CHAPTER III

METHODOLOGY

In this chapter, selection of the subjects, selection of the variables, selection of tests, reliability of the data, criterion measures, administration of tests, administration of training programme, experimental design, instrument reliability, collection of data and the statistical techniques employed for analyzing the data are described.

This study was designed to find out the “Effect of physical exercise and yoga on hypertensive patients”.

3.1 SELECTION OF THE SUBJECTS

To achieve the purpose of the study ninety stage 1 medicine free hypertensive patients were randomly selected as subjects from Surampatty area in the Erode district, Tamil Nadu and their age ranged between 30 and 45 years. They were randomly divided into three groups of thirty each, in which group I underwent physical exercise training, group II yoga practices and Group III acted as control group. The subjects in control group were not engaged in any activity other than their regular curriculum i.e. conventional exercise during this training period. The subjects were free to withdraw their consent in case of feeling any discomfort during the period of their participation but there was no drop out during the study.

3.2 SELECTION OF VARIABLES

In the present study the following factors were selected as variables is presented in table 3.1.
TABLE-3.1. 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. Grip strength</td>
</tr>
<tr>
<td></td>
<td>2. Flexibility</td>
</tr>
<tr>
<td></td>
<td>3. Body mass index (BMI)</td>
</tr>
<tr>
<td>2.</td>
<td>Physiological variables</td>
</tr>
<tr>
<td></td>
<td>1. Percent body fat</td>
</tr>
<tr>
<td></td>
<td>2. Resting heart rate</td>
</tr>
<tr>
<td></td>
<td>3. Resting blood pressure</td>
</tr>
<tr>
<td></td>
<td>4. Cardio – vascular endurance</td>
</tr>
<tr>
<td>3.</td>
<td>Biochemical variables</td>
</tr>
<tr>
<td></td>
<td>1. Total Cholesterol (TC)</td>
</tr>
<tr>
<td></td>
<td>2. High Density Lipo Protein (HDL)</td>
</tr>
<tr>
<td></td>
<td>3. Low Density Lipo Protein (LDL)</td>
</tr>
</tbody>
</table>

3.3. SELECTION OF TESTS

In this study the variables were measured by administrating the following tests and presented in table 3.2.

TABLE-3.2. 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>Grip strength</td>
<td>Grip dynamometer</td>
</tr>
<tr>
<td></td>
<td>Flexibility</td>
<td>Sit and reach test</td>
</tr>
<tr>
<td></td>
<td>Body mass index</td>
<td>Height weight chart</td>
</tr>
<tr>
<td>2.</td>
<td>Physiological variables</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Percent body fat</td>
<td>Plastic skin fold caliper</td>
</tr>
<tr>
<td></td>
<td>Resting heart rate</td>
<td>Stethoscope, stop watch</td>
</tr>
<tr>
<td></td>
<td>Resting blood pressure</td>
<td>Sphygmomanometer</td>
</tr>
<tr>
<td></td>
<td>Cardio – vascular endurance</td>
<td>Coopers 12 min run / walk test</td>
</tr>
<tr>
<td>3.</td>
<td>Biochemical variables</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Cholesterol (TC)</td>
<td>Bio – chemical lab test</td>
</tr>
<tr>
<td></td>
<td>High Density Lipo Protein (HDL)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low Density Lipo Protein (LDL)</td>
<td></td>
</tr>
</tbody>
</table>
3.4 RELIABILITY OF DATA

The reliability of data was ensured by establishing the instrument reliability, tester reliability and subject reliability.

3.4.1 Instrument Reliability

Grip dynamometer, Sphygmomanometer, stethoscope, weighing machine, sit and reach box, stadiometer, skin fold caliber and stop watch were used to measure various variables. The instruments were obtained from standard firms which cater to the needs of various research laboratories from the Lab of Koviloor Andavar College of Physical Education. Certificates of accuracy of the above instruments were obtained from appropriate instrument testing agencies, and also by recalibrating the scale by using amounts of variables wherever required. To determine the reliability of instruments, measurement on each variable were recorded five times under similar conditions using the same instrument. The scores obtained were also compared with those form other reputed firms. Hence, their calibrations were accepted as accurate enough for the purpose of the study.

3.4.2 Tester reliability

To ensure that the investigator was well versed in the technique of conducting the tests, the investigator had a number of training sessions in the testing procedures. All the measurements were taken by the investigator with the assistance of persons well acquainted with the tests and their procedures. In selected physical, physiological and biochemical variables, the qualified lab technical administered the test.

The testers competency was obtained by pre – test, mid – test, post test process whereby the consistencies of results were obtained. As very high correlation was obtained the tester competency in taking measurement and test reliability were accepted.

3.4.3 Subject reliability

The subject reliability was established by test – retest co-efficient of correlation for the scores in each of the criterion measures. Retesting was done within a period of week of initial test in each of the criterion measures to get data for calculating test, retest
coefficient of correlation for reliability of the subjects. However, in case of serum cholesterol, only five subjects were retested. The scores of the first and second measurements of the subjects were correlated using the Pearson product movement method. Since, the obtained “r” was higher than the table value, the reliability of the subject was considered at 0.05 level of confidence.

The reliability coefficient for criterion variables are obtained by test and retest method and the same are presented in the below table-3.3.

**TABLE-3.3. RELIABILITY CO-EFFICIENT FOR CRITERION VARIABLES**

<table>
<thead>
<tr>
<th>S. No</th>
<th>Criterion variables</th>
<th>Co-efficient of correlation “r”</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td><strong>Physical variables</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Grip strength</td>
<td>0.93*</td>
</tr>
<tr>
<td></td>
<td>Flexibility</td>
<td>0.83*</td>
</tr>
<tr>
<td></td>
<td>Body mass index</td>
<td>0.85*</td>
</tr>
<tr>
<td>2.</td>
<td><strong>Physiological variables</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Percent body fat</td>
<td>0.92*</td>
</tr>
<tr>
<td></td>
<td>Resting heart rate</td>
<td>0.83*</td>
</tr>
<tr>
<td></td>
<td>Resting systolic blood pressure</td>
<td>0.41*</td>
</tr>
<tr>
<td></td>
<td>Resting diastolic blood pressure</td>
<td>0.50*</td>
</tr>
<tr>
<td></td>
<td>Cardio – vascular endurance</td>
<td>0.96*</td>
</tr>
<tr>
<td>3.</td>
<td><strong>Biochemical variables</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Cholesterol (TC)</td>
<td>0.91*</td>
</tr>
<tr>
<td></td>
<td>High Density Lipo Protein (HDL)</td>
<td>0.94*</td>
</tr>
<tr>
<td></td>
<td>Low Density Lipo Protein (LDL)</td>
<td>0.88*</td>
</tr>
</tbody>
</table>

*Significance at 0.05 level of confidence

The table value “r” for significance at 0.05 level with df (30) is 0.35

**3.5 EXPERIMENTAL DESIGN**

The study mainly aimed at finding out the effects of physical exercise and yogic practices on selected physical, physiological and biochemical variables of hypertensive patients.
The experimental design used in this study was random group design. In this study ninety hypertensive patients from Surampatty area in the Erode district were involved as subjects. They were divided into three groups of thirty each.

Among the randomly selected groups in which group I underwent physical exercise training, Group II yogic training, Group III acted as control group for 12 weeks of training on the selected physical, physiological and biochemical variables.

3.6 PILOT STUDY

A pilot study was conducted to assess the initial capacity of the subjects in order to fix the load and to make sure that the duration of exercise included in the program was within the limits of the subjects to ensure the satisfactory effect.

For this, ten subjects were selected at random from the ninety subjects selected for the study and they were divided into two groups of five each, in which group I underwent physical exercise training and group II yogic training under the watchful eyes of the experts and the researchers.

The average performance of the five subjects in each group was calculated and based on that the initial load and twelve weeks of training were drawn to the group respectively. Based on the response of the subjects in the pilot study and during training program, the training schedules for group I and group II were constructed. However, the individual differences were considered while constructing the training programs and the basic principles of training were also followed by the investigator.

3.7 COLLECTION OF DATA

All test data were collected in the same day. The entire tests were measured early in the morning to avoid water hydration changes resulting from activity. The data of physical, physiological and bio-chemical variables collected by various tests are explained below. The pre-test data were collected a day before the commencement of the training program and post-test data a day after 12 weeks of the last training session.

3.8 COLLECTION OF BLOOD

A tourniquet was tied above the elbow without obliterating the arterial pulse at the wrist. The skin was sterilized over the vein and a disposable sterile needle fitted to a
A disposable syringe of appropriate capacity, usually 10 ml, was inserted into the vein, the piston was withdrawn slightly. The tourniquet was released when the blood appeared and the desired amount of blood with drawn into the syringe. The tourniquet was released. The needle was withdrawn. The needle still in position, the blood was slowly transferred to an appropriate container using minimum amount of pressure.

3.9 TEST ADMINISTRATION

The investigator held a meeting with the subjects prior to the administration of the tests. The purpose, the significance of the study and the requirements of the testing procedure were explained to them in detail so that there was no ambiguity in their minds, regarding the efforts required of them. All the subjects agreed voluntarily to co-operate in the testing procedures and they were trained to put in their best efforts in the interest of the scientific investigations and in order to enhance their own health. The subjects were very enthusiastic and co-operative throughout the research training period and test administration period.

3.10 PHYSICAL VARIABLES TEST

3.10.1 Grip strength – Grip dynamometer test

Purpose

The purpose of the test was to determine the grip strength of the hand muscular strength.
Equipment

Hand Grip dynamometer

Procedure

The grip dynamometer was used to measure strength score of the grip. The concave edge of the dynamometer was placed between the first and second joint of the fingers with the dial towards the palm. The subject squeezed the instrument.

Scoring

The best reading out of two chances was recorded as the score of the subject.

3.10.2 Flexibility - Sit and reach test

Purpose

To measure the muscular flexibility.

Equipment

Sit and reach box.

Procedure

The subject was asked to sit on the floor with hips backs and head against a wall, legs fully extended and the bottom of his feet against the sit and reach box, placed his hand as far as possible without lifting his hips back or head come off the wall.
To perform test, the subjects extends arms forwards with hands placed on top of each other. The subjects head and back could came off the wall and done gradually reach forward as far as possible on the measurement unit of the sit and reach box.

**Scoring**

Recorded the final number of centimeters reached.

### 3.10.3 Body Mass Index (BMI)

#### Purpose

To measure the body mass index.

#### Equipment

Weighing machine, stadio meter.

#### Procedure

$$\text{BMI was calculated as } = \frac{\text{Weight in kg}}{\text{Height in m}^2}$$

#### Scoring

The results of weight in kg height \(^{-1}\) in m\(^2\) is the score of the BMI.

### 3.10.3.1 Weight Measurement
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 in ideal cloths. At the time of measuring the heels were on the weighing machine without diversion and the body in erect position. After the stop of the scale vibration the reading was noted.

Scoring

The reading was taken in kilograms and was considered as the individual scores.

3.10.3.2 Height Measurement

Purpose

To measure the height of the subjects.

Equipment

The subjects were made to stand on the stadiometer with bare foot. At the time of measuring the heels were on the platform without elevation and the scale was brought down firmly in contact with vertex. A mark was made with a piece of chalk 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 mark was measured. The measurement was taken to the nearest one centimeter.

3.11 PHYSIOLOGICAL VARIABLES TEST

3.11.1 Percent Body Fat

Purpose

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

Equipment

Harpenden skin folds caliper and scoring sheet.

Procedure

Measurements were taken on the right side of the body with the subject standing. As the investigator selected men subjects, the sites selected for the skin fold are chest, abdomen and thigh.

Chest

The measurement of the skin fold at the chest was taken from a diagonal fold halfway between the shoulder crease and the nipple.

Abdomen

The measurement of the skin fold at the abdomen was taken from a vertical fold about one inch to the right of the umbilicus.
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. Each site was measured by grasping a double thickness of skin firmly with the thumb and forefinger, pulling the fold slightly away from the muscular tissue. The caliper was held perpendicular to the fold and the measurements were taken one-half inch below the finger fold.

Scoring

Each site was measured three times and the average of the two closest reading was recorded as the final score. Formula Siri (1994)

\[
\text{Percent Body Fat} = \left(\frac{4.95}{\text{body density}}\right) - 4.50 \times 100
\]

3.11.2 Resting Heart Rate

Purpose

To measure the subjects resting heart rate

Equipments

Stethoscope, stopwatch

Procedure

Heart rate was taken in the resting condition of the subject for ten minutes. Stethoscope was used to measure the heart beat. The subject is asked to lie down on the table comfortably. The chest piece of the Stethoscope is on the left inter-costal space of the body. The heart rate can be recorded by hearing the sounds lub – dub which is taken as one beat. Stop watch is used for the time calculation.

Scoring

The total number of resting heart rate per minute for each subject was recorded.

3.11.3 Resting Blood Pressure

Purpose

To measure the resting blood pressure of systolic and diastolic.
Equipments

Sphygmomanometer and stethoscope

Procedure

The cuff of the sphygmomanometer was wrapped around the upper arm above the elbow with the ear knobs of the stethoscope in the tester’s ears. The ball of the stethoscope was placed on the brachial artery and pressure was given by pumping. The pressure then slowly released as the tester watched the mercury column. The first sound of the pulse was heard, the reading in millimeters of mercury at that instant was recorded as the systolic pressure. The tester continued to release the pressure slowly until a very dull weak pulsation was noted. At the instant the pressure in millimeters of mercury was noted which represents the diastolic pressure.

Scoring

The readings were recorded in millimeters.

3.11.4 Cardiovascular Endurance - Coopers 12 minutes run and walk test

Purpose

To measure cardiovascular endurance.

Facilities and equipment

A 400 meters track, marked at 50 meters interval, stop watch.

Procedure

The group was divided into two for testing purpose. Each subject worked with a partner and while one subject is ran / walked, the other partner checked the laps. The partner was instructed to count the number of laps within the allotted time. When eleven minutes elapsed, the instructor called out the time left of run. At the end of the 12 minutes, the instructor blows his whistle and the runner notes the marking he had just passed.

Scoring

The observing partner gave the runner the number of completed laps he run. The runner then reported his score in terms of number of laps plus the number of 50 meter zones passed on the last lap.
3.12 BIO – CHEMICAL VARIABLES TEST

3.12.1 Total cholesterol - Wybenga Pilliggi Method

Aim

To estimate the total amount of blood cholesterol from given sample of blood

Apparatus

Colorimeter, test tube, centrifuge tube, sterilized syringe and needle spirited cotton pipette distilled water etc.

Reagent

Sulphuric acid, ethyl acetate, ferric per chlorate

Principle

The cholesterol of the serum is oxidized to a tetranic derivative by ferric ions derived from ferric per chlorate, and the absorbance of the mixture is compared with that of a pre solution of cholesterol.

Procedure

A clean and dry test tube was taken and it was named as T, S, B pipette the following

<table>
<thead>
<tr>
<th>Content</th>
<th>Test (t)</th>
<th>Standard (s)</th>
<th>Blank (b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cholesterol reagent</td>
<td>5 ml</td>
<td>5 ml</td>
<td>5 ml</td>
</tr>
<tr>
<td>Serum</td>
<td>0.1 ml</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Working cholesterol</td>
<td>-</td>
<td>0.1 ml</td>
<td>-</td>
</tr>
<tr>
<td>standard</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distilled water</td>
<td>-</td>
<td>-</td>
<td>0.1 ml</td>
</tr>
</tbody>
</table>

All the tubes were mixed well and kept in a boiling water bath for 90 seconds, and then all the tubes were cooled simultaneously in a bath of cold water for 5 minutes.

The test tubes removed and mixed by inversion (each separately). The optical densities (O.D) of test, standard and control in the photo colorimeter/ spectrophotometer
were determined setting zero optical density (absorbance) with the blank at 590 nm wavelength yellow green filter

**Calculations**

\[
\text{O.D. Test} \quad \frac{\text{X Concentration of standard (200 mgs %)}}{\text{O.D. standard}} = \text{cholesterol in mgs %}
\]

**Results**

The calculated value is the amount of blood cholesterol present in 100 ml blood.

**3.12.2 High Density Lipoprotein Test (HDL)**

**Aim**

To estimate the total amount of High Density Lipoprotein from given sample of blood.

**Apparatus**

Colorimeter, test tube, centrifuge tube, sterilized syringe and needle, spirited cotton, pipette, distilled water etc.

**Reagent**

HDL cholesterol reagent and HDL standard (50 mgs %)

**Working reagent preparation**

Mix HDL cholesterol reagent 0.3 ml and serum (or) plasma 0.3 ml. take the tube centrifuge 3500 rpm and finally take the supernatant.

**Procedure**

A clean and dry test tube was taken and named as T, S, B pipette the following

<table>
<thead>
<tr>
<th>Content</th>
<th>Test (t)</th>
<th>Standard (s)</th>
<th>Blank</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDL cholesterol reagent</td>
<td></td>
<td>5 ml</td>
<td>5 ml</td>
</tr>
<tr>
<td>Serum</td>
<td>0.05 ml</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Working cholesterol</td>
<td></td>
<td>0.05 ml</td>
<td>-</td>
</tr>
<tr>
<td>standard</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distilled water</td>
<td></td>
<td>-</td>
<td>0.05 ml</td>
</tr>
</tbody>
</table>
All the tubes were mixed well and kept in a boiling water bath for 90 seconds, and then all the tubes were cooled simultaneously in a bath of cold water for 5 minutes.

The test tubes removed and mixed by inversion (each separately). The optical densities (O.D) on tests, standard and control in photo colorimeter/ spectrophotometer were determined setting zero optical density (absorbance) with the blank at 590 nm wavelength green filter.

**Calculations**

\[
\frac{\text{O.D. Test}}{\text{O.D. standard}} \times \text{Concentration of standard (50 mgs %)} = \text{HDL cholesterol in mgs %}
\]

**Results**

The calculated value is the amount of HDL blood cholesterol present in 100 ml.

### 3.12.3 Low Density Lipoprotein Test (LDL)

Total amount of Low Density Lipoprotein (LDL) is found out through the given formula.

\[
\text{LDL Cholesterol} = \text{TC} - \text{HDL} - \text{TGL} / 5
\]

- \(\text{LDL} = \text{Low Density Lipoprotein}\)
- \(\text{TC} = \text{Total Cholesterol}\)
- \(\text{HDL} = \text{High Density Lipoprotein}\)
- \(\text{TGL} = \text{Triglycerides}\)

### 3.13 TRAINING PROGRAM AND PROCEDURE

The training program of this study was based according to the pilot study.

The experimental groups underwent the respective programs as per the schedules under the supervision of the Investigator. All the subjects involved in the training programs were questioned about their stature throughout the training period. The exercise programmers, load patterns and the selection of asanas were based on a critical approach to training by outlining the selected physical, physiological and biochemical variables demands of the hypertensive persons.
The program schedules of Experimental Groups are as follows:

3.14 EXPERIMENTAL GROUP I (PHYSICAL EXERCISE GROUP)

During the training period, experimental group I (N= 30) underwent physical exercise training which included brisk walking everyday in the morning session for a period of 12 weeks. Every day the workout lasted for 20 – 45 minutes approximately. Prior to and after training session the group had a warm up and warm – down exercise for 10 minutes each in every session involving jogging, low intensity resistance exercise and stretching exercises. The 12 weeks training program schedule of physical exercise training group is presented in table – 3.4.

TABLE 3.4. PROGRAM SCHEDULE FOR 12 WEEKS FOR PHYSICAL EXERCISE GROUP (GROUP I)

<table>
<thead>
<tr>
<th>Mode of exercise</th>
<th>Physical exercise training (brisk walking)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>Every day for 12 weeks</td>
</tr>
<tr>
<td>Duration</td>
<td>20 – 45 minutes approximately</td>
</tr>
<tr>
<td>Intensity</td>
<td>Moderate intensity 55 – 75 % of maximum heart rate</td>
</tr>
</tbody>
</table>

PHYSICAL EXERCISE PROGRAM FOR A SESSION

<table>
<thead>
<tr>
<th>5 minutes</th>
<th>Warm – up with light walking /jogging low intensity resistance exercise and stretching</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 - 35 minutes</td>
<td>As per the schedule prescribed below</td>
</tr>
<tr>
<td>5 minutes</td>
<td>Warm – down with light walking/jogging and stretching</td>
</tr>
</tbody>
</table>

PHYSICAL EXERCISE SCHEDULE FOR 12 WEEKS

<table>
<thead>
<tr>
<th>Week</th>
<th>Intensity</th>
<th>Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>55%</td>
<td>15 min</td>
</tr>
<tr>
<td>2&lt;sup&gt;nd&lt;/sup&gt;</td>
<td>55%</td>
<td>20 min</td>
</tr>
<tr>
<td>3&lt;sup&gt;rd&lt;/sup&gt;  and 4&lt;sup&gt;th&lt;/sup&gt;</td>
<td>60 %</td>
<td>25 min</td>
</tr>
<tr>
<td>5&lt;sup&gt;th&lt;/sup&gt;  and 6&lt;sup&gt;th&lt;/sup&gt;</td>
<td>65 %</td>
<td>25 min</td>
</tr>
<tr>
<td>7&lt;sup&gt;th&lt;/sup&gt;  and 8&lt;sup&gt;th&lt;/sup&gt;</td>
<td>70 %</td>
<td>30 min</td>
</tr>
<tr>
<td>9&lt;sup&gt;th&lt;/sup&gt;  and 10&lt;sup&gt;th&lt;/sup&gt;</td>
<td>70 %</td>
<td>30 min</td>
</tr>
<tr>
<td>11&lt;sup&gt;th&lt;/sup&gt;  and 12&lt;sup&gt;th&lt;/sup&gt;</td>
<td>75 %</td>
<td>35 min</td>
</tr>
</tbody>
</table>
3.15 EXPERIMENTAL GROUP II (YOGA GROUP)

The experimental group II underwent yogic training which included asanas and pranayama for a period of 12 weeks everyday in the morning session. During the training, the work out lasted for 30 – 50 minutes approximately. Each asana had a gap of 30 sec to 1 min and at the end of each training session the subjects were made to study in savasana, for a period of 10 minutes. The 12 weeks training program schedule of yogic exercise group is presented in table – 3.5.

TABLE 3.5. PROGRAM SCHEDULE FOR 12 WEEKS FOR YOGA GROUP (GROUP II)

<table>
<thead>
<tr>
<th>S.No</th>
<th>Name of the asanas</th>
<th>Duration</th>
<th>Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Sukhasana</td>
<td>10 min</td>
<td>10 min</td>
</tr>
<tr>
<td>2.</td>
<td>Virasana</td>
<td>2 min</td>
<td>4 sec</td>
</tr>
<tr>
<td>3.</td>
<td>Utthita Trikonasana</td>
<td>2 min</td>
<td>6 sec</td>
</tr>
<tr>
<td>4.</td>
<td>Vakrasana</td>
<td>2 min</td>
<td>4 sec</td>
</tr>
<tr>
<td>5.</td>
<td>Pachimottanasana</td>
<td>2 min</td>
<td>6 sec</td>
</tr>
<tr>
<td>6.</td>
<td>Bhusangasana</td>
<td>2 min</td>
<td>6 sec</td>
</tr>
<tr>
<td>7.</td>
<td>Shalabasana</td>
<td>2 min</td>
<td>4 sec</td>
</tr>
<tr>
<td>8.</td>
<td>Usattasana</td>
<td>2 min</td>
<td>6 sec</td>
</tr>
<tr>
<td>9.</td>
<td>Nadi sodana pranayama</td>
<td>8 min</td>
<td>-</td>
</tr>
<tr>
<td>10.</td>
<td>Savasana</td>
<td>10 min</td>
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3.16 METHOD OF YOGASANA TRAINING

3.16.1 Sukhasana
In Sanskrit ‘sukham’ means ‘easy’. ‘Asana’ means ‘posture’. This asana is easy to perform. So it is called sukhasana.

**Posture:** Easy posture

**Position:** sitting position

**Procedure**

The subjects were instructed to do the following:

1. Sit cross legged on the mat with heals under opposite thighs and ankles crossed.

2. Keep their body straight, spine erect, abdomen drawn in, and head poised.

3. Place hands on respective knees, palms downwards, completely relax the body of all tension and close the eyes.

4. Watch their normal inhalation and exhalation, concentrate on breathing, shutting out all other thoughts from the mind.

**Duration:** Maintain the final posture for 10 minutes.

**Closure:** Slowly come back to the starting position by releasing the stages in the reverse order.

**3.16.2 Virasana**

Vira means a hero, warrior and champion. ‘Asana’ means ‘posture’. This sitting posture is done by keeping the knees together, spreading the feet and resting them by the side of the hips.
**Posture:** Warrior posture

**Position:** Sitting position.

**Procedure:**

The subjects were instructed to do the following:

1. Kneel on the floor. Keep the knees together and spread the feet about 18 inches apart.
2. Rest the buttocks on the floor. Keep the feet by the side of thighs, the inner side of each calf touching the outer side of its respective thigh. Keep the toes pointing back and touching the floor. Keep the wrists on the knees, palms facing up, and join the tips of the thumbs and forefingers. Keep the other fingers extended. Stretch the back feet.
3. Stay in this position with deep breathing. Then rest the palms on the knees for a while.
4. Interlock the fingers and stretch the arm straight over the head, palms up.
5. Stay in this position for a minute with deep breathing.
6. Exhale, release the finger lock, place the palms on the soles, bend forward and rest the chin on the knees.
7. Stay in this position for a minute with normal breathing.

**Duration:** Do this exercise and return to starting position.

**Closure:** In the final position try to relax the whole body as much as possible. Inhale, raise the trunk up, and bring the feet forward. Then slowly come back to the starting position by releasing the stages in the reverse order.
3.16.3 Utthita Trikonasana

In Sanskrit ‘kona’ means ‘Angle’, ‘Asana’ means ‘posture’. The posture is called ‘Angle pose’ because there are angles in different parts of the body. So is called konasana.

**Posture:** Angle posture

**Position:** Standing position

**Procedure:**

The subjects were instructed to do the following

1. Stand erect with feet parallel and 24” apart

2. Breath in 3 seconds while extending the arms wide apart at shoulder level.

3. Extend the arms and head backward for further chest expansion.

4. Bend down and touch the left foot toe with fingers of the right hand while exhaling 3 seconds.

5. Suspension for 6 seconds, while the spine and head are twisted and the face is turned upwards to look at the nail of left thumb which is extended straight above the head, in line with the ear.

6. Inhale 3 seconds and revert to original position (standing).
**Duration:** Repeat the same as above, touching right toe with left hand fingers and look at the nail of the right thumb.

Do this same for complete 6 rounds around 2 minute’s duration.

**Closure:** In the final position try to relax the whole body as much as possible. Then slowly come back to the starting position (standing position) by releasing the stages in the reverse order.

**3.16.4 Vakrasana**

In Sanskrit ‘vakram’ means ‘squeeze (or) twist’. It twists the spine and squeeze the belly. It is the ‘spinal twist’ posture. So it is called ‘Vakrasana’.

**Posture:** Spinal twist posture

**Position:** Standing position

**Procedure:**

The subjects were instructed to do the following

1. Stand erect with feet 12” apart

2. While 2 seconds inhaling, raise arms at shoulder level, palms turned downwards

3. While 2 seconds exhaling, twist body from waist up, moving hands and head to the right

4. Retain the position for 4 seconds in suspension of breath
5. Inhale 2 second and return to original position

6. Do the same exercise twisting on left.

**Duration:** Do this asana for 5 times slowly and rhythmically with continuous inhalation and exhalation for 2 minutes duration.

**Closure:** Slowly come back to the starting position by releasing the stages in the reverse order.

**3.16.5 Pachimottasana**

This posture is called ‘Pachimottasana’ because it stretches the posterior muscles of the body. In Sanskrit ‘Pachima’ means ‘posterior’ and ‘tan’ means ‘stretch’. Thus ‘Pachimottasana’ means stretching the posterior that is the back and hip muscles.

**Posture:** Back stretching posture

**Position:** Long sitting position

**Procedure**

The subjects were instructed to do the following:

1. Sit on the ground with feet together and legs straight. Place palms on the ground besides the hips.

2. While inhaling 3 seconds slowly raise the hands up through sideways (without bending elbows).
3. Slowly bring the hands downward on forward direction and try to catch the big toes with fingers during exhalation. If this is not possible try to hold the ankles, as near to the feet as possible.

4. Slowly bend the body forward and try to touch the knees with the forehead, without any strain, with 6 seconds suspension period.

**Duration:** Repeat the posture for six times. Do this practice for about 2 mins.

**Closure:** Slowly comeback to the starting position by releasing the stages in the reverse order with 3 seconds inhalation.

3.16.6 Bhujangasana

In Sanskrit ‘Bhujang’ means ‘cobra’. ‘Asana’ means ‘posture’. In this asana the shoulders are being lift and stretched to its maximum resembling a ‘cobra pose’.

**Posture:** Cobra posture

**Position:** Prone position.

**Procedure:**

The subjects were instructed to do the following:

1. Lie on the stomach with legs pointing out, heels together

2. Place palms on the floor at the side of the chest
3. Lift head and shoulders backwards without pressure on the palms while inhaling 3 seconds

4. Do not lift higher than the navel region, while retaining breath for 6 seconds

5. Breath out 3 seconds and return to starting position.

**Duration:** Do this exercise and return to starting position.

**Closure:** In the final position try to relax the whole body as much as possible. Keep their eyesight on the forehead. Then slowly come back to the starting position by releasing the stages in the reverse order.

### 3.16.7. Shalabasana

![Shalabasana](image)

In Sanskrit ‘Shalabham’ means ‘locust’. ‘Asana’ means ‘Posture’. When the legs are lifted as resembles to the posture of locust. So it is called as Shalabasana. It is also called ‘grasshopper pose’.

**Posture:** Locust posture.

**Position:** Prone position.

**Procedure:**

The subjects were instructed to do the following

1. Lie on the abdomen
2. Keep arms alongside body
3. While exhaling 2 seconds, lift the right leg straight up as far as possible without bending the knees.
4. Stay in suspension position for 4 seconds.
5. With inhalation of 2 seconds bring down the right leg and assume the starting position.
6. Repeat the same for left leg.
7. Having practiced alternate legs well, continue the same with both legs.

**Duration:** Do this exercise for 6 rounds around 2 minute’s duration.

**Closure:** Then slowly come back to the starting position by releasing the stages in the reverse order.

### 3.16.8. Ustrasana

![Ustrasana Image]

Ustra means a camel.

**Posture:** Camel posture

**Position:** Sitting positon

**Procedure**

1. Kneel on the floor, keeping the thighs and feet together, toes pointing back and resting on the floor.
2. Rest the palms on the hips. Stretch the thighs, curve the spine back and extended the ribs.
3. Exhale, place the right palm over the right heel and the left palm over the left heel. If possible, place the palms on the soles of the feet.

4. Press the feet with the palms, throw the head back and push the spine towards the thighs, which should be kept perpendicular to the floor.

5. Contract the buttocks and stretch the dorsal and coccyx regions of the spines still further, keeping the neck stretched back.

6. Remain in this position for about half a minute with normal breathing

7. Release the hands one by one and rest them on the hips. Then sit on the floor and relax. 

**Duration:** Do this exercise for 4 rounds around 2 minute’s duration.

**Closure:** then slowly come back to the starting position by releasing the stages in the reverse order.

3.16.9 Nadi sodhana Pranayama(without retention)

Nadi is a tubular organ of the body like an artery or vein for the passage of prana or energy. A nadi has three layers like an insulated electric wire. The innermost layer is called sira, the middle layer damani and the entire organ as well as the outer layer is called nadi. Sodhana meaning purifying or cleansing, so the object of Nadi sodhana Pranayama is the purification of the nerves.

**Position:** sitting position
Procedure

1. Sit in sukhasana and keep the back erect and rigid. Lower the head to the trunk. rest the chin between the collar- bones.

2. Stretch the left arm and rest the back of left wrist on the left knee. Perform Jnana Mudra with the left hand.

3. Bend the right arm at the elbow. Bend the index and middle fingers towards the palm, keeping them passive. Bring the ring and little fingers towards the thumb.

4. Place the right thumb on the right side of the nose just below the nozzle bone, the ring and little fingers on the left side of the nose just below the nozzle bone.

5. Press the ring and little finger to block the left side of the nose completely.

6. With the right thumb press the fatty tissue on the right side so as to make the outer edge of the right nostril parallel to the lower edge of the cartilage of the septum.

7. The right thumb is bent at the top joint and the tip of the thumb is placed at the right angle to the septum.

8. Empty the lungs completely through the right nostril and now inhale slowly, steadily and deeply through the right nostril, controlling the aperture with the tip of the right thumb near the nail. Fill the lungs to the brim (puraka). During this inhalation the left nostril is completely blocked by the ring and little fingers.

9. After full inhalation, lock the right nostril completely with the pressure of the thumb and release the pressure of ring and little fingers on the left nostril. Readjust them on the outer edge of the left nostril and keep it parallel to the septum. Exhale slowly, steadily and deeply through the left nostril. Empty the lungs completely. The pressure should be exerted from the inner sides of the tips of the ring and little fingers.

10. After full exhalation through the left nostril, change the pressure on it by adjusting the fingers. In the changed position, the tips of the ring and the little finger nearer the nails exert the pressure.
11. This completes the one cycle of nadi sodhana pranayama. Here the rhythm of breathing is as follows.

   a. Exhale through the right nostril
   b. Inhale through the right nostril
   c. Exhale through the left nostril
   d. Inhale through the left nostril
   e. Exhale through the right nostril
   f. Inhale through the right nostril
   g. Exhale through the left nostril
   h. Inhale through the left nostril
   i. Exhale through the right nostril
   j. Inhale through the right nostril ..... and so on.

12. Hypertensive patients should practice nadi sodhana pranayama without retention

13. Always conclude by lying down in savasana.

   **Duration:**

   Do this practice, 6 to 8 minutes.

3.16.10 Savasana
In Sanskrit, ‘sava’ means ‘corpse’. This posture derives its name from the fact that one lies on the back like a corpse with mind and body totally relaxed. This season is also called shanthi asana or savashantha asana.

**Posture:** Corpse posture

**Position:** Supine position

**Procedure**

The subjects were instructed to do the following:

1. Lie supine, feet approximately two feet apart hands 10 inches away from sides.
2. Create a ‘let go’ sensation, eyes closed.
3. Breathing normally and relax 10 minutes.

**3.17 CONTROL GROUP III**

Subjects in group III as control group did not participate in any physical exercise or specific training throughout the training program except the day – to – day regular activities which were performed by them earlier.

**3.18 STATISTICAL PROCEDURE**

The data collected from the three groups namely physical exercise group, yogic group and control group on selected physical, physiological and biochemical variables were statistically analyzed to determine the significant difference, if any, applying analysis of covariance (ANACOVA).

Ninety subjects were divided at random and assigned into three groups of thirty each. The group mean gains recorded by the various groups during the experimental period of 12 weeks in the criterion measures were tested for significance by applying “t” test. No attempt was made to equate the groups in any manner. Hence, to make adjustments for difference in the initial means the analysis of co-variance was used.

Whenever the ‘F’ ratio was found to be significant for adjusted post – test means, scheffe’s post hoc test was used to determine which of the paired mean difference was significant.