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## Different Physical Fitness Training Protocols: Impact On High Density Lipoprotein (Hdl)

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### Abstract

The physical aspect of the development denotes the development of the individual's physique and its various systems to the optimum, so that the bodily status of the individual is optimally high, so as not to get affected by diseases, injuries and also to carry on the physical rigors of the day to day life without much stress. This is possible only when the individual's body is functionally well developed with regard to all the systems of the body and all these systems perform to the best of their required status, then the individual is said to have very good physical development. So, the physical and physiological efficiency leads to the health of the individuals, which in turn makes the individual to participate more efficiently and more vigorously in physical activities so that the individual's physical and physiological status will grow further. The results proved that the aerobic training group significantly increased the HDL levels when compared to the anaerobic training and yogasanas groups. There was insignificant difference between anaerobic training and yogasanas groups.

**Key Words:** Physical fitness, training, aerobics, anaerobic, yogasanas, high density lipoprotein

### Introduction

Physical fitness is considered as the most desirable lifestyle component of human beings to lead healthy and very active life. This aspect of the human life is now given so much of importance and studied worldwide very extensively. The physical educators around the world sponsor for the concept of all round development of the human beings through the physical activities. All round development of the individual encompasses the development of the individuals' physical, mental, social and emotional aspects. Since, the development of all these domains in the individuals is sought by the physical educators by means of physical activities; optimum level of physical fitness is an ideal pre-requisite for the individuals to participate in such kind of physical activities. To participate in any kind of physical activity requires minimum or optimum amount of physical fitness and the development of the required physical fitness is an important aspect. But, development of the physical fitness depends on the participation in physical activities. In this way, the physical fitness and participation in physical activities are interrelated and mutual.

## Physical Fitness

The term physical fitness in view of a coach or a sports trainer is something different. In their view the term physical fitness denotes the physical capacity to tackle the external load that is placed by various exercises and excel in physical performances of the various sports and games situations. These people describe the physical fitness in terms of the capacity to do work.

Physical fitness is the individual's ability to meet the requirements of their environments (**Harold M.Barrow, Rosemary McGee et al., 1979**).

## Health Related Fitness

The health of the body depends directly on the functional efficiency of various organs of the various systems and in turn the functional efficiency of the various systems of the body. It has been found, that simple speed development is in no way helpful in increasing the health status of an individual and in the same way the simple strength improvement is not an essential aspect to keep the health at an appreciable levels. Development of agility may be very essential and highly useful for functional efficiency in tackling the complicated movements in various sporting activities, but this ability may not be that essential or important to enhance one's health status.

Harold M.Barrow, Rosemary McGee et.al., denotes the following as the health related physical fitness components:

- Cardio-respiratory/Circulo-respiratory Endurance
- Muscular Endurance
- Muscular Strength
- Body Composition
- Flexibility

## Coronary Diseases

Physiological systems respond to various appropriate stimuli. Sometimes the stimulus is called "stress" and the response is called the "strain". Repeated stresses on physical systems frequently lead to adaptations resulting in an increase in functional capacity. Physiologically the purpose of any training session is to stress the body so that the response results in adaptation.

The modern heterogeneous population is interested in assuming active lifestyles to derive maximum health and well being. Heart disease and osteoarthritis, which are now considered as primary health problems can be prevented through active life styles and regular exercising habits, since most of these degenerative diseases are amenable to change through modification of the life style, such as ensuring regular exercise. The importance of exercise in a program of preventive medicine has reinforced the role of the physical educator as part of the interdisciplinary team concerned with health care and maintenance.

Physical activity level or cardio-respiratory fitness and risk of fatal and non fatal ischemic heart disease (IHD), indicate that a sedentary life style or a low level of habitual physical activity increases the risk of IHD mortality. The effect graded in the sense that the risk decreases progressively with the increase in the level of habitual physical activity or in cardio-respiratory fitness. The volume of activity necessary to induce some of these apparent benefits is not overwhelmingly high because the risk diminishes rapidly when comparing low with moderate weekly energy expended in physical activity. Even though moderate levels of habitual physical activity an important effect higher levels reduce the risk even more, for the levels of habitual physical activity and level of cardio-respiratory fitness. The effects on the IHD events or mortality are significant and graded even after adjustment for a variety of common risk factors such as body mass index, blood pressure, smoking, blood cholesterol and parental history of IHD.

Atherosclerosis starts as an injury to arterial endothelium because of various factors. The injury to this endothelial wall may be because of chronic hypertension, wear and tear and toxic chemicals. The injury at endothelium allows substances in the plasma, like cholesterol to penetrate into the intima of the artery. Ordinarily endothelial cells act as barrel to cholesterol and other lipids. However an injury to the

endothelial cells results in their inundation with blood fats. This process causes a proliferation of the arterial smooth muscle that eventually results in its encroachment into the intima and arterio-vascular space.

Higher level of lipid circulation, than the desired level in person's blood circulation, and this may be a strong cause for the incidence of cardio vascular disease (CVD) among such people. The circulating lipids in the blood may be categorized in to five types of lipoproteins according to their density, composition and size. Very Low Density Lipoproteins (VLDL), Low Density Lipoprotein (LDL), Intermediate Density Lipoprotein (IDL) and High Density Lipoproteins (HDL) and chylomicrons. Again there are sub fractions in HDL like HDL-1, HDL-2, and HDL-3. Total cholesterol is the sum total of cholesterol carried by VLDL, LDL HDL and chylomicrons.

The percentage of LDL is most significant risk factor in the development of coronary heart disease (CHD). LDL cholesterol is the main component in atherosclerotic plaque formed in the term of blood arteries, causing blockage of blood stream. Incidentally, the HDL cholesterol acts as reverse cholesterol transfer stem that resist the development of atherosclerosis.

## **Blood Lipid Profiles**

### **Low Density Lipoprotein (LDL)**

LDL cholesterol is a specific kind of lipoprotein that is the form in which cholesterol is transported in the blood. LDL cholesterol is called 'Bad' cholesterol.

### **High Density Lipoprotein (HDL)**

HDL cholesterol is a group of proteins found in the blood plasma and lymph that are combined with lipids. They transport cholesterol from the tissue the liver to be broken down and excreted HDL cholesterol is called "Good" cholesterol.

### **Triglycerides**

Triglyceride is an ester of three fatty acids and glycerol, which are the main components of animal and plant lipids. They are the most concentrated source of usable energy in the human body and are stored as subcutaneous fat deposits where they contributed to insulation.

## **Aerobic Activity**

Aerobic is a new work, but not a new Idea. (Jackson, 1985). The old concept of calisthenics or physical jerk was essentially the same. Both involve various exercises which are not too energetic, but when repeated many times they result in an excellent form of aerobic training which improves flexibility as well as aerobic fitness. In other words aerobics is a progressive physical conditioning program that stimulates cardio respiratory activity for a time period sufficiently long to produce beneficial changes in the body.

## **Anaerobic Activity**

Anaerobic activity is a short-duration exercise that is powered primarily by metabolic pathways that do not use oxygen. Such pathways produce lactic acid, resulting in metabolic acidosis. Examples of anaerobic exercise include sprinting and weight lifting. It is a physical activity, which instigates a metabolism that does not depend on oxygen. Examples include isotonic, in which the muscles contract against an object of resistance with movement (e.g., weight lifting); isometrics, in which muscles contract against resistance but without movement; and calisthenics (e.g., sit-ups and knee-bends), which increase flexibility and improve joint mobility. The study was conducted on the trained young men to know how for aerobic training, anaerobic training and yogasanas would influence on the selected blood lipid profiles of coronary heart disease.

## **Yoga**

Yoga is a simple and easy practice, acceptable to the people of all professions. In India, yoga exercises have been practiced since thousands of years. During the early days, yoga was confined to be practiced by the chosen few like the rishies, kings and princesses, sidhas, religious heads. Now it is accepted

that many yoga exercises are suitable for all people and are recommended for long living and healthy life. The practice of yoga has also been made systematic by the exponent of the system, **Patanjali** being an important teacher. The yoga exercises, according to **Patanjali** have to practice in a systematic way; he advocates eight steps of progressive achievement, namely abstention (Yama) regulations discipline (Niyama) easy posture (Asana) control of breathing (Pranayama) sense of control (Pratyahara) concentration (Dharana) meditation (Dhyana) and super conscious state (Samadhi). Of these asanas and pranayamas are very popular and very few people go beyond the steps. These yoga exercises improve the functioning of organs and upgrade the mental and body efficiency of the practitioners.

### Statement of the Problem

The purpose of the present study was to analyze the effect of aerobic training, anaerobic training, and yogasanas on the selected blood lipid profiles i.e. LDL, HDL and triglycerides, which normally considered as risk factors in the coronary heart diseases.

### Hypotheses

The following hypotheses were formulated at the beginning to guide the researcher in conducting the research experiment.

1. It was hypothesized that the resting HDL cholesterol levels may increase and LDL cholesterol and triglyceride levels may decrease significantly because of the effect of the selected aerobic, anaerobic and yogasana training protocols.
2. It was hypothesized that the medium intensity aerobic training may reduce resting LDL cholesterol levels significantly than the medium intensity anaerobic training and yogasanas.
3. It was also hypothesized that the medium intensity aerobic training may increase resting HDL cholesterol levels significantly than the medium intensity anaerobic training and yogasanas.
4. It was also hypothesized that the medium intensity aerobic training may reduce triglycerides levels significantly than the medium intensity anaerobic training and yogasanas.

### Delimitations

1. The study was confined to sixty sedentary young men selected from Narayana B.P.Ed. College, Tadipatri, Anantapur District, Andhra Pradesh which is affiliated to Sri Krishnadevaraya University, Anantapuram, Andhra Pradesh, India.
2. The selected subjects were divided into three experimental groups and one control group with fifteen subjects (n=15) in each group. Experimental Group-I (AG=15) underwent aerobic training, Group-II (ANG=15) underwent anaerobic training, Group-III (YG=15) underwent yogasanas training and Group-IV served as control group (CG=15).
3. The age group of the subjects ranged between 18 and 22 years only.
4. Three types of physical activities i.e. aerobic training, anaerobic training, and yogasanas were used as experimental variables.
5. The study was further delimited by selecting yogasanas protocol established by Swami Chidanand Saraswathi of Paramarth Niketan, Rishikesh, India. Yogasanas was limited to ten which already identified as medium intensity yogasanas by the researcher.

### Limitations

1. Hereditary and endogenous factors could not be controlled, which might have influenced the results of the study especially the LDL cholesterol, HDL cholesterol and triglyceride cholesterol levels.
2. The time period of experimentation i.e. five months or twenty weeks was considered as medium range period to elicit the responses physiologically was on the knowledge of relevant material.
3. The study was conducted during the months of July to November, 2012 and this could have influenced the metabolic rate and this might show some impact on the results of the study.
4. Social status, food habits and the way of life which could influence on the results could not be controlled by the researcher personally though orientation was given about these aspects to the subjects.

### Significance of the Study

The physical fitness has become an important asset of human being and the modern day man is sincerely interested to improve and maintain this aspect as this would ensure the man a happy and healthy qualitative life. The contribution of Physical Educationists and Physical fitness experts in this area praise worthy. Throughout the world the researches are conducted to know the various exercises or exercise protocols which could prevent and cure the deadly ailments like coronary heart disease, hypertension, diabetes and etc.

The researcher endeavored in this research to contribute at least minute constructive information in this direction.

1. More constructive evidence will be available regarding the effect of various selected exercises or protocols of conditioning on the status of the selected risk factors that cause or precipitate the occurrence of the diseases like coronary heart disease, atherosclerosis of small blood vessels etc.
2. This study also creates a path to conduct several researches in the same direction and area with different experimental variables and with different combinations of variables on the risk factors of various diseases.

### Selection of Subjects

The purpose of the present study was to analyze the effect of aerobic training, anaerobic training, and yogasanas on the selected blood lipid profiles i.e. LDL, HDL and triglycerides which normally considered as risk factors in the coronary heart diseases. For the present study, sixty young men studying Bachelor of Physical Education (B.P.Ed.) courses out of one forty two students (N = 142) were selected randomly as subjects from Narayana B.P.Ed. College, Tadipatri, Anantapur District, Andhra Pradesh, India. The selected subjects were divided into three experimental groups and one control group with fifteen subjects (n=15) in each group. Experimental Group-I (ATG=15) underwent aerobic training, Group-II (ANTG=15) underwent anaerobic training, Group-III (YG=15) underwent yogasanas training and Group-IV served as control group (CG=15). The age group of the subjects ranged between 18 and 22 years. All the subjects were informed about the nature of the study and their consent was obtained to co-operate till the end of the experiment and testing period. The subjects were free to withdraw their consent in case they felt any discomfort during the period of their participation, but there no dropouts. A qualified physician examined the subjects medically and declared them fit for the study.

### Selection of Variables

#### Dependent variables:

1. Low Density Lipoprotein (LDL)
2. High Density Lipoprotein (HDL)
3. Triglycerides

#### Independent Variables

1. Aerobic Training
2. Anaerobic Training
3. Yogasanas

### Design of the Experimental Programmes

The following exercise protocols have been designed and implemented for the period of experimentation by following the procedure explained below.

#### Aerobic Training Protocols

The experimentation period was lasted for six months, the first month the subjects were kept under conditioning, consolidation process to develop minimum cardio-respiratory and muscular fitness and to acquire the knowledge of intensity of exercises. Hence only five months were the actual experimentation

with the intended physical exercise. During this initial one month the subjects were asked to walk and slowly jog for five to ten minutes before going to light calisthenics and stretching exercises. Then the subjects took an easy and comfortable jog for 15 minutes and by the end of the month, the subjects jogged for twenty minutes. All the time the subjects were asked to monitor their pulse rates to see that their pulse rate may not go beyond 60% to 70% of their maximum heart rate. After this initial one month period the protocol of aerobic exercises. To initiate and maintain the utility of oxygen during the each training session and also throughout the experimental period the following physical exercises were incorporated in each training session. Walking for ten minutes slowly increasing the pace.

1. Calisthenics and light stretching immediately after walk.
2. Slow and continuous jogging for four kilometers keeping their heart rate at 60% to 70% of maximum heart rate.
3. Warm down and cooling the body slowly.

The above routine work was done five times per week and for five months continuously.

### **Anaerobic Training Protocols**

Anaerobic training group went through the following protocol of exercises, which require anaerobic metabolic energy pathway as a major source of energy. Hence fast and vigorous exercise protocol was implemented for this group, before they started their experimentation exercise regime they underwent one month conditioning and consolidation of fitness programme. During this period the subjects in each session jogged for five to ten minutes and then did light stretching and calisthenics exercise. After the subjects did acceleration sprints of up to 60 to 80 meters with full recovery in between four times initially and improving them to 8 to 10 times for the month end. After the first month conditioning program the subjects took to the actual experimentation protocol for five months as follows in each session.

1. Slow jogging for one kilometer and then for stretching and calisthenics.
2. Acceleration sprints with a speed of 70% to 80% of the maximum speed for 10 times with a recovery period of 3 minutes for each repetition while walking back slowly.
3. Cool down the body by slow limbering down exercises.
4. This group did this anaerobic protocol for five times a week and for five months continuously.

### **Yogasanas**

The researcher selected yogasanas in such a way that the intensity was medium. After extensive reading and also after extensive consultations with yoga experts, the researcher came to know that the protocol of yogasanas developed by Pujya Swami Chidanand Saraswathi of Paramarth Niketan, Rishikesh would serve the purpose of research. Hence the series taught in Rishikesh Paramarth Niketan of Pujya Swami Chidanand Saraswathi consisting of nine asanas and one Banda apart from breathing exercises was selected for the experimentation. This series developed by Pujya Swami Chidanand Saraswathi takes nearly 30 minutes and all the asanas are moderately difficult asana. Even the timings suggested by the Pujya Swami Shidanand Saraswathi were of moderate time intensity hence highly suitable for the experimentation. Most of the asanas in the series control the diseases that are influenced by the selected dependent factors like L.D.L, H.D.L and Triglyceride levels. The yogasanas selected for experimentation are presented below in Table-I

Table I

## LIST OF YOGASANAS

| Sl.No | Name of the Asana                    | Time/Duration   |
|-------|--------------------------------------|-----------------|
| 1     | Sarvangasana or Candle Posture       | 1 Minute        |
| 2     | Halasana or Plough Posture           | 2 Minutes       |
| 3     | Matsyasana or Fish Posture           | 1 Minute        |
| 4     | Paschimothasana or Forward bend      | 2 Minutes       |
| 5     | Bhujangasana or Cobra Posture        | 1 Minute        |
| 6     | Shalabasana or Locust Posture        | 1 Minute        |
| 7     | Dhanurasana or Bow posture           | ½ Minute        |
| 8     | Artha-Matsyendrasana or Spinal twist | 1 Minute        |
| 9     | Shirshasana or Head stand            | 1 to 10 Minutes |
| 10    | Uddiyana Banda                       | 1 to 2 Minutes  |
| 11    | Breathing                            | 3 Minutes       |
| 12    | Shavasana                            | 3 Minutes       |

## Collection of Data

The data on selected dependent variables viz. LDL cholesterol, HDL cholesterol and triglycerides levels were collected by conducting pre-test and post-test measurement in a very standard medical technology laboratory, by well trained and graduated testers one day prior to and after the training protocols respectively. The subjects were asked to be present at the appointed hour to the Rayalaseema Diagnostic Centre, Anantapur, where the blood samples were drawn from the subjects and further processing was done immediately. This procedure was adopted for both pre-test and post-test measurement of the variables. The laboratory used the very standard and costly equipment for the administration of the various medical tests and been recognized as standard laboratory by various corporate hospitals in the Anantapuram town, Andhra Pradesh.

## Statistical Techniques

To find out the significant differences if any due to the experimental variables in the selected criterion variables analysis of covariance (ANCOVA) was applied.

## Analysis and Interpretations of the Data

The pre-test and post-test values of the selected blood lipid profiles viz. HDL cholesterol is compared for the variance through the technique of analysis of covariance (ANCOVA) with a testing significant level of 0.05. The analysis of covariance was done on the basis of the pre-test values. The effects of three different protocols of aerobic training, anaerobic training and yogasanas were compared with the control group with the above statistical technique. To understand the significant difference among the groups and to find out the comparative effects of the three variable protocols of the selected experimental variables the Scheffe's post hoc individual comparison tests were done. The post hoc comparison tests were conducted with the help of the post-test adjusted mean values adjusted on the pretest values.

### High Density Lipoprotein (HDL)

The pre-test and post-test means of aerobic training group, anaerobic training group, yogasanas group and control group has been presented in Table I.

**Table I**

#### SUMMARY OF MEANS AND STANDARD DEVIATIONS OF PRE AND POST TESTS ON HDL OF EXPERIMENTAL GROUPS AND CONTROL GROUP

| Tests     |      | Aerobic Training | Anaerobic Training | Yogasanas Group | Control Group |
|-----------|------|------------------|--------------------|-----------------|---------------|
| Pre Test  | Mean | 42.40            | 40.27              | 41.80           | 39.73         |
|           | SD   | 7.14             | 3.79               | 4.63            | 4.37          |
| Post Test | Mean | 55.40            | 47.53              | 46.33           | 39.33         |
|           | SD   | 3.50             | 4.84               | 4.39            | 4.27          |

The table I shows that the pre-test mean values of aerobic training, anaerobic training, yogasanas and control groups are 42.4, 40.3, 41.8 and 39.7 respectively; the post-test means are 55.4, 47.53, 46.3 and 39.3 respectively.

The table I also shows that the pre-test standard deviation values of aerobic training, anaerobic training, yogasanas and control groups are 7.14, 3.79, 4.63 and 4.37 respectively; the post-test means are 3.50, 4.84, 4.39 and 4.27 respectively.

The pre-test and post-test data on HDL of aerobic training, anaerobic training, yogasanas and control groups has been subjected to analysis of covariance and presented in table II.

**Table II**

#### ANALYSIS OF COVARIANCE FOR THE DATA ON HDL OF AEROBIC TRAINING, ANAEROBIC TRAINING, YOGASANAS GROUPS AND CONTROL GROUP

| Comparison         | Source of variance | Degrees of freedom | Sum of squares | Mean sum of squares | f value |
|--------------------|--------------------|--------------------|----------------|---------------------|---------|
| Pre test           | Between            | 3                  | 70.983         | 23.661              | 0.87    |
|                    | Within             | 55                 | 1481.9         | 26.943              |         |
| Post test          | Between            | 3                  | 1949.6         | 649.88              | 34.90*  |
|                    | Within             | 55                 | 1024           | 18.618              |         |
| Adjusted post test | Between            | 3                  | 1609.5         | 536.5               | 44.80*  |
|                    | Within             | 54                 | 646.63         | 11.975              |         |

\*Significant at .05 level

(The table value required for significance at .05 level with df 3 and 55, 3 and 54 are 2.78 and 2.79 respectively.)

The table II shows that the pre-test mean values of aerobic training, anaerobic training and yogasanas and control groups resulted an f ratio 0.87 is less than the table value required for significance. It indicates insignificant difference between pre-test means. The post-test means had an f ratio of 34.90 which is higher than the table value for significance. The adjusted post test means yielded an f ratio 44.90 which is also higher than the table value. It indicates significant difference among the training groups and the control group. To determine which of the paired means are significantly differed Scheffe's post hoc test was followed. The results of the post hoc test were presented in table III.

TABLE III

**SCHEFFE'S POST-HOC TEST FOR THE DIFFERENCES BETWEEN THE ADJUSTED POST TESTS PAIRED MEANS OF EXPERIMENTAL GROUPS AND CONTROL GROUP ON HDL**

| Adjusted Post-Test Means |                          |                 |               | Mean Differences | Confidential Interval Value |
|--------------------------|--------------------------|-----------------|---------------|------------------|-----------------------------|
| Aerobic Training Group   | Anaerobic Training Group | Yogasanas Group | Control Group |                  |                             |
| 54.71                    | 47.92                    |                 |               | 6.79*            | 3.65                        |
| 54.71                    |                          | 45.95           |               | 8.76*            |                             |
| 54.71                    |                          |                 | 39.99         | 14.72*           |                             |
|                          | 47.92                    | 45.95           |               | 1.97             |                             |
|                          | 47.92                    |                 | 39.99         | 7.93*            |                             |
|                          |                          | 45.95           | 39.99         | 5.96*            |                             |

\*Significant at .05 level.

Table III shows that the mean differences between aerobic training and anaerobic training 6.79, aerobic training and yogasanas group 8.76, aerobic and control group 14.72, anaerobic training and control group 7.93 and yogasanas and control group 5.96 are greater than the critical difference value 3.65. It shows significant difference between the above paired means in HDL. The mean difference between anaerobic training and yogasanas group 1.97 is less than the critical difference value 3.65. It indicates insignificant difference between the above two groups.

The results of the study indicates that the experimental groups such as aerobic training, anaerobic training, and yogasanas groups are significantly differed when compared to control group on HDL. It reveals that the experimental groups namely aerobic training, anaerobic training and yogasanas groups increased the HDL cholesterol levels when compared to the control group.

But when the experimental groups are compared with each other, the aerobic training group significantly increased the HDL cholesterol levels when compared to the anaerobic training and yogasanas groups. There was insignificant difference between anaerobic and yogasanas group.

The pre-test, post-test and adjusted post-test mean values of aerobic training, anaerobic training, yogasanas and control groups on HDL are graphically represented in the figure I.

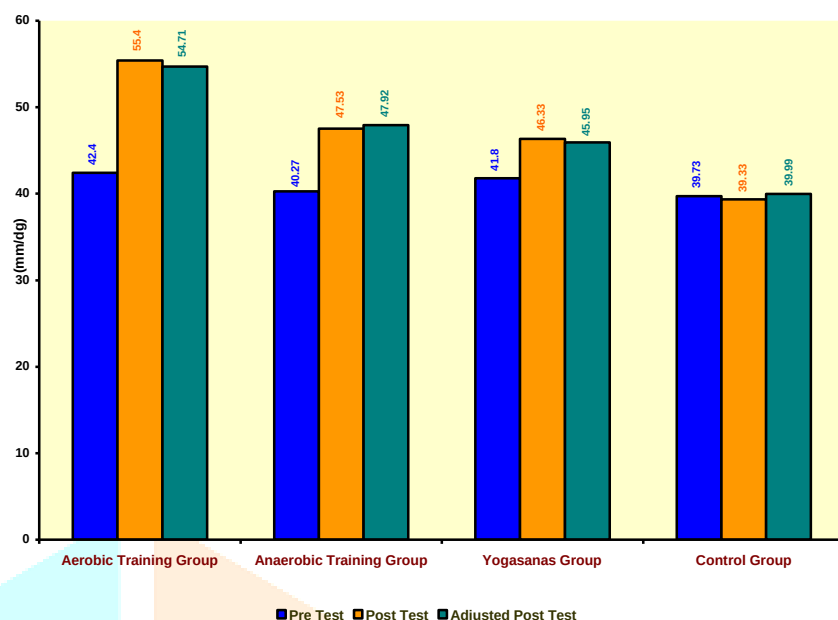


**FIGURE II : MEAN VALUES OF PRE, POST AND ADJUSTED POST TESTS OF EXPERIMENTAL GROUPS AND CONTROL GROUP ON HDL**

### Results of the study

The following results were obtained based upon the above analysis.

1. The aerobic training, anaerobic training, and yogasanas groups were significantly increased in HDL when compared to control group.
2. The aerobic training group significantly increased the HDL levels when compared to the anaerobic training and yogasanas groups. There was insignificant difference between anaerobic training and yogasanas groups.

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