Chapter III

METHODOLOGY
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All activities in research methodology, the behaviours of performing the different expansion of demonstration is evidently inevitable for the progress of invention in research. The research methodology leads the order of following by which the research scholar begins with the primary solution for the matter and reach its final destination.

This chapter describes the procedures followed in the selection of subjects, selection of variables, selection of tests, competency of the tester, instruments' reliability, reliability of data, orientation of the subjects, collection of data, administration of tests, experimental design and statistical procedures were discussed.

Selection of Subjects

The purpose of the study was to find out the effect of walking and physical exercises on selected physical and physiological variables of cardiovascular and diabetic patients. To achieve the purpose of the study, 40 male patients (20 diabetic - type II and 20 cardiac-mild patients) were selected randomly as subjects. Their age ranged from 40 to 50 years. The selected subjects were randomly assigned to four groups of ten each such as four experimental groups. There is no control group.
The subjects were free to withdraw their consent in case they felt any discomfort during the period of their participation. But there were no dropouts in the study. A qualified physician examined the subjects and medically they were fit for the tests.

**Selection of Variables**

The investigator reviewed the available scientific literature pertaining to the problem under study from books, journals magazines, research papers and also consideration of the feasibilities and criteria of availability of instruments relevant to the present study.

Regular physical activity provides enormous health benefits. It helps to reduce heart disease, cancer, type II diabetes and many other diseases and metabolic conditions. Regular fitness exercise is also highly beneficial for weight reduction and weight maintenance, and may
improve brain chemistry to reduce depression. By contrast, health studies that have monitored the wellbeing of large groups of people over many years clearly show that inactivity significantly increases the risk of overweight, obesity and chronic diseases.

Research studies on walking like the Nurses' Health Study, Health Professionals Follow-up Study, Women's Health Study, Harvard Health Study, National Health Interview Survey, Honolulu Heart Program, and others show that this simple form of exercise substantially reduces the risk of developing heart disease, stroke, and diabetes in different populations. The following physical and physiological variables were selected for the study,

**Dependent Variables**

a) **Physical Variables**

1) Cardiovascular Endurance  
2) Abdominal Strength  
3) Flexibility  
4) Balance

b) **Physiological Variables**

1) Resting Heart Rate  
2) Blood Pressure  
3) Blood Sugar  
4) Total Cholesterol

**Independent Variables:**

a) Walking  

b) Physical Exercises
Subjects
N=40

Walking Group
(n=20)

Physical Exercise Group
(n=20)

Cardiovascular Patients
(n=10)

Diabetic Patients
(n=10)

Cardiovascular Patients
(n=10)

Diabetic Patients
(n=10)

Pre Test - Training - Post Test

Physical Variables
1) Cardiovascular endurance
2) Abdominal strength
3) Flexibility
4) Balance

Physiological Variables
1) Resting Heart Rate
2) Blood Pressure
3) Blood Sugar
4) Total Cholesterol

Dependent 't' test – Within the group
ANCOVA – Between the group
Scheffe’s Test – Post hoc test
Selection of Tests

The present study was undertaken primarily to find out the Effect of Walking and Physical Exercises on Selected Physical and Physiological Variables of Cardiovascular and Type II Diabetic Patients. As per the available literature, the following tests were used to collect relevant data on the selected criteria variables and they were presented in the table I.

**TABLE I (A)**
**TESTS SELECTION**

<table>
<thead>
<tr>
<th>S.NO</th>
<th>Criterion variables</th>
<th>Test Items/Instrument</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cardiovascular Endurance</td>
<td>One mile run/walk</td>
</tr>
<tr>
<td>2</td>
<td>Abdominal Strength</td>
<td>Sit-ups</td>
</tr>
<tr>
<td>3</td>
<td>Flexibility</td>
<td>Sit and reach test</td>
</tr>
<tr>
<td>4</td>
<td>Balance</td>
<td>Standing Balance Test</td>
</tr>
<tr>
<td>5</td>
<td>Resting heart rate</td>
<td>Radial artery method</td>
</tr>
<tr>
<td>6</td>
<td>Blood Pressure</td>
<td>Automatic digital blood pressure monitor</td>
</tr>
<tr>
<td>7</td>
<td>Blood Sugar</td>
<td>Method of Dubowski</td>
</tr>
<tr>
<td>8</td>
<td>Total Cholesterol</td>
<td>Enzymatic calorimetric method</td>
</tr>
</tbody>
</table>
**Competency of the Tester**

To ensure that the investigator is well versed in techniques of conducting the test and had a number of practice sessions in the testing procedures. The investigator took all the measurements with the assistance of Dinu.M.R, Assistant Director Physical Education, Sanskrit University Kalady, Kearala who was well acquainted with the test and their testing procedures.

**Instruments’ Reliability**

To conduct the tests on selected criterion variables, instruments like stop watch, measuring tape, sit and reach box, automatic digital blood pressure monitor, stethoscope were purchased from Department of Physical Education, Mahatma Gandhi University, Kottayam, Kerala. These instruments were all in good condition. They were purchased from the reliable companies and their calibrations were accepted as accurate enough to serve the purpose of this study. The physiological variables were tested in Modern Diagnostic Center, Kottayam and Divine Lab, Changanacherry, Kerala by qualified medical personnel.

**Reliability of Data**

Test and retest method was followed in order to establish the reliability of data by using ten subjects. All the dependent variables selected in the present study were twice for the subjects by same personals under similar conditions. The intra class co-efficient correlation was used to find out the reliability of the data and the results have been presented in table II.
TABLE II
INTRA CLASS CO-EFFICIENT OF CORRELATION ON SELECTED DEPENDENT VARIABLES

<table>
<thead>
<tr>
<th>S.NO</th>
<th>Criterion variables</th>
<th>r-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cardiovascular Endurance</td>
<td>0.84*</td>
</tr>
<tr>
<td>2</td>
<td>Abdominal Strength</td>
<td>0.89*</td>
</tr>
<tr>
<td>3</td>
<td>Flexibility</td>
<td>0.82*</td>
</tr>
<tr>
<td>4</td>
<td>Balance</td>
<td>0.89*</td>
</tr>
<tr>
<td>5</td>
<td>Resting pulse rate</td>
<td>0.82*</td>
</tr>
<tr>
<td>6</td>
<td>Blood Pressure</td>
<td>0.83*</td>
</tr>
<tr>
<td>7</td>
<td>Blood Sugar</td>
<td>0.83*</td>
</tr>
<tr>
<td>8</td>
<td>Total Cholesterol</td>
<td>0.88*</td>
</tr>
</tbody>
</table>

*Significance at 0.05 level of performance.
(Table value required for significance at 0.01 level of confidence is 0.77).

Since the obtained ‘r’ values were much higher than the required value, the data were accepted, as reliable in items of instrument, tester and the subject.

Orientation to the Subjects

Prior to the administration of the test items, the subjects were oriented with the purpose of the study and the importance of the training programme. The testing procedures of all the physical and physiological variables were explained to the subjects by the investigator to get their co-operation as well as to secure reliable data. The investigator explained the beneficial effects of the training programme in order to get active participation of the subjects.
**Training Programme**

During the training period, the experimental groups underwent walking and physical exercises. The subjects of the experimental group underwent their respective training programme for twelve weeks with four days per week. On every day of the training session the exercises were done for approximately 1 hour which included warming-up and warming-down.

The experimental group underwent their respective training programme under the supervision of the investigator. The subjects were carefully monitored and questioned about their health status throughout the training programme. None of the subjects reported any difficulty in following the training programme. The training schedules for the experimental groups are presented below.

**Duration of the Exercise Session**

All the subjects do the physical exercise and walking session's alternate days for each week. After 10 minutes warm-up, the duration of each physical exercise and walking session was 15 to 20 minutes at the start of the study, and it was gradually increased 25 to 30 minutes at 10th week and at the end of the study it was increased to 35 minutes. Physical exercise and walking programme was at mild intensity of 55 to 60% of heart rate. After that warming-down at 10 minutes
It was not possible to control the dietary habits of the patients they were at their own will. Care was taken to control the factors like drugs. The medical history of the patients was recorded before the exercise programme.

Programme schedule

<table>
<thead>
<tr>
<th>SUN</th>
<th>MON</th>
<th>TUE</th>
<th>WED</th>
<th>THU</th>
<th>FRI</th>
<th>SAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breathing exercise</td>
<td>Breathing Exercise</td>
<td>Warm-up exercise</td>
<td>Rest</td>
<td>Breathing exercise</td>
<td>Warm-up exercise</td>
<td>Rest</td>
</tr>
<tr>
<td>Warm-up exercise</td>
<td>Warm-up exercise</td>
<td>Stretching</td>
<td>Rest</td>
<td>Warm-up exercise</td>
<td>Range of motion</td>
<td>Rest</td>
</tr>
<tr>
<td>Range of motion</td>
<td>Exercise/walking</td>
<td>Exercise/walking</td>
<td>Exercise/walking</td>
<td>Exercise/walking</td>
<td>Exercise/walking</td>
<td>Exercise/walking</td>
</tr>
</tbody>
</table>

Schedule for 12 weeks of Exercise group (Group 1)

- Mode of exercise: Exercise – by count
- Frequency: Alternate days for 12 weeks
- Duration: Approximately one hour
- Intensity: Mild intensity 55-60 %

Exercise programme for a session

- 5 – 8 minutes: Breathing exercise
- 10 minutes: Warm up
- 25 – 30 minutes: Exercise
- 10 minutes: Cool down exercise with light walking
Breathing

Breathing session - Breathing is important because it is the only means to supply one's body and its various organs with the supply of oxygen which is vital for our survival.

Exercise 1

- Stand straight, feet apart about shoulder width, look straight, shoulder level arms placed comfortably on hips.
- Inhale through the nose slowly and comfortably, hold the breath for three to five seconds and then slowly exhale through the nose.
- Repeat five times after an interval of five seconds between each repetition.

Exercise 2

- Stand straight, feet apart about shoulder width, look straight, chin parallel to the ground, arms placed comfortably in front of the thighs.
- Slowly inhale and simultaneously raise the arms upward closer to the ear, palms facing each other, fingers pointing upward and hold the breath for 3 to 5 seconds and exhale slowly and arms down.
- Repeat 5 times after an interval of five seconds between each repetition.
Exercise 3

- Stand straight, feet apart about shoulder width, look straight, chin parallel to the ground, arms close to body
- Inhale slowly and simultaneously raise the arms side wards, closer to the ears, fingers pointing upwards and hold the breath for 3 to 5 seconds.
- Slowly exhale, simultaneously arms down, back to the starting position.

Warm up

Warm-up – warm-up session prepared the skeletal muscles, heart and lungs for progressive increase in further exercise.

Warm up Exercise

- Head tilt (side to side, up and down), Neck rotation.
- Arms stretch
- Bend (side)
- Shoulder shrugs
- Leg stretch
- Calf stretch (10 seconds)
- Quadriceps (10 seconds)

Range of Motion

Exercise 1

- Stand straight, Feet apart about shoulder width, arms extended forward with fist closed.
- Rotate your wrist clock wise and anti clock wise.
Exercise 2

- Stand straight, Feet apart about shoulder width, arms close to the body.
- Rotate the arms forward and then backward

Exercise 3

- Stand straight, Feet apart about shoulder width, arms placed on hip
- Slowly turn the neck to right side left side and back to position.

Exercise 4

- Stand straight, Feet apart about shoulder width, arms raised side ward, at shoulder level and parallel to the ground, palms facing downward.
- Slowly twist the trunk to the right side, maintain the position for 3 seconds and back to position.
- Repeat the same towards the left side

Stretching Exercise

Neck

- Stand straight, arms close to the body.
- Turn head to the right side, then left.
- Hold for 5 seconds each side
- Repeat 4 to 5 times.

Shoulder

- Interlock fingers and palms out
- Extend arms in front at shoulder height
- Hold for 10 seconds, relax, and repeat 4 to 5 times.
Triceps

- Keep knees slightly flexed.
- Stand with arms overhead
- Hold elbow with other hand
- Pull elbow behind head gently and slowly learn to side until mild stretch is felt.

Calf

- Stand little away from wall and lean on it with forearms, head resting on arms.
- Place right foot forward, knee bend, left leg, straight behind, and feet keep flat.
- Slowly hip move forward, until feel stretch in calf of left leg.
- Maintain the position 10 – 15 seconds.
- Repeat other side.

Inner thigh and Groin

- Stand straight feet apart about shoulder width.
- Bend right knee slightly and move left hip down ward towards right knee.
- Hold for 10 – 15 seconds
- Repeat the same on left leg.
EXERCISE. No. 1

Count 1  Attention position: Left leg take one-step at the left side, arms stretch sideward, elbows straight, fingers pointing sideward.

Count 2  Stretch the hands upward, elbows straight, fingers pointed, palms facing each other.

Count 3  Same as Count 1.

Count 4  Back to attention position.

Count 5  Right leg take one step at the right side, arms stretch sideward, elbows straight, fingers pointing sideward.

Count 6  Stretch the hands upward, elbows straight, fingers pointed palms facing each other.

Count 7  Same as Count 5.

Count 8  Back to attention position.

EXERCISE. No. 2

Count 1  Attention position: Left leg takes one-step forward, arms stretch forward, elbows straight, fingers pointed forward and palms facing each other.

Count 2  Arms raise upwards elbows straight, fingers pointed forward and palms facing each other.

Count 3  Same as Count 1.

Count 4  Back to attention position.

Count 5  Right leg takes one step forward, arms stretch forward, elbows straight, fingers pointed forward and palms facing each other.

Count 6  Arms raise upwards, elbows straight, fingers pointed forward and palms facing each other.
Count 7  Same as Count 5.
Count 8  Back to attention position.

**EXERCISE. No. 3**

Count 1  Attention position: Stretch the hands sideward, elbows straight, fingers pointed palms facing downward.
Count 2  Arms upward raise and clap.
Count 3  Same as Count 1.
Count 4  Back to attention position.
Count 5  Stretch the hands sideward, elbows straight, fingers pointed, palms facing downward.
Count 6  Arms forward raise and clap.
Count 7  Same as Count 5
Count 8  Back to attention position.

**EXERCISE. No. 4**

Count 1  Attention position: Left leg takes one step at the left side and stretch the hands sideward, elbows straight, fingers pointed sideward.
Count 2  Keep the hands in front of the chest, elbows should bend and pointing sideward
Count 3  Same as Count 1.
Count 4  Back to attention position.
Count 5  Right leg take one step at the right side and stretch the hands sideward, elbows straight, fingers pointed sideward.
Count 6  Keep the hands in front of the chest, elbows should bend and pointing sideward.
Count 7  Same as Count 5.
Count 8  Back to attention position.

**EXERCISE. No. 5**

Count 1  Left leg take one step at the left side and stretch sideward, elbows straight, fingers pointed sideward, palms facing upward.

Count 2  Elbows should bend and touch the shoulder with the fingers.

Count 3  Same as Count 1.

Count 4  Back to attention position.

Count 5  Right leg take one step at the right side and stretch the hands sideward, elbows straight, fingers pointed sideward, palms facing upward.

Count 6  Elbows should bend and touch the shoulder with the fingers.

Count 7  Same as Count 5

Count 8  Back to attention position.

**EXERCISE. No. 6**

Count 1  Attention position: Left leg take one step at the left side and keep the hands at the hip.

Count 2  Bend the knees.

Count 3  Same as Count 1.

Count 4  Back to attention position.

Count 5  Right leg take one step at the right side and keep the hands at the hip.

Count 6  Bend the knees.
Count 7  Same as Count 5
Count 8  Back to attention position.

**EXERCISE. No. 7**

Count 1  Attention position, raise the arms upward, elbows straight, Fingers pointing upward, Palms facing each other
Count 2  Bend forward, try to touch the ground with fingers, knees straight.
Count 3  Same as Count 1.
Count 4  Back to attention position.
Count 5  Raise the arms upward, elbow straight, fingers pointing upward, palms facing each other.
Count 6  Bend forward, try to touch the ground with fingers knees straight.
Count 7  Same as Count 5
Count 8  Back to attention position.

**Schedule for 12 weeks of walking group (Group 2)**

<table>
<thead>
<tr>
<th>Mode of exercise</th>
<th>Walking – on flat surface</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>Alternate days for 12 weeks</td>
</tr>
<tr>
<td>Duration</td>
<td>Approximately – one hour</td>
</tr>
<tr>
<td>Intensity</td>
<td>Mild intensity of 55 - 60%</td>
</tr>
</tbody>
</table>

**Walking programme for a session**

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 – 8 minutes</td>
<td>Breathing exercise</td>
</tr>
<tr>
<td>10 minutes</td>
<td>Warm up</td>
</tr>
<tr>
<td>25 – 30 minutes</td>
<td>Walking</td>
</tr>
<tr>
<td>10 minutes</td>
<td>Cool down with light walking</td>
</tr>
</tbody>
</table>
Breathing

Breathing session - Breathing is important because it is the only means to supply one's body and its various organs with the supply of oxygen which is vital for our survival.

Exercise 1

➢ Stand straight, feet apart about shoulder width, look straight, shoulder level arms placed comfortably on hips.

➢ Inhale through the nose slowly and comfortably, hold the breath for three to five seconds and then slowly exhale through the nose.

➢ Repeat five times after an interval of five seconds between each repetition.

Exercise 2

➢ Stand straight, feet apart about shoulder width, look straight, chin parallel to the ground, arms placed comfortably in front of the thighs.

➢ Slowly inhale and simultaneously raise the arms upward closer to the ear, palms facing each other, fingers pointing upward and hold the breath for 3 to 5 seconds and exhale slowly and arms down.

➢ Repeat 5 times after an interval of five seconds between each repetition.
Exercise 3

➢ Stand straight, feet apart about shoulder width, look straight, chin parallel to the ground, arms close to body
➢ Inhale slowly and simultaneously raise the arms side wards, closer to the ears, fingers pointing upwards and hold the breath for 3 to 5 seconds.
➢ Slowly exhale, simultaneously arms down, back to the starting position.

Warm up

Warm-up - warm-up session prepared the skeletal muscles, heart and lungs for progressive increase in further exercise.

Warm up Exercises

➢ Head tilt (side to side, up and down), Neck rotation.
➢ Arms stretch
➢ Bend (side)
➢ Shoulder shrugs
➢ Leg stretch
➢ Calf stretch (10 seconds)
➢ Quadriceps (10 seconds)

Range of Motion

Exercise 1

➢ Stand straight, Feet apart about shoulder width, arms extended forward with fist closed.
➢ Rotate your wrist clock wise and anti clock wise.
Exercise 2

➢ Stand straight, Feet apart about shoulder width, arms close to the body.
➢ Rotate the arms forward and then backward

Exercise 3

➢ Stand straight, Feet apart about shoulder width, arms placed on hip
➢ Slowly turn the neck to right side left side and back to position.

Exercise 4

➢ Stand straight, Feet apart about shoulder width, arms raised side ward, at shoulder level and parallel to the ground, palms facing downward.
➢ Slowly twist the trunk to the right side, maintain the position for 3 seconds and back to position.
➢ Repeat the same towards the left side

Stretching Exercises

Neck

➢ Stand straight, arms close to the body.
➢ Turn head to the right side, then left.
➢ Hold for 5 seconds each side
➢ Repeat 4 to 5 times.
Shoulder

- Interlock fingers and palms out
- Extend arms in front at shoulder height
- Hold for 10 seconds, relax, and repeat 4 to 5 times.

Triceps

- Keep knees slightly flexed.
- Stand with arms overhead
- Hold elbow with other hand
- Pull elbow behind head gently as and slowly learn to side until mild stretch is felt.

Calf

- Stand little away from wall and lean on it with forearms, head resting on arms.
- Place right foot forward, knee bend, left leg, straight behind, and feet keep flat.
- Slowly hip move forward, until feel stretch in calf of left leg.
- Maintain the position 10 – 15 seconds.
- Repeat other side.

Inner thigh and Groin

- Stand straight feet apart about shoulder width.
- Bend right knee slightly and move left hip down ward towards right knee.
- Hold for 10 – 15 seconds
- Repeat the same on left leg.
Walking schedule for 12 weeks

<table>
<thead>
<tr>
<th>Week</th>
<th>Intensity</th>
<th>Duration</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1\textsuperscript{st} &amp; 2\textsuperscript{nd}</td>
<td>50%</td>
<td>15 minutes</td>
<td>0.5 km</td>
</tr>
<tr>
<td>3\textsuperscript{rd} &amp; 4\textsuperscript{th}</td>
<td>55%</td>
<td>20 minutes</td>
<td>0.75 km</td>
</tr>
<tr>
<td>5\textsuperscript{th} &amp; 6\textsuperscript{th}</td>
<td>55%</td>
<td>25 minutes</td>
<td>0.75 km</td>
</tr>
<tr>
<td>7\textsuperscript{th} &amp; 8\textsuperscript{th}</td>
<td>60%</td>
<td>30 minutes</td>
<td>1 km</td>
</tr>
<tr>
<td>9 &amp; 10\textsuperscript{th}</td>
<td>60%</td>
<td>35 minutes</td>
<td>1.25 km</td>
</tr>
<tr>
<td>11 &amp; 12\textsuperscript{th}</td>
<td>60%</td>
<td>35 minutes</td>
<td>1.50 km</td>
</tr>
</tbody>
</table>

**Cool down** - Gradually brings the heart rate down to its pre exercise level (10 Minutes).

**Precautions to be taken**

➤ **Before Exercise**
  - Be careful about exercising if one have skipped a recent meal. Check the blood glucose. If it's below 100, have a small snack.
  - If one takes insulin, ask the health care team whether he should change the dosage before the exercise.

➤ **During Exercise**
  - Wear the medical identification or other ID card
  - Always carry food or glucose tablets so that will be ready to treat hypoglycemia.
If exercising for more than an hour, check the blood glucose at regular intervals. And may need snacks before finish.

**After Exercise**

- Check to see how exercise affected the blood glucose level, heart rate, blood pressure etc.

**Collection of Data**

The data were collected on selected physical and physiological variables such as cardiovascular endurance was measured by one mile run/walk test, abdominal strength was assessed by sit-ups, flexibility was measured by sit and reach test and balance was assessed standing balance test, systolic and diastolic blood pressure measured by using Omron digital blood pressure monitor, and the heart rate measured by using radial artery method before and immediately after the training programme as pre-test and post-test. The blood samples were collected from the subjects in the early morning in fasting condition to assess the physiological parameters viz., total cholesterol and blood sugar. The collected blood samples were tested in the medical laboratories at Kottayam and Changanachery, Kerala. The blood samples were collected from experimental groups prior to and immediately after the training programme.
Administration of the Tests

1. Cardiovascular Endurance:

Test item - One mile Run/ Walk Test.

Purpose

To evaluate cardiovascular endurance

Equipment

A track, measured area including outside fields or an indoor court, stopwatch, score cards and pencils.

Procedure

Subjects were instructed to run/ walk one mile in the fastest possible time. Although walking is permitted the test administrator emphasized the use of the fastest pace that can be sustained. Subjects were encouraged to practice walking or running the mile prior to the test day. Subjects were asked to warm up prior to testing.

Scoring

The run / walk is scored in seconds. Elapsed time was being called out to participants or their partners as they crossed the finish line.
2. Abdominal Strength

Test item - Bent-knee sit ups

Purpose

To evaluate abdominal strength by performing repeated sit ups.

Equipment

Stop watch and mats.

Procedure

Subjects should lie on their backs with knees flexed, feet on floor and heels between 12 & 18 inches from the buttocks. Arms are crossed over chest with hands on opposite shoulders. Feet one held to the mat by a partner. On “Ready”, “Go” the Subjects curls to a sitting position, maintaining arm contact with chest. When elbows touch the thighs the sit-up is completed. The Subjects then uncurls to a position where the midback contacts the mat. Subjects have to complete as many sit-ups in this manner as possible in one minute rest between sit-ups is allowed in either the up and down position.

Scoring

Only correctly performed sit-ups completed in one minute are counted.
3. Flexibility

Test item - Sit and Reach

Purpose

To evaluate flexibility of the lower back and hamstring muscles.

Equipment

Sit and Reach Box, a specially constructed box with a measuring scale with a 23cm mark in the line with the surface for the examiner’s feet.

Procedure

Subjects remove their shoes and sit at the test apparatus with knees fully extended, heels, should be about a shoulder-width apart and feet should be flat against the box. Arms are extended forward, palms down, with one hand on top of the other. Subjects then lean forward, extending the fingertips along the ruler as far as forward as possible. 4 trials were taken. The 4th trial was held for atleast 1 sec.

When the trial is invalid it was re-administered, if the knees fail to remain fully extended, or if the hands reach unevenly. The test administrator placed one hand lightly on the Subject’s knees to encourage that knees stay extended.

Scoring

The score, measured to the nearest centimeter is the most distant point reached on the 4th trial by both hands and held for 1 second.
4. Balance Test

Test item - Standing balance test

Purpose

To measure the balance ability

Equipment

Flat, non-slip surface, stopwatch

Description

The person stands on one leg for as long as possible. Give the subject a minute to practice their balancing before starting the test. The timing stops when the elevated foot touches the ground or the person hops or otherwise loses their balance position. The best of three attempts was recorded. Repeat the test on the other leg.

Scoring

Calculate the total length of time a person can stay in the balance position.

5. Heart Rate

Test item - Radial artery method

Purpose

The purpose of this test was to measure the heart rate of the subjects using Radial artery method.
Procedure

Subject was made to sit comfortably with the forearm slightly pronated and wrist slightly flexed. The radial artery was palpated with the tips of three fingers compressing the vessel against the lower end of radius. The index finger towards the heart varies the pressure on the artery, the middle finger feels the pulse, while the distal finger prevents the reflections of the pulsations from the palmer arch of the arteries. Now the pulse is examined systematically by rate of pulse.

Scoring

The heart rates were recorded in count the radial pulse for one minute completely.

6. Blood Pressure

Test item - Automatic digital blood pressure method

Purpose

The purpose of this test was to measure both systolic and diastolic blood pressures of the subjects.

Equipment Used

Omron automatic digital blood pressure monitor.

Procedure

Subject was made to sit comfortably. The instrument and brachial artery was kept at the level of heart. A cuff applied on the forearm was one inch above the cubital fossa. The tester switched on the monitor. After getting signal with a sound, the monitor started to measure. The air
filled in the cuff was relieved from the cuff. The systolic and diastolic blood pressures were shown in the monitor.

**Scoring**

The systolic and diastolic blood pressures were recorded in millimeters of mercury (mm Hg) per minute.

7. Blood Sugar

**Test item- Method of Dubowski**

**Purpose**

Glucose was estimated using O-toluidine reagent by the method of Dubowski modified by Sasaki and Matsui (1972).

**Reagents**

1. Trichloroacetic acid (TCA) – 10%
2. Ortho-toluidine-boric acid reagent – 2.4 g boric acid and 2.5 g thio urea were dissolved in 100 ml of a sodium-containing water, glacial acetic acid and freshly distilled O-toluidine in the ratio 10:75:15.
3. Stock glucose standard – 100 mg of D-glucose in 100 ml of 0.1% benzoic acid 10 ml of this solution was diluted to 100 ml to get a working standard containing 100 mg glucose/ml.

**Procedure**

0.2 ml of plasma was treated with 2.8 ml 10% TCA to precipitate the proteins, which was removed by centrifugation. To 1.0 ml of the supernatant, 4 ml O-toluidine reagent was added. Standard solutions of concentration 25-100 mg glucose and a blank containing 1.0 ml distilled
water were also processed similarly. All the tubes were heated in boiling water bath for 8 minutes. The colour developed was read at 640 nm. Glucose content was expressed as mg/dl plasma.

8. Total Cholesterol

Test item - Enzymatic calorimetric method

Collection of Blood Sample

Venous blood was collected in the early morning after the subjects abstained from food and drink except water for 12 hours to estimate the selected biochemical variables. 5 ml of blood was drawn from the subjects anticubital vein by venous puncture method and the blood was immediately transferred into sterilised small bottles. Blood samples were taken at the beginning (pre-test) and at the end of the experimental period of 12 weeks (post-test).

Method

Enzymatic colorimetric method recommended by Siedel et al. and Kattermann et al. was applied for estimation of cholesterol. Erba Smart lab autoanalyser was used for this purpose. Enzymatic colorimetric method (Autoanalyser), “Enzokit”, supplied by BMK Laboratories, Rable, Thane, Maharashtra, under the licence from Boehringer Mannheim GmbH, Mannheim, Germany, was used for this purpose.
**Test Principle**

Cholesterol esters + H$_2$O $\xrightarrow{\text{Cholesterol esterase}}$ Cholesterol + RCOOH

Cholesterol + O$_2$ $\xrightarrow{\text{Cholesterol oxidase}}$ $\Delta^4$ - Cholesterol + H$_2$O$_2$

POD

2 H$_2$O$_2$ + 4-aminophenazone + Phenol $\xrightarrow{\text{POD}}$ 4-p Benzoquinone-monoiminol-phenazone + 4 H$_2$O$_2$

Concentrations in the reagent:

- Tris buffer : 100 m mol/1 PH 7.71
- Mg$^{2+}$ : 50 m mol/1
- 4-amino phenazone : 1 m mol/1
- Sodium chlorate : 10 m mol/1
- Phenol : 6 m mol/1
- 3,4-dichlorophenol : 4 m mol/1
- Fatty alchol polyglycol ether: 0.6%

Cholesterol esterase ≥ 0.4 U/ml

Cholesterol oxidase ≥ 0.25 U/ml

Peroxidase ≥ 0.2 U/ml

**Procedure**

Ten ml of serum, standard and distilled water (blank) was incubated with 1000 ml 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.
Experimental Design and Statistical Procedure

The pre and post test random group design was used as experimental design in which forty men subjects were divided into four groups of ten each at random. No attempt was made to equate the group in any manner. The subjects were tested on the selected criterion variables such as selected physical and physiological variables prior to and immediately after the instruction period.

The collected data from the four experimental groups prior to and immediately after the instruction period on selected criterion variables were statistically analyzed with dependent “t” test to find out the significant improvement between pre and post-test means of four experimental groups separately and analysis of covariance (ANCOVA) was used to find out the significant difference among experimental groups. Whenever ‘F’ ratio was to be found significant for adjusted post test, the Scheffe’s test was used as a post hoc test. In all the cases .05 level of significant was fixed to test the hypothesis.