Chapter - III

METHODOLOGY

Research methodology involves the systematic procedure by which the researcher starts from the initial identification of the problem to its final conclusion. The role of the methodology is to carry out the research work in a scientific and valid manner.

In this chapter discusses the methodology that was used in the study. It describes in detail about the selection of participants, selection of variables, selection of tests, orientation to the participants, competence of the tester, reliability of the instruments, reliability of the data, pilot study, training programme, collection of the data, administration of the tests, administration of questionnaire, experimental design and statistical techniques employed in analyzing the data are presented.

SELECTION OF SUBJECTS

The purpose of this study was to investigate the effect of isolated and combined aerobic exercise and yogic practices on selected bio-motor physiological and psychological parameters of Alagappa University male students. To achieve this purpose, eighty male students studying under and post graduates course students of Alagappa University hostel male students, Karaikudi, Tamil Nadu. They were selected as subjects at randomly. The ages of the subjects were ranged from 18 to 25 years only. The subjects selected were medically examined by the qualified physician and certified that they were medically and physically fit to undergo the selected training programme.

The subjects selected were randomly assigned into four groups of twenty each such as three experimental groups and a control group. The group I underwent aerobic exercise, group II
underwent yogic practices, group III underwent combined training (aerobic exercise and yogic practices) for duration of twelve weeks with four days per week in addition to the regular schedule of the college curriculum and group IV acted as control group and they were asked to refrain from any special training except their leisure time pursuit as college students. A written consent was obtained from the subjects. However, they were free to withdraw their consent in case of feeling any discomfort during the period of their participation, there were no dropouts in this study.

**SELECTION OF VARIABLES**

The investigator reviewed the available scientific literature on the basis of discussion with experts, criteria, feasibility and availability of instruments, equipments and the relevance of the variables to the present study. The following variables were selected for the present study.

**INDEPENDENT VARIABLES**

1. Yogic practices
2. Aerobic training

**DEPENDENT VARIABLES**

**Bio-Motor Variables**

1. Flexibility
2. Leg strength
3. Cardio respiratory endurance

**Physiological Variables**

1. Resting Heart Rate
2. Breath holding time
3. Vital capacity
Psychological Variables

1. Mental health
2. Self concepts

SELECTION OF TESTS

The present study was undertaken primarily to assess the impact of isolated and combined aerobic exercise and yogic practices on selected criterion variables such as Flexibility, Leg strength, Cardio respiratory endurance, Resting pulse rate, Breath holding time, Vital capacity, Mental health and Self concepts respectively. As per the available literature the following standardized tests were used to collect relevant data on the selected dependent variables and they were presented in Table I.

**TABLE I**

**SELECTION OF TESTS**

<table>
<thead>
<tr>
<th>No</th>
<th>Criterion Variables</th>
<th>Test items</th>
<th>Unit of measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Flexibility</td>
<td>Sit and reach test</td>
<td>In centimeter</td>
</tr>
<tr>
<td>2</td>
<td>Leg strength</td>
<td>1RM leg press test</td>
<td>In weights</td>
</tr>
<tr>
<td>3</td>
<td>Cardiac Respiratory Endurance</td>
<td>12 min run/ walk test</td>
<td>In metres</td>
</tr>
<tr>
<td>4</td>
<td>Resting pulse rate</td>
<td>Bio-monitor</td>
<td>In numbers</td>
</tr>
<tr>
<td>5</td>
<td>Breath holding time</td>
<td>Breath hold count test</td>
<td>In seconds</td>
</tr>
<tr>
<td>6</td>
<td>Vital capacity</td>
<td>Spiro meter</td>
<td>In litres</td>
</tr>
<tr>
<td>7</td>
<td>Mental health</td>
<td>Peter Becker Questionnaire</td>
<td>In points</td>
</tr>
<tr>
<td>8</td>
<td>Self concepts</td>
<td>Muktha Rani Rastogi Questionnaire</td>
<td>In points</td>
</tr>
</tbody>
</table>
FIGURE 1: FLOW CHART OF RESEARCH PLAN

Selection of subjects

100 students were selected from Alagappa University men hostel

Standard Stabilization Test for 80 students were passed

20 students selected on each group

Randomly selected

Group-I Aerobic Exercise Group

Group –III combined training

Group –IV Control Group

Group-II Yogic practices Group

PRE-TEST

Flexibility- sit and reach test, Leg strength – 1RM leg press, Cardio respiratory endurance-Cooper’s twelve minutes Run/Walk Test, Resting pulse rate – Bio-monitor, Breath holding time – stop watch, Vital capacity – Spiro meter, Mental health – Peter Becker questionnaire, Self concept Muktha Rani Rastogi questionnaire.

Training for 12 week

POST-TEST

Flexibility- sit and reach test, Leg strength – 1RM leg press, Cardio respiratory endurance-Cooper’s twelve minutes Run/Walk Test, Resting pulse rate – Bio-monitor, Breath holding time – stop watch, Vital capacity – Spiro meter, Mental health – Peter Becker questionnaire, Self concept Muktha Rani Rastogi questionnaire.

Statistical Analysis of Results

‘F’ Test for Training

ANCOVA for Effect Differences

END
**CRITERION MEASURES**

By glancing the literature in consultation with the professional experts, the following variables were selected as the criterion measures in the study for testing the hypothesis.

**FLEXIBILITY**

Flexibility was measured by using sit and reach test. The measurement flexibility was recorded in centimeters.

**LEG STRENGTH**

Leg strength was measured by using 1 RM leg strength (leg press). The measurement leg strength was kilogram.

**CARDIO RESPIRATORY ENDURANCE**

Cardio respiratory endurance was measured by cooper 12 minutes run and walk test. The measurement cardio respiratory endurance was recorded in metres.

**RESTING PULSE RATE**

Resting pulse rate was measured using Bio-Monitor. The measurement resting pulse rate was recorded in number of beats / minute.

**BREATHE HOLDING TIME**

Breath holding time was measured by stop watch. The measurement breath holding time was recorded in seconds.

**VITAL CAPACITY**

Vital capacity was measured by using Wet Spiro meter test. The measurement vital capacity was recorded in litres.
MENTAL HEALTH

Mental health was measured by Peter Becker Questionnaire. The measurement mental health was recorded in points.

SELF CONCEPTS

Self concept was measured by Muktha Rani Rastogi Questionnaire. The measurement self concepts was recorded in points.

ORIENTATION TO THE PARTICIPANTS

The investigator explained the purpose of training period to the subjects and their part in the study. For the collection of data, the investigator explained the procedure of testing on selected dependent variables and gave instructions about the procedures to be adopted by them. Two sessions were spent to familiarize the subjects with the techniques involved to execute the aerobic exercise and yogic practices. It helped them perform the aerobic exercise, yogic practices and combined training programme perfectly and avoid injuries. 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. The subjects of all the groups were sufficiently motivated to perform their maximal level during testing periods.

COMPETENCY OF THE TESTER

All the measurement in this study was taken by the investigator with the assistance of students from Alagappa University hostel students, Karaikudi. To ensure that the investigator and his assistants were well versed with the techniques of conducting tests, they had a number of practice sessions in the correct testing procedure. The reliability of the test for the present investigation was established through the test-retest method.
RELIABILITY OF THE INSTRUMENTS

The stopwatches and measuring tape used in this study were availed from Alagappa University College of Physical Education, Karaikudi, Tamilnadu. The instruments were purchased from reliable and standardized companies and were considered accurate enough to serve for the purpose of this study.

REALIABILTY OF THE DATA

Test and retest method was followed in order to establish the reliability of the data by using twenty subjects at random. All the dependent variables selected in the present study were tested twice by the same personnel under similar conditions.

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

<table>
<thead>
<tr>
<th>S.No</th>
<th>Tests (Variables)</th>
<th>‘R’ Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Flexibility</td>
<td>0.91*</td>
</tr>
<tr>
<td>2</td>
<td>Leg strength</td>
<td>0.89*</td>
</tr>
<tr>
<td>3</td>
<td>Cardiac Respiratory Endurance</td>
<td>0.90*</td>
</tr>
<tr>
<td>4</td>
<td>Resting pulse rate</td>
<td>0.89*</td>
</tr>
<tr>
<td>5</td>
<td>Breath holding time</td>
<td>0.90*</td>
</tr>
<tr>
<td>6</td>
<td>Vital capacity</td>
<td>0.91*</td>
</tr>
<tr>
<td>7</td>
<td>Mental health</td>
<td>0.89*</td>
</tr>
<tr>
<td>8</td>
<td>Self concept</td>
<td>0.90*</td>
</tr>
</tbody>
</table>

Significant at .01 levels. (Table value required for significant at .01 level with df 14 is 0.622)
PILOT STUDY

A pilot study was conducted to assess the initial capacity of the subjects to fix the load and also to design the training programme. For the purpose, fifteen subjects were selected at random and they were divided into three groups of five subjects each. Group I underwent aerobic exercise, group II underwent yogic practices, Group III underwent combined training (aerobic exercise & yogic practices) for two sessions under the watchful eyes of the investigator. The initial loads of the subjects were fixed and the training programme for aerobic exercise and yogic practices were designed separately based on the performance in the pilot study. While constructing the training programme the basic principles of sports training (progression of overload and specificity) were followed. During the construction of the training programme, the individual differences were also considered.

TRAINING PROGRAMME

During the training period, the experimental groups underwent their respective training programmes in addition to their regular programme. Group I underwent aerobic exercise in the evening session, group II underwent yogic practices in the morning session and Group III underwent combined training group (aerobic exercise & yogic practices) in the morning & evening session for four days per week (Monday, Tuesday, Thursday and Friday) for the duration of twelve weeks. In this training three experimental groups namely, Group I underwent Aerobic exercise, Group II underwent yogic practices, Group III underwent Combined training (aerobic exercise and yogic practices). Group IV acted as control that did not participate in any specific training on par with experimental Groups. All the subjects involved in this study were carefully monitored throughout the training programme to be away from the injuries. They were questioned about their health status throughout the training programme. None of them reported
with any injuries. However, muscles soreness appeared in the earlier period of the training programme and was reduced in due course.

COLLECTION OF THE DATA

The data on bio-motor variables of flexibility, Leg strength, cardio respiratory endurance, the physiological variables namely resting pulse rate, breath holding time, vital capacity and the psychological variables namely mental health and self concept were selected as criterion variables and the selected variables were measured by administering sit and reach test, 1RM leg press test, Cooper 12 minutes run/walk test, Bio-Monitor test, stop watch, Spirometer test and psychological Peter Becker questionnaires test, Muktha Rani Rastogi questionnaires test respectively. The data were collected from each subject before and after the training period.

ADMINISTRATION OF THE TESTS

BIO-MOTOR VARIABLES

Flexibility (Sit and Reach Test):

- **Purpose:**

  The aim of this test is to determine flexibility.
• **Equipment required:**

Sit and reach box (or alternatively a ruler can be used and a step or box).

• **Procedure:**

This test involves sitting on the floor with legs stretched out straight ahead. Shoes should be removed. The soles of the feet are placed flat against the box. Both knees should be locked and pressed flat to the floor - the tester may assist by holding them down. With the palms facing downwards and the hands on top of each other or side by side, the subject reaches forward along the measuring line as far as possible. Ensure that the hands remain at the same level, not one reaching further forward than the other. After some practice reaches, the subject reaches out and holds that position for at one-two seconds while the distance is recorded. Make sure there are no jerky movements. See also video demonstrations of the Sit and Reach Test.

• **Scoring:**

The score is recorded to the nearest centimeter or half inch as the distance reached by the hand. Some test versions use the level of the feet as the zero mark, while others have the zero mark 9 inches before the feet. There is also the modified sit and reach test which adjusts the zero mark depending on the arm and leg length of the subject. There are some norms for the sit and reach test and also examples of some actual athlete results.

**LEG STRENGTH  1-RM TESTS (Repetition Maximum Tests)**

• **Purpose:**

To measure maximum strength of various leg muscle and muscle groups.

• **Equipment required:**

Free weights (multi gym) or other gym equipment.
**Procedure:**

One repetition maximum tests (1-RM leg press) is a popular method of measuring isotonic muscle strength. It is a measure of the maximal weight a subject can lift with one repetition. It is important to reach the maximum weight without prior fatiguing the muscles. After a warm up, choose a weight that is achievable. Then after a rest of at least several minutes, increase the weight and try again. The athletes chooses subsequent weights until they can only repeat one full and correct lift of that weight.

**Scoring:**

The maximum weights lifted is recorded. The sequence of lifts should also be recorded as these can be used in subsequent tests to help in determining the lifts to attempt. Maximum three attempts allowed. This 1RM calculator returns predictions of 1RM based on Brzycki: $1RM = W \times \frac{36}{(37 - R)}$. Matt. Brzycki (2015)
CARDIO RESPIRATORY ENDURANCE (Coopers Twelve Minutes Run/walk)

Purpose

The aim of this test is to determine Cardio respiratory endurance.

Equipment required

Measuring tape, marked 400m track, stopwatch, cones and starting clapper.

Procedure

For this test, a 400 meters track was prepared with marking at every tenth meters. The investigator and the testers served as the lab scorer. The subjects were asked to stand on the starting line drawn at the finish line of the 400 meters track and they were given instructions to
cover as much distance as possible by running/walking. They were instructed to continue the run/walk till the final whistle.

Scoring

The distance covered by each in twelve minutes was recorded to the nearest tenth meter. The distance covered by the subjects was used as a measure of cardio respiratory endurance.

PHYSIOLOGICAL VARIABLES

3.14.3 RESTING PULSE RATE

Objective

To measure the resting pulse rate of each subject per minute.

Equipment

Heart rate monitor of the Bio-Monitor was used to measure the resting pulse rate.
**Procedure**

The pulse rate of all the subjects was recorded in position in the morning between 6 a.m. to 7 a.m. before taking resting pulse rate the subjects were asked to relax to about 30 minutes. To record the pulse rate the fingertips were placed on the radial artery at the wrist in such a manner that palpation was clear and the number palpation were counted from one full minute.

**BREATH HOLDING TIME**

**Purpose**

The purpose of this test was to measure the breath holding capacity of the subjects.

**Equipment**

Stop watch and nose clip.
Procedure

The subjects were asked to standing or sitting position. The subjects were asked to deep inhale and hold the breathing. The time was started while taking the test the nose of the subject was clipped using a nose clip.

Scoring

The time taken of the breath holding capacity from after the inhalation and before the exhalation by the subjects. The score was measured by time.

VITAL CAPACITY TEST

Purpose

The purpose of this test was to measure the vital capacity of the subjects.

Equipment

Spiro meter and nose clip.
Procedure

Vital capacity of the subject was determined by the Spiro meter in sitting position. The subject was allowed to inspire the maximum amount of air voluntarily and then he was asked to blow into the dry Spiro meter to the maximum extent. While taking the test the nose of the subject was clipped using a nose clip.

Scoring

The Vital capacity of the subject was obtained from the movement of circular volume indicator which was set at ‘0’ before the vital capacity measure was taken. The result was recorded in litres.

PSYCHOLOGICAL VARIABLES

TRIER PERSONALITY INVENTORY FOR MENTAL HEALTH

Purpose

The purpose of this test was to measure the mental health of the subjects.

Equipment

Peter Becker Questionnaires and pencil.

Description

The Trier Personality inventory was devised by Peter Becker and it was used to assess mental health of the subjects. The Trier Personality Inventory contains 20 statements and these statements were categorized into 9 sub-areas. Among these nine sub-areas, one of them was mental health. In Trier Personality Inventory there was a section containing 20 statements to assess the mental health. These statements were given in a jumbled order and they include both positive and negative statements. These 20 statements were selected separately and these
statements constituted the Trier Mental Health Inventory (TMHI) for the purpose of this investigation. This was a four point scale and each statement had four alternative responses namely; ‘Always’, ‘Often’ ‘Sometimes’ and ‘Never’. The reliability of the Inventory by the test-retest method was found to be 0.83. Since the reliability value was high, the inventory in its original form was made use of in this investigation. A copy of the inventory was given in the appendix II.

**Scoring**

For the positive statements the four answers were given a weight age of 4 to 1 respectively for ‘Always’, ‘Often’, ‘Sometimes’, ‘Never’. For the negative statements the reverse order was followed from 1 to 4, 9 which is given below. Scoring key (value) Category Positive Statements, Negative Statements, Always 4, 1 Often 3, 2 Sometimes 2, 3 Never 1,4 the inventory yielded a maximum score of 80 and a minimum score of 20. A high score indicates a relatively high mental health.

**MUKTA RANI RASTOGI INVENTORY FOR SELF-CONCEPT**

**Purpose**

The purpose of this test was to measure the self concept of the subjects.

**Equipment**

Mukta Rani Rastogi Questionnaires and pencil.

**Description of the Scale**

The self-concept scale which was constructed and standardized by Dr. (Miss) Mukta Rani Rastogi was used to assess the self concept of the subjects. It consisted of 51 statements and these statements were given in a jumbled order and they included both positive and negative statements.
The positive statements are 1, 2, 4, 6, 7, 8, 9, 18, 20, 22, 25, 27, 34, 36, 37, 40, 42, 43, 44, 46, 47, 48, 49 and the negative statements are 3, 5, 10, 11, 12, 13, 14, 15, 16, 17, 19, 21, 23, 24, 26, 28, 29, 30, 31, 32, 33, 35, 38, 39, 41, 45, 50, 51. Each statement has five responses namely ‘Strongly agree’, ‘Agree’, ‘Undecided’, ‘Disagree’, ‘Strongly Disagree’. The subject had to put a tick mark (✓) for any of the five responses that fits them best. Reliability was computed by using test and retest method. The reliability obtained was 0.85. Hence, the test in its original form was made use of in this study. A copy of the questionnaire is given in the appendix III.

**Scoring**

For the positive statements, the five responses were given a weight age of 5, 4, 3, 2, 1 respectively for the ‘Strongly Agree’, ‘Agree’, ‘Undecided’, ‘Disagree’, ‘Strongly Disagree’. For the negative statements, the reverse order was followed 1 to 5 which was given below.

<table>
<thead>
<tr>
<th>Category</th>
<th>Scoring key (value)</th>
<th>Positive Statement</th>
<th>Negative Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Agree</td>
<td>5</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Agree</td>
<td>4</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Undecided</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Disagree</td>
<td>2</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>1</td>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>

**ORIENTATION OF SUBJECTS**

Before administering the psychological questionnaire, the investigator briefly explained the purpose of the study and their role in data collection to all the subjects. All the subjects were motivated to give relevant personal data and to co-operate to complete the psychological questionnaire.
ADMINISTRATION OF QUESTIONNAIRE

The investigator met the warden of Alagappa University hostel in Karaikudi, obtained permission to collect data from the students. As per the instruction given by the warden, the investigator met the students and fixed the date and time for data collection. The investigator distributed the questionnaire to the subjects along with sharpened pencils for marking the responses. The subjects went through the instructions, read each statement carefully and indicated their responses. All the questionnaires were administered by the researcher in person in a face to face relationship. Data was collected as per the programme fixed. All the filled in questionnaires were collected from the subjects and scored according to the scoring key. The total scores obtained were tabulated and statistically treated to arrive at meaningful conclusions.

EXPERIMENTAL DESIGN

The pre test and post test random group design was used as experimental design in which eighty male subjects were randomly divided into four groups of twenty each. No attempt was made to equate the group in any manner. Group I underwent aerobic exercise, group II underwent yogic practices, Group III underwent aerobic exercise & yogic practices and group IV acted as control. The selected subjects were tested on selected criterion variables such as Flexibility, Leg strength, Cardio respiratory endurance, resting pulse rate, Breath holding time, Vital capacity, mental health and self concept prior too immediately after the training programme.
STATISTICAL TECHNIQUES

The dependent ‘t’ ratio was used to find out the significant improvement on selected criterion variables and also one way analysis of covariance (ANCOVA) was used to find out the significant differences, if any among the adjusted post test means of experimental and control group on each variables separately. Whenever they obtained ‘F’ ratio for adjusted post test means was found to be significant, the scheffe’s test was applied, as a post hoc test to determine which of the paired mean differences was significant. In all the cases .05 level of confidence was fixed as a level of confidence to test the hypotheses.