CHAPTER III

MATERIALS AND METHODS
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In this chapter the selection of the subjects, selection of variables, reliability of instruments, competency of the tester, reliability of data, orientation of subjects, collection of the data, administration of the tests, the experimental design and the statistical procedures used have been presented.

Selection of Subjects

To achieve the purpose of the study, a survey was made among the 30 to 50 years women of Coimbatore city to find out their level of obesity. (BMI expressed as weight in Kilogram / height in m^2 (BMI ≥30)). The investigator with the help of various wards representatives and by observation selected 150 obese women between the age group of 30 to 50 years and explained to them about the purpose and nature of the study and requested to co-operate for the study.

The subjects participated in this study were tested for medical clearance from physician based on physical examination. Among the obese women who had cardio pulmonary diseases and hyper tension (i.e.) systolic blood pressure 160 mm Hg were not included in the study. Also obese women who were taking tablets for blood pressure were excluded in the
study. The rest of the obese women were listed. 45 subjects were medically fit for this study and they were divided randomly into three groups as two experimental groups and one control group. Their ward representatives consent was obtained after clearly explaining the nature of the study, the training program and the variables under which they would be tested and they were assured that their data would not be used for any purpose other than the present study. They were also assured that the results would be kept strictly confidential. They were also informed that they were free to opt out of the study at any time if they felt any discomfort or difficulty in continuing with the training program.

The selected forty five subjects were randomly divided into three groups of fifteen each, out of which group-I (n-15) underwent walking, group-II (n-15) underwent walking with stretching exercise and group-III (n-15) remained as control group. All the subjects revealed that they had no ailment of any sort and were taking medicines for treatment after a general medical check up done on them. The physician confirmed this and the subjects were given clearance to take part in the physical training.
Selection of Variables

Obesity is now -a-days, considered to be some what like a disease. It gives rise to many health problems. Generally obese persons have a shorter life, because they have a greater risk of early death from cardiovascular disease, stroke, cancer, diabetes, hypertension, and other diseases. As their weight increases, obese patients tend to be at a higher risk for chronic diseases.

However, programs that emphasize realistic goals, gradual progress, sensible eating, and exercise can be very helpful and are recommended by many doctors. Programs that promise instant weight loss or severely restricted diets are not effective and, in some cases, can be dangerous.

Before proceeding with the study the researcher had gone through the available literature in the area and on the basis of her personal experience discussed the results with her research supervisor. Consultation with experts was made to consider the factors of feasibility, availability of proper technique and instruments and based on the certain variables have been selected for this study.

Taking into consideration all these factors, a set of variables is selected to the test on the selected subjects, for observing the variations in their levels due to the training effect.
In the present study the following factors were selected as variables.

**TABLE-3.1**

**Table for Selected Variables**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>VARIABLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Physical Variables</td>
</tr>
<tr>
<td></td>
<td>1. Body Mass Index (BMI)</td>
</tr>
<tr>
<td></td>
<td>2. Abdominal Muscular Endurance</td>
</tr>
<tr>
<td></td>
<td>3. Flexibility</td>
</tr>
<tr>
<td>2</td>
<td>Physiological Variables</td>
</tr>
<tr>
<td></td>
<td>4. Percent body fat</td>
</tr>
<tr>
<td></td>
<td>5. Blood Pressure</td>
</tr>
<tr>
<td></td>
<td>6. Resting Heart rate</td>
</tr>
<tr>
<td></td>
<td>7. Cardio Respiratory Endurance</td>
</tr>
</tbody>
</table>
Selection of Tests

In this study the variables were measured by administering the following tests.

In below table the related test to assess each of the selected variables has been indicated.

**TABLE-3.2**

Table for Testing Components and Test Items

<table>
<thead>
<tr>
<th>S.No.</th>
<th>VARIABLES</th>
<th>TESTS/EQUIPMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Physical Variables</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Body Mass Index (BMI)</td>
<td>Height weight Chart</td>
</tr>
<tr>
<td></td>
<td>2. Abdominal Muscular Endurance</td>
<td>Modified sit-ups</td>
</tr>
<tr>
<td></td>
<td>3. Flexibility</td>
<td>Sit and reach test</td>
</tr>
<tr>
<td>2</td>
<td>Physiological Variables</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Percent Body Fat</td>
<td>Skin fold Caliper</td>
</tr>
<tr>
<td></td>
<td>5. Resting Heart rate</td>
<td>Radial Method</td>
</tr>
<tr>
<td></td>
<td>6. Blood Pressure</td>
<td>Sphygmomanometer</td>
</tr>
<tr>
<td></td>
<td>7. Cardio-Respiratory Endurance</td>
<td>Coopers 12min run/walk test</td>
</tr>
</tbody>
</table>
Body Mass Index (BMI)  Height and weight are measured by stadiometer and weighing machine while the subject in standing position. The height and weight measurement was recorded in centimeter and Kilograms. The individual score considered following the formulae recomended by Nancy et al., (1999)

\[
\text{BMI was calculated as } = \frac{\text{Weight in Kg}}{\text{Height in m}^2}
\]

Abdominal Muscular Endurance The score is recorded by number of correctly executed sit-ups performed in 60 seconds while the subject lies on the back with her knees bent, feet on the floor and heels not more than 12 inches from the buttocks.

Flexibility is used to measure the sit and reach box and scale while the subject was asked to sit on the floor the score is the farthest point reached measured to the nearest centimeter.

Percent of body fat the amount of body fat is measured, using the sum of skin fold caliper, measurement at all three locations were converted into percentage of body fat with the help of conversion table (Wallance C. Donoshul- 1998) considering age and sex of the subjects.
**Blood Pressure** Systolic and diastolic blood pressure are measured, using spygmomanometer and stethoscope while the subjects are resting in a seated position. The values are recorded in mm Hg.

**Resting Heart rate** The number heart beats per minute at the resting condition while the subjects are lie down on the table comfortably. Radial Method pulse was taken by placing three fingers on the radial artery (fore arm on the side of the thumb). Stopwatch used for the time calculation.

**Cardio respiratory Endurance** A 400mts track, marked at 50 meters interval and stopwatch are used to measure Cardio respiratory endurance through Coopers 12min run/walk test. The score in terms of number of laps plus the number of 50-meter zones passed on the last lap.
Orientation of the Subjects

In order to get full co-operation from the subjects they were oriented as follows. Before conducting the test, the researcher had demonstrated each test for the entire variable to every subject. The model performance by some of the subjects was also done to make the subject clearly understand the test items. The method of doing the walking preparation exercise for the whole body was explained both to the walking and walking with stretching exercise groups.

Collection of Data

For the purpose of collection of data the subjects were asked to report early in the morning, one day prior to the commencement of training and one day after the training data was collected. It was ensured that the subjects did not take food.

Tester’s Reliability

To measure uniformity and reliability of testing technique, the investigator had a number of practice session in the testing procedure with the guidance of respective experts. The investigator took all the measurements in this study with the assistance of physical educationist.
Instrument Reliability

All the instruments and equipments used for the study were standard ones and of high quality. Sphygmomanometer and stethoscope were acquired from a physician who has been using it for diagnostic purpose on his patients for quite some time. The stop watches, skin fold caliper, stadiometer & sit and reach box were available in the Maruthi college of Physical Education. The instruments were good in condition and standardized one. Skinfold caliper is a device, which measures the thickness of skinfold with its underlying layer of fat. Skinfold caliper has a spring which exerts 10 gm mm$^2$ of pressure on the skin fold. The skinfold caliper which is used for the test had maintained same tension throughout the range of motion.

The reliability of the data was established by test and re-test process where consistency of scores were statistically tested by computing univariate co-efficient for fifteen subjects on all the eight variables. All the variables revealed high correlation when tested and re-tested, thus ensuring their reliability. The results are presented in Table-3.3.
TABLE –3.3

UNIVARIATE CO-EFFICIENT ON SELECTED CRITERION VARIABLES

<table>
<thead>
<tr>
<th>Variables</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body Mass Index (BMI)</td>
<td>1.00*</td>
</tr>
<tr>
<td>Abdominal Muscular Endurance</td>
<td>0.97*</td>
</tr>
<tr>
<td>Flexibility</td>
<td>0.98*</td>
</tr>
<tr>
<td>Percent Body Fat</td>
<td>1.00*</td>
</tr>
<tr>
<td>Systolic Blood Pressure</td>
<td>0.99*</td>
</tr>
<tr>
<td>Diastolic Blood Pressure</td>
<td>1.00*</td>
</tr>
<tr>
<td>Resting Heart Rate</td>
<td>0.98*</td>
</tr>
<tr>
<td>Cardio Respiratory Endurance</td>
<td>0.98*</td>
</tr>
</tbody>
</table>

* Significant at .05 level.

The table value “r” for significance at 0.05 levels with Degrees of Freedom 13 is 0.514
TEST ADMINISTRATION

Body Mass Index (BMI)

Purpose

To measure the body mass index.

Equipment

Weighing machine, stadio meter

Procedure

\[
\text{BMI was calculated as } \frac{\text{Weight in Kg}}{\text{Height in mt}^2}
\]

Scoring

The result of Weight in Kg / Height in mt\(^2\) is the score of the BMI.

<table>
<thead>
<tr>
<th>BMI</th>
<th>Weight status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 18.5</td>
<td>Underweight</td>
</tr>
<tr>
<td>18.5 – 24.9</td>
<td>Normal</td>
</tr>
<tr>
<td>25.0 – 29.9</td>
<td>Overweight</td>
</tr>
<tr>
<td>30.0 and above</td>
<td>Obese</td>
</tr>
</tbody>
</table>
Weight Test

Purpose

To measure the weight of the subject.

Equipments

Weight machine, pencil and score sheet.

Procedure

The subjects were made to stand on the weighing machine with ideal clothes. At the time of measuring the heels were on the weighing machine without shaking it and the body in erect position, when the vibration in the scale scored the reading was noted and the subject stepped away from the weighing machine.

Scoring

The reading was taken in kilograms and was considered as the individual score.
Height Test

Purpose

To measure the height of the subjects.

Equipment

Stadiometer, scale, piece of chalk and score sheet.

Procedure

The subjects were made to stand on the stadiometer with bare foot. At the time of measuring the heels were on the platform without elevating it and the scale was brought down firmly in contact with vertex. A mark was made with chalk piece on the side of score in the stadiometer. After that the subject stepped away from the stadiometer stand board.

Scoring

The vertical distance from the stadiometer stand board to chalk piece mark was measured. The measurement was taken to the nearest one centimeter.
Bent Knee Sit-ups

Purpose
To measure abdominal muscular endurance.

Equipments
Mat, floor, dry turf.

Procedure
Subject lies on the back with her knees bent, feet on the floor and heels not more than 12 inches from the buttocks. The angle at the knee should be less than 90 degrees. The subject put her hands behind the neck with fingers clasped and places her elbows on the mat, floor or turf. Her feet are held by her partner to keep them in touch with the surface. The person tightens her abdominal muscles and brings her head and elbows forward as she curls-up finally touching elbows to knees. This action constitutes one sit-up. The subject returns to the starting position with her elbows on the surface before another sit-up. The timer gives the signal “ready go” and sit-up performance is started on uttering the word “go” performance is stopped on uttering the word “stop”.

Scoring
The number of correctly executed sit-ups performed in 60 seconds is the score.
Sit and Reach Test

Purpose

To measure the muscular flexibility.

Equipment

Sit and reach box, scale.

Procedure

The subject was asked to sit on the floor with her hips, backs, and head against a wall, legs fully extended, and the bottom of her feet against the sit and reach box placing her hands as far as possible without lifting her hips, back, or head from the wall. The examiner should then slide the reach indicator on the measuring scale along the top of the box until the end of the indicator touches the tips of the fingers. Then the subject's head and back can now move from the wall and gradually reach forward as far as possible on the measuring scale.

Scoring

The score is the farthest point reached measured to the nearest centimeter.
Percent Body Fat

Purpose

The purpose of the test was to determine the percent body fat of an individual.

Equipment

High quality plastic skin folds caliper and scoring sheet.

Procedure

The skin fold was grasped firmly with thumb and forefingers and fold the skin and subcutaneous fat, pulling it away from the underlying muscular tissue following the natural centaur of the fat fold, constant tension of 10 gm mm$^2$ was exerted by the pincer arms of the caliper at their point of contact with skin. The thickness of the double layer of skin and subcutaneous tissue was read directly from within two seconds after the full force of caliper was applied.

Location: Measurements were taken on the right side of the body with the subject standing. As the investigator has taken women subjects, the sites selected for the skin fold is Triceps, Thigh, and Supraillium.
Triceps

A vertical fold on the back of the upper arm, halfway between the shoulder and the arm.

Thigh

The measurement of the skin fold at the thigh was taken from a vertical fold on the front of the thigh, midway between the knee and hip.

Supraillium

A diagonal fold above the crest of the ileum (on the side of the hip).

Scoring

Each site was measured three times and the average of the two closest reading was recorded as the final score. Wallace C. Donoshul (1998). The sum of skin fold measurement at all three locations were converted into percentage of body fat with the help of conversion table (given in appendix VI) considering age and sex of the subjects.
**Blood Pressure**

Blood pressure was measured by indirect method using Sphygmomanometer and stethoscope, as recommended by Cromwell et al., (1992)

**Purpose**

To measure the systolic and diastolic blood pressure.

**Equipment’s**

Sphygmomanometer and stethoscope

**Procedure**

For measuring blood pressure, the subjects were asked to report early in the morning and were allowed to relax for half an hour by lying down on the mattress. After ensuring that the subjects relaxed mentally and physically, they were asked to sit in a chair and the cuff of the sphygmomanometer was placed on the right upper arm of the subjects. The stethoscope was placed over the brachial artery down stream from the cuff.

The pressure cuff on the upper arm was inflated by pressing the rubber bulb and the cuff was inflated till no sounds were heard in the stethoscope, as the brachial artery had been collapsed by the pressure of the cuff.
The pressure in the cuff was then gradually reduced by deflating the cuff through the valve. As the cuff started deflating gradually, a small sound called “korotkoff” sounds were heard through the stethoscope. At this stage the mercury level in the manometer was recorded in millimeters and this recording was taken as systolic pressure.

The pressure of the cuff that was indicating on the manometer when the fir “korotkoff” sound was heard, was recorded as the systolic blood pressure. As the deflation continued and the pressure started falling at one stage the “korotkoff” sounds disappeared, as the pressure was no longer sufficient to occlude the vessel.

The cuff pressure shown in the manometer was noted as soon as the “korotkoff” sounds disappeared and this reading was recorded in millimeters.

Scoring

Each site was measured three times and the average of the two closest reading was recorded as the final score.
**Resting Heart Rate**

**Purpose**

To measure the subjects resting heart rate.

**Equipments**

Stopwatch

**Procedure**

Resting heart rate was taken calculated by the number of heart beats in one minute when the subject was in resting condition. Ten minutes before taking heart rate, the subject was asked to lie down on the table comfortably. The radial pulse was taken by placing three fingers on the radial artery (forearm on the side of the thumb). Stop watch is used for the time calculation.

**Scoring**

The resting heart rate was counted for fifteen seconds and multiplied by four for heart rate per minute.

**Cardio Respiratory Endurance**

**Cooper’s 12 Minutes Run and Walk Test**

**Purpose**

To measure cardio respiratory endurance
Facilities and Equipment

A 400mts track, marked at 50 meters interval and stopwatch.

Procedure

The group was divided into two for testing purpose. Each subject worked with a partner and while one subject runs/walks, the other partner checks the laps. The partner was instructed to count the number of laps either by running/walking within the allotted time. When eleven minutes have elapsed, the instructor calls out the time left for running. At the end of the 12 minutes, the instructor blows a blast on her whistle and the runner notes the marking she has just passed.

Scoring

The observing partner gave the runner the number of completed laps she had run. The runner then reports her score in terms of number of laps plus the number of 50 meter zones passed on the last lap. The training load fixed dependence upon the individual initial performance (given in appendix I & II).
## Training Program

### Training Details

<table>
<thead>
<tr>
<th>Details</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration</td>
<td>12 weeks</td>
</tr>
<tr>
<td>Session</td>
<td>3 days per week one session per day</td>
</tr>
<tr>
<td>Duration of 1 session</td>
<td>45 minutes</td>
</tr>
</tbody>
</table>

### Session details

- **Warm up**: 8 minutes
- **Walking/walking with stretching exercise**: 32 minutes
- **Warm down**: 5 minutes

For walking Cooper test was administered for both walking and walking with stretching exercise groups to find out their maximum performance. The initial load was fixed individually in accordance with their maximum distance covered in 12 minutes.

Stretching exercise was administered for walking with stretching exercise group after the completion of walking. They have done the stretching exercise for 12 minutes slowly and evenly.

During the initial week, the warming up period and warming down period were fixed as eight and five minutes respectively for walking and
walking with stretching exercise groups. Half a minute was increased for each and every week from the second week to twelth week for both the groups.

Training Schedule

Both experimental groups (walking and walking with stretching exercise groups) underwent their respective training program three days per week (alternate days) for twelve weeks. Group I underwent walking and group II underwent walking with stretching exercise. Group III was instructed not to participate in any strenuous physical exercise and they were requested to do regular work throughout the study.

The training program for walking was designed individually on the basis of Cooper test performance. Training program for stretching exercise was designed to execute the stretching exercise by the individual slowly and evenly. The two experimental groups (walking and walking with stretching exercise groups) who participated in it were informed to report at the early hours of the day around 6.30 am at their respective training places.

The training program for both experimental group walkers was designed with interval training, the progressive overload principal being
applied. Each training session was divided into three phases: warming up phase, overload phase and cooling down phase.

For the walking group their warming up phase consisted of walking, slow jogging, stretching and free hand exercise for 8 minutes. In the overload phase the subjects walk to complete their walking distance calculated on the basis of their initial 12 minutes Cooper test performance (two repetitions). The cooling down phase followed the overload phase and consisted of slow jogging, bending & stretching and relaxation for 5 minutes.

For the walking with stretching exercise group their warming up phase consisted of walking, slow jogging, stretching and free hand exercise for 8 minutes. In the overload phase the subjects walk to complete their walking distance calculated on the basis of their initial 12 minutes Cooper test performance (one repetition). After completion of walking the subjects had gone through stretching exercise program for 12 minutes slowly and eventually holding the position for 6 seconds. The exercise is 4 to 6 times with two sets of repetition. The cooling down phase followed the overload consisting of slow jogging, bending & stretching and relaxation for 5 minutes. The duration of the walking and walking with stretching exercise was twelve weeks with three days per week (alternative days).
Training Program for Walking Group

Interval training program was designed individually on the basis of the initial Cooper test performance (initial load fixed on 55% of individual initial performance given in appendix-I). From the I week to the VI week, walking distance intensity was increased from 55% to 80% for each individual to complete their stipulated distance within 12 minutes with two repetitions with a rest of 8 minutes between repetitions. After the completion of the VI week, the load intensity was constant up to XII week, but the overload principle adapted through decrease in the rest period. For the VII and the VIII weeks, rest period in between repetition was 7 minutes, for the IX and the X weeks, the rest between repetitions was reduced to 6.5 minutes, and for the XI, XII weeks rest given was only for 6 minutes.

Training Program for Walking with Stretching Exercise Group

For walking with stretching exercise group for the walking Interval training program was designed individually on the basis of the initial Cooper test performance (initial load fixed on 55% of individual initial performance given in appendix-II). From the I week to the VI week, walking distance
intensity was increased from 55% to 80% for each individual to complete their stipulated distance with in 12 minutes with one repetition with a rest of 8 minutes followed that they done stretching exercise for 12 minutes. The subject executed the stretching exercise (given in appendix II) slowly and evenly holding the position for six seconds. The exercise is repeated 4 to 6 times with two sets of repetitions upto 12 weeks of training. For walking alone after the completion of the VI week, the load intensity was constant upto XII week, but the overload principles adapted through decrease in the rest period. For the VII and the VIII weeks, rest period in between walking to stretching exercise was 7 minutes, for the IX and the X weeks, the rest between walking to stretching exercise was reduced to 6.5 minutes, and for the XI, XII weeks rest given was only for 6 minutes.

**Experimental Design and Statistical Technique**

The experimental design of the study was random group design. In this study forty five subjects were selected randomly and divided into two experimental groups and control group. The data collected from these subjects prior and after 12 weeks training period on selected variables were statistically examined for significant difference if any, by applying Analysis of Covariance (ANACOVA) since no attempt was made to equate the group in any manner and therefore to eliminate the variation in pre-test means.
After eliminating the influence of pre-test, the adjusted post-test means of control and experimental groups were tested for significance by using Analysis of Co-Variance (ANACOVA).

In all the cases, to test the significance 0.05 level of confidence was utilized. Since three groups were involved, Scheffe’s test was used as post-hoc test for significance.