Chapter – I

INTRODUCTION

"Better to hunt in fields, for health unbought,
Than see the doctor for a nauseous draught
The wise, for cure, on exercise depend:
God never made his work for man to mend."

- John Dryden

The active life is the one almost everyone led before people achieved the benefits of industrial modernization, technological development, the automobile, the labour-saving devices, television, and computers. These marvels of ingenuity now make it possible to minimize daily energy expenditure by using buttons, keystrokes, and voice commands to meet survival, work and entertainment needs. Parallel to the decline in the need for human energy expenditure has been an increase in the consumption of fatty, convenience and fast foods. Food chemists found it possible to add hydrogen to vegetable oils to prolong shelf (but not human) life, to substitute low-cost palm and coconut oils for other ingredients and to cater to our demands for tasty food – in a hurry. Individually the decline in activity and the rise in food consumption may not have been such a problem. However, coming together, as they have in recent years, they create the potential for alarming growth in the epidemic diseases caused by the way we live, by our lifestyle. Fortunately these behaviours can be changed (Sharkey, 1997).
The healthy man should be stimulated to voluntary physical exercise and this training should be an essential part of the increasing amount of leisure time. Sport activity is certainly essential in modern society. It should be conducted by persons among the laity with basic knowledge of the elementary work physiology and psychology. Different types of sport are a valuable substitution for the augmented physical inactivity at home and in a man’s occupation and irreplaceable means in preventive medicine. In this connection it is also worthwhile emphasizing the necessity for persons in different positions of the medical profession to be educated in the physiological basis of exercise.

As Missiuso (1965) has demonstrated the replacement of motor function by the mechanical device and all kinds of labour saving electronic instruments contains the danger of disintegration of the biosocial human entity.

Fortunately, the times are changing. As we work to rebuild our ailing health care system, we are searching for ways to reduce costs and the reliance on drugs and medical procedures. At the same time, researchers are questioning the value of operations and drugs, and confirming the contributions of physical activity and related habits to health, longevity, and quality of life. Physically active life is a magnet that attracts composite behaviour or habits that collectively are our greatest hope for personal health and vitality and for the integrity of the health care system.

Physical activity is defined as bodily movement produced by the skeletal muscles that requires energy expenditure and produces progressive health benefits. “Exercise, a type of physical activity, is defined as “a planned, structured and repetitive bodily
movement done to improve or maintain one or more components of physical fitness.” Physical inactivity denotes a level of activity less than needed to maintain good health.

Exercise makes all the individual motors that power the systems, organs, tissues and even the cells in the body to operate at higher revolution per minute. Through exercise we not only maintain or develop the physical fitness but also prevent many health related diseases such as coronary heart diseases, atherosclerosis, diabetes etc.

The term physical fitness has taken numerous meanings over the years. General definitions have included the concepts as the ability to function normally without undue fatigue and being able to enjoy leisure time activities without debilitating physical stress. In recent times the term has been divided into two distinct categories: skill related and health related fitness. Skill related fitness includes speed, agility, co-ordination, power, balance etc. Health related fitness refers to those aspects of physiological and psychological functioning which are believed to offer the individual some protect against degenerative type diseases such as coronary heart diseases, obesity and various musculo-skeletal disorders. (Gabbard and Lowy, 1987).

Sports persons are doing the skill related fitness, because they have to enhance their performance as well as gain a place in the sports world. But ordinary men and women need not go for skill related fitness. They have to maintain a different fitness called Health Related Fitness. The need to maintain health related fitness is due to the higher incidence of CHD, diabetes, postural and anatomical ailments etc., mainly on account of their inactiveness and unhealthy food habits.
There are two classification of doing an exercise. They are aerobic and anaerobic. Anaerobic exercises are shorter form of exercise, which will not develop the health related fitness especially the endurance. Unlike anaerobic exercise, aerobic exercises are for a prolonged period and they help in improving the cardio-vascular efficiency, lung capacity, resting pulse rate, the transport system and controls the heart beat and decrease the health related risk factors.

Aerobic endurance is the body’s ability to work muscle groups at moderate intensity, using aerobic (which means, with air) energy. The aerobic system uses oxygen to crack carbohydrates for energy. As this need is sustained, fats and proteins are also broken down, making aerobic exercises ideal for slimming. These systems also raise the pulse rate, strengthening the heart’s ability to contract, and stronger contractions mean an improved, stronger blood flow. This in turn tunes the body for exercise. (Gosh, 1996).

Aerobic exercise is essential to a healthy cardio-vascular system. Briefly, aerobic exercise is activity that can be sustained for an extended period of time without building an oxygen debt in the muscles. It is a type of exercise that overloads the heart and lungs and causes them to work harder than they do when a person is at rest. Aerobic exercise is the type in which the amount of oxygen taken into the body is slightly more than or equal to the amount of oxygen used by the body. It was also pointed out that some of the benefits of aerobic exercise include the ability to utilise more oxygen during strenuous exercise, a lower heart rate at rest, the production of less lactic acid, and greater endurance. Also many exercise physiologists have found that it reduces blood pressure
and changes blood chemistry. It also improves the efficiency of the heart. More evidence
is needed to substantiate the belief by some persons that aerobic exercise is responsible
for the development of supplemental blood vessels to the heart, which would be helpful
in the event of a heart attack, and also that such exercise results in increasing the size of
coronary arteries and thus assisting the flow of blood to the heart if the artery is narrowed
by a clot or atherosclerosis. (Bucher, 1983).

Aerobic exercises are considered to be more effective than anaerobic exercise in
developing fitness, especially ‘Cardiorespiratory Endurance.’ Aerobic exercises can be
performed for longer periods and they should leave the exerciser refreshed rather than
exhausted. Aerobic activities include jogging or slow running, swimming, cycling, rope
skipping, aerobic dance, brisk walking and the like, that significantly increases the heart
and respiratory rates and which can be done continuously for longer periods.

Aerobic exercises are all done under submaximal speed, (55% to 70% of
maximum heart rate) where by they may be carried on for a considerable time so that the
heart may be engaged in pumping blood at a faster rate continuously over the period of
exercise. For achieving benefits of aerobic exercises the heart rate has to be raised and
retained much higher than the usual heart rate for a period of at least 15 to 20 minutes.

Aerobic exercises depends upon the continuous action of a number of groups of
muscles over a period of time. As you get fitter you are able to get more work out of your
muscle for longer periods. The process of increasing aerobic fitness involved increasing
the rate at which oxygen can be carried from the lungs to the exercising muscles. This
obviously depends partly upon the lungs and the heart itself, but it also depends on increasing the blood supply to the muscle tissue, and increasing their ability to extract oxygen from the blood. Aerobic exercise is also the kind that aids weight loss. (Jackson, 1987).

Inspite of tremendous progress in the last twenty five years, heart disease or more specifically coronary artery disease (CAD), remains the number one killer. Heart diseases, stroke, and blood vessel diseases kill almost one million people in one year, far more than all the lives lost in the four major wars in the 20th century. CAD is responsible for more than half of those deaths, often in a sudden dramatic event called heart attack. But, this seemingly sudden event is actually the product of a gradual process called atherosclerosis, which narrows the arteries and restricts the blood flow to the heart.

Atherosclerosis may begin to develop during childhood, and the process is accelerated by a number of primary risk factors. Inactivity is a risk factor for the development of coronary artery disease, along with the other big three risk factors – cigarette smoking, elevated blood cholesterol, and high blood pressure.

Like in the west, in India too, coronary heart disease is becoming one of the major causes of mortality. Atherosclerosis is an important cause of coronary heart disease and the biochemical metabolic abnormality in lipid metabolism is the principal factor responsible for atherogenesis. (Jadhav, 1990).

Lipids are heterogeneous group of chemicals that include free fatty acids (FFA) and substances found naturally in chemical association with them. The major lipids found
in man are FFA, triglycerides (TG), steroids, phospholipids prostaglandins, fat soluble vitamins, provitamins and lipoproteins.

Estimation of various level of serum lipid concentration have been used as discriminators of coronary heart disease. The lipid profile contains cholesterol, high density lipoprotein cholesterol (HDL-C), low density lipoprotein cholesterol (LDL-C), very low density lipoprotein cholesterol (VLDL-C), and triglycerides.

Cholesterol is not a single entity. There is a low-density lipoprotein cholesterol (LDL-C), the most common form of cholesterol in the blood stream; an elevated level may mean an increased risk of coronary heart disease (CHD). All kinds of cholesterol are not considered to be risk factors. There is also a high density lipoprotein cholesterol (HDL-C), which in elevated concentrations may reduce risk. Everyone has high-density lipoprotein (HDL) and low density lipoprotein (LDL). Interestingly, HDL contains almost 50 per cent protein and less than a quarter cholesterol while LDL contains close to 50 per cent cholesterol and less than a quarter of protein (Work, 1987).

Regular exercise programmes have shown to increase the HDL-C fraction. One of the reasons why HDLs are not harmful is that they do not collect or adhere to the inner linings of arteries. In fact, they actually help to break down the fatty deposits already present. The fatty atherosclerotic deposits are composed of LDL and VLDL cholesterol fraction. Therefore, an overall low cholesterol level, with low LDL and VLDL fractions but a high HDL fraction appears to be a healthy balance with respect to blood cholesterol. (Fox and Mathews, 1981).
There is a level of exercise below which you would not see changes in HDL-C levels. That threshold would be due partly to the exercise intensity and partly to its duration. Three separate aspects of exercise contribute to HDL-C levels. They are the amount (as measured in calories), the intensity (whether the exercise is done all at once and quickly or gradually over a period of time), and the time (duration). (William, 1982).

Plasma triglycerides levels when compared to total cholesterol have shown to decrease considerably following endurance type exercise. Furthermore a physically active lifestyle has been shown to prevent the age related rise in plasma triglycerides concentration typically observed in sedentary men. Though, a number of studies have been done to find out the effect of aerobic training on triglycerides, the results have not always been consistent. (Thorland and Gilliam, 1981).

Although clinical manifestation of cardio-vascular risk factors only appears late in life, it is recognized that risk-related behavior patterns for coronary heart disease (CHD) have their origin in the life style of children and adolescents. Only a few studies have attempted to estimate the independent effect of aerobic training on body composition and blood lipid profile; and the results have not always been consistent.

Another health hazard confronted in today’s sedentary society is obesity. Obesity has been defined as an excessive accumulation of adipose (fat) tissue in the body. It differs from over-weight defined as “over heavy” which indicates a weight greater than that assumed to be desirable, without reference to body composition, and may or may not involve an excessive amount of body fat. Because the body is made up of different type
of tissues, such as muscles, fat, organs, fluid and bones and because each contributes weight to the total body, an athlete, for example, may be over weight but not obese. An individual who is obese is usually over weight, but not all over weight individuals are obese.

Body composition is defined as a relative percentage of fat and fat free mass. Excessive body fat is a health hazard and has been implicated as contributing to a variety of conditions including hypertension and hyper lipoproteinemia. While all the mechanisms of how excess fat causes these problems have not been completely explained, health authorities stress the statement ‘it is better to be lean than to be fat’.

Body composition is a function of caloric balance, and although the emphasis has traditionally been on the caloric input side of the equation, we are now increasingly aware of the importance of energy output in regulating body weight. Short-term experimental trials and large-scale community studies show that vigorous physical activity helps to reduce body fat.

Regular exercise is of proven value in the regulation of obesity of excess body fat. Used as an adjacent to a controlled low calories diet, exercise will increase the percentage of muscle in the total body composition and decrease the percentage of fat. There is rather convincing evidence that regular moderate physical activity not only causes a greater caloric expenditure during the exercise itself, but may also increase the resting metabolic rate for some hours after exercise. Regular exercise may also reduce one’s appetite somewhat, there by affecting not only caloric expenditure but also caloric intake.
Systematic physical activity and athletic training can change body composition in a characteristic way. Under these conditions lean body mass increases significantly at the expense of fat. This applies to growing children as well as adults and the aged.

During intensive training, the specific gravity of the body increases, while the skinfold thickness decreases. Increased specific gravity indicates a reduction in the fat content. This is also supported by the reduced skinfold thickness observed. In the case of fat-free body mass, however, it is only a matter of variation of few kilograms in the body weight alone in an inadequate index of possible alterations in body composition (Astrand and Rodahl, 1970).

The most effective weight reduction and fat reduction procedure involve the use of exercise, the role of which is often misunderstood in weight control. Two erroneous ideas persist – that appetite increases proportionately to an increase in physical activity thus nullifying the weight reduction achieved through that activity and that an immense amount of work or exercise is required for a very small loss in weight. (Wallis and Geve, 1964).

It is quite common in the contemporary society that even the very active individuals of yesteryears tend to refrain from doing some physical activities for many reasons as they approach the middle age. Entering into marital life and shouldering of heavy responsibilities in official and domestic affairs are cited as main reasons for the same. In fact this is a very crucial phase, where the sedentary lifestyle lays the foundation stones for succumbing to some serious health hazards such as diabetes, cardiovascular
diseases, hypertension, obesity etc. This is the time when most people argue that it is rather difficult to find time for physical exercising or getting involved in some recreative or playful activities.

The sedentary lifestyle is marked first by gaining of some additional weight, and becoming obese in due course of time. The functional efficiency too is decreased in gradual progression. To add fuel to the fire, the modern food habits facilitates increased cholesterol levels and open the doors towards chronic health hazards. Another class, the occasional participants in some physical activities, normally are not very regular and do not adhere to a systematic exercise protocol. As a matter of fact, a good majority in this group may also fall at risk to such chronic ailments.

The investigator, being interested in the role of exercise in promoting better health status, especially in the middle-aged, was motivated to observe the beneficial effects of aerobic training programme on serum lipoproteins and body composition variables among two groups (sedentary and occasional participants in physical activities) of middle aged men.

**Statement of the Problem**

The purpose of the study was to find out the effect of sixteen weeks aerobic training programme on lipoprotein profiles and body composition variables among middle aged men.
Delimitations

1. The study was confined to sixteen weeks progressive aerobic training programme on middle aged men between forty and fifty years of age.

2. The study was delimited to two groups of middle aged men: (a) sedentary individuals and (b) occasional participants in physical activities.

3. The study was confined to aerobic training programme which included brisk walking and jogging only.

4. The study was further delimited to the following lipoprotein profiles and body composition variables:

**Lipoprotein Profiles**

1. Total Cholesterol (TG)
2. High Density Lipoprotein Cholesterol (HDL-C)
3. Low Density Lipoprotein Cholesterol (LDL-C)
4. Triglycerides (TG)
5. Very Low Density Lipoprotein Cholesterol (VLDL-C)

**Body Composition Variables**

1. Total Body Weight
2. Fat Weight
3. Lean Body Weight.


**Limitation**

Though utmost care has been taken to select the two experimental groups as the sedentary and occasional participants in physical activities, and the control groups, any variation in their living conditions, life style, diet etc. from subject to subject may be considered as limitation of the study.

**Hypothesis**

On the basis of the literature reviewed, research findings and scholar’s own understanding about the problem, the following hypotheses were formulated:

1. There would be significant effect of the aerobic training programme on lipoprotein profiles and body composition variables of middle-aged men.

2. There would be significant variations in lipoprotein profiles and body composition changes between the middle aged sedentary men and the occasional participants in physical activities as result of sixteen weeks aerobic training programme.

**Definition and Explanation of the Terms**

**Aerobic Training**

Physical activities in which metabolic demands can be met by oxygen transport system i.e. oxygen supplied by respiration during activity provide sufficient energy for executing the activities (Ragg 1974).
Lipoproteins

Combination of fat and protein (lipoproteins) are important cellular constituents occurring both in the cell membrane and in the mitochondria within the cytoplasm, and serving also as the means of transporting lipids in the blood (Harper, 1977).

Cholesterol

Cholesterol is a sterol, possessing a four-ringed steroid nucleous and a hydroxyl group. The latter is attached to the third carbon atom of the A ring and is β – oriented (Mosoro, 1968).

Body Composition

Body composition is the proportion of the lean, fat free body mass and depot fat. It is one of the most important morphological features characterizing human organism (Rarick, 1973).

Middle Aged Sedentary Men

Middle aged sedentary subjects as chosen for the study will include subjects among the age ranging between 40 and 50 years, who are not involved in any form of regular physical activities.

Middle Aged Occasional Participants

Middle aged occasional participants as chosen for this study will be subjects between 40 and 50 years of age who indulge in some kind of physical activity such as health club activities, recreational sports participation etc.
Significance of the Study

For years epidemiologists have studied the relationships of occupational and leisure-time activity to health, and an impressive list of benefits has emerged. The studies clearly show how activity enhances health while it reduces the risk of coronary artery disease, hypertension, and stroke as well as some cancers, diabetes, osteoporosis, obesity and other chronic disorders.

The present study employing middle aged sedentary and occasional participants of physical activity in a sixteen week aerobic training programme on lipoprotein profiles and body composition variables would be significant in the following ways:

1. The study would quantify the serum lipoprotein and body composition profiles of middle-aged sedentary and occasional physical activity participants.

2. The study, in addition to discovering new facts in the area of exercise physiology/biochemistry might bring to light the role of regular exercise as a preventive measure in atherosclerosis and coronary heart disease.

3. The study would reveal the effect of aerobic training programme on serum lipoprotein profiles and body composition variables in general and that of middle aged sedentary and occasional participants in particular.
4. The results of the study would be useful for physical education teachers, coaches, and physicians in formulating effective fitness training programmes for middle-aged men.