CHAPTER I

INTRODUCTION

From the immemorial Indians have laid emphasis on ‘yoga’ and physical exercises not only to keep the body and mind fit but to prevent and treat the ailments.

Physical exercises have been considered as an essential part of human life. The survival of man is physical and movement or the activity is the foremost important thing one learns soon after birth. The literate meaning of ‘physical’ is ‘body’ which strictly relates to physique, health, strength, endurance, speed, agility, flexibility, and physical performance on the sports ground **(Uppal, 2000)**. A well planned and regular lifetime programme of exercise will help us feel better, look better and enable us to enjoy a much comfortable life than we may have been leading until now. Exercise means treating our body with new respect, working with it instead of against it. And all this should be fun. It is therefore important to select a method that suits us and our personality **(Ann Carpenter, 1984)**.

1.1 YOGA

Yoga is one of India’s wonderful gifts to mankind. One of its valuable qualities is that it builds up a store of physical health through the practice of a system of exercises called Asanas which keep the body clean and fit. Yogic exercises are essential for speedy removal of toxins and for keeping good blood circulation and for all internal process to function smoothly. Apart from the physical side of life, yoga provides beneficial effects to the mental faculties

also. Different breathing exercises or techniques quieten the mind and brain, offering inner peace and an ability to face upheavals and deal with problems. Yoga therefore has a role both in every day practical life, and in the more thoughtful, idealistic scheme of things. Its value needs to be experienced and savoured **(Iyengar, 1999)**.

Yoga is considered to be a philosophy, a science and an art. In philosophical term “Yoga is the union of the individual self with universal self”. According to Patanjali, Yoga has eight stages of clearly defined aspects and in its purest form is a complete system capable of answering all human needs. However it has always been, and still is, used as a basis for other activities and disciplines. Today for example, physiotherapy and exercise classes often adopt movements from yoga postures **(Iyengar, 1999)**.

The stages of yoga are eight, Yama, Niyama, Asana, Pranayama, Pratyahara, Dharana, Dhyana and Samathi, they are all integrated **(Iyengar, 1999)**.

1. Yama is five universal commandments aimed to create a better world; the five principles are non violence or ahimsa, satya or truthfulness, chastity, being non grasping and non stealing.
2. Niyama is five principles which are cleanliness; contentment; self discipline, study of scriptures and one’s own self, which includes the body, mind, intellect and ego and the final principle is devotion to God.
3. Devoted and conscientious practice of the various types of posture is called Asana.

4. Pranayama (Practice of breath control) is practicing breathing techniques with care and determination
5. Pratyahara (Detachment from worldly activities) is developing a non – attached attitude of body and mind.
6. Dharana (Concentration) is being able to hold on to a subject mentally
7. Dhyana (Meditation) is a developing a quiet, meditative stage.
8. Samathi (Trance (or) state of bliss) is reaching a state absorption in a subject (or) in the Divine **(Iyengar, 1999)**.

1.1.1 ASANA

Asana are one of the major tools of Yoga. Asana brings steadiness, health and lightness of limb. A steady and pleasant posture produces mental equilibrium and prevents fickleness of mind. Asanas are not merely gymnastic exercises, they are postures. To perform them one needs a clean airy place, a blanket and determination, while for other systems of physical training one needs large playing fields, skills and costly equipments. Asanas can be done alone. The limbs of the body provide the necessary weights and counter–weights. By practicing them one develops agility, balance, endurance, co-ordination and great vitality.

Asanas have evolved over the centuries so as to exercise every muscle, nerve and gland in the body. Asanas balance the respiratory, circulatory, nervous, hormonal, digestive excretory and reproductive systems perfectly. The equilibrium in the body then brings mental peace and enhances intellectual clarity **(Iyengar, 2001**). It secures a fine physical structure, which is strong and flexible without being muscle-bound and helps to keep the body free from diseases. Asanas reduce fatigue and soothe the nerves, boosts metabolism,

lymphatic circulation, hormonal secretion, and bring about chemical balance in the body. Asanas and pranayama are interrelated and inter-woven. Sage Pathanjali clearly specifies that pranayama should be attempted only after the Asanas are mastered **(Iyengar, 2001)**.

Many actors, acrobats, athletes, dancers, musicians and sportsmen possess superb physique and have great control over the body, but they lack control over the mind, the intellect and the self. Hence they are in a disharmony with themselves and one rarely comes across a balanced personality among them. By performing Asanas, the sadhake (performer) first gains health, which is not mere existence. It is an asset to be gained by sheer hard work **(Iyengar, 2001)**.

1.1.2 PATHS OF YOGA

There are four main paths of yoga, i.e. Karma Yoga, Bhakti Yoga, Jnana Yoga and Raja Yoga, with each suited to a different temperament or approach to life. All paths lead ultimately to the same destination of union with Brahman (or) God.

The back bone of Raja Yoga is furnished by Patanjalis Yoga Sutras **(Rabinovitch et al.,., 1983)** thought to have been written in the third century BC. The path Raja Yoga deals with the science of physical and mental control exercises which are often called “Royal Road”. Asana or postures and pranayama or the regulators of breath form the sub division of Raja Yoga known as Hatha Yoga which forms the basis of modern practice of yoga. The classical text, Hatha Yoga Pradipika is on Hatha Yoga. The form of yoga stressing is the importance of physical exercise and positions and breathing control in promoting physical and mental well being **(Schewarz et al., 1984).**

There are three stages to each asana, viz. coming into the pose, holding it, and coming out of the pose and those steps should be performed as one continuous movement up to the final position **(Rabinovitch et al., 1983).**

The Asanas are done with a few warm up movements and are done in a sequence that keeps at rest certain groups of muscles in the next asana. For example exercises that involve flexion of the spine (Paschimothasana) are followed by those that extend the spinal muscles (Bhujangasana). This is called “viayas”. The exercises are interspaced with rest periods (Savasana) to eliminate the factor of fatigue **(Ray, 1998)** .

1.1.3 YOGA AND BODY MIND RELATIONSHIP

Yoga can be explained in the angle of neurological mechanism. Mechanical and rhythmic stimulation of muscle over limited periods, produce improved muscle tone of the organ concerned. Rhythmic stretching of muscles is the body lead to its increase in strength of muscle spindles, suppleness and plasticity of the muscles. It has been documented that with increased mastery over Asanas there is economic, diminished muscular activity as shown by Electro Myo Graphic (EMG) studies **(Karambelkar et al., 1972)**.

Yogasana and pranayama with their rhythmic mechanical stimulation of connective tissues and muscular fibers lining lungs, liver, gall bladder, stomach and intestines cause an improvement in their muscle tone and contractile power which in turn improve their functional capacity **(Gharote et al., 1977)**.

Yoga postures tend to arrest catabolism and have specific effects on the glands and internal organs and to certain extent alter electrochemical activity in the nervous system **(Swamy Satyananda Saraswathi, 1996).**

In human beings the maintenance of postural regulation is not unconscious or automatic (through the propreoceptors in muscles, tendons and semicircular canals in internal ears) or reflex activity of the neural circuits (through the spinal cord, medulla, pans, cerebellum, mid brain and thalamus). The cerebral cortex has a more dominating, inhibiting influence on these lower (such cortical) regions of the brain. Hence one important function of yogic exercises is not only to improve muscle tone and postural reflexes but to render the lower centers a greater degree of freedom from inhibitory control of cerebral cortex **(Ray, 1998)** .

Mental concentration on certain internal sensations of organs like lungs, intestines and stomach may activate the thalamic, hypothalamic, forbrain and endocrine connections in a subtle manner that is not available in other forms of exercises where the concentration remains bound to the surface of the body. The yogic para-sympathetic dominance is reflected in one's capacity to voluntarily control the rate of heart, rate of breathing, elimination of waste, maintenance of body temperature, the reduced requirement of food, sleep etc., all fostering a state of economical self preservation and conservation of energy. Yoga helps to recruit newer territories in the brain to improve dormant faculties **(Ray, 1998)**.

1.2 SURYA NAMASKAR

Bihar Yoga provides a system that restores order to our lives, creating harmony so that imbalances in the form of disease and neurosis drop away. The mind regains its peace, the emotions begin to harmonize and the body recovers its vital capacity, so that the individual can face life and its distractions with a greater sense of inner serenity and balance.

The Bihar Yoga system is a complete science of harmonious living, suitable for everyone, regardless of age, gender, nationality, religion, mental condition or level of fitness. It is a holistic system which addresses all aspects of human life in the spheres of physical health, mental well-being, emotional behavior and work environment. Awareness is emphasized and practitioners are encouraged to learn about all aspects of their personality through yoga. Adjustment in stages is emphasized, not a total change in one's lifestyle and environment.

The beauty of Bihar Yoga is that it slowly grows on one, and it is totally up to the practitioner to decide how much to implement. If the need is relief from chronic diseases, such as asthma, diabetes or hypertension, then a simple package of practices can be implemented. If the need is to improve one's physical fitness, or one's mental abilities, or take up yoga teaching, or find a direction in life, or live a spiritual life, then Bihar Yoga also provides that opportunity.

Bihar Yoga is a living tradition based on the realizations of two masters, Sri Swami Sivananda Saraswati and Sri Swami Satyananda Saraswati. Sri Swami Sivananda was the first spiritual personality in the twentieth century to emphasize that divine life was everyone's birthright and could be practiced in

simple ways even while living in the normal social environment. He introduced the concept of integral yoga for harmonious development of the personality, incorporating a practical philosophy and a holistic lifestyle. Sri Swami Satyananda Saraswati was given the mandate of taking yoga to humanity ‘from door to door and from shore to shore’.

During nine years as a wandering ascetic, he discerned the needs of the general public, and then travelled around the world teaching the practices of yoga in a systematic and easily comprehensible way. He simplified and systematized the yogic practices, and at the same time added depth to every dimension of yoga. Shankhaprakshalana (intestinal cleansing) was made a practical and effective technique in the hatha yoga shatkarma series for physical purification. Asanas were classified and grouped according to position and sequence, and prefaced with the pawanmuktasana series, so that everyone could benefit. Pranayama as a complete system was revealed for the first time. The deep relaxation practice of yoganidra provided major relief from stress as well as a means of personality transformation.

Sri Swami Satyananda Saraswati taught yoga in practically every country around the world. He found total acceptance everywhere due to his simple approach and universality. His successor, Swami Niranjanananda, has built up and consolidated this solid foundation of yoga. Thus Bihar Yoga evolved into a complete and integrated system of yoga with its practices and philosophy culled from the Vedic and tantric traditions.

Surya Namaskara (IAST: Surya namaskara) or Sun Salutation (lit. "Salute to the sun"), is a common sequence of Hatha yoga Asanas. Its origins lie in a worship of Surya, the Hindu solar deity. This sequence of movements

and poses can be practiced on varying levels of awareness, ranging from that of physical exercise in various styles, to a complete sadhana which incorporates asana, pranayama, mantra and chakra meditation.

The physical base of the practice links together twelve Asanas in a dynamically performed series. These Asanas are ordered so that they alternately stretch the spine backwards and forwards. When performed in the usual way, each asana is moved into with alternate inhalation and exhalation (except for the sixth asana where the breath is held in external suspension). A full round of Suryanamaskar 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.

Proponents of the use of Suryanamaskar as part of the modern yoga tradition prefer to perform it at sunrise, which the orthodox consider to be the most 'spiritually favourable' time of the day.

1.2.1 HEALTH BENEFITS OF SURYA NAMASKAR

Suryanamaskar provides all of the key health benefits of yoga in a very succinct package. It is a holistic exercise that provides physical health benefits, but also mental or emotional as well as spiritual benefits. The obvious advantage of Suryanamaskar is the workout it provides for the muscles, but it also benefits joints, ligaments and the skeletal system by improving posture, flexibility and balance.

In addition to these physical benefits, Suryanamaskar practice stimulates and conditions virtually every system in the body. It is good for the heart and stimulates the cardiovascular system. It oxygenates the blood and helps strengthen the heart. Suryanamaskar is good for the digestive system and the

nervous system. It stimulates the lymphatic system and supports respiratory system health, as well.

Practicing Suryanamaskar also benefits the Endocrine system and enables the various endocrinal glands to function properly. These include the thyroid, parathyroid and pituitary glands as well as the adrenal gland, testes and ovaries.

Like most forms of exercise, Suryanamaskar provides mental benefits to regular practitioners. You will feel wonderful after performing the Sun Salutation. It is relaxing and rejuvenating, and tension, stress and anxiety melt away as you perform Suryanamaskar.

Suryanamaskar is an excellent alternative to caffeine and other stimulants. If you suffer from insomnia or sleep disturbances, you will find practicing Suryanamaskar aids in helping you fall asleep without the need for depressants.

With regular practice, Suryanamaskar is an excellent way to manage stress and alleviate depression. You will expend a tremendous amount of energy as you move through the two sets of poses. Suryanamaskar teaches you to concentrate, and learning to achieve the poses is incredibly gratifying.

1.3 COMMON OBJECTIVES OF YOGA AND PHYSICAL EDUCATION

Health, Physical fitness and emotional stability are the objectives which bring yoga and physical education on a common platform for the benefit of human individual. Health is a more general and comprehensive term conveying the ‘felling of well being’, while physical fitness is a more specific term. Physical fitness is the capacity of an individual to perform a given task at a particular time. Health and physical fitness are not static.

They are always changing they follow ‘the law of use and disuse’. Health and physical fitness can be maintained only by carefully selected physical activities which are called ‘exercise’. The utility of the particular exercise programme can be evaluated only in terms of the effects that are obtained in promoting a particular factor or factors of physical fitness. Through constant practice of yoga, one can overcome all difficulties and eradicate all weakness. Pain can be transmitted into bliss, sorrow into joys, and failure into success and sickness into perfect health. Determination, patience and persistence lead one to goal **(Ananda, 1982)** .

1.4 PHYSICAL EXERCISE

Physical exercise is any bodily activity that enhances or maintains physical fitness and overall health and wellness. It is performed for various reasons including strengthening muscles and the cardiovascular system, honing athletic skills, weight loss or maintenance, as well as for the purpose of enjoyment. Frequent and regular physical exercise boosts the immune system, and helps prevent the "diseases of affluence" such as heart disease, cardiovascular disease, Type 2 diabetes and obesity. It also improves mental health, helps prevent depression, helps to promote or maintain positive self esteem, and can even augment an individual's sex appeal or body image, which is also found to be linked with higher levels of self esteem. Childhood obesity is a growing global concern and physical exercise may help decrease the effects of childhood obesity in developed countries. Health care providers often call exercise the "miracle" or "wonder" drug - alluding to the wide variety of proven benefits that it provides **(Manson et al., 2001)** .

The benefits of exercise have been known since antiquity. Marcus Cicero, around 65 BC, stated: "It is exercise alone that supports the spirits, and keeps the mind in vigor." However, the link between physical health and exercise (or lack of it) was only discovered in 1949 and reported in 1953 by a team led by Jerry Morris. Dr. Morris noted that men of similar social class and occupation (bus conductors versus bus drivers) had markedly different rates of heart attacks, depending on the level of exercise they got: bus drivers had a sedentary occupation and a higher incidence of heart disease, while bus conductors were forced to move continually and had a lower incidence of heart disease. This link had not previously been noted and was later confirmed by other researchers **(Kuper, Simon 2009).**

1.4.1 TYPES AND CATEGORIES OF PHYSICAL EXERCISES

Physical exercises are generally grouped into three types, depending on the overall effect they have on the human body:

a. Flexibility exercises, such as stretching, improve the range of motion of muscles and joints.

b. Aerobic exercises, such as cycling, swimming, walking, skipping rope, rowing, running, hiking or playing tennis, focus on increasing cardiovascular endurance.

c. Anaerobic exercises, such as weight training, functional training, eccentric training or sprinting, increase short-term muscle strength **(Wilmore and Knuttgen, 2003)**.

The following are three categories of physical exercise

1. Strength training
2. Agility training
3. Eccentric Training

Sometimes the terms 'dynamic' and 'static' are used. 'Dynamic' exercises such as steady running tend to produce a lowering of the diastolic blood pressure during exercise, due to the improved blood flow. Conversely, static exercise (such as weight-lifting) can cause the systolic pressure to rise significantly (during the exercise).

1.4.2 PHYSICAL EXERCISE IS USED TO IMPROVE PHYSICAL SKILLS.

Physical skills fall into the following general categories, as per Cross Fit **(Sibley, Benjamin A. Oct 2012)** :

1. Cardiovascular/respiratory endurance
2. Stamina
3. Strength
4. Flexibility
5. Power
6. Speed
7. Coordination
8. Agility
9. Balance
10. Accuracy

Physical exercise is important for maintaining physical fitness and can contribute positively to maintaining a healthy weight, building and maintaining healthy bone density, muscle strength, and joint mobility, promoting physiological well-being, reducing surgical risks, and strengthening the immune system.

Exercise reduces levels of Cortisol, which causes many health problems, both physical and mental. Frequent and regular aerobic exercise has been shown to help prevent or treat serious and life-threatening chronic conditions such as high blood pressure, obesity, heart disease, Type2diabetes, insomnia, and depression. Endurance exercise before meals lowers blood glucose more than the same exercise after meals. According to the World Health Organization, lack of physical activity contributes to approximately 17% of heart disease and diabetes, 12% of falls in the elderly, and 10% of breast cancer and colon cancer **(Joanne, 2010)**.

There is some evidence that vigorous exercise (90–95% of VO_2 Max) is more beneficial than moderate exercise (40 to 70% of VO_2 Max). Some studies have shown that vigorous exercise executed by healthy individuals can increase opioid peptides (a.k.a. endorphins, naturally occurring opioids that in conjunction with other neurotransmitters are responsible for exercise-induced euphoria and have been shown to be addictive), increase testosterone and growth hormone, effects that are not as fully realized with moderate exercise. More recent research indicates that anandamide may play a greater role than endorphins in "runner's high". However, training at this intensity for long periods of time, or without proper warm up beforehand and cool down afterwards, can lead to an increased risk of injury and overtraining.

Both aerobic and anaerobic exercise work to increase the mechanical efficiency of the heart by increasing cardiac volume (aerobic exercise), or myocardial thickness (strength training). Such changes are generally beneficial and healthy if they occur in response to exercise.

1.4.3 EFFECT OF PHYSICAL EXERCISE ON THE CARDIOVASCULAR SYSTEM

The beneficial effect of exercise on the cardiovascular system is well documented. There is a direct relation between physical inactivity and cardiovascular mortality, and physical inactivity is an independent risk factor for the development of coronary artery disease. There is a dose-response relation between the amount of exercise performed from approximately 700 to 2000 kcal of energy expenditure per week and all-cause mortality and cardiovascular disease mortality in middle-aged and elderly populations. The greatest potential for reduced mortality is in the sedentary who become moderately active. Most beneficial effects of physical activity on cardiovascular disease mortality can be attained through moderate-intensity activity (40% to 60% of maximal oxygen uptake, depending on age) persons who modify their behavior after myocardial infarction to include regular exercise have improved rates of survival. ... Persons who remain sedentary have the highest risk for all-cause and cardiovascular disease mortality (**Hubal, et al., 2005)**.

1.4.4 EFFECT OF PHYSICAL EXERCISE ON THE IMMUNE SYSTEM

Although there have been hundreds of studies on exercise and the immune system, there is little direct evidence on its connection to illness. Epidemiological evidence suggests that moderate exercise has a

beneficial effect on the human immune system; an effect which is modeled in a J curve. Moderate exercise has been associated with a 29% decreased incidence of upper respiratory tract infections (URTI), but studies of marathon runners found that their prolonged high-intensity exercise was associated with an increased risk of infection occurrence. However, another study did not find the effect. Immune cell functions are impaired following acute sessions of prolonged, high-intensity exercise, and some studies have found that athletes are at a higher risk for infections. The immune systems of athletes and non athletes are generally similar. Athletes may have slightly elevated natural killer cell count and cytolytic action, but these are unlikely to be clinically significant **(Gleeson, 2007)**.

Vitamin C supplementation has been associated with lower URTIs in marathon runners. Biomarkers of inflammation such as C-reactive protein, which are associated with chronic diseases, are reduced in active individuals relative to sedentary individuals, and the positive effects of exercise may be due to its anti-inflammatory effects. The depression in the immune system following acute bouts of exercise may be one of the mechanisms for this anti-inflammatory effect.

1.4.5 EFFECTS OF PHYSICAL EXERCISE ON BRAIN FUNCTION

A 2008 review of cognitive enrichment therapies (strategies to slow or reverse cognitive decline) concluded that "physical activity, and aerobic exercise in particular, enhances older adults' cognitive function" **(Hertzog, et al., 2008)**.

Exercise improves cognitive functioning via improvement of hippocampus-dependent spatial learning, and enhancement of synaptic plasticity and neurogenesis. In addition, physical activity has been shown to be neuroprotective in many neurodegenerative and neuromuscular diseases. For instance, it reduces the risk of developing dementia. Furthermore, anecdotal evidence suggests that frequent exercise may reverse alcohol-induced brain damage.

There are several possibilities for why exercise is beneficial for the brain. Examples are as follows:

- increasing the blood and oxygen flow to the brain
- increasing growth factors that help create new nerve cells and promote synaptic plasticity
- increasing chemicals in the brain that help cognition, such as dopamine, glutamate, norepinephrine, and serotonin

Physical activity is thought to have other beneficial effects related to cognition as it increases levels of nerve growth factors, which support the survival and growth of a number of neuronal cells.

1.4.6 EFFECTS OF PHYSICAL EXERCISE ON DEPRESSION

A number of factors may contribute to depression including being overweight, low self esteem, stress, and anxiety. Endorphins act as a natural pain reliever and antidepressant in the body. Endorphins have long been regarded as responsible for what is known as "runner's high", a euphoric feeling a person receives from intense physical exertion. However, recent research indicates that anandamide may possibly play a greater role than endorphins in "runner's high". When a person exercises, levels of both

circulating serotonin and endorphins are increased. These levels are known to stay elevated even several days after exercise is discontinued, possibly contributing to improvement in mood, increased self-esteem, and weight management. Exercise alone is a potential prevention method and/or treatment for mild forms of depression **(Buman and King, 2010)** .

1.4.7 EFFECTS OF PHYSICAL EXERCISE ON SLEEP

A 2010 review of published scientific research suggested that exercise generally improves sleep for most people, and helps sleep disorders such as insomnia. The optimum time to exercise *may* be 4 to 8 hours before bedtime, though exercise at any time of day is beneficial, with the possible exception of heavy exercise taken shortly before bedtime, which may disturb sleep. There is, in any case, insufficient evidence to draw detailed conclusions about the relationship between exercises and sleep **(Buman and King, 2010)** .

Signs that encourage the use of stairs, as well as community campaigns, have been shown to be effective in increasing exercise in a population. The city roads on morning, Sundays and holidays are being used for walking, which make it easier for its citizens to get exercise. These pedestrian zones are part of an effort to combat chronic diseases, including obesity (**Khan, et al., 2002) .**

The Compendium of Physical Activities was developed for use in epidemiologic studies to standardize the assignment of MET intensities in physical activity questionnaires. The Compendium is list of physical activities and the associated energy cost of each activity. The original Compendium was published in 1993, the first update in 2000, and the most recent update in 2011.

MET (Metabolic Equivalent): The ratio of the work metabolic rate to the resting metabolic rate. One MET is defined as 1 kcal/kg/hour and is roughly equivalent to the energy cost of sitting quietly. A MEt al.,so is defined as oxygen uptake in ml/kg/min with one MET equal to the oxygen cost of sitting quietly, equivalent to 3.5 ml/kg/min.

1.4.8 PHYSICAL EXERCISES FOR PHYSICAL FITNESS

Fitness is a key to enjoy life. Exercise is an important of a total fitness programme. Modern living has taken all the exercise out of our lives and so in order to get fit and have to put it back again, regular exercise is necessary to develop and maintain an optional level of health, performance and appearance. It makes feel good, both physically and mentally. It gives psychological lift and strengthens a sense of accomplishment. Looking young is a reflection of good health. Regular physical exercise enhance the function of the joints; increase the sense of physical well-being and promotes a sense of feeling good; increases physical working capacity by increasing cardiorespiratory fitness, muscle strength and endurance and decreases the risk of serious diseases that could lead to early disability and death.

Ukoho (1988) express that exercise has shown to improve health prospects in various ways. It helps to reduce body fat and overall weight and reduce blood pressure. Exercise ensures better digestion, respiration and efficient blood circulation. Proper exercise programme can reduce the probability of injuries among older people as well as back injuries among certain occupational group. Exercise tolerance is increased, risk factors are controlled and even progression and regression of coronary artery disease can

be influenced by training and diet. Psychological effects include lessened depression and reduced anxiety. Regular physical activity is important for maintenance of health and may lead to a better quality of life. Training has to be followed not less than two to three hours per week in at least three sessions at an intensity corresponding to 60 to 85% of maximum heart rate achieved in a symptom limited maximum exercise test. Cardiac patients at high risk should exercise at lower intensities. Exercise occupies a leading role in keeping persons fit. It will be quite difficult to adjust one's life in term of stress, diet sleep and so on without proper exercise. Exercise means using and tuning the body. Exercise builds and maintains physical fitness **(Niederhauser, 1996)**.

Every individual must know the need of physical exercise. In other words one must have fundamental knowledge of Anatomy and Physiology. This fundamental knowledge enables a person to understand physical fitness. Physical fitness is the capacity of a person to function steadily and smoothly when a situation arises.

Physical exercises makes one mentally sharpen, physically comfortable and ease with his body and better able to cope with the demands that everyday life makes upon him.

Increased physical fitness not only improves health but improves performance at work. Hundreds of American companies have back this idea financially by employing full time directors of fitness for their work.

1.5 YOGIC PRACTICES AND PHYSICAL EXERCISES

It is necessary to note that the nature of all yogic practices is psychological and physiological. Some exercises emphasizing the control of mental processes directly are more psychological. Other exercises are more physical or physiological. It is the later part of yogic practices that has become more popular and is being extensively used for the development and promotion of health and fitness. The yogic exercises in general differ from the physical exercises and the important differences are:

1. The physical exercises are repetitive in character and utilize a lot of energy whereas yogic exercise helps to conserve energy. The caloric requirement of yogic exercises is only 0.9 to 3 calories per minute depending upon the severity of exertion.
2. Relaxation forms the most important aspect of yogic exercise unlike physical exercises, during the practice of asana; muscles which do not support weight or which are not actively involved are relaxed. With relaxation, the muscles return to normality after contraction and therefore yogic exercises keep the body more flexible. Physical exercises improve the circulation of blood in voluntary system, thereby resulting in better muscular development as a result of improved function of the muscles. Yogic exercises aim at improving blood circulation to the entire vital organism thus improve their function.
3. Unlike physical exercises, in yogic exercises spine has been given an important place and various exercises for the spine aim at keeping the spine flexible and joints supple.

4. Yogic exercises influence both mind and body whereas physical exercises have their effect mainly on the body. They have more positive reaction to stress, thus minimizing its ill effects.

1.6 HEALTH RELATED PHYSICAL FITNESS

Health - related physical fitness is important to everyone and should be stressed by physical educators and medical people alike. Health related fitness is defined as the ability to perform strenuous activity without excessive fatigue showing evidence of traits that limit the risks of developing diseases and disorders which affect a person's functional capacity. Components of health related physical fitness are identified as muscular strength, endurance, flexibility, cardiorespiratory endurance and body composition **(Beverly Nichols, 1986).**

To enjoy an optimum state of health and physical fitness, exercises are quite necessary. Exercises are helpful in maintaining the sound body throughout life. Health and fitness afford the people an opportunity to live longer and they add to the quality of everyday life **(Greenberg and Pargnam, 1986)** .

Physical education has long believed that exercise is essential to maintain good health. During the past twenty years a great deal of evidence has been reported by the medical researches supporting the value of vigorous exercise for the promotion of health. Health-related physical fitness components are those, development of which enrich one's health and on the other hand which are related to certain diseases. **(Ted A. Baumgartner and Andrew S. Jackson , 1987)** The variables, cardiorespiratory endurance, muscular endurance, muscular strength, flexibility and body composition were considered for this study.

1.7 PHYSIOLOGY

Physiology is the science of functioning of all the organs and systems of an organism. For the physiological system of the body to be fit, they must function well enough to support to specific activity that the individual is performing more over different activity make different demands upon the organism with respect to circulatory, respiratory, metabolic and neurologic process which are specific to the activity **(Ajmer Singh, 2005)**.

In physiology, one learn how the organs, systems, tissues, cells and molecules within cells work and how their functions are put together to maintain the internal environment. Physiology is the science dealing with the study of human body functions. Exercise physiology is the study of how body's structures and functions are changed as a result of exercise. It applies the concept of exercise physiology to training the athlete and enhancing the athlete's sports performance **(Ajmer Singh, 2005)**.

1.7.1 IMPORTANCE OF PHYSIOLOGICAL VARIABLES

Understanding the importance of physiology in physical education is to study the training effects, to study the ways and means by which the athletes can improve their performance and the principle of training methods. Sports consist of preparation and performance about 99% preparations and 1% performance. We need to make the most, effective use of our preparation time so that our athletes can achieve high level performance. For that the physiological systems should be taken care very much for the adaptation to their particular activities as because function decides structure. The system will change or adapt according to the nature of the activity. Therefore to know this fact among the players is very important for the improvement of performance.

Because the level of fitness of physiological system may vary from players to player according to conditional status of the proper functioning of physiological system is needed to achieve in sports.

One of the main morphological differences between men and women is the greater amount of fat that women carry; this softens the outline of the muscles, more or less erases the osseous indicators, and rounds out the surfaces while creating characteristic folds and grooves. Fat in normal women represents between 18% and 20% of body weight, whereas in men it represents only 10% to 15%. The reason for this difference is that women at some point in their lives may nourish a fetus and then a baby from their own reserves, so women have to stock energy in the form of fat in anticipation of future pregnancies (and must stock even more energy during the last two trimesters of pregnancy).

For various reasons, different fat distributions occur in women according to climate. In hot countries, the fat is localized on the buttocks (black Africans), on the hips (Mediterraneans), and around the navel (certain Asians). This distribution avoids covering the woman with a hot coat of fat that would be difficult to bear and inefficient for thermoregulation during hot periods. In cold countries, the distribution of fat is more uniform, which provides for better protection during rigorous winters. However the fat is distributed, its main function is for the survival of the species as it provides for survival of the woman and her offspring during times of scarcity. It is important to note that all healthy people have fat reserves necessary for the proper functioning of their bodies. Obsession with obesity or the need to follow deviant aesthetic fashions should not lead to the complete elimination of fat. In fact, the almost complete

disappearance of fat can lead to serious hormonal problems involving the cessation of the period (amenorrhea, which is a temporary absence of ovulation and therefore momentary sterility), as this means has been put in place during evolution to avoid bringing progeny into the world that the female could not nourish with her own organic reserves.

Thus, it was found that physiological variables plays vital role in limiting the functions of physiological system and in this research, whether, physical exercises or suryanamaskar influence physiological variables, VO_2 max, vital capacity, Resting Pulse Rate and blood pressure can be favourably altered was studied.

1.8 BIOCHEMICAL VARIABLES

Biochemistry is the study of the chemical processes in living organisms. It deals with the structure and function of cellular components such as proteins, carbohydrates, lipids, nucleic acids and other biomolecules.

Exercises produces biochemical changes in the cardiorespiratory system and other important alterations in body composition such as proteins, carbohydrates, lipids and triglyceride levels **(Fox and Mathews, 1981)**.

The investigator is to find out the influence of physical exercise and suryanamaskar on biochemical variables, selected variables, triglyceride, total cholesterol, high density lipoprotein and low density lipoprotein for this study.

1.9 REASON FOR SELECTION OF TOPIC AND VARIABLES

Not everyone benefits equally from exercise. There is tremendous variation in individual response to training; where most people will see a moderate increase in endurance from aerobic exercise, some individuals will as

much as double their oxygen uptake, while others can never augment endurance. However, muscle hypertrophy from resistance training is primarily determined by diet and testosterone. This genetic variation in improvement from training is one of the key physiological differences between elite athletes and the larger population. Studies have shown that exercising in middle age leads to better physical ability later in life.

Physical exercise helps a man to possess a high degree of physical conditions. In school there is compulsory activities programme for all girls and boys. So it would be interesting to find out which of the components have better physical fitness.

Physical, physiological and psychological factors play a dominant role in addition to the motor fitness for the best sports performance. Each sports required a predominant motor fitness, psychological and physiological quality which helps to win competitions. Though a number of studies have been under taken on motor fitness, psychological and physiological factors, no attempt has been made to find out the effects of physical exercise and suryanamaskar on selected health related physical fitness, physiological and biochemical variables among college women students. Further it is found from the previous researches that suryanamaskar and physical exercises can improve physical, physiological and biochemical qualities of individuals, which are needed for the specific activity, keeping the above facts in mind the investigator has chosen this study.

The investigator selected health related fitness variables, cardiorespiratory endurance, muscular endurance and muscular strength; flexibility and body composition; physiological variables, forced vital capacity,

VO_2 max, mean arterial blood pressure and resting pulse rate and biochemical variables, triglycerides, total cholesterol, high density lipoprotein and low density lipoprotein. All these variables should improve through physical exercises and suryanamaskar keeping the above facts in mind the investigator chosen these variables for this study.

1.10 OBJECTIVE OF THE STUDY

Researches show that the physical exercises significantly improve health related physical fitness, physiological and biochemical variables. There are researches to show that health conditions are improved due to suryanamaskar.

The objective of this study was to compare the effect of physical exercises and suryanamaskar on selected health related physical fitness, physiological variables and biochemical variables among college women students.

1.11 STATEMENT OF THE PROBLEM

The purpose of the study was to find out the effects of physical exercises and suryanamaskar practices on selected health related physical fitness, physiological and biochemical variables among college women students.

1.12 HYPOTHESES

To aid the findings of this study, the following hypotheses were formulated:

1. It was hypothesized that physical exercises and suryanamaskar practices would significantly increase selected health related physical fitness variables, cardiorespiratory endurance, muscular strength, muscular endurance, flexibility and body composition comparing to and control group.

2. It was hypothesized that physical exercises and suryanamaskar practices would significantly alter physiological variables, forced vital capacity, VO_2 max, mean arterial blood pressure and resting pulse rate comparing to and control group.
3. It was hypothesized that physical exercises and suryanamaskar practices would significantly alter biochemical variables, triglycerides, total cholesterol, HDL and LDL comparing to and control group.
4. It was hypothesized that comparing between suryanamaskar and physical exercises there would be no significant differences in selected health related physical fitness, physiological and biochemical variables. .

1.13 SIGNIFICANCE OF THE STUDY

In recent years physical educationists, sports psychologists and sports scientists have started realizing the importance of introducing yoga in the center of learning. The significance of study based on the fact that yoga can be valuable tool to improve the health related physical fitness, physiological and biochemical capacities. The significances of the study are:

1. The findings of the study would be a reliable source to the physical education teachers and coaches to include the suryanamaskar as a part of their training while designing the training schedule for their students.
2. The results of the study would enhance the awareness of physical exercises and suryanamaskar practices among the college women students, as these training methods provide more benefits increasing their health related physical fitness.

3. The study will reveal the extent to which the physical exercises and suryanamaskar practices will help to improve the selected physiological variables.
4. The findings of the study may help the individuals to compare and contrast the changes that occur in selected health related physical fitness, physiological and biochemical variables before and after the specific training programmes.

1.14 DELIMITATION

The study was delimited to the following:

1. This study was restricted to the college women students studying in Arul Anandar Colleges, Karumathur, Madurai.
2. The age group of the students were between 19 to 23 years.
3. This study was restricted to 20 college women under each group
4. The study was restricted to the following dependent and independent variables:

Dependent Variables

Health Related Physical Fitness Variables

1. Cardiorespiratory Endurance
2. Muscular Endurance
3. Muscular Strength
4. Flexibility
5. Body Composition

Physiological Variables

1. VO_2 Max
2. Mean Arterial Blood Pressure
3. Resting Pulse Rate.
4. Forced Vital Capacity

Biochemical Variables

1. Triglycerides
2. Total Cholesterol
3. High Density Lipoprotein
4. Low Density Lipoprotein

Independent Variables

1. Twelve weeks of Physical exercises
2. Twelve weeks of suryanamaskar practices

1.15 LIMITATIONS

This study will be limited in the following aspects and these limitations have to be taken into consideration.

1. Socio-economic and cultural status of the subjects will not be taken into consideration.
2. Factors like nutrients, heredity, environment, life style habits and the students programme outside the college will not be taken into consideration.
3. The height and weight of the subjects will not be taken into consideration.

1.16 DEFINITION OF THE TERMS

1.16.1 YOGA

Yoga is a way of life which can be practiced by any human being regardless of age and condition of health. Yoga is a gaining process of control over the mind, thereby improving the physiological and psychological behaviour of an individual **(Sharman, 1984)**.

1.16.2 SURYANAMASKAR

Suryanamaskar is a special sequence of yoga postures and chants that together comprise the traditional Sun Salutation **(TheresaAnn, 2002)**.

1.16.3 ASANA

Asana means holding the body in a particular posture to bring stability to the body and poise to the mind. The practices of asana bring purity in tabular channels firmness to the body and vitality to the body and the mind **(Sharma, 1984)**.

1.16.4 HEALTH RELATED PHYSICAL FITNESS

Physical activity, which can have definite influences on the health and the well being of children and adolescents, as well as adults, is defined as health related fitness **(Michaud and Narring, 1996) .**

1.16.5 CARDIORESPIRATORY ENDURANCE

Cardio respiratory endurance is the ability of the body's circulatory and respiratory systems to supply fuel during sustained physical activity **(Astrand, 1977)**.

1.16.6 MUSCULAR STRENGTH

Muscular strength is the ability of the muscle to exert force during an activity. The key to making your muscles stronger is working them against resistance, whether that is from weights or gravity **(Mathews, 1981)**.

1.16.7 MUSCULAR ENDURANCE

Muscular endurance is the ability of the muscle to continue to perform without fatigue (**Mathews, 1981)**.

1.16.8 BODY COMPOSITION

Body composition refers to the relative amount of muscle, fat, bone and other vital parts of the body. A person's total body weight may not change over time. But the bathroom scale does not assess how much of that body weight is fat and how much is lean mass, body composition is important to consider for health and managing (**Palanivel, 2004)**.

1.16.9 FLEXIBILITY

Flexibility is the range of motion around a joint. Good flexibility in the joints can help prevent injuries through all stages of life **(Johnson and Nelson 1988)**.

1.16.10 PHYSIOLOGY

Physiology is the study about the function of the body **(Astrand, 1977)**.

1.16.11 RESTING PULSE RATE

The time from the end of one contraction to the end of the next contraction is a complete heart beat or pulse or cardiac cycle. The complete

cardiac cycle takes less than one second (about 0.08 sec) in a normal adult at rest and it shortened by exercise **(Eva Lurie Weinerb, 1984)**.

1.16.12 MEAN ARTERIAL PRESSURE

It is defined as the average arterial pressure during a single cardiac cycle.

As blood is pumped out of the left ventricle into the arteries, pressure is generated. The mean arterial pressure (MAP) is determined by the cardiac output, systematic vascular resistance and central venous pressure according to the following relationship, which is based upon the relationship between flow, pressure and resistance **(Edward and Mathews, 1981)**.

1.16.13 FORCED VITAL CAPACITY

The volume of air that can be moved out of the lungs after maximum inspiration is called vital capacity **(Strukic, 1981)**.

1.16.14 VO_2 MAX

VO_2 max (also maximal oxygen consumption, maximal oxygen uptake or aerobic capacity) is the maximum capacity of an individual's body to transport and utilize oxygen during incremental exercise, which reflects the physical fitness of the individual. The name is derived from V - volume per time, O_2 - oxygen, max – maximum **(Strukic, 1981)**.

1.16.15 HIGH DENSITY LIPOPROTEIN (HDL)

High Density Lipoprotein, a type of protein molecule carried in the blood that removes cholesterol from tissues and appears to protect against coronary heart disease. Reduces the development of atheroma and atherosclerosis.

High Density Lipoprotein was estimated by phophotungstate method and is expressed as mg/dl **(Harvey Richard A, 2011)**.

1.16.16 LOW DENSITY LIPOPROTEIN (LDL)

Low Density Lipoprotein Cholesterol is the major cholesterol carrying lipoprotein. Elevated LDL levels herald a strong predisposition to coronary heart disease, stroke and peripheral vascular disease. LDL was calculated using Priedwalad's equation and expressed as mg/dl **(Harvey Richard A, 2011)**.

1.16.17 TRIGLYCERIDES (TG)

Triglycerides are composed of the three carbon molecule glycerol and three fatty acids, one attached to each of the glycerol carbons. Triglycerides make up 95% of the fats found in foods. TG were estimated by enzymatic calorimetric method and expressed as mg/dl **(Harvey Richard A, 2011)**.

1.16.18 CHOLESTEROL (TC)

Cholesterol is the fatty substance formed in the blood. Cholesterol is a white fatty alcohol of steroid group, found in body tissue, blood and bile, assists in synthesis of vitamin D and various hormones. Excessive deposits of cholesterol inside arteries are associated with arteriosclerons and coronary heart disease. TC was estimated using erymatic calorismetric method and expressed as mg/dl **(Harvey Richard A, 2011)**.