Chapter – III
Methodology

In this chapter, procedures and methods applied in selection of subjects, selection of variables, selection of tests, competency of the tester, reliability of the instruments, reliability of the data, orientation to the subjects, pilot study, training programme, collection of the data, administration of the tests, experimental design and statistical technique were presented.

Selection of Subjects

The purpose of the study was to design to find out the effect of yoga practices on selected physiological and biochemical variables among the diabetic patients. Forty five (N=45) men diabetic patients from Erode district, Tamilnadu India, were selected randomly as subjects. The age, height and weight of the subjects ranged from 40 to 50 years, 163 to 171 cms and 62 to 78 kg respectively, and the standard deviations were 0.18, 0.06, and 0.09 kilograms respectively. Subjects were randomly assigned into three groups of fifteen each, namely yoga practices three days per week group (Group I) and yoga practices five days per week (Group II) and (Group III) acted as Control group. Experimental groups (Group I & Group II) underwent the respective yoga practices for duration of twelve weeks. A written
consent was obtained from the subjects. However, they were free to withdraw their consent in case they felt any discomfort during the period of their participation. There were no such dropouts in this study.

**Selection of Variables**

**Dependent Variables**

Breath-holding and hyperventilating disturb our body's balance of oxygen, CO₂, and NO. Nitric oxide, not to be confused with the nitrous oxide used in dental offices, plays an important role in our health. From a briefing document prepared for the Royal Society and Association of British Science Writers, Pearce Wright explains, "The immune system uses nitric oxide in fighting viral, bacterial and parasitic infections, and tumors. Nitric oxide transmits messages between nerve cells and is associated with the processes of learning, memory, sleeping, feeling pain, and, probably, depression. It is a mediator in inflammation and rheumatism."

The so called yoga breathing count where you breathe in hold the breath for several counts and breathe out and hold the several counts are in my opinion training us to hold our breathing
even more than we do already. Breath holding can give some relief from hyperventilation but at the cost of tightening the stomach muscles, worsening the startle response and making inviting shallow breathing (www.breathing.com).

Regular sustained (at least an hour) of brisk aerobic exercise three times a week will help you maintain a lower resting pulse rate. Daily is better. Cycling, Hiking, walking, Swimming, Running are all good aerobic exercises to maintain a healthier resting pulse rate. Your aerobic exercise should be at a level to increase your heart rate. Researchers have found maintaining a Log encourages sticking with an exercise routine.

Once pulse is how many times your heart beats, and we usually measure it in beats per minute. The harder you work the greater demand you put on your body and the harder it works. Usually we consider a resting heart rate that is your heart rate when you are just sitting, to be normal if it works at 70 – 75 beats per minute. Ninety beats per minute, although a tad on the high side could still be considered to be in the normal range. Over 90 would be considered poor, and 60 are under good.
The difference in heart rate between the person with the 90bpm and the person with the 70bpm is 30bpm. In an hour the difference is 1,800 beats, and the difference in a day is 43,200 beats. In a week 302,400 beats and in a month 1,209,600. In a year the difference is 14,515,200 beats, which means that the 90bpm person’s heart is working at over fourteen and a half million beats to do the same thing as the 60bpm person (www.fitnessandhealthpages.com).

The intake of oxygen and releasing carbon dioxide is probably the most basic but a pivotal respiratory system function. The process, as we all know, is called respiration. Although it seems very simple from its basic definition, the process can reflect the state of human body. The respiratory rate is one such parameter of this process which can reveal many facts about overall working of the body. It is considered very important to maintain a normal respiratory rate. But, what is respiratory rate? and why is it so important to maintain it in the normal respiratory rate range? Here are the answers to these questions.

Respiratory rate, also known as breathing rate, is defined as the number of breaths (inhalation and exhalation) a living being takes per unit time, generally in a minute. It is calculated by
counting the number of times a person's chest expands and contracts in one minute. The unit of respiratory rate is breaths per minute. This rate can range from a low of 12 breaths per minute in resting adults to a high of 75 breaths per minute in case of athletes while doing extremely strenuous work. But, these are not called normal as this rate is recorded in special conditions. Read more on respiratory system facts (http://www.buzzle.com).

The lipid profile is a group of tests that are often ordered together to determine risk of coronary heart disease. They are tests that have been shown to be good indicators of whether someone is likely to have a heart attack or stroke caused by blockage of blood vessels or hardening of the arteries (atherosclerosis). The lipid profile typically includes Total cholesterol, High density lipoprotein , cholesterol (HDL-C) often called good cholesterol, Low density lipoprotein cholesterol (LDL-C) often called bad cholesterol Triglycerides An extended profile may also include Very low density lipoprotein cholesterol (VLDL-C)and Non-HDL-C.

The lipid profile is used to help determine your risk of heart disease and to help to guide you and your health care provider in deciding what treatment may be best for you if you have
borderline or high risk. The results of the lipid profile are considered along with other known risk factors of heart disease to develop a plan of treatment and follow-up. Depending on your results and other risk factors, treatment options may involve lifestyle changes such as diet and exercise or lipid-lowering medications such as statins (www.labtestsonline.org).

Keeping the above concepts in mind the investigator has selected the following variables which were found appropriate and worthy to investigation.

1. Breath holding time
2. Resting pulse rate
3. Respiratory rate
4. High density lipoproteins cholesterol (HDL)
5. Low density lipoproteins cholesterol (LDL)
6. Very low density lipoproteins cholesterol (VLDL)

**Independent Variables**

Regular practice of yoga helps in cultivating a strict discipline in food habits, cleanliness, sex and character, thus enabling one to become a better person.

The therapeutic use of yoga is widely known. In fact, today, yoga is considered a global phenomenon and an essential part of
modern civilization. However, yoga, when practiced in the wrong manner, and without professional guidance, can do more harm than good.

Yogis say that our human body has seven energy centers located in the spine. These energy centers or chakras are centers of spiritual energy. They receive the prana from the cosmic reservoir of energy and distribute it to the physical body. The chakras are located in the astral body (an energy field surrounding the gross body), which have corresponding plexuses, centers or points, in the physical or gross body. These chakras emanate energy and vibrate in a certain frequency.

The manipura chakra or the solar plexus is the source of will power and self-assertiveness. All the metabolic activities in the body are controlled by this chakra. Energy blockages are cleansed by asanas and pranayama. These help in activating the energy centers.

Regular yogic practice energizes and helps the obese acquire the power to control their eating habits. The desired mental strength to break away from wrong dietary habits is gained only by yogic practice. Yoga encourages the practitioner to achieve goals by enabling a focused mind and promotes everlasting peace.
The most important benefit of yoga is physical and mental therapy. The aging process, which is largely an artificial condition, caused mainly by autointoxication or self-poisoning, can be slowed down by practicing yoga. By keeping the body clean, flexible and well lubricated, we can significantly reduce the catabolic process of cell deterioration. To get the maximum benefits of yoga one has to combine the practices of yogasanas, pranayama and meditation.

Regular practice of asanas, pranayama and meditation can help such diverse ailments such as diabetes, blood pressure, digestive disorders, arthritis, arteriosclerosis, chronic fatigue, asthma, varicose veins and heart conditions. Laboratory tests have proved the yogi's increased abilities of consciously controlling autonomic or involuntary functions, such as temperature, heartbeat and blood pressure. Research into the effects of yogic practices on HIV is currently underway with promising results.

According to medical scientists, yoga therapy is successful because of the balance created in the nervous and endocrine systems which directly influences all the other systems and organs of the body. Yoga acts both as a curative and preventive therapy. The very essence of yoga lies in attaining mental peace,
improved concentration powers, a relaxed state of living and harmony in relationships \( (www.lifepositive.com) \).

The presence of risk factors and diseases associated with obesity are also used to establish a clinical diagnosis. Coronary heart disease, type 2 diabetes, and sleep apnea are possible life-threatening risk factors that would indicate clinical treatment of obesity. Smoking, hypertension, age and family history are other risk factors that may indicate treatment.

In more recent years, attention has been focused on different methods of fitness programmes for decreasing physiological and biochemical variables benefits. The doctor and coach who are looking for the best method of developing basic physical fitness qualities must consider various kinds and frequencies of yogic practices. Based on the above mentioned concepts the following independent variables have been designed.

1. Yoga practices three days per week group
2. Yoga practices five days per week group

**Selection of Tests**

The present study was undertaken to find out the effect of yoga practices on selected physiological and biochemical variables among the diabetic patients. As per the available literature, the
following standardized tests were used to collect relevant data on the selected dependent variables and they are presented in Table 1.

Table – 1
Tests Selection

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Criterion Variables</th>
<th>Test Items</th>
<th>Unit of Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Breath Holding Time</td>
<td>Stop watch(Manual)</td>
<td>In Seconds</td>
</tr>
<tr>
<td>2.</td>
<td>Resting Pulse Rate</td>
<td>Radial Pulse method (Manual)</td>
<td>In Numbers</td>
</tr>
<tr>
<td>3.</td>
<td>Respiratory Rate</td>
<td>Stop Watch (manual method)</td>
<td>In Numbers</td>
</tr>
<tr>
<td>4.</td>
<td>High Density Lipoproteins (HDL)</td>
<td>Blood samples test (Phophotungstate Method)</td>
<td>In mg/dl</td>
</tr>
<tr>
<td>5.</td>
<td>Low Density Lipoproteins (LDL)</td>
<td>Blood samples test (Priedwalad’s equation Method)</td>
<td>In mg/dl</td>
</tr>
<tr>
<td>6.</td>
<td>Very Low Density Lipoproteins (VLDL)</td>
<td>Equation Method</td>
<td>In mg/dl</td>
</tr>
</tbody>
</table>

Competency of the Tester

All the measurements in this study were taken by the investigator along with the assistance of Doctors and qualified laboratory assistants working in Raja Medical Centre in Erode,
Tamilnadu, India. To ensure that the assistants of the investigator were well versed with the technique of conducting tests, they had a number of practice sessions in the correct testing procedure. The tester’s reliability was established by test and re-test methods.

**Reliability of the Instruments**

The clinical stopwatches, and laboratory Equipments used in this study were availed from Clinical laboratory in Raja Medical Centre in Erode, Tamilnadu, India. These instruments had been purchased from reliable and standard companies and were considered accurate enough for the purpose of the study.

**Reliability of the Data**

Test and retest method was followed in order to establish the reliability of data by using ten subjects at random. All the dependent variables selected in the present study were tested twice for the subjects by the same personnel under similar conditions. The intra-class co-efficient of correlation was used to find out the reliability of the data as suggested by *Johnson* and *Nelson (1982)* and the results are presented in Table 2.
Table – 2

Intra class co-efficient of correlation on selected dependent variables

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Criterion Variables</th>
<th>‘R’ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Breath Holding Time</td>
<td>0.89*</td>
</tr>
<tr>
<td>2.</td>
<td>Resting Pulse Rate</td>
<td>0.91*</td>
</tr>
<tr>
<td>3.</td>
<td>Respiratory Rate</td>
<td>0.92*</td>
</tr>
<tr>
<td>4.</td>
<td>High Density Lipoproteins (HDL)</td>
<td>0.93*</td>
</tr>
<tr>
<td>5.</td>
<td>Low Density Lipoproteins (LDL)</td>
<td>0.98*</td>
</tr>
<tr>
<td>6.</td>
<td>Very Low Density Lipoproteins (VLDL)</td>
<td>0.85*</td>
</tr>
</tbody>
</table>

* Significant at 0.01 level of confidence.

(Table value required for significance at 0.01 level of confidence is 0.77)

Since the obtained ‘r’ values were much higher than the required value, the data were accepted as reliable in terms of instruments, testers and subjects.

**Orientation to the Subjects**

The investigator explained the purpose of the training programme and their part in the study to the subjects. For the collection of data, the investigator explained the procedure of testing on selected dependent variables and gave instruction about the procedure to be adopted by them for measuring. Five
sessions were spent to familiarize the subjects with the techniques involved in undergoing yogic practices. It helped them to perform the yogasana perfectly without injuries. The subjects of all the groups were sufficiently motivated to perform their assigned tasks during the testing periods.

**Pilot Study**

A pilot study was conducted to assess the initial capacity of the subjects to fix the load and also to design the training programme. For that purpose, ten middle aged men were selected at random and they were given different frequency of yogasana under the watchful eyes of the investigator. The initial loads of the subjects were fixed based on the results of the pilot study and the directions given by Dan Wathen and William B. Allerheibigen (1994). While constructing the yogasana programmes the basic principles of sports training (progression of overload and specificity) were followed. During construction of the yogasana programme, the individual differences were also being considered.
Training Programme

During the training period, the experimental groups underwent their respective training programmes. Group-I underwent yoga practices three days per week, Group-II underwent yoga practices five days per week for twelve weeks. The duration of training session in all the days was between one hour to one and half hour approximately which included warming up and limbering down. All the subjects involved in this study were carefully monitored throughout the training programme to be away from injuries. They were questioned about their health status throughout the training programme. None of them reported any injuries or discomfort. However, muscle soreness appeared in the earlier period of the training programme and was reduced in due course.

Training Details of yogic practice:

- Duration of the training : 12 Weeks
- Number of days per week : 5/3 Days
- Duration of the session : 90 Minutes
Training phases of yogic practice:

The yogic practices consist of three phases in a session.

Phase -- I  -- Asanas
Phase -- II  -- Pranayama
Phase -- III -- Meditation

Time schedule for a session:

Asanas        -- 40 Minutes
Pranayamas    -- 20 Minutes
Distributed Relaxation -- 15 Minutes
Meditation    -- 15 Minutes

The training period consisted of three days per week for twelve weeks. The yogic practice was carried on Tuesday, Thursday and Saturday. Out of 48 sessions of yogic practices rotations of various asanas and pranayamas in the sequence of sitting, lying and standing were performed. The performance of asanas had three phases.

1. The start
2. The Hold
3. The Release
The asanas from the designed package were performed with a sequences of sitting lying and standing while care was also taken that the counter movements exist during the variations from one asana to another (i.e.) when an asana required forward bending it was complimented by an asana that had a backbend while going for the next.

Example: Paschimothasana (against) Bhujangasana.

The pranayama practice was also practiced in this similar manner, which also had three distinct phase of breathing like.

1. Inhalation
2. Suspension and
3. Exhalation

Care was taken to provide a suitable noise free, dust free and comfortable ambience to undergo systematic yogic practices. It was also checked that all the asanas and pranayamas selected are covered systematically on rotations from the framed training package.
Collection of the Data

The data on breath holding time was assessed by manual method, resting pulse rate was assessed by radial pulse method, respiratory rate was assessed by expirograph, high density lipoproteins cholesterol (HDL) was assessed by enzymatic colorimetric method, low density lipoproteins cholesterol (LDL) was assessed by Friedwald, Levy and Fredrickson (1972) equation method and very low density lipoproteins cholesterol (VLDL) was assessed by formula method. Pre test data was collected two days before the training programme and post test data was collected immediately after twelve weeks of training session. In all the cases, the data was collected in a single day, morning session biochemical variables and evening session physiological variables data were taken.

Administration of the Tests

1. Breath Holding Time

Purpose

The objective was to measure the ability of the subjects to hold the breath for longer time.
**Equipment used**

A stopwatch with calibration of 1/10 second, score sheet and a pencil were used to administer the test.

**Procedure**

The subject stood at ease and inhaled deeply after which he held his breath for a length of time possible to him. The index finger of the respondent served as an indicator for the investigator to know the start and end of the recording time. The thumb and center finger were used to hold the nose to avoid letting the air through the nostrils. The subjects were requested not to let the air out by opening the mouth while recording the breath holding time. The time of holding the breath till the subject let the air out was clocked by using the stopwatch to the nearest 1/10 of second as breath holding time.

**2. Resting Pulse Rate (Manual Method)**

**Purpose**

To record the resting pulse rate per minute

**Equipment**

Stop watch and chair.
**Procedure**

The pulse rates of all the subjects were recorded in a sitting position in the morning session between 6.00 am 7.00 am. Before taking the pulse rate, the subjects were asked to sit in a chair and relax for 15 min. To record the pulse rate, the first three finger tips were placed on the left radial artery at the wrist so as to feel the pulse beat.

**Scoring**

The pulse beats were noted for 15 seconds and then multiplied by four to record for a full minute.

**3. Respiratory Rate (Manual Method)**

**Objective**

The objective was to measure the subject's number of breaths per minute.

**Equipment**

Stop watch and Long Bench.

**Procedure**

Place the subject in a position of comfort on the bench, preferably sitting. Discomfort can cause the subject to breathe more rapidly. Place the subject’s arm in a relaxed position across
the abdomen or lower chest, or place your hand directly over the subject’s upper abdomen. This is the same position used during the assessment of the pulse. Both the subject’s and the researchers/observer’s hands rise and fall during the respiratory cycle. Measurement of the respirations is done immediately after the pulse assessment and is not perceived by the patient. Observe the complete respiratory cycle (consists of one inspiration and one expiration). This ensures that the count will begin with a normal respiratory cycle. Once a cycle is observed, monitor the watch’s second hand and begin to count the rate of respirations. When the second hand reaches a number on the dial, count “one” to begin the first cycle.

**Scoring**

Timing of the respirations begins with a count of 1. Respirations occur more slowly than the pulse; therefore, the count begins with 1. For adults, count the number of respirations in 30 seconds, then multiply by 2. For infants or young children, count the respirations for 1 full minute. The respiratory rate is equivalent to the number of respirations per minute.
4. Estimation of High Density Lipoprotein Cholesterol (HDL-C) Method

HDL- Cholesterol was estimated by applying enzymatic colorimetric method, as recommended by Burstein et.al, (1970) and Lopes et al. (1977) Erba Smart lab auto analyzer was used for this purpose.

Test Principle.

Chylomicrons, VLDL(Very Low-Density Lipoproteins) and LDL (Low Density Lipoproteins) are precipitated , by adding Phosphotungstic acid and magnesium ions to the sample, Centrifugation leaves only the HDL in the supernatant, their cholesterol content is determined enzymatically by cholesterol oxidize paraaminophenazone method.

Reagents

Phosphotungstic acid – 0.44m mol/1

Magnesium Chloride --- 20 m mol/1

Procedure

To 200 mgl of sample, 500 ml of precipitating reagent was added, mixed and kept for 10 minutes at room temperature. The tubes were centrifuged at 4000 rpm for 10 minutes and 100
mg/dl of clear supernatant was removed within two hours for cholesterol estimation by cholesterol oxidase—paraaminophenazone method with 1000 mg/dl of the reagent. Serum HDL cholesterol is expressed as mg/dl.

5. Estimation of Low Density Lipoprotein Cholesterol (LDL)

LDL-Cholesterol was calculated from Total Cholesterol Triglycerides and HDL Cholesterol levels, by using the following formula recommended by Friedewald, Levy and Fredrickson (1972) equation.

\[ \text{LDL-C} = \frac{\text{TC} - \text{TG}}{5} - \text{HDL-C} \]

LDL-C was expressed as mg/dl.

6. Estimation of Very Low Density Lipoprotein (VLDL)

VLDL-C was calculated from TG using the formula

\[ \text{VLDL-C} = \frac{\text{TG}}{5} \]

VLDL-C was expressed as mg/dl.
Experimental Design and Statistical Technique

The experimental design used in this study was random group design. The selected subjects were divided at random into three groups of fifteen each (n=15). Group I underwent yoga practices three days per week, Group-II underwent yoga practices five days per week for twelve weeks and Group III acted as Control. All the subjects were tested prior to and immediately after the training period for all the selected variables.

The data collected from the three groups prior to and immediately after the training programme on the selected criterion variables were statistically analyzed with dependent ‘t’ test and Analysis of Covariance (ANCOVA). Whenever the ‘F’ ratio for adjusted post test means was found to be significant, Scheffe’s test was followed, as a post hoc test to determine which of the paired mean differences was significant. In all the cases .05 level of confidence was fixed as a level of confidence to test the hypotheses.