CHAPTER – 1

INTRODUCTION

In this dynamic age of science and technology the human element is threatened as ever before, its goal indistinct and unsatisfying. It is being driven to over exertion in response to the demand for maximum production and all out effort. The development and conservation of material sources is constantly stressed while every little is said about protecting human resources. In this competitive age no culture can service unless its men and women can permitted to attain and maintain vigorous and abundant vitality and can be helped to recuperate quickly from strain and fatigue. Extreme physical fitness is the demand of the day for sports.

The mechanization revolution has reduced the importance of physical endeavor for every walk of Modern life. People do not have to climb a flight of stairs any more, they instead
prefer to listen to their earphones while comfortably reaching their destination through an elevator. Manual washing is outdated as the work has been taken over by washing machines. To add to these the remote control system does the rest, from opening the gates of your bungalows to switching off your television sets.

Another reason attribute to the lowering of the general physical fitness is that physical work is often considered being below the dignity of many as evident from the increasing level of labor charges in all spheres of life. People feel it embarrassing in walking a few hundred yards on the Streets.

Thus, we see that the importance of physical fitness through organized physical education and sports programs are of greater significance in today's sedentary life or else the risks of physical Diseases and organic malfunction will be ever mounting.
In fact properly directed exercise is the only means for acquiring the ability the engage in activities demanding sustained physical efforts. Human being have to revert to the age of old customs and Habits of physical exertion in order to restore the diminishing physical fitness levels. Consequently, we find that the existing physical education program can be of utmost assistance in reaching this desired goal.

"The body must needs be vigorous in order to obey the soul; a good servant Ought to be Robust. The weaker the body the more it commands, the stronger it is the better it obeys . In order to think we must exercise our limbs, our senses and our organs, which are the Instruments of our intelligence. In order to derive all the advantages possible from these instruments; it is necessary that the body which furnishes them should be robust and sound." These are not hollow words or the fiction of idealist philosopher’s brain; they are Pregnant with a Stark reality – a
reality that the individual and the nations must take cognizance of Health and Fitness is sine quo non of human life. Healthy and fit citizen is an asset while a weak Person is a Liability; is a truism; the former commands and the latter demands. Realizing that human Efficiency And productivity are very much dependent exclusively on one's health and fitness, almost all the Countries have been compelled to give adequate attention to this vitally important aspect of their national life. The importance of health and fitness through the medium of physical activity can hardly be underestimated in the mourned times, especially when the life style is changing fast as a consequence of pursuit of materialistic philosophy.

Tremendous urbanization and mechanization of daily routines almost everywhere seems to have resulted not only in “hurrying and scurrying” but also depriving people of a natural vitality, vigor, muscular power and prowess so essential for a purposeful life. The World Health Organization (WHO) has set a
target that every person in the world should become health conscious by 2000 AD and it is a right step in the attainment of health for all. The international Olympic committee has signed an agreement with WHO for furthering the cause of health for all and sports for all by 2000 AD. This agreement is clearly directed towards attaining total fitness of all individuals by 2000 AD. To attain this objective the citizens of all the nation is to be made health and fitness conscious and for this purpose scientific programs and criteria to evaluate are to be formulated to cover all individuals belonging to both sexes and of all ages.¹

Sports training based on scientific knowledge, are a pedagogical process of sports perfection which through systematic effects on psychophysical performance, ability and performance readiness aims at leading the sportsmen to high and the highest performance. Through active and conscious interaction with the

given demands in sports training, the sportsmen's personality develops according to the norms and standards of socialist society. ²

Like west, in India too, coronary heart diseases are becoming one of the major causes of mortality. Antherislerosis is an important cause of coronary heart disease and the biochemical metabolic abnormality in lipid metabolism is the principle factor responsible for antherogenesis. Estimation of various levels of serum lipid concentration has been used as discriminators coronary heart diseases. Over years the choice of serum lipid to be estimated has changed and with the advent of estimation of lipoproteins a great deal of sensitivity has been reached in determining risk of myocardial infraction. ³


3. P. P. Jadhav ET. Al. "Changes In Lipid Profile After Myocardial Infection" *The Indian Practitioner* vol. XL, 111, No.9 (September 1990): 30 - 33.
The more the man is active (physically) the less will be his cardiac arrest risk factor. To decrease the risk of cardiac disease. A person must have to maintain some short of physical fitness. Two type of persons are there in the world viz. Athletes and non--athletes. For making himself a world known person and to project a good name and fame the athletes type elevate his performance by means of training. Training needs extra load in systematic and regular way, which upset the internal homeostasis and makes some permanent effect upon the vegetative system of the body, which increase the potentiality of that athlete.

The circulatory adjustment of an athlete in response of physical training creates cardiac hypertrophy with resting bradicardia. So, aerobic exercise is essential to a healthy cardiovascular system. Briefly, aerobic exercise is an activity that can be sustained for an extended period of time without building an oxygen debt in the muscles. More evidence is needed to
substantiate the heart, which would be helpful in the event of a heart attack and also that such belief by some persons that aerobic exercise supplemented blood vessels to the exercise results in increasing the size of the coronary arteries and thus assisting the flow of the blood to the heart in the artery in narrowed by a clot or antherosclerosis.  

Aerobic exercise is essential to a healthy cardio-vascular system. Briefly, aerobic exercise is an activity that can be sustained for an extended period of time without building and 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 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 aerobics exercise include the ability to utilize more oxygen during

4. C. A. Bucher and William E. Prentice, *Fitness for College And Life*.
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 substantiate the belief by some persons that aerobic exercise is responsible for the development of supplement of 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 a clot or antherosclerosis narrows the artery.

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 exercise 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 exercise are all done under submaximal speed, 130 to 150 heart beat per minute, 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 exercise the heart rate has to be raised and retained much higher than the usual heart rate for a period of 15 to 20 minutes.

Aerobic exercise depends upon the continuo 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 muscles 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 exert oxygen from the blood. Aerobic exercise is also the kind that Aids weight loss.  

Estimation of various level of serum lipid concentration have been used as discriminators of coronary heart disease. Over the years the choice of serum lipid to be estimated has changed and with the advent of estimation of a lipoprotein, a great deal of sensitivity has been reached in determining the risk of myocardial infection.

Lipid profile contains cholesterol, high-density lipoprotein cholesterol (HDL-C), and low-density Lipoprotein cholesterol (LDL-C), very low-density lipoprotein cholesterol (VLDL-C), triglycerides, HDL-C/total cholesterol etc.


7. Ibid.
Cholesterol is not a single entity. There is a low-density lipoprotein cholesterol (LDL-C), the most common form of cholesterol in the bloodstream. An elevated may mean an increase of risk of coronary heart diseases (CHD).

There is also a high-density lipoprotein cholesterol (HDL-C), which in elevated concentrations may reduce risk. 8.

Every one has high-density lipoprotein (HDL) and low density lipoprotein (LDL) interestingly, HDL contains almost 50 percent protein and less than a quarter cholesterol while LDL contains close to 50 percent cholesterol and less than a quarter of proteins.

All kinds of cholesterol are not considered to be risk factors. Infact, the HDL-C is thought to be protective against...

coronary heart disease. Regular exercise programs have been 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 balanced with respect to blood cholesterol.  

There is a level of exercise below which we 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 aspect 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).

Although clinical manifestation of cardiovascular 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 lifestyle of children and adolescents. Only a few studies have attempted to estimate the undefended effect of aerobic training on body composition and blood lipid profile and the results have not always been consistent.

Plasma triglycerides levels when compared to total cholesterol are regularly associated with decrease level of plasma triglycerides after endurance type exercise. Furthermore a


physically active life style 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 has not always been consistent.\textsuperscript{12}

The determination of heart volume has been an area of study as early as 1916. This parameter however, was also reappreciated with the advent of modern sports and high intensive training. It is well known that the heart of elite endurance athletes are enlarge in size and volume as compared to the sedentary population. Roentgenography was considered as a

very useful method to determine the same. Of late, echocardiography instead of Roentgenography has become popular to find out the different kinds of hypertrophy in various sports discipline. Heart volume by Roentgenography was first determined by Rohrer, followed by Danzer, Kaslstof – musshoff and Reindel, Blumchem et al., Nicogossin et al., Pennien et al., D. N. Mathur and others.


Heart does not undergo an adaptive increase in respiratory capacity such as seen in skeletal muscle in response to intensive endurance exercise.\textsuperscript{17,18}

The contrast to skeletal muscle, the heart hypertrophies in response to strenuous endurance exercise, so that trend individual has heavier hearts than sedentary controls of the same body weight. In normal individuals, these increase in the size of the heart relative to the body could play an important role in the increase in work capacity brought about by training.

\textsuperscript{17} L. B. Oscai, P. A. Mole, B. Beri et al., \textit{Cardiac Growth And Respiratory Enzyme Levels In Male Rats Subjected To A Running Program.} Am. J. Physiology. 220: 1238-241, 1971

In the absence of cardio-vascular pathology, there appears to be a good correlation between the heart size and maximum cardiac output.\textsuperscript{19}

And Increase in the ratio of the heart weight to body weight should, therefore, result in an increase in the maximum capacity of deliver blood to the working muscle. As a consequence, the Hypertrophied-trained heart should be able to supply oxygen to a large mass of muscle during Exercise.

Studies of the cardiovascular adjustment to exercise and training have mainly been concern with Central circulatory parameters. Pre-requisite to a High level of endurance

performance is a great Capacity of oxygen transport system. For example, maximal oxygen uptake has been correlated to Heart volume, blood volume, and the total amount of hemoglobin.  

It is also been studied that changes in the heart volume and E. C. G. of athletes have no fixed patterns. But the hypertrophy of the heart was evidenced after a continuous sustained endurance training which also facilities to increase the heart volume. Endurance is usually defined


as the ability of the body to undergo prolonged activity or to resist stress set up as a result has prolong activity.

Endurance primarily depend upon the various aspects of cardiac efficiency, which in turn exerts influence on the performance of the other portion of the human organism. Heart size will increase as the result of a training program. The thickening of the heart muscle causes the increase heart size. It results in a more powerful contraction and according, a large volume output of blood per stroke. The heart becomes slower as training progress. 23.

Marathon running an cross-country race is popular since the beginning of competitive sports. previously it was thought that heredity plays a dominant role in determining heart size but

it is proved that difference in cardiac hypertrophy are related to the type of sport or activity performed by the athletic thus indicating the heart size is influence by training. A long period of continuous and vigorous training makes an athlete training to achieve the qualities of a long distance runner.

The major changes resulting from training that are apparent at rest are changes in heart size, the size of the heart is increased. The cardiac hypertrophy of endurance of athletes (distance runners and swimmers) is caricaturized by large ventricular cavity and normal thickness of the ventricular wall. This means that the volume of blood that fills the ventricle during diastole is also larger. Also volume capabilities of endurance will be greater than those of non-endurance athletes.

A normal sized ventricular cavity and thicker ventricular wall characterize athletes engaged in high resistance and isometric type of activities. Therefore the stroke volume capabilities is less
when compared to endurance athletes Resting heart rate will be decreased and stroke volume will be increased proportionately. Volume of blood and hemoglobin content in the blood increases by training. Regular exercise program causes decrease in both blood cholesterol and triglycerid levels. This change is apparent in individuals who initially have very high blood levels prior to training. Training causes decrease in total body fat. The loss of body fat is dependent upon the balanced between calories taken and calories expanded. In terms of how many calories are expanded, it is not how fast you run but rather how far you travel. 24.

In the post-absorptive state i.e., over 95% of all the lipids in the plasma (in terms of mass, but not in the terms of rate of transport) are in the form of lipoproteins, which are small particles, constraining mixtures of triglycerides,

phospholipids, cholesterol and proteins. The protein in the mixtures averages about one fourth to one third of the total constituents, and the remainder is lipids. The total concentration of lipoproteins in the plasma averages about 700 mg per 100 ml, and this can be broken down into cholesterol, phospholipids, triglycerides and lipoproteins.

Lipoproteins are of:

(1) very low density lipoprotein, which contain high concentration of triglycerides and moderate concentrations of both phospholipids and cholesterol (VLDL-C).

(2) low density lipoprotein, which contain relatively few triglycerides but a very high percentages of cholesterol (LDL-C).

(3) High-density lipoproteins which contain about 50% protein with smaller concentrations of lipids (HDL-C).
The function of the lipoproteins in the plasma is poorly known to be a means by which lipid substances can be transported through out the body, mainly from liver to other parts of the body. More important is the transport of cholesterol and phospholipids by the lipoproteins, because these substances are not known to be transported to any significant extent in any other form. Atherosclerosis is often assorted eight high plasma concentration of low-density lipoproteins. 25.

Regular exercise programs have been shown to increase the HDL fractions. One of the reasons why HDLs are not harmful is that they do not collect or adhere to the inner linings of arteries infect they may actually help break down the fatty deposits already present.

The fatty antheroscleotic deposits are composed of low-density lipoprotein (LDL) and very low-density lipoprotein

The LDL is the primary carrier of cholesterol in the blood stream, where as the principal lipid components of VLDL, are triglycerides. 

Running is an isotonic contraction, the muscle shortens with varying tension while lifting a constant load. Isokinetic concentration is one, is which the tension developed by the muscle as it shortens at constant speed is maximal at all joint angles over the full range of Motrin. Such contraction are common during sports performance, a good example is the arm stroke during free style swimming.

Although isotonic and isokinetic contractions are both concentric i.e. involved shortening the two is not identical. Maximal tension can be developed though out full range of motion during isotonic contraction.

In Long distance running, are quick and plentiful supply of oxygen to the muscles is essential and though training it is possible to enlarge the heart and improve its efficiency. In the average adult the pumping cycle is completed about 72 times a minute at rest.

But the fitter you are, the stronger and larger the heart, and the fewer times it needs to beat to pump the same volume of blood. In the top minute have been recorded.\(^{27}\)

All the forms of athletic training are associated with left ventricular hypertrophy (LVH). However, the exact effects on cardiac structure and function depend upon the type of training. Endurance training exerts a volume overload on the left ventricle and produces left ventricular cavity enlargement with proportional

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increases in myocardial thickness. Conversely resistance training exerts predominant pressure over load, which results in increase septum and free wall thickness without affecting cavity dimensions. 28.

In comparison with non-athletes, endurance athletes have a larger left ventricular end diastolic diameter at rest. From several studies it has been shown that during dynamic physical exercise trained subjects increase end diastolic left ventricular internal dimension and ejection fraction to develop a high stroke volume, cardiac output and oxygen uptake.

In contrast, sedentary subjects rely more on an increase of ejection fraction effect of physical training, but cannot excludes a genetic predisposition in the athletes to increase pre-.

load during exercise.\textsuperscript{29}

It is most interesting that one of the adaptations of marathon running is an increase in size of the ventricular chambers. The increased stroke volume, together with a lower heart rate molder to maintain a very high level cardiac output, also provides optimum heart muscle perfusion – the time in between beats even during exercise is till fairly long.\textsuperscript{30}

The serum lipid variables such as HDL –C, LDL –C triglycerides. Total cholesterol beside cardiac volume is likely to be affected by training. A clear-cut information is still not available referring the effect of aerobic training on the plasma lipids, lipoproteins and cardiac volume which has motivated the investigator to undertake the present study.


STATEMENT OF THE PROBLEM

The purpose of the study was to find out determine the effects of aerobic training on plasma lipids, lipoproteins and cardiac volumes of adolescent males.

DELIMITATIONS

1. The study was delimited to the adolescent male students at Alwar public school, Alwar, Rajasthan.

2. Only aerobic training was provided to the students which is a delimitation of the study.

3. There were 30 students in the study, which further comes under delimitation.

4. The study was delimited to following lipoproteins and serum lipid parameters.
   
   a) High Density Lipoprotein - Cholesterol.
   b) Low Density Lipoprotein - Cholesterol.
   c) Very Low Density Lipoprotein - Cholesterol
   d) Total cholesterol.
   e) High Density Lipoprotein Cholesterol Ratio.
   f) Triglycerides.
LIMITATIONS

1. The quantum of physical activities beyond regular training and conditioning program to which the subjects was involved is impossible to assess and control which is to be recognized as the limitation of the study.

2. The nullifying effect of these factors and lifestyle that may vary considerably among the students was also be considered as a limitation.

HYPOTHESIS

There was significant effect of aerobic training on plasma lipids, lipoproteins and cardiac volume of the subjects.
DEFINITION AND EXPLANATION OF TERMS AEROBIC TRAINING

Physical activities in which the metabolic demands can be meant by oxygen transport system, i.e., oxygen supplied by respiration during activity provide sufficient energy for executing and activities. 31.

PLASMA

Plasma is the liquid part of blood in which the blood cells are suspended. 32.

LIPIDS

The lipids are heterogeneous group of compounds related,


either actually or potentially to the fatty acids. They have the common property of being (1) relatively insoluble in water and (2) soluble in non-polar solvent such as ether, chloroform, and benzene. Thus, the lipids include fats, oils, waxes, and related compounds. 33.

LIPOPROTEINS

Combination of fat and protein (lipoprotein) 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. 34.

34. Lbid. P. 108.
TRIGLYCERIDES

The triglycerides are so called natural fat are esters of the alcohol, glycerol and fatty acid. 35.

CHOLESTEROL

A monotonic alcohol, occurring in the form of square scaly crystals with a notched corner. It is found in file, in gallstones, in brain, blood cells, plasma, egg yolk, seeds and animal tissue generally in varying amount. 36.

CARDIAC VOLUME

It is the total volume of heart measures from teleroentgenograms. 37.


SIGNIFICANT OF THE STUDY

The study may help the coaches to assess his program during preparatory phase. The lipid profile of circulatory fluids of the body is the most significance aspects for coronary risk factor and cardiac volume is related to this risk aspect of an individual. For elevating the performance level of an athlete, the cardiac volume and lipid profiles are most vital aspect to switch over. Since aerobic training is vital component of any prolong big muscular activity, any lacuna of positive effectiveness of his component is facilitate the coaches to fix the program accordingly.

The study was significant in the following ways:

1. The study was reveal the effect of aerobic training on plasma lipid and lipoproteins.
2. The study was help to establish the effect of aerobic training on cardiac volume.

3. The was have some application in correcting various lipid problems and cardiac volume aspect with the help of activity.

4. The study was also help to see the relationship between various lipid profile and cardiac volume.