Chapter III
METHODOLOGY
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METHODOLOGY

In this chapter the selection of subjects, Criterion measures, experimental design, experimental treatment programme, procedure of administering tests, and statistical model of analysing the data are described.

This study was conducted with a view to evaluate the efficacy of selected yogic practices, and selected aerobic exercises for the health related fitness benefit of diabetics. Further, this study may contribute to develop awareness about both exercise and yoga especially for diabetic population to enrich health.

Subject selection

Sixty male patients (N=60), who were suffering from diabetes mellitus, were volunteered as subjects. Their age ranged from 40 to 65 years. The purpose sampling technique was employed to pool the subjects from Jawaharlal Institute of Post – Graduate Medical Institute and Research, Puducherry. All the subjects were taking anti-diabetic drugs and diet as suggested by their physician / diabetologist. In fact almost all the patients were very much conscious about their diabetic diet. Since all the patients attended this study from their respective homes, therefore diet control phase was not possible. Before the group were divided for experimental treatment, all the subjects were screened medically with the help of professionally qualified diabetologist.
The criteria for inclusion and exclusion of the subjects for experimental training programme were as follows:

The subjects below and above 40 to 65 years were excluded from this study as suggested by the diabetologist. Only male subjects were included.

The subjects who are expected to remain present till the experimental treatment were incorporated in this study, were included.

The subjects suffering from serious health problems were excluded. Moreover, the subjects having incapacitating physical illness as ruled out by clinical investigation were excluded prior to this study.

The subjects who were found drug addicts and alcoholics excluded due to complex nature of their problem and expected poor compliance.

The subjects with reasonable physical ability and willingness to undergo the experimental training programme voluntarily were included in the study.

**Research Design**

The study was formulated as a parallel group design. The experimental treatment consists of two experimental interventions having two experimental groups and one control group. The groups were, in fact, divided into three groups randomly.
Experimental Design

The selected subjects were equated into three equal groups, viz., Control group (Group I), Aerobic exercises group (Group II), and Yogic practices group (Group III).

The subjects from all the groups were diabetic; they were directed to continue the anti-diabetic drugs during the experimental training period. The experimental treatment was given for a period of 12 weeks.

Prior to and at the end of the eighteen weeks training all the subjects were tested the post test was called post-test-1. Following the twelve weeks training programme there was a detraining period of another six weeks, known as Follow - Up (F.U.) and during this period no training was imparted to any of the group. Thus, the total duration of the experimental period was for 18 weeks (Twelve weeks training and six-week follow up) and at the end of the detraining period of six weeks the final test was administered on the selected health related Physical Fitness Variables, selected physiological, selected lipid profiles, and selected biochemical variables. The final test was called as the post-test-2.

Criterion measures

The following criterion measures selected in this study were as follows:

Selected Health related physical fitness included abdominal muscle strength, flexibility, cardio-vascular efficiency, and body fat.
Selected Physiological variables included pulse rate, respiratory rate, systolic blood pressure and diastolic blood pressure.

Selected biochemical variables included total cholesterol, low density lipoprotein (LDL), high density lipoprotein (HDL), very low density lipoprotein (VLDL), tri Glyceride, cardio-vascular risk ratio, of blood urea, creatinine, uric acid, and blood sugar (fasting and post prandial).

Collection of data was administered through standard tests to measure the above variables, before and after the experimental training programme.

The selected training programme included aerobic exercise, and yogic practice respectively. The justification of selecting these training programs are as follows:

Yoga improves the functioning of the respiratory, circulatory, digestive and hormonal systems. Regular practice of yogasana 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. Moreover, basic levels of physical fitness can be excellently maintained by indulging in a selected yogic routine. Yogic exercises deal with the vital organs of the body, on which health depends. This seems to be a useful means for diabetics.

Aerobic exercise too develops musculo-skeletal fitness while building strength, flexibility and co-ordination. Aerobics when exercised
regularly decreases the percentage of body fat such as cholesterol and triglycerides and attains the other metabolic benefits of fitness. The results can be seen in increase in red blood cells count, which contains haemoglobin, responsible for transporting oxygen in the blood, a decrease in resting blood pressure and a decrease in blood lipids. It seems aerobic training may be useful for diabetic also.

**Tools Used**

1) Tools Used for Health Related Physical Fitness (HRPF) Variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Tools / Means used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominal Strength (No. /min.)</td>
<td>Modified Sit-ups</td>
</tr>
<tr>
<td>Flexibility (Cms)</td>
<td>Sit and Reach</td>
</tr>
<tr>
<td>Endurance (Mts.)</td>
<td>One mile Run / Walk</td>
</tr>
<tr>
<td>Body Fat (Skin fold Measurement)</td>
<td>Skin Fold Caliper</td>
</tr>
<tr>
<td>Triceps Skin Fold (mm.)</td>
<td></td>
</tr>
</tbody>
</table>

2) Tools Used for Physiological Variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Tools used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood Pressure</td>
<td>Sphygmomanometer</td>
</tr>
<tr>
<td>Pulse Rate (Beats/min.)</td>
<td>Stop Watch</td>
</tr>
<tr>
<td>Respiratory Rate (No. / Min.)</td>
<td>Stop Watch</td>
</tr>
</tbody>
</table>
3) Tools used for analysis of Lipid Profiles (Blood Analysis)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lipid Profiles</td>
<td>Lipid Analysis Kit</td>
</tr>
<tr>
<td>Total Cholesterol</td>
<td>(Cholesterol Oxidise)</td>
</tr>
<tr>
<td></td>
<td>(Per oxidize) method</td>
</tr>
<tr>
<td></td>
<td>(normal range - Male and Female: 150-250 mg/dL)</td>
</tr>
<tr>
<td>High Density Lipoprotein–Cholesterol</td>
<td>(Cholesterol oxidase)</td>
</tr>
<tr>
<td></td>
<td>(Per oxidase) method</td>
</tr>
<tr>
<td></td>
<td>(normal range - Male and Female: 30-70 mg/dL)</td>
</tr>
<tr>
<td>Low Density Lipoprotein–Cholesterol</td>
<td>Formula:</td>
</tr>
<tr>
<td></td>
<td>Low Density Lipoprotein = Total Cholesterol – (Very Low Density Lipoprotein+ High Density Lipoprotein)</td>
</tr>
<tr>
<td></td>
<td>(normal range - Male and Female: upto 150 mg/dL)</td>
</tr>
<tr>
<td>Very Low Density Lipoprotein</td>
<td>Formula:</td>
</tr>
<tr>
<td></td>
<td>Very Low Density Lipoprotein= Tri-glyceride (TG) / 5</td>
</tr>
<tr>
<td></td>
<td>(normal range - Male and Female: upto 30 mg/dL)</td>
</tr>
<tr>
<td>Triglyceride</td>
<td>(Glycerol Phosphate Oxidase)</td>
</tr>
<tr>
<td></td>
<td>(Peroxidase) method</td>
</tr>
<tr>
<td></td>
<td>(normal range – Male and Female: upto 170 mg/dL)</td>
</tr>
<tr>
<td>Cardio-vascular risk ratio</td>
<td>Using formula:</td>
</tr>
<tr>
<td></td>
<td>Cardio-vascular Risk = Total Cholesterol ÷ High Density Lipoprotein</td>
</tr>
<tr>
<td></td>
<td>(normal range: 2.5 – 3.5).</td>
</tr>
</tbody>
</table>
4) Tools used for Biochemical analysis of Other Variables (Blood Analysis)

<table>
<thead>
<tr>
<th>Test</th>
<th>Method</th>
<th>Normal Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood Urea</td>
<td>Liquichem Berthelot Method</td>
<td></td>
</tr>
<tr>
<td>Serum Creatine</td>
<td>AGAPPE – Modified Jaffe’s method</td>
<td>(Normal range: 10-50 mg./dL.)</td>
</tr>
<tr>
<td>Uric Acid</td>
<td>Enzymatic colorimetric method</td>
<td>(Normal range: 4.0-7.0 mg./dL.)</td>
</tr>
<tr>
<td>Blood Glucose (fasting and)</td>
<td>(Glucose Oxidase) ÷ Peroxidase method²</td>
<td>(Normal range - Fasting: 60-100 mg./dL; PP: up to 150 mg./dL).</td>
</tr>
<tr>
<td>post prandial</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Experimental Treatment**

The subjects were assigned to three equated groups. The experimental training programme on yogic practices and aerobic exercises were administered to two experimental groups. of I and II, and III acted as the control group. The training programme consisted of two different combination of different proportion of yogic practices and aerobic exercise training to develop the health related physical fitness changes in selected physiological and biochemical variables.

Group I was trained with the stretching ratio of 70 percent yogasana and 30 percent other yogic practices. Group II with 70 percent aerobic exercises and 30 percent stretching exercise. The training was imparted six days a week for twelve weeks under the supervision the research scholar. The selected health related physical fitness, selected
physiological and selected biochemical variables were recorded at the beginning and after the completion of 12 weeks of an experimental period, (pre test and post test -1). Follow up period was for a duration of six weeks and post test – 2 was recorded as mentioned in post test -1

Description of Tests

Health-Related Physical Fitness Test (AAHPERD)

*Purpose:* The health-related physical fitness test program is designed to (1) teach children and youth the basics of healthy living; (2) provide test items that measure components of health-related physical fitness; and (3) help youth integrate fitness activities into their daily lifestyles.

*Test items:* The fitness test program included a battery of five test items designed to measure aerobic endurance, flexibility, upper body strength and endurance, abdominal muscular strength and endurance, and body composition. This program also included criterion standards for excellence, educational materials to aid the physical educator in teaching the cognitive, affective, psychomotor, and health-related physical fitness areas of fitness, and a comprehensive recognition award system. Because the program is based on personal goal setting, all subjects were able to learn, participate, and be recognized through the program.  

One-Mile Run (Run and Walk)

*Purpose:* The purpose of this test was to find out the endurance of the subjects.
**Equipment:** 1/10 of a second Stopwatches and segment markings in the running area, measuring tape.

**Procedure:** Subjects were instructed to run/walk the one-mile distance as fast as possible. Subjects began on the command “Ready”, “Go.” Only one trial was permitted.

**Scoring:** The time taken to cover the one-mile distance was recorded in minutes and seconds.\(^4\)

**Sit-and-Reach:**

**Purpose:** The purpose of this test was to measure at the upper back and hip joint.

**Equipment:** The sit-and-reach apparatus and a metric scale used to measure performance on this test and score sheet.

**Procedure:** The Subjects removed their shoes and sat down on the floor with legs fully extended and with their feet a shoulder-width apart, they sat flat against the sit-and-reach apparatus. Arms were extended from the body over the measuring scale with hands placed one on top of the other with finger pads on top of fingernails. The student reached directly forward sliding along the scale four times and held the position of maximum reach on the fourth trial.

**Scoring:** The most distant point reached on the fourth trial was recorded to the nearest centimeter as the Subject’s score.\(^5\)
Modified Sit-Ups:

**Purpose:** The purpose of this test was to measure abdominal strength and endurance of the subjects in one minute.

**Equipment:** Mats and a 1/10 of second stopwatches.

**Procedure:** The subjects took a spine lying position, their legs were bent at the knee with feet flat on the floor approximately 15 inches from the buttocks. The arms were folded across the chest with hands were placed on opposite shoulders. On the command “Ready, Start”, the subjects curled into the sitting position was until their arms contacted with the upper leg. Returning to the starting position constituted one complete sit-up and counted as the successful sit – ups. The subjects were continued for one minute. The number of correct sits – ups was counted.

**Scoring:** The number of correctly completed sit-ups within one minute was recorded as the subject’s score.6

Body Composition

**Purpose:** The purpose of this test was to find out the body fat of the subjects.

**Equipment Needed:** Skin fold caliper.

**Procedure:** The triceps site was recorded for this skin fold test. A specific instruction for locating and measuring this site was found.
**Scoring**: The median of three trials for the test was recorded as the subject’s score.\(^7\)

**Lipid Analysis**

**Collection of Blood Sample**

Each subject’s blood was collected in the morning (before food) in a chemically clean and sterile container. Containers were thoroughly rinsed and dried after washing. The container was labeled with code numbers corresponding to each of the subject.

EDTA (Disodium and dipotassium) salts acting as anticoagulants were used in each container prior to blood collection.

The vein of arm was punctured by dry disposable syringes; the experts collected the total blood sample (3 ml.\(^\_\) ). The subject sat on a chair by extending his arm at the corner of a table. Both the subject and the operator were comfortable and there was a sufficient light in the room. Material for cleaning the arm, tourniquet, containers for placing blood and other equipments were conveniently made ready. The subject rolled up both sleeves in order that the best vein was selected. The operator made sure that there were no armbands or that the sleeves were not so tight that they act as tourniquets. Since the selection of larger veins palpated in the anticubital region was more satisfactory, the puncture of superficial veins (which are loosely fixed and tend to roll away from the needle) and cord-like veins (which are usually thromboses) was avoided.
Devices to increase the amount of blood in the arm and to distend the veins were:

- Placing of a tourniquet around the arm above the elbow.
- Having open and close fist;
- Massaging arm
- Slapping or thumping the arm at the site of puncture;
- Immersed the arm in warm water for 5 or more minutes previous to puncture.

The skin was then cleaned with 70% alcohol. (For the collection of blood for culture, the alcohol should be preceded by iodine). Since it was a routine analysis, iodine was not used. After cleaning the site, the tourniquet was tightened and the subject closed the fist. The needle was attached tightly with the syringe, air was expelled from it and the syringe was held between the thumb and forefinger. Holding the level of the needle up for large veins and down for small veins the skin below the site of puncture was fixed with the thumb of the other hand. Holding the needle at an angle $45^\circ$ (approximately) it was entered about one cm below the site of the intended vein entry. After going through the skin, the syringe was lowered and advanced more nearly parallel to the vein until the lumen was entered. On entering; the vein aspirated with the pulling of the plunger back with the left hand. After sufficient blood had been removed the tourniquet was loosened and the subject opened the fist. By placing a pledged of dry cotton over the site of puncture the needle was withdrawn. The subject was asked to hold the pledged on firmly for several minutes. The needle was removed from the syringe and the blood
ejected carefully into the receptacle, allowing the blood to run down the inside of the container to avoid foaming which could cause hemolysis.

**Total Cholesterol**

**Method**

Enzymatic colorimetric method recommended by Siedel et al.\textsuperscript{14} and Kuatterman et al., was applied for the estimation of cholesterol. Bio systems Semi Auto Analyser (model BTS-320) was used for this purpose. Enzymatic colorimetric method, “Enzokit” supplied by BMK …

**Test Principle**

\[
\text{Cholesterol+esters +H}_2\text{O} \xrightarrow{\text{Cholesterol esterase}} \text{Cholesterol + RCOOH} \\
\text{Cholesterol + O}_2 \xrightarrow{\text{Cholesterol oxidase}} \text{- Cholesterolone + H}_2\text{O}_2 \\
\text{2H}_2\text{O}_2 + 4\text{Aminophenazone} \xrightarrow{\text{POD}} \text{4-P Benzoquinone-} \\
\text{Phenol} \xrightarrow{\text{Monoiminol -}} \text{Monoiminol - Phenazone +} \\
\text{4 H}_2\text{O}_2
\]

**Procedure**

Ten µl of serum, standard and distilled water (blank) was incubated with 1000 µl of the reagent at 37° C for five minutes and the absorbance of the sample and standard were read at 546 mm within one hour against
reagent blank. Serum Cholesterol is expressed as mg/dl (normal range
- Male and Female: 150-250 mg/dl)

**High Density Lipoprotein Cholesterol**

**Method**

High Density Lipoprotein – Cholesterol was estimated by applying enzymatic colorimetric method, as recommended by Burstein et al.\textsuperscript{15}, and Lopes et al., Bio Systems Semi Auto Analyzer (Model BTS 320) was used for this purpose.

**Principle**

Chylomicrons, VLDL (very low density lipoproteins) and LDL (low density lipoproteins) were precipitated by adding phosphotungtic acid and magnesium ions to the sample. Centrifugation leaves only the HDL (high density lipoproteins) in the supremacy, their cholesterol content is determined enzymatic ally by cholesterol oxidase paraaminophenazone method.

**Reagents**

- Phosphotungstic acid – 0.44 mmol/1
- Magnesium chloride – 20 mmol/1
**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. (Normal range - Male and Female: 30-70 mg/dl).

**Triglycerides**

**Method**

Serum triglycerides were estimated by GPO-PAP method as recommended by Fossati and Bio-systems Semi Auto Analyzer (model BTS 320) was used for this purpose.

**Test Principle**

\[
\text{Triglycerides} + 3 \text{H}_2\text{O} \xrightarrow{\text{lipase}} \text{Glycerol} + 3 \text{ROOCH} \\
\text{Glycerol} + \text{ATP} \xrightarrow{\text{Glycerol Kinase}} \text{Glycerol-3-phosphate} = \text{ADP} \\
\text{Glycerol-3-phosphate} + \text{O}_2 \xrightarrow{\text{Glycerol – phosphate Oxidase}} \text{Dihydroxyacetone Phosphate} + \text{H}_2\text{O}_2
\]
H₂O₂ + 4
aminophenazone + 4-
Peroxidase
Chlorophenol

4-(P-benzoquinone-
mono-imino)-
Phenazone + 2H₂O +
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 triglyceride is expressed as mg/dl. (Normal range – Male and Female: up to 170 mg/dl).

Low Density Lipoprotein Cholesterol

Low Density Lipoprotein-cholesterol was calculated from the Total Cholesterol, Triglycerides and High Density Lipoprotein cholesterol levels, by using the following formula recommended by Friedwald, Levy and Fredickson.

Low Density Lipoprotein – C = Total Cholesterol – [High Density Lipoprotein Cholesterol + [TriGlyceride÷5]]. (Normal range - Male and Female: up to 150 mg/dl).

Cardiovascular Risk Ratio

Cardiovascular Risk was calculated by using a formula (Raphael, 1983):
Cardiovascular Risk = Total Cholesterol ÷ High Density Lipoprotein (Normal range: 2.5 – 3.5).\(^8\)

Other Biochemical Tests

Blood urea

Blood urea level represents one’s kidney function. This was measured using Liquichem Berthelot Method. The result of this test was reconfirmed by assessing serum creatinine with the help of AGAPPE – Modified Jaffe’s\(^9\) method (Normal range: 10-50 mg./dL.)

Uric Acid (Enzymatic colorimetric Method)

Keeping the sample into test tubes, mix well and incubate for 10 mins at 37°C (or 15 minutes at 20-25°C). Measure absorbance of sample (Ac) and standard (As) against reagent blank. The colour is stable for 60 minutes at 20-25°C. Further, calculation is done with linearity (Ac/As x C = … mg/dL i.e., uric acid in Serum or Plasma). Here C=Concentration of standard. This method is linear up to a concentration of 25 mg/dL. Dilute samples above this concentration 1:1 with 0.9% saline and reassay. Multiplied the result by 2. (Normal value for men: 3.4-7.0 mg/dL and for women: 2.4-5.7 mg/dL.).\(^11\)

Blood Glucose

Fasting and Post Prandial (PP) sugar was assessed using GOD (Glucose Oxidase) / POD method
(Normal range - Fasting: 60-100 mg./dL; Post Prandial: upto 150 mg./dL).

**Tester Competency**

All the measurements were administered by the researcher along with the assistance of professionally qualified physical education teachers and laboratory technicians. To determine the tester’s competency the selected variables were conducted on randomly selected ten subjects. To determine the consistency in scoring the Coefficient of correlation method of ‘r’ was applied on the collected data as shown in Table I.

### TABLE I

**TESTER COMPETENCY**

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Variable</th>
<th>Coefficient of Correlation ‘r’</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Abdominal muscular strength</td>
<td>0.862</td>
</tr>
<tr>
<td>2.</td>
<td>Flexibility</td>
<td>0.796</td>
</tr>
<tr>
<td>3.</td>
<td>Cardiovascular endurance</td>
<td>0.701</td>
</tr>
<tr>
<td>4.</td>
<td>Body Fat</td>
<td>0.924</td>
</tr>
<tr>
<td>5.</td>
<td>Pulse rate</td>
<td>0.724</td>
</tr>
<tr>
<td>6.</td>
<td>Respiratory rate</td>
<td>0.724</td>
</tr>
<tr>
<td>7.</td>
<td>Systolic blood pressure</td>
<td>0.698</td>
</tr>
<tr>
<td>8.</td>
<td>Diastolic blood pressure</td>
<td>0.656</td>
</tr>
</tbody>
</table>

Sig. at .05 level of confidence with eight degree of freedom ‘r’ value was 0.632.
Procedure

The experimental treatment was conducted on the basis of four phases:

Phase-I: Pretest
Phase-II: Experimental Treatment Programme
Phase-III: Post-test and
Phase-IV: Follow-up

Phase-I: Pretest

All the subjects of three groups were then exposed for pre-test. The test of all the selected variables were conducted by using reliable and valid tests that assessed the health related physical fitness, physiological status and blood analysis.

Experimental Treatment

The subjects were assigned to three equated groups. The experimental training programme on yogic practices and aerobic exercises were administrated to two experimental groups of I and II and group III acted as the control group. The training programme consisted of two different combinations of different proportions of aerobic exercises and yogic practices training to develop the health related Physical fitness changes in the selected selected physiological and biochemical.

Group ‘A’ was trained with the stretching rated of 70 percent yogasana and 30 percent other yogic practices like kirya, pranayama and meditation. Group ‘B’ with 70 percent aerobic and 30 percent stretching
exercises. The training was imparted six days a week under the supervision of the research scholar. The selected Health Related Physical Fitness, selected physiological, and selected biochemical were recorded at the beginning and after the completion of 12 weeks of an experimental period, (pre test and post test -1) Follow up period was for a duration of six weeks and post test – 2 was recorded as mentioned in post test – 1.

**Phase-II: Experimental Treatment Programme**

The Experimental Treatment was conducted every day except Sundays. The intensity of the selected Experimental Treatment programme was for 60 minutes (one hour) per day in morning session from 6.30 to 7.30 p.m. The total duration of training was for 18 weeks period. During the follow-up for another 6 weeks no training was imparted.

**a) Content of yogic training programme**

The content of yogic training programme consists of selected asanas, kriya, pranayama and meditation. The yogic training programme was given to Group ‘B’ for six days in a week for a period of twelve weeks. The schedule of yogic training programme is given below:
TRAINING PERIOD:
12 Weeks, 6 days in a week for 60 minutes per day.

**TABLE II**

**YOGIC EXERCISES TRAINING SCHEDULE**

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Name of Yogic Exercises</th>
<th>Repetition</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Shavasana</td>
<td>One time</td>
<td>10 minutes</td>
</tr>
<tr>
<td>2.</td>
<td>Pawanmuktasana</td>
<td>One time</td>
<td>One minute</td>
</tr>
<tr>
<td>3.</td>
<td>Ardha halasana</td>
<td>One time</td>
<td>Two minutes</td>
</tr>
<tr>
<td>4.</td>
<td>Makrasana</td>
<td>One time</td>
<td>Five minutes</td>
</tr>
<tr>
<td>5.</td>
<td>Niralambasana</td>
<td>One time</td>
<td>One minute</td>
</tr>
<tr>
<td>6.</td>
<td>Bhujangasana</td>
<td>One time</td>
<td>One minute</td>
</tr>
<tr>
<td>7.</td>
<td>Ardha shalabhasana</td>
<td>One time</td>
<td>Two minutes</td>
</tr>
<tr>
<td>8.</td>
<td>Shalabhasana</td>
<td>One time</td>
<td>One minute</td>
</tr>
<tr>
<td>9.</td>
<td>Dhanurasana</td>
<td>One time</td>
<td>One minute</td>
</tr>
<tr>
<td>10.</td>
<td>Vakrasana</td>
<td>One time</td>
<td>Two minutes</td>
</tr>
<tr>
<td>11.</td>
<td>Janu sirsasana</td>
<td>One time</td>
<td>Two minutes</td>
</tr>
<tr>
<td>12.</td>
<td>Yoga Mudra</td>
<td>One time</td>
<td>One minute</td>
</tr>
<tr>
<td>13.</td>
<td>Ardha Katichakrasana</td>
<td>One time</td>
<td>Two minutes</td>
</tr>
<tr>
<td>14.</td>
<td>Padahastasana</td>
<td>One time</td>
<td>One minute</td>
</tr>
<tr>
<td>15.</td>
<td>Kapalabhati (kriya)</td>
<td>Three times</td>
<td>Three minutes</td>
</tr>
<tr>
<td>16.</td>
<td>Bhastrika Pranayama</td>
<td>20 times</td>
<td>10 minutes</td>
</tr>
<tr>
<td>17.</td>
<td>Meditation</td>
<td>One time</td>
<td>15 minutes</td>
</tr>
</tbody>
</table>
### TABLE III

**YOGIC EXERCISES TRAINING SCHEDULE FOR I, II, III AND IV WEEKS**

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Name of Yogic Exercises</th>
<th>Repetition</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Shavasana</td>
<td>One time</td>
<td>10 minutes</td>
</tr>
<tr>
<td>2.</td>
<td>Pawanmuktasana</td>
<td>Three times</td>
<td>Three minutes</td>
</tr>
<tr>
<td>3.</td>
<td>Ardha halasana</td>
<td>Three times</td>
<td>Six minutes</td>
</tr>
<tr>
<td>4.</td>
<td>Makrasana</td>
<td>One time</td>
<td>Five minutes</td>
</tr>
<tr>
<td>5.</td>
<td>Niralambasana</td>
<td>Two times</td>
<td>Two minutes</td>
</tr>
<tr>
<td>6.</td>
<td>Ardha shalabhasana</td>
<td>Two times</td>
<td>Four minutes</td>
</tr>
</tbody>
</table>

### TABLE IV

**YOGIC EXERCISES TRAINING SCHEDULE FOR V, VI, VII AND VIII WEEKS**

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Name of Yogic Exercises</th>
<th>Repetition</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Shavasana</td>
<td>One time</td>
<td>10 minutes</td>
</tr>
<tr>
<td>2.</td>
<td>Pawanmuktasana</td>
<td>Two times</td>
<td>Two minutes</td>
</tr>
<tr>
<td>3.</td>
<td>Ardha halasana</td>
<td>One time</td>
<td>Two minutes</td>
</tr>
<tr>
<td>4.</td>
<td>Makrasana</td>
<td>One time</td>
<td>Three minutes</td>
</tr>
<tr>
<td>5.</td>
<td>Niralambasana</td>
<td>Two times</td>
<td>Two minutes</td>
</tr>
<tr>
<td>6.</td>
<td>Bhujangasana</td>
<td>Three times</td>
<td>Three minutes</td>
</tr>
<tr>
<td>7.</td>
<td>Ardha shalabhasana</td>
<td>Two times</td>
<td>Four minutes</td>
</tr>
<tr>
<td>8.</td>
<td>Shalabhasana</td>
<td>Three times</td>
<td>Three minutes</td>
</tr>
<tr>
<td>9.</td>
<td>Vakrasana</td>
<td>Two times</td>
<td>Four minutes</td>
</tr>
<tr>
<td>10.</td>
<td>Janu sirsasana</td>
<td>Two times</td>
<td>Four minutes</td>
</tr>
<tr>
<td>11.</td>
<td>Kapalabhati (kriya)</td>
<td>Three times</td>
<td>Three minutes</td>
</tr>
<tr>
<td>12.</td>
<td>Bhastrika Pranayama</td>
<td>10 times</td>
<td>Five minutes</td>
</tr>
</tbody>
</table>
**TABLE V**

**YOGIC EXERCISES TRAINING SCHEDULE**
**FOR IX, X, XI AND XII WEEKS**

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Name of Yogic Exercises</th>
<th>Repetition</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Shavasana</td>
<td>One time</td>
<td>10 minutes</td>
</tr>
<tr>
<td>2.</td>
<td>Pawanmuktasana</td>
<td>One time</td>
<td>One minute</td>
</tr>
<tr>
<td>3.</td>
<td>Ardha halasana</td>
<td>One time</td>
<td>Two minutes</td>
</tr>
<tr>
<td>4.</td>
<td>Makrasana</td>
<td>One time</td>
<td>Five minutes</td>
</tr>
<tr>
<td>5.</td>
<td>Niralambasana</td>
<td>One time</td>
<td>One minute</td>
</tr>
<tr>
<td>6.</td>
<td>Bhujangasana</td>
<td>One time</td>
<td>One minute</td>
</tr>
<tr>
<td>7.</td>
<td>Ardha shalabhasana</td>
<td>One time</td>
<td>Two minutes</td>
</tr>
<tr>
<td>8.</td>
<td>Shalabhasana</td>
<td>One time</td>
<td>One minute</td>
</tr>
<tr>
<td>9.</td>
<td>Dhanurasana</td>
<td>One time</td>
<td>One minute</td>
</tr>
<tr>
<td>10.</td>
<td>Vakrasana</td>
<td>One time</td>
<td>Two minutes</td>
</tr>
<tr>
<td>11.</td>
<td>Janu sirsasana</td>
<td>One time</td>
<td>Two minutes</td>
</tr>
<tr>
<td>12.</td>
<td>Yoga Mudra</td>
<td>One time</td>
<td>One minute</td>
</tr>
<tr>
<td>13.</td>
<td>Ardha Katichakrasana</td>
<td>One time</td>
<td>Two minutes</td>
</tr>
<tr>
<td>14.</td>
<td>Padahastasana</td>
<td>One time</td>
<td>One minute</td>
</tr>
<tr>
<td>15.</td>
<td>Kapalabhati (kriya)</td>
<td>Three times</td>
<td>Three minutes</td>
</tr>
<tr>
<td>16.</td>
<td>Bhastrika Pranayama</td>
<td>20 times</td>
<td>10 minutes</td>
</tr>
<tr>
<td>17.</td>
<td>Meditation</td>
<td>One time</td>
<td>15 minutes</td>
</tr>
</tbody>
</table>
The exercises programme was imparted systematically from simple to complex manner; they were practiced as per the subject’s individual need.

**SHAVASANA**

**Introduction**

It is a traditional relaxative posture. The posture is called Shavasana as it resembles a dead body. In Sanskrit shava means ‘a dead body’.

**Starting position**

The subject was in supine position. The feet were together, the hands were placed side wards of the body and palms were facing downward the head was facing upward. The body was in a straight line.

**Stages for practice**

The subjects were lying on their backward feet were slightly apart, toes slightly turned out. The hands were kept slightly and were facing upward. The fingers were kept half flexed manner. The subjects were asked to breath normally through the nose. The subjects were deliberately loosening each and every muscle. The subjects were asked to concentrate in heart and felt relaxed, relaxed, relaxed, relaxed – absolutely free from all thoughts, completely relaxed. In this condition the subjects must feel light, light, and very light. It makes the muscles soft and pliable and
enables the blood flow to return to its normal pace. The body and mind was relaxed. This reduced the stress and high blood pressure. The subjects were (relaxed) in the final position for ten minutes at end of the training daily.

**Important points to Remember**

Do’s

1. The subjects took a comfortable supine position which offered least resistance to the gravity.
2. The eyes were closed throughout the practice.

Don’ts

1. Once the final posture was assumed the subjects should not move the body.

**ARDHAPAVANAMUKTASANA**

**Starting position**

The subject was in supine position. The feet were together, the hands were placed side wards of the body and palms were facing downward the head was facing upward. The body was in a straight line.\(^{10}\)

**Stages of practice**

The subjects were lying on their back and folded the right knee and kept it close to the chest with help of both hands. Then finally brought the
head and kept close to the knee and maintained for thirty seconds. The subjects were practiced the technique with left leg for thirty seconds. Removes gas from the abdomen and reduces abdominal fat. Increases the flexibility of the knee and hip. Useful for constipation.

Important points to Remember

Do’s

The subjects took a comfortable supine position which offered least resistance to the gravity and kept the leg close to the chest.

Don’ts

The subjects were instructed that they should not maintain with strain in the final position.

ARDHA HALASANA (TRADITIONAL)

Introduction

The posture is called Ardha Halasana because in the final position it resembles the shape of the Indian plough. In Sanskrit, ardha means half, hala means ‘plough’.

Starting position

The subject was in supine position. The feet were together, the hands were placed side wards of the body and palms were facing downward the head was facing upward. The body was in a straight line.\textsuperscript{11}
Stages of practice

The subjects were slowly brought their right leg straight to $30^\circ$, $60^\circ$ and $90^\circ$ and maintained the position for thirty seconds in the final position. The subjects were slowly brought their left leg straight to $30^\circ$, $60^\circ$ and $90^\circ$ and maintained the position for thirty seconds in the final position.

Important points to Remember

Do’s

The subjects were slowly performed without jerk and bent on knee throught the practice of this asana.

Don’ts

The subjects were instructed that they should not maintain with strain and also should not raise the hip.

MAKARASANA

Introduction

The posture is called Makarasana as the body resembles the shape of makara, which in Sanskrit means ‘crocodile’.
Starting position

The subject was in prone position. The feet were together, the hands were placed side wards of the body and palms were facing upward the head was facing downward. The body was in a straight line.12

Stages for practice

The subjects were kept their feet a comfortable distance between the feet, the toes pointing outward and the ankles resting on the ground. The subjects were raised the head and kept it on right hand then slowly brought the left hand and placed in front of the right hand. The subjects were released their final position step by step reverse order to starting position.

Important points to Remember

Do’s
The subjects kept their legs fully stretched with a comfortable distance between them. The subjects kept their big toes and the ankles on the ground. The subjects performed a little deeper abdominal breathing during relaxation time.

Don’ts
The subjects were instructed that they should not press the chest on the ground so that the breathing becomes uncomfortable.
BHUJANGASANA

Introduction

The posture is named Bhujangasana as the full display of it resembles a hooded snake under irritation.

Starting position

The subject was in prone position. The feet were together, the hands were placed side wards of the body and palms were facing upward the head was facing downward. The body was in a straight line.13

Stages for practice

The subjects placed both their hands by the side of the chest bending their elbows and kept close to the body. They slowly raised the head and looked up. This is the final position. The subjects released step by step reverse order from the final position to starting position.

Important points to Remember

Do’s
The trunk should be raised only up to the navel region. Least pressure should be exerted on the hands. The subjects maintained one minute in the final position.
Don’ts

The subjects avoided straightening the elbows.
The subjects avoided widening the elbow.

ARDHA-SHALABHASANA

Introduction

This posture is a simple modification of the original posture named as Shalabhasana. In Sanskrit shalabha means ‘locust’. While performing this posture the body resembles the shape of a locust. Imitating the Shalabha with one leg in this posture is called Ardha-Shalabhasana.

Starting Position

The subject was in prone position. The feet were together, the hands were placed side wards of the body and palms were facing upward the head was facing downward. The body was in a straight line.¹⁴

Stages for Practice

The subjects were raised both their leg from the ground as far as possible and maintained the posture comfortably for one minute. The subjects were released the final position step by step to starting position.
Important points to Remember

Do’s

The legs should be raised only to the point where the pelvis should not be tilted. The chin should be kept on the ground throughout.

Don’ts

The subjects were instructed that their knee should not be bent

SHALABHASNANA

Introduction

In Sanskrit, shalabha means ‘locust’. In the full posture, the body resembles the shape of a locust. Hence the name, it is a further development of Ardha-Shalabhasana. Lie prone with the hands by the side of the body and chin resting on the ground. Clench the fists and inhale a little. Raise both legs together making an angle of about 45° and keep the knees straight. Maintain the posture for some time and lower the legs to their original position. Exhale and have normal breathing for some time and repeat the asana, if so desired.

Starting position

The subject was in prone position. The feet were together, the hands were placed sides of the body and palms were facing upward the head was facing downward. The body was in a straight line.¹⁵
Stages for Practice

The subjects were raised their right leg from the ground as far as possible and maintained the posture comfortably for thirty second. The subjects were raised their left leg from the ground as far as possible and maintained the posture comfortably for thirty second after releasing their right leg. The subjects were released the final position step by step to starting position.

Important points to Remember

Do’s

The legs should be raised only to the point where the pelvis should not be tilted. The chin should be kept on the ground throughout.

Don’ts

The subjects were instructed that knee should not be bent

DHANURASANA

Introduction

It is a posture in which the body is supposed to imitate the shape and stand of a bow. This traditional asana is mentioned in the Gheranda Samhita (11:18) and Hathapradipika (1:25). In Sanskrit “dhanus” means “bow” and “asana” indicates “a stable and comfortable posture”. Dhanurasana can be considered as a combination of Bhujangasana and Shalabhasana.
Starting position

The subject was in prone position. The feet were together, the hands were placed side wards of the body and palms were facing upward the head was facing downward. The body was in a straight line.\textsuperscript{16}

Stages for practice

The subjects were slowly folded their knees, holed their respect ankle by their respective hands then finally brought to final position by raised their head, chest, legs and maintained for one minute.

The subjects released the final position step by step reverse order to starting position.

Important points to Remember

Do’s:

The subjects performed without strain in the final position.

Don’ts:

The subjects were instructed that they should not force to reach the final position pulling the legs too much.
VAKRASANA

Introduction

The posture is called Vakrasana because in doing so, the spine is twisted. Vakra in Sanskrit means ‘twisted’. It is a simplified form of Ardha-Matsyendrasana and has been introduced by Swami Kuvalayananda as preparatory posture for vakrasana.

Starting Position

The subjects were sat with the legs extended together, and kept their hands sideward.  

Stages for Practice

The subjects folded right leg in the knee and placed their foot by the side of the right knee. Placed their left hand at the back and kept the body in erect position. The subjects were kept their left arm over the right knee and placed their palm on the ground. The subjects gave good twist to the trunk to the right and turned the head over the right shoulder. This was the final position and maintained for thirty seconds. The subjects were Turned their head to the front, brought their left hand to left hand side, extended their right leg and came to starting position. The subjects performed the same practice to the left hand side.
Important points to Remember

Do’s

The subjects were instructed to perform their body twisting position well.

Don’ts

The subjects were instructed that they should not strain more when twisting the body.

YOGA MUDRA

Starting Position

The subjects sat with the legs extended together, and kept their hands sideward.18

Stages for Practice

The subjects sat in normal sitting position, kept their hands back, then bent forward and kept their head on the ground for one minute in the final position. The subjects released the final position slowly step by step reverse order to the starting position.

Important points to Remember

Do’s

The subjects were instructed to perform this asana comfortably.
Don’ts

The subjects were instructed that they should not forcibly touch the ground by head, and should not raise the hip.

**JANUSIRSHASANA**

**Introduction**

Janu means the knee. Sirs is the head. In this posture sit with one leg stretched out on the ground and the other bent at the knee. Then catch the extended foot with both the hands and place the head on that knee.

**Starting Position**

The subjects sat with the legs extended together, and kept their hands sideward.\(^1^9\)

**Stages for practice**

The subjects folded their right leg like ‘L’ shape on the floor, held their right leg toe by both hands fingers, then touched their head on their knee and maintained for thirty seconds in the final position. The subjects were released their final position to starting position reverse order step by step. The subjects folded their left leg like ‘L’ shape on the floor, held their left leg toe by both hands fingers, then touched their head on their knee and maintained for thirty seconds in the final position. The subjects released their final position to starting position reverse order step by step.
Important points to Remember

Do’s

The subjects were instructed that Elbow should be kept on the floor as much as possible comfortably.

Don’ts

The subjects were instructed that they should not strain more to touch the knee by head. The subjects were instructed that they should not raise the knee while maintaining the position.

ARDHA-KATICHAKRASANA

Starting Position

The subjects stood with the legs together, and kept their hands sideward straight in standing position.\(^{20}\)

Stages for practice

The subjects raised their right hand forward and kept it straight near their right ear. The subjects were bent their body to left side slowly as much as possible for thirty seconds in the final position. The subjects were released their final position to starting position reverse order slowly. The subjects were performed on the left side and maintained for thirty seconds in the final position.
Important points to Remember

Do’s

The subjects performed without strain in the final position.

Don’ts

The subjects were instructed that they should not bend their leg in the final position.

PADHASTASANA

Starting Position

The subjects stood with the legs together, and kept their hands sideward straight in standing position.²¹

Stages for practice

The subjects were raised both their hands forward up straight till near their ear, then slowly bent forward and touched their knee by head as much as possible and maintained for one minute in the final position. The subjects released final position to starting position step by step reverse order.

Important Points to Remember

Do’s

The subjects performed without strain in the final position.
Don’ts

The subjects were instructed that they should not bend the knee to touch knee by head.

KAPALABHATI

Kapalabhati is classed as one of the six cleansing processes in yoga. Kapala, in Sanskrit, means ‘forehead’ and bhati means ‘to shine’, hence the name. It removes impurities from the passage of the nostrils and the sinuses by the forceful current of the air. This is done in sitting position. Form a fool-lock by placing right foot on the left thigh and left foot on the right thigh. Place the hands on the knees. Sit erect. Exhale suddenly and forcibly giving an inward abdominal stroke at the navel region. Let the abdomen relax and simultaneously inhale. In the beginning practice 10-20 rounds of Kapalabhati. The number of strokes and the speed may be increased as one gets used to the practice.

Starting Position

The subjects sat in a comfortable sitting position and kept their palms on their respective knees.\(^{22}\)

Stages for Practice

The subjects were performed forceful inhalation and exhalation concentrating on their lower abdomen for one minute. Then subjects were given one minute rest. Again subjects were performed two more times
same practice for two minutes after taking rest one minute in between the practice.

**Important points to Remember**

**Do’s**

The subjects were maintained the body straight throughout the practice.

**Don’ts**

The subjects were instructed that they should not perform with strain on their face, and chest during in the practice.

**BHASHRIKA PRANAYAMA**

**Introduction**

It is one of the pranayama of Gheranda Samhita. In Sanskrit, Bhashrika means bellows. This pranayama is called Bhashrika because it is characterized by incessant and quick expulsions of breath, imitating the actively hissing bellows of a village smith.

**Starting Position**

The subjects were sat in a comfortable position keeping their palms on their respective knees and back straight.23
Stages of practice

The subjects were sat in a comfortable position, and then began with 20 strokes of Kapalabhati followed by inhalation through both the nostrils and exhalation through the left nostril after holding the breath comfortably for 20 rounds of ujjai.

Important points to Remember

Do’s

The subjects were instructed that to do slowly as per their individual capacity during this practice.

Don’ts

The subjects were instructed that they should not perform this practice with strain.

MEDITATION

Meditation should positively be done only in a comfortable manner in the meditative asana, because entire body should be within the sphere of chakra centres from muladhara to sahasrara chakras. The technique of meditation, the subjects were asked to sit in a comfortable sitting position, the spinal should be kept erect, and the eyes were closed and instructed them to focus their middle of the eyebrow for fifteen minutes. Observing meditation and avoiding the twin factors that act as a solder rule to achieve progress in the path of yogic practices. The purpose of
meditation is to reduce the stress from the physical and the mental level and receive a peace of mind.\textsuperscript{24}

\textbf{Perspectives of Health Related Physical Fitness}

The concept of Health related physical fitness has been evolved by AAHPERD (American Alliance for Health, Physical Education, Recreation and Dance) during 1975 because AAHPERD Youth Fitness Test did not place enough emphasis on the health related aspects of physical fitness. A joint committee AAHPERD and ARAPCS (Association for Research and Professional Councils and Societies) in 1975 recommended that a physical fitness test should meet the following criteria:

That it measures an area which extends from severely limited dysfunction to high levels of functional capacity. That it can be improved with appropriate physical activity. That its changes in functional capacity are accurately reflected by changes in test scores.

The joint committee’s recommendations, consisting the fundamental components of health related fitness, were forwarded to the AAHPERD Board of Governors and in late summer, 1977, AAHPERD president, le Roy Walker, appointed an AAHPERD Task Force on Youth Fitness. The Task Force was charged with following on the joint committee’s recommendations and achieving a revision of the Youth Fitness Test. Test Force members were Steven Blair, Harold B. Falls (Chair), B. Don Franks, Andrew S. Jackson, Michael L. Pollock, and
Margaret j. Safrit, where Raymond A. Ciszek served as AAHPERD Staff Liaison.

However, the Task force was active for three years. Its work culminated in the publication of the Health Related Physical Fitness Test Manual in 1980. The AAHPERD Youth Fitness Test was not revised. Although the Task Force recommended that the Health Related Physical Fitness Test replace the Youth Fitness Test, the AAHPERD Board of Governors made a decision that the two tests would co-exist—at least for a limited evaluation period.

In fact, the responses to the Health Related Physical Fitness Test have varied since publication of the test manual in 1980. Even some national organizations have been reluctant to accept the concept that health related physical fitness is of primary importance for citizens. On the other hand, other groups, many state level organizations. Individuals have enthusiastically endorsed the new test and moved forward with its promotion and use. Illinois, for example, has developed an outstanding programme to provide workshops so that school personnel can learn about the concepts of health related fitness and the techniques of using the test. The test was included as one of the instructional modules in the1982 by Post Cereals Forums on youth fitness. The University of Wisconsin, in a project by Margaret J. Safrit, has developed an instrument for evaluation the use of the test. The test has been adopted for use in the Boys Clubs of America Super-Fit All Stars programme.

The 1980 version of the AAHPERD Health Related Physical Fitness Test was not the final answer, nor was it purported to be. Early in
its deliberations, the Task Fore recognized the need for much additional research in this area. The concept of a technical manual to accompany the test manual was conceived in response to that perception. The Task Force realized that the mere act of publication 9th the new test would stimulate research. Indeed, various individuals and groups have undertaken a significant number of studies in the three ensuing years. However, more impetus was then felt necessary. The Task Force anticipates that publication of this Technical Manual would more clearly identify needed areas for research for the many investigators who might potentially conduct research on health related physical fitness.

In fact, publication of the Technical Manual represents a milestone of sorts. Physical fitness tests published in the past have not had an accompanying technical manual, even though provision of such information part of the total test development process. However the test manual of Health Related Physical Fitness Test contains the following information:

The rationale underlying the health related physical fitness approach: The rationale for selection of the items included in the test battery.25

Development of “Exercise schedule” for promotion of Health Related Physical Fitness

The investigator of this piece of research has developed on “Exercise Schedule “depending upon the results of the normative study and on the basis of review of literature as well as o his long standing
professional experience in the field of physical education. It was assumed that the ‘Schedule’ as proposed in this study would show some significant effect for the improvement of health related physical fitness.

The exercise schedule as developed in this study composed walking, some stretching exercises and yogic exercises. Which have been selected on the basis of the following:

. Since stretching exercises useful in improving range of movement (Webright et.al., 1997), elasticities of muscles and tendon (Moralesero, 1990; Taylor et al., 1990), Muscle’s ability to rapid and forceful contraction (Astrand and Rodahl, 1986; Berg, 1980), delaying muscle soreness (Torgan, 1985), they are assumed to prevent injury and enhance the performance concerning fine motor skills (Ekstrand et al., 1983; Gleim et al., 1990), It was, therefore, thought desirable to include stretching exercises as an independent variable.

. On the other hand, Yogic exercises are known to increase steadiness of body (Kocher, 1972), breath control (Bhole and Karambelkar, 1972, 1988; Robson, 1973), neuromuscular coordination (Sahu and Bhole, 1983), perceptual abilities (Sahu and Gharote, 1985) and provide better psychological health in terms of emotional control (Kocher and Pratap, 1971), and reduce in anxiety level (Kocher, 1976; Lorrye, 1971). They in turn increase concentration and provide muscular relaxation and contribute various other factors which are essential in improvement of performance. Yogic exercises were, therefore, selected as one of the independent variables of
recording better level of selected health related physical fitness, and other sub problems of selected physiological and biochemical variables.

Walking for 45 minutes, and Stretching exercises for 15 minutes. Subjects were asked to do for one hour daily either in the morning or in the evening for six days in a week for 12 weeks.

Content of Aerobic Exercise Programme

Constituents of ‘Aerobic Exercise Schedule’

On the basis of above justification the list of the stretching exercises constituting the muscular stretching schedule is as follows:

Walking
Rotation of joints from neck to ankle
Upper and lower back stretch
Shoulder-Hip extension stretch
Shoulder rotation stretch
Quad stretch
Abduction stretch
Sitting adduction stretch
Stretch based on the spread leg stretch
Cooling down

The stretching exercises were done as per the schedule given below:
STRETCHING EXERCISES

TRAINING PERIOD:
12 Weeks, 6 days in a week for 60 minutes per day.

TABLE VI

AEROBIC EXERCISES TRAINING SCHEDULE

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of The Exercise</th>
<th>Repetition</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Walking</td>
<td>One time</td>
<td>45 minutes</td>
</tr>
<tr>
<td>2.</td>
<td>Rotation of joints</td>
<td>Five times</td>
<td>One minute</td>
</tr>
<tr>
<td>3.</td>
<td>Upper and lower back stretch</td>
<td>Five times</td>
<td>One minute</td>
</tr>
<tr>
<td>4.</td>
<td>Shoulder-Hip extension stretch</td>
<td>Five times</td>
<td>One minute</td>
</tr>
<tr>
<td>5.</td>
<td>Shoulder rotation stretch</td>
<td>Five times</td>
<td>One minute</td>
</tr>
<tr>
<td>6.</td>
<td>Quad stretch</td>
<td>Five times</td>
<td>One minute</td>
</tr>
<tr>
<td>7.</td>
<td>Abduction stretch</td>
<td>Five times</td>
<td>One minute</td>
</tr>
<tr>
<td>8.</td>
<td>Sitting adduction stretch</td>
<td>Five times</td>
<td>One minute</td>
</tr>
<tr>
<td>9.</td>
<td>Spread leg stretch</td>
<td>Five times</td>
<td>One minute</td>
</tr>
<tr>
<td>10.</td>
<td>Cooling down</td>
<td>Five times</td>
<td>Seven minutes</td>
</tr>
</tbody>
</table>

TABLE VII

AEROBIC EXERCISES TRAINING SCHEDULE
FOR I, II, III AND IV WEEKS

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of The Exercise</th>
<th>Repetition</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Walking</td>
<td>One time</td>
<td>20 minutes</td>
</tr>
<tr>
<td>2.</td>
<td>Rotation of joints</td>
<td>Five times</td>
<td>Three minutes</td>
</tr>
<tr>
<td>3.</td>
<td>Upper and lower back stretch</td>
<td>Five times</td>
<td>Three minutes</td>
</tr>
<tr>
<td>4.</td>
<td>Cooling down</td>
<td>Five times</td>
<td>Four minutes</td>
</tr>
</tbody>
</table>
## TABLE VIII

**AEROBIC EXERCISES TRAINING SCHEDULE**

**FOR V, VI, VII AND VIII WEEKS**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of The Exercise</th>
<th>Repetition</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Walking</td>
<td>One time</td>
<td>25 minutes</td>
</tr>
<tr>
<td>2.</td>
<td>Rotation of joints</td>
<td>Eight times</td>
<td>Four minutes</td>
</tr>
<tr>
<td>3.</td>
<td>Upper and lower back stretch</td>
<td>Eight times</td>
<td>Four minutes</td>
</tr>
<tr>
<td>4.</td>
<td>Shoulder-Hip extension stretch</td>
<td>Eight times</td>
<td>Four minutes</td>
</tr>
<tr>
<td>5.</td>
<td>Shoulder rotation stretch</td>
<td>Eight times</td>
<td>Four minutes</td>
</tr>
<tr>
<td>6.</td>
<td>Cooling down</td>
<td>Five times</td>
<td>Four minutes</td>
</tr>
</tbody>
</table>

## TABLE IX

**AEROBIC EXERCISES TRAINING SCHEDULE**

**FOR IX, X, XI AND XII WEEKS**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of The Exercise</th>
<th>Repetition</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Walking</td>
<td>One time</td>
<td>45 minutes</td>
</tr>
<tr>
<td>2.</td>
<td>Rotation of joints</td>
<td>Five times</td>
<td>One minute</td>
</tr>
<tr>
<td>3.</td>
<td>Upper and lower back stretch</td>
<td>Five times</td>
<td>One minute</td>
</tr>
<tr>
<td>4.</td>
<td>Shoulder-Hip extension stretch</td>
<td>Five times</td>
<td>One minute</td>
</tr>
<tr>
<td>5.</td>
<td>Shoulder rotation stretch</td>
<td>Five times</td>
<td>One minute</td>
</tr>
<tr>
<td>6.</td>
<td>Quad stretch</td>
<td>Five times</td>
<td>One minute</td>
</tr>
<tr>
<td>7.</td>
<td>Abduction stretch</td>
<td>Five times</td>
<td>One minute</td>
</tr>
<tr>
<td>8.</td>
<td>Sitting adduction stretch</td>
<td>Five times</td>
<td>One minute</td>
</tr>
<tr>
<td>9.</td>
<td>Spread leg stretch</td>
<td>Five times</td>
<td>One minute</td>
</tr>
<tr>
<td>10.</td>
<td>Cooling down</td>
<td>Five times</td>
<td>Seven minutes</td>
</tr>
</tbody>
</table>
Walking

The subjects were assembled on the starting line. The research scholar given a command “Ready” and “Go”, the subject walked briskly for forty five minutes as fast as possible. After, fifteen minutes stretching exercises were done by the subjects.

Description of the techniques of stretching exercises

Rotation of joints from neck to ankle

Subjects practiced rotation of each joints from neck to ankle slowly five times after walking and before starting stretching exercises.

Upper and lower back stretch

Sat in a chair with feet separated greater than shoulder width. Placed arms to the inside of the thighs and the chest down toward the floor. At the sametime, attempted to reach back as far as subjects could with their arms. Here upper and lower back muscles and ligaments were stretched.

Shoulder hip extension stretch

Had a partner grasped their arms from behind by the wrist and slowly pushed them upward. Held the final position for a few seconds. Here deltoid and pectoral muscles and ligaments of the shoulder joint were stretched.
**Shoulder Rotation stretch**

With the aid of surgical tubing or an aluminum or wood stick. Placed the tubing or stick behind subjects’ back and grasped the two ends using a reverse (thumbs-out). Slowly brought the tubing or stick over their head, keeping the elbows straight. Repeated five times (brought their hands closer together for additional stretch). Deltoid, latissimus dorsal, and pectoral muscles and shoulder ligaments were stretched.

**Quad stretch**

Stood straight up and brought up one foot, flexing the knee. Grasped the front of the ankle and pulled the ankle towards the gluteal region. Held for one minute. Repeated with the other leg. During this stretch, quadriceps muscle, and knee and ankle ligaments were stretched.

**Adducton stretch**

Stood with their feet about twice shoulder width and placed their hands slightly above the knee. Flexed one knee and slowly bent down as far as possible, held the final position for one minute. Repeated with the other leg. Here the area of stretch was hip adductor muscle.

**Sitting Adducton stretch**

Sat on the floor and brought subjects’ feet closed allowing the soles of the feet to touch each other. Now placed their forearms (or elbows) on
the inner part of the thigh and pushed the legs downward, held the final stretch for one minute. Hip adductor muscles were stretched.

**Stretch based on the Spread leg stretch**

Stood on the ground spreading the legs as wide as possible. Then slowly sat on the ground turning the body to the direction of the left leg, which was stretched on the ground completely. Now started bending their trunk forward and downward till the head rests on the knee. Held the sole of the left foot with both hands lacing fingers. Simultaneously stretched the right leg with inside foot flat on the ground locking the knee. Remained in this position for one minute then returned to the original standing position. Next repeated the exercise with right leg.

**Cooling down**

**Subjects practiced cooling down their body after stretching exercises.**

All the above walking and stretching exercises were beneficial to the spine, the feet, the knees and the thighs. They kept the hip joint flexible and pelvic joint. Also subjects were given proper exercises to knee joints. The stretching alleviated stiffness in legs and stretched knees and thighs. The most striking effect was that the body became supple, so that it could turn and twisted with great ease.

Those who had heavy thighs and buttocks could derive extraordinary benefits from these stretches. The waist became supple and these exercises relieved pain in the knees, thighs and legs.
On the basis of the principles of Indian traditional exercises. The exercises programme were imparted systematically from simple to complex manner, they were practiced as per the subjects individual need.

**Phase-III: Post-test**

The post-test in the all selected variables were conducted on the subjects of all the groups after completion of experimental treatment period of 12 weeks. The procedure of post-test was same like the pre-test.

**Phase-IV: Follow-up**

The subjects were kept under observation even after completion of the experimental treatment period of 12 weeks to know the Follow-up effect. The duration of the follow-up period was for a period of six weeks. The procedure of follow-up test was same like the pre-test.

**Statistical Analysis**

The data collected from sixty diabetic subjects on the criterion measures (on selected health related physical fitness, on selected physiological and on biochemical variables) was statistically analysed by analysis of Covariance. In Analysis of Covariance, the final means are adjusted for differences in initial means, and the adjusted means are tested for significance. In this method of application the analysis of variance is first computed for the differences between initial means, in each of the criterion measures. A non – significant ‘F’ ratio will provide
confidence that the initial samples come from the same population and the sampling bias is devoid.

The post-hoc method of Bonferroni testing was used to determine the significance of the differences between paired means following a significant ANOVA ‘F’ ratio was applied to the differences between paired adjusted final means after a significant covariance ‘F’ ratio. Adjustments were made to the equivalent covariance values. The test of significance was fixed at the 0.05 level of confidence.43
REFERENCES


