 level of significance with df 1 & 48 is 4.04).

Homogeneity of variances is a term that is used to indicate that groups have the similar variances. Thus, in Levine’s test of equality of error variances table, the obtained F-values of the selected dependent variables were lesser than the critical value of 0.05, indicates that the variance of each group was not significantly different from one another.

Therefore, the homogeneity of variance of comparing the two groups regardless of the ability level for each of the dependent variables indicated that homogeneity of variance has
been met for all the selected dependent variables. Hence it was concluded that the assumption of homogeneity of variance has been met for computing univariate ANCOVA.

After determining the assumptions for computing ANCOVA have been met with the pre data analysis, the univariate ANCOVA statistical output was examined. Then, providing the ANCOVA result was statistically significant, the univariate results were examined for each dependent variable. For the significant univariate results, the post hoc comparisons were performed to identify where the differences resided. The pairwise comparisons statistic was used for the post hoc results. The results of the descriptive analysis, dependent ‘t’ test, univariate tests, the pair wise comparisons among the selected dependent variables are reported in chapter four.