CHAPTER-I

INTRODUCTION

“Money is the most envied, but least enjoyed. Health is the most enjoyed but the least envied.”

Physical fitness should be an important part of all people’s life no matter what age or gender. A healthy life style is something that will not only help us to live longer but will help the years we live to be more enjoyable. Everyone needs good nutrition and physical activity to give their bodies the best possible chance of health and longevity. Exercise is an essential component of fitness during which endorphins are released which helps teens deal with stress. Thus, being fit can be a way for teens to let off stress. Physical activity is a healthy outlet for problems like anger and stress that tend to plague teenagers during the difficult transition into adulthood. (Avraham ben Yaakov, 2010)

Recent studies reported by the National Institute of Health show that exercise by children and teens can result in larger and stronger bones, even if they stop exercising. Most people consider themselves to be healthy as long as they are not sick. However, there is a difference between being healthy and simply not being sick. Being healthy and fit means that your body is well maintained. However, it is especially important for teens, since if teens develop good habits in their youth, they may continue those habits throughout the course of their entire life span lives, ultimately becoming healthier, fitter adults. The reason fitness is important for a teenager is that all the benefits associated with exercise and healthy eating could be practiced early and could be followed for the rest of their lives.

Elimination of waste is essential for a healthy living. There are many ways for the elimination of waste matter produced in the body such as by daily physical
activities and functioning of the digestive system through eyes, ears, mouth, nose, anus, genitals and skin. Most of the diseases are the result of the absence of sufficient and regular elimination of waste matter such as urine and stool from the body. Asanas help the process of elimination of waste matter from the body and keep the body in perfect sound health. Asanas are the means for people of any age not only to get and stay in shape but also to develop balance, coordination, and a sense of centeredness. It renews, invigorates, and heals the body, stretching and toning the muscles, joints, and spine and directing blood and oxygen to the internal organs including the glands and nerves. (Krishna Raman, 1998)

Resistance training improves the functional performance of the neuromuscular system, the system of muscles and nerve pathways that directs and controls movement. Resistance training produces increased strength, superior movement performance and general fitness, including enhanced function of the respiratory, cardiac and metabolic systems. Other improvements include an increase in muscle mass, strengthening of connective tissue and supportive tissue as well as improvements in posture and physique.

Regular aerobic training improves the efficiency of respiratory system. The respiratory pathways and area for exchange of gases are constantly used and increased blood flow is present in these areas. This improves efficiency of the respiratory system. Aerobic exercise is perfect for teens who are independent and like variety. The American Heart Association suggests that teens raise their heart rates for twenty minutes without stopping, three or more times a week. Teens should be reassured that aerobic exercise, when done correctly, should not resemble running timed laps in fitness class. Exercise should never hurt, although a little muscle soreness can be expected, especially in the initial weeks of a workout program.
Father of our nation ‘Mahatma Gandhi’ says “It is health that is real wealth and not pieces of gold and silver.” In this competitive world, many people find it hard to dedicate time for physical activities and exercises, although one of their first priorities is to stay in perfect shape. Men are burdened with lot of responsibilities. They have to play versatile roles in life as a family leader, an official leader, a societal member and so on. Though they do consider most of it as duty, the scarce resources and optimum developments have made man run a rat’s race in search of wealth. The search of wealth has lead to a path of search for health. The increased pandemic disease and changes in life style on the other hand has made most of the men pregnant. The formation of “Belly” which I have mentioned here as pregnancy. Unlike female pregnancy which lasts for few months. Men have bellies permanently are more fascinated about doing resistance training. They feel that body build and strength are the determinants of masculinity.

1.1 INNOVATIONS OF THE STUDY

A. J. Reb Materi says “Many people spend their health for gaining wealth and then have to spend their wealth to regain their health”. It’s true especially in Indian scenario, the condition of male adults are even worse. Day and night they run in search of money for the sake of their family’s well being. In such a busy life style it is rarely possible to allocate time for fitness. Even if they provide space in their schedule they blindly prefer to do resistance training.

The aim of this study is to provide two various training programs in combination with the men favorite resistance training to sensitize male population about the other physical activities which may contribute for their fitness avoiding monotony of activity thereby helping them to find peace and immunity, improved abilities and processing efficiency with their abilities and skills.
That became the inspiration for the researcher to choose this topic which will contribute for the better living of the male population.

1.2 INDEPENDENT VARIABLES

The independent variables chosen for this noble cause are Yoga, Aerobics and Resistance training. Keeping resistance training as a constant, aerobics and yoga are combined with it to try out a new, innovative and a really interesting package. One group will perform yoga and resistance training on alternate days, same way the second group will perform Aerobics and resistance training and the other group will do all the three as twice a week one after the other.

1.2.1 Resistance Training

Mark Twain’s expression "It's not the size of the dog in the fight but the size of the fight in the dog" well explains the importance of strength for every individual to coup up with this competitive world. Resistance training is an important tool for achieving a complete healthy life. Resistance training is not just for athletes, who want to build and tone the muscles, or are using resistance training to achieve a better-looking body. According to the American Sports Medicine Institute (ASMI), resistance training is a “specialized method of conditioning designed to increase muscle strength, muscle endurance and muscle power”. Resistance training can be performed in a variety of ways; with resistance machines, free-weights (dumbbells and barbells), rubber tubing, or own body weight, as in doing pushups, squats, or abdominal crunches.

1.2.2 Benefits of Resistance Training

As the goal of resistance training, the ASMI says, is to “gradually and progressively overload the musculoskeletal system so it gets stronger”. Regular resistance training will strengthen the bones and the muscles. According to Keith Cinea, any fitness programme should include resistance training, along with
aerobic exercise and flexibility training. Aerobic workouts, which strengthen the cardiovascular system, focus primarily on the large muscle groups of the lower body. Strength training offers a way of balancing that by challenging all the major muscle groups, including those in the chest, arms, back and abdomen. According to medical research, generally the resistance training strengthens the muscular system, strengthens the skeletal system, improves the bone density (decreases the chance of osteoporosis) and increases metabolism. So a well-planned resistance training program should be a part of everyone’s health, fitness and lifestyle regardless of age, gender or goals.

In particular, resistance training improves the functional performance of the neuromuscular system, the system of muscles and nerve pathways that directs and controls movement. Resistance training produces increased strength, superior movement performance and general fitness, including enhanced function of the respiratory, cardiac and metabolic systems. Other improvements include an increase in muscle mass, strengthening of connective tissue and supportive tissue as well as improvements in posture and physique.

1.2.3 Strength Adaptations to Resistance Training

The increases in muscular strength during the initial periods of a resistance training program are not associated with changes in cross-sectional area of the muscle Sale, (1988). Changes in strength evidenced in the first few weeks of resistance training are more associated with neural adaptations, Moritani & deVries, (1979), which encompass the development of more efficient neural pathways along the route to the muscle. The motor unit (motor nerve fiber and the muscle fibers it innervates) recruitment is central to the early (2 to 8 weeks) gains in strength. Collectively, the learned recruitment of additional motor units, which may respond in a synchronous (the coincident timing of impulses from 2 or more motor units) fashion (Wilmore & Costill, 1994), the increased activation of synergistic muscles, and the inhibition of neural protective mechanisms
(Kraemer, 1994), all contribute to enhance the muscle's ability to generate more force. It is possible that two adjacent muscle fibers, with different motor nerves, could result in one fiber being activated to generate force while the other moves passively.

Long-term changes in strength are more likely attributed to hypertrophy of the muscle fibers or muscle group, (Sale, 1988). The range of increase of strength is quite variable to the individual and may range from 7% to 45% (Kraemer, 1994). It should be noted that strength results appear to be velocity specific. Velocity specificity best characterizes the probability that the greatest increases in strength occur at or near the velocity of the training exercise (Behm & Sale, 1993). Although several researchers often select untrained subjects, the failure to plan and control for a learning effect (subject improves because they learn the correct performance of the muscle action) may result in erroneous conclusions from the study.

1.2.4 Heart Rate Adaptations of Resistance Training

Heart rate is acutely elevated immediately following a workout and affected by the amount of resistance, the number of repetitions and the muscle mass involved in the contraction (small vs. large mass exercises) (Fleck, 1988). Interestingly, in terms of chronic adaptations, there appears to be a reduction in heart rate from resistance training, which is considered beneficial (Stone et al., 1991). Long term adaptations observed in the research, from no change up to a 11% decrease in heart rate, may be explained by the differences in intensity, volume, rest between sets, use of small vs. large muscle mass, duration of study and fitness level of the subjects.
1.2.5 Blood Pressure Adaptations to Resistance Training

Conservative estimates postulate that 50 million Americans, approximately 1 in 4 adults, have high blood pressure. More than 90% of these cases are identified as primary hypertension, which increases the risk of heart failure, kidney disease, stroke, and myocardial infarction Tipton, (1984). During a resistance exercise bout, systolic and diastolic blood pressures may show dramatic increases, which suggest that caution should be observed in persons with cardiovascular disease Stone et al., (1991), or known risk factors. The extent of the increase in blood pressure is dependent on the time the contraction is held, the intensity of the contraction, and the amount of muscle mass involved in the contraction Fleck, (1988). More dynamic forms of resistance training, such as circuit training, that involve moderate resistance and high repetitions with short rests are associated with reductions in blood pressure. Studies have shown decreases in diastolic blood pressure Harris & Holly, (1987), The same was supported Blumenthal, Siegel, & Appelbaum, (1991). The effects of resistance training on blood pressure are varied largely due to differences in study design, which suggests that more research is necessary to clearly understand the role of resistance training in blood pressure management.

1.2.6 Lipid Adaptations to Resistance Training

Epidemiological research has decisively demonstrated that low concentrations of total cholesterol and low-density lipoprotein cholesterol (LDL-C) and high levels of high-density lipoprotein cholesterol (HDL-C) are associated with a decrease in coronary heart disease, (Kannel, 1983). Lower concentrations of blood triglycerides and LDL-C, along with higher levels of HDL-C have been observed with endurance-trained individuals. Several investigators have reported favorable changes in blood lipids and lipoproteins following a strength training intervention Kokkinos & Hurley (1990). However, Kokkinos and Hurley add that
the lack of control in body composition, day-to-day variations in lipoproteins, dietary factors, and distinction of acute vs. chronic adaptations needs to be thoroughly addressed in future strength training research, to provide a more credible summary of the effect of resistance training on blood lipids and lipoproteins. In addition, more research is needed to determine if there is an optimal resistance training format that positively affects lipoprotein-lipid profiles.

1.2.7 Glucose Metabolism Adaptations to Resistance Training

An important risk factor for cardiovascular disease and diabetes is glucose tolerance. High blood glucose and high insulin levels can also have a deleterious effect on hypertension and blood lipids Hurley (1994). Initially, improvements in glucose metabolism were associated with decreases in percent body fat and increases in aerobic capacity, thus suggesting that aerobic exercise would provide the better catalyst for improvements in glucose metabolism. However, improvements in glucose metabolism with strength training, independent of alterations in aerobic capacity or percent body fat, have been shown Hurley et al., (1988). Interestingly, Smutok et al., (1993) concluded that strength training and aerobic training improved glucose tolerance and reduced insulin responses to oral glucose (in men) similarly.

The strength training program consisted of three sets (90- 120 second rests between sets) of exercise, using loads that could be lifted 10 - 12 times (per set) for 24 different exercises as 8 exercises for four weeks each. Exercises included squats, leg extensions, leg curls, decline presses, pullovers, arm cross-over, overhead presses, lateral raises, rows, hip and back exercises, peck-deck, arm curls and modified sit-ups. Additionally, it has been shown that body builders, who traditionally employ a high volume style of training, favorably alter glucose tolerance and insulin sensitivity Stone et al., (1991)
1.3 AEROBIC TRAINING

“Endurance is one of the most difficult disciplines, but it is to the one who endures that the final victory comes.” These are the beautiful verses of Buddha which signifies not only mental but also physical endurance. Here comes the easy method of maintaining a perfect figure and gain endurance - aerobics. As the name suggests, Aerobics is an exercise that combines the rhythmic steps of aerobics with graceful dance movements. It can be broadly divided into four types - high-impact exercises, low-impact exercises, step aerobics and water aerobics. High impact exercises involve intense jumping actions that are synchronized with the rhythmic beats of the music being played.

The word aerobic means "with oxygen" but aerobics usually refers to any kind of activity that gets heart pumping and muscles using oxygen. Aerobic dancing involves any kind of exercise put to music and can include everything from country music line dance aerobics to hip-hop dancing. It's recommended that kids and teens get at least 20 minutes of good aerobic exercise three times a week, so aerobic dancing can be a fun way to stay in shape.

Aerobic exercise is any activity that can be practiced continuously over a longer period. It is a type of exercise that works the body at the lower end of the target heart rate zone, causing the heart and lungs to adapt by becoming stronger. The step test is a sub maximal test for estimating aerobic fitness. It is commonly used in studies involving large numbers of people, like the cardiac fitness. When the body is challenged with a bout of physical exertion, like stepping up and down, the heart rate increases to deliver oxygen to the working muscles. The efficiency with which the muscles perform the challenge is reflected in the increase in heart rate. The body adapts to regular physical activity by becoming more efficient. A lower heart rate at the end of the 3-minute step test indicates greater aerobic fitness.
(i.e., more fit). Higher fitness levels are indicative of an active lifestyle, which is what the people strive for.

1.3.1 The Effects of Aerobic Exercise

There are numerous performance benefits by doing regular aerobic training. The training increases storage of energy molecules such as fats and carbohydrates within the muscles, allowing for increased endurance. Neuro-vascularization of the muscle sarcomeres to increase blood flow through the muscles is also developed by training, increasing speed at which aerobic metabolism is activated within muscles, allowing a greater portion of energy for intense exercise to be generated aerobically, improving the ability of muscles to use fats during exercise, preserving intramuscular glycogen. The aerobic training enhancing the speed at which muscles recover from high intensity exercise.

Aerobic training increases the aerobic capacity of an individual. Aerobic capacity describes the functional status of the cardio respiratory system including the heart, lungs & blood vessels. Aerobic capacity is defined as the maximum volume of oxygen consumed by one’s muscle during exercise. Bouchard (2009). It is a function both of ones cardio respiratory performance and of the ability of the muscles to extract the oxygen and fuel delivered to them. Higher aerobic capacity means higher the level of aerobic fitness.

Regular aerobic training improves the efficiency of the complete respiratory system. The respiratory pathways and the area for exchange of gases are constantly used and increased blood flow is present in these areas. This improves the efficiency of the respiratory system.

Important factors that are necessary for exchange of gases are increased surface area of the alveoli and a reduced thickness of the membrane of the alveoli. Regular exercise causes continuous movement of air in and out of the lungs in
large volumes and as a result the elasticity and surface tension of alveoli are greatly increased. This helps in faster exchange of oxygen and carbon-dioxide across the membrane of the alveoli Laurence (1967).

During heavy aerobic exercise with the increased active movement of the respiratory muscles the oxygen consumption of the ventilatory muscles increases to about eight to ten percent of the total oxygen consumption of the body. This increase in oxygen cost of the respiratory muscles is sufficient to meet the demands of strenuous exercises.

1.3.2 Combined Aerobic and Resistance Training

Resistance training provides numerous and important health benefits through multiple mechanisms that may reduce the risks of diabetes, heart disease, possibly cancer and disabilities. There is much more extensive and long-standing evidence, however, about the benefits of aerobic training on cardiovascular fitness and disease risk reduction, particularly for reducing the risks of heart disease and for premature death from heart disease. A resistance training protocol for hypertrophy would try to increase protein synthesis and also stress the primarily interested need in resistance training. The tricky issue is how to incorporate aerobic training into an overall programme without undermining strength development or hypertrophy (gaining muscle mass). Docherty and Sporer (2000) have recently attempted in an extensive review article to advance the science by postulating specific physiological mechanisms affected by different training protocols that can predict when there will and will not be interference between aerobic and resistance training. They noted that aerobic training increases maximum oxygen consumption and hence the body's ability to transport and use oxygen is dependent upon both a central component involving adaptations in the cardiopulmonary system and a peripheral component involving adaptations in muscle tissues. Central and peripheral adaptations are, in turn, dependent upon
different mechanisms. It does appear that higher the intensity of the stimulus used to increase maximum oxygen consumption (e.g., high intensity interval training), the greater the increase in oxygen consumption. However, the location of the adaptation to aerobic training may shift depending upon the intensity of the stimulus. At lower levels of intensity, it appears that most of the adaptations occur centrally.

With higher intensity training, more adaptations occur peripherally. The previous research suggests that training between 70% and 80% of VO$_2$max (70% to 80% of heart rate reserve; about 80% to 85% of maximum heart rate; just slightly below the anaerobic threshold) results in maximal contractile force in the heart and thus maximizes central adaptations important for health benefits. These findings are critical and suggest how concurrent training can be optimized. Aerobic training favourably influences health through central adaptations and there may be no reason to train at levels that will result in more peripheral adaptations. The ability to perform at higher levels does require training at high levels of intensity and specific peripheral adaptations, but such performance levels are not the goal of most people. Aerobic training at very high intensities, through its effects on mechanisms associated with peripheral adaptations, may be the cause of blunting of strength gains and hypertrophy when aerobic training is done along with resistance training.

Docherty and Sporer (2000) discussed the mechanisms that appear involved in increasing strength and hypertrophy. The basic theory holds that high intensity aerobic training such as interval training affects specific mechanisms in peripheral adaptations those involved anaerobic energy system.

1.3.3 Need for Combining Aerobic & Resistance Training

Different types of exercises provide different benefits to the body. To develop all-round fitness and health, combining both aerobic and resistance
training into the weekly routine may produce changes. This can be done in a couple of ways: either perform aerobic work and resistance training on separate days or combine them in the same workout.

1.3.4 The Benefits of Combining Aerobic and Resistance Training

According to the American College of Sports Medicine (2009) (ACSM), Improved cardiovascular health, lower blood pressure and reduced risk of suffering from coronary heart disease are proved; whereas resistance training improves the tone and strength of the muscles and also increase the bone mass, which is important for reducing risk of developing osteoporosis. To get the most out of aerobic exercise, according to the ACSM (2009), perform at least three 20-minute workouts per week where the heart rate is elevated to between 60 and 90 percent of maximum. This prescription improves aerobic fitness and health. Résistance training, sometimes called strength or weight training, doesn't necessarily mean bodybuilding or weightlifting. Both bodybuilding and weightlifting are sports, whereas resistance training is done not for competition but for the benefits associated with working out with weights. To get the most from resistance training, you should lift weights two to three times a week ensuring all of your muscles receive equal attention.

1.3.5 Combining Aerobic and Resistance Training

To develop all-round fitness and health, both aerobic and resistance training can be included in the weekly schedule. This can be done in a number of ways, depending on how many days a week are available for working out, and also based on personal preferences. So by doing three aerobic and two to three resistance workouts a week, one can enjoy the benefits of both of these types of exercise. The advantage of combining aerobic and resistance training into the same workout is that one will be able to exercise less often; however, because of time limitations we have to compromise with how much work can be performed for each exercise.
component. According to the National Association of Strength and Conditioning (2008), it does not matter whether resistance training is done before aerobic workout or the other way round. Authors Steven Fleck and William Kraemer in their book "Designing Resistance Training Programs" suggest that performing aerobic work after cardio may slightly improve the ability to work out with weights as will be less fatigued.

1.3.6 Aerobic and Resistance Training in Separate Workouts

To make significant improvements in either aerobic or muscular fitness, one can perform aerobic and resistance training on separate days, says Steven Fleck and William Kraemer (2003). This will allow dedicating more time to each exercise component, which will lead to a higher level of fitness. Splitting aerobic and resistance training will, however, require more frequent workouts, which may be disadvantageous if you're short on time. Trying to alternate aerobic and resistance training on a day-by-day basis, it is better to include at least one rest day per week where no exercise is done; otherwise, it’ll lead to overly fatigued.

1.4 YOGA

B.K.S. Iyengar says ‘Yoga is a light, which once lit, will never dim. The better your practice, the brighter the flame’. The younger, the old, the extremely aged, even the sick and the infirm obtain perfection in yoga by constant practice. Success in yoga is not obtained by more theoretical study or talking about it or reading the sacred texts. Constant practice alone is the secret of its success”

For a long time, yoga was considered to be a women’s thing. While women signed up for yoga classes all over the world, men still pumped iron and lifted weights to grow more muscular. While all gyms offer some workout routine for men, it is yoga that not only helps in toning body and making you flexible but also helps in building endurance and maintaining good health. Men, especially those
who indulge in competitive sports, can benefit greatly from yoga. The particular areas of their bodies where men are especially stiff, when injured, causes a lot of discomfort. The stiffness greatly reduces the chances of healing of the injured areas of the body.

(Raphaelhage, 2009) Yoga poses for men who have the potential to give a full body workout. These make the stiff portions of the body, like the shoulders and the hips, a little more flexible. These exercises also work upon the often neglected parts of the body like the knees and the lower back. There are not only many yoga exercises for men but also many yoga benefits for men. Kevin Pederson (2011) says that Yoga helps men perform chosen competitive sports better. All sports have their own vocabulary and you may find it tough.

Meaning

The word yoga is derived from the Sanskrit root ‘yuj’ meaning to bind, join, attach and yoke, to direct and concentrate one’s attention on, to use and apply. It also means union or communion. Yoga was collated, co-ordinate and systematized by patanjali in his classical work, the yoga sutras, which consists of 185 terse aphorisms. Iyengar B K S, (2008) Hatha Yoga Pradipika

1.4.1 History of Yoga

The origin of yoga is shrouded in the mists of time-for yoga is regarded as a divine science of life, revealed to enlighten sages in meditation. The oldest archaeological evidence of its existence is provided by a number of stone seals showing figures in yogic postures, excavated from the Indus Valley from around 3000BC. Yoga is first mentioned in the vast collection of scriptures called the vedas, portions of which date back to 2500 BC, but it is the upanishads, which form the later part of the vedas, that provide the main foundation of yoga teaching. Around the sixth century BC appeared two massive epics. The Ramayana, written
by Valmiki and the Mahabharata, written by Vyasa and containing the Bhagavad Gita, perhaps the best known of all yogic scriptures. The backbone of Raja yoga is furnished by patanjalis yoga sutras though to have been written in the third century BC. The classical text on Hatha yoga is the Hatha yoga pradipika, which describes the various asanas and breathing exercises which form the basis of the modern practice of yoga. *Lucylidell (1983).*

Yoga is not a religion. It is a philosophy of life based on certain psychological facts, and its aim is to develop a perfect balance between the body and the mind that permits union with the divine. It is a perfect harmony between the individual and the cosmos. All the sacred writings of India (the Vedas, the Upanishads, the Puranas and the Tantras) are full of exploits by men and women of all castes, creeds and religions; people from all walks of life that arrived at the highest degree of knowledge through the discipline of yoga-while carrying on their various occupations. *Sri Ananda, (2006).*

### 1.4.2 The Stages of Yoga

Patanjali enumerated the eight limbs or stages of yoga for the quest of the soul. They are

1. Yama (Universal moral commandments)
2. Niyama (Self purification by discipline)
3. Asana (Posture)
4. Pranayama (Rhythmic control of breath)
5. Prathyahana (Withdrawal of the mind form the senses and exterior objects)
6. Dharana (Concentration)
7. Dhyana (Meditation)
8. Samadhi (A state of super-consciousness)

*Iyengar B K S, (2008).*
Ancient books on Yoga, such as Yoga Shastra, Hatha-Yoga Pradipika and Yoga sutra by Patanjali state that the ‘Yama’ (mental discipline) and the ‘Niyama’ (mental purification) should be practiced first and only then followed by the ‘Asanas’ and ‘Pranayama’. Ahimsa (non-violence), Satya (truth), Asteya (non-stealing), Brahmacharya (chastity) and Aparigraha (non-covetousness) are yama, i.e., rules of good conduct for society and the individual. Saucha (Purity of body and mind), Santosa (contentment), Tapas (self-discipline and austerity), Svadhyaya (study of scriptures) and Ishwara Pranidhana (contemplation) are the Niyama. i.e., rules of self-purification related to personal discipline. *Sri Ananda*, (2006).

According to *Tiwari O.P*, (1984) regular practice of ‘Asanas’ give strength, ‘Mudras’ give rise to steadiness, ‘Shatkriyas’ helps in purification and ‘Pranayama’ develop lightness. These practices ensure nourishment to tissues through their beneficial influence on various systems of the body and thus help in preserving and promoting mental and physical health.

Yogasanas are not only to develop muscles and the body but also mainly to regulate the proper activities of all the internal organs and glands to affect the nervous system which in turn controls the over well being of muscles to a greater degree than we actually suppose. *Indira Devi*, (1969).

Yoga is a positive way of maintaining physical ‘up keep’ mental alertness and spiritual attainment. It teaches us how to control one’s senses resulting in an integrated personality, freedom, stress, and conflict. It stabilizes one behavioral pattern, developed will power and ultimately helps one to lead healthy, happy and balanced life. *Swami Githananda and Meenakshi Bhavan*, (1989).
1.4.3 Asana or Posture

The third limb of yoga is asana or posture. 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. Asanas have been evolved over the centuries so as to exercise every muscle, nerve and gland in the body. They reduce fatigue and soothe the nerves. But their real importance lies in the way they train and discipline the mind. *Iyengar BKS, (2008).*

Asanas are postures or postural patterns. In Hatha yoga there are number of asanas which may be classified into three main groups as follows *Swami Sathyanandha Saraswathi, (1973).* Any physical activity or even sitting in a meditational posture for a long duration disturbs the tonic equilibrium between antagonistic muscles. This disturbs the proprioceptive component of awareness. Through relaxation postures such as Savasana and Makrasana one can recognise the tensions and release them by gross movement or subtle adjustments till one develops a uniform proprioceptive awareness of the whole body with lightness and a kind of openness from with outwards. Technically it is useful for removal of ‘tug of war’ type of conflicts at the level of muscles.

After relaxation of skeletal muscles, one is expected to switch over to experimenting of the breathing movements and to proceed from experiencing of breathing movements, and to proceed from experiencing of gross movement experienced in the extremities right up to the tips of the toes and fingers.

*Swami Kuvalayananda (1933).* The aim of cultural asanas is to produce physiological balance in the different systems working in the human body. So that, it can produce the best organic vigor. The other aim is training the spinal cord and the digestive system to work elastic. Asanas like bhujangasana, shalabhasana, dhanurasana, yoga mudra, paschimotanasana and halasana are the best to give
efficient exercise to abdominal muscles. Asanas are simple actions for keeping the internal and external body in good health. Asanas give sufficient exercise to the internal organs of the body. Consequently, an individual can maintain good health and longevity of life.

1.4.4 Hints and Cautions for the Practice of Asanas

The requisites

The qualities demanded from the aspirant are discipline, faith, tenacity and perseverance to practice regularly without interruptions.

Cleanliness

Before starting to practice asanas, the bladder should be emptied and the bowels evacuated.

Bath

After doing asanas, it is desirable to take bath some 15 minutes later. Taking a bath or a shower both before and after practicing asanas refreshes body and mind.

Food

Asanas should be preferably done on an empty stomach. If this is difficult, a cup of milk may be taken before doing them. Food may be taken half an hour after completing the asanas.

Time

The best time to practice is either early in the morning or late in the evening.
**Sun**

Do not practice asanas after being out in the hot sun for several hours.

**Place**

Asanas should be done in a clean airy place, free from insects and noise. Do not practice asanas on the bare floor or on an uneven place, but on a folded blanket laid on a level floor.

**Cautions**

No undue strain should be felt in the facial muscles, ears and eyes or in breathing during the practice.

**The Brain**

During the practice of asanas, it is the body alone which should be active while the brain should remain passing, watchful and alert.

**Breathing**

In all the asanas, the breathing should be done through the nostrils only and not through the mouth. *Iyengar B K S (2008).*

**1.4.5 Benefits of Asanas**

Whatever our age, yoga can enhance our lifestyle. Learning yoga develops self-discipline and can enhance their physical and mental health. Asanas are good for developing coordination and help to improve concentration and memory. Regular practice can enable young people to keep their natural flexibility for many years. It can help teenagers to keep their youthful flexibility and give them the inner strength to say no to negative influences. Older people often find that gentle
yoga exercises allow them to retain mobility and may relieve problems such as arthritis and poor circulation.

Yogic asana are also helpful and essential for the elimination of waste matter. There are some ways for the elimination of waste matter produced in the body by daily physical activities and functioning of the digestive system through eyes, ears, mouth, nose, anus, genitals and skin. Most of the diseases are the result of the absence of sufficient and regular elimination of waste matter such as urine and stool from the body. Asanas help the process of elimination of waste matter from the body and keep the body in perfect sound health.

Asanas provide the means for people of any age not only to get and stay in shape but also to develop balance, coordination, and a sense of centeredness. It renews, invigorates and heals the body, stretching and toning the muscles, joints and spine, and directing blood and oxygen to the internal organs including the glands and nerves. (Krishna Raman, 1998).

1.4.6 Physical Benefits of Yoga

Yoga increases flexibility, physical fitness and general health. Yoga lubricates the joints, ligaments and tendon. It maintains correct posture, strengthen the weak parts of the body and control the body weight.

1.4.7 Physiological Benefits of Yoga

Yoga increases functional ability of all systems of the body, cardiovascular efficiency, respiratory efficiency, breathe holding time, vital capacity, intake of oxygen, vision, hearing ability, neuro-muscular coordination, pain tolerance, energy level, immunity power and EEG – alpha waves. Yoga decreases pulse rate, respiratory rate, blood pressure, reaction time and EMG activity.
1.4.8 Biochemical Benefits of Yoga

Yoga increases HDL cholesterol, hemoglobin, thyroxin, total serum protein and vitamin C. Yoga decreases glucose, sodium, total cholesterol, LDL cholesterol, VLDL cholesterol and triglycerides. (Sathyanandha, 1973).

1.4.9 Benefits of Hatha Yoga

Yoga has both preventive and therapeutic benefits. It has been shown to offer both physical and mental benefits to the body and the mind. Hatha yoga improves flexibility and muscle joint mobility; strengthens tones and builds muscles; corrects posture; strengthens the spine; eases back pain; improves muscular-skeletal conditions such as bad knees, tight shoulders and neck, sway back and scoliosis; increases stamina; creates balance and grace; stimulates the glands of the endocrine system; improves digestion and elimination; increases circulation; improves heart conditions; corrects breathing disorders; boosts immune response; decreases cholesterol and blood sugar levels and encourages weight loss.

The mental benefits include: increases of body awareness; relieves chronic stress patterns in the body; refreshes the body by relieving muscle strain; relaxes the mind and body; centers attention; sharpens concentration and lightens the spirit. Western doctors and scientists are discovering additional health benefits of hatha yoga. Studies have shown that it can relieve the symptoms of several common and potentially life-threatening illnesses; such as arthritis, arteriosclerosis, chronic fatigue, diabetes, AIDS, asthma and obesity. Many believes it even fends off the ravages of old age.

1.4.10 Concept of Hatha Yoga

Traditional Hatha Yoga is a holistic yogic path, including moral disciplines, physical exercises that are asanas, pranayama and meditation. Hatha represents
opposing energies that are hot and cold (fire and water, following the same concept as the yin-yang), male and female, positive and negative. Hatha yoga attempts to balance mind and body via physical exercises or “asanas”, controlled breathing and the calming of the mind through relaxation and meditation. Asanas teach poise, balance & strength; and are practiced to improve the body’s physical health and clear the mind in preparation for meditation in the pursuit of enlightenment.

1.4.11 Yoga Combined With Resistance Training

In this study Resistance training was combined with yoga and also separately with aerobic exercise in order to break monotony of same kind of training and also to find out which works good when combined with the men favoured resistance training.

1.5 DEPENDENT VARIABLES

The dependent variables chosen in this study are from three main domains namely physical fitness variables, physiological and biochemical parameters. Physical fitness is an essential factor to be considered. In physical fitness components speed, agility, muscular strength endurance and flexibility were chosen .In physiological variables VO\(_2\) max, resting heart rate, systolic blood pressure and diastolic blood pressure were chosen. Among bio chemical variables low density lipo protein, high density lipo protein, fasting glucose and post prandial glucose were chosen.

1.5.1 Physical Fitness Variables

Speed

Speed is the ability to move the body or a part of the body as rapidly as possible from one point to another. It is the rate of movement, or the amount of
time it takes for a body or object to travel between two points. Speed is obviously extremely important in all forms of racing, but also in team and goal related sports when someone has the chance to 'runaway' from the opposition. One of the major requirements in many sport activities is speed. In sports such as sprinting, soccer, cycling, hockey, fencing, games and many other team sports, speed is a major factor determining the overall outcome. In fact, all skill-related components contribute to speed. Speed requires the expenditure of a large amount of energy in a short period. It is an important factor in almost all court and field games. It can make the difference in whether a performer is able to gain an advantage over his opponent. In games like basketball, football, hockey, and hand ball both acceleration speed and running speed are basic the need for success (Jensen and Fisher, 1979).

Performing sports skills economically with ease, correct positioning of body levers and good neuro-muscular coordination will result in efficient use of energy and a higher speed of the movement. In addition to relaxation ability, joint flexibility is an important ingredient for performing movements with high amplitude (e.g. long stride in running) which in many sports is essential to execute optimum range of movement for maximum speed. Speed is determined not only by mobility and well synchronized neuro-muscular response but also by the frequency of the precise nervous impulses and strong concentration. This is because quick, explosive movements depend on a high level of power. Willpower and strong concentration are very important factors in achieving high speed. Exercises of will must be included in the training process to achieve a high level of speed. (DeVries, 1974).

**Agility**

Agility is important in all activities that require quick changes in positions of the body and its parts. In basketball, fast starts, stops and quick changes in
direction are fundamental for good performance. Agility enables an individual to rapidly and precisely alter the position and direction of the body and is an important ingredient for successful participation in wide variety of sports. An agile person can quickly and efficiently mobilize the large muscle groups of the body in order to make rapid changes in direction of movement. Agility involves coordinating quickly and accurately the big muscles of the body in a particular activity. One’s level of agility is probably a result of both innate capacity, training and experience. It is revealed to a great extent in sports involving efficient footwork and quick changes in body position force. (Barrow and McGee, 1979).

**Muscular Strength and Endurance**

When planning an exercise programme for overall health and wellness, all health-related components of fitness should be included. This should include a programme to enhance muscular fitness (muscular strength and muscular endurance.) Unfortunately, in today’s world, with all of its modern conveniences, we can accomplish most of our daily tasks with a minimum level of effort. Thus, in general, our muscular development tends to be lower than standards required for optimal health. If we are interested in the benefits of muscular fitness, we must make a conscious effort to develop both muscular strength and muscular endurance. Although the concepts of muscular strength and muscular endurance are closely related, it is important to distinguish between the two. Muscular strength is defined as the maximum amount of force a muscle can produce in a single effort. It is generally measured by a single maximal contraction. Muscular endurance, on the other hand, is defined as the ability of a muscle to exert a sub-maximal force repeatedly over time. It is generally measured by lifting a given amount of weight as many times as possible. Depending on desired outcome, one can specify one’s training regimen to make one’s programme strength or endurance- oriented or a balance of both. Keeping in mind that these two
components are closely interrelated and there is some overlap, some improvement will be seen in each component even if the concentration is on only one.

**Flexibility**

Flexibility is the ability of an individual to move the body joints through a maximum range of motion without undue strain. It is more dependent on the soft tissues (ligaments, tendons and muscles) of a joint than on the bony structure of the joint itself. Flexibility is also related to body size, sex, age and activity. Any increase in body fat usually decreases flexibility. Women are generally more flexible than men of the same age. Active individuals tend to be more flexible than inactive individuals. Lack of flexibility can create disorders of functional problems, bad posture and limit work efficiency, etc. Physical activity with wide ranges of movements helps to reduce these problems and increase flexibility. It is measured by Sit and Reaches test method.

**1.5.2 PHYSIOLOGICAL VARIABLES**

**Maximum Oxygen Consumption (VO₂ max)**

Maximum oxygen uptake (VO₂ max) refers to the highest rate at which oxygen can be taken up and consumed by the body during intense exercises. Traditionally, the magnitude of an individual’s VO₂ max has been viewed as one of the most important predictors of endurance. The ability of the cardio respiratory system to transport oxygen to the exercising muscles refers to the central component of VO₂ max. The role of the central component is for oxygen to be transported from the atmosphere and delivered to the muscles where it is utilized during mitochondrial respiration to produce ATP. The major limitations in oxygen delivery are pulmonary diffusion, cardiac output, blood volume and flow. In aerobic work, oxygen is obtained from the air and is transferred from the lungs to the blood and then to the muscles via the circulatory system. Maximal oxygen
uptake or maximal aerobic power (VO$_2$ max) is the indicator of aerobic fitness. As VO$_2$ max increases, the level of aerobic fitness also increases which refers to individual aerobic capacity. An individual who is fit will have a cardio-respiratory system that is capable of meeting the demands of the tissues under conditions of intense exercise.

**Blood Pressure**

Blood pressure is the force of the pressure which the blood is exerting against the walls of the blood vessels in which it is contained. During ventricular systole, when the left ventricle is forcing blood in to the aorta the pressure raises to a peak, systolic pressure. During diastole the pressure falls, the lowest value it reaches being called diastolic pressure. Systolic blood pressure is produced by the heart muscle which drives the contents of the ventricle in to the already stretched arteries. During diastole the arteries are kept partly distended because the peripheral resistance of the arterioles prevents all the blood running off into the tissues. Thus the blood pressure depends partly on the force and volume of the blood pumped by the heart and partly on the contraction of the muscles in the walls of the arterioles. This contraction is maintained by vasoconstrictor nerves which are controlled by the vasomotor centre in the medulla oblongata of the brain. The vasomotor centre adjusts the peripheral resistance to maintain the blood pressure relatively constant. It changes slightly in physiological variations of exertion as in exercise, with mental changes of anxiety and emotion, in sleep and when eating. For this reason the blood pressure is always taken when a person is relaxed, resting and preferably recumbent. *(Evelyn Pearce, 1997).*

**Moorthy. A. M (2004)** if the arteries or capillaries are weakened and become sick, circulation of blood cannot be natural through them. The heart then is obliged to be overactive to give extra pressure to circulate blood through them. This extra pressure is called blood pressure.
According to medical science, if the pressure of blood exceeds 155 mmHg, it is termed High Blood Pressure and if it falls below 110 mmHg, it is called Low Blood Pressure. Usually the pressure in a normal healthy person can be obtained by adding one-fifth of his age with 120 mm. According to others, half of his age added to 100 mm will give the normal pressure. According to the normal blood pressure in a man of sixty should be 120 + (60 / 5) = 132 mmHg, while in the other method it should be 100 + (60 / 2) = 130 mmHg.

Protein in food replenishes some deficiencies in the body. This protein food is not much required by those who are over 40 or who do not undergo heavy physical labor. When indolent men and women take protein food almost daily, it is sure to accumulate in their bodies; whereas stored up protein is useless for the body. As there is no arrangement in the body system for storing up extra protein, the liver and glands of the digestive system are bound to be over-active to drain out this surplus protein from the body.

The arteries lose their elasticity and become stiffened. Blood cannot flow naturally through such inelastic and stiff arteries; consequently the heart has to be over active to give extra pressure in order to push the blood through them forcibly. The heart necessarily vibrates extra ordinarily to create such force and extra pressure. This over action and unnatural vibration of the heart finally culminates in high blood pressure.

Fat accumulates even in the superior and inferior venacava, as also in the arteries of fat people, consequently the passage of blood narrowed down. Thus requisite amount of blood cannot pass through such narrow channels and the heart in its turn, has to force the circulation by extra pressure and strength. It results into high blood pressure.

The term blood pressure usually refers to the pressure measured at a person's upper arm. It is measured on the inside of an elbow at the brachial artery, which is
the upper arm's major blood vessel that carries blood away from the heart. The rating system for blood pressure levels in millimeters of mercury (mm Hg). A person's BP is usually expressed in terms of the systolic pressure over diastolic pressure, for example 120/80 mm Hg.

Classification of Blood Pressure for Adults

<table>
<thead>
<tr>
<th>BP classification</th>
<th>SBP mmHg</th>
<th>DPB mmHg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&lt;120</td>
<td>&lt;80</td>
</tr>
<tr>
<td>Pre hypertension</td>
<td>120-139</td>
<td>80-89</td>
</tr>
<tr>
<td>Stage 1 hypertension</td>
<td>140-159</td>
<td>90-99</td>
</tr>
<tr>
<td>Stage 2 Hypertension</td>
<td>&gt;160</td>
<td>&gt;100</td>
</tr>
</tbody>
</table>

Chobanian et al.(2003)

Resting Pulse Rate

The pulse rate is a wave of increased pressure which is felt at the arteries when blood is pumped out of the heart. It may be conveniently felt at any point where an artery crosses a bone and lies superficially, as the radial artery at the front of the wrist, the temporal artery over the temporal bone, or the dorsalis pedis artery at the bend of the ankle. It is not the blood pumped by the heart into the aorta that is felt, but the pressure transmitted from the aorta which travels more rapidly than blood. (Evelyn Pearce, 1997).

The pumping rate of the heart varies in health under conditions of living, working, food intake, age and emotion. The pulse rate corresponds with the cardiac cycle. If the pulse count is 70, the cardiac cycle will occur 70 times a minute.
Measuring the pulse can give very important information about health. Any change from normal heart rate can indicate a medical condition. Fast pulse may signal an infection or dehydration. In emergency situations, the pulse rate can help determine if the patient's heart is pumping. The pulse measurement has other uses as well. During exercise or immediately after exercise, the pulse rate can give information about the fitness level and health. It is observed that the lower the resting heart rate is the healthier heart. For calculating resting pulse rate, sit quietly for 10 minutes before checking the pulse rate. **Seidel HM et al. (2007)**

1.5.3 Bio-Chemical Variables

**Low and High Density Lipoprotein (HDL & LDL)**

Cholesterol is a soft, oily substance referred to as a fat or lipid. In moderate amount cholesterol is essential for good health and it is incorporated in all cell walls and membranes.
Lipoprotein particles contain cholesterol, triglycerides, phospholipids and various proteins. The four general lipoprotein classifications are chyomicron, very low-density lipoprotein (VLDL), low density lipoprotein (LDL) and high density lipoprotein (HDL). All lipoprotein have some association with risk of heart disease. LDL is known as the bad cholesterol. It is a major factor in arterial plaque development. Oxidation occurs when LDL comes in contact with free radicals, which are highly unstable, reactive oxygen molecules circulating in the blood. Oxidized LDL readily adheres to the endothelial lining of the arteries and is much more likely to form plaque. Oxidized LDL can cause other damage as well, including damage to the lipid membranes of the arterial cells. Oxidized LDL is found significantly greater amounts in arterial plaque and because it plays a major role in the formation of artery-blocking plaque, oxidized LDL is a dangerous factor. (Larry Durstine, J, 2006).

In contrast, cholesterol, carried in HDL complex has been dubbed ‘good’ cholesterol, because HDL removes cholesterol from the cells and transports it to the liver for partial elimination from the body. Not only does HDL help remove excess cholesterol from the tissues, but in addition, it protects by inhibiting oxidation of LDL. The risk of atherosclerosis is inversely related to the concentration of HDL in the blood; that is, elevated levels of HDL are associated with a low incidence of atherosclerotic heart disease. (Lauralee Sherwood, 2006).

HDL elevation is less likely to have heart disease. Epidemiologic studies suggest that for every 1mg/dl HDL levels increase, a person achieve 2 percent decrease in heart disease risk if he is a man and a 3 percent decrease if she is a woman. As in the case with other lipoproteins, HDL is affected by genetics as well as environmental factors. Factors improving HDL levels include exercise, reduction in some dietary influences, body weight reduction and body composition change. HDL is generally responsive to endurance exercise training and it increases in a dose dependent manner. Exercise programmes must last at least 12
weeks to increase HDL values. These exercise induced HDL increases usually range from 4 to 22 percent while the actual values range from 2mg/dl to 8mg/dl (Durstine et al. (2001)).

**Desirable level of Blood Fats**

<table>
<thead>
<tr>
<th>Blood Fat</th>
<th>Desirable level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Cholesterol</strong></td>
<td>&lt;200 mg/dl (if no CAD*)</td>
</tr>
<tr>
<td></td>
<td>&lt;150 mg/dl (if CAD)</td>
</tr>
<tr>
<td><strong>Triglycerides</strong></td>
<td>&lt;150 mg/dl (if no CAD)</td>
</tr>
<tr>
<td></td>
<td>&lt;100 mg/dl (if CAD)</td>
</tr>
<tr>
<td><strong>LDL cholesterol</strong></td>
<td>&lt;130 mg/dl (if No CAD)</td>
</tr>
<tr>
<td></td>
<td>&lt; 100 mg/dl (if CAD)</td>
</tr>
<tr>
<td></td>
<td>&lt;80 mg/dl (Ideal)</td>
</tr>
<tr>
<td><strong>HDL Cholesterol</strong></td>
<td>&gt;45 mg/dl</td>
</tr>
</tbody>
</table>

*CAD – Coronary Artery Disease (Generally defined as having had a heart attack, bypass, angioplasty or having had an abnormal stress test indicating heart disease). Diabetes also dramatically increases the risk of developing a cardiac event. If a person has diabetes, the cholesterol levels are the same as a person who has CAD. (Mary P. McGowan and Jo McGowan Chopra, 2005).

The following conditions listed below are metabolic risk factors for heart disease. A person can develop any one of these risk factors by itself, but they tend to occur together. Metabolic syndrome is diagnosed when a person has at least three of these heart disease risk factors:

(a) A large waistline. This is also called abdominal obesity or “having an apple shape.” Excess fat in the abdominal area is a greater risk factor for heart
disease than excess fat in other parts of the body, such as on the hips. This increases the release of free fatty acid into the portal system, leading to increased apolipoprotein B, increased low-density lipoprotein (LDL), decreased high-density lipoprotein (HDL), and increased triglycerides. As a result, the risk of cardiovascular disease is increased. (b) Higher triglyceride level in the blood. Triglycerides are a type of fat found in the blood. Lower level of HDL cholesterol i.e., high-density lipoprotein cholesterol in the blood. HDL is considered “good” cholesterol because it lowers your chances of heart disease. Low levels of HDL increase your chances of heart disease. (c) Higher blood pressure. Blood pressure is recorded as two measures, usually written as 120/80. The first number, called the systolic blood pressure, measures the pressure in the bloodstream when your heart beats. The second number, called the diastolic blood pressure, measures the pressure in your bloodstream between heartbeats when the heart is relaxed. Higher than normal fasting blood sugar. Mildly high blood sugar can be an early warning sign of diabetes.

Type 2 diabetes mellitus is a risk factor because a hallmark for metabolic syndrome is a fasting glucose level greater than 110 mg/dl. People with diabetes develop atherosclerotic heart disease at a younger age than other people. They’re also at increased risk of macrovascular disease (ischemic heart disease, stroke, and peripheral vascular disease). Diabetes is a coronary heart disease risk equivalent. The more of these risk factors have the greater chance of developing heart disease, diabetes or a stroke. In general, a person with metabolic syndrome is twice as likely to develop heart disease and five times as likely to develop diabetes as someone without metabolic syndrome. Other risk factors aside from those of the metabolic syndrome also increase your risk for heart disease. A high level of LDL cholesterol that is, low-density lipoprotein cholesterol which is considered as “bad” cholesterol and smoking are key risk factors for heart disease, but they aren’t components of metabolic syndrome. Even a single risk factor raises your
risk for heart disease and every risk factor should be lowered to reduce the risk. Alberti KG, et.al (1998)

As the metabolic syndrome is associated with obesity, the syndrome is more common in people with overweight and that leads to a sedentary standard of living. So modification to the lifestyle can effectively treat metabolic syndrome in women. Weight reduction process usually requires a specifically designed program including diet and an exercise routine. It is good to follow a Mediterranean diet, a new diet trend that is rich in good fats with good amount of carbohydrates and proteins. Also, follow an exercise regimen for about thirty minutes for five days a week. It provides effective results on cholesterol levels, blood pressure and insulin sensitivity.

In controlling weight, strenuous asana like back bends are more useful than the milder standing poses and inversions. The practice of viparita chakrasana is very invigorating and has effects similar to aerobic exercises, but here the mind is in deeper relation to the body. Hence, the cells are not irritated as in the case of jogging and aerobics; yet, they are dynamically stimulated. Twisting asana are useful to prevent fat accumulation around the waist and hips.

It is a mistaken notion that yoga can reduce excess flab in the system quickly. The practice of yoga is so difficult for the overweight persons that they cannot lose fat so easily. Moreover, even with a high intensive practice, a few years are required. The idea of ‘instant’ weight loss is wrong. A person loses weight very fast during an illness, as in malaria, for instance. Hence, even this should be considered an indirect blessing to the overweight person. Besides, unless the dietary factor is corrected, any exercise programme is of no value. Once the ideal weight is reached, and the one who maintains the exercise programme, can eat fairly liberally, but should be alert to insidious weight gain.
Instead of tackling the root of the problem, which is to change the lifestyle, doctors prescribe drugs. No doubt the pressure has to be reduced but the emphasis must be to make the patient live without drugs. This is now possible with a wealth of new facts about hypertension. One important point we must remember is that the human body will not respond to constant drugging. The system will become unresponsive in the long run, necessitating an increase in the drug dosage; even then, sometimes it fails.

**Blood Glucose**

The glucose is found in the blood and the same is the body's main source of energy. It is also called blood sugar. Glucose is the most important carbohydrate. Diseases associated with carbohydrate metabolism include diabetes mellitus, galactosemia, glycogen storage diseases, and lactose intolerance.

Blood glucose level means the amount of glucose in a given amount of blood. Blood glucose level monitoring can be done by either self i.e. Blood Glucometer or Urine Gluco test or in the laboratory on a regular basis. Gluco meter helps to provide digital readings by using minimal drop of blood i.e. virtually pain free testing during emergencies. It is noted in milligrams in a deciliter, or mg/dl. Regular monitoring or checking up of blood glucose helps a diabetic to maintain the blood glucose under control.

**Fasting Blood Glucose**

A method for learning how much glucose (sugar) in a blood sample taken after an overnight fast. The fasting blood glucose test is commonly used in the detection of diabetes mellitus. A blood sample is taken in a lab, doctor's clinic, or hospital. The test is done in the morning before the person has taken food. The normal, non diabetic range for blood glucose is from 70 to 110 mg/dl, depending on the type of blood being tested. If the level is over 140 mg/dl, it usually means
the person has diabetes (except for newborns and some pregnant women).

Richard Kahn and N. Beauregard, (2001) Fasting blood glucose (FBG) test is a blood sugar test to check a person's blood glucose level after the person has not eaten for 8 to 12 hours (usually overnight). This test is used for diagnosing pre-diabetes and diabetes.

Post Prandial Blood Glucose

The word post prandial means after a meal; therefore, Post Prandial Blood Glucose (PPG) concentrations refer to plasma glucose concentrations after eating. Many factors determine the PPG profile. In non diabetic individuals, fasting plasma glucose concentrations (i.e., following an overnight 8 to 10 hours fast) generally range from 70 to 110 mg/dl. Glucose concentrations begin to rise; 10 minutes after the start of a meal as a result of the absorption of dietary carbohydrates. The PPG profile is determined by carbohydrate absorption, insulin and glycogen secretion, and their coordinated effects on glucose metabolism in the liver and peripheral tissues. The magnitude and time of the peak plasma glucose concentration depend on a variety of factors, including the timing, quantity, and composition of the meal. In non diabetic individuals, plasma glucose concentrations peak; 60 minutes after the start of a meal, rarely exceed 140 mg/dl, and return to pre-prandial levels within 2–3 hours. Even though glucose concentrations have returned to pre-prandial levels by 3 hours, absorption of the ingested carbohydrate continues for at least 5–6 hours after a meal. Since people with type 1 diabetes have no endogenous insulin secretion, the time and height of peak insulin concentrations, and resultant glucose levels, are dependent on the amount, type, and route of insulin administration.

In type 2 diabetic patients, peak insulin levels are delayed and are insufficient to control PPG excursion adequately. In type 1 and type 2 diabetic individuals, abnormalities in insulin and glucagon secretion, hepatic glucose uptake, suppression of hepatic glucose production, and peripheral glucose uptake
contribute to higher and more prolonged PPG excursions than in non diabetic individuals. Because the absorption of food persists for 5–6 hours after a meal in both diabetic and non diabetic individuals, the optimal time to measure postprandial glucose concentration must be determined. Practical considerations limit the number of blood samples that can be obtained. In general, a measurement of plasma glucose 2 hours after the start of a meal is practical, generally approximates the peak value in patients with diabetes, and provides a reasonable assessment of postprandial hyperglycemia. Specific clinical conditions, such as gestational diabetes or pregnancy complicated by diabetes, may benefit from testing at 1 hour after the meal. (Richard Kahn and N. Beauregard, 2001).

1.6 STATEMENT OF THE PROBLEM

The purpose of the study is to find out the Effects of varied combinations of yogic practices, aerobic and resistance training on selected physical fitness, physiological and biochemical variables of college male students.

1.7 HYPOTHESES

It was hypothesized in the following manner

1. There may be significant difference on selected physical fitness, physiological and biochemical variables of the college male students due to yoga and resistance training.
2. There may be significant difference on selected physical fitness, physiological and biochemical variables of the college male students due to aerobic and resistance training.
3. There may be significant difference on selected physical fitness, physiological and biochemical variables of the college male students due to combination of yoga, aerobic and resistance training.
4. When comparing the effects of three training, the combination of yoga, aerobic and resistance training group (CYART) may be a superior group than the other two experimental groups in the improvements of selected physical fitness, physiological and biochemical variables of the college male students.

5. When comparing the yoga & resistance training group (YRTG) and aerobic & resistance training group (ARTG), the yoga and resistance training group (YRTG) may show better results than the aerobic and resistance training group (ARTG) in the improvements of selected physical fitness, physiological and biochemical variables of the college male students.

6. When comparing the effects of three experimental groups with control group there may be significant improvement in experimental groups than control group on selected physical fitness, physiological and biochemical variables of the college male students.

1.8 SIGNIFICANCE OF THE STUDY

The finding of this study will be of significance in the following ways.

1. This study will contribute more to the society to utilize the combination of training for the improvement of fitness.
2. This study will help in creating awareness about the importance of aerobic dance.
3. This study may helpful for male adults to realize the power of yoga.
4. This study may help to compare the changes that occur in the variables before and after performing the aerobic dance.
5. This study may help to compare the changes that occur in the variables before and after performing the yogic practices.
6. This study may help to compare the changes that occur in the variables before and after performing the combined package.
1.9 DELIMITATIONS

The study was delimited to the following aspects and these delimitations will be taken into consideration in the interpretation of the data.

1. The study was delimited to 80 college male students studying at Sankara College of Arts and Science, Coimbatore, Tamilnadu only.
2. The age group of the subject was ranged from 17 to 22 years only.
3. The study was delimited to selected physical variables (speed, agility, muscular strength endurance and flexibility), physiological variables (maximal oxygen, systolic blood pressure, diastolic blood pressure and resting heart rate) and Biochemical variables (low Density Lipoprotein, high Density Lipoprotein, fasting Blood Glucose and Post Prandial Glucose) only.
4. The study was delimited to Yoga and Resistance training, Aerobic and Resistance training and Combinations of Yoga, Aerobic and Resistance training only.
5. The study was delimited to the training period of 12 weeks.

1.10 LIMITATIONS

The study was limited to the following aspects and these limitations will be taken into consideration in the interpretation of the data.

1. Certain factors like habits, lifestyle, daily routines, etc., which may affect the results of this investigation are not taken into consideration.
2. Socio- economic factors are also not taken into consideration.
3. The effect of uncontrollable factors like heredity and environment are also considered as limitation of this study.
1.11 DEFINITION OF OPERATIONAL TERMS

Yoga

The term yoga means the surrender of Jeevathma with Paramathma. It is the union of body and mind.

Aerobic exercises

A system of exercises combining aerobics with dance steps.

Resistance training

Resistance training is a form of strength training used to resist, overcome or bear force to increase muscle strength and endurance by doing repetitive exercises with weights, weight machines, or resistance bands.

Speed

Speed is the ability of an athlete to move as fast as possible, through the optimal range of motion, in a deliberate and intentional manner, in a particular direction.

Agility

Agility is the ability to perform a series of change of directions in rapid successions.

Muscular strength endurance

It is the ability of a muscle to resist a force over time or to make repeated muscle contractions against a force. Strength endurance is a measure of the ability of a muscle or muscle group to work continuously. It has a meaning similar to muscle endurance, but with strength endurance there is a greater emphasis on the amount of the force which can be resisted.
Flexibility

Flexibility is the ability to achieve an extended range of motion at a joint without being impeded by excess tissues.

Aerobic activity

It is the constant moderate intensity work that uses up oxygen at a rate in which the cardio respiratory system can replenish oxygen in the working muscles.

Systolic blood pressure

The pressure exerted on the blood stream by the heart when it contracts, forcing blood from the ventricles of the heart into the pulmonary artery and the aorta.

Diastolic blood pressure

The pressure in the bloodstream when the heart relaxes and dilates, filling with blood.

Resting heart rate

Resting heart rate (RHR) refers to the number of times your heart beats in one minute while at rest. The average RHR is 70-80 beats per minute (BPM).

Low Density Lipoprotein

LDL stands for low-density lipoprotein. It's also sometimes called "bad" cholesterol.

High Density Lipoprotein

HDL stands for high-density lipoprotein. It's also sometimes called "good" cholesterol.
Fasting glucose

A method for learning how much glucose (sugar) there is in a blood sample taken after an overnight fast. The normal, non-diabetic range for blood glucose is from 70 to 110 mg/dl, depending on the type of blood being tested. If the level is over 140 mg/dl, it usually means the person has diabetes.

Post Prandial Glucose

A postprandial rise in the blood glucose level is one that occurs after eating. The "post-" in Latin means afterward. The "Prandial" comes from the Latin, "prandium" which means "a late breakfast or lunch."