

CHAPTER III

METHODOLOGY

In this chapter, procedures and methods applied in the selection of the subjects, selection of experimental variables, experimental design, pilot study, criterion measures, instrument reliability, tester competency, reliability of tests, subject's reliability, orientation of the subjects, training programme, administration of test, collection of data and statistical analysis are explained.

3.1 SELECTION OF THE SUBJECTS

To achieve the purpose of the study, the investigator used double sampling procedure. 1000 students were screened for Body Mass Index (BMI) based on their body weight and height from various Affiliate Colleges of Anna University in Chennai, Tamil Nadu, India. From the screening test, the students found obese category I with the BMI score of 30.0 to 34.9 were identified separately. From the identified obese category I student's one hundred and twenty (120) students were selected randomly as subjects for the study. Their age ranged between 18 to 23 years. They were assigned randomly in to three groups. The selected subjects divided in to experimental group I, experimental group II and control group at random.

The purpose, nature and importance of experiment, the procedure to be employed in the collection of data and the role of the subjects during experimentation and testing periods were explained. Four days were given to them, to think and accept their willingness.

The subjects were free to withdraw their consent in case they feel any difficulty during experiment and testing period. However there were no drop outs in the study and all the volunteered subjects cooperated well throughout the period of experimentation. A written consent was also obtained from the subjects.

3.2 SELECTION OF EXPERIMENTAL VARIABLES

The researcher reviewed various scientific literatures, journals, internet sources and research papers which revealed the importance of health related Physical Fitness and physiological components for obese engineering students. Taking into consideration of feasibility, criteria availability of instruments and the relevance of this variable of the present study, the following dependent and independent variables were selected for the present study.

3.3 DEPENDENT VARIABLES

3.3.1 HEALTH RELATED PHYSICAL FITNESS VARIABLES

1. Cardio respiratory endurance
2. Flexibility
3. Body Composition
4. Muscular strength
5. Muscular endurance

3.3.2 PHYSIOLOGICAL VARIABLES

1. Breath Holding Time
2. Resting Pulse rate
3. Vital Capacity
4. Mean Arterial Blood Pressure
5. Anaerobic Power

3.4 INDEPENDENT VARIABLE

1. Indian Indigenous Exercise Programme with nutritional counseling.
2. Indian Indigenous Exercise Programme without nutritional counseling.

3.5 EXPERIMENTAL DESIGN

Pre test and post test randomized group design was useful to this problem. One Hundred and twenty (N=120) obese students from various colleges affiliated to Anna University, Chennai, Tamil Nadu, India were selected randomly as subjects between the age 18-23 years. They were divided into three equal groups, each consisted of forty (n=40) subjects. Pre test was conducted for all the one hundred twenty subjects in the selected creation variables namely Cardio respiratory endurance, Flexibility, Body Composition, Muscular strength, Muscular endurance, Breath Holding Time, Resting Pulse rate, Vital Capacity, Mean Arterial Blood Pressure, Anaerobic Power. The initial

test scores formed on pre test scores. Experimental group-I was exposed to Indian indigenous exercise programme with nutritional counseling, Experimental group-II was exposed to Indian indigenous exercise programme without nutritional counseling and the control group was not exposed to any experimental training other than their regular activities.

Experimental groups underwent the respective treatments for 12 weeks. After the experimental treatment all the One Hundred and twenty subjects were measured on the selected Cardio respiratory endurance, Flexibility, Body Composition, Muscular strength, Muscular endurance, Breath Holding Time, Resting Pulse rate, Vital Capacity, Mean Arterial Blood Pressure, Anaerobic Power. The final test scores formed as post test scores of the subjects. The pre and post test scores were subjected to statistical analysis using analysis of covariance (ANCOVA) to find out the significant among the mean differences. Whenever the 'F' ratio for adjusted test found to be significant, Scheffe's post hoc test was used. In all cases 0.05 level of significance was fixed to test the hypotheses.

3.6 COLLECTION OF THE DATA

Pre test data were collected two days before the training session and post test data were collected immediately after twelve weeks of the training session.

Table – I
CRITERION MEASURES

S.No	Variables	Test items	Unit of Measurement
1	Cardio respiratory endurance	Cooper's Run/Walk	Meters
2	Flexibility	Sit and Reach	Centimetres
3	Body Composition	Skin fold calibre	Millimetre
4	Muscular strength	Push – ups	Numbers
5	Muscular endurance	Bent Knee Sit-Ups	Numbers
6	Breath Holding Time	Stop watch and nose clip	Seconds
7	Resting Pulse rate	Digital Heart Rate Measuring Machine	Minutes
8	Vital Capacity	Spiro meter test	Litter
9	Mean Arterial Blood Pressure	Sphygmomanometer,D BP+1/3(SBP-DBP)	mm/Hg
10	Anaerobic Power	MargariaKalamen Test	Kilogram/meter/ seconds

3.7 RELIABILITY OF THE INSTRUMENTS

The instruments used in this study were availed from the Department of Physical Education, Prathyusha Engineering college, Chennai, Tamil Nadu, in India. These instruments had been purchased from reliable companies and were considered accurate enough for the purpose of the study.

3.8 COMPETENCE OF THE TESTER

The tester competency was evaluated together with reliability of tests. To determine the reliability of the tests, the performance of ten subjects selected at random were recorded twice on the selected variables under identical conditions. The Pearson's product movement correlation was computed between the selected two measures of each variable separately and the correlation co-efficient 'r' was presented in Table-II.

Table – II

CORRELATION CO-EFFICIENT OF SELECTED VARIABLES

S.No	Name of the test	Correlation Co-efficient
1	Cardio respiratory endurance	0.90*
2	Flexibility	0.91*
3	Body Composition	0.94*
4	Muscular strength	0.91*
5	Muscular endurance	0.92*
6	Breath Holding Time	0.93*

7	Resting Pulse rate	0.934*
8	Vital Capacity	0.925*
9	Mean Arterial Blood Pressure	0.91*
10	Anaerobic Power	0.93*

* Significant at 0.01 level of confidence.

(Table value required for significance at 0.01 level of confidence is 0.77)

3.9 SUBJECT RELIABILITY

The test-retest method was established to ensure the subject's reliability which was determined at 0.01 level. For the purpose two subjects were selected at random on the chosen variables, which were recorded twice under identical conditions on different occasion by the investigator.

3.10 ORIENTATION OF THE SUBJECTS

Prior to the administration of the tests, the scholar demonstrated the tests with brief explanation. The data was collected both in the morning and evening sessions from selected subjects. The use of equipments were explained and clearly demonstrated by the scholar to the subjects, so as to become familiar with the various test items.

3.11 TRAINING PROGRAMME

TABLE - III

TRAINING PROGRAMME FOR EXPERIMENTAL GROUPS

S.No	Name of the Group	Duration	Frequency
1	Experimental Group I (Indian Indigenous Exercise Programme with nutritional counseling) (IPEPWNC)	12 weeks	Five days per week
2	Experimental Group II (Indian Indigenous Exercise Programme without nutritional counseling) (IPEPWONC)	12 weeks	Five days per week

TABLE - IV

DURATION FOR THE TRAINING SESSIONS

Session	Duration
Warm up and stretching	10 minutes
Experimental Training Session	40 minutes
Cool down	10 minutes
Total	60 minutes

TABLE - V

**INDIAN INDIGENOUS EXERCISE PROGRAMME WITH
NUTRITIONAL COUNSELLING (IIEPWNC)**

Day	Fitness Training	Duration
Monday	Warm up, Stretching, Dhands and Baithaks training, cool down and Nutritional Counseling	1. Warm up and stretching – 10 minutes. 2. Dhands and Baithaks training with Nutritional Counselling– 40 minutes. 3. Cool down – 10 minutes.
Tuesday	Warm up, Stretching, Malkamph training, cool down and Nutritional Counselling	1. Warm up and stretching – 10 minutes. 2. Malkamph training with Nutritional counseling – 40 minutes. 3. Cool down - 10 minutes.
Wednesday	Warm up, Stretching, Yogic Practices, cool down and Nutritional Counseling	1. Warm up and stretching – 10 minutes. 2. Yogic Practices (Kriyas, Asanas, Pranayama) with Nutritional Counselling – 40 minutes. 3. Cool down - 10 minutes.
Thursday	Warm up, Stretching, Lezium/ Wands/ Dumb bells training, cool down and Nutritional Counseling.	1. Warm up and stretching – 10 minutes. 2. Lezium/ Wands/ Dumb bells training with Nutritional Counselling – 40 minutes. 3. Cool down - 10 minutes.
Friday	Warm up, Stretching, Surya Namaskar Training, cool down and Nutritional Counseling	1. Warm up and stretching – 10 minutes. 2. Surya Namaskar training with 3. Nutritional counselling– 40 minutes. Cool down - 10 minutes.

TABLE - VI
INDIAN INDIGENOUS EXERCISE PROGRAMME WITHOUT
NUTRITIONAL COUNSELLING (IPEPWONC)

Day	Fitness Training	Duration
Monday	Warm up, Stretching, Dhands and Baithks training and cool down	1.Warm up and stretching – 10 minutes. 2.Dhands and Baithks training – 40 minutes. 3.Cool down - 10 minutes.
Tuesday	Warm up, Stretching, Malkamph training and cool down	1.Warm up and stretching – 10 minutes. 2.Malkamph training– 40minutes. 3.Cool down - 10 minutes.
Wednesday	Warm up, Stretching Yogic Practices and cool down	1.Warm up and stretching – 10 minutes. 2.Yogic Practices (Kriyas, Asanas, Pranayama)– 40 minutes. 3.Cool down - 10 minutes.
Thursday	Warm up, Stretching, , Lezium/ Wands/ Dumb bells training and cool down	1.Warm up and stretching – 10 minutes. 2.Lezium/ Wands/ Dumb bells training– 40minutes. 3.Cool down - 10 minutes.
Friday	Warm up, Stretching,SuryaNamsakar training and cool down	1.Warm up and stretching – 10 minutes. 2.SuryaNamsakar training – 40 minutes. 3.Cool down - 10 minutes.

The experimental groups underwent their respective training programmes in addition to their daily routine activities as per the schedule. The experimental group-I underwent Indian indigenous exercise programme with nutritional counselling, the experimental group-II underwent Indian indigenous exercise programme without nutritional counselling and control group (group-III) was not engaged in any type of training other than their regular activities. The training load was increased progressively from 60 – 80% based on the perceived exertion method and completely of exercises.

3.12 ADMINISTRATION OF TESTS

Before the conduct of the tests, the researcher demonstrated each test to the subjects. A model performance by a few persons other than the active participants has also been done to make them clearly understand the test procedures. The test items and the procedure for the administration used in the present study are explained below.

3.12.1 HEALTH RELATED FITNESS VARIABLES

3.12.1.1 Cardiovascular endurance - Cooper test

The Cooper 12 minute run is a popular maximal running test of aerobic fitness, in which participants try and cover as much distance as they can in 12 minutes. There are several other variations of running/walking tests, including the Cooper 1.5 mile run test.

Purpose: To test aerobic fitness (the ability of the body to use oxygen to power it while running)

Equipment required: flat oval or running track, marker cones, recording sheets, stop watch.

Procedure: Place markers at set intervals around the track to aid in measuring the completed distance. Participants run for 12 minutes, and the total distance covered is recorded. Walking is allowed, though the participants must be encouraged to push themselves as hard as they can to maximize the distance covered.

Scoring: Distance covered in 12 minutes was measured in meters.

3.12.1.2 Muscular Flexibility

Muscular flexibility was measured through Sit and Reach test (**Johnson and Nelson, 1982**).

The sit and reach test is a common measure of flexibility, and specifically measures the flexibility of the lower back and hamstring muscles. This test is important as because tightness in this area is implicated in lumbar lordosis, forward pelvic tilt and lower back pain.

Procedure : The basic outline of the sit and reach test is described below. Some of the more popular variations are described in more detail above.

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.

3.12.1.3 Muscular Strength

Muscular Strength was measured through push ups (**Yobu, 1987**)

Push Up Fitness Test

The push-up fitness test (also called the press up test) measures upper body strength and endurance.

Purpose: Push-ups are used to assess the strength of the upper body muscles in the shoulders, chest, and back of the upper arms (the triceps).

Equipment required: floor mat or other flat surface, 4 inch foam cube.

Procedure: The aim of this test is to perform as many push-ups in you can. The starting position is with your arms straight with the elbows locked, body in a straight line, hands placed slightly wider than shoulder-width apart with fingers pointing forward, and both feet on the floor. A foam block is placed under the chest (located at the costal arch and above the zyphoid bone). The subject lowers their body until they slightly compress the foam cube, and arms are at least parallel to the floor, then pushes up again. The back must be kept straight, and in each extension up, the elbows should lock. Resting is allowed, though only in the up (starting) position.

Scoring: The maximum number of correctly performed push ups is recorded. There are some individuals who can do a lot of consecutive pushups, so it may be appropriate to have a maximum that when it is reached the participant stops the test.

3.12.1.4 Muscular Endurance

Muscular Endurance was measured through sit up test (**Johnson and Nelson, 1982**).

Muscular Endurance test: The test used to measure muscular endurance is the 1 Minute Sit up Test.

Equipment:

The only equipment that is required is minimal:

1. Stop watch
2. Mat
3. X 2 Administrators

Procedure:

1. The subject begins by sitting comfortably on the mat.
2. He should start with his back straight on the mat.
3. His knees should be bent and his feet on the mat.
4. The subject should then place his hands on both sides of his head with his elbows pointing out to the sides.
5. When the administrator starts the watch and says “GO”, the subject can then begin performing a sit up.
6. From the starting position he should raise his upper body of the mat by tensing his core and lifting himself up towards his knees. His hands should remain on the side of his head and his knees should be bent with his feet placed firmly on the ground.
7. To increase the tests reliability, the administrator who isn't recording the time should hold down the subjects feet so he doesn't raise them upwards, this prevents the subject from lifting his feet and making the sit up easier.

Score: Numbers of sit ups in a minute.

3.12.1.5 Body Composition

Body Composition was calculated based on the following formulae

$$\text{Percent body fat} = 0.41563X(\text{sum of 3 sites}) - 0.00112X(\text{sum of 3 sites})^2 + 0.36661X(\text{age}) + 4.03653$$

where sum of 3 sites were skinfold caliber measures at triceps, medial region of navel part and suprailium. **(Johnson and Nelson, 1982)**

Skinfold Measurement

Taking skinfold measurements is a common method for determining body fat composition. Accurate measurement technique is important. Here is the standard technique that is used. You should read this information in conjunction with the description of each of the standard measurement sites.

Aim: To estimate body fat level by the measurement of skinfold thickness

Equipment: skinfold calipers, tape measure, marker pen, recording sheets.

Procedure: Skinfold measurement can use from 3 to 9 different standard anatomical sites around the body. The right side is usually only measured (for consistency). The tester pinches the skin at the appropriate site to raise a double layer of skin and the underlying adipose tissue, but not the muscle. The calipers are then applied 1 cm below and at right angles to the pinch, and a reading in millimeters (mm) taken two seconds later. The mean of two measurements should be taken. If the two measurements differ greatly, a third should then be done, then the median value taken.

3.12.2 PHYSIOLOGICAL VARIABLES

3.12.2.1 Vital capacity

Vital capacity was measured through Spirometer (**Johnson and Nelson, 1982**)

Procedure: The usual measures of lung function are of forced vital capacity (FVC) and forced expired volume in 1 second (FEV_1). These can be measured with a full maximal expiration. Explain to the subject that they must fill their lungs completely, seal

their lips around the mouthpiece, and empty their lungs as hard and fast as possible. The best of two trials is usually recorded.

Equipment required: Spirometer (e.g. Vitalograph)

Interpretation: Lung function tests are of little value for predicting fitness and exercise performance, provided that the values fall within a normal range. You must always take into consideration that lung volumes vary with age, sex and body size (especially height).

3.12.2.2 Mean Arterial Blood pressure

Mean Arterial Blood pressure was measured through Systolic and Diastolic blood pressure as suggested by **Mathews, D.K. and Fox E.L. (1985)**

Blood Pressure Test : Blood pressure measurement is important as it is highly related to heart disease risk.

Equipment required: Mercury sphygmomanometer, cuff, stethoscope.

Procedure: The sphygmomanometer is placed on a bench where the subject cannot see the mercury column. Blood pressure is recorded after the subject has rested quietly for 5 minutes, and this measure should precede all other measures. The subject is seated with the arm resting on the bench, the elbow approximately at the level of the heart. The cuff is attached, the pressure then increased to approximately 180 mm Hg. The stethoscope is placed over the brachial artery in the cubital fossa. The pressure is released at a rate of approximately 2 mm per second. The pressure at which the first sounds are

heard (systolic pressure) and the pressure when all sounds disappear (diastolic pressure) are recorded.

Measurement: Blood pressure is recorded in the units of millimeters of mercury (mm Hg). Normal blood pressure is usually considered to be 120 for systolic and 80 for diastolic pressure - the same for both men and women.

Formula

$$\text{MAP} = [(2 \times \text{diastolic}) + \text{systolic}] / 3$$

$$\text{MAP} = \frac{\text{SBP} + 2 (\text{DBP})}{3}$$

3

3.12.2.3 Breath Holding Time

Breath Holding Time was measured using nose clip and stop watch as suggested by **Mathew (1978)**.

Purpose: The purpose of this test was to measure the breath holding time.

Equipments: For recording the breath holding time, a stop watch (1/10th of second) and nose clip were used.

Procedure: The subject was instructed to stand at ease and to inhale deeply after which he holds his breath for a length of time possible by him. A nose clip was placed on nose to avoid letting the air through nostrils. The duration from the time of holding his breath until the movement he let air out was clocked by using the stop watch to the

nearest one tenth of a second as breath holding time. The co-operation of the subject to let out the air by opening the mouth was sought to clock the exact breath holding time.

Scoring: The time is recorded in seconds and the beset of two trials were recorded **(Mathew, 1988)**.

3.12.2.4 Anaerobic Power

Margaria Kalamen Power Test

Purpose: this is a classic test of power of the lower extremities.

Equipment required: stopwatch, timing mats (optional, like this one), tape measure, flight of 12 steps with a starting line of 6 meters in front of the first step. Each step is approximately 17.5 cm high with the 3rd, 6th and 9th step clearly marked. The vertical distance between the 3rd and 9th step must be accurately measured for use in the results formula.

Procedure: The athlete's weight is determined in kilograms. The athlete is given a few practice runs up the steps to warm up. The athlete stands ready at the starting line 6 meters in front of the first step. On the command "Go", the athlete sprints to and up the flight of steps, taking three steps at a time (stepping on the 3rd, 6th and 9th steps), attempting to go up the steps as fast as possible. The time to get from the 3rd step to the 9th step is recorded (either using a stopwatch or using switch mats placed on the 3rd and 9th steps), starting when the foot was in first in contact with the 3rd step, and stopped when the foot contacts the 9th step. Allow three trials of the test, with 2-3 minutes recovery between each trial.

Scoring: Power (Watts) is calculated from the formula below, where P = Power (Watts), M = Body mass (kg), D = Vertical distance, between steps 3 & 9 (meters), t = Time (seconds). 9.8 is the constant of gravity:

$$P = (M \times D) \times 9.8 / t$$

3.12.2.5 Resting Heart Rate

Purpose: To measure the resting heart rate of each subject per minute

Equipments: Digital Heart Rate Measuring Machine, Model No. EW 243, manufactured by National Company, Japan.

Procedure: The pulse rate of all the subjects were recorded in a sitting position, in the morning between 6 and 6.30 a.m. Before taking heart rate the subjects were asked to relax for about 30 minutes.

Then the subjects were instructed to sit in a back supported chair and maintain in a slight incline position and placed his left hand on the table. Next the researcher was collected Heart Rate by using Digital Heart Rate measuring machine which was placed in the chest level on a table. In this way the researcher was measured the heart rate of the subject.

Scoring: The number of pulse beats per minute were recorded as the scores. **(Robergs R and Landwehr R 2002)**

3.13 STATISTICAL ANALYSIS

The collected data from the three groups prior to and after the training programme on selected criterion variables were statistically analyzed by analysis of covariance (ANCOVA). Whenever the 'F' ratio for adjusted post test means was found to be significant, Scheffe's test was followed as a post hoc test to determine which of the paired means difference was significant. In all the cases 0.05 level of confidence was fixed as a level of confidence to test the hypothesis.

Figure – 1

FLOW CHART SHOWING THE METHODOLOGY ADOPTED IN THIS STUDY

