CHAPTER III

METHODOLOGY

Research methodology involves the systematic procedure by which the research starts from the initial identification of the problem to its final conclusions. The role of the methodology is to carry on the research work in a scientific and valid manner.

In this chapter, procedures and methods were applied in selection of subjects, selection of variables, experimental design, pilot study, criterion measures, reliability of the data, reliability of instruments, tester’s reliability, subject reliability, orientation to the subjects, training programme, training schedule, selection of tests, administration of tests, collection of data and statistical procedure followed in this study.

3.1 SELECTION OF THE SUBJECTS

To achieve the purpose of this study ninety subject were randomly selected from Rajapalayam Raju’s College, Rajapalayam, Tamilnadu, during the academic year 2009 - 2010. The subject’s age ranged between 18-25 years only. They were randomly divided into three equal groups. Swami Satyananda Saraswati Yogic Practices group, Swami Vishnudevananda Yogic Practices group were considered as two experimental groups and the other group was control group. All the subjects were healthy and physically fit. The nature and importance of the study was explained to the subjects and subjects expressed their willingness to serve as subjects in this study. The study was formulated as pre post test pre experimental design.

3.2 SELECTION OF VARIABLES

The research scholar reviewed the various scientific literatures pertaining to the Swami Satyananda Saraswati Yogic Practices and Swami Vishnudevananda yogic practices on selected motor ability, physiological, hematological and bio-chemical variables from books, journals, periodicals, magazines and research papers. Taking into consideration of feasibility criteria, availability of instruments and the relevance of the variables of the present study, the following variables were selected dependent variables.
3.2.1 DEPENDENT VARIABLES

a. MOTOR ABILITY VARIABLES

i. Flexibility

ii. Muscular Strength

iii. Cardio Vascular Endurance

b. PHYSIOLOGICAL VARIABLES

i. Resting Pulse Rate

ii. Vital Capacity

iii. VO₂ Max

c. HEMATOLOGICAL VARIABLES

i. RBC Count (Red Blood Cell Count)

ii. WBC Count (White Blood Cell Count)

iii. Platelets Count

d. BIO-CHEMICAL VARIABLES

i. Blood Sugar

ii. High Density Lipoprotein (HDL)

iii. Low Density Lipoprotein (LDL).

3.2.2 INDEPENDENT VARIABLES

(i) Experimental Yogic Practices - Swami Satyananda Saraswati Yogic Practices


(iii) Control group - No training

3.3 EXPERIMENTAL DESIGN

The study was formulated as a true random group design. Consisting of a pre test and post test the subjects (n =90) were randomly assigned to three equal groups of thirty
college men students each. The groups were assigned as experimental group I, II and control group respectively. Pretest was conducted for all the subjects on selected Motor Ability Physiological Hematological and Bio-Chemical Variables such as Flexibility, Muscular Strength, Cardio Vascular Endurance, Resting Pulse Rate, Vital Capacity, VO$_2$ Max, RBC Count (Red Blood Cell Count), WBC Count (White Blood Cell Count), Platelets Count, Blood Sugar, High Density Lipoprotein (HDL) and Low Density Lipoprotein (LDL). The experimental groups participated in their respective Swami Satyananda Saraswati Yogic Practices and Swami Vishnudevananda Yogic Practices group for a period of 12 weeks. The post test was conducted on the above said dependent variables after a period of 12 weeks in the respective treatments. The training Program was scheduled at 4 to 5p.m and 5 to 6p.m from Monday to Friday in progression.

3.4 PILOT STUDY

In order to find out the accuracy of measurement of various tests, a pilot study was conducted with a few subjects prior to the Study.— Test

3.5 CRITERION MEASURES

By glancing the literature, and in consolation with professionals and experts, the following variables were selected as the criterion measures in this study.

1. Flexibility was measured through sit and reach test. (Johnson and Nelson, 1982).
2. Muscular strength was measured through push-ups test. (Yobu, 1987).
3. Cardio vascular endurance was measured through 12 Minutes Run\Walk Cooper’s Test. (Cooper, 1967).
5. Vital capacity was measured through Spiro meter. (Johnson and Nelson, 1982).
6. VO$_2$ max was measured through Astrand-Rhyming Nomogram Test. (Fox, 1989).
7. RBC Count (Red Blood Cell Count) measured through measured through Blood Test (Lab). (Talib, 1988).
8. WBC Count (White Blood Cell Count) measured through Blood Test (Lab). \cite{Talib, 1988}.

9. Platelets Count measured through Blood Test (Lab). \cite{Talib, 1988}.

10. Blood Sugar measured through Blood Test (Lab). \cite{Talib, 1988}.

11. High Density Lipoprotein (HDL) measured through Blood Test (Lab). \cite{Yogaraj, 2007}.

12. Low Density Lipoprotein (LDL) measured through Blood Test (Lab). \cite{Yogaraj, 2007}.

**TABLE I**

Names of Variables, Tests/ Tools Administered and the Unit Measurement

<table>
<thead>
<tr>
<th>S. NO</th>
<th>Variables</th>
<th>Test/ Tools Administered</th>
<th>Unit of Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Flexibility</td>
<td>Sit and Reach</td>
<td>Centimeters</td>
</tr>
<tr>
<td>2</td>
<td>Muscular strength</td>
<td>Push – Ups</td>
<td>Numbers</td>
</tr>
<tr>
<td>3</td>
<td>Cardio vascular endurance</td>
<td>12 Minutes Run\Walk</td>
<td>Meters</td>
</tr>
<tr>
<td>4</td>
<td>Resting pulse rate</td>
<td>Digital Heart Rate Measuring</td>
<td>beats/minute</td>
</tr>
<tr>
<td>5</td>
<td>Vital capacity</td>
<td>Spiro meter</td>
<td>Milliliters</td>
</tr>
<tr>
<td>6</td>
<td>VO$_2$ max</td>
<td>Astrand–Rhyming Nomogram Test</td>
<td>ml/kg/min</td>
</tr>
<tr>
<td>7</td>
<td>RBC Count (Red Blood Cell Count)</td>
<td>Blood Test (Lab).</td>
<td>million/cu mm</td>
</tr>
<tr>
<td>8</td>
<td>WBC Count (White Blood Cell Count)</td>
<td>Blood Test (Lab).</td>
<td>cells/cu mm</td>
</tr>
<tr>
<td>9</td>
<td>Platelets Count</td>
<td>Blood Test (Lab).</td>
<td>lakhs/cu mm</td>
</tr>
<tr>
<td>10</td>
<td>Blood Sugar</td>
<td>Blood Test (Lab).</td>
<td>mg/dl</td>
</tr>
<tr>
<td>11</td>
<td>High Density Lipoprotein (HDL)</td>
<td>Blood Test (Lab).</td>
<td>mg/dl</td>
</tr>
<tr>
<td>12</td>
<td>Low Density Lipoprotein (LDL)</td>
<td>Blood Test (Lab).</td>
<td>mg/dl</td>
</tr>
</tbody>
</table>
3.6 RELIABILITY OF DATA

In order to establish the reliability of the data, the investigator has established instrument reliability, tester reliability and subject reliability.

3.7 RELIABILITY OF INSTRUMENTS

For training purpose the equipment’s like Gymnastic mats, the measuring yardstick, scale, stop watch, Spiro meter, and bench used in the study were obtained from standard suppliers and which are properly calibrated. The instruments available at the department of physical education were used in the present study. Therefore, it is considered as reliable and accurate. All the instruments were in good condition and workable.

Excretion of blood and laboratory tests on RBC Count (Red Blood Cell Count), WBC Count (White Blood Cell Count), platelets count, blood sugar, high density lipoprotein (HDL) and low density lipoprotein (LDL) were done at the Government hospital, Rajapalayam by a biochemists. They used instruments for this study such as small bottle, needle, disposable syringes, cotton, etc., and the experiment was done in a well-established computerized laboratory.

3.8 TESTER’S RELIABILITY

To measure uniformity and reliability of the testing technique, the investigator had a number of practice session in the testing procedure with the guidance of their teacher. The investigator has done all the experimental parameters with the assistance of their teacher and laboratory experts.

3.9 SUBJECT RELIABILITY

The interclass correlation value of the above test and retest also indicated the same tester used subjects under similar conditions. The co-efficient of reliability were significant at 0.05 levels, for the above test under investigation.
3.9.1 ORIENTATION TO THE SUBJECTS

Before the collection of data, the subjects were oriented about the purpose of the study that was the effect of selected motor ability, physiological, hematological and biochemical variables. The scholar has explained the training methods and its procedures, the training schedule and utility. Procedure of the training was instructed to the subjects.

3.10 TRAINING PROGRAMME

During the training period the experimental group-I underwent Swami Satyananda Saraswati Yogic Practices programme for weekly five days, from Monday to Friday 4 to 5p.m. Experimental Group –II underwent Swami Vishnudevananda Yogic Practices programme for weekly five days, from Monday to Friday 5 to 6p.m. Experimental treatment was restricted to 12 weeks.

3.11 TRAINING SCHEDULE

**TABLE II**

TRAINING SCHEDULE FOR PACKAGE I YOGIC PRACTICES – SWAMI SATYANANDA SARASWATI YOGIC PRACTICES

<table>
<thead>
<tr>
<th>SL.NO</th>
<th>NAME OF THE PRACTICE</th>
<th>DURATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>1 TO 4 WEEKS</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>30 minutes</td>
</tr>
<tr>
<td>1</td>
<td>Pawanmuktasana</td>
<td>3 minutes</td>
</tr>
<tr>
<td>2</td>
<td>Surya Namaskara</td>
<td>3 minutes</td>
</tr>
<tr>
<td>3</td>
<td>Ardha Padma Paschimottanasana</td>
<td>2 minutes</td>
</tr>
<tr>
<td>4</td>
<td>Ardha Matsyendrasana</td>
<td>2 minutes</td>
</tr>
<tr>
<td>5</td>
<td>Bhujangasana</td>
<td>2 minutes</td>
</tr>
<tr>
<td>6</td>
<td>Sarvangasana</td>
<td>2 minutes</td>
</tr>
<tr>
<td>7</td>
<td>Halasana</td>
<td>2 minutes</td>
</tr>
<tr>
<td>8</td>
<td>Matsyasana</td>
<td>2 minutes</td>
</tr>
<tr>
<td>9</td>
<td>Shavasana</td>
<td>2 minutes</td>
</tr>
<tr>
<td>10</td>
<td>Kapalbhati</td>
<td>2 minutes</td>
</tr>
<tr>
<td>11</td>
<td>Yoga Nidra</td>
<td>8 minutes</td>
</tr>
</tbody>
</table>
TABLE III

TRAINING SCHEDULE FOR PACKAGE II YOGIC PRACTICES –
SWAMI VISHNUDEVANANDA YOGIC PRACTICES

<table>
<thead>
<tr>
<th>SL.NO</th>
<th>NAME OF THE PRACTICE</th>
<th>DURATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1 TO 4 WEEKS</td>
</tr>
<tr>
<td>1</td>
<td>Loosening</td>
<td>30 minutes</td>
</tr>
<tr>
<td>2</td>
<td>Sun Exercises</td>
<td>5 minutes</td>
</tr>
<tr>
<td>3</td>
<td>Relaxation</td>
<td>4 minutes</td>
</tr>
<tr>
<td>4</td>
<td>Head Stand (Sirshasana)</td>
<td>2 minutes</td>
</tr>
<tr>
<td>5</td>
<td>Shoulder Stand (Sarvangasan)</td>
<td>2 minutes</td>
</tr>
<tr>
<td>6</td>
<td>Fish Pose (Matsyasana)</td>
<td>2 minutes</td>
</tr>
<tr>
<td>7</td>
<td>Head - Knee Pose (Paschimottanasana)</td>
<td>2 minutes</td>
</tr>
<tr>
<td>8</td>
<td>Spinal Twist (Ardha Matsyendrasana)</td>
<td>2 minutes</td>
</tr>
<tr>
<td>9</td>
<td>Corpse Pose (Savasana)</td>
<td>2 minutes</td>
</tr>
<tr>
<td>10</td>
<td>Bhasrika Pranayama</td>
<td>2 minutes</td>
</tr>
<tr>
<td>11</td>
<td>Meditation</td>
<td>8 minutes</td>
</tr>
</tbody>
</table>

3.11.1 PACKAGE I YOGIC PRACTICES - SWAMI SATYANANDA SARASWATI YOGIC PRACTICES GROUP TRAINING PROGRAMS

The following are the selected yogic practices given to the experimental group I.

1. Pawanmuktasana
2. Surya Namaskara
3. Ardha Padma Paschimottanasana
4. Ardha Matsyendrasana
5. Bhujangasana
6. Sarvangasana
7. Halasana
8. Matsyasana
9. Shavasana
10. Kapalbhati
1. PAWANMUKTASANA

This group of asanas is concerned with loosening up the joints of the body. It is excellent for those debilitated by rheumatism, arthritis, high blood pressure, heart problems or other ailments where vigorous physical exercise is not advised. It is particularly useful for eliminating energy blockages in the joints of the physical body, and for improving coordination, self-awareness and self-confidence. (Swami Satyananda Saraswati, 1969).

Prarambhik Sthiti (base position)

- Sit with the legs outstretched, feet close together but not touching.
- Place the palms of the hands on the floor to the sides, just behind the buttocks.
- The back, neck and head should be comfortably straight. Straighten the elbows.
- Lean back slightly, taking the support of the arms.
- Close the eyes and relax the whole body in this position.

Practice 1: Padanguli Naman (toe bending)

- Sit in the base position with the legs outstretched and the feet together. Place the hands beside and slightly behind the buttocks.
- Lean back a little, using the arms to support the back.
- Keep the spine straight.
• Be aware of the toes. Move only the toes of both feet slowly backward and forward, keeping the feet upright and the ankles relaxed and motionless.
• Hold each position for a few seconds. Repeat 10 times.

**Breathing**

• Inhale as the toes move backward.
• Exhale as the toes move forward.

**Awareness**

• On the stretching produced by the movement and the breath.

**Practice 2: Goolf Naman (ankle Bending)**

• Remain in the base position.
• Slowly move both feet backward and forward, bending them from the ankle joints.
• Try to stretch the feet forward to touch the floor and then draw them back towards the knees.
• Hold each position for a few seconds. Repeat 10 times

**Breathing**

• Inhale as the feet move backward.
• Exhale as the feet move forward.

**Awareness**

• On the stretch in the foot, ankle, calf and leg, and the breath.
Practice 3: Goolf Chakra (ankle rotation)

- Remain in the base position.
- Keep the leg shoulder-width apart and straight.
- Keep the heels on the ground throughout the practice.

Breathing

- Inhale on the upward movement.
- Exhale on the downward movement.

Awareness

- On the rotation of the ankle and the breath.

Practice 4: Goolf Ghoornan (ankle crank)

- Remain in the base position.
- Bend the right knee and bring the foot towards the groin. Turn the knee out to the side and if there is no strain, gently place the foot on the left thigh. Make sure the ankle is far enough over the thigh to be free for rotation.
- Hold the right ankle with the right hand. Hold the toes of the right foot with the left hand. With the aid of the left hand, slowly rotate the right foot 10 times clockwise, then 10 times anti-clockwise.
- Change the leg and repeat with the left foot placed on the right thigh.

**Breathing**

- Inhale on the upward movement.
- Exhale on the downward movement.

**Awareness**

- On the rotation and the breath.

**Practice 5: Janufalak Akarshan (kneecap contraction)**

- Stay in the base position.
- Gently contract the muscle surrounding the right knee, drawing the kneecap back towards the thigh.
- Hold the contraction for 3 to 5 seconds, counting mentally.
- Release the contraction and let the kneecap return to its normal position.
- Practice 10 times. Repeat with the left kneecap 10 times, then with both kneecaps together.

**Breathing**

- Inhale while contracting.
- Exhale while relaxing the knee muscles.

**Awareness**

- On the contraction and the breath.
Practice 6: Janu Naman (knee bending)

Breathing

- Inhale while straightening the legs.
- Exhale while bending the legs.

Awareness

- On the knee bend and associated movement and the balance, and the breath.

Practice 7: Janu Chakra (knee crank)

Breathing

- Inhale on the upward movement.
- Exhale on the downward movement.

Awareness

- On the movement and perfection of circular rotation, and the breath.
Practice 8: Ardha Titali asana (half butterfly)

- Sit in the base position.
- Bend the right leg and place the right foot comfortably on the left thigh.
- Place the right hand on top of the bent right knee.
- Hold the toes of the right foot with the left hand.
- This is the starting position.

Awareness

- On the movement of the knee, ankle and hip joints, relaxation of the inner thigh muscles, and the breath.

Practice 9: Shroni Chakra (hip rotation)

- Sit in the same starting position as for Ardha titali asana with the right foot on the left thigh. Use the right hand to rotate the right knee in a circle and make the circular movement as large as possible.
- The index finger may be pointed out and used as a guide to perfection of the circular movement. Practice 10 rotations clockwise and then 10 rotations anticlockwise.
- Straighten the leg slowly. Repeat with the left leg
Breathing

- Inhale on the upward movement.
- Exhale on the downward movement.

Awareness

- On the rotation of the knee, ankle and hip joint, and the breath.

Practice 10: Poorna Titali Asana (full butterfly)

- Sit in the base position.
- Bent the knees and bring the soles of the feet together,
- Keeping the heels as close to the perineum as possible.
- Fully relax the inner thigh muscles.

Breathing

- Normal breathing, unrelated to the practice.

Awareness

- On the hip joint, movement and relaxation.

Contra-indications

- People with sciatica and sacral conditions should avoid this asana.
Practice 11: Mushtika Bandhana (hand clenching)

- Stretch out your arms
- Fold your fingers in fist first and then unfold them.

Breathing

- Inhale on opening the hands.
- Exhale on closing the hands.

Awareness

- On the stretching sensation and movement, and the breath.

Practice 12: Manibandha Naman (wrist bending)

- Open your hand and stretch downward and then backward.

Breathing

- Inhale with the backward movement.
- Exhale with the forward movement.

Awareness

- On the movement in the wrist joint and stretching of the forearm muscles, and the breath.
Practice 13: Manibandha Chakra (wrist joint rotation)

- Fold your fingers into fist and rotate at the wrist clockwise and counterclockwise

Benefits

- The hand and wrist asanas are beneficial for the related joints. They also relieve tension caused by prolonged writing, typing and so on.

Practice 14: Kehuni Naman (elbow bending)

- Fold hands at elbow so that the fist rests on the shoulders then unfold it.

Breathing

- Inhale while straightening the arms.
- Exhale while bending the arms.

Awareness

- On the movement of the elbow joint and arm muscles, and the breath.

Practice 15: Kehuni Chakra (elbow rotation)

Breathing

- Inhale on the upward stroke.
- Exhale on the downward stroke.
Awareness

- On the rotation of the elbow joint with the breath and on keeping the upper arm steady.

Variation

- To begin with, the left hand can support the right arm just above the elbow, so that the upper arm remains steady throughout the practice.

Practice 16: Skandha Chakra (shoulder socket rotation)

- Lift your shoulder and then rotate your shoulders clockwise and counter clockwise.

Breathing

- Inhale on the upward stroke.
- Exhale on the downward stroke.

Awareness

- On the stretching sensation around the shoulder joint and the breath.

Practice 17: Greeva Sanchalana (neck movements)
1. Sit crosses legs, hands on your Knee or in your lap
2. Slowly rotate head to the right.
3. Now slowly rotate head to the left.
4. Now slowly bring head back to center position.
5. Now slowly move your head up and then slowly bring it back down.
6. Then look straight ahead and lower the head to right - towards the shoulder
7. To the left.

Benefits

- All the nerves connecting the different organs and limbs of the body pass through the neck. Therefore, the muscles of the neck and shoulders accumulate tension, especially after prolonged work at a desk.

- These asanas release tension, heaviness and stiffness in the head, neck and shoulder region. (Swami Satyananda Saraswati, 1969)

2. SURYA NAMASKARA

The physical base of the practice links together twelve asanas in a dynamically performed series after loosening the limbs. These asanas are ordered so that they alternately stretch the spine backwards and forwards.

When performed in the usual way, each stage was moved into with alternate inhalation and exhalation (except for the sixth asana where the breath is held in external suspension). A full round of surya Namaskara is considered to be two sets of the twelve
poses with a change in the second set to moving the opposite leg first through the series a
good daily practice was 12 rounds performed by the college men.

"Hiranmayena Patrena Satyasyapihitam Mukham,
Tat tvam Pushan Apavrnu Satya- dharmaya Drishtaye"

(Like a lid to vessel, O sun, your
Golden orb covers the entrances to Truth.
Kindly open the entrance, to lead me to Truth).

Each round of surya Namaskara is done, after the utterance of 'Omkar' with the
appropriate "Bija mantra, along with the corresponding name of sun god in the following sequence:

Each stage of surya Namaskara is accompanied by regulation of breath. The 12 counts of the surya Namaskara are as follows: *(Swami Satyananda Saraswati, 1981)*
POSITION 1: PRANAMASANA (PRAYER POSES)

Keep the eyes closed. Remain standing upright with the feet together. Slowly bend the elbows and place the palms together in front of the chest in namaskara mudra, mentally offering homage to the sun, the source of all life. Relax the whole body.

Breathing:

- Breath : Exhale, Breathe normally
- Chakra : Anahata
- Surya mantra : Om Mitraya Namaha
- Bija mantra : Om hram
- Muscles : postural, from soles of feet to crown of the head
- Organs/glands : cerebellum, thymus
- Benefits : establishes balance, concentration, calmness
- Spiritual : raising consciousness to higher levels of awareness

POSITION 2: HASTA UTTHANASANA (RAISED ARMS POSE)

Separate the hands raise and stretch both arms above the head, keeping them shoulder width apart. Bend the head, arms and upper trunk slightly backward.

- Breath : Inhale
- Chakra : Vishuddhi
- Surya mantra : Om Ravaye Namaha
- Bija mantra : Om hrim
- Muscles : back, shoulders, arms, chest, abdomen
- Organs/glands : kidneys, intestines, lungs, adrenal glands, thyroid / parathyroid,
- Benefits : opening emotionally, corrects poor posture
- Spiritual : Invoking the grace and power of higher forces
POSITION 3: PADAHASTASANA (HAND TO FOOT POSE)

Bend forward from the hips until the fingers or palms of the hands touch the floor on either side of the feet. Bring the forehead as close to the knees as is comfortable. Do not strain. Keep the knees straight.

- Breath: Exhale
- Chakra: Swadhisthana
- Surya mantra: Om Suryaya Namaha
- Bija mantra: Om hroom
- Muscles: hamstrings, buttocks, back, neck, shoulders
- Organs/glands GIT: kidneys, thyroid
- Benefits: improves digestion, circulation & respiration
- Spiritual: surrender to the powerful forces of gravity

POSITION 4: ASHWA SANCHALANASANA (EQUESTRIAN POSE)

Place the hands on the floor beside the feet. Stretch the right leg back as far as is comfortable and grasps the floor with the toes.

At the same time, bend the left knee, keeping the left foot on the floor in the same position. Keep the arms straight. In the final position, the weight of the body should be supported on hands, the left foot, right knee and toes of the right foot. The head should be tilted backward, the back arched and the inner gaze directed upward to the eyebrow center.

- Breath: inhale
- Chakra: Ajna
- Surya mantra: Om Bhanave Namaha
- Bija mantra: Om hraim
- Muscles: legs, buttocks, abdomen, thorax and neck
- Organs: cerebellum
- Benefits: sense of balance, centre of gravity
- Spiritual: removes darkness from delusions
POSITION 5: PARVATASANA (MOUNTAIN POSES)

Keep the hands and right foot still, and take the left foot back beside the right foot. Simultaneously, raise the buttocks and lower the head between the arms so that the back and legs form two sides of a triangle. The legs and arms straighten in the final position and the heels come down towards the floor in the final pose. Bring the head and shoulders towards the knees. Do not strain.

- Breath: exhale
- Chakra: Vishuddhi
- Surya mantra: Om Khagaya Namaha
- Bija mantra: Om hraum
- Muscles: legs, buttocks, abdomen, thorax and neck
- Organs: cerebellum, tones spinal nerves
- Benefits: sense of balance, centre of gravity, improves circulation
- Spiritual: Salute to the one by whom time is measured

POSITION 6: ASHTANGA NAMASKARA (SALUTE WITH EIGHT PARTS OR POINTS)

Keep the hands and feet in place. Lower the knees, chest and chin to the floor, the feet will come up on to the toes. In the final position only the toes, knees, chest, hands and chin touch the floor. The knees, chest and chin should touch the floor simultaneously.
If this is not possible, first lower the knees, then the chest, and finally the chin. The buttocks, hips and abdomen should be raised.

- **Breath**: retain breath (out)
- **Chakra**: Manipura
- **Surya mantra**: Om Pushne Namaha
- **Bija mantra**: Om hraha
- **Muscles**: legs, abdomen, thorax, shoulders and forearms
- **Organs**: recharges solar plexus, stimulates metabolism, Adrenal glands, Kidneys
- **Benefits**: strengthening and nourishing the body
- **Spiritual**: Salute to the giver of strength

**POSITION 7: BHUJANGASANA (COBRA POSE)**

Keep the hands and feet in place. Slide the chest forward and raise first the head, the shoulders, then, straightening the elbows, arch the back into the cobra pose. This will lower the buttocks and hips to the floor. Bend the head back and direct the gaze upward to the eyebrow center. The thighs and hips remain on the floor and the arms support the trunk.

Unless the spine is very flexible the arms will remain slightly bent.

- **Breath**: inhale
- **Chakra**: Swadhisthana
- **Surya mantra**: Om Hiranya Garbhaya Namaha
- **Bija mantra**: Om hram
- **Muscles**: stretches abdomen muscles, anterior neck muscles strengthens posterior back muscles
- **Organs**: kidney and liver, digestive system
- **Benefits**: Good for asthma, constipation Spiritual praying to the awakening of creativity
POSITION 8: PARVATASANA (MOUNTAIN POSE)

The hands and feet do not move from position 7. From Bhujangasana assume parvatasana. Keep the arms and legs straight, grip the floor with the toes and use the strength of the arms to raise the buttocks and lower the heels to the floor.

- Breath : exhale
- Chakra : Vishuddhi
- Surya mantra : Om Marichaye Namaha
- Bija mantra : Om hrim
- Muscles : legs, buttocks, abdomen, back and neck
- Organs : thyroid
- Benefits : stretches spinal nerves, circulation
- Spiritual : salutations to the lord of the dawn

POSITION 9: ASHWA SANCHALANASANA (EQUESTRIAN POSE)

Keep the palms flat on the floor and the right foot in place.

Bend the left leg and bring the left foot forward between the hands. Simultaneously, lower the right knee so that it touches the floor and push the pelvis forward. Tilt the head backward, arch the back and gaze at the eyebrow center.

- Breath : inhale
- Chakra : Ajna
- Surya mantra : Om Adityaya Namaha
• Bija mantra : Om hroom
• Muscles : stretches hip muscle, strengthens quads loosens tight hips
• Organs : massages abdominal organs, nervous system
• Benefits : nervous system, pineal gland
• Spiritual : salutations to he who illumines

POSITION 10: PADAHASTASANA (HAND TO FOOT POSE)

Bring the right foot forward next to the left foot. Straighten both legs. Bring the forehead as close to the knees as possible without straining.

• Breath : Exhale
• Chakra : Swadhisthana
• Surya mantra : Om Savitre Namaha
• Bija mantra : Om hraim
• Muscles : stretches hamstrings, buttocks, back, posterior neck, shoulders muscles
• Organs/glands GIT, : kidneys, thyroid
• Benefits : improves digestion, circulation & respiration
• Spiritual : salutations to the benevolent mother

POSITION 11: HASTA UTTANASANA (RAISED ARMS POSE)

Keep the arms and spine in a straight line.
Raise the torso and stretch the arms above the head.
Keep the arms separated, shoulder width apart.
Bend the head, arms and upper trunk backward slightly.

• Breath : Inhale
• Chakra : Vishuddhi
• Surya mantra : Om Arkaya Namaha
• Bija mantra : Om hraum
• Muscles : back, shoulders, arms, chest, abdomen
• Organs/glands : kidneys, intestines, lungs, adrenal glands, thyroid/parathyroid,
• Benefits : opening emotionally, corrects poor posture
• Spiritual : salutations to he who is fit to be praised

POSITION 12: PRANAMASANA (PRAYER POSES)

Bring the palms together in front of the chest.

Breathing:

• Breath : Exhale while assuming the final position.
• Chakra : Anahata
• Surya mantra : Om Bhaskaraya Namaha
• Bija mantra : Om hraha
• Muscles : postural, from soles of feet to crown of the head
• Organs/glands : cerebellum, thymus
• Benefits : sense of balance, centre of gravity, concentration
• Spiritual : salutations to he who leads to enlightenment.


3. ARDHA PADMA PASCHIMOTTANASANA

Method

• Sit with both legs outstretched
• Bend the left leg and place the left foot as high as possible on the right, turning the sole of the foot up.
• Press the heel firmly into the abdomen.
• Bent forward slightly, folds the left arm behind the back and try to grasp the toes of the left foot with the left hand.
• Sit upright again.
• Relax the whole body, especially the back muscles.
• Lean forward and grasp the toes of the right foot with the right hand.
• Utilizing the arms, not the back muscles, slowly pull the trunk forward so that the forehead is near to or resting on the straight knee.
• This is the final position.
• Hold the pose for as long as is comfortable.
• Release the hands and slowly sit up.
• Repeat the technique with the other leg.
• Practice up to 3 rounds, gradually extending the duration.

Breathing

• Inhale in the upright position.
• Exhale bending forward into the final position.
• Breathe slowly and deeply in the final position or retain the breath outside if holding the pose for a short time.
• Inhale while returning to the upright position.

Other details

• As for Paschimottanasana.

Benefits

• Stretches the back and spine
• Stretches the shoulders
• Stretches the hamstrings
• Beneficial for the kidneys, liver, ovaries and uterus. (It is thus a must for women. It also helps ease menstrual discomfort.)
• Beneficial for diabetics and improves digestion.
• This asana also prepares the legs and hips for prolonged sitting in meditation asanas. (Swami Satyananda Saraswati, 1969).

4. ARDHA MATSYENDRASANA

This asana is named after the great Yogi Matsyendranath, one of the founders of Hatha Yoga, and hence the name.

Sequence

• Sit on the floor with both legs extended.
• Cross your right foot over your left knee, place it firmly on the floor, keeping the left hand on the right toes.
• Stretch out the right arm and twist it around the back of your waist line as far as you can. The open palm and the wrist should be resting on the left hip bone.
• Keep both the head and spine straight, and the entire sole of your right foot on the floor. Inhale deeply.
• While exhaling, slowly start turning your head, then shoulders and back, to the right. When you have finished exhaling, you will find that you are able to twist still a little more to your right. Do not bend your head while doing so. Keep your chin up.
• Remain in this position, holding your breath for as long as you can, then start inhaling. At the same time, slowly unwind the twist until the head, shoulders, and back are in the original position again.
• Concentrate on the stretching taking place in your spine.
• Pause for a while and repeat the twist.
• Reverse the position of the legs and arms, and assume the same position with the twist to the left side.

**Benefits**

• The twist benefits the adrenal glands, kidneys, liver and spleen.
• It is very helpful for asthma, indigestion, constipation, and obesity.
• This exercise strengthens the spine and deep muscles. They are also made flexible. It corrects stooping shoulders, a bent back, and defective posture.

This is the only asana which twists the spine. The other asanas stretch the spine in the flexion (forwards) and extension (backwards). The twist completes the stretching of the spine so that now every muscle and ligament of the back and neck has been stretched in all directions. *(Swami Satyananda Saraswati, 1981).*

**5. BHUJANGASANA - COBRA POSE**

"Bhujanga" means "cobra" in Sanskrit. This asana is called 'Bhujangasana' as the raised trunk, neck and head while practicing it resemble a cobra rearing its hood and about to strike, while the joined and stretched legs resemble its tail.

**Sequence**

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

Caution

• Do this asana on an empty stomach.
• Persons with peptic ulcer, hernia or high blood pressure must not practice it.
• Women must avoid it during pregnancy because of the pressure on the abdomen.

Benefits

• Helps to remove backache and neck ache as well as keeping the spine supple and healthy. By arching the spine blood circulation is increased to that region toning the nerves along the spinal column and improving the communication between the brain and the rest of the body.
• The pressure on the abdomen is also beneficial to the abdominal organs and in particular the digestive organs, it stimulates the appetite, relieves flatulence and constipation.
• Tones the kidneys which help with purification of blood, removing any stagnant blood and improving the health of the whole body.
• Strengthens the adrenal gland which is responsible for secretions of adrenaline, cortisol and other stress hormones, the balancing effect on the hormone secretions is the benefit of asanas.
• Tones the liver, making it beneficial for those with a sluggish liver.
• Helps the functioning of thyroid gland, which is responsible for metabolic activities.
• Expands and opens the chest which encourages deep breathing as well as helping to correct rounded shoulders.
• Useful for slipped disc and sciatica as it relieves the pain and can also relocate the slipped disc.

In normal day-to-day life we do a lot of forward bending but not much backward bending, therefore it is good to practice for a healthy back and to give general balance to the body. (Swami Satyananda Saraswati, 1981).

6. SARVANGASANA

The Sanskrit name for this posture sarvangasana means 'all the body'.

Technique

• Lie flat on your back. Inhale deeply while raising your legs and spine until the toes point to the ceiling.
• The body rests on the shoulders and the back of the neck. The body is supported by the hands, which are placed on the center of the spine between the waist and the shoulder blades. Keep your spine and legs straight.
• Breathe slowly and deeply with the abdomen and concentrate on the thyroid gland. On a male, the thyroid gland is located behind the Adams apple. For women, it is located in the same area which is a few inches above the sternal notch (hollow of the neck where the neck joins the rest of the body.) or approximately half way up the neck from the sternal notch. Stay in this position for about two minutes.

• To come out of this posture, just bend your knees, curve your back and slowly return to lying on the floor while exhaling. First bend your knees, put the palms on the floor, then curving the spine, gradually unfold it the way one unrolls a carpet. When your entire back touches the floor, straighten the knees, take a deep breath and slowly lower your legs to the ground while breathing out.

• If you wish, you may go straight into the next posture (the 'reverse posture') instead of lying down.

Benefits

• The main benefit of the shoulder stand is to get the thyroid gland working at peak efficiency. It's the thyroid gland which is mainly responsible for your correct weight and youthful appearance.

• The shoulder stand also regulates the sex glands.

• It vitalizes the nerves, purifies the blood and promotes good circulation, strengthens the lower organs and helps them to stay in place.

• It gives a healthy stretch to the neck muscles.

• It is beneficial for people suffering from poor circulation, constipation, indigestion, asthma and reduced virility.

This pose is especially recommended for women after childbirth and for those suffering from painful menstruation, other female disorders, and seminal weakness.

7. HALASANA

The reference of this Asana is not found in any old text. It is a very important Asana which has come through tradition. It is known as Halasana because in its final position the body resembles the shape of Indian plough.

Technique

- Take supine position hands straight by the side of thighs, palm resting on the ground.
- Slowly raise your legs together without bending at knees by pressing your hands and stop at 30° angle.
- After few seconds raise your legs further up to 60° angle and maintain.
- Now slowly bring the legs at 90° angle.
- Pressing both the hands bring the legs little towards the head.
- Continue the bending of legs till toes touch the ground and then stretch your legs backward as far as possible.
- Now place both the palms on the head making finger lock. Bring the elbows on the ground.
- While returning back to the original position first release the finger-lock. Stretch the hands straight and place them on the ground by the side of the body.
- Lower the waist and raise the legs from the ground. Slowly let the waist rest on the ground and stop bringing the legs at 90° angle.
- Slowly come back to the original position.
Benefits

- Due to the disturbance of abdominal muscles if there is a complaint of Dyspepsia or constipation, it can be corrected by the practice of this Asana.
- The practice of this Asana is also useful in certain types of diabetes.
- Maximum benefits of Halasana can be derived when Bhujangasana is practiced immediately after Halasana.
- Those suffering from cervical spondylitis or stiffness in spine should practice it very carefully. (Swami Satyananda Saraswati, 1981).

8. MATSYASANA

Technique

- Lie on your back with your knees bent and arms at your side.
- Arch your back as much as you can while raising it off the ground by pushing the floor with your elbows. At the same time, throw your head backwards, resting the crown of your head on the floor. Use your forearm and elbows to support you.
- Expand your chest. Breathe deeply with the abdomen and concentrate on the thyroid gland.
- Stay in this position for about one minute. Slowly come back to the starting position.

Benefits

- The fish posture normalizes the function of the thyroid, pituitary, pineal and adrenal glands. It limbers and stretches the neck, strengthens and tones the nervous system, the kidneys, the stomach and intestines, the pelvic organs, and the nerves connected with the sex functions.
• This is the only posture in this sequence which bends the spine (including the neck) backwards. This is essential, to counteract the preceding asanas which bend the spine forwards. The result is to give a healthy stretch to the muscles and ligaments of the spine in the opposite direction.

This posture benefits people with asthma. (Swami Satyananda Sarawati, 1981).

9. SHAVASANA

This asana is also known as mitrasana (the dead man’s pose).

Technique:

• Come to lie down on the back.
• Let the feet fall out to either side.
• Bring the arms alongside the body, but slightly separated from the body, and turn the palms to face upwards.
• Relax the whole body, including the face. Let the body feel heavy.
• Let the breath occur naturally.
• To come out, first begin to the deepen the breath. Then move the fingers and toes, awakening the body.
• Bring the knees into the chest and roll over to one side, keep the eyes closed.
• Slowly bring yourself back up into a sitting position.

Benefits

• Basically shavasana relaxes the whole physiological-psychological system.
A relaxed mind allows you to see and relate to the world and the people around you in a more realistic light, carry out your work more smoothly and attain more happiness in life.

A tense mind automatically implies a tense body.

From this combination result the majority of diseases which inflict mankind. Shavasana, by relaxing the mind-body complex, helps to relieve and prevent disease.

Its benefits are inestimable.

The reader should not believe us when we say how effective this practice is-you should try it and find out for yourself. (Swami Satyananda Saraswati (1981).

10. KAPALBHATI

"Kapala" means "skull" (and by implication, the brain) and "Bhati" means "shines" in Sanskrit. This practice cleanses the nasal passages in the skull and other passages of the respiratory system.

SEQUENCE:

- Sit comfortably on the floor in Padmasana posture or if you prefer sit in a chair. Keep your spine erect.

- To exhale, the belly is sucked into the spine forcing the air out of the nose. Place a hand on your belly to feel the belly actively pumping. You could perform 45-60 exhalations/30 seconds.
• You should keep a steady rhythm. Start with 2-3 rounds of 30 exhalations, and gradually increase the exhalations if comfortable.

• You must be very careful with this technique because there is a danger of creating tension in the breath. You may also become dizzy when you breathe rapidly; for this reason you should always conclude the practice of Kapalbhati with some slow breaths.

• It is important not to breathe rapidly too many times, but after a few rapid breaths take several slow ones.

BENEFITS

• Kapala Bhati flushes out stale residual air in the lungs and helps a fresh supply of air to reach them.

• It lends elasticity to the diaphragm and increases the capacity of the lungs. (Swami Satyananda Saraswati, 1981)

11. YOGA NIDRA

Yoga Nidra was devised by Swami Satyananda Saraswati from traditional Tantric practices and has had a major impact on the world of yoga. Yoga Nidra is a pratyahara technique in which the distractions of the mind are contained and the mind is allowed to relax. This practice has had a profound transformative effect on practitioners.

People feel that they are relaxing when they collapse in an easy chair with a cup of tea or coffee, a drink or a cigarette and read a newspaper or switch on the television. But this, in fact, is merely sensory diversion. Twentieth century research into sleep has proven that even entering into this traditional haven will rarely banish stress. True relaxation is an experience far beyond all this. For absolute relaxation one must remain aware. This is Yoga Nidra, the state of dynamic sleep.

Yoga Nidra is a systematic method of inducing complete physical, mental and emotional relaxation. During the practice, one appears to be asleep, but the consciousness is functioning at a deeper level of awareness.
PREPARATION

- Lie down comfortably in savasana, with the arms and the feet slightly apart and eyes gently closed.
- Become aware of the slow steady gentle breathing coordinated with the abdominal movements.

RELAXATION

- Become aware of the whole body which is resting comfortably and beginning to relax.
- Listen to the few rounds of “Om kar” chanting feeling the relaxation and resonance.

RESOLVE

- Time for making a resolve.

ROTATION OF CONSCIOUSNESS

- Rotation of the awareness on the body parts - right side, left side, back, front and major parts.

BREATHING

- Counting of breath in descending order and relaxing more and more with each count down.

IMAGE VISUALIZATION

- Taking the awareness away from the body and visualizing a few relaxing imageries.

RESOLVE REPEATEATION

- Repeat the resolve with shraddha.
FINISH

- Bring the feet together. Palms by the side of the body. Gently roll over to one side and sit up in any comfortable position and finish the practice with Om kar chanting followed by a prayer. Gently open the eyes. (http://www.yogamag.net, march, 2011).

3.11.2 PACKAGE II YOGIC PRACTICES - SWAMI VISHNUDEVANANDA YOGIC PRACTICES GROUP TRAINING PROGRAMS

The following are the selected yogic practices given to the experimental group II.

1. Loosening
2. Sun Exercises
3. Relaxation
4. Head Stand (Sirhasana)
5. Shoulder Stand (Sarvangasana)
6. Fish Pose (Matsyasana)
7. Head - Knee Pose (Paschimottanasana)
8. Spinal Twist (Ardha Matsyendrasana)
9. Corpse Pose (Savasana)
10. Bhastrika Pranayama

1. LOOSENING

Some loosening and stretching exercise called Sithilikarana Vyayama are introduced with help to make the body supple and flexible so that they aid in Asanas that are designed to conserve the energies and transform them to subtle forms of mental energies.

The first series of Sithilikarana Vyayama are meant to achieve this goal of a good physique by proper training of mainly the muscles and the spine. They not only help in
performing the asanas better by loosening the joints for patients of different ailments, but they also help in building up stamina and tolerance.

Sithilikarana Vyayama as the name indicates are loosening exercises performed normally with speed and repetitions. These dynamic practices are akin to conventional Physical training exercises except that most of these practices involve flexing of the spine.

**The Principles of Sithilikarana Vyayama**

- Loosen the various joints in the body
- Flex the spine, by repeatedly stretching relaxing the different muscles.

**The Objectives**

- Remove the lethargy and tardiness in the body.
- Develop the stamina of the body.
- Discipline the body-mind complex.

**Special Tips for Good Learning**

- Practice the stepwise.
- Count the steps slowly and perform the same with attention.
- Check the performance of each step before increasing the speed.
- Learn to synchronize each step in a group.
- Increase the number of repetitions depending on your capacity.

**Forward and backward bending**

- Come to sthiti tadasana.
- Stretch the arms straight above the head with the palms facing forward.
- Inhale and bend backwards with arms stretched above the head.
• While exhaling bend forward as much as possible.
• While inhaling come up and bend backwards and go on rapidly to forward bending with exhalation.
• Repeat 20 times with increasing speeds.
• Gradually slow down and ultimately stop the practice.

Note

• Start slowly and gradually increase the speed with in your limits.
• You may also practice this while standing with legs apart when the arms will be moving between the legs.
• While bending forward don’t let the hands touch the ground, swing them in the air backwards.
• Always bend from the lower waist.
• Make the movement free, ease and flowing.

Side Bending

• Come to sthiti tadasana.
• Keep the legs about one meter apart.
• Raise the hand sideways parallel to the ground while inhaling.
• Bend to the right till the right hand touches the right heel while exhaling. Bend in the same plane.
• Look at the palm of the left hand directing forwards. Come up with inhalation.
• Repeat 4 to 5 times to the right and left side alternate.
• Relax in sithila tadasana.

Twisting

• Come to sthiti tadasana.
• Spread the legs about one miter apart.
• Raise the hands sideways parallel to the ground while inhaling.
• Keeps the leg firm on the ground and twist to the right, keeping the right hand straight.
• Simultaneously twist the neck and look up the tips of the fingers.
• Bend the left hand at the elbow to bring the hand close to the chest.
• Come back while inhaling.
• Repeat the same on the left.
• Gradually increase the speed to your maximum capacity.
• Repeat 10 to 20 rounds.
• Slow down the speed and stop the practice.
• Relax in sthiti tadasana.

Note

All twisting should be above the waist level. Keep the body below the waist, straight and firm and do not bend the knees.

Jogging

Stage I: Slow jogging

• Come to sthiti tadasana.
• Make loose fists of your hands and place them on the chest.
• Collapse and relax your shoulders.
• Start jogging on your toes slowly.
• Jog about 20 times (As days go by, gradually increase up to 100 times).

Stage II: Backward jogging

• Lean a little forward and increase the speed of jogging gradually.
• Start hitting the buttocks with the heels.
• Repeat this 20 times at your maximum speed.
• Then gradually slow down the speed (Do not stop).
• Continue and move on to slow jogging for at least 10 times.
Stage III: Forward jogging

- Lean backward a little and now as you increase the speed again try to raise the knees higher and higher.
- Raise the knees forwards to reach the chest level.
- Repeat 20 times at your maximum speed.
- Slow down the practice coming back to the stage of slow jogging again.
- Continue slow jogging for a few rounds, count 10 times.

Stage IV: Side jogging

- Gradually increase the speed taking the heels sideways.
- As the speed increases bring the heels as close to the elbows as possible.
- Repeat this movement 20 times at your maximum speed.
- Gradually slow down to come back to slow jogging stage.
- Keep jogging a few more rounds (10 times) and finally stop the practice.

Note

- Increase the speed of jogging gradually and not too quickly.
- Try not to stop at any stage of the practice until you have completed all 4 stages of jogging.
- Keep the feast on the chest throughout the practice.

Mukha Dhouti

- Stand with forward bend of the trunk, palm on your thighs and legs about a meter apart.
- Inhale deeply and expel the air forcibly as in a jet through the mouth continuously.
- Repeat several times.
Pawanmuktasana Kriya

Stage 1: Leg Rotation

Come to supine posture

- While inhaling raise the right leg up to $45^\circ$ positions, without bending the knee. Keep the left leg firm in the ground.
- At $45^\circ$ exhale and again while inhaling raise the leg further up to $90^\circ$ positions.
- Now while exhaling, bend the right leg at the knee and pull the right knee towards the chest with the hands (fingers interlocked) and lift the head simultaneously and place the chin on the right knee. Keep your breathing normal.
- Maintain with lift the left leg and rotate 5 rounds clockwise and 5 round anti-clockwise without bending the knee with normal breathing.
- Then lower the left leg to the ground.
- Now while inhaling release the hands bring the head back on to the ground and straighten the right leg.
- While exhaling lower the right leg to $45^\circ$ positions.
- Here inhale and while exhaling again lower the right leg further down to the ground. Relax for a while.
- Repeat the same practice on the left side.

Note

- While rotating the leg, try to draw as big as a circle as possible in the air.
- Maintain the compression around the abdomen to have the best results.
- Here, the leg is raised to $90^\circ$. Position with two inhalation and similarly lowered on to the ground with two exhalations.
- Do not bend the leg at the knee, which is being rotated.

Stage II: Rocking and rolling

- Come to supine posture.
- Inhale and raise both legs to $45^\circ$ positions.
• Exhale here and while inhaling again, raise the legs further up to 90 positions.
• While exhaling fold both the knees and pull them towards the chest with the hands interlock around the knees and place the chin on the knees.
• Have normal breathing.

Practice:

a) Rocking

• Rock the body forwards and backwards 5 to 10 rounds.
• While rocking forwards try to stand on the feet and while rocking backward, feel the nice massage to the spine.
• Relax for a while in the same position and go on for rolling.

b) Rolling

• Roll the entire body to the right until the right elbow touches the ground.
• Then roll to the left until the left elbow touches the ground.
• Repeat this rolling alternately to the right and left 5 rounds.
• Stop the movement.
• Inhaling, release the hands, bring the head on to the ground and straighten both the legs to 90°.
• While exhaling, lower the legs slowly to 45° positions.
• Inhale here and while exhaling again lower the legs further down till the legs are on the ground.
• Relax in savasana.
2. SUN EXERCISES

This exercise is called soorya namaskara because it is practiced in the early morning facing the sun. The sun is considered to be the deity for health and long life. In ancient days, this exercise was a daily routine in the daily spiritual practices. One should practice this at least twelve times by repeating twelve names of the Lord Sun. this exercise is a combined process of Yoga asanas and breathing. It reduces abdominal fat, brings flexibility to the spine and limbs, and increase the breathing capacity: it is easier to practice asanas after doing soorya namaskara. (Swami Vishnudevananda, 1972)

The ‘Sun Salutation’ pose of the ‘Surya Namaskar’ is a series of poses that you will be adopting when practicing yoga. The origin of this pose can be traced back to the Veda’s - Hindu religious scriptures that defined a series of poses that were meant to praise the sun for its profitable effect on one’s health. The surya namaskar is a collection of a series of twelve poses that are designed to exercise the spine by having the person bend it back and forward. The ideal way to perform the poses also includes alternating the breathing between inhaling and exhaling. There are some other stipulations that need to be followed while performing the sun salutation and one of them is that it should be done on an empty stomach. This means that the exercises should be performed prior to eating or at least two hours after eating. The salutation has certain medical advantages, some of which include oxygenating the lungs, improving the digestive system and improving muscle flexibility. The ideology behind the poses is that it indicates ones complete surrender to God.

Sun Salutation Sequence

As mentioned earlier, there are twelve postures that are adopted, in a set sequence, to complete the poses meant for sun salutations.
Position No. 1

Face the sun. Fold the hands. Legs together, stand erect

Position No. 2

Inhale and raise the arms, bend backward.

Position No. 3

Exhale and bend forward till the hands are in line with the feet. Touch the knees with your head can tough them. After some practice, the knees should be straightened.
Position No. 4

Inhale and move the right leg away from the body in a big backward step. Keep the hands and left foot firmly on the ground, bending the head backward. The left knee should be between the hands.

Position No. 5

Inhale and hold the breath. Move the left leg from the body and, keeping both feet together and the knees off the floor, rest on the hands (arms straight) and keep the body in a straight line from head to foot.

Position No. 6

Exhale and lower the body to the floor. In this position, known as sastanga namaskar or eight-curved prostration, only eight portions of the body come in contact with the floor; two feet, two knees, two hands, chest, and forehead. The abdominal region is raised and, if possible, the nose is also kept off the floor, the forehead only touching it.
Position No. 7

Inhale and bend backward as much as possible, bend the spine to the maximum.

Position No. 8

Exhale and lift the body. Keep the feet and heels flat on the floor.

Position No. 9

Inhale and bring the right foot along the level of the hands; left foot and knee should touch the ground. Look up, bending the spine slightly. (Same as position No. 4)

Position No. 10

Exhale and bring the left leg forward. Keep the knees straight and bring the head down to the knees as in the third position.
Position No. 11

Raise the arms overhead and bend backward inhaling, as in Position No. 2.

Position No. 12

Exhale, drop the arms, and relax. *(Swami Vishnudevananda, 1972)*.

3. RELAXATION (Savasana)

In order to achieve perfect relaxation, three methods are used by the yogis. The three methods are known as physical, mental and spiritual. No relaxation is complete until man reaches the stage of spiritual relaxation, which only yogis know.

a. Physical Relaxation.

We all know that every action is the result of thought originated in the mind consciously or subconsciously. Thoughts take from in action and the body reacts to it. When we want to perform an act, the thought is generated in the mind, is transmitted to the brain and, simultaneously, the brain telegraphs the message through the nerves, and the muscles contract. Just as behind the muscular contraction or tension there is thought, so also behind the relaxation there is again thought vibration. Just as we send a message to contract the muscles, so also another message will bring relaxation to the third muscles. This relaxation message is known as autosuggestion or suggesting one’s own muscles and internal organs relax. But as we have no control over such involuntary organs as the heart, lungs, liver, brain, etc., we cannot directly send the thoughts for
relaxing to these organs. Yet they, too, need rest and relaxation to increase their efficiency to do their work. Here the yogis use the subconscious mind, which controls all the automatic functions of these involuntary organs for relaxation. During relaxation, the conscious mind sends a message is received by the instinctive mind and the order is immediately carried out. Thus one could relax all the involuntary organs too. First, physical relaxation starts from the toes upward and the autosuggestion passes through the muscles and reaches up to the eyes and ears at the top. Then, slowly, messages are sent to the kidneys, liver and so on, internally.

b. Mental Relaxation

The constant tension put on the mind owing to unnecessary worries and anxieties takes away more energy than physical tension. During mental tension one should breathe slowly and rhythmically for a few minutes and concentrate on breathing. Slowly the mind will become calm and one is able to feel a kind of floating sensation, as if one were as light as a feather; one feels peace and joy.

c. Spiritual Relaxation

However one tries to relax the mind, one cannot completely remove all tensions and worries from the mind unless one goes to spiritual relaxation. As long as man identifies himself with the body and mind there will be worries, sorrows, anxieties, fear, and anger which, in turn, bring tension. Yogis know that unless man can withdraw himself from the body idea and separate himself from the ego consciousness, there is no way obtaining complete relaxation. So, from the mental relaxation, he withdraws himself and identifies himself with the all-pervading, all-powerful and joyful self or pure consciousness within himself, because all the sources of power, knowledge, peace, and strength are in the soul and not in the body. Man has become prey to all evil emotions of the mind by identifying himself with the body and mind, and the only sure way to free himself from its clutches is by asserting his real nature, that is, I am that pure consciousness or self”. This identification with the self completes the process of relaxation. This relaxation position is known as savasan, or dead body pose. (Swami Vishnudevananda, 1972).
4. HEAD STAND (SIRHASANA)

The exercise is practiced with help of the hands and arm. The whole weight of the head and trunk is placed on the interlocked hands and the elbows. The two elbows and inter locked fingers from the three points or tripod on which the body is balanced. The weight on the head is so little that it is not even felt. When the weight is divided equally between the elbows and the locked fingers, it is easy to balance.

Use a soft cushion or a four –folded blanket. Spread the blanket on the floor. Sit on your knees. By interweaving the fingers, make a finger lock and keep it on the blanket so that the locked hands serve as a vertex and the two elbows as the base, enabling the forearms to balance the body. The top of the head may be supported from behind by the finger lock while doing this asana.

Keep the top of your head on the blanket close to the finger lock. The parietal (frontal) portion of the top of the head should be placed on the blanked and not the portion nearer to the forehead. This will help you to keep the spine erect in this asana. If the portion nearer to the forehead is used, the spine will suffer a curvature in balancing the whole body.

Now the knees are brought close to the body, and the toes are allowed to touch the ground for balancing. When the trunk is sufficiently thrown back, you can slowly remove the toes from the ground. Slowly raise the legs high up in the air till the whole body
becomes erect. Stand in the asana 1 or five seconds only and gradually increase the period to 15 minutes. By regularly practicing even five to ten minutes of headstand, the maximum benefits can be derived.

Always breath through the nose only and never through the mouth. In the beginning, some persons will find it difficult to breathe through the nose, but after a few days this will change.

In learning the headstand in the above manner you will not need any help. You can learn the method of balancing by repeated attempts. Instead of a finger lock method, you can keep the palms of your hands on the blanked, one on each side. You will find this easy. When you have learned to balance the whole body, you can take to the finger lock method.

Lower the legs slowly to the floor to the original position. Lower the legs very, very slowly and avoid jerks. After completing the asana, stand erect for a minute or two. This will harmonize the blood circulation. (Swami Vishnudevananda, 1972)

5. SHOULDERSTAND (SARVANGASAN)

This exercise is similar to the headstand. In headstand, circulation and concentration are directed to the brain, but in shoulderstand the concentration and circulation are directed to the thyroid and parathyroid. We have seen in the previous chapters what effect the thyroid and parathyroid secretions have on the body. The thyroid is the most important gland of the endocrine system, and this exercise gives it a rich
supply of blood. Again it stretches the deltoid, supraspinatus, and infraspinatus of the shoulder muscle. Then chin lock by the chin on the chest exerts an extra pressure on the thyroid through which its secretions are kept at par. This asana is a good substitute for modern thyroid treatment. The ligaments of the cervical region are especially stretched in this exercise.

There are many variations of the shoulder stand to increase the circulation and stretch various ligaments and muscles. Sarvanga means all parts, so the very name suggests that this pose is concerned with all parts of the body. It will also give a helping hand for persons with varicose veins.

Fifteen minutes is the maximum for this pose; starting time for beginners is one minute. Breathe normally through the nose. Some persons practice this for half an hour.

**Technique:**

Spread a thick blanket on the floor. Lie flat on the back. Slowly raise the legs. Lift the trunk, hips, and legs to a vertical position. Rest the elbows firmly on the floor and support the back with both hands. Raise the leg till they become vertical. Press the chin against the chest. This is the chin lock.

While you perform this asana, back of the neck, the posterior part of the head, and the shoulders should touch the floor. Breathe slowly and concentrate on the thyroid glands. Do not allow the body to shake to and fro. When the asana is over, lower the legs very slowly and smoothly. Avoid jerking. Do this asana very gracefully. In it the whole weight of the body is thrown on the shoulders. You can do this twice daily, morning and evening. To derive full benefit from this asana, the Matsyasana should follow in sequence. (Swami Vishnudevananda, 1972).

**6. FISH POSE (MATSYASANA)**

Owing to improper clothing, our bodily movement is generally restricted to a very limited area, especially the cervical region of the vertebrae and the shoulder muscles; clothing supported by suspenders and
shoulder straps pressing on the points of the shoulders tends to pull them downward and forward. It is a common deformity among students, together with other postural defects. It has been noted that the cut of most ready-made clothing causes pressure on the back of the neck and the tip of the shoulders, constantly pulling them.

Moreover, neckties, tightly battened shirt collars, and poorly cut jackets restrict movements of the cervical region and stop the free flow of circulation to the upper portion of the body. Women’s tight foundation garments can cause considerable havoc with blood circulation, breathing, and movements of the sacral and lumbar region, which can produce headaches and weaken the abdominal muscles.

To remove stiffness from the cervical and lumbar regions and shoulder muscles and increase the circulation to these affected parts, Matsyasan or fish pose is invaluable. Moreover, this also strengthens the thyroid and parathyroid and relieves the congestion and cramp of the shoulder muscles caused by the shoulder stand. This exercise should immediately follow the shoulder stand.

**Technique**

For beginners: Lie on your back. Stretch the legs and keep the hands, palms down, under the thighs. Raise the chest with the help of the elbows and, bending the neck as much as possible backward, rest on the top of the head.

For advanced students: Spread a blanket on the ground and sit on it with the legs stretched. Bend the right leg and place the heel on the left hip joint. Again bend the left leg and place the heel on the right hip joint. This is padmasan or foot lock. Then lie on the back. The padmasan should not be raised from the floor. Rest the elbows on the floor. Now lift the trunk and head. Rest the top of the head on the floor by bending the back and neck well. Then catch hold of the toes. This is Matsyasan. Remain in this asana for two or three minutes. Those individuals who have difficulty performing padmasan may to the first form of Matsyasan.
In this position, the chest is thrown open and so deep breathing through the nose should be practiced. This helps to remove the spasm from the bronchial tubes and thus relieves asthma. (Swami Vishnudevananda, 1972).

7. HEAD - KNEE POSE (PASCHIMOTTANASANA)

Lie flat on your back on the blanket, with arms overheat on the floor. Keep the legs and thighs firmly on the floor. Stiffen your body. Slowly raise the head and chest and assume a sitting pose. Now exhale and bend yourself further until you are able to catch hold of your toes. You may even bury your face between the knees.

Remain thus for five seconds and then slowly raise the body and resume the supine position. You should now inhale. Repeat this asana three to six times.

This is a powerful abdominal exercise. It stimulates such abdominal viscera as the kidneys, liver, and pancreas. This exercise is invaluable for diabetic patients. The hamstring muscles of the back of the knees are strengthened. The spine becomes elastic and thereby perennial youth is established. (Swami Vishnudevananda, 1972).

8. SPINAL TWIST (ARDHA MATSYENDRASANA)

This posture was first promoted by the great Yogi Matsyendranath, one of the founders of Hatha Yoga, and hence the name.

Sequence:

- Sit on the floor with both legs extended.
- Cross your right foot over your left knee, place it firmly on the floor, keeping the left hand on the right toes.
- Stretch out the right arm and twist it around the back of your waist line as far as you can. The open palm and the wrist should be resting on the left hip bone.
- Keep both the head and spine straight, and the entire sole of your right foot on the floor. Inhale deeply.
- While exhaling, slowly start turning your head, then shoulders and back, to the right. When you have finished exhaling, you will find that you are able to twist still a little more to your right. Do not bend your head while doing so. Keep your chin up.
- Remain in this position, holding your breath for as long as you can, then start inhaling. At the same time, slowly unwind the twist until the head, shoulders, and back are in the original position again.
- Concentrate on the stretching taking place in your spine.
- Pause for a while and repeat the twist.
- Reverse the position of the legs and arms, and assume the same position with the twist to the left side.

Benefits:

- The twist benefits the adrenal glands, kidneys, liver and spleen.
- It is very helpful for asthma, indigestion, constipation, and obesity.
- This exercise strengthens the spine and deep muscles. They are also made flexible. It corrects stooping shoulders, a bent back, and defective posture.

This is the only asana which twists the spine. The other asanas stretch the spine in the flexion (forwards) and extension (backwards). The twist completes the stretching of the spine so that now every muscle and ligament of the back and neck has been stretched in all directions. (http://yoga-resources.com).

9. CORPSE POSE (SAVASANA)

In order to achieve perfect relaxation, three methods are used by the yogis. The three methods are known as physical, mental and spiritual. No
relaxation is complete until man reaches the stage of spiritual relaxation, which only yogis know.

**a. Physical Relaxation.**

We all know that every action is the result of thought originated in the mind consciously or subconsciously. Thoughts take from in action and the body reacts to it. When we want to perform an act, the thought is generated in the mind, is transmitted to the brain and, simultaneously, the brain telegraphs the message through the nerves, and the muscles contract. Just as behind the muscular contraction or tension there is thought, so also behind the relaxation there is again thought vibration. Just as we send a message to contract the muscles, so also another message will bring relaxation to the third muscles. This relaxation message is known as autosuggestion or suggesting one’s own muscles and internal organs relax. But as we have no control over such involuntary organs as the heart, lungs, liver, brain, etc., we cannot directly send the thoughts for relaxing to these organs. Yet they, too, need rest and relaxation to increase their efficiency to do their work. Here the yogis use the subconscious mind, which controls all the automatic functions of these involuntary organs for relaxation. During relaxation, the conscious mind sends a message is received by the instinctive mind and the order is immediately carried out. Thus one could relax all the involuntary organs too. First, physical relaxation starts from the toes upward and the autosuggestion passes through the muscles and reaches up to the eyes and ears at the top. Then, slowly, messages are sent to the kidneys, liver and so on, internally.

**b. Mental Relaxation**

The constant tension put on the mind owing to unnecessary worries and anxieties takes away more energy than physical tension. During mental tension one should breathe slowly and rhythmically for a few minutes and concentrate on breathing. Slowly the mind will become calm and one is able to feel a kind of floating sensation, as if one were as light as a feather; one feels peace and joy.
c. Spiritual Relaxation

However one tries to relax the mind, one cannot completely remove all tensions and worries from the mind unless one goes to spiritual relaxation. As long as man identifies himself with the body and mind there will be worries, sorrows, anxieties, fear, and anger which, in turn, bring tension. Yogis know that unless man can withdraw himself from the body idea and separate himself from the ego consciousness, there is no way obtaining complete relaxation. So, from the mental relaxation, he withdraws himself and identifies himself with the all-pervading, all-powerful and joyful self or pure consciousness within himself, because all the sources of power, knowledge, peace, and strength are in the soul and not in the body. Man has become prey to all evil emotions of the mind by identifying himself with the body and mind, and the only sure way to free himself from its clutches is by asserting his real nature, that is, I am that pure consciousness or self”. This identification with the self - completes the process of relaxation. This relaxation position is known as savasan, or dead body poses. (Swami Vishnudevananda, 1972).

10. BHASTRIKA PRANAYAMA

In Sanskrit, Bhastrika means bellow. A rapid succession of forcible expulsions is a characteristic feature of this breathing. Just as a blacksmith blows his bellows rapidly, so also you should move your breath rapidly. This is the best exercises Yogic practice to awaken the kundalini after purifying the nadis and nervous system. If the nadis are purified, even a few rounds of Bhastrika will stir the kundalini. Then the Yogi can fell that his whole body is charged with a new energy. The whole spinal cord will pulsate and the kundalini rises to higher centers. In whichever center kundalini is active, that chakra
will become like a dynamo generating high voltage of nerve energy. This is the best exercises for the vascular and nervous system and tones the entire nervous system. It increases the circulation all over the body and increase the bodily temperature, which is followed by a reduced bodily temperature owing to profuse perspiration, which eliminates all impurities. When the body is free from physical impurities, the concentration power of the mind increases to a very high degree, the rapid motion of Bhastrika increases the fresh supply of blood to the brain. After a few rounds of Bhastrika it is amazing to see how clear the brain is. The wonderful result, both psychic and physical, derived by the practice of Bhastrika, and cannot be understood until one starts practicing it.

Practice of Bhastrika, Bhastrika resembles Kapalbhati breathing. It is easy to practice if you know to do Kapalbhati. In Kapalbhati only the diaphragm moves during the breathing exercises but in Bhastrika the entire respiratory system is put into full action, through the diaphragm plays a prominent role in it.

Through Bhastrika resembles Kapalbhati, its effect is entirely different from Kapalbhati, which is only a cleansing exercises. Moreover, there is kumbaka (retention) in Bhastrika, and all three bandhas or locks (jalandhara bandha, moola bandha, and uddiyana) are firmly and very carefully applied here in order to unite the prana and apana and awaken the kundalini. You should always get the proper technique from teacher.

Sit in any one of the meditative poses, preferably the lotus pose. Next inhale and exhale rapidly with emphasis on the exhalation, bringing the diaphragm and the entire respiratory muscles into quick action-making a noise that can be felt in the throat and the head.

In the beginning you should start with rapid expulsions of breath is suspended as long as can be done with comfort. Then the breath is suspended as long as can be done with comfort. Then exhale through the right nostril. During retention apply the chin lock and the anal contraction and concentrate on the kundalini sakthi at the lowest spinal center muladhara chakra.

This is one round. Rest awhile after the round by taking a few normal breaths, you can gradually increase the number of expulsions from ten to a maximum of thirty in each
round of Bhastrika. Start with three rounds and increase up to eight rounds. Do not overdo this exercise.

Bhastrika performed properly breaks the three knots of grandhis: (1) Brahma grandhi of the muladhara; (2) Vishnu grandhi of manipura; (3) Rudra grandhi of ajna chakra.

These three grandhis or knots are the three locations in the sushumna in the spinal column. These knots are blocks that prevent the free movement of the pranic current in the sushumna. With the help of Bhastrika these three knots are broken and then the kundalini can rise gradually toward the sahasrara chakra in the brain.

As soon as kundalini has been aroused, Bhastrika should be practiced more in order to take it to higher centers in the sushumna. (Swami Vishnudevananda, 1972)

11. MEDITATION

**Padmasana** (Lotus Pose)

Padmasana is the sitting asana par excellence. Padma in Sanskrit refers to the lotus flower. It is the ultimate yoga pose.

Padmasana requires open hips and consistent practice. It is very good for alignment of chakras. Traditional texts say that Padmasana destroys all disease and awakens Kundalini.
Asana technique

- Sit on the floor with your legs straight in front.
- Bend your right knee and bring the lower leg up into a cradle: The outer edge of the foot is notched into the crook of the left elbow, the knee is wedged into the crook of the right elbow, and the hands are clasped (if possible) outside the shin.
- Lift the front torso toward the inner right leg so the spine lengthens (and the lower back does not round).
- Rock your leg back and forth a few times, exploring the full range of movement of the hip joint.
- Bend the left knee and turn the leg out. Rock your right leg far out to the right, then lock the knee tight by pressing the back of the thigh to the calf.
- Swing the leg across in front of your torso, swiveling from the hip and not the knee, and nestle the outside edge of the foot into the inner left groin.
- Be sure to bring the right knee as close to the left as possible, and press the right heel into the left lower belly. Ideally the sole of the foot is perpendicular to the floor, not parallel.
- Now lean back slightly, pick the right leg up off the floor, and lift the left leg in front of the right. To do this, hold the underside of the left shin in your hands.
- Carefully slide the left leg over the right one. Snuggle the edge of the left foot deep into the right groin.
- Swivel again into position from the hip joint, pressing the heel against the lower belly, and arrange the sole perpendicular to the floor.
- Draw the knees as close together as possible. Use the edges of the feet to press the groins toward the floor and lift through the top of the sternum. If you wish, you can place the hands palms up in anjali mudra, with the thumbs and first fingers touching. In the beginning, only hold the pose for a few seconds and quickly release.
Remember that Padmasana is a "two-sided pose". Therefore, be sure to work with both leg crosses each time you practice. Gradually add a few seconds each week to your pose until you can sit comfortably for a minute or so. Ideally you should work with a teacher to monitor your progress.

Experienced students can use it as a seat for their daily pranayama or meditation, but beginners may need to use other suitable positions.

**Post asana**

Perform Padmasana. Then hold your feet with the opposite-side hands, lift your chest, and extend your neck and head.

Slowly lean back with an exhalation until the crown of your head touches the floor. Cross the forearms, clasp the elbows with the opposite hands, and swing the forearms overhead, onto the floor.

Take a few breaths. Finally, release the torso fully onto the floor and stretch the arms out on the floor, parallel to each other.

Hold for 30 seconds to a minute. Inhale to come up, leading with the sternum and keeping the head back. Repeat with the other leg on top for the same length of time.

**Benefits of Padmasana**

- The asana calms the brain.
- It stimulates the pelvis, spine, abdomen, and bladder.
- Stretches the ankles and knees.
- Eases menstrual discomfort.
- Consistent practice of this pose until late into pregnancy is said to help ease Childbirth.

**Precautions**

Do not perform this asana while suffering from:

- Ankle injury
- Knee injury

Padmasana is considered to be an intermediate to advanced pose. Do not perform this pose without sufficient prior experience or unless you have the supervision of an experienced teacher. ([http://health.indianetzone.com/yoga/hathyoga/1/padmasana.htm](http://health.indianetzone.com/yoga/hathyoga/1/padmasana.htm)).
3.12 PHOTOS
3.13 TEST ADMINISTRATION

3.13.1 MEASURING MOTOR ABILITY VARIABLES

3.13.1.1 FLEXIBILITY (SIT AND REACH TEST)

Purpose

To measure the flexibility

Equipments

Measuring stick and Mat

Procedure

The subject sat on the mat, both legs were extended forward, the measuring stick was placed on the floor in between both legs. The zero end of the measuring stick was placed as proximal end. The subject bent forward and extends both arms forward. The zero point of the measuring stick was placed to the tip of the middle finger. The subject slowly stretch forwards the hip, back and the arm. The maximum distance reached was recorded with the help of measuring stick in cm. Three trails were given with adequate rest in between.

Scoring

The best of three trails was treated as final score in cm. (Johnson and Nelson, 1982).

3.13.1.2 MUSCULAR STRENGTH (PUSH –UPS TEST)

Purpose

To estimate the muscular strength

Equipment

Gymnastic mats
Procedure

The subject being tested took prone lying position on the ground with the hands under the shoulder and fingers stretched, legs straight and parallel with comfortably apart and the toes under the feet. On the command ‘go’ the subjects performed push up with the arms and extended it completely the legs and the back were kept straight throughout the test. Then the subject lowered her body using the arm until it came 90 degree angle and upper arms were parallel to the ground. The action was repeated as many times as possible.

Scoring

Total number of correct push-ups was recorded as the score of the test. (Yobu, 1987)

3.13.1.3 CARDIO VASCULAR ENDURANCE (12 MINUTES RUN\WALK COOPER’S TEST)

Purpose

To Measure Cardio Vascular Endurance

Equipment

400 mts track, stop watch and whistle.

Procedure

The subjects were assigned to each spotter. The subjects started behind a line and upon the starting signal, run and/ or walk as many laps possible around the track within 12 minutes. The spotters maintained account of each cap. When the stop signal is given the subject stops walking/running. The spotter immediately run to the subject and recorded the distance.
Scoring

The score in meters is determined by multiplying the number of laps completed, plus the number of segment of a lap, plus the meters stopped off between a particular segments. (Johnson and Nelson, 1982)

3.13.2 MEASURING PHYSIOLOGICAL VARIABLES

3.13.2.1 RESTING PULSE RATE

Purpose

To measure the resting heart rate of each subject per minute.

Equipment

Digital heart rate measuring machine, Model No. EW 243, Manufactured by National Company, Japan,

Procedure

The pulse rate of all the subjects were recorded in a sitting position, in the morning between 6 and 6.30 am before fasting heart rate the subjects were asked to relax for about 30 minutes.

Then the subjects were instructed to sit in a back supported chair and maintain in a slight incline position and placed his left hand on the table. Next the researcher was collected heart rate measuring machine which was placed in the chest level on a table. In this way the researcher was measured the heart rate of the subject.

Scoring

The numbers of Pulse beats per minute were recorded as the scores. (Robergs and Landwehr, 2002)
3.13.2.2 VITAL CAPACITY TEST

**Purpose**

Determination of vital capacity

**Equipment**

Spiro meter, Chair, and nose clips

**Procedure**

Vital capacity of the subject was determined by the Spiro meter in sitting position. The subject was allowed to inspire the maximum amount of air voluntarily and then he was asked to blow into the dry Spiro meter to the maximum extent. While taking the test the nose of the subject was clipped using a nose clip.

**Scoring**

The Vital capacity of the subject was obtained from the movement of circular volume indicator which was set at ‘0’ before the vital capacity measure was taken. The result was recorded in milliliter. *(Mathew, 1988)*

3.13.2.3 Astrand-Rhyming Nomogram Test

**Purpose**

The purpose of this test was to predict VO\(_2\) Max of the subjects.

**Equipments Required**

Stopwatch, 40 centimeter high bench, metronome and weighing machine

**Testing Procedure**

The subject was asked to step up and down on a 40 centimeter high bench for five minutes. On the commend ‘start’ the subject was covered 22.5 step per minute, all the time the subjects stepped process in four counts as follows.
1. Left foot was placed on the bench
2. Right foot was placed on the bench
3. Left foot was placed on the floor, and
4. Right foot was placed on the floor

The subject was allowed to load off with the same foot each time or to change the foot as he desired but the four counts were maintained, by the help of the metronome. The counting was done as “up, up and down, down”. The subject stopped when he heard the command ‘stop’ from the investigator.

**Scoring Procedure**

After the completion of stepping exercise the pulse rate was measured for 15 seconds period from 5 to 20 seconds in to recovery. Multiply the 15 seconds pulse count by 4 to express the scores in beats per minute (bpm).

To predict the maximal oxygen uptake (VO₂ Max) “Astrand–Rhyming monogram” was used (Fox, 1989).

### 3.13.3 MEASURING HEMATOLOGICAL VARIABLES

#### 3.13.3.1 RED BLOOD CELL COUNT (RBC)

**Specimen**

Erythrocyte count can be done on oxalated blood or on capillary blood directly collected into the pipette. In the former case, the sample, unless refrigerated must not be more than 6 hours old.

**Apparatus**

- Red cell pipette
- Diluting fluid: 40% formaldehyde 10ml
- Trisodium citrate (3% w/v) 990ml
  - or
- Trisodium citrate 3.8gms
Formalin

Distilled water

Neubauer’s chamber with cover-slip

**Technique**

1. If oxalated blood is to be used, first mix it thoroughly by gentle shaking.

2. Fill the red cell pipette exactly up to 0.5 mark by holding the pipette almost horizontally. The pipette must be clean and dry.

3. Now draw in the diluting fluid up to the mark 101 (dilution 1 in 200). While filing the pipette should be gently rotated to obtain good mixing.

4. The cover slip is placed over the Neubauer’s chamber so as to cover both the ruled platforms evenly.

5. Now load the chamber. This is done in three steps:
   
   (a) Mix the contents of pipette for 3 minutes.
   
   (b) Expel 6 drops from the pipette to remove the fluid in the stem which has not been mixed with blood.
   
   (c) By holding the pipette at an angle of 45° and touching the space between the cover slip and the chamber by the point of the pipette, an appropriate drop of the mixture is allowed to run under the cover glass by the capillary action; it must be sufficiently large to cover the whole ruled platform yet not large enough to fill the moat. Also there must be no air bubbles.

6. Allow two minutes for setting of the cells and then count.

7. The count is done as follows:

   In the erythrocyte count, the central double ruled square is used. Red cells lying in 80 very small squares have to be counted. These 80 small squares comprise 5 medium sized squares, each of which is bound by a triple line. It is recommended that the five medium sized squares chosen for counting cells should consist of four corners and one
central; this is to secure an even distribution of cells. In counting, cells which touch the left hand lines or the upper lines of the square are taken to be within that square and those which touch the left hand lines are omitted as outside the square.

To obtain accuracy at least 400 to 600 cells must be counted. If the count of the 80 small squares is less than this figure, more squares must be counted.

**Calculation**

The total area of the whole large central square is 1 sq mm. The smallest square has side of 1/20mm so that its area is 1/400 sq mm and since the depth is 1/10 mm, its volume is 1/4000 cu mm. Total volume of 80 small squares is therefore 80/4,000 cu mm =1/50 cu mm. Dilution is 1 in 200.

**Red Blood Cell Count (RBC)**

\[
\text{Red Blood Cell Count (RBC)} = \text{Dilution} \times \frac{1}{\text{Volume}} \times \text{Number of cells counted (N)}
\]

\[
= 200 \times 50 \times N
\]

\[
= 10,000 \times N \text{ Cells/cu mm.}
\]

**Sources of Error**

- Sampling error in collection of blood.
- Equipment error in the pipette and haemocytometer.
- Technical errors involved in the exercises from the filling of the pipette to the final count.

Inherent or field errors of the distribution of cells are in the counting chamber.

**Normal values**

<table>
<thead>
<tr>
<th>Gender</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td>5.5±1.0×10^{12}/l</td>
</tr>
<tr>
<td>Women</td>
<td>4.8±1.0×10^{12}/l</td>
</tr>
<tr>
<td>Infants (full term cord blood)</td>
<td>5.0±1.0×10^{12}/l</td>
</tr>
<tr>
<td>Children 3 months</td>
<td>4.0±1.0×10^{12}/l</td>
</tr>
</tbody>
</table>
Children 1 year  $4.4\pm0.8\times10^{12}/1$
Children 3-6 years  $4.8\pm0.7\times10^{12}/1$
Children 10-12 years  $4.7\pm0.7\times10^{12}/1$  *(Talib, 1988)*

### 3.13.3.2 WHITE BLOOD CELL COUNT (WBC)

#### Specimen:

The leucocyte count may be done on oxalated blood or on capillary blood. In the former case the sample must be examined within 6 hours of collection.

#### Apparatus

- A white cell pipette (white lead).
- Diluting fluid: 4% acetic acid with two drops of gentian violet per liter
- Neubauer’s chamber with coverslip.
- Microscope.

#### Procedure

- Draw blood in a clean dry pipette upto the mark 0.5 with all possible accuracy. The oxalated sample must be thoroughly mixed before use.
- Wipe off the outside of the pipette with gauge.
- Now draw the diluting fluid upto the mark 11 (dilution 1 in 20). While drawing the fluid rotated the pipette.
- Mix the contents of pipette for 3 minutes.
- Dispel the first 4 drops of the contents.
- Adjust the Neubauer’s chamber. It must be clean and dry. By holding the cover glass between the fingers at the edges, place it in such manner that both the ruled platforms are evenly covered by it. Lord it with the mixture, by holding the pipette at angle of 45° and touching the space between the cover glass and the chamber by the point of the pipette, an appropriate drop of the mixture is allowed to run under the cover glass by the capillary action. It must be sufficiently large to
cover the whole ruled platform yet not large enough to fill the moat. Also there must be no air bubbles.

- Allow two minutes for setting of the cells, then count.
- The count is done as follows:

The improved Neubauer chamber has two central platforms each of which is ruled. When the cover glass is in place there is a space of 0.1 mm depth over the ruled area. The surface of the ruled area is 3×3 mm (9 sq mm). Nine large squares can be recognized in the ruled area; the four corner squares are double ruled. Each of the corner single ruled square is divided into 16 smaller squares; the central double ruled square is divided in to 400 very small squares. Each of the four large corner squares (with 16 small squares) has an area of 1 sq mm; each of the very small squares (400 in all) in the central square has is meant for the erythrocyte count; the four large corner squares are used for the erythrocyte count. Shows pattern of good and poor distribution of white blood cells and shows procedure and score of counting. In counting, cells which touch the left hand lines of the upper lines of the square are taken to be within that square and those which touch the lower and right lines are omitted as outside the square.

**Calculation**

The area of each large square is 1 sq mm, the depth of the chamber being 0.1 mm, the volume of the square is 0.1 cu mm.

Volume of four corner squares = 0.1× 4= 0.4 cu mm.

**White Blood Cell Count (WBC)**

Number of cells in four corner squares = N
0.4 cu mm contains = N cells.

\[
\text{1 cu mm contains} = \frac{N \times 20 \text{ (dilution factor)}}{0.4} = N \times 50
\]
Sources of Error

- Sampling error in collection of blood.
- Equipment error in the pipette and chamber.
- Technical errors involved in the exercises from the filling of the pipette to the final count.
- Inherent or field errors of the distribution of cells in the counting chamber. This can be minimized by counting large number of cells.

Normal values

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Normal Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adults</td>
<td>$7.5 \pm 3.5 \times 10^3$ / cu mm</td>
</tr>
<tr>
<td>Infants (full term 1st day)</td>
<td>$18 \pm 8 \times 10^3$ / cu mm</td>
</tr>
<tr>
<td>Infants 1 year</td>
<td>$12 \pm 6 \times 10^3$ / cu mm</td>
</tr>
<tr>
<td>Children 4-7 years</td>
<td>$10 \pm 5 \times 10^3$ / cu mm</td>
</tr>
<tr>
<td>Children 8-12 years</td>
<td>$9 \pm 4.5 \times 10^3$ / cu mm</td>
</tr>
</tbody>
</table>

(Talib, 1988).

3.13.3.3 PLATELET COUNT

Direct Method

Specimen:

Venous blood is collected by a clean puncture and delivered without frothing into a bottle or tube containing the anti-coagulant di potassium EDTA. EDTA prevents the clumping of platelet or it may by finger prick. Venous blood is preferred.

Procedure

- Draw the blood into a clean dry R B C pipette up to the mark 0.5. The accuracy in filling the pipette has to be of high order.
- Wipe of the outside of the pipette.
- Draw the diluting fluid up to the mark 101.
The diluting fluid (Rees-Ecker) has the following formula:

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium citrate</td>
<td>3.8g</td>
</tr>
<tr>
<td>Brilliant cresol blue</td>
<td>0.05g</td>
</tr>
<tr>
<td>Neutral formalin</td>
<td>0.65g</td>
</tr>
<tr>
<td>Distilled water</td>
<td>100ml</td>
</tr>
</tbody>
</table>

Filter and centrifuge at 2,800 r.p.m. for 30 minutes. Stock the solution in a refrigerator in a well stoppered bottle and filter before use every time.

Another good diluent is the formal citrate solution used for red cell count.

- Shake the pipette for 5 minutes.
- Discard the first four drops. Load the chamber; both the haemocytometer and the cover-slip must be scrupulously clean.
- Allow the preparation to stand for 15 minutes in a moist chamber. An inverted petridish with a piece of wet filter paper in the top makes a good moist chamber.
- Count under the high power with the light partially cut off. Platelets are lilac-coloured. Count at least 300 platelets and calculate by the formula.

\[
\frac{\text{Number of platelets counted} \times 10 \times \text{dilution}}{\text{Number of 1mm squares counted}} = \text{Platelets per cu mm}
\]

Normal value – 1, 50,000 to 4, 00,000 cells/cu mm*.  

*(Talib, 1988).

Abrivation:

cells/cu mm = cells per cubic millimeter,

3.13.4 MEASURING BIO-CHEMICAL VARIABLES

3.13.4.1 BLOOD SUGAR

Techniques

1. Glucose oxidase techniques – specific and represent true glucose.
2. Techniques dependent on the reducing property of glucose. These may overestimate the blood glucose levels by as much as 5-20%. However since glucose
oxidase method is not freely available in developing countries like India, we shall discuss in detail the reducing methods. Most commonly used is Folin We method.

**Principle**

A protein free blood filtrate is treated with alkaline copper solution; the cuprous oxide formed is treated with a phosphomolybdic acid solution, blue color being obtained which is compared with that of a standard.

**Reagents**

1. Alkaline CuSO₄ solution.
2. Phosphomolybdic acid solution.
3. Standard glucose solution (0.1mg/ml)
4. 10% sodium tungstate solution.
5. 2/3 N H₂SO₄

**Procedure**

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>T</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distilled water</td>
<td>3.2ml</td>
<td>3.2ml</td>
<td>3.2ml</td>
</tr>
<tr>
<td>Blood</td>
<td>-</td>
<td>0.2ml</td>
<td>-</td>
</tr>
<tr>
<td>Standard</td>
<td>-</td>
<td>-</td>
<td>0.2ml</td>
</tr>
<tr>
<td>Distilled water</td>
<td>0.2ml</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>10% Sod. Tungstate</td>
<td>0.3ml</td>
<td>0.3ml</td>
<td>0.3ml</td>
</tr>
<tr>
<td>2/3 N H₂SO₄</td>
<td>0.3ml</td>
<td>0.3ml</td>
<td>0.3ml</td>
</tr>
</tbody>
</table>

Mix well and centrifuge at 3000r.p.m. for 5 minutes.

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>T</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear filtrate from above</td>
<td>2.0ml</td>
<td>2.0ml</td>
<td>2.0ml</td>
</tr>
<tr>
<td>Alkaline copper reagent</td>
<td>2.0ml</td>
<td>2.0ml</td>
<td>2.0ml</td>
</tr>
</tbody>
</table>

Mix & keep in boiling water baths for 6 minutes

Cool for 2-3 minutes. Add 2ml of phosphomolybdic acid to each one and dilute to 25ml with distilled water. Read in colorimeter

\[
\frac{T - B}{S - B} \times 100 = \text{Sugar in mg/dl.} 
\]

(Talib, 1988).
3.13.4.2 HIGH DENSITY LIPOPROTEIN (HDL)

METHOD

Polythelene Glycol-CHOD-PAP
End point Colorimetry
Reagent chemistry with LCF (Lipid Clearing Factor)

PRINCIPLE

Low and very low density lipoproteins (VLDL) are precipitated by a solution containing PEG 6000, leaving behind high-density-lipoproteins in solution, HDL cholesterol is estimated in the supernatant by a series of enzymatic reactions which are initiated by the oxidation of cholesterol to choleternone by cholesterol oxidase, accompanied by the formation of hydrogen peroxide. In a second reaction catalyzed by peroxide, 4-aminoantipyrine and phenol react with hydrogen peroxide to form red colored quineimine. Absorbance at 505 nm is directly proportional to HDL cholesterol concentration.

SPECIMEN

Serum, free from hemolysis, stable for 7 days at 2-8°C. a fasting sample is preferred.

EQUIPMENT

Liquid Gold cholesterol reagent is suitable for use on all automated and semi-automated analyzers.

PROCEDURE

Step (a) HDL Cholesterol separation

<table>
<thead>
<tr>
<th>Pipette into Centrifuge tube</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample</td>
<td>0.2 mL</td>
</tr>
<tr>
<td>Precipitating reagent</td>
<td>0.2 mL</td>
</tr>
</tbody>
</table>
Mix well, keep at R.T. for 10 min and then centrifuge at 2000 rpm for 15 minutes to obtain a clear supernatant. Proceed to step-B

**PROGRAMME**

Method sheets for specific analyzers are available on required. The basic assay parameters are:

<table>
<thead>
<tr>
<th>Mode</th>
<th>End Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wavelength</td>
<td>505 nm (490-530 nm)</td>
</tr>
<tr>
<td>Temperature</td>
<td>37˚C or R.T.</td>
</tr>
<tr>
<td>Optical path length</td>
<td>1 cm</td>
</tr>
<tr>
<td>Blanking</td>
<td>Reagent blank</td>
</tr>
<tr>
<td>Sample volume</td>
<td>10 µL</td>
</tr>
<tr>
<td>Working reagent volume</td>
<td>1000µL</td>
</tr>
<tr>
<td>Incubation time (minutes)</td>
<td>10 at 37˚C or 30 at R.T.</td>
</tr>
<tr>
<td>Concentration of standard</td>
<td>200 mg/dl</td>
</tr>
<tr>
<td>Maximum absorbance limit</td>
<td>2.000</td>
</tr>
<tr>
<td>Stability of color</td>
<td>1 hour</td>
</tr>
<tr>
<td>Units</td>
<td>mg/dl</td>
</tr>
</tbody>
</table>

**CALCULATION**

\[
\text{HDL Cholesterol (mg/dl)} = \frac{\text{Absorbance of sample}}{\text{Absorbance of standard}} \times 50 \times 2
\]

**REFERENCE RANGE**

1. Reduced risk for CHD, if HDL cholesterol concentration is less than 60 mg/dl
2. Major risk factor for CHD, if HDL cholesterol concentration is more than 35 mg/dl
3. Double total cholesterol/HDL cholesterol ratio is less than 5.0 (Yogaraj, 2007)
*Abbreviation:

\[ \text{R.T} = \text{Room Temperature} \quad \mu\text{L} = \text{Micro liter} \]
\[ \text{rpm} = \text{Revolution per minute} \quad \text{CHD} = \text{Coronary Heart Disease} \]
\[ \text{mg/dl} = \text{milligrams per deciliter of blood} \]

3.13.4.3 LOW DENSITY LIPOPROTEIN (LDL)

Low density lipoprotein was calculated from LDL test. This is also same test as HDL.

**CALCULATION**

\[
\text{LDL Cholesterol (mg/dL)} = \frac{\text{Absorbance of sample}}{\text{Absorbance of standard}} \times 50 \times 2
\]

(Yogaraj, 2007)

3.14 COLLECTION OF DATA

The purpose of the study was the effect of varied packages of yogic practices on selected motor ability physiological hematological and bio-chemical variables among college men students. For this purpose, the research scholar followed the following procedure.

The subjects of the study were selected at random and divided into three homogeneous groups. Among the three groups, the control group was strictly under control, without undergoing any special activity. The experimental groups were undergone with the experimental treatments. The data on selected dependent variables for pre-tests and post-tests were collected two days before and after the training programme respectively. On the first day vital capacity, flexibility, cardio-vascular endurance and muscular strength were tested whereas VO\(_2\)max, resting pulse rate, hematological and bio-chemical variables was tested on the second day.
3.15 STATISTICAL TECHNIQUE

The data collected from the three groups before and after the experimental period were statistically examined for significant improvement by using analysis of covariance. (Clarke and Clarke, 1972) Whenever the ‘F’ ratio was found to be significant, Scheffe’s test was used as post-hoc test to determine which of the paired means differed significantly. In all cases the criterion for statistical significance was set at 0.05 level of confidence (P<0.05).

Justifications for Using ANCOVA

Analysis of covariance was used to determine how each dependent variable is influenced by independent variables while controlling for a covariate (Clarke and Clarke, 1972). Analysis of covariance adjusts the mean of each dependent variable to what they would be if all groups started out equally on the covariate. Analysis of covariance gives results preferable to those of a direct comparison of gain scores i.e., post-test minus pre-test for the two groups, because gains are limited in size by the difference between the test’s ceiling and the magnitude of the pre-test score (Tuckman, 1999). In this study, pre-test scores of the selected variables have been shown to correlate with the post test scores and thus they were considered as appropriate covariates.
3.16 FLOW CHART SHOWING THE METHODOLOGY

Number of Subjects
N=90

Experimental Group I
n =30

Experimental Group II
n =30

Control Group
n =30

Pre test

Physiological Variables
1. Resting Pulse Rate
2. Vital Capacity
3. VO₂ Max

Hematological Variables
1. RBC Count
2. WBC Count
3. Platelets Count

Bio-Chemical Variables
1. Blood Sugar
2. HDL
3. LDL

Swami Satyananda Saraswati Yogic Practices
No. of Weeks = 12

Swami Vishnudevananda Yogic Practices
No. of Weeks = 12

No Training

Post test

Motor Ability Variables
1. Flexibility
2. Muscular Strength
3. Cardio Vascular Endurance

Motor Ability Variables
1. Flexibility
2. Muscular Strength
3. Cardio Vascular Endurance

Motor Ability Variables
1. Flexibility
2. Muscular Strength
3. Cardio Vascular Endurance

Statistical technique
ANCOVA & Scheffe’s Post hoc Test

Results, Discussions & Conclusions