CHAPTER III

METHODOLOGY

The methodology used in this research involves the selection of subjects, selection of variables, selection of tests, reliability of instruments, tester competency and reliability of the data, orientation to the subjects, pilot study, training programmes, test administration, collection of data, experimental design and the statistical procedure that were used have been explained in this chapter.

SELECTION OF SUBJECTS

This study designed to find out the effect of Yoga and Aerobics on physical, physiological, haematological and bio-chemical parameters. To achieve the purpose of the study forty five women students of Madras Veterinary College, Chennai-7 falling in the age group of 18 to 23 years were selected randomly from the group of two hundred. The forty five women students were examined by a qualified medical practitioner and were found to be medically and physically fit to participate in the training programme.

The subjects were hostel inmates and hence there was no difference in their feeding habits and life pattern and hence were considered a homogeneous group. Three groups were randomly formed consisting of 15 subjects in each group. Group I was assigned Yoga Training and group II were subjected to Aerobics Exercise Training for a
duration of twelve weeks with three days per week, while group III were monitored as control group. The control group did not participate in any training programme.

SELECTION OF VARIABLES

The training of Yoga and Aerobics aims to improve all the functions of the body. Such kind of different categories of training concentrate of general fitness such as endurance, muscle power, speed, strength, agility and co-ordination. Yoga and Aerobics improves general fitness, which links in the transport of carrying oxygen from the air to the working muscle.

Yoga improves the functioning of the respiratory, circulatory, digestive and hormonal systems. Regular practice of yoga helps to keep our body fit, controls cholesterol level, reduces weight, normalizes blood pressure and improves heart performance. Yoga can be a powerful enhancement in regular training exercises.

Basic levels of physical fitness can be excellent maintained by indulging in a selected yogic routine. Yogic exercises deal with the vital organs of the body on which health depends.

Aerobics is also a very good way to develop musculoskeletal fitness while building strength, flexibility and co-ordination.

Aerobics is a good way to decrease percentage of body fat and to attain the other metabolic benefits of fitness.
"Aerobics" increases red blood cells count, which contains haemoglobin that is responsible for transporting oxygen in the blood, a decrease in resting blood pressure and a decrease in blood lipids. A regular aerobic exercise program will cause a reduction in blood fats such as cholesterol and triglycerides.

Training of yoga and aerobics builds stamina and increases the efficiency of muscles, heart and circulatory system. Yoga and Aerobics were selected as independent variables. Since Yoga and Aerobic exercise training causes changes in the above said variables, the following dependent variables were selected for this study as criterion variables.

**PHYSICAL VARIABLES**

1) Shoulder strength  
2) Abdominal Strength  
3) Speed  
4) Muscular power

**PHYSIOLOGICAL VARIABLES**

1) Breath Holding Time  
2) Resting Heart Rate  
3) Systolic Pressure  
4) Diastolic Pressure
HAEMATOLOGICAL VARIABLES

1) Red Blood Corpuscles
2) Haemoglobin
3) Packed Cell Volume

BIO-CHEMICAL VARIABLES

1) Blood Cholesterol
2) High Density Lipoprotein Cholesterol
3) Triglycerides
4) Low Density Lipoprotein Cholesterol
5) Total Protein

SELECTION OF TESTS

The purpose of this study was to assess the effect of Yoga and Aerobics on Physical, Physiological, Haematological and Bio-chemical variables. Physical Fitness variables such as abdominal strength, shoulder strength, speed and muscular power were measured by sit-ups, flexed arm hang, 50 mts dash and standing broad jump and Physiological variables such as Breath holding time, Resting heart rate, Blood pressure were measured by stop watch, stethoscope and sphygmomanometer. Haematological variables - Red Blood corpuscles, Haemoglobin and Packed Cell Volume were estimated in the Physiology laboratory of Madras Veterinary College. The biochemical variables such as Total Cholesterol, High density lipoprotein cholesterol, Triglycerides, Low density lipoprotein cholesterol and Total Protein were estimated in
centralized clinical laboratory at Madras Veterinary College, Chennai-7. Ten ml of blood was collected from every subject in fasting condition early in the morning under the supervision of a qualified doctor and it was assayed for the above said haematological and bio-chemical variables.

RELIABILITY OF INSTRUMENTS

Standard equipments were used for this study and these were supplied by Madras Veterinary College, Chennai. Stop watch, Stethoscope, Sphygmanometer, microscope, haemocytometer, RBC pipette, Neubeur counting chamber, Wintrobe hematocrit tubes, Photo electric centrifue, Wintrobe Stand and Bio systems Semi Auto Analyser instruments available in the Physiology Laboratory, Madras Veterinary College, Chennai-7. These instruments were supplied by the reputed scientific firms and the calibrations of the instruments were accepted as accurate enough for the purpose of the study.

TESTER COMPETENCY AND RELIABILITY OF THE DATA

To ensure uniformity and reliability of the testing techniques, the investigator had a number of practice sessions in the testing procedures with the guidance of experts. The test was conducted on the trial subjects by both the investigator and the experts. All the measurements were taken by the investigator with the assistance of their colleagues. Care was taken that each test item was administered by the same person, so that reliable results could be ensured. After trials and familiar with the test the
investigator tested the data on each of the variables and was correlated with the scores obtained by the expert on the same subject.

The tester reliability was established by test retest method. The intraclass co-efficient of correlation was obtained from ten subjects on selected physical, physiological, haematological and biochemical variables are given in Table I.
<table>
<thead>
<tr>
<th>S.No.</th>
<th>Variables</th>
<th>Co-efficient of Correlation ‘R’</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Physical Variables</strong></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Shoulder strength</td>
<td>0.897*</td>
</tr>
<tr>
<td>2.</td>
<td>Abdominal strength</td>
<td>0.921*</td>
</tr>
<tr>
<td>3.</td>
<td>Speed</td>
<td>0.937*</td>
</tr>
<tr>
<td>4.</td>
<td>Muscular power</td>
<td>0.982*</td>
</tr>
<tr>
<td></td>
<td><strong>Physiological Variables</strong></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Breath holding time</td>
<td>0.971*</td>
</tr>
<tr>
<td>6.</td>
<td>Resting Heart Rate</td>
<td>0.971*</td>
</tr>
<tr>
<td>7.</td>
<td>Systolic Blood Pressure</td>
<td>0.986*</td>
</tr>
<tr>
<td>8.</td>
<td>Diastolic Blood Pressure</td>
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</tr>
<tr>
<td></td>
<td><strong>Haematological Variables</strong></td>
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</tr>
<tr>
<td>9.</td>
<td>Red Blood Cells</td>
<td>0.921*</td>
</tr>
<tr>
<td>10.</td>
<td>Haemoglobin</td>
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<td>11.</td>
<td>Packed Cell Volume</td>
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<tr>
<td></td>
<td><strong>Bio-Chemical Variables</strong></td>
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<tr>
<td>12.</td>
<td>Blood Cholesterol</td>
<td>0.893*</td>
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<tr>
<td>13.</td>
<td>High Density Lipoprotein Cholesterol</td>
<td>0.982*</td>
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<td>14.</td>
<td>Triglycerides</td>
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</tr>
<tr>
<td>15.</td>
<td>Low Density Lipoprotein Cholesterol</td>
<td>0.897*</td>
</tr>
<tr>
<td>16.</td>
<td>Total Protein</td>
<td>0.937*</td>
</tr>
</tbody>
</table>

* Significant at 0.01 level. Table value of 0.01 level = 0.623

The test retest values were highly reliable above 0.01 level of significance.
ORIENTATION TO THE SUBJECTS

To make the subjects involve themselves in the training program an orientation class was arranged. The researcher has explained the purpose of the study to the subjects and their part in the study. Five sessions were spent to familiarize the subjects with the technique involved to execute the Yoga and Aerobics. The subjects were verbally motivated to attend the training sessions regularly. 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.

PILOT STUDY

A pilot study was conducted before finalizing the training program to ensure that the intensity and duration of the activities included in the Yoga and Aerobic training program were within the limits of the subjects capacity to produce the desired effects.

TRAINING PROGRAM

The training program scheduled with the duration and load were based on the results of the pilot study. The training program was carried out for a period of twelve weeks. The details of Yoga and Aerobics training programme was presented in Appendix I and II and the details of Yogasanas and Aerobics are given below.
DETAILS OF YOGASANAS

The Yogatraining program was scheduled for one session in the morning between 6.30 AM to 7.30 AM for 3 days (Monday, Wednesday and Friday) a week and the same was continued for 12 weeks. Five to ten minutes warm up and cool down periods were also included. Every 3 weeks the duration of the training program was gradually increased and also the number of repetitions. The following Asanas and Pranayamas were given:

Sitting Position

Padmasana

Sit on the ground. Spread the legs forward and place the right foot on the left thigh and left foot on the right thigh. Some persons like to place first the left foot on the right thigh and then to put the right foot on the left thigh. Either process is right. Let the left hand rest on the left knee and the right hand on the right knee. Let the tips of the thumbs of both the hands touch the tips of the index fingers. Keep the hand and the spinal column erect. Keep your eyes close or open.

Parvatasana

The subjects are asked to sit in Padmasana. Join the palms of the hands. Stretch the arms vertically up over the head.
Pashchimottanasana

Sit on the floor with the legs stretched straight in front. Bend the trunk forward and hold the feet with the thumbs and the first and the middle fingers. Exhale, and bend the trunk lower so that the head rests on the knees. Draw the abdomen in while bending lower. This will make the bending of the trunk easy. While bending bring the head between the arms. The aspirants having flexible spine can touch the knees with the head at the first attempt.

Vakrasana

Sit on the ground with the legs stretched out. Place the left leg near the right knee, stretching out the left hand behind the back, with the palm of the hand flat resting on the ground. Then press the left knee with the right arm and put the palm on the ground. Keep the waist erect and look as far backward as possible.

Ardha Matsyendrasana

Place the right heel near the anus (buttock). Do not move the heel from this position. Bend the left knee and put the left ankle on the outer side of the right knee. Let the right armpit rest on the outer side of the left thigh. Now push the knee backwards so that it touches the back part of the armpit. Then hold the toe of the left foot with the right hand. Twist the spine slowly exerting force on the joint of the left shoulder. Let the spine be twisted to the left side as far as possible. Turn the head to the
left side as far as it can go. Bring it to the line of the left shoulder. Take the left hand backwards and try to hold the right thigh with it. Keep the spine erect.

SUPINE POSTURES

Shavasna

Lie flat on the back. Place the hands a little away from the thighs with the palms up. Keep the eyes and the fists slightly closed. Stretch the legs out. Keep the heels together and the toes apart. Now close the eyes and breathe very slowly. Begin by consciously and gradually relaxing each part and each muscle of the body: feet, calves, knees, thighs, abdomen and hips. Then relax the muscle of the back, chest, arms, fingers, neck, head and face in that order. Inhale and exhale slowly and deeply. Relax the brain during exhalation. Direct your attention to the breathing, to the soul and to God.

Pavanamuktasana

Lie flat on the back. Keep the heels of both the legs together. Inhale deeply and bend the right knee towards the stomach and hold it with both the hands. Raise the head above the ground and bring the chin closer to the knee so that it touches the knee-cap. Exhale and press the muscle of the right abdomen with the right thigh. Keep the stomach pressed till the breath is suspended. This asana is called ‘Dakshina Pavanamuktasana’. If this asana is performed with the left leg, it is called
Vama Pavanamuktasana'. Practise this exercise with both the legs together. This is called 'Purna Pavanamuktasana'. While holding the legs with both the hands, exhale and control the breathing. Then slowly begin inhaling while stretching the legs out.

Uttanapadasana

Lie flat on the back. Keep the arms by the side of the body. Keep the heels and the feet together. Inhale slowly. Then lift the legs up slowly. Retain this position for six to eight seconds. Hold the breath. Bring the legs slowly down on the floor. Exhale. Take rest for six to eight seconds and repeat the same. In the beginning, practise this asana four times a day and gradually increase it to five or six times a day.

Setubandhasana

Lie on the back. Bend both the knees. Raise the thighs upward. Keep the back of the head, the neck and the shoulders firmly on the floor. Breath normally. Remain in this position for six to eight seconds.

Ekapada Uttanasana

Lie on the back. Keep the heels together. Put the hands on the floor by the side of the body. Stretch one of the feet forward and loosen the other leg. Inhale slowly. Slowly lift the tight leg up. Hold the breath. Remain in this position for six to eight seconds. Then slowly lower the leg without jerk and exhale.
PRONE POSITION

Ardha Shalabhasana

Lie on the stomach with the face down on the ground. Stretch both the arms beside the body and clench the fists tightly. The hands can also be placed under the thighs. Inhale and retain the breath till the completion of the asana. Pull the body and raise either of the legs by about 30 cms off the ground. Raise the leg as high as possible. Stretch the soles of the feet. Hold this position for five to thirty seconds. Then slowly bring the leg down on the ground. Exhale very slowly. Repeat this exercise with the other leg.

Purna Shalabhasana

Lie on the stomach with the forehead touching the ground. Stretch the arms beside the body. Keep the thumbs and the index fingers on the ground and clench the fists. Stiffen the body and raise the legs as high as possible. Stretch the soles of the feet. Put the legs, the thighs and the lower part of the abdomen up. Hold this position for five to thirty seconds and the rest the breath. Bring the legs down slowly and then exhale smoothly.

Bhujangasna

Lie on the floor with the face downwards. Relax all the muscles of the body. Place the palms on the ground underneath the shoulders. Slowly raise the head and the trunk like the hood of a serpent.
Bend the spine backwards. Stretch the feet backwards so that the toes touch the ground. This will stretch well the muscles of the back and the shoulders. There will be strain on the abdomen. Hold the breath and hold this position for six to eight seconds. Then exhale and bring the head to its original position. When you first lie on the ground, keep the chin touching the chest. Hold the breath till the head remains in the raised position. Then exhale slowly.

Dhanurasana

Lie prone on the floor on the stomach, face downwards. Relax the muscles. Keep the arms resting along side the body. Bend the legs at the knees. Raise the arms and hold the ankles with the hands. Raise the chest and the head. Fill the lungs with air. Straighten and stiffen the hands. Stiffen the legs also. The body now assumes the posture of a convex arch. If you lift the legs up, you can raise the chest. Hold the breath. Then exhale slowly. Attempt to keep the knees together.

In this asana, the abdomen supports the whole body. So practise this asana when the stomach is empty. The body in Dhanurasana pose gets good exercise if it is lightly rocked from left to right and forward and backward. Stay in this position as long as possible.

Makarasana

Lie on the ground face down, the chest touching the ground and both legs stretched out. Let the upper parts of the feet touch the
ground. Keep the heels upwards. Raise the arms and put them in front of the head and hold the middle part of the right upper arm with the left hand. Keep the head downwards and close the eyes. The head will rest on the arms. The parts of the arms from the elbows to shoulders, the abdomen, the thighs and the upper parts of the feet will touch the ground in a straight line. Relax the body while practicing this asana. Breath deeply and meditate on God.

KNEELING POSITION

Vajrasana

Bend the legs at the knees. Place the heels at the sides of the anus in such a way that the thighs rest on the legs and the buttocks rest on the heels. Support the whole body on the knees and ankles. Breath normally while performing this asana. The knees and the ankles will perhaps ache in the beginning but this ache or pain will disappear by itself. Stretch the arms and place the hands on the knees. Keep the knees close by. Sit erect keeping the trunk, the neck and the head in a straight line. This is a very simple posture and one can hold this posture with ease for a longer time.

Supta Vajrasana

Attain Vajrasna. Then with the support of the elbows lie with the back on the ground. The back should touch the ground. Interlace the arms and put them on the chest. Tilt the head as far back as possible.
Hold this position for eight to ten seconds. In the beginning, the back may not wholly touch the ground. The lower part of the back may remain in a raised position.

**Ushtrasana**

Kneel on the ground as in Vajrasana keeping the distance of about fifteen cms between the knees and between the heels. Breath deeply. Hold the right ankles firmly with the right hand and the left ankles with the left hand. Raise the arms and take them behind the neck. Breath in the normal way. Hold this position for six to eight seconds. Repeat this asana two or three times a day.

**Vrushasana**

Bend the right leg at the knee and place the heel under the anus. Place the left knee on the right knee in such a way that the left heel touches the right thigh. Sit erect and place the palm of the right hand on the knee. Then place the palm of the left hand on it. Breathe in the normal way. Direct your sight and attention to the navel.

**Bhoo-Namana-Vajrasana**

Attain Vajrasana. Slowly and cautiously bend the trunk forward. Take the arms to the back. Hold the right forearm with the left hand and the left forearm with the right hand. Fill the air in the lungs. Slowly exhale and stretch the neck downward so that the nose touches the ground.
STANDING POSITION

Vrukshasana

Stand on either leg. If difficulty is experienced to balance the body on one leg, take the support of a wall. Bend the other leg at the knee and place its heel at the root of the thigh of the former leg. Join the palms and raise the arms straight over the head as if you are making an obeisance to the sky. Straighten the elbows. Inhale slowly. Hold this position for about ten seconds. Then repeat the pose, standing on the other leg.

Santulanasana

Stand straight and erect on the ground. Keep the body straight and erect. Keep the arms on the sides. Bend either leg at the knee, keeping the knee facing downwards and the heel upwards. Hold the foot of this leg with the corresponding hand. Raise the other arm close to the ear. Hold this position for eight to ten seconds. Repeat this exercise with the other leg.

Utkatasana

Stand with the legs together. Raise the body on the heels and bring the arms straight over the head and join the palms. Then slowly lower the trunk. This asana does not require much strength to practise it. An aspirant should only know how to balance the body. One who is slim but has a strong physique can practise this asana with ease and comfort.
Trikonasana

Stand erect keeping a distance of about 75 cms between the feet. Stretch the arms sideways. Then raise them to the level of the shoulders. Let the palms face the ground. Stand erect. Then bend the trunk to the left side and touch the left toes with the left hand. Stretch the right arm upwards and straighten it. Keep the eyes fixed on the right arm. Bring the left hand near to the left toe. Keep the left hand in the same position and rotate the right arm from over the waist and bring it to the head level. Look downward. Then touch the right toes with the right hand. This is the final position of Trikonasana.

Chakrasana

Lie flat on the back. Draw the legs in till the heels are close to the hips and the soles touch the ground. The gap between the legs should be of four to six inches. Bend the arms at the elbows and place them on the ground on either side of the hand.

Raise the body from the waist to the hind part of the head and breath in the normal way. Tilt the head backwards as far as possible. Keep the hands straight. Keep the body steady. Do not shift either the arms or the legs from their positions. Raise the back as far as it allows it to do. Remain in this position for about a minute. Then inhale and lower the body to the ground and bring it to the original position. Then breath normally.
PRANAYAMA

Nadi Shodan

Sit in any comfortable asana and check which nostril is flowing more freely than the other. Suppose the left is free, close the right nostril with your thumb and start inhaling through the left very slowly.

Count 15 numbers during inhalation. Close your nostrils with your thumb and ring finger and hold your breath inside till you have finished counting so. Open the right nostril and exhale the air slowly in 20 counts.

Kapalabhati

Sit in either the Padmasana or the Siddhasana position. Place the hands on the knees. Lower the eyes. Inhale and exhale quickly and forcefully like the bellows of a blacksmith. This exercise should be done with full force so that the body perspires.

Start with one exhalation in a second. Then gradually increase the speed to get two exhalations in a second. In the beginning, complete one cycle of ten exhalations. Then gradually increase the cycles.

Ujjayi

Sit in the position of Padmasana or Siddhasana. Close the mouth. Contract the lower part of the tongue and the glottis and inhale rapidly and deeply through both the nostrils and fill the lungs up to the
brim. Then practise Kumbhaka for as much time as possible. Then close the right nostril with the right thumb and slowly exhale through the left nostril. While inhaling, expand the thoracic cage. This makes a faint sobbing sound as the glottis is half-closed.

Sitakari

Sit in the position of Pasmasana or Siddhasana. Let the tip of the tongue touch the palate. The middle part of the tongue should touch the lips. Draw the air in through the mouth with a sibilant sound (si...si...si...). Hold the breath for as possible. Then exhale through the nostrils.

AEROBIC EXERCISE TRAINING

The Aerobic exercise training program was scheduled for one session in the morning between 6.30 A.M. to 7.30 A.M. for 3 days (Tuesday, Thursday and Saturday) a week and the same was continued for 12 weeks. Every 3 weeks the duration of training program was gradually increased by means of intensities, repetitions and durations. The exercises for the subjects were given according to the following order.

1. Marching  
   (i) Left leg up and down
   (ii) Right leg up and down

2. Side to side  
   Right leg move apart and left leg tap down
   (Both sides right and left alternate)
3. Double side to side: Right leg apart and left leg tap down and repeat the same towards right one more time (Both sides right and left alternate)

4. Grapevine: Right leg move apart left leg tap down behind right leg and Right leg move apart bring left leg parallel (close) to the right leg. (Both sides right to the right leg)

5. Knee Up: Right knee up • and down (Both sides right and left alternate)

6. Leg curl: Right leg apart and curl left leg (Both sides right and left curl alternate)

7. Touch out: Right leg stretch apart and toe touching the ground (Both sides right and left alternate)

8. Side Lunge: Right leg stretch sideward and lunge. (Both sides right and left alternate)

9. Back Lunge: Right leg stretch at the back and lunge. (Both sides right and left alternate)

10. Kick front: Right knee up and kick forward (Both sides right and left alternate)

11. Kick side: Right leg stretching and kick sideward (Both sides right and left alternate)
12. Step-Touch: Right leg diagonally forward on right side; left leg close to the right leg; left leg diagonally forward on left side; right leg close to the left leg; repeat the same backward. (Both sides right and left alternative).

13. 'L' Shape: Right leg apart, left leg tap down close to right leg and right turn; left leg apart, right leg tap down close to left leg. (Both sides right and left alternate)

14. 'V' Shape: Right leg diagonally forward right side and left leg diagonally forward left side. Right leg back to the center and left leg back to the center close to the right leg. (Both sides right and left alternate)

The Aerobic weekly training program schedule are given in Appendix -II.

COLLECTION OF DATA

The data on physical fitness variables were collected by administering AAHPERD Youth Fitness test. Stop watches and measuring tape were used to measure the physical fitness variables. Fasting blood sample was collected from every subject early in the morning and it was assayed for Red Blood corpuscles, packed cell volume and Haemoglobin. The readings were taken from Haemoglobinometer tube and Haemoglobinometer pipette and Spynomanometer and stop watches were used to monitor the measurements for breath holding time, pulse
rate, systolic pressure and diastolic pressure. Bio-chemical variables such as total cholesterol, HDL-Cholesterol, Triglycerides, LDL-Cholesterol and Total protein were assayed in the centralized clinical laboratory of Madras Veterinary College, Chennai-7. The data was collected two days before (pre test) and after (post test) the experimental period of 12 weeks.

ADMINISTRATION OF TESTS

PHYSICAL FITNESS VARIABLES

To assess the students performance on physical variables, the following tests were administered.

(i) Shoulder strength - Flexed Arm Hang (Women)
(ii) Abdominal strength - Sit-ups
(iii) Speed - 50 mts Dash
(iv) Muscular power - Standing Broad Jump

SHOULDER STRENGTH : Flexed Arm Hang (Women)

Purpose

The shoulder strength was measured through the Flexed Arm Hang.

Administration

The subjects performed the flexed arm hang in the Horizontal bar. The subjects grasped the bar with an overhand grasp. The subject
raised her body off the floor with the help of assistants to a position where in the chin was above the bar. The elbows were fixed and the chest was closed to the bar. The subject held the hang position as long as possible. The stop watch was started as soon as the subject assumed the starting position and was stopped up to the subject maintained the hanging position.

Scoring

The score was the elapsed time to the nearest second that the subject maintained the proper hanging position.

ABDOMINAL STRENGTH

Purpose

The abdominal strength was measured through bent knee sit-ups.

Administration

The starting position of the test was a back lying position with knees flexed, feet on the floor and heels between one foot from the buttocks. The hands are positioned behind the neck and fingers are clasped. A partner held the examinee's feet to keep him in contact with the testing surface. The examinee curled to a sitting position, touching the elbows to the opposite knee. The examinee curled back down to the floor until the mid-back contacted the testing surface. Another sit-up was then attempted.
**Scoring**

One point was scored for each correct sit-up. The score was the maximum number of sit-ups completed in 60 sec.

**SPEED**

**Purpose**

The purpose of the test was to measure the speed of an individual.

**Administration**

The subject took a position behind the starting line. The starter used the command, "ready" and "go". The latter was accompanied by a downward sweep of the arm as a signal to the timer. The subjects ran across the finish line. One trial was permitted.

**Scoring**

The score was the elapsed time to the nearest one tenth of a second between the starting signal and the instant of the subject crossed the finishing line.

**MUSCULAR POWER**

**Purpose**

The explosive power was measured through standing broad jump.
Administration

The subject stand behind the take off line with his feet several inches apart. Before jumping, the subject dips at the knees and swunged the arms backward. The subject then jumped forward by simultaneously extending the knees and swing the arms forward. Three trials were given. Measurement was taken from the heel mark nearest to take-off line.

Scoring

The score was the distance between the take off line and the nearest point where any part of the subjects body touched the floor. The best of the three trials was recorded.

PHYSIOLOGICAL VARIABLES

1. Breath Holding Time
2. Resting Heart Rate
3. Blood Pressure (Systolic and Diastolic)

MAXIMUM BREATH HOLDING TIME

Purpose

To find out the ability of the subject to hold her breath for her maximum duration.

Instrument

A stop watch, a nose clip.
Procedure

The test consisted of a voluntary forced inhalation and holding the breath as long as possible without inhaling or exhaling after holding the breath. The subject was asked to sit on the chair and the nose clip was clamped over the nostrils. The subject then took a voluntary forced maximal inhalation through his mouth. When the subject finished inhalation as indicated by raising the index finger by the subject, the stop watch was started. It was stopped as soon as the subject exhaled. To prevent exhalation or inhalation through the mouth during the recording time the subject was asked to couple his lips tightly. To detect exhalation or inhalation through mouth the investigator maintained a careful watch on the subject's mouth. Two trials were permitted for each subject and the best time was recorded.

Scoring

The best of two breath holding time was recorded in seconds as score.

BLOOD PRESSURE

Purpose

To measure the blood pressure.

Instrument

Sphygmomanometer and stethoscope.
Procedure

The subjects were given an adequate time to relax on the chair in a comfortable position before the blood pressure was recorded. While taking the blood pressure the subjects right arm was completely made bare to make certain that the clothing did not constrict the blood vessels. The instrument was kept at the level of the heart on the table. The blood pressure measure was taken with the subjects in the sitting position, the fore arm being kept straight in a relaxed position on the table. The pressure cuff was wrapped around the arm evenly, the lower edge being placed approximately on inch above anti cubical space. The stethoscope receiver was placed firmly over the bronchial artery in the anti cubical space taking care that the stethoscope was not in contact with the cuff. The cuff was inflated until the artery was fully pressed so that no pulse beat was heard. When the pulse beat was not audible, air was slowly released by opening the air valve of the rubber tube and the systolic stroke of the heart sent the blood spurt into the artery and the peak of the systolic stroke the first pulse beat become audible at which instant the reading of the mercury was recorded in millimeter. With the gradual release of the air the pulse beat became more and more audible and then sound became muffled and then disappeared. This indicated blood pressure at the diastolic stage and the reading was recorded in millimeter.
RESTING HEART RATE

Purpose

To find out the resting heart rate.

Instrument

A stop watch

Procedure

The pulse rate of the subjects was recorded in the sitting position. Before taking the normal pulse rate subject was asked to relax in the sitting position for 30 minutes. The pulse rate was taken at the wrist in such a manner that palpitation was clearly felt by the finger tips. The measurement of palpitation was counted for 30 seconds and doubled to record for one minute.

HAEMATOLOGICAL VARIABLES

RED BLOOD CORPUSCLES

Purpose

To find out the number of red blood cells in the blood.

Apparatus

Haemocytometer and coverslip, RBC pipette, Hayem’s fluid.
Procedure for RBC Counting

(1) The Haemocytometer was cleaned and focused under high power of a microscope and the rulings were observed. A clean coverslip was placed over the chambers.

(2) A clean dry RBC pipette was taken and blood was drawn up to 0.5 mark. The tip of the pipette was wiped.

(3) Hayem’s fluid was drawn into the pipette up to 101 mark carefully avoiding air bubbles.

(4) The contents of the pipette were gently mixed taking care to avoid haemolysis.

(5) First few drops that come out of the pipette were discarded to avoid pure Hayem’s fluid. Then a small drop of the mixture from pipette slip was let under the cover slip by applying the same at the edge of the cover slip. Now the mixture is held in the NEUBEUR counting chamber.

(6) Five minutes was allowed for the cells to settle on the Haemocytometer and then the number of cells in 1 square millimeter area were counted.

(7) During routine tests only cells in the first five squares out of 25 squares were counted.
HAEMOGLOBIN CONCENTRATION

Purpose

To find out the percentage of haemoglobin concentration in blood.
To assess the haemoglobin concentration was estimated by Cyanmethalmoglobin method was used.

Apparatus and Chemicals Required: Sterilized syringe with needle, cotton, spirit stopper, test tube, rubber bung and drabkin's solution, photoelectric calorimeter.

Procedure: 2ml of EDTA blood from the subjects were taken in a test tube and 5ml of drabkin's solution was also added to the test tube, stopper tube by means of a rubber bung and fix the solution through inverting several times.

1. Allow it to stand for 10 minutes at room temperature.
2. Compare the values with the standard in a photoelectric calorimeter.
3. Drabkin's solution was a mixture of 18ml solution bicarbonate, 0.2 gm of potassium cyanide and 0.2g of potassium ferricyanide and 1 litre of distilled water.
PACKED CELL VOLUME

Purpose

To find out the packed cell volume in the blood.

Apparatus

Wintrobe hematocrit tubes, pipette, centrifuge, wintrobe stand.

Procedure

Collected venous blood in a wintrobe's anti coagulant bottle. Shake the blood to resuspend the cells properly. Fill the blood in to wintrobe tube up to 10 mm mark with the help of a pasteur pipette having a capillary long enough of reach the bottom of the wintrobe tube centrifuge for 30 min at 3000 rev/min in a centrifuge of 22.5 cm radius at a speed of 3800 rev/min centrifuge of 15 cm radius. Read the height of red cell column and express it as a percentage of whole blood. This shows the concentration of the packed cell volume.
BIO-CHEMICAL VARIABLES

TOTAL CHOLESTEROL

Collection of Blood Sample

Venous blood was collected in the early morning after the subjects were abstained from food and drink except water for 12 hour to estimate the selected biochemical variables. Ten ml of blood was drawn from the subjects anti cubical vein by venous puncture method and the blood was immediately transferred into sterilized small bottles. Blood samples were collected before and after the experimental period of 12 weeks. All biochemical parameters were done by Bio-systems semi auto analyser. (Model BTS-320)

Method

Enzymatic colorimetric method recommended by Siedel et al. and Kuattermann et al., was applied for estimation of cholesterol. Bio systems Semi Auto Analyser (model BTS-320) was used for this purpose. Enzymatic colorimetric method, “Enzokit” supplied by BMK laboratories, Rable, Thane, Maharashtra under the licence from Boehringer Mannheim GMbH, Mannheim, Germany was used for this purpose.

Test Principle

\[
\text{Cholesterolesterase} \quad \text{Cholesterolesters} + \text{H}_2\text{O} \longrightarrow \quad \text{Cholesterol} + \text{RCOOH}
\]
Cholesterol Oxidase

\[
\text{Cholesterol} + O_2 \rightarrow \Delta^4\text{-Cholesterolone} + H_2O_2
\]

\[
2H_2O_2 + 4 \text{ Aminophenazone} + \text{Phenol} \rightarrow 4-p \text{ Benzoquinone - POD} \rightarrow \text{Monoiminol - phenazine} + 4 H_2O_2
\]

**Procedure**

Ten µl of serum, standard and distilled water (blank) was incubated with 1000 µl of the reagent at 37°C for 5 minutes and the absorbance of the sample and standard were read at 546 nm within 1 hour against reagent blank.

Serum Cholesterol is expressed as mg/dl.

**HIGH DENSITY LIPOPROTEIN CHOLESTEROL**

**Method**

HDL - Cholesterol was estimated by applying enzymatic colorimetric method, as recommended by Burstein et al., and Lopes et al., Bio Systems Semi Auto Analyser (Model BTS-320) was used for this purpose.

**Principle**

Chylomicrons, VLDL (very low density lipoproteins) and LDL (low density lipoproteins) are precipitated by adding phosphotungstic acid and magnesium ions to the sample. Centrifugation
leaves only the HDL (high density lipoproteins) in the supernatant, their cholesterol content is determined enzymatically by cholesterol oxidase paraaminophenazone method.

Reagents

Phosphotungstic acid - 0.44 mmol/l
Magnesium chloride - 20 mmol/l

Procedure

To 200 μl of sample, 500 ml of precipitating reagent was added, mixed and kept for 10 minutes at room temperature. The tubes were centrifuged at 4000 rpm for 10 minutes and 100 μl of clear supernatant was removed for cholesterol estimation by cholesterol oxidase-paraaminophenazone method with 1000 μl of the reagent.

Serum HDL cholesterol is expressed as mg/dl.

TRIGLYCERIDES

Method

Serum triglycerides were estimated by GPO-PAP method as recommended by Fossati and Bio-systems Semi Auto Analyser (Model BTS-320) was used for this purpose.
**Test Principle**

\[
\text{Triglycerides} + 3 \text{H}_2\text{O} \quad \xrightarrow{\text{Lipase}} \quad \text{Glycerol} + 3 \text{RCOOH}
\]

\[
\text{Glycerol} + \text{ATP} \quad \xrightarrow{\text{Glycerol Kinase}} \quad \text{Glycerol-3-phosphate} + \text{ADP}
\]

\[
\text{Glycerol-3-phosphate} + \text{O}_2 \quad \xrightarrow{\text{Glycerol-phosphate Oxidase}} \quad \text{Dihydroxyacetone Phosphate} + \text{H}_2\text{O}_2
\]

\[
\text{H}_2\text{O}_2 + 4 \text{aminophenazone} + 4\text{-Chlorophenol} \quad \xrightarrow{\text{Peroxidase}} \quad 4\cdot (\text{P-benzoquinone-mono-imino})\cdot\text{Phenazone} + 2\text{H}_2\text{O} + \text{Hcl}
\]

**Procedure**

To 10 µl of the sample, standard and distilled water (blank) 1000 µl of the reagent were added, mixed and incubated for 10 minutes at 29°C and the absorbance of the test and standard were read at 500nm, against the reagent blank.

Serum triglycerides is expressed as mg/dl.

**LOW DENSITY LIPOPROTEIN CHOLESTEROL**

LDL-Cholesterol was calculated from the Total Cholesterol, Triglycerides and HDL cholesterol levels, by using the following formula recommended by Friedwald, Levy and Fredickson.

\[
\text{LDL-C} = \text{Total Cholesterol} - \left( \text{HDL Chol} + \frac{\text{TGL}}{5} \right)
\]
TOTAL PROTEIN

Total protein was estimated using Biuret method as recommended by Doumas, Bio-systems Semi Auto Analyser (Model BTS-30) was used for this purpose.

Procedure

To 20 μl of the sample, standard and distilled water (blank) 1000ml of the reagent were added, mixed and incubated for 15 minutes at 29°C and the absorbance of the test and standard were read at 540 nm against the reagent blank.

Normal reference values

Serum and plasma: 6.8 - 8.0 g/dl.

EXPERIMENTAL DESIGN AND STATISTICAL PROCEDURE

The study was based on the groups pre-test and post-test design. The subjects chosen for the study were divided into two experimental groups and one control group, each group consisting of 15 subjects. Of the two experimental groups, one was assigned Yoga and the other was given Aerobics. The subjects of the control group were not allowed to participate in any of the training programme except in their routine activities. The data was collected for the selected Physical, Physiological, Haematological and Bio-chemical variables first at the beginning (pre-test) and finally at the end of the experimental period of 12 weeks (post-test). The study was aimed at mainly in finding out the
effects of training on selected dependent variables. In addition to that it had been analysed if there was any significant difference between the Yoga and Aerobics training program.

The data collected from the three groups were statistically analysed for significance, the analysis of covariance (ANCOVA) was used and the ‘F’ ratio was found out. Hence to make the adjustments for difference in the initial means and test the adjusted post test means for significant difference, the analysis of covariance was used. Since, three groups were involved, whenever the ‘F’ ratio was found to be significant for adjusted post means, Scheffe’s Post Hoc test was followed to determine which of the paired means difference was significant. In all the cases to test the significance, 0.05 level of significance was fixed. The data were analysed by computer using statistical packages.