

T.R.N.C
NEAR EAST UNIVERSITY
INSTITUTE OF HEALTH SCIENCES

**EFFECT OF 12 WEEKS AEROBIC AND ANAEROBIC TRAINING
ON SOME PHYSIOLOGICAL, LIPID PROFILE AND BODY
COMPOSITION VARIABLES OF UNDER 20 YEARS
OLD MALE FOOTBALL PLAYERS**

TALHA KHANAFDL OMAR

PHYSICAL EDUCATION AND SPORT

MASTER THESIS

NICOSIA
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MASTER THESIS

SUPERVISOR

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**NICOSIA
2015**

The Directorate of the Institute of Health Sciences

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Dedicated to my mother

ACKNOWLEDGEMENT

Alhamdulillah, First and foremost, I would like to thank Allah Almighty for endowing me with patience and knowledge to complete this study.

I would like to thank the school of physical education and sports and graduate school of health sciences at NEU, and its deanship, I extend my utmost gratitude for their continued support and in giving me the opportunity to pursue my graduate studies in their school / institute.

Special thanks and appreciation to my supervisor Assco.Prof. Dr.Cevdet TINAZCI, for his support and encouragement throughout my study at NEU and for guiding me in each step to the completion of this research.

I would like to thank my teacher Assist. Prof. Dr.Ula YAVUZ and all academic and administrative staff of the school of physical education and sports.

Furthermore, I also want to express my special thanks to all my friends especially my friend and my nephew WahabNahmt.

Finally I would like to express my deepest heartfelt gratitude to my mother, my brothers, my sisters, my future wife, and all my relatives for their enduring moral support.

TALHA KHANAFDL OMAR

ABSTRACT

TALHA KHANAFDL OMAR. Effect of 12 weeks aerobic and anaerobic training program on some physiological, lipid profile and body composition variables of under 20 years old male football players. Near East University, Institute of Health Sciences, School of physical education and Sports, Master Thesis, Nicosia, 2015.

The purpose of the study was to find out the effect of training on selected physiological lipid profile, and body composition variables of under 20 years old male football players. A total of 24 youth male under 20 years old football players (U20, age: 16-19 years, mean age: 17.3 ± 1.0 years, playing for last 4 - 6 years) volunteered for this study, 24 players divided into two group, 12 players for the experimental group (XG) 12 players for the control group (CG). The training program consists of aerobic training, anaerobic training, recreational game and practice football game. Data was collected at zero level (pre-test), in the mid of the program (mid-test) and at the end of program (post-test). For analyzing data repeated measures and independent sample t-test were used. In the experimental group a significant increase ($P < 0.05$) in number of shuttles, skeletal muscle, and resting metabolism and a significant decrease ($P < 0.05$) in body fat, total cholesterol, and triglyceride levels has been noted in (mid-test) and (post-test) when compare to (pre-test). However, a decrease was noted in body mass index, blood lactate, maximal heart rate, and visceral fat, and LDL but not to significantly different level also HDL increase but not to significant difference level. In the control group negative significant increase ($P < 0.05$) in body fat and negative significant decrease ($P < 0.05$) in skeletal muscle and resting metabolism, no significant difference observed in number of shuttle, body mass index, blood lactate, maximum heart rate, visceral fat, total cholesterol, triglyceride, LDL and HDL. This study would provide useful information for training and exercise physiology and they may have a beneficial impact on health.

Key words: aerobic training, anaerobic training, blood lactate, lipid profile, body composition, football player.

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LIST OF USED ABBREVIATIONS

NEU	: Near East University
VO₂max	: Maximum voluntary oxygen consumption
VO₂max	: Maximal oxygen uptake
HR	: Heart rate
MHR	: Maximum heart rate
HRmax	: Maximum heart rate
BMI	: Body mass index
RMR	: Resting metabolic rate
LBM	: Lean body mass
H₀	: Null hypothesis
H₁	: Alternative hypothesis
LDH	: Lactate dehydrogenase
TC	: Total cholesterol
TG	: Triglycerides
LDL-C	: High density lipoprotein cholesterol
HDL-C	: Low density lipoprotein cholesterol
HDL	: High density lipoprotein
LDL	: Low density lipoprotein
ATP	: Adenosine triphosphate
PC	: Phosphocreatine
ADP	: Adenosine diphosphate
Pi	: Inorganic Phosphate
Mmol/L	: Millimoles per liter
CHD	: Coronary heart disease
FM	: Fat mass
FFM	: Free fat mass

Lbs	: Pound
Kcal	: Kilocalorie
mmol	: millimole
HIIT	: High intensity interval training
TEE	: Total energy expenditure
ANCOV	: Analysis of covariance
ST	: Strength training
PP	: Preparatory Phase
CP	: Competitive Phase
BD	: Baseline data
EEPA	: Energy expenditure of physical activity
SPSS	: Statistical package of social sciences
XG	: Experimental group
CG	: Control group

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1. INTRODUCTION

Football is unarguably the world's most popular sport game. A common aspect of this sport is the necessity of teamwork to complement individual skills. In order to adapt to technical evolution within the game, players have to meet the physical demands required. To achieve the best possible performance, training has to be formulated according to the principles of periodization (Bompa & Carrera, 2005). The training induced changes have been observed in various physiological, biochemical and body composition parameters can be attributed to appropriate load dynamics(Hoff,2005; Reilly,2005). As the players have to cover a big area in the ground during attack and defense, the game demands high aerobic fitness(Reilly,2005; Gacesa et al,2009; Miller,2007).

Practicing sports, especially aerobic training, have been proposed to be an effective mechanism for cardiovascular protection, however its effectiveness depends on many factors, including age, sex, body composition and nutrition, as well as training duration and intensity. According to the literature, aerobic training improves plasma lipids, particularly in obese and overweight subjects (Ounis et al, 2008; Kim & Kim, 2012; Du Preez, 2013).

A high number of accelerations and decelerations, associated with a large number of changes in the direction of play create an additional load to muscles of football players, which indicates a high need for both the aerobic and anaerobic energy delivery pathways (Miller et al, 2007).

During aerobic exercise the demand for oxygen increases at the working muscle, so an optimum level of hemoglobin is required to perform at the highest level with high intensity. As football performance depends very much on the aerobic component of an athlete, the players need to maintain a normal hemoglobin level to optimize performance (Urhausen & Kindermann, 2002).

Recent studies have identified the anaerobic threshold during resistance exercise, allowing determination of the critical metabolic and cardiovascular changes during this type of exercise. Generally, the anaerobic threshold in resistance exercise occurs in the low-moderate intensity with high number of repetitions (Simoes et al, 2010).

During soccer training, these parameters may be evaluated at regular intervals to assess the training load imposed on the athlete. In order to adapt to the technical evolution within the game, the players have to develop physiologically to meet the physical demand required at elite levels (Reilly & Borrie, 1992).

Physiological variables may exhibit in response to different categories of exercise and as a result of training adaptations. All available research evidence suggests that all physiological variables that are responsive to exercise training also respond to detraining (Plowman & Smith, 2013, 1, 418). In the present research, we have three physiological variables to study; blood lactate level, maximum heart rate and cardio-respiratory endurance.

The 20 m multi-stage shuttle run test, originally developed by Leger and Lambert in 1982, has been widely used as a predictive test for VO₂max. The shuttle run was originally designed to predict fitness in healthy adults attending fitness classes and in athletes participating in sports characterized by frequent starts and stops (Leger et al., 1988). In the present study, researcher modify the similar above test (3 minute multistage 20 meter shuttle run test) for indirect measure cardio-respiratory endurance without using beep and counting the number of shuttles during three minutes. The Shuttle run test was administered outdoor on the artificial football surface.

Lactate is the end product of the anaerobic carbohydrate breakdown. It is the metabolite displaying the most spectacular concentration change in muscle and the blood with exercise. We usually determine lactate in whole blood rather than plasma or serum. In addition to the conventional laboratory equipment, there is a practical, portable device that measures lactate within a 10-15 second a drop of blood from fingertip or earlobe.

The blood lactate concentration at rest is about 1 mmol, where after maximal exercise lasting at least one-half minute, it can go over 20 mmol (Mougios, 2006, 285).

Heart rate (HR) is a physiological variable of control of exercise intensity, widely used for prescription of physical training in soccer. With the arrival of heart rate monitors, the measurement of this variable has become very practical, accurate, fast and cheap, making their use even more accessible, the use of HR as a training method is usually done by applying percentages of maximum heart rate (MHR), which varies according to the desired training intensity. In sports such as soccer, in which characteristics are intermittent and maximum, there is an indication that MHR should be obtained during competition, since these values have proved to be higher than in tests of maximum effort in training practice, heart rate often is used as the standard for exercise intensity (Silva et al, 2013). Cardiovascular status, as indicated by heart rate recorded during exercise and recovery, plays a vital role in the identification and selection of players as well as planned for training (Ghosh et al, 1991).

Endurance exercise training improves plasma lipoprotein and lipid profiles and reduces cardiovascular disease risk (Atzmon et al., 2006). Lipids have important beneficial biological functions that include the use of triglycerides for energy production or as stored fat in adipose tissue and the use of cholesterol as a component, in conjunction with phospholipids of cellular membranes or in the synthesis of steroid hormones. Elevated plasma cholesterol concentrations have been implicated in the development of coronary artery disease (Kelley & Kelley, 2009). Carbohydrate is an important source of energy for high-intensity work as well as for prolonged activity. Lipids, on the other hand, cannot be used during high-intensity exercise, although they are an important source of energy in the recovery period between high-intensity bouts and, indeed, during prolonged aerobic exercise. Therefore, lipids cannot be used anaerobically; they require aerobic processes (MacLaren & Morton, 2011, 110).

Body composition has an important role for playing football (Gil et al, 2007). Since football is a physical contact sport and lots of movements and skills are involved

in playing the game, a high level of physical demand is required for match play (Hoff, 2005; Reilly, 2005). Body composition generally refers to the absolute amount of fat and nonfat tissue within the body as well as the ratio of fat to total body mass (Kraemer et al, 2011, 330). Body composition is not only influenced by genetic and environmental factors, but also affected by physical activity and nutritional factors (Wackerhage & Rennie, 2006).

The Body Mass Index (BMI) is currently the most often used parameter for evaluation of the nutritive status. The body mass index (BMI), is a heuristic proxy for estimating human body fat based on an individual's weight and height (Knutson, 2005). Normal values for adults range between 18.5 and 25 (kg/m^2) values under 18.5 (kg/m^2) indicate malnutrition, and values higher than 25 (kg/m^2) and up to 30 (kg/m^2) indicate overweight, while BMI higher than 30 (kg/m^2) indicates obesity (World Health Organization, 1995). Body mass index (BMI) is now the most widely used clinical standards to estimate obesity. To determine a person's BMI, body weight in kilograms is divided by the square of the body height in meters (Kenney et al, 2011, 547).

As in younger people, an endurance training program lasting several months can reduce body fat by up to 3 kg, or around 4% of body mass. Many people perform aerobic exercise to help maintain a healthy body weight and percentage body fat (Kraemer et al, 2011, 455). Most sports require a low body fat to optimize performance. Some sports have weight categories, and others, such as gymnastics and ballet, encourage a thin appearance for aesthetic reasons (Whyte, 2006, 199).

Skeletal muscle is a highly active tissue that contributes a great deal to resting metabolism. The quantity of skeletal muscle in your body is something that you can control to some extent through resistance training. Moderate to high-intensity resistance training performed two or three days per week for three to six months improves muscular strength and muscular endurance in men and women of all ages by 25% to 100% or more, depending on the training program and the initial level of physical conditioning (Bushman, 2011, 267, 283).

The amount of calories you burn on a daily basis is commonly referred to as total energy expenditure. Three major components contribute to total energy expenditure, the calories expended at rest, the calories expended during voluntary exercise, and the calories expended during the digestion, absorption, and storage of food after eating. The largest component, which accounts for about 60% to 70% of total energy expenditure, is the calories used while the body is resting comfortably, also known as resting metabolism rate (RMR) or basal metabolic rate (Bushman, 2011, 283).

Visceral fat accumulation is one of the risk factors of coronary heart disease. Visceral fat was reported to promote secretion of free fatty acid and decrease the insulin receptor sensitivity (Reaven, 1988). Also, if amounts of visceral fat accumulate, blood sugar, insulin secretion and serum triglyceride concentrations increase, so morbidity of diabetes mellitus, ischemic heart disease and apoplexy may appear (Poehlman & Horton, 1989). Aerobic training increases energy expenditure by activation of lipolysis. Therefore, aerobic training affects the reduction of weight and body fat, whereas resistance training affects the maintenance or increase in LBM (Ballor et al., 1988).

This study has been focused on the football players as the game is the most popular and widely played all over the world. The physiological, lipid profile and body composition variables have important roles in the evaluation of training and for assessment of the players' health as well as their metabolic and cardiovascular status. There are insufficient studies in Kurdistan region-Iraq, in this aspect particularly among soccer players under 20 years of age. In view of the above, the present study has been designed.

1.2. Statement of the problem

In the present study, the researcher had tried to observe the effects of 12 weeks aerobic and anaerobic training on some physiological, lipid profile and body composition variables of under 20 years old male football players, as we know that exercise plays a very vital role in the all-round development of a person. Therefore, on the basis of this the researcher wants to ascertain the effects, both positively and

negatively, of 12 weeks aerobic and anaerobic training on some physiological, lipid profile and body composition variables of under 20 years old male football players.

1.3. Significance of the Study

1. This study will provide information about the effect of 12 weeks aerobic and anaerobic training on some physiological, lipid profile and body composition variables of under 20 years old male football players.

2. The result of this study will help coaches and physical education teachers to understand the effects of 12 weeks aerobic and anaerobic training on some physiological, lipid profile, and body composition variables.

3. This study will help to increase the awareness about the physiological, lipid profile, and body composition variables, status of under 20 years old male football players.

4. This study will help to increase the information for coaches and physical educators about exercise biochemistry and exercise physiology.

5. This research will provide a base for the further research in the same field.

1.4. Delimitations

1. The study delimited to 24 male football players.

2. The study delimited to football players of age group under 20 years old.

3. The study delimited to male football players of Harir Youth and SportsCentre.

4. The study delimited to aerobic and anaerobic training.

5. The study delimited to recreational game and practice football game.

6. The study delimited to some physiological, lipid profile and body composition variables.

1.5. Limitations

1. All the subjects were from different socioeconomic background, therefore their interests and dietary habits were different, thus, the limitations of this study.

2. No Special devices or technique was used to motivate the subject for performing better during the experimental period. Therefore, their limitation was recognized by the research.

1.6. Hypothesis

1.6.1. Null hypothesis and alternative hypothesis

The null hypothesis (H_0) is used when there is no significant difference between groups and tests. If there is statistically no significant difference found, then P value is greater than 0.05, in this case the null hypothesis will be accepted and the alternative hypothesis will be rejected. Alternative hypothesis (H_1) is used when there is a significant difference between the groups and tests. If there is a statistically significant difference found, then P value is equal or less than 0.05, in the latter scenario the alternative hypothesis will be accepted and the null hypothesis will be rejected.

H_{01} : There is no significant difference between pre-test and post-test on selected lipid profile, body composition, and physiological variables of under 20 years old male football players of the experimental group.

H_{11} : There is a significant difference between pre-test and post-test on selected lipid profile, body composition and physiological variables of under 20 years old male football players of the experimental group.

H_{02} : There is no significant difference between pre-test and post-test on selected lipid profile, body composition and physiological variables of under 20 years old male football players of the control group.

H₁₂: There is a significant difference between pre-test and post-test onselected lipid profile,body composition and physiological variables of under 20 years old male football players of the control group.

1.7. Assumptions

1. It was assumed that all the subjects will take part actively in the training and tests of programs.

2. It was assumed that all the subjects will be well versed with the system of testing and will be provided with the knowledgeable about the equipment and instruments used in the tests.

3. It was assumed that the playground, equipment and tools are available will be of standard quality.

4. It was assumed that the instructional authorities will cooperate fully.

5. It was assumed all subjects regularly towards participation in the training program.

1.8. Objective of the Study

1. To prepare and design an optimum schedule of aerobic and anaerobic training for under 20 years old male football players.

2. To find out the effect of 12 weeks aerobic and anaerobic training program on some physiological, lipid profile and body composition variables of under 20 years old male football players.

3. To improve performance and developing physical fitness of the players.

4. To achieve better health aspect of the players.

1.9. Definition of Terms

Aerobic training: Aerobic training that improves the efficiency of the aerobic energy-producing systems and can improve cardio-respiratory endurance (Kenney et al, 2011, 573).

Anaerobic training: Anaerobic training that improves the efficiency of the anaerobic energy-producing systems and can increase muscular strength and tolerance for acid-base imbalances during high-intensity effort (Costill et al, 2012, 574). A high intensity exercise that can be sustained for not more than 30-60 second, such exercise depends predominantly on non-oxidative energy turnover (Bar-Or & Rowland, 2004, 387).

Physiological variables: Perceived exertion is related to heart rate, blood lactate, oxygen uptake, respiratory frequency, ventilatory volume and body temperature, among other factors. Some factors are characterized by linear growth of increases in intensity, for example heart rate, and some factors are characterized by a non-linear positive accelerating growth function (Armstrong, 2007, 355).

Lactate: A salt formed from lactic acid. Lactate dehydrogenase LDH is a key glycolytic enzyme involved in the conversion of pyruvate to lactate. Lactate threshold is the point during exercise of increasing intensity at which blood lactate begins to accumulate above resting levels, where lactate clearance is no longer able to keep up with lactate production (Wilmore & Costill, 2004, 706). Lactate threshold is defined as the velocity, power, heart rate, or VO₂max is resulting in a sustained increase in blood lactate above baseline values (Whyte, 2006, 236).

Maximum heart rate (HR_{max}): The highest heart rate value attainable during an all-out effort to the point of exhaustion (Costill et al, 2012, 707).

Cardio-respiratory endurance: Cardio-respiratory endurance is the ability of the heart and lungs to supply oxygen-rich blood to the working muscle tissues and the ability of the muscles to use oxygen to produce energy for movement (National Physical

Activity Guidelines, 2010). Cardio-respiratory endurance is an important part of overall physical fitness.

Lipid profile: The lipid profile is defined as the relationship between the blood concentrations of total cholesterol, TC, high-density lipoprotein cholesterol, HDL-C, low-density lipoprotein cholesterol, LDL-C, and triglycerides TG (Grundey et al., 2005).

Cholesterol: The most common type of steroid in the body. Cholesterol has a reputation for being associated with an increased risk for heart and blood vessel disease (medical term dictionary, 2015)

Triglycerides: the body's most concentrated energy source and the form in which most fats are stored in the body (Kenney et al, 2011, 589).

High density lipoprotein (HDL): A cholesterol carrier regarded as a scavenger; theorized to remove cholesterol from the arterial wall and transport it to the liver to be metabolized (Wilmore & Costill, 2004, 705).

Low-density lipoprotein (LDL): A cholesterol carrier theorized to be responsible for depositing cholesterol in the arterial wall (Kenney et al, 2011, 582).

Body Composition: Body composition refers to the makeup of your body. The body is made up of lean tissue (including muscle) and fat tissue. Typically, the focus of body composition is the relative amounts of muscle versus fat. Although the bathroom scale can help you track your overall body weight, this measurement is general and does not reveal the amount of fat compared to muscle. Excessive amounts of body fat relate to poor health outcomes, and this is especially true for fat around the abdominal area (Bushman, 2011, 17).

Body mass index (BMI): Body mass index is defined as the individual's body mass divided by the square of his or her height (kg/m^2) (Knutson, 2005).

Body fat:A class of organic compounds with a limited water solubility that exists in the body in many forms, such as triglycerides, free fatty acids, phospholipids, and steroids (Costill et al, 2012, 579).

Skeletal muscle:human skeletal muscle is a mosaic with mixed fiber types among individual muscles (Kenney et al, 2011, 290).

Resting metabolism:The term resting metabolism is actually a misnomer because the body is never truly at rest. Inside your body is a constant array of activity that must be fuelled at all times (Bushman, 2011, 283).

Visceral fat:Subcutaneous in the abdominal region, it is different fat found directly underneath the skin, which is referred to as subcutaneous fat (McArdle et al, 2011, 726; Omron health care, 2012, 8)

Football Players: Individual who is skilled enough to participate in the competitions of Football game and their age is under 20 years.

2. GENERAL INFORMATION

2.1. Exercise physiology

Exercise physiology is the science of human performance under physical stress and the relationships between physical activity and the structure and function of the human body. From an evolutionary point of view, exercise physiology helps us to have a better understanding about human adaptation capabilities, and it provides valuable insights into today's problems regarding the so called "lifestyle" diseases. To this end, it demonstrates the complex interactions between metabolism, thermoregulation, and the cardiovascular, respiratory, and muscular systems. Adaptation processes in human endurance and strength through exercise training or the lack thereof can be quantified via different means of ergometry, allowing for comparison of athletic performance using standardized parameters such as maximum oxygen consumption. Applied exercise physiology also helps us to have a better understanding about the limits of human performance, especially when that performance takes place under different environmental conditions (Gunga, 2014, 77,78)

2.1.1 Aerobic training

During a single bout of aerobic exercise, the human body precisely adjusts its cardiovascular and respiratory function to meet the energy and oxygen demands of actively contracting muscle. When these systems are challenged repeatedly, as happens with regular exercise training, they adapt in ways that allow the body to improve VO₂max and overall endurance performance. Aerobic training, or cardio-respiratory endurance training, improves cardiac function and peripheral blood flow and enhances the capacity of the muscle fibers to generate greater amounts of adenosine triphosphate ATP (Kenney et al., 2011, 248). Several important studies have suggested that aerobic exercise training should be a critical part of the recovery process. Aerobic exercise training can result in improved tolerance performing activity of daily living and allow more physical activity to be completed at a lower submaximal threshold, thus reducing myocardial oxygen demand (American College of Sports Medicine, 2009, 7).

Regular aerobic exercise profoundly improves long chain fatty acid oxidation, particularly from triacylglycerols within active muscle, during mild to moderate intensity exercise, illustrates how regular aerobic exercise affects oxidative response and the potential for tissue damage as well as protective adaptive responses (McArdle et al., 2010, 29, 52). Determination of aerobic exercise capacity is an important component for developing appropriate exercise programs and evaluating the effectiveness of the programming. Because of a significant loss of muscle function resulting from hemiparesis or hemiplegia, stroke survivors have severely reduced maximal or peak oxygen uptake (American College of Sports Medicine, 2009, 5). During intense aerobic exercise, intramuscular glycogen becomes the preferential energy fuel. This provides an advantage because glycogen supplies energy for exercise twice as rapidly as fat and protein (McArdle et al., 2010, 40). The aerobic exercise increases both metabolic heat production and the demand for blood flow and oxygen delivery to the working muscles. This excess heat can be dissipated only if blood flow increases to the skin (Kenney et al., 2011, 291).

When aerobic exercise begins, the oxygen transport system (respiration and circulation) does not immediately supply the needed amount of oxygen to active muscles. Oxygen consumption requires several minutes to reach the required (steady state) level at which the aerobic processes are fully functional, even though the body's oxygen requirements increase the moment exercise begins because oxygen needs and oxygen supply differ during the transition from rest to exercise. Most of the oxygen consumed during aerobic exercise is used in the mitochondria for oxidative phosphorylation and is reduced to water (Kenney et al., 2011, 123, 378). With prolonged aerobic exercise, or aerobic exercise in the heat, stroke volume gradually decreases and HR increases proportionally to maintain cardiac output. This is referred to as cardiovascular drift and is associated with a progressive increase in blood flow to the vasodilation skin and losses of fluid from the vascular space (Kenney et al., 2011, 192).

Regular aerobic exercise is associated with a decreased risk of cardiovascular disease in middle aged and older adults. The mechanisms by which regular aerobic

exercise favourably influences central and peripheral vascular function do not merely result from changes in other cardiovascular disease risk factors. Improvements in endurance that accompany regular daily, every other day, etc. aerobic training, such as running, cycling, or swimming, the result of multiple adaptations to the training stimuli. Some adaptations occur within the muscles themselves, promoting more efficient utilization of oxygen and fuel substrates. Still other important changes occur in the cardiovascular system, improving circulation to and within the muscles. Aerobic adaptations to training generally occur independently of gender and age (Kenney et al., 2011, 248, 456).

Low intensity aerobic training would allow the body to use more fat as the energy source, hastening the loss of body fat. Indeed, the body uses a higher percentage of fat for energy at lower exercise intensities. However, the total calories expended do not necessarily change as a result of the body's use of fat. Low intensity aerobic exercise burns no more fat than more vigorous exercise, and more total calories are spent in a more strenuous workout (Kenney et al., 2011, 563-565). "Adaptations to aerobic training are an increase in maximum cardiac output without any cardiac structural changes" (Woolf-May, 2006, 29). More specifically, during aerobic exercise both heart rate and stroke volume increase to achieve a greater cardiac output (Smith & Fernhall, 2011, 196).

2.1.2. Anaerobic training

When exercise begins, regardless of how light or heavy it is, there is an immediate need for additional energy. Thus, the most obvious exercise response is an increase in metabolism. All three energy systems are involved in this response, their relative contributions being proportional to the intensity and duration of the activity. Activities of the very short term, high intensity anaerobic exercise from a few seconds to approximately 3 minutes depend on high power, anaerobic energy and are often supramaximal (Plowman & Smith, 2013, 7 - 68).

High intensity exercise requires the rapid re-synthesis of ATP to provide energy for muscular contraction. The demand for ATP and energy exceeds the rate at which oxygen delivery and consumption can support oxidative energy production. Consequently, a large part of the total energy demand is derived from anaerobic sources. While the oxidative pathway provides a relatively efficient but slow resynthesis of ATP, the anaerobic pathways are relatively fast. There is, however, a limit to the energy yield from the anaerobic pathways during maximal exercise (Gregory Whyte, 2006, 93).

Unfortunately, there is no generally accepted means by which directly measures the contribution of anaerobic energy to exercise. Two general approaches are used, however, to describe the anaerobic exercise response. One approach describes changes in the chemical substances either used in lactic anaerobic metabolism (specifically, ATP and PC levels) or produced as a result of lactic anaerobic metabolism (lactate). The second approach quantifies the amount of work performed or the power generated during short-duration, high-intensity activity. The assumption is that such activity could not be done without anaerobic energy. Therefore, measuring such work or power indirectly measures anaerobic energy utilization and provides an indication of anaerobic capacity (Plowman & Smith, 2013, 64).

“Carbohydrate provides the main energy nutrient for short-duration and for anaerobic exercise” (McArdle et al., 2010, 96). Anaerobic sources supply most of the energy for fast movements and during increased resistance to movement at a given speed. Also, when the movement begins at either fast or slow speed, at the short duration extreme of maximum effort, the intramuscular Phosphagen supplies the major energy for the exercise. The ATP-PC and lactic acid systems contribute about one-half of the energy required for best effort exercise lasting two minutes, aerobic reactions contribute the remainder (McArdle et al., 2010, 193).

Accordingly, researchers have tried to establish a time course for recovery. It has been shown that heart rate and blood pressure will return to baseline values in the hour following exercise. After intensive aerobic exercise, 10–48 hours are required for the

body to replenish glycogen stores depending on intensity and duration of exercise, whereas 5–24 hours would usually be needed for glycogen replenishment after anaerobic exercise (Gregory Whyte, 2006, 17).

2.1.3. Physiological variables

Physiological variables are affected by training conditions; an exercise response is the pattern of change in physiological variables during a single acute bout of physical exertion. A physiological variable is any measurable bodily function that changes or varies under different circumstances. Just as all physiological variables do not adapt at the same rate, therefore all physiological variables do not reverse at the same rate, the timeline for detraining is different for different physiological variables (Plowman & Smith, 2013, 5, 11, 20, 21).

Most physiological variables that are normally measured during exercise are similarly influenced by environmental fluctuations. Whether one is comparing a person's exercise results from one day to another or comparing the responses of two different subjects, all of these factors must be controlled as carefully as possible. Physiological responses, both at rest and during exercise, also vary throughout the day. The term diurnal variation refers to fluctuations that occur during a 24 hour-day. If you are testing a person in the morning on one day and in the afternoon on the next can and will produce different results. Test times must be standardized to control for this diurnal effect (Costill et al., 2011, 18-19).

2.1.3.1. Multistage 20 meter shuttle run test

A maximal multistage 'twenty-meter shuttle-running test' has already been developed to estimate maximal oxygen uptake (VO₂ max). This field test requires little equipment or expertise, can be performed simultaneously by several subjects, and is widely used in physical education lessons. 20 m shuttle run test consisted of running back and forth between two lines 20 m apart following a pace dictated by recorded beeps. All the subjects ran together up to a maximum of 30 in total. The initial running

speed was set at 8.0 km/h and increased by 0.5 km/h every minute. An adult person pacer ran with the subjects during the whole test. This starting speed and the use of a 'pacer' were chosen because of the young age of the participants. The increase in speed occurred every minute and was signaled by a tone. If a subject reached the line before the beep, the subject was to wait for the beep before continuing the run. If the line was not reached before the beep, the subject was given a warning and was to continue running up to the line, then to turn back and try catching up with the pace. The test was stopped at one end, when the subject failed to reach the line for two consecutive times speed increases. The hall was split into three lanes with a band and children were divided into three groups for the test. Since many halls were too small, the wall was set as one of the lines for changing direction instead of a line on the ground. The total number of lanes was measured. The qualified testing person explained and demonstrated the tests, surveyed the execution and measured the results of the tests. In the shuttle run, one qualified testing person at each lane monitored the execution of the test, allowed the children to only turn back at the line and stopped children after failure (Leger & Lambert, 1982).

In this study, researcher modify a similar test mentioned above (3 minute multistage 20 meter shuttle run) without using beep and counting the number of shuttles during three minutes for indirect measure cardio-respiratory endurance. It was administered outdoors on artificial football surface.

2.1.3.2. Blood lactate

The term lactate threshold and onset of blood lactate accumulation. However, it has different meanings. Lactate threshold is defined as the exercise intensity at which blood lactic acid begins to accumulate above the resting concentration. In untrained individuals, lactate threshold occurs in approximately 50% to 60% of maximal oxygen consumption. Endurance trained individual lactate threshold occurs in approximately 65% to 80% of maximal oxygen consumption, which allows the performance of higher exercise intensity without an increase in blood lactic acid concentration. This is

important for endurance performances because the lactate threshold represents the exercise intensity or race pace that can be maintained for a long period. It should be noted that the increased lactic acid concentration in blood and muscle may not be the direct cause of increased the acidity. Rather, the increase in acidity may be more related to an inability to maintain ATP synthesis from ADP and Pi. Recall that ATP breakdown produces a hydrogen ion, whereas its synthesis consumes a hydrogen ion. As exercise intensity increases, so does acidity, because increasing amounts of ATP are hydrolyzed, however active muscles experience difficulties in re-synthesizing it, resulting in an accumulation of hydrogen ions (Butler et al, 2003; Geusen & Dinant, 2007). Regardless of the cause, increased acidity affects the ability of muscle to generate force and power because, among other things, increased acidity affects the sarcoplasmic reticulum's ability to release and sequester calcium, impairs the binding of calcium to troponin, and decreases myosin ATPase activity (Butler et al, 2003).

Lactate threshold is of interest to endurance athletes because it has been shown that as lactate threshold increases, or occurs at a higher intensity, so does endurance performance, with significant correlations between lactate threshold and endurance performance being demonstrated (Eckel et al., 2005).

Measures of blood lactate are more reliable indicators of changes in aerobic fitness, since blood lactate accumulates at higher levels of exertion and at a slower rate with increasing aerobic fitness (Woolf-May, 2006, 158). During exercise, the heart uses lactate to produce ATP, the uptake of lactate by the heart increases as a function of arterial lactate levels. Thus, as exercise intensity increases and lactate levels in the blood increase, the heart relies more heavily on lactate oxidation to produce ATP (Smith & Fernhall, 2011, 54). Specific sprint power, anaerobic training produces high blood lactate levels during maximal exercise, which then decrease when training ceases. Sprint power athletes often achieve 20% to 30% higher blood lactate levels than untrained counterparts during maximal short duration exercise (McArdle et al., 2010, 187).

The lactate content of the blood is a parameter of great importance; this content is measured in mmol/L of lactate per litre of blood. Healthy persons at rest have value 1 and 2 mmol/L, and strenuous exercise increases this value. Even slight increases in lactate content 6 to 8 mmol/L, may impair an athlete's coordination. Regularly high lactate values impair aerobic endurance capacity. During European football, maximum lactate value is reached between 15 and 24 mmol/L, this high lactate value requires a minimal recovery time of 48 hours. During this period, the risk of injuries is very high, and technical skills cannot be trained, because coordination is disturbed (Janssen, 2001, 107,167).

2.1.3.3. Heart rate

Heart rate (HR) is one of the physiological parameters most frequently assessed by physicians in daily practice and simple heart rate measurement by pulse (Camm & Tendra, 2006, 10). In training practice heart rate often is used as the standard for exercise intensity, therefore heart rate can be a good indicator of training intensity. An optimal endurance training workout takes place at an intensity that activates the entire oxygen transport system (Janssen, 2001, 25).

For each person, heart rate and oxygen consumption relate linearly over a large range of exercise intensities. From this intrinsic relationship, the exercise heart rate provides an estimate of oxygen consumption during aerobic exercise. This approach has proved useful when the oxygen consumption could not be measured during the actual activity (McArdle et al, 2010, 203).

Heart rate monitoring is one of the most convenient and most effective ways of training. You're on your way of becoming better conditioned in a more time efficient manner. When you understand your heart rate, learn how to measure it, and have a reliable monitor, you are on your way to a scientifically designed exercise program, individualized just for you, that will guarantee results. Modern technology has produced a wide selection of affordable heart rate monitors. They provide instant, reliable

feedback about your body's response to your chosen exercise and intensity (Benson & Connolly, 2011, 9).

2.1.3.3.1. Maximum Heart rate

Maximum heart rate is the fastest, highest number of times the heart can beat in a minute. The maximum heart rate does not really change as a result of training, but all your training zones are calculated from that number. Therefore, you need an accurate maximum heart rate. Maximum heart rate numbers will be different for each activity. Therefore, you will need a true maximum heart rate for each activity. Incorrect heart rate information can be observed from two reasons. The first is incorrect training zone numbers. This might be the case if your predicted maximum heart rate (MHR) is different from your actual MHR. Also, the monitor itself may be displaying erroneous numbers because of poor contact or other technical problems. Awareness of the origin of the error usually leads to an easy fix (Benson & Connolly, 2011, 20, 16, 47). The maximum heart rate has commonly been estimated as 220 minus age in years, with values independent of race or gender in children and adults (McArdle et al., 2010, 473).

2.1.4. Lipid profile

The inclusion of elevated lipids as a primary risk factor needs to be further defined. For many years, cholesterol and triglycerides were the only lipids observed in these epidemiological studies. The public was confused by conflicting data and opinions about the role of lipids in the development of atherosclerosis. More recently, scientists studied the manner in which lipids are transported in the blood. Lipids by themselves are insoluble in blood, so they are packaged with a protein to allow transport through the body. Lipoproteins are the proteins that carry the blood lipids. Two classes of lipoproteins of major concern for CHD are low-density lipoprotein (LDL) and high density lipoprotein (HDL). High levels of low-density lipoprotein cholesterol (LDL-C) and low levels of high-density lipoprotein cholesterol (HDL-C) place a person at extremely high risk of having a heart attack at a relatively young age to under age 60.

Conversely, a high level of (HDL-C) and a low level of (LDL-C) place a person at an extremely low risk (Kenney et al., 2011, 530, 531).

Lipids and lipoproteins are risk factors for coronary heart disease. It has been demonstrated that high levels of serum total cholesterol (TC), triglycerides (TG), LDL cholesterol, low concentration of (HDL) cholesterol, and increased body mass index (BMI) are significantly associated with coronary heart disease (George & Ludvik, 2000). Increased levels of triglyceride (TG), total cholesterol (TC), LDL cholesterol, and decreased levels of (HDL) cholesterol are documented as risk factors for atherogenesis as HDL cholesterol is associated with cholesterol removal from peripheral tissues. Excessive caloric intake, with higher component of fat, is associated with an increased serum level of total cholesterol (TC) and LDL cholesterol (Rizvi & Nagra, 2013). Lipids cannot be used anaerobically, they require aerobic processes. Lipids are Importance for energy sources during exercise of increasing intensity. Lipids are unable to be used as an energy source for intense bouts of activity (MacLaren & Morton, 2011, 110).

2.1.4.1. Total cholesterol

At birth, total cholesterol levels are approximately 70 mg-dl, during the first few weeks, the level of TC rises rapidly to between 100 and 150 mg-dl. By two years and until adulthood, the average value for males is about 160 mg-dl. In general, cholesterol levels do track from childhood to adulthood, although not all children with high juvenile levels of cholesterol will have elevated adult levels (Plowman & Smith, 2013, 475).

Cholesterol, the most widely known derived lipid, exists only in animal tissue and from a dietary viewpoint classifies as a lipid. Cholesterol does not contain fatty acids; instead, it shares some of lipid's physical and chemical characteristics. High levels of total serum cholesterol and the cholesterol rich LDL molecule are powerful predictors of increased risk for coronary artery disease (McArdle et al., 2010, 25, 27). The serum cholesterol concentration relates strongly to the risk for atherosclerosis (Mougios, 2006, 290).

2.1.4.2. Triglycerides

The major lipid components in the blood are triglycerides. Triglycerides, the predominant fat content in the body, Triglycerides are compound structures of glycerol and three fatty acids. Triglycerides stored in adipose tissue must first be broken down into glycerol and free fatty acids before they can be used as fuel. One glycerol and three fatty acids make up a triglyceride. The breakdown of triglycerides into glycerol and fatty acids is catalyzed by the enzyme hormone-sensitive lipase. The glycerol is soluble in blood, but the free fatty acids are not. Triglycerides stored in adipose cells or stored intramuscularly are the major storage form of energy in humans. Triglycerides are composed of fatty acids and glycerol. Muscle cells can only use fatty acids as a fuel (Plowman & Smith, 2013, 43, 52). Triglycerides are major energy sources. Triglycerides are stored in fat cells and between and within skeletal muscle fibers. To be used for energy, a triglyceride must be broken down to its basic unit's one molecule of glycerol and three FFA molecules. This process is called lipolysis, and it is carried out by enzymes known as lipases. Free fatty acids are the primary energy source for fat metabolism. Once liberated from glycerol, FFAs can enter the blood and be transported throughout the body, entering muscle fibers by either simple diffusion or transporter mediated. Their rate of entry into the muscle fibers depends on the concentration gradient. Increasing the concentration of FFAs in the blood increases the rate of their transport into muscle fibers (Kenney et al., 2011, 60).

2.1.4.3. High density lipoprotein (HDL)

High density lipoproteins (HDL) are the smallest and the densest of all plasma lipoproteins. They consist of several distinct subpopulations of particles of varying size, shape, density, surface charge, and composition. Large-scale epidemiological studies and studies in animals have identified an inverse relationship between HDL levels and the incidence of cardiovascular disease. In addition to preventing atherosclerotic lesion progression, the results of animal studies indicate that HDL also has the capacity to mediate lesion regression. The cardio-protective properties of HDL have been attributed

to several processes. The best understood of these involves their ability to accept cholesterol from peripheral cells, including macrophages in the artery wall, in the first step of the reverse cholesterol transport pathway. HDL also inhibits LDL oxidation, enhance endothelial repair, and improve endothelial function. In addition, HDL display antithrombotic and anti-inflammatory properties and have recently been shown to inhibit the activation and binding of monocytes to the endothelium (Schaefer, 2010, 56).

High density lipoprotein (HDL-C) is a lipoprotein in blood plasma composed primarily of protein and a minimum of cholesterol or triglyceride. The purpose of HDL is to transport cholesterol from body tissues to the liver, where the cholesterol can be broken down and eliminated in the bile. Because HDL transports cholesterol it is abbreviated HDL-C. Some speculate that HDL-C may also block or in some way interfere with the deposition of cholesterol in the arterial wall lining. The major apolipoprotein of HDL-C is called Apo-A1. High-density lipoproteins (HDL) may block cholesterol uptake at the cellular or tissue level. HDL definitely carries cholesterol away from the sites of deposit to the liver, where the cholesterol can be broken down and eliminated in the bile (Plowman & Smith, 2013, 457). High levels of HDL cholesterol (>60 mg/dl or 1.6 mmol/l) are protective of CHD, and low levels (<40 mg/dl or 1.0 mmol/l) are a significant CHD risk factor (Schaefer, 2010, 12).

2.1.4.4. Low density lipoprotein (LDL)

Low density lipoproteins (LDLs) are mainly produced from the conversion of VLDLs to intermediate density lipoproteins (IDLs) to LDLs. LDLs have a molecular weight of about 2×10^6 Daltons, a diameter of 18–25 NM, a plasma density of 1.019–1.063 g/ml, and migrate in the beta region on lipoprotein electrophoresis. These particles are rich in cholesterol ester (about 40% by weight in the core of the particle) and contain about 5% triglyceride. On their surface, these particles contain about 25% protein, 10% free cholesterol, and 20% phospholipids (Schaefer, 2010, 23).

LDL is composed of protein, a small portion of triglyceride, and a large portion of cholesterol. LDL transports 60–70% of the total cholesterol in the body to all cells

except liver cells, hence the abbreviation LDL-C. The major Apolipoprotein of LDL is called upon-B. As mentioned earlier, LDL-C is involved in the formation of atherosclerotic plaque (Plowman and Smith, 2013, 457). Low density lipoproteins (LDL) accumulate in the area of the lesion and the lipids they carry become partially oxidized, probably by the action of reactive oxygen species and free radicals such as superoxide produced by leukocytes (Reed, 2009, 165). It is known that low density lipoprotein (LDL) cholesterol can be deposited in the artery wall, especially at sites of damage. Therefore, high levels of LDL cholesterol (>160 mg/dl or 4.2 mmol/l) associated with high total cholesterol values (>240 mg/dl or 6.2 mmol/l) are a significant risk factor for CHD (Schaefer, 2010, 12).

2.1.5. Body composition

Technological advances in recent decades have increased the range of opportunities through which the human body can be assessed. However, implementation of the tools available to all populations in the same way may not always be appropriate. Children are not miniature adults. Therefore, while the needs of children and adolescents may be similar to those of adults in many ways, it is important always to be mindful of the differences that exist. This is particularly the case when assessing body composition of individuals of varying ages, ethnic backgrounds, and health status. Body composition refers to the characteristic size and distribution of the component parts of total body weight. Body composition analysis involves subdividing body weight into two or more compartments according to the elemental, chemical, anatomical, or fluid components. The assessment of body composition has traditionally been based on the two-compartment model in which the body is divided into fat mass (FM) and fat-free mass (FFM) (Hills et al., 2011).

Traditional simple approaches in body composition assessment include the use of body stature and body mass as indices of obesity and using the two-component system of estimating fat and lean body mass for describing body composition changes associated with children's growth and development. The development of better

approaches to body composition assessment will lead to an improved understanding of growth and development and the effects of exercise and dietary restriction on body composition. In addition, further research may help provide sound criteria for the validation of new methods of assessment (Jürimäe & Hills, 2001).

2.1.5.1. Body mass index

Body mass index (BMI) is a number calculated from a person's weight and height. BMI is a reliable indicator of body fatness for people. BMI does not measure body fat directly, but researches shown that BMI correlates direct measure of body fat. BMI is used as a screening to identify possible weight problem for adults (Omron health care, 2012, 7).

BMI is perhaps the most common anthropometric measure used to predict relative overweight. However, the value of the measurement in children and adolescents is regularly questioned. The natural course of growth and maturation in children, plus the individual variability during the same period mean that indices of weight-for-height, including the BMI (W/H^2) are not very good indices of adiposity. In children younger than 15 years of age, BMI is not totally independent of height and thus should be used with caution. Examined the value of various weight-for-height indices and found that BMI was the most useful. However, in pediatric populations there is a correlation with height that is not noted in adult populations. BMI was found to correlate less strongly with the triceps skinfold measure at younger ages (Hills et al., 2011).

2.1.5.2. Body fat

Body fat serves a vital role in storing energy and protecting the internal organs. We carry two types of fat in our bodies. First, essential stored in small amounts in the body, and second stored fat, which is stocked for energy during physical activity. While too much body fat may be unhealthy, having too little fat can be just as unhealthy. Also, the distribution of body fat in men and women is different, so the basis for classifying the body fat percentage is different between the genders (Omron health care, 2012, 7).

Energy is available from fat at 150 lbs. A person with 15% body fat has approximately 22.5 lbs of fat. Each pound of fat contains approximately 3,500 kcal. Assuming it requires approximately 100 kcal to run one mile, this individual theoretically contains the energy in body fat alone to run almost 800 miles (Kraemer et al, 2011, 44). Maximal whole body fat oxidation during exercise is not affected by an increase in either the oxygen delivery capacity of the blood or the capacity to oxidize fat from the mitochondria in healthy males (Guadalupe et al, 2014). Individuals who are overweight from an excess of body fat, but who are not obese incur mild to moderate health risks. Individuals who are obese possess an excess of body fat that represents a significant health risk (Plowman & Smith, 2013, 211).

2.1.5.3. Skeletal muscle

Skeletal muscle is the type of muscle that we can see and feel. When you work out to increase muscle mass, skeletal muscle is being exercised. Skeletal muscle attaches to the skeleton and come in pairs, one muscle to move the bone in one direction and another to move it back the other way. The increasing skeletal muscle will increase your body's energy requirement. The more muscle you have, the more calories your body will burn. Building skeletal can help prevent "rebound" weight gain. The maintenance and increase of skeletal muscle are closely linked resting metabolism rate (Omron heart rate, 2012, 10).

Each kilogram (kg) of skeletal muscle stores approximately 5 mmol of ATP and 15 mmol of PC. For a person with 30 kg of muscle mass, this amounts to between 570 and 690 mmol of phosphagens. If physical activity activates 20 kg of muscle, then stored Phosphagen energy could power a brisk walk for 1 minute, a slow run for 20 to 30 seconds, or all-out sprint running and swimming for about 6 to 8 seconds (Katch et al, 2011, 186).

2.1.5.4. Resting metabolism

Regardless of your activity level, a minimum level of caloric intake is required to sustain the body's every function. Known as the resting metabolism, this indicates how many calories you need to ingest in order to provide enough energy for your body to function (Omron health care, 2012, 9).

Inside your body is a constant array of activity that must be fuelled at all times. For example, your heart beats about 70 times per minute, your neurons fire at light speed 24 hours per day and your white cells are constantly fighting the invaders and replacing old or damaged tissue. All of these activities that keep you alive and allow you to look basically the same from one day to the next are exceedingly costly from an energy standpoint. So, your resting metabolism is essentially what makes you "you," and the more of "you" there is, the greater your RMR is. Thus, it is not surprising that RMR is highly related to body mass, particularly the amount of muscle you have. Skeletal muscle is a highly active tissue that contributes a great deal to resting metabolism (Bushman, 2011, 283).

2.1.5.5. Visceral fat

Visceral fat is found in the abdomen and surrounding vital organs. It is different fat found directly underneath the skin, which is referred to as subcutaneous fat. Visceral fat can go largely unnoticed because it's not visible to the naked eye. One way visceral fat can be seen is through Magnetic Resonance Imaging. Too much visceral fat is thought to be closely linked to increased levels of fat in the bloodstream, which may lead to conditions such as high cholesterol, heart disease and type 2 diabetes. In order to prevent or improve these conditions, it is important to try to reduce the amount of visceral fat levels to an acceptable level (Omron health care, 2012, 8).

In obese adults with no metabolic disorders, there is a significant relationship between aerobic exercise training and visceral fat reduction, and that although the visceral fat reduction is significantly related to weight reduction during the aerobic

exercise training, a significant reduction in visceral fat can occur without significant weight loss. Moreover, there is a dose-response relationship between the amount of aerobic exercise and the amount of visceral fat reduction (American College of Sports Medicine, 2009).

2.2. Review of related literature

Adequate and modern facilities are the vital importance in physical education program. So much research work has been done in this field. The researcher in this chapter made every effort to locate and collect the literature relevant to the study, however, there was very little he could locate and collect from the different library sources.

A study of relevant literature is an essential step to get a full picture of what has been done with regard to the problem under study. Such review brings about a deep and clear perspective of the overall field.

Hence the research, researcher mentions below the various sources the review the related literature available in the Near East university library and few from other sources are presented in abstract in this chapter to provide the variable background material for this study.

Familiarity with the literature related to any problem helps the researcher to discover what is already known, what others have attempted to find out, what methods of approach have been promising or disappointing and what problems remain to be solved. The review would enable the investigator to have a profound insight. Clear perspective and a better understanding of a chosen problem and various factors are connected with the study.

The researcher has attempted in this chapter to locate the literature related to this study. The relevant studies taken from a World Wide Web site and other sources, which the research, researcher has come across, are cited below.

(Giannaki et al., 2015) Eight weeks of a combination of high intensity interval training and conventional training reduce visceral adiposity and improve physical fitness: a group-based intervention.

High intensity interval training (HIIT) has been recently promoted as an effective, low volume and time--efficient training method for improving fitness and health related parameters. The aim of the current study was to examine the effect of a combination of a group--based HIIT and conventional gym training on physical fitness and body composition parameters in healthy adults. Thirty nine healthy adults volunteered to participate in this eight--week intervention study. Twenty three participants performed regular gym training 4 days a week (C group), whereas the remaining 16 participants engaged twice a week in HIIT and twice in regular gym training (HIIT--C group) as the other group. Total body fat and visceral adiposity levels were calculated using bioelectrical impedance analysis. Physical fitness parameters such as cardio-respiratory fitness, speed, lower limb explosiveness, flexibility and isometric arm strength were assessed through a battery of field tests. Both exercise programs were effective in reducing total body fat and visceral adiposity ($p < 0.05$) and improving handgrip strength, sprint time, jumping ability and flexibility ($p < 0.05$) whilst only the combination of HIIT and conventional training improved cardio-respiratory fitness levels ($p < 0.05$). A between of group changes analysis revealed that HIIT--C resulted in significantly greater reduction in both abdominal girth and visceral adiposity compared with conventional training ($P < 0.05$). Eight weeks of combined group--based HIIT and conventional training improve various physical fitness parameters and reduce both total and visceral fat levels. This type of training was also found to be superior compared with conventional exercise training alone in terms of reducing more visceral adiposity levels. The group--based HIIT may consider as a good method for individuals who exercise in gyms and craving to acquire significant fitness benefits in a relatively short period of time.

(Manna and Khanna, 2013) Effect of Training on Selected Biochemical Variables of Elite Male Swimmers

The aim of the present study was to find out the effect of training on biochemical variables of elite male swimmers. A total of 60 Indian elite male swimmers (age: 17.33 ± 1.47 yrs; height: 173.08 ± 5.80 cm; body mass: 68.11 ± 5.02 kg) who regularly participate in competitive swimming volunteered for this study. A well-designed training program for the swimmers was employed for 12 weeks. The training sessions were divided into 2 phases (a) Preparatory Phase (PP, 8 weeks) and (b) Competitive Phase (CP, 4 weeks). Each phase was further subdivided into macro cycles and micro cycles, and were completed 4 HR/d; 5 d/wk. Selected variables were measured at zero level (baseline data, BD) and at the end of the preparatory phase (PP) and competitive phase (CP) of training. A significant increase ($P < 0.05$) in serum urea, uric acid, high density lipoprotein cholesterol (HDL-C) was observed after training. On the other hand, a significant reduction ($P < 0.05$) in resting and peak blood lactate, hemoglobin, total cholesterol (TC), triglyceride (TG) and low density lipoprotein cholesterol (LDL-C), TC/HDL and LDL/HDL were noted after the conclusion of training. The training program was effective for improving selected lipid profile parameters for swimmers, and may be employed for monitoring training.

(Manna et al., 2012) Effect of training on anthropometric, physiological and biochemical variables of U-19 volleyball players

The effect of training on anthropometric, physiological and lipid profile variables of Indian male Under 19 year old volleyball players was aimed in the present study. A total of 30 Indian male volleyball players (age range: 16.00-18.99 yr; mean age: 17.7 ± 0.5 yr) regularly playing competitive volleyball volunteered for this study. The training sessions were divided into 2 phases (a) Preparatory Phase (PP, 8 weeks) and (b) Competitive Phase (CP, 4 weeks). The training program consist of aerobic, anaerobic and skill development, and were completed 4 hrs/day; 5 days/weeks. Selected variables were measured at zero level (baseline data, BD) and at the end of PP and CP. A

significant increase ($P < 0.05$) in anaerobic power, back and grip strength, serum urea and HDL-C; and significant decrease ($P < 0.05$) in body fat, recovery heart rate, haemoglobin, triglyceride and LDL-C were noted after training. No significant change was observed in stature, body mass, LBM, HR_{max} , VO_{2max} , uric acid and total cholesterol level of the players after the training. This would enable the coaches to assess the current status of an athlete and the degree of training, adaptability and provide an opportunity to modify the training schedule accordingly to achieve the desired performance. Many terminologies have been given to dysplastic hepatocellular nodules, which are preneoplastic lesions. In 1995, the International Working Party meeting established the nomenclature and body composition criteria for hepatocellular nodular lesions. Nevertheless, an unequivocal differential diagnosis is sometimes difficult, particularly among large regenerative nodules, dysplastic nodules and hepatocellular carcinoma. Angiogenesis are observed during hepatocarcinogenesis and the presence of the isolated arteries may help to discriminate these nodules. The relevance of the International Working Party histological variables and the presence of the isolated arteries were analyzed with regard to the diagnosis of large regenerative nodules, low and high grade dysplastic nodules and hepatocellular carcinoma, in order to evaluate which have a real contribution in such diagnoses. One hundred and seven nodular hepatocellular lesions over 5 mm (or smaller nodules with a different colour) from explanted cirrhotic livers were analyzed and classified following the criteria of the International Working Party. Classifications were as follows: large regenerative nodules, low grade dysplastic nodules, high grade dysplastic nodules and hepatocellular carcinoma. The presence of isolated arteries (not related to the portal tracts or fibrosis) was verified for the nodules. Among the 107 nodular lesions studied, 17 were classified as large regenerative nodules, 38 as low grade dysplastic nodules, 28 as high grade dysplastic nodules and 24 as hepatocellular carcinoma. The most relevant International Working Party variables in the differential diagnosis of the nodules were cellularity, trabeculae thickness, cytoplasmic staining, nuclear atypia, pseudoacinar pattern, portal tracts, nucleocytoplasmic ratio and mitosis. The isolated arteries, identified by haematoxylin and eosin staining, were important discriminating between two groups: low grade

lesions (large regenerative nodules/low grade dysplastic nodules) and high grade lesions (high grade dysplastic nodules/hepatocellular carcinoma) ($P < 0.001$). The International Working Party criteria allow for the classification of the majority of hepatocellular nodules. However, other features such as cytoplasmic nuclear affinity and pseudoacinar pattern may contribute to these diagnoses. The finding of isolated arteries in a nodular lesion should be investigated carefully, since the nodule could be a dysplastic lesion or hepatocellular carcinoma.

(Lemmer et al., 2001) Effect of strength training on resting metabolic rate and physical activity: age and gender comparisons

The purpose of this study was to compare age and gender effects of strength training (ST) on resting metabolic rate (RMR), energy expenditure of physical activity (EEPA), and body composition. RMR and EEPA were measured before and after 24 wk of ST in 10 young men (20-30 yr), 9 young women (20-30 yr), 11 older men (65-75 yr), and 10 older women (65-75 yr). When all subjects were pooled together, absolute RMR significantly increased by 7% (5928 ± 1225 vs 6328 ± 1336 KJ. d⁻¹, $P < 0.001$). Furthermore, ST increased absolute RMR by 7% in both young (6302 ± 1458 vs 6719 ± 1617 KJ x d⁻¹, $P < 0.01$) and older (5614 ± 916 vs 5999 ± 973 KJ x d⁻¹, $P < 0.05$) subjects, with no significant interaction between the two age groups. In contrast, there was a significant gender x time interaction ($P < 0.05$) for absolute RMR with the men increasing RMR by 9% (6645 ± 1073 vs 7237 ± 1150 KJ x d⁻¹, $P < 0.001$), whereas women showed no significant increase (5170 ± 884 vs 5366 ± 692 KJ x d⁻¹, $P = 0.108$). When RMR was adjusted for fat-free mass (FFM) using ANCOVA, with all subjects pooled together, there was still a significant increase in RMR with ST. Additionally, there was still a gender effect ($P < 0.05$) and no significant age effect ($P = \text{NS}$), with only the men still showing a significant elevation in RMR. Moreover, EEPA and TEE estimated with a Tritrac accelerometer and TEE estimated by the Stanford Seven-Day Physical Activity Recall Questionnaire did not change in response to ST for any group. In conclusion, changes in absolute and relative RMR in response to ST are influenced by gender but not age. In contrast to what has been suggested previously,

changes in body composition in response to ST are not due to changes in physical activity outside of training.

(Manna et al 2009), Training induced changes on physiological and biochemical variables of young Indian field hockey players

The present study aims to find out the training induced changes on different physiological and biochemical parameters in young Indian field hockey players. A total of 30 Indian male field hockey players (age range 14-16 yrs) regularly playing competitive field hockey were selected; a training program consists of aerobic and anaerobic exercise were followed for 6 weeks and 12 weeks respectively. Results showed a significant decrease ($P<0.05$) in body fat, and a significant increase ($P<0.05$) in LBM following both 6 weeks and 12 weeks of training. Strength of backs and handgrip muscles were also increased significantly ($P<0.05$) after the training. Significant reduction ($P<0.05$) in heart rates during sub-maximal exercises, maximal exercises and recoveries were noted after both the training program. Moreover, significant increase ($P<0.05$) in aerobic capacity and anaerobic power were observed after the training. Further, significant reductions ($P<0.05$) were noted in hemoglobin, total cholesterol, triglyceride and LDLC after the training. On the other hand plasma levels of urea, uric acid and HDLC were increased significantly ($P<0.05$) following the training. The present study showed a decrease in body fat and the plasma levels of cholesterol as well as LDLC and an increase in HDLC, which is beneficial for good health and better performance. However, reduction in hemoglobin and an increase in plasma urea and uric acid may be due to increased training load. Since the data on field hockey players are limited in India, therefore the present study may provide useful information to the coaches to develop their training program.

(Kirkendall et al., 1998) studied The Effects of Aging and Training on Skeletal Muscle

Aging results in a gradual loss of muscle function, and there are predictable age-related alterations in skeletal muscle function. The typical adult will lose muscle mass

with age; the loss varies according to sex and the level of muscle activity. At the cellular level, muscles lose both cross-sectional area and fiber numbers, with type II muscle fibers being the most affected by aging. Some de-enervation of fibers may occur. The combination of these factors leads to an increased percentage of type I fibers in older adults. Metabolically, the glycolytic enzymes seem to be little affected by aging, but the aerobic enzymes appear to decline with age. The aged skeletal muscle produces less force and there is a general “slowing” of the mechanical characteristics of muscle. However, neither reduced muscle demand, nor the subsequent loss of function is inevitable with aging. These losses can be minimized or even reversed with training. Endurance training can improve the aerobic capacity of muscle, and resistance training can improve central nervous system recruitment of muscle and increase muscle mass. Therefore, physical activity throughout life is encouraged to prevent much of the age-related impact on skeletal muscle.

3. MATERIAL AND METHOD

In this chapter, population and sampling of the study, the material and Methodology adopted for the selection of test, administration of training programs, experimental design, collection of data and statistical procedure employed will be explained.

3.1. Population and sampling

3.1.1. Population

All the male football players in Harir youth and sports centre of Erbil city between the age group from 16 to 19 years are the population for the study. The total population is 69 players of Harir youth and sports centre.

3.1.2. Sampling

Sampling of this study consists 24 male football players in the age group of under 20 years of age were selected for the present study. The subjects were selected using the non-random sampling method. 24 players were selected from Harir youth and sportscentre for the present study. The selected individuals were divided into two groups, with 12 players selected for the experimental group (XG) and 12 players selected for the control group (CG).

3.2. Research design of the study

As the researcher wanted to study of “effect of 12 weeks aerobic and anaerobic training program on some physiological, lipid profile and body composition variables of under 20 years old male football players” the study was conducted by experimental methods.

3.3. Procedure of the study

The researcher personally met the authorities of Harir youth and sports center in Erbil city and notified them about the need and importance of the study, the researcher was granted authorization for 60 minutes of embarking the aerobic and anaerobic training program in a day. In the same way the researcher assembled all the subjects and following instructions was given to them; the need and importance of experiment, description of the experiment, explanation of core exercises. The researcher selected 24 male players of under 20 years of age using the non random sampling technique. The selected subjects were pretested before core training program. During training mid test was taken and after completion of 12 weeks aerobic and anaerobic training program subjects were post tested. The training was given on alternate days, that is, three days in a week. The data collected was analyzed and the results were drawn.

3.5. Administration of training program

To begin the program, the researcher was to calculate maximum heart rate of each player using the formula: $(220 - \text{age} = \text{HRmax})$, then to adjust for each player their heart rate to %60 and %80 for running pace for aerobic training and anaerobic training respectively. Aerobic training consisted of 3 minutes running with the pace of %60 heart rate beat and one minute rest and repeated for 5 times. Anaerobic training consisted of sprint 30 meter dash and sprint 50 meter dash. Each player sprint with the pace of %80 heart rate beat sprint 30 meter dash and positive rest for 30 meters by walking back to the start point and repeated for 5 times. Another anaerobic training sprint 50 meter dash and positive rest for 50 meters by walking back to the start point and repeated for 5 times. The training was given in the evening time for one hour for the first two weeks and then 10 minutes, which were increased after every two weeks and in the last two weeks the training duration was 110 minutes in a day. The training program was conducted to all the players of the experimental group on every Monday, Wednesday and Friday alternately for 3 months. No special treatment was given to the control group. Therefore, only in this year control group did not participate regular training in the youth

and sports centre, because of financial problem and no competition. Subjects of control group participated in physical activity as like recreational and physical education lesson in the school.

3.6. Experimental design

24 football players under 20 years old non-random group design were selected for the study. The subjects were further divided into two groups, consisting of 12 players in each group, they were known as Experimental Group - (XG) and Control Group - (CG). The experimental treatments were given to an experimental group (XG) and the other group (CG) acted as a control group. Scores on Physiological, Lipid profile, and Body composition variables were obtained before, in the mid and after the experimental period of 12 weeks.

3.7. Variables of the study

3.7.1. Physiological variables

Blood Lactate level test, maximum heart rate, cardio-respiratory endurance.

3.7.2. Lipid profile variables

Lipid profile consists of total cholesterol, Triglycerides, LDL, and HDL.

3.7.3. Body composition variables

Body mass index (BMI), Body fat percentage, skeletal muscle, resting metabolism, visceral fat.

3.8. Method of the Study

Experimental method was used for this study. Both groups conducted the tests, that is, Pre-test, mid-test and Post-test, however on the experimental group participated in the training. This is presented below

Groups	Pre-test		Training		Mid-test		Training		Post-test	
Experimental	O		X	O	X		O			
Control	O	O					O			

3.9. Tools for data collection

In this study data was collected by the following ways:

3.9.1. Measurement of physiological variables

The maximum heart rate was measured after (3 minute 20 meter shuttle run) by using(polar RS 400 heart rate monitor USA model), and lactate blood level was measured after (3 minute 20 meter shuttle run) by using(lactate pro 2 test meter and lactate pro 2 strips, Arkary model, Japan). Cardio-respiratory endurance indirect was measured during (3 minute 20 meter shuttle run) by counting the number of shuttles, cone, stop watch and clapper was used for this test. The Shuttle run test was administered outdoor on the artificial football surface.

3.9.2. Measurement of lipid profile variables

Lipid profile, variable total cholesterol, triglycerides. HDL,and LDL were measured inthe laboratory of the Harir Hospital after 12-hour fast,were tested according to standard methodology by Full Automatic Biochemistry Analyzer,model number (bt35i),Turkey.

3.9.3. Measurement of body composition variables

In the morning as soon as the selected subjects awoke, body mass index, body fat percentage, skeletal muscle percentage, resting metabolism and visceral fat level, all of them were measured using the bioelectrical impedance method by using a full body sensor and a body composition monitor and scale (Omron machine model HBF-514, USA).

3.10. Procedure for data collection

The data were collected during the pre, mid as well as Post-test for the above chosen variables from the subjects selected for the tests. The data were collected on the basis of the selection of the test. The necessary data on Physiological, Lipid profile, and Body composition variables were collected by administering the Physiological, Lipid profile and Body composition variable tests.

3.11 Statistical procedure employed

For testing the statistical significance difference between the pre-test, mid-test, and post-test repeated measures were performed and independent sample t-test was used to find out the significant difference between pre-test, mid-test and post-test of both groups at each level of the tests. The level of significance was kept $P = 0.05$ in order to test the null hypothesis and alternative hypothesis. Data was analyzed with the help of SPSS (Version 22.0), and graph pad prism (Version 6) was used to present the statistical data graphically.

4. RESULTS

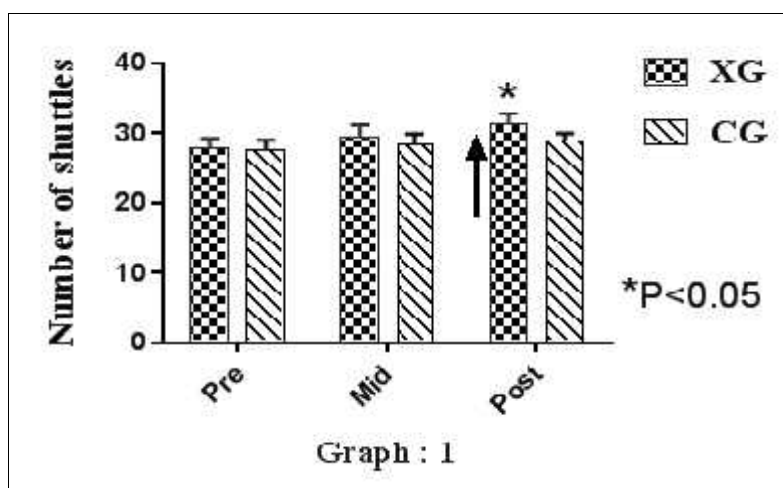
In this chapter the tabulation, statistics, graphs, analysis, and interpretation of data are included.

Table.1:Effect of training on number of shuttles of experimental (XG) and control (CG) group

n=12	Pre-test x ± sd	Mid-test x ± sd	Post-test x ± sd	P	F
XG	27.8 ± 1.4	29.5 ± 1.6	31.1 ± 1.5	0.01*	15.94
CG	27.5 ± 1.3	28.3 ± 1.5	28.7 ± 1.0	0.07	11.46

*P < 0.05

According to the table number 1 there is a significant difference between pre-test and post-test on the number of shuttles of experimental (XG) group because P value is (0.01), and there is no significant difference between pre-test and post-test on the number of shuttles of control (CG) group because P value is (0.07). Graph number 1 brings a visual understanding for this matter.

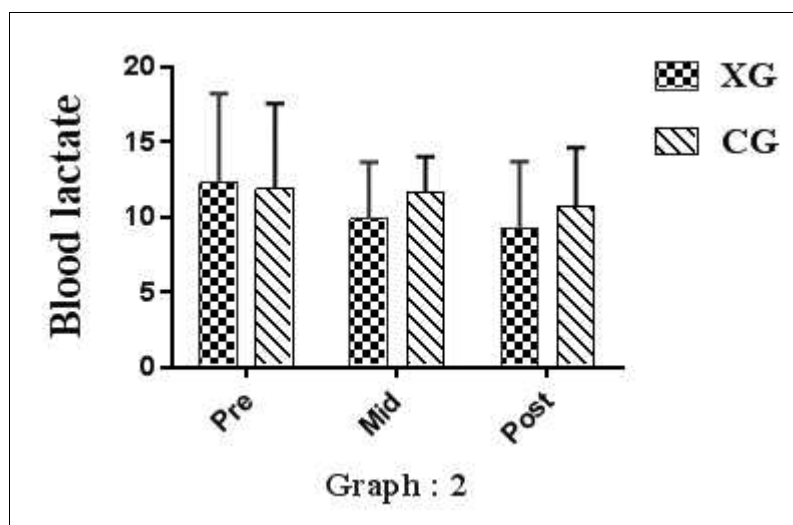


Graph.1: Effect of training on number of shuttles on experimental (XG) and control (CG) group

Table.2: Effect of training on blood lactate level of experimental (XG) and control(CG) group

n=12	Pre-test	Mid-test	Post-test	P	F
	x ± sd	x ± sd	x ± sd		
XG	12.2 ± 5.9	9.8 ± 3.7	9.1 ± 4.5	0.44	4.07
CG	11.8 ± 5.6	11.6 ± 2.3	10.6 ± 3.9	0.32	0.27

According to the table number 2 there is no significant difference between pre-test and post-test on the blood lactate level of experimental (XG) group because P value is (0.44), also there is no significant difference between pre-test and post-test on the blood lactate level of control (CG)group because P value is (0.32). Graph number 2 brings a visual understanding for this matter.

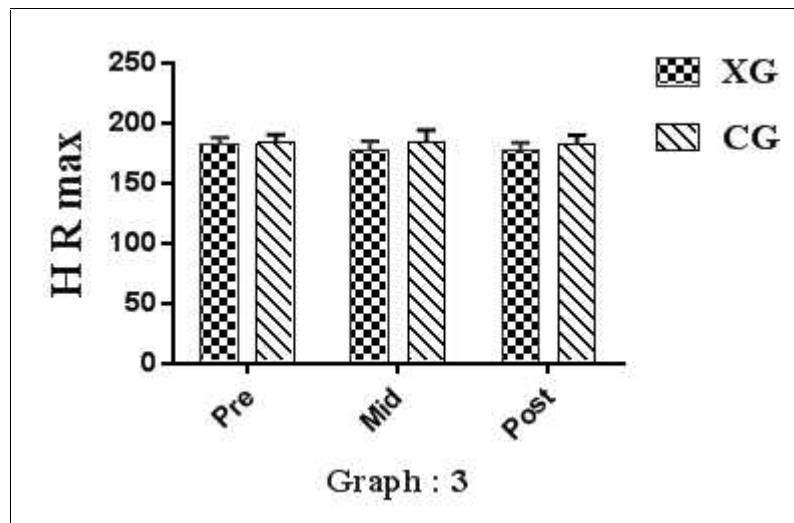


Graph.2: Effect of training on blood lactate level of experimental (XG) and control (CG) group

Table.3: Effect of training on maximum heart rate of experimental (XG) and control (CG) group

n=12	Pre-test	Mid-test	Post-test	P	F
	x ± sd	x ± sd	x ± sd		
XG	182.0 ± 5.5	176.8 ± 7.8	176.6 ± 6.6	0.74	14.37
CG	183.4 ± 6.7	183.7 ± 9.9	182.0 ± 7.4	0.37	0.32

According to the table number 3 there is no significant difference between pre-test and post-test on maximum heart rate of experimental (XG) group because P value is (0.74), also there is no significant difference between pre-test and post-test on maximum heart rate of control (CG) group because P value is (0.37). Graph number 3 brings a visual understanding for this matter.

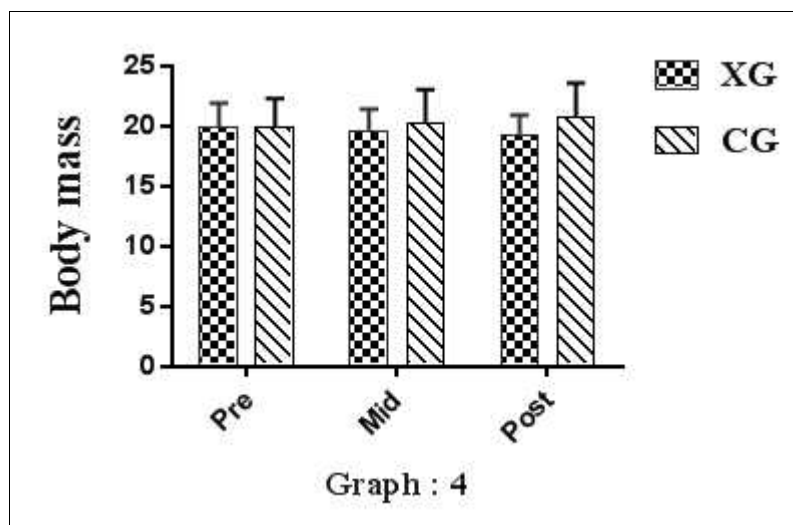


Graph.3: Effect of training on maximum heart rate of experimental (XG) and control (CG) group

Table.4: Effect of training on body mass index of experimental (XG) and control (CG) group

n=12	Pre-test	Mid-test	Post-test	P	F
	x ± sd	x ± sd	x ± sd		
XG	19.9 ± 1.9	19.5 ± 1.8	19.2 ± 1.6	0.20	16.40
CG	19.8 ± 2.3	20.2 ± 2.8	20.6 ± 2.9	0.16	13.00

According to the table number 4 there is no significant difference between pre-test and post-test on body mass index of experimental (XG) group because P value is (0.20), also there is no significant difference between pre-test and post-test on body mass index of control (CG) group because P value is (0.16). Graph number 4 brings a visual understanding for this matter.



Graph.4: Effect of training on body mass index of experimental (XG) and control (CG) group

Table.5: Effect of training on body fat of experimental (XG) and control (CG) group

n=12	Pre-test			Mid-test			Post-test			P	F
	x	±	sd	x	±	sd	x	±	sd		
XG	11.9	±	4.6	10.9	±	4.4	10.6	±	4.5	0.01*	200.12
CG	11.8	±	5.7	12.7	±	5.6	13.4	±	5.9	0.03*	35.94

*P < 0.05

According to the table number 5 there is a significant difference between pre-test and post-test on Body fat of experimental (XG) group because P value is (0.01), also there is negative significant difference between pre-test and post-test on the Body fat of control (CG) group because P value is (0.03). Graph number 5 brings a visual understanding for this matter.

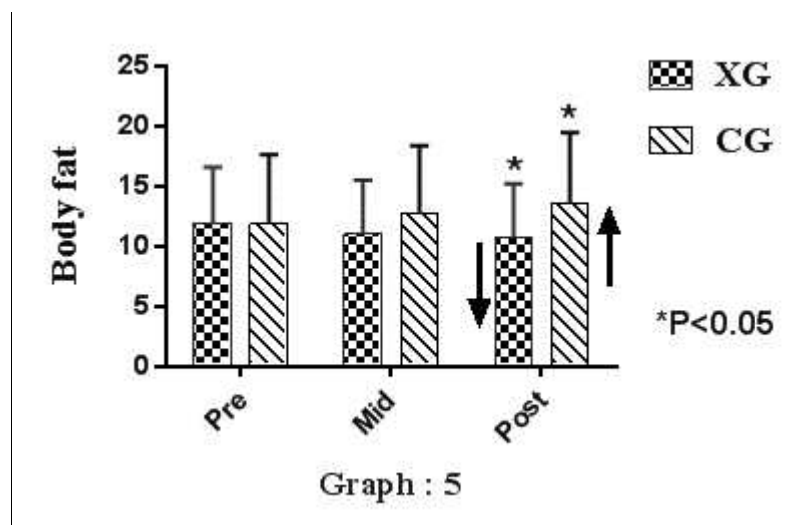
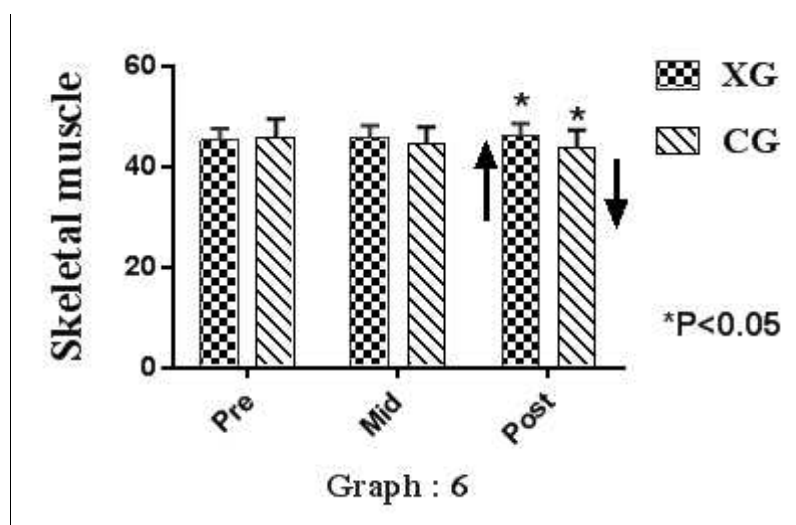
**Graph.5:** Effect of training on body fat of experimental (XG) and control (CG) group

Table.6: Effect of training on skeletal muscle of experimental (XG) and control (CG) group

n=12	Pre-test	Mid-test	Post-test	P	F
	x ± sd	x ± sd	x ± sd		
XG	45.1 ± 2.4	45.8 ± 2.2	46.2 ± 2.2	0.05*	91.33
CG	45.7 ± 3.6	44.3 ± 3.4	43.6 ± 3.4	0.006*	28.94

*P < 0.05

According to the table number 6 there is a significant difference between pre-test and post-test on skeletal muscle of experimental (XG) group because P value is (0.05), also there is negative significant difference between pre-test and post-test on skeletal muscle of control (CG) group because P value is (0.006). Graph number 6 brings a visual understanding for this matter.



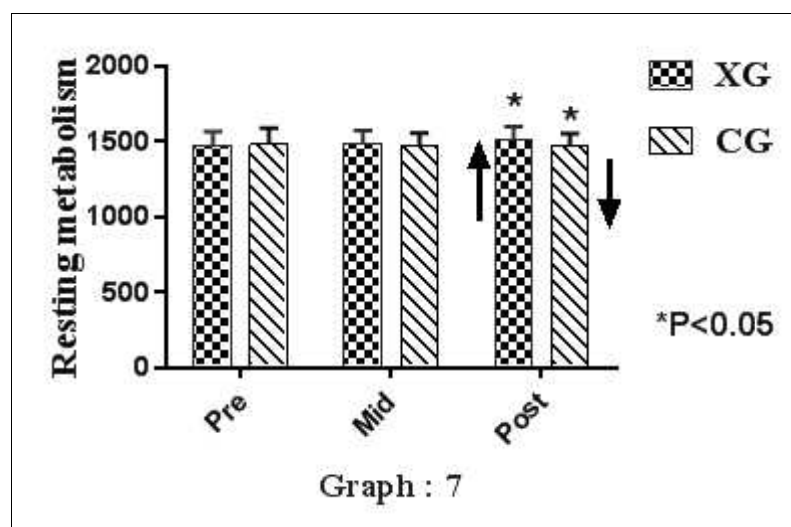
Graph.6: Effect of training on skeletal muscle of experimental (XG) and control (CG) group

Table.7: Effect of training on resting metabolism of experimental (XG) and control (CG) group

n=12	Pre-test			Mid-test			Post-test			P	F
	x	±	sd	x	±	sd	x	±	sd		
XG	1475	±	87.7	1483	±	87.6	1505	±	91.1	0.01*	26.78
CG	1481	±	105.4	1469	±	84.3	1466	±	84.3	0.01*	0.54

*P < 0.05

According to the table number 7 there is a significant difference between pre-test and post-test on resting metabolism of experimental (XG) group because P value is (0.01), also there is a significant difference between pre-test and post-test on Resting metabolism of control (CG) group because P value is (0.01). Graph number 7 brings a visual understanding for this matter.



Graph.7: Effect of training on resting metabolism of experimental (XG) and control (CG) group

Table.8: Effect of training on visceral fat of experimental (XG) and control (CG) group

n=12	Pre-test			Mid-test			Post-test			P	F
	x	±	sd	x	±	sd	x	±	sd		
XG	2.5	±	1.6	2.0	±	1.3	1.6	±	1.3	0.18	8.87
CG	2.5	±	2.1	3.0	±	2.2	3.3	±	2.4	0.19	8.55

According to the table number 8 there is no significant difference between pre-test and post-test on visceral fat of experimental (XG) group because P value is (0.18), there is no significant difference between pre-test and post-test on visceral fat of control (CG) group because P value is (0.19). Graph number 8 brings a visual understanding for this matter.

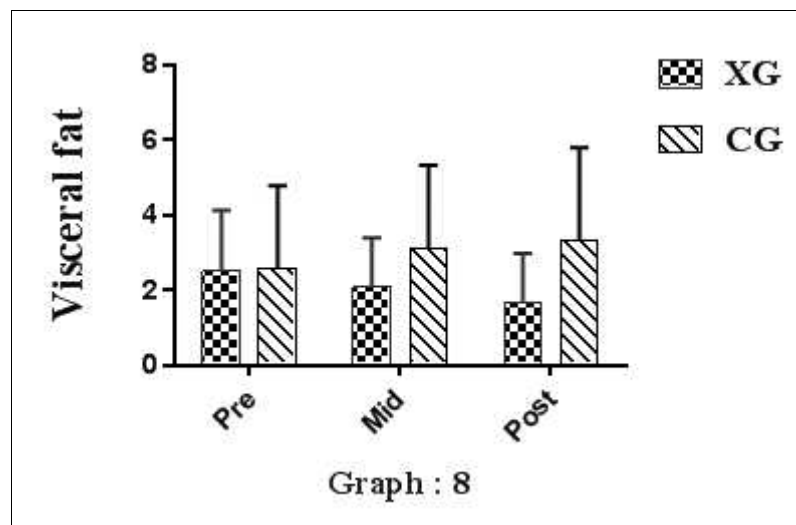
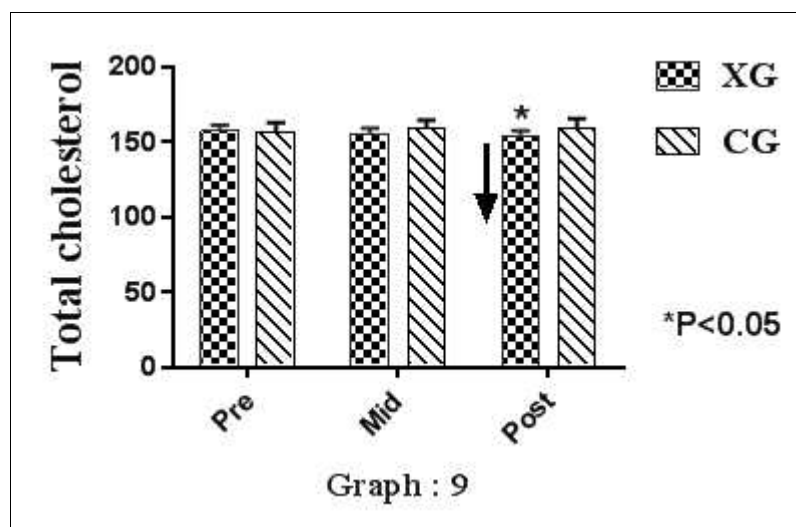
**Graph.8:** Effect of training on visceral fat of experimental (XG) and control (CG) group

Table.9: Effect of training on total cholesterol of experimental (XG) and control (CG) group

n=12	Pre-test			Mid-test			Post-test			P	F
	x	±	Sd	x	±	sd	x	±	sd		
XG	156.9	±	4.1	154.9	±	4.1	153.2	±	4.1	0.01*	500.50
CG	156.3	±	5.6	157.2	±	5.9	158.0	±	5.6	0.34	56.11

*P < 0.05

According to the table number 9 there is a significant difference between pre-test and post-test for total cholesterol of experimental (XG) group because P value is (0.01*), also there is no significant difference between pre-test and post-test for total cholesterol of control (CG) group because P value is (0.34). Graph number 9 brings a visual understanding for this matter.



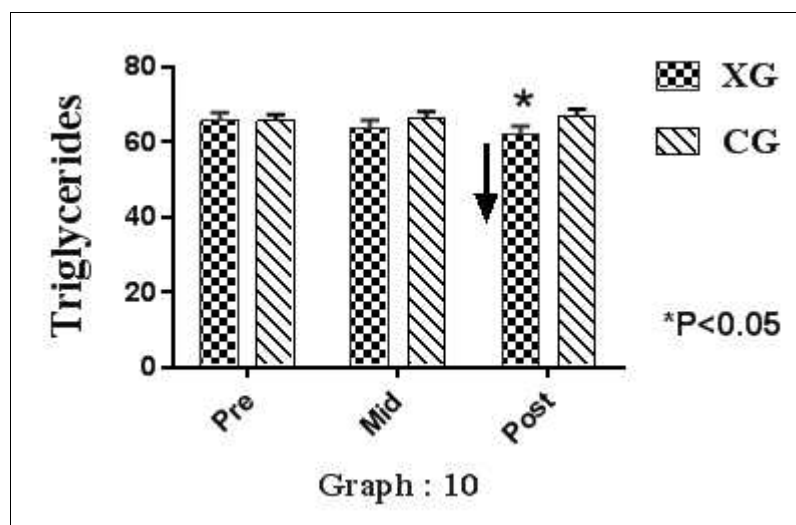
Graph.9: Effect of training on total cholesterol of experimental (XG) and control (CG) group

Table.10: Effect of training on triglycerides of experimental (XG) and control (CG) group

n=12	Pre-test x ± sd	Mid-test x ± sd	Post-test x ± sd	P	F
XG	65.6 ± 2.0	63.5 ± 2.1	61.8 ± 2.3	0.01*	101.16
CG	65.5 ± 1.6	66.1 ± 1.7	66.9 ± 1.7	0.34	40.45

*P < 0.05

According to the table number 10 there is a significant difference between pre-test and post-test for triglycerides of experimental (XG) group because P value is (0.01), and there is no significant difference between pre-test and post-test on the triglycerides of control (CG) group because P value is (0.34). Graph number 10 brings a visual understanding for this matter.



Graph.10: Effect of training on triglycerides of experimental (XG) and control (CG) group

Table.11: Effect of training on HDL of experimental (XG) and control (CG) group

n=12	Pre-test			Mid-test			Post-test	P	F
	x	±	sd	x	±	sd			
XG	41.8	±	1.8	42.6	±	1.7	43.4 ± 1.8	0.86	38.71
CG	41.5	±	2.0	40.7	±	1.5	40.1 ± 1.5	0.64	15.75

According to the table number 11 there is no significant difference between pre-test and post-test for HDL of experimental (XG) group because P value is (0.86), also there is no significant difference between pre-test and post-test for HDL of control (CG) group because P value is (0.64). Graph number 11 brings a visual understanding for this matter.

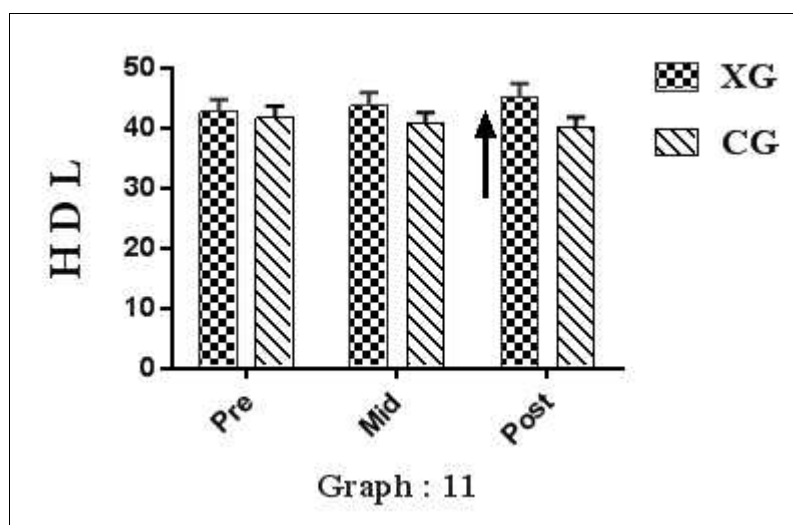
**Graph.11:** Effect of training on HDL of experimental (XG) and control (CG) group

Table.12: Effect of training on LDL of experimental (XG) and control (CG) group

n=12	Pre-test			Mid-test			P	F
	x	±	sd	x	±	sd		
XG	96.3	±	1.7	95.5	±	1.7	0.06	39.28
CG	96.0	±	2.3	97.1	±	2.4	0.55	53.95

According to the table number 12 there is no significant difference between pre-test and post-test on LDL of experimental (XG) group because P value is (0.06), also there is a significant difference between pre-test and post-test on LDL of control (CG) group because P value is (0.55). Graph number 12 brings a visual understanding for this matter.

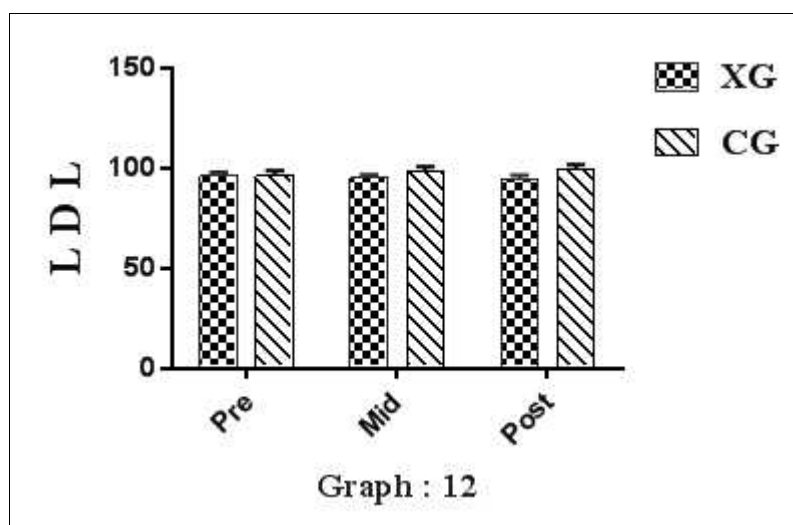
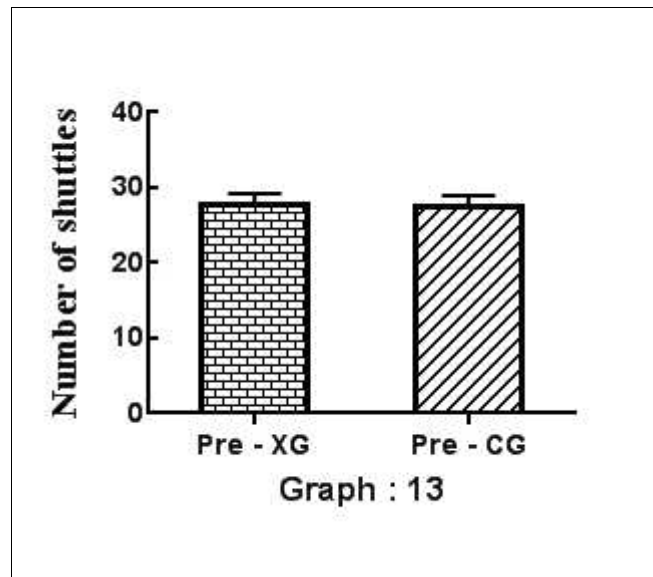
**Graph.12:** Effect of training on LDL of experimental (XG) and control (CG) group

Table.13: Comparison between pre-test of experimental (XG) and pre-test of control (CG) group of number of shuttles

n=24	Pre-XG x \pm sd	Pre-CG x \pm sd	P	T
12~12	27.8 \pm 1.4	27.5 \pm 1.3	0.66	0.44

According to the table number 13 there is no significant difference between pre-test of experimental (XG) and pre-test of control (CG) group of number of shuttles because P value is (0.66). Graph number 13 brings a visual understanding for this matter.

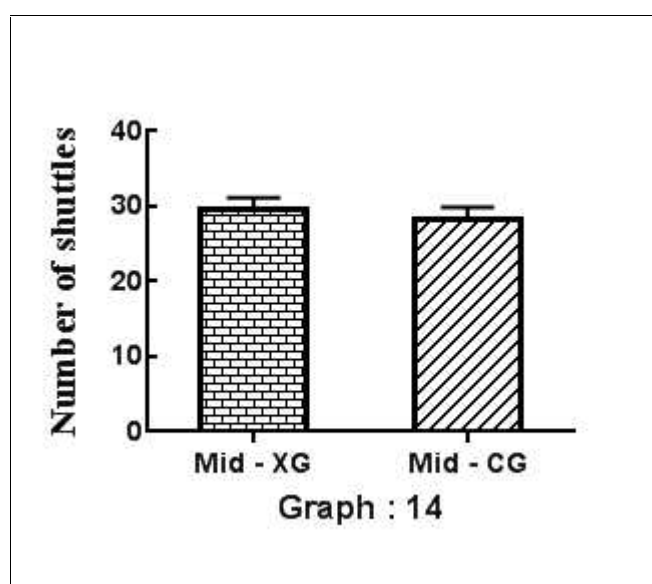


Graph.13: Comparison between pre-test of experimental (XG) and pre-test of control (CG) group of number of shuttles

Table.14: Comparison between mid-test of experimental (XG) and mid-test of control (CG) group of number of shuttles

n=24	Mid-XG $\bar{x} \pm \text{sd}$	Mid-CG $\bar{x} \pm \text{sd}$	P	T
12~12	29.5 \pm 1.6	28.3 \pm 1.5	0.08	1.79

According to the table number 14 there is no significant difference between mid-test of experimental (XG) and mid-test of control (CG) group of number of shuttles because P value is (0.08). Graph number 14 brings a visual understanding for this matter.



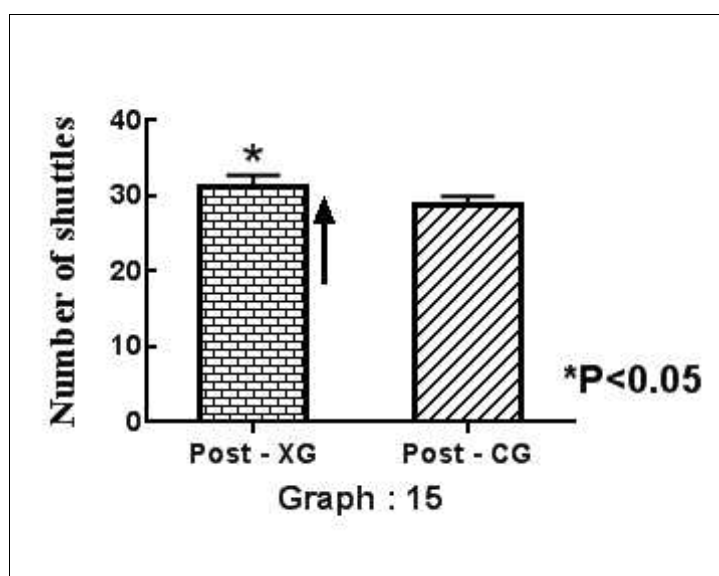
Graph.14: Comparison between mid-test of experimental (XG) and mid-test of control (CG) group of number of shuttles

Table.15: Comparison between post-test of experimental (XG) and post-test of control (CG) group of number of shuttles

n=24	Post-XG x ± sd	Post-CG x ± sd	P	T
12~12	31.1 ± 1.5	28.7 ± 1.0	0.04*	4.29

*P < 0.05

According to the table number 15 there is a significant difference between post-test of experimental (XG) and post-test of control (CG) group on a number of shuttles because P value is (0.04). Graph number 15 brings a visual understanding for this matter.

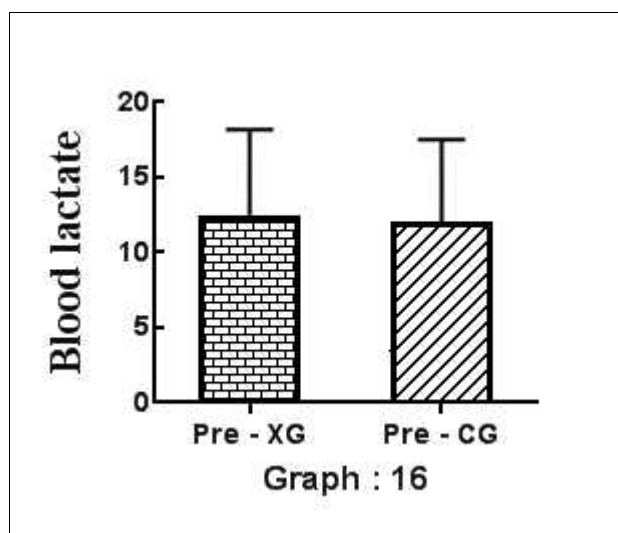


Graph.15: Comparison between post-test of experimental (XG) and post-test of control (CG) group of number of shuttles

Table.16: Comparison between pre-test of experimental (XG) and pre-test of control (CG) group of blood lactate level

n=24	Pre-XG x \pm sd	Pre-CG x \pm sd	P	T
12~12	12.2 \pm 5.9	11.8 \pm 5.6	0.87	0.16

According to the table number 16 there is no significant difference between pre-test of experimental (XG) and pre-test of control (CG) group of blood lactate level because P value is (0.87). Graph number 16 brings a visual understanding for this matter.

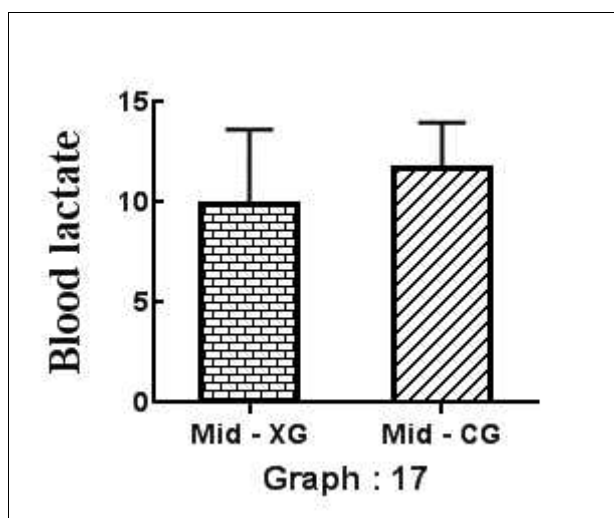


Graph.16: Comparison between pre-test of experimental (XG) and pre-test of control (CG) group of blood lactate level

Table.17: Comparison between mid-test of experimental (XG) and mid-test of control (CG) group of blood lactate level

n=24	Mid-XG $\bar{x} \pm \text{sd}$	Mid-CG $\bar{x} \pm \text{sd}$	P	T
12~12	9.8 \pm 3.7	11.6 \pm 2.3	0.17	1.39

According to the table number 17 there is no significant difference between mid-test of experimental (XG) and mid-test of control (CG) group of blood lactate level because P value is (0.17). Graph number 17 brings a visual understanding for this matter.

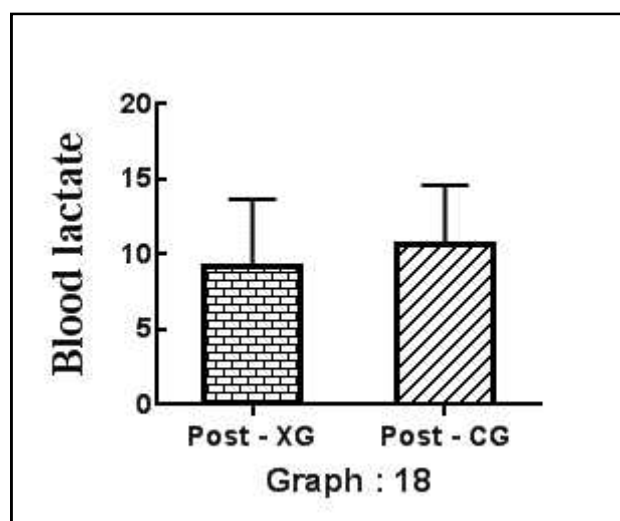


Graph.17: Comparison between mid-test of experimental (XG) and mid-test of control (CG) group of blood lactate level

Table.18: Comparison between post-test of experimental (XG) and of blood lactate level control (CG) group of blood lactate level

n=24	Post-XG $\bar{x} \pm sd$	Post-CG $\bar{x} \pm sd$	P	T
12~12	9.1 ± 4.5	10.6 ± 3.9	0.39	0.86

According to the table number 18 there is no significant difference between post-test of experimental (XG) and post-test of control (CG) group of blood lactate level because P value is (0.39). Graph number 18 brings a visual understanding for this matter.

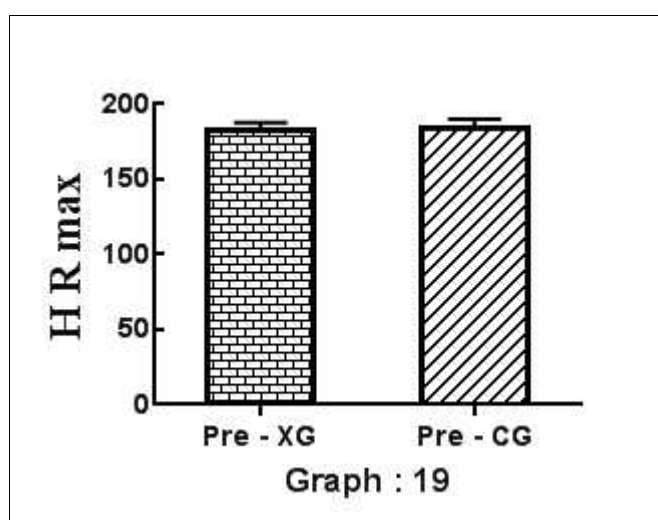


Graph.18: Comparison between post-test of experimental (XG) and of blood lactate level control (CG) group of blood lactate level

Table.19: Comparison between pre-test of experimental (XG) and pre-test of control (CG) group of maximum heart rate

n=24	Pre-XG x \pm sd	Pre-CG x \pm sd	P	T
12~12	182 \pm 5.5	183 \pm 6.7	0.60	0.53

According to the table number 19 there is no significant difference between pre-test of experimental (XG) and pre-test of control (CG) group of maximum heart rate because P value is (0.60). Graph number 19 brings a visual understanding for this matter.

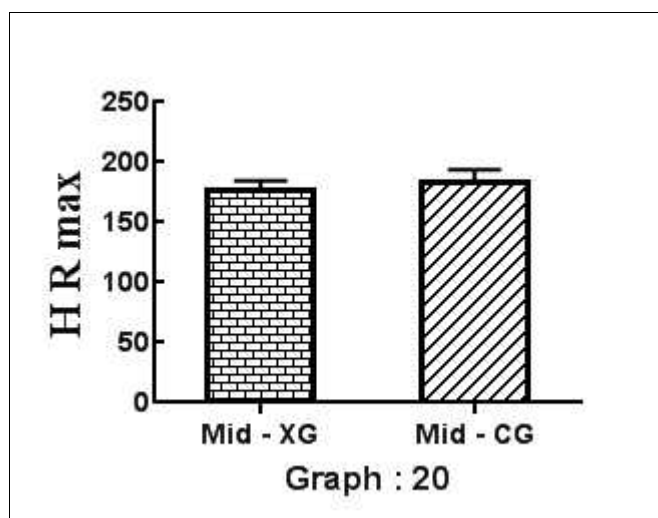


Graph.19: Comparison between pre-test of experimental (XG) and pre-test of control (CG) group of maximum heart rate

Table.20: Comparison between mid-test of experimental (XG) and mid-test of control (CG) group of maximum heart rate

n=24	Mid-XG $\bar{x} \pm \text{sd}$	Mid-CG $\bar{x} \pm \text{sd}$	P	T
12~12	176.8 \pm 7.8	183.7 \pm 9.9	0.07	1.88

According to the Table number 20 there is no significant difference between mid-test of experimental (XG) and mid-test of control (CG) group of maximum heart rate because P value is (0.07). Graph number 20 brings a visual understanding for this matter.

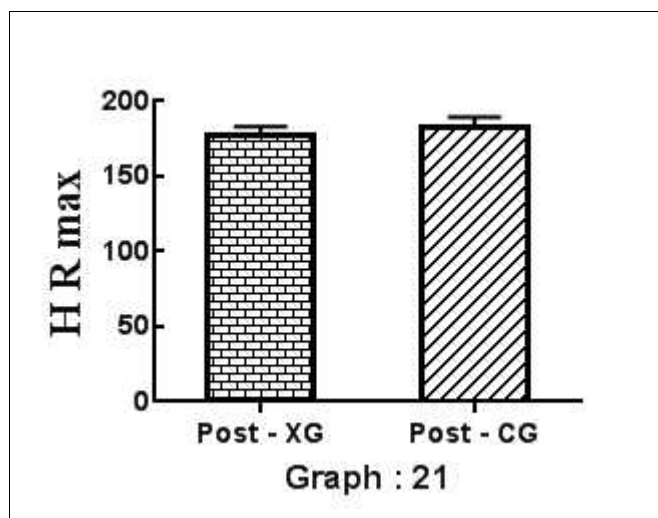


Graph.20: Comparison between mid-test of experimental (XG) and mid-test of control (CG) group of maximum heart rate

Table.21: Comparison between post-test of experimental (XG) and post-test of control (CG) group of maximum heart rate

n=24	Post-XG x \pm sd	Post-CG x \pm sd	P	T
12~12	176.6 \pm 6.6	182.0 \pm 7.4	0.07	1.88

According to the table number 21 there is no significant difference between post-test of experimental (XG) and post-test of control (CG) group of maximum heart rate because P value is (0.07). Graph number 21 brings a visual understanding for this matter.

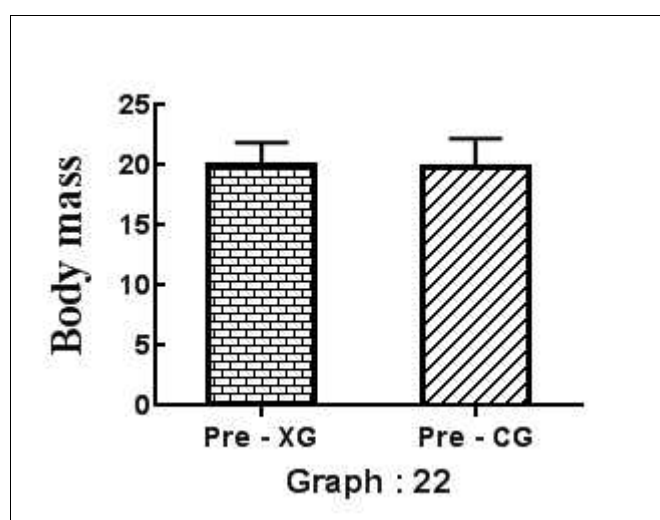


Graph.21:Comparison between post-test of experimental (XG) and post-test of control (CG) group of maximum heart rate

Table.22: Comparison between pre-test of experimental (XG) and pre-test of control (CG) group of body mass index

n=24	Pre-XG $\bar{x} \pm \text{sd}$	Pre-CG $\bar{x} \pm \text{sd}$	P	T
12~12	19.9 ± 1.9	19.8 ± 2.3	0.94	0.06

According to the table number 22 there is no significant difference between pre-test of experimental (XG) and pre-test of control (CG) group of body mass index because P value is (0.94). Graph number 22 brings a visual understanding for this matter.

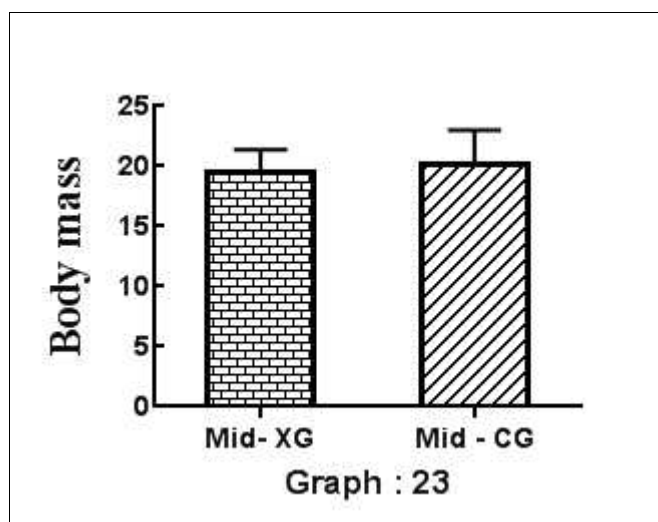


Graph.22: Comparison between pre-test of experimental (XG) and pre-test of control (CG) group of body mass index

Table.23: Comparison between mid-test of experimental (XG) and mid-test of control (CG) group of body mass index

n=24	Mid-XG $\bar{x} \pm \text{sd}$	Mid-CG $\bar{x} \pm \text{sd}$	P	t
12~12	19.5 ± 1.8	20.2 ± 2.8	0.50	0.67

According to the table number 23 there is no significant difference between mid-test of experimental (XG) and mid-test of control (CG) group of body mass index because P value is (0.40). Graph number 23 brings a visual understanding for this matter.

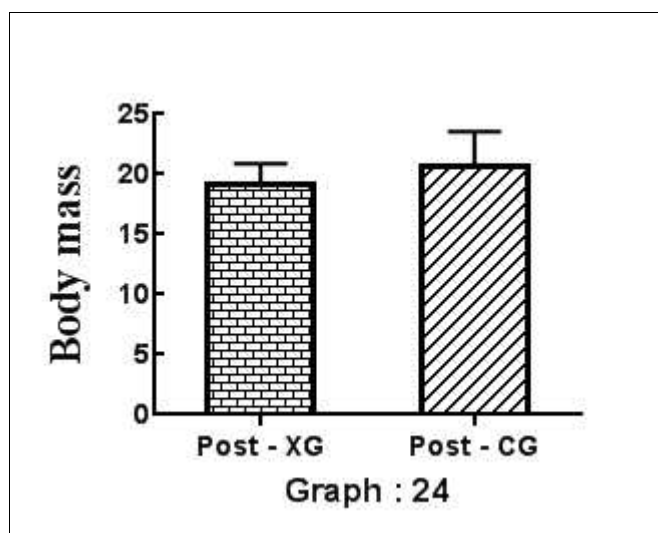


Graph.23:Comparison between mid-test of experimental (XG) and mid-test of control (CG) group of body mass index

Table.24: Comparison between post-test of experimental (XG) and post-test of control (CG) group of body mass index

n=24	Post-XG $\bar{x} \pm \text{sd}$	Post-CG $\bar{x} \pm \text{sd}$	P	t
12~12	19.2 ± 1.6	20.6 ± 2.9	0.14	1.50

According to the table number 24 there is no significant difference between post-test of experimental (XG) and post-test of control (CG) group of body mass index because P value is (0.14). Graph number 24 brings a visual understanding for this matter.

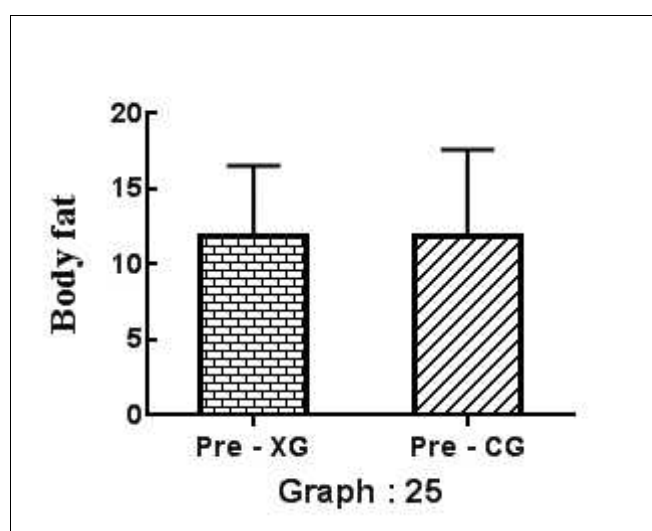


Graph.24: Comparison between post-test of experimental (XG) and post-test of control (CG) group of body mass index

Table.25: Comparison between pre-test of experimental (XG) and pre-test of control (CG) group of body fat

n=24	Pre-XG $\bar{x} \pm \text{sd}$	Pre-CG $\bar{x} \pm \text{sd}$	P	t
12~12	11.9 ± 4.6	11.8 ± 5.7	0.97	0.03

According to the table number 25 there is no significant difference between pre-test of experimental (XG) and pre-test of control (CG) group of body fat because P value is (0.97). Graph number 25 brings a visual understanding for this matter.

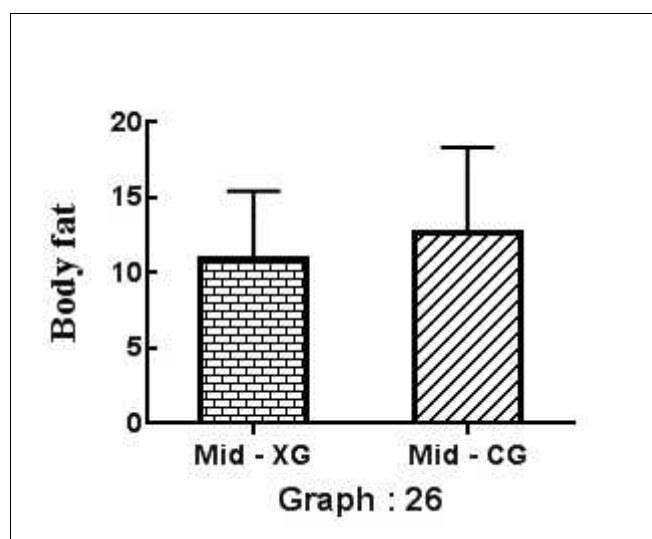


Graph.25: Comparison between pre-test of experimental (XG) and pre-test of control (CG) group of body fat

Table.26: Comparison between mid-test of experimental (XG) and mid-test of control (CG) group of body fat

n=24	Mid-XG $\bar{x} \pm \text{sd}$	Mid-CG $\bar{x} \pm \text{sd}$	P	t
12~12	10.9 ± 4.4	12.7 ± 5.6	0.40	0.85

According to the table number 26 there is no significant difference between mid-test of experimental (XG) and mid-test of control (CG) group of body fat because P value is (0.40). Graph number 26 brings a visual understanding for this matter.

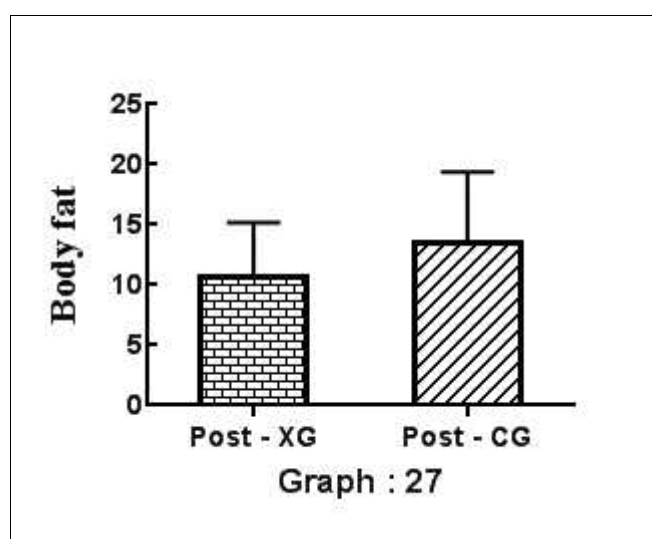


Graph.26: Comparison between mid-test of experimental (XG) and mid-test of control (CG) group of body fat

Table.27: Comparison between post-test of experimental (XG) and post-test of control (CG) group of body fat

n=24	Post-XG $\bar{x} \pm sd$	Post-CG $\bar{x} \pm sd$	P	t
12~12	10.6 ± 4.5	13.4 ± 5.9	0.20	1.29

According to the table number 27 there is no significant difference between post-test of experimental (XG) and post-test of control (CG) group of body fat because P value is (0.20). Graph number 27 brings a visual understanding for this matter.

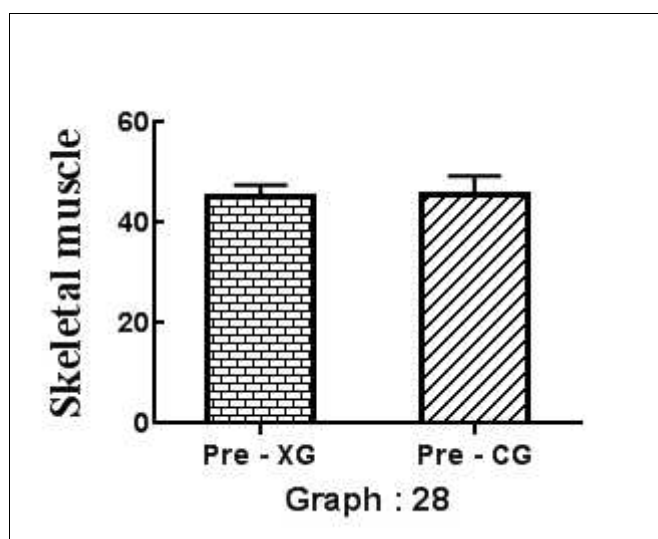


Graph.27: Comparison between post-test of experimental (XG) and post-test of control (CG) group of body fat

Table.28: Comparison between pre-test of experimental (XG) and pre-test of control (CG) group of skeletal muscle

n=24	Pre-XG x \pm sd	Pre-CG x \pm sd	P	T
12~12	45.1 \pm 2.4	45.7 \pm 3.6	0.62	0.50

According to the table number 28 there is no significant difference between pre-test of experimental (XG) and pre-test of control (CG) group of skeletal muscle because P value is (0.62). Graph number 28 brings a visual understanding for this matter.

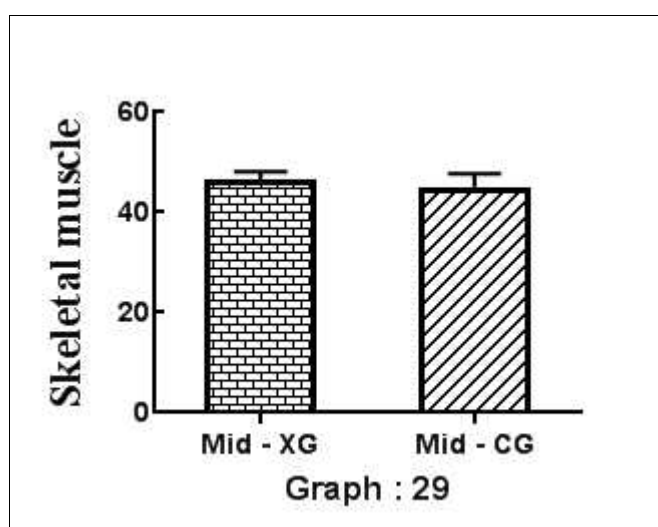


Graph.28: Comparison between pre-test of experimental (XG) and pre-test of control (CG) group of skeletal muscle

Table.29: Comparison between mid-test of experimental (XG) and mid-test of control (CG) group of skeletal muscle

n=24	Mid-XG x \pm sd	Mid-CG x \pm sd	P	t
12~12	45.8 \pm 2.2	44.3 \pm 3.4	0.21	1.27

According to the table number 29 there is no significant difference between mid-test of experimental (XG) and mid-test of control (CG) group of skeletal muscle because P value is (0.21). Graph number 29 brings a visual understanding for this matter.



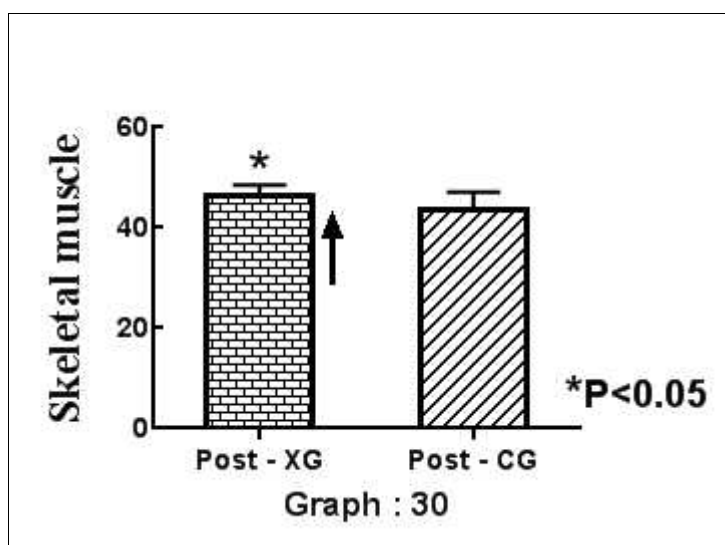
Graph.29: Comparison between mid-test of experimental (XG) and mid-test of control (CG) group of skeletal muscle

Table.30: Comparison between post-test of experimental (XG) and post-test of control (CG) group of skeletal muscle

n=24	Post-XG	Post-CG	P	t
	$\bar{x} \pm \text{sd}$	$\bar{x} \pm \text{sd}$		
12~12	46.2 ± 2.2	43.6 ± 3.4	0.04*	2.10

*P < 0.05

According to the table number 30 there is a significant difference between post-test of experimental (XG) and post-test of control (CG) group of skeletal muscle because P value is (0.04). Graph number 30 brings a visual understanding for this matter.

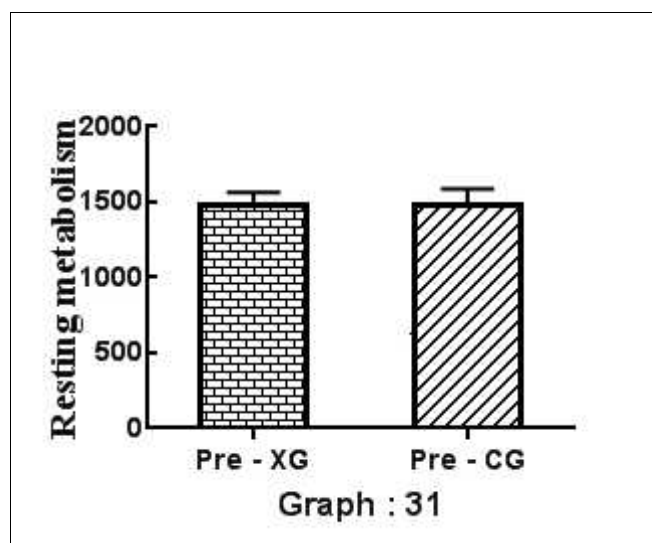


Graph.30: Comparison between post-test of experimental (XG) and post-test of control (CG) group of skeletal muscle

Table.31: Comparison between pre-test of experimental (XG) and pre-test of control (CG) group of resting metabolism

n=24	Pre-XG x \pm sd	Pre-CG x \pm sd	P	t
12~12	1475 \pm 87.7	1481 \pm 105.4	0.86	0.17

According to the table number 31 there is no significant difference between pre-test of experimental (XG) and pre-test of control (CG) group of resting metabolism because P value is (0.86). Graph number 31 brings a visual understanding for this matter.

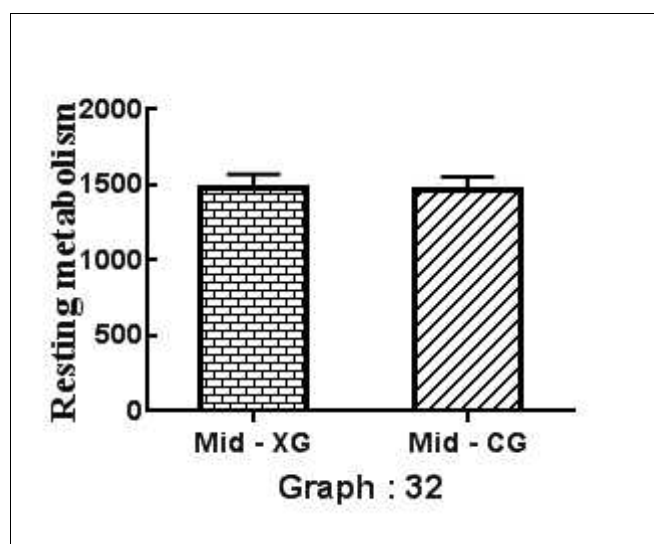


Graph.31: Comparison between pre-test of experimental (XG) and pre-test of control (CG) group of resting metabolism

Table.32: Comparison between mid-test of experimental (XG) and mid-test of control (CG) group of resting metabolism

n=24	Mid-XG x \pm sd	Mid-CG x \pm sd	P	t
12~12	1483 \pm 87.6	1469 \pm 84.3	0.70	0.38

According to the table number 32 there is no significant difference between mid-test of experimental (XG) and mid-test of control (CG) group of resting metabolism because P value is (70). Graph number 32 brings a visual understanding for this matter.

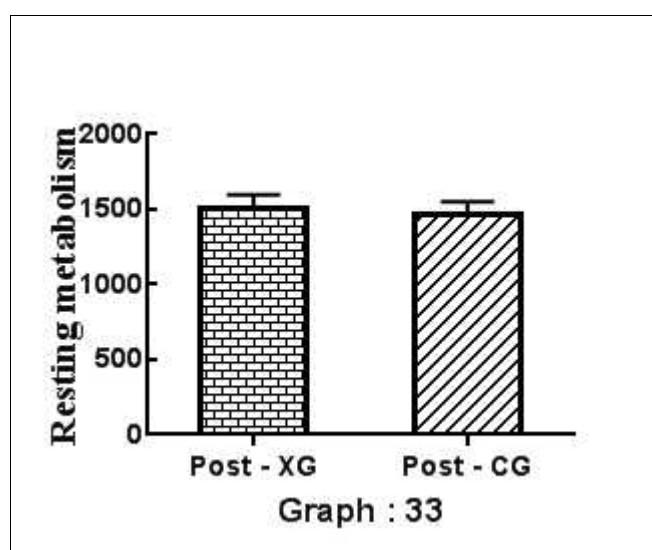


Graph.32: Comparison between mid-test of experimental (XG) and mid-test of control (CG) group of resting metabolism

Table.33: Comparison between post-test of experimental (XG) and post-test of control (CG) group of resting metabolism

n=24	Post -XG x \pm sd	Post -CG x \pm sd	P	t
12~12	1505 \pm 91.1	1466 \pm 84.3	0.28	1.10

According to the Table number (33) there no significant difference between post-test of resting metabolism of experimental (XG) and control (CG) group because value is (P=0. 28). Graph number 33 brings a visual understanding for this matter.

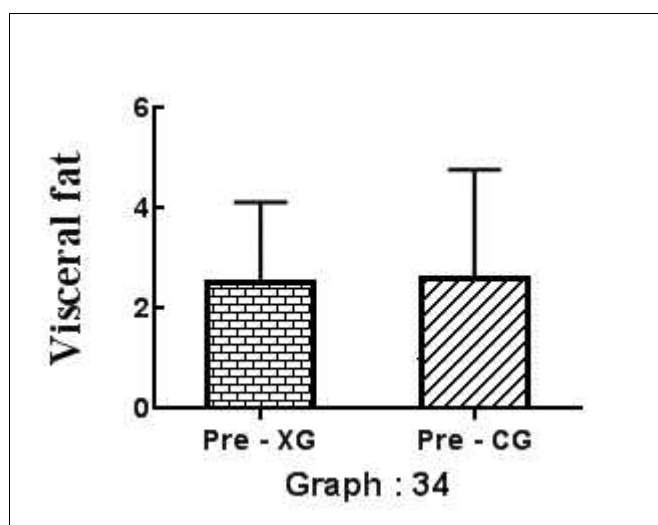


Graph.33: Comparison between post-test of experimental (XG) and post-test of control (CG) group of resting metabolism

Table.34: Comparison between pre-test of experimental (XG) and pre-test of control (CG) group of visceral fat

n=24	Pre -XG x \pm sd	Pre -CG x \pm sd	P	t
12~12	2.5 \pm 1.6	2.5 \pm 2.1	0.91	0.10

According to the table number 34 there is no significant difference between pre-test of experimental (XG) and pre-test of control (CG) group of visceral fat because P value is (0.91).Graph number 34 brings a visual understanding for this matter.

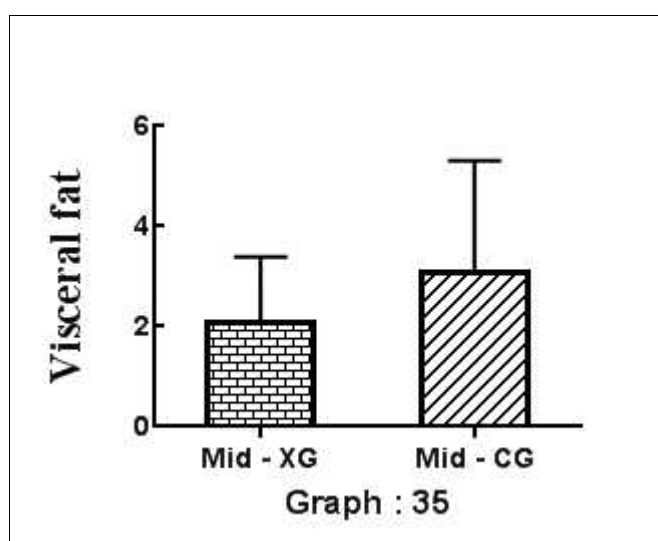


Graph.34: Comparison between pre-test of experimental (XG) and pre-test of control (CG) group of visceral fat

Table.35: Comparison between mid-test of experimental (XG) and mid-test of control (CG) group of visceral fat

n=24	Mid-XG x \pm sd	Mid-CG x \pm sd	P	t
12~12	2.0 \pm 1.3	1.3 \pm 2.2	0.19	1.33

According to the table number 35 there is no significant difference between mid-test of experimental (XG) and mid-test of control (CG) group of visceral fat because P value is (0.18). Graph number 35 brings a visual understanding for this matter.



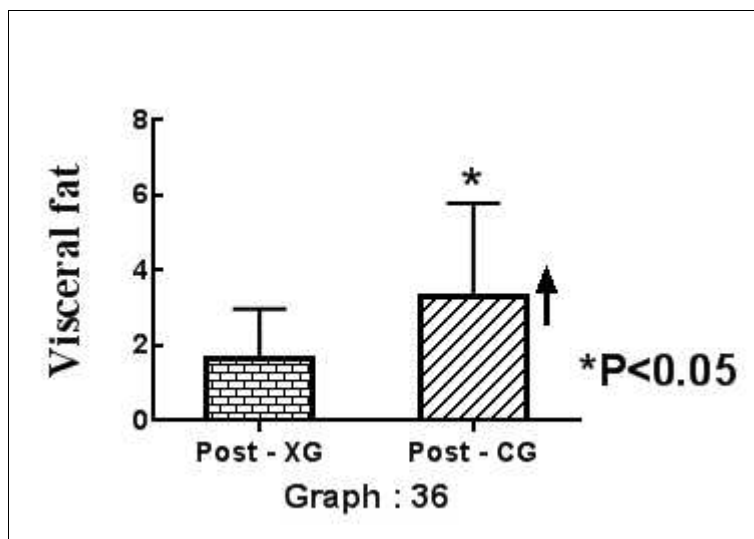
Graph.35: Comparison between mid-test of experimental (XG) and mid-test of control (CG) group of visceral fat

Table.36: Comparison between post-test of experimental (XG) and post-test of control (CG) group of visceral fat

n=24	Post-XG $\bar{x} \pm sd$	Post-CG $\bar{x} \pm sd$	P	t
12~12	1.6 ± 1.3	3.3 ± 2.4	0.05*	2.37

*P < 0.05

According to the table number 36 there is a significant difference between post-test of experimental (XG) and post-test of control (CG) group of visceral fat because P value is (0.05). Graph number 36 brings a visual understanding for this matter.

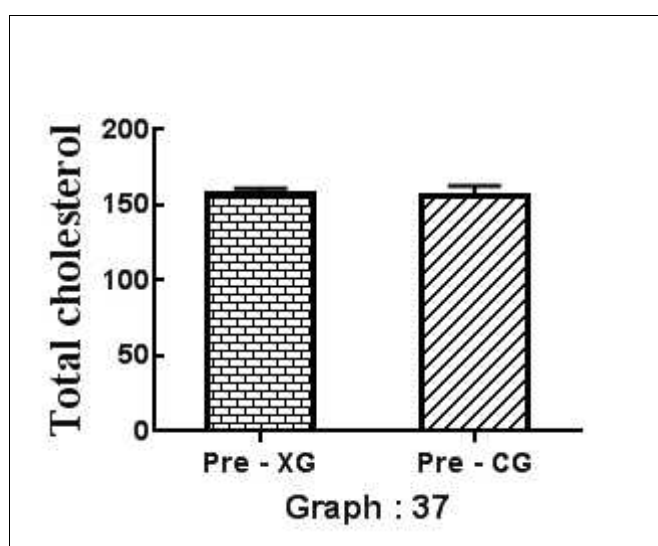


Graph.36: Comparison between post-test of experimental (XG) and post-test of control (CG) group of visceral fat

Table.37: Comparison between pre-test of experimental (XG) and pre-test of control (CG) group of total cholesterol

n=24	Pre-XG x \pm sd	Pre-CG x \pm sd	P	t
12~12	156.9 \pm 4.1	156.3 \pm 6.1	0.77	0.28

According to the table number 37 there is no significant difference between pre-test of experimental (XG) and pre-test of control (CG) group of total cholesterol because P value is (0.77). Graph number 37 brings a visual understanding for this matter.

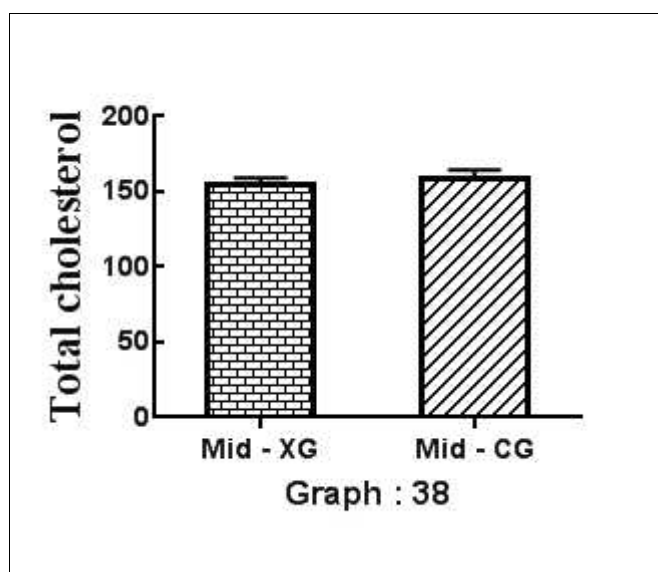


Graph.37: Comparison between pre-test of experimental (XG) and pre-test of control (CG) group of total cholesterol

Table.38: Comparison between mid-test of experimental (XG) and mid-test of control (CG) group of total cholesterol

n=24	Mid-XG x \pm sd	Mid-CG x \pm sd	P	t
12~12	154.9 \pm 4.1	157.2 \pm 5.9	0.27	1.11

According to the table number 38 there is no significant difference between mid-test of experimental (XG) and mid-test of control (CG) group of total cholesterol because P value is (0.27). Graph number 38 brings a visual understanding for this matter.



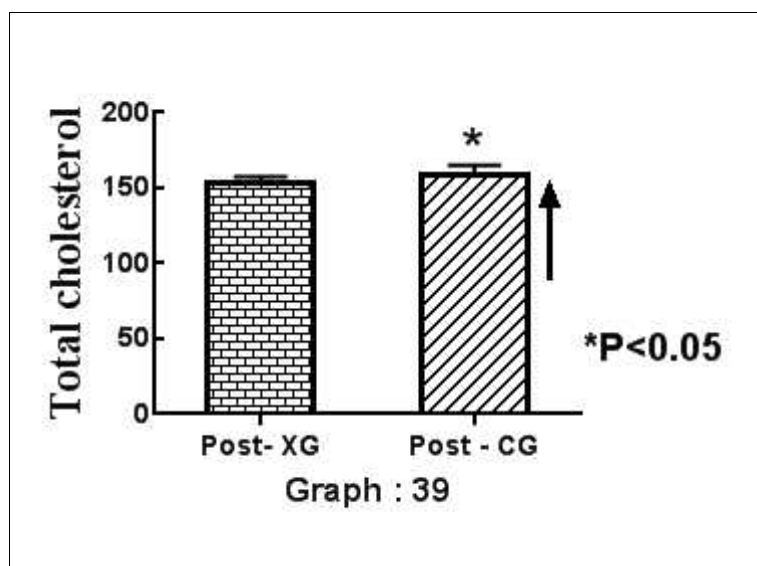
Graph.38: Comparison between mid-test of experimental (XG) and mid-test of control (CG) group of total cholesterol

Table.39: Comparison between post-test of experimental (XG) and post-test of control (CG) group of total cholesterol

n=24	Post-XG x \pm sd	Post-CG x \pm sd	P	t
12~12	153.2 \pm 4.1	158.0 \pm 5.8	0.02*	2.36

*P < 0.05

According to the table number 39 there is a significant difference between post-test of experimental (XG) and post-test of control (CG) group of total cholesterol because P value is (0.02). Graph number 39 brings a visual understanding for this matter.

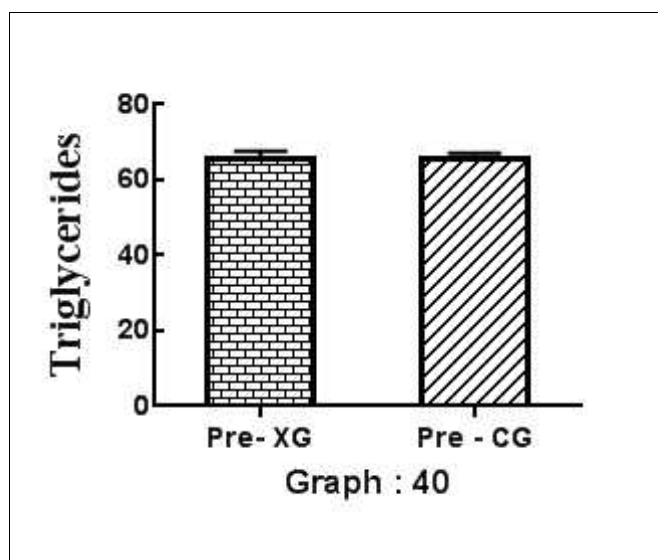


Graph.39: Comparison of total cholesterol between post-test of experimental (XG) and control (CG) group

Table.40: Comparison between pre-test of experimental (XG) and pre-test of control (CG) group of triglycerides

n=24	Pre-XG $\bar{x} \pm \text{sd}$	Pre-CG $\bar{x} \pm \text{sd}$	P	t
12~12	65.6 ± 2.0	65.5 ± 1.6	0.83	0.21

According to the table number 40 there is no significant difference between pre-test of experimental (XG) and pre-test of control (CG) group of triglycerides because p value is (0.83). Graph number 40 brings a visual understanding for this matter.



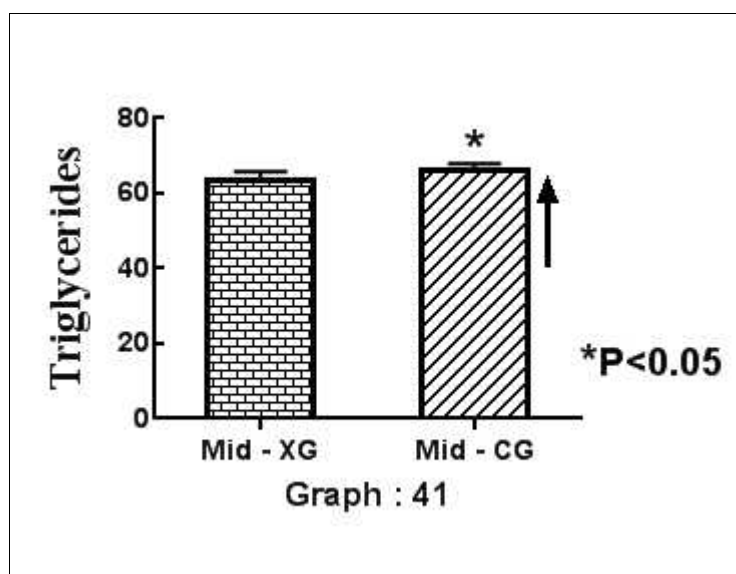
Graph.40: Comparison between pre-test of experimental (XG) and pre-test of control (CG) group of triglycerides

Table.41: Comparison between mid-test of experimental (XG) and mid-test of control (CG) group of triglycerides

n=24	Mid-XG x \pm sd	Mid-CG x \pm sd	P	t
12~12	63.5 \pm 2.1	66.1 \pm 1.7	0.04*	3.22

*P < 0.05

According to the table number 41 there is a significant difference between mid-test of experimental (XG) and mid-test of control (CG) group of triglycerides because P value is (0.04). Graph number 41 brings a visual understanding for this matter.



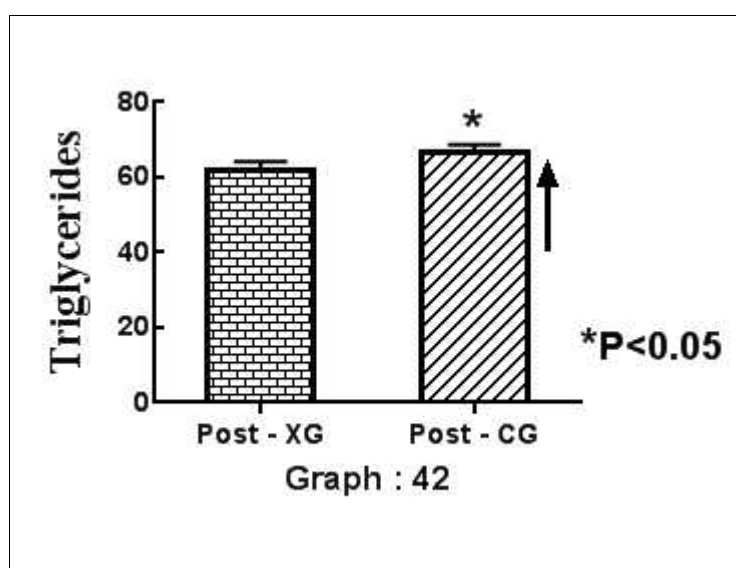
Graph.41: Comparison between mid-test of experimental (XG) and mid-test of control (CG) group of triglycerides

Table.42:Comparison between post-test of experimental (XG) and post-test of control (CG) group of triglycerides

n=24	Post-XG x \pm sd	Post-CG x \pm sd	P	t
12~12	61.8 \pm 2.3	66.9 \pm 1.7	0.01*	6.22

*P < 0.05

According to the table number 42 there is a significant difference between post-test of experimental (XG) and post-test of control (CG) group of triglycerides because P value is (0.01). Graph number 42 brings a visual understanding for this matter.

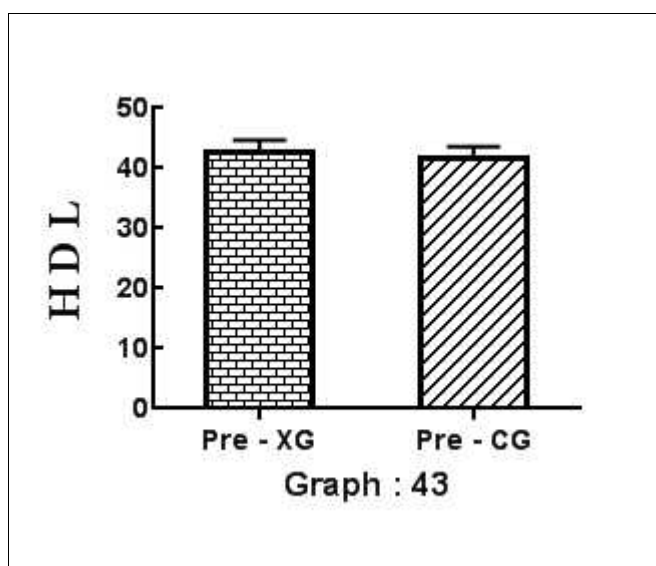


Graph.42: Comparison between post-test of experimental (XG) and post-test of control (CG) group of triglycerides

Table.43: Comparison between pre-test of experimental (XG) and pre-test of control (CG) group of HDL

n=24	Pre-XG x \pm sd	Pre-CG x \pm sd	P	t
12~12	41.8 \pm 1.8	41.5 \pm 2.0	0.51	0.66

According to the table number 43 there is no significant difference between pre-test of experimental (XG) and pre-test of control (CG) group of HDL because P value is (0.51). Graph number 43 brings a visual understanding for this matter.



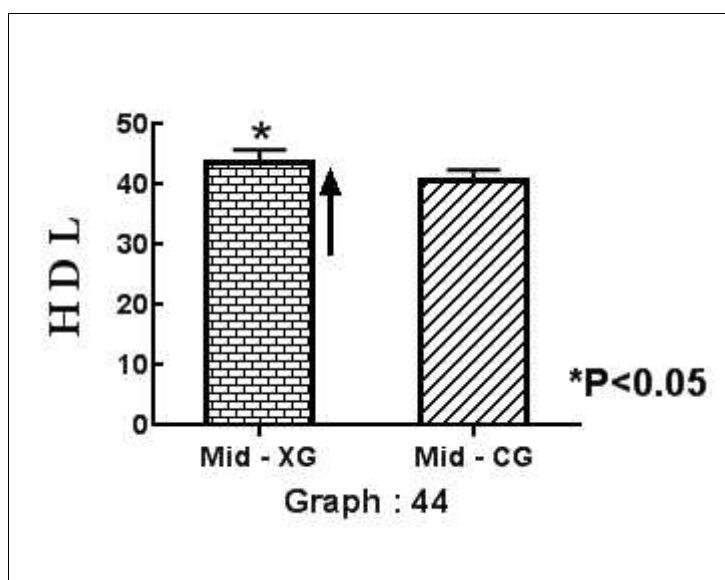
Graph.43:Comparison between pre-test of experimental (XG) and pre-test of control (CG) group of HDL

Table.44: Comparison between mid-test of experimental (XG) and mid-test of control (CG) group of HDL

n=24	Mid-XG x \pm sd	Mid-CG x \pm sd	P	t
12~12	42.6 \pm 1.7	40.7 \pm 1.7	0.01*	1.33

*P < 0.05

According to the table number 44 there is a significant difference between mid-test of experimental (XG) and mid-test of control (CG) group of HDL because P value is (0.01). Graph number 44 brings a visual understanding for this matter.



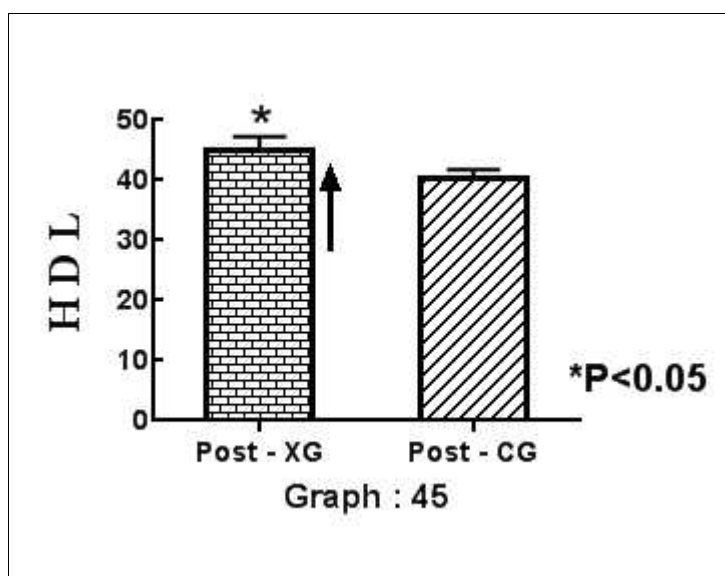
Graph.44: Comparison between mid-test of experimental (XG) and mid-test of control (CG) group of HDL

Table.45: Comparison between post-test of experimental (XG) and post-test of control (CG) group of HDL

n=24	Post-XG x \pm sd	Post-CG x \pm sd	P	t
12~12	43.4 \pm 1.8	40.1 \pm 1.5	0.01*	4.64

*P < 0.05

According to the table number 45 there is a significant difference between post-test of experimental (XG) and post-test of control (CG) group of HDL because P value is (0.01). Graph number 45 brings a visual understanding for this matter.

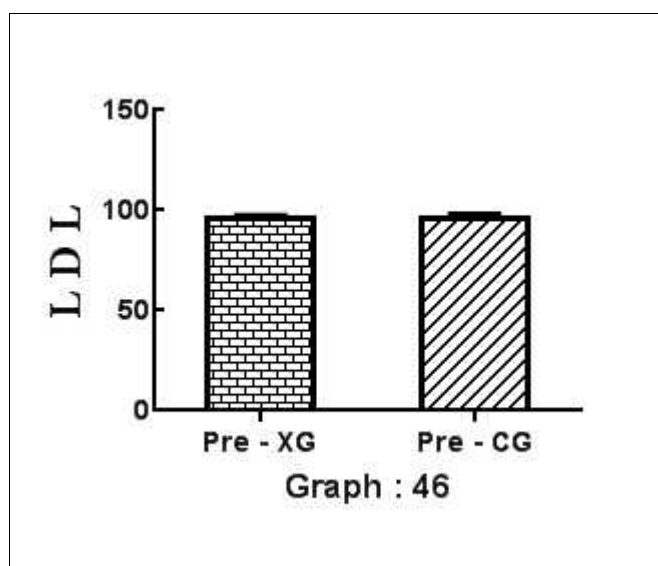


Graph.45: Comparison between post-test of experimental (XG) and post-test of control (CG) group of HDL

Table.46: Comparison between pre-test of experimental (XG) and pre-test control (CG) group of LDL

n=24	Pre-XG x \pm sd	Pre-CG x \pm sd	P	t
12~12	96.3 \pm 1.7	96.0 \pm 2.3	0.76	0.30

According to the table number 46 there is no significant difference between pre-test of experimental (XG) and pre-test of control (CG) group of LDL because P value is (0.76). Graph number 46 brings a visual understanding for this matter.

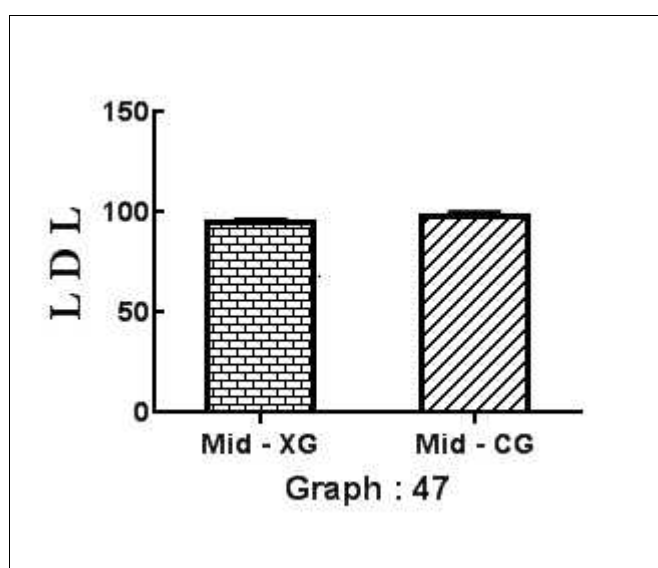


Graph.46: Comparison between pre-test of experimental (XG) and pre-test control (CG) group of LDL

Table.47:Comparison between mid-test of experimental (XG) and mid-test of control (CG) group of LDL

n=24	Mid -XG x \pm sd	Mid -CG x \pm sd	P	t
12~12	95.5 \pm 1.7	97.1 \pm 2.4	0.07	1.90

According to the table number 47 there is no significant difference between mid-test of experimental (XG) and mid-test of control (CG) group of LDL because P value is (P=0. 07). Graph number 47 brings a visual understanding for this matter.

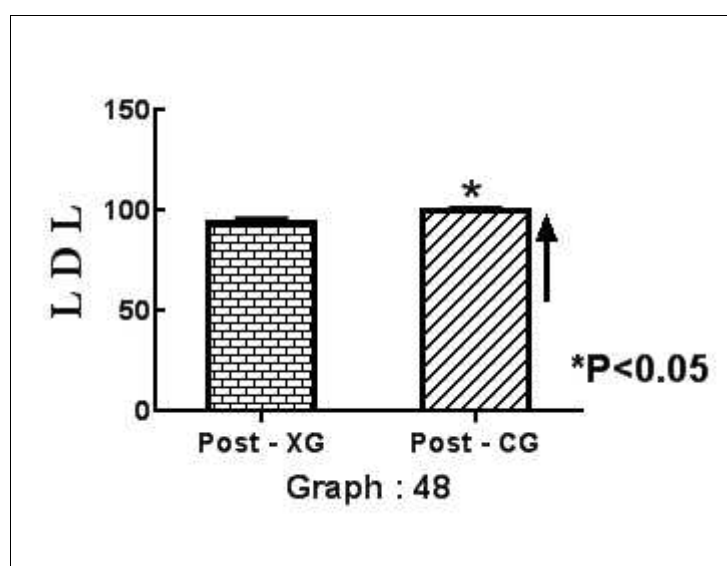


Graph.47: Comparison between mid-test of experimental (XG) and mid-test of control (CG) group of LDL

Table.48: Comparison between post-test of experimental (XG) and post-test of control (CG) group of LDL

n=24	Pre-XG x \pm sd	Pre-CG x \pm sd	P	T
12~12	94.6 \pm 2.1	97.7 \pm 2.2	0.02	3.42

According to the table number 48 there is a significant difference between post-test of experimental (XG) and post-test of control (CG) group of LDL because P value is (0.02). Graph number 48 brings a visual understanding for this matter.



Graph.48: Comparison between post-test of experimental (XG) and post-test of control (CG) group of LDL

5. DISCUSSION

The purpose of this study was to find out the effect of 12 weeks of aerobic and anaerobic training program on some physiological, lipid profile, and body composition variables of under 20 years old male football players. No special treatment was given to the control group. Therefore, only in this year control group did not participate regular training in the youth and sports centre, because of financial problem and no competition. Subjects of control group participated in physical activity as like recreational and physical education lesson in the school. During the 12 weeks of the program, players participated regularly in the training program because of the recreational games and practice football matches included in the training program.

In the present study, it was observed that subjects under 20 years of age were more interested in the recreational games and practice football matches more than the aerobic and anaerobic training. After analyzing and interpretation of the data, the study revealed a significant increase ($P = 0.01$) in number of shuttles of the experimental group (X), in this case null hypothesis number (H_{01}) was rejected and alternative hypothesis number (H_{11}) was accepted. This is because cardio-respiratory endurance is one of the physiological variables that is measured indirectly by counting number of shuttles. The increase in the number of shuttles during 3 minutes after training reflects improved cardio-respiratory endurance capacity and aerobic capacity. Cardio-respiratory endurance and aerobic capacity certainly play an important role in football game and has a major influence on technical performance and tactical choices (Reilly, 2005; McArdle et al, 2006; Wilmore & Costill, 2005). The aerobic endurance training enhances the activity of the cardiovascular system as well as the developed oxidative capacity of the skeletal muscles, and thus oxygen delivery to the working muscle is increased. This was accepted as the main reason for the elevation of aerobic capacity after a training program (McArdle et al, 2006; Wilmore & Costill, 2005). A similar observation was noted by other researchers (Hoff, 2005; Reilly, 2005; Miller et al, 2007). On the other hand, no significant difference ($P=0.07$) in number of shuttles of control group (C), in this case null hypothesis number (H_{02}) was accepted and alternative hypothesis number (H_{12})

was rejected because Cardio-respiratory endurance is one of the physiological variables there was measure indirect by counting number of shuttles.

During the exercise of increasing intensity there is a rise in blood lactate concentration resulting from increased glycogenolysis. This increase in blood lactate concentration has been interpreted as a reflection of the onset of hypoxia in skeletal muscles and the exercise intensity at which anaerobic metabolism generates ATP is known as the anaerobic threshold (McArdle et al, 2006; Wilmore & Costill, 2005). Increased activity of the muscle form of lactate dehydrogenase and sensitivity to increasing metabolic acidosis. A major effect of endurance training is thought to enhance lactate clearance (Ali et al, 2012). The experimental group of this study showed a decrease of blood lactate level, but no statistical significant difference ($P=0.44$) observed, in this case null hypothesis number (H_{01}) was accepted and alternative hypothesis number (H_{11}) was rejected, because blood lactate included in the physiological variables. Another research which was done by (Manna and Khanna, 2013) in the study “effect of training on selected biochemical variables of elite male swimmers”, they are reported significant decreased ($P< 0.05$) in peak blood lactate levels of the swimmers. It may be due to the difference in the type of sports and games has on the effect of blood lactate level, and controlling blood lactate level not easy for researchers in the day of testing. It should also be noted that activity of daily living has an effect on the blood lactate level. Also the control group (CG) showed that no significant difference was observed because P value is (0.44) in this case null hypothesis number (H_{02}) was accepted and alternative hypothesis number (H_{12}) was rejected because blood lactate was included in the physiological variables.

Heart rate increases with an increase in work intensity and shows a linear relationship with work rate (Astrand & Rodhal, 1986). The highest rate at which the heart can beat is the maximal heart rate (McArdle et al., 2006; Wilmore and Costill, 2005). The experimental group of this study showed a decrease of blood lactate level, but no statistical significant difference ($P=0.74$) observed, in this case null hypothesis number (H_{01}) was accepted and alternative hypothesis number (H_{11}) was rejected,

because blood lactate included in the physiological variables. Another research finding showed similar results which was done by (Manna et al., 2012) in the study “Effect of training on anthropometric, physiological and biochemical variables of U-19 volleyball players”. It has been seen that short term exercise has no significant effect on maximum heart rate (Mc Ardle et al., 2010; Wilmore and Costill, 2005). Also in control group (CG) no significant difference between pre-test and post-test in maximum heart rate was observed because value is ($P = 0.37$), in this case null hypothesis number (H_{02}) was accepted and alternative hypothesis number (H_{12}) was rejected because the heart rate was included in the physiological variables.

Body mass index has significant impact on football teams (Hoff, 2005; Johnson et al., 2009; Silvestre et al., 2006) Body mass is a considerable factor in football since body contact is essential in this game (Hoff, 2005; Johnson et al., 2009). The experimental group of this study showed that there was no significant difference ($P=0.20$) observed in body mass index of the football players after the post-test. In this case null hypothesis number (H_{01}) was accepted and alternative hypothesis number (H_{11}) was rejected because body mass index included in the body composition variables. It may be due to the shorter duration of the training. It has been reported that short term exercise training has no significant effect on body mass of the sports persons (McArdle et al., 2006; Wilmore and Costill, 2005). Another research finding showed similar results which was done by (Manna et al., 2009) in the study “Training induced changes on physiological and biochemical variables of young Indian field hockey players”. Also In other side with a control group of the present study observed no significant difference ($P=16$) has been observed in body mass index of the football players after the post-test. In this case null hypothesis number (H_{02}) was accepted and alternative hypothesis number (H_{12}) was rejected because body mass include in the body composition variables.

The percentage of body fat plays an important role in the assessment of physical fitness of the soccer players (Hoff, 2005; Silvestre et al., 2006; Ostojic, 2003). A low-body fat may improve athletic performance by improving the strength to weight ratio

(Reilly, 2005; McArdle et al., 2006; Wilmore and Costill, 2005). Excess body fat adds to the load without contributing to the body's force-producing capacity (Reilly, 2005; McArdle et al., 2006; Wilmore and Costill, 2005). The experimental group of this study showed that significant reduction ($P=0.01$) in percent body fat has been noted among the players after the training program. In this case null hypothesis number (H_{01}) was rejected and alternative hypothesis number (H_{11}) was accepted because body fat include in the body composition variables. The possible reason of reduction of body fat is exercise training which increases greater utilization of fat for energetic (McArdle et al., 2006; Wilmore and Costill, 2005). Similar findings were also noted by other research groups who studied on soccer players and reported that percent body fat decreased significantly during preparatory and competitive phase of training when compared to baseline data (Reilly, 2005; Kutlu et al., 2007). On the other hand, in a control group of the present study observed negative significant increase difference ($P=0.03$) observed, in this case null hypothesis number (H_{02}) was rejected and alternative hypothesis number (H_{12}) was accepted because body mass included in the body composition variables.

A recent research finding which was done by (Kirkendall et al., 1998) in the study "The Effects of Aging and Training on Skeletal Muscle" reported that Endurance training can improve the aerobic capacity of muscle, and resistance training can improve central nervous system recruitment of muscle and increase muscle mass. Therefore, physical activity throughout life is encouraged to prevent much of the age-related impact on skeletal muscle. The experimental group of this study showed a positive significant increase ($P=0.05$) in skeletal muscle, In this case null hypothesis number (H_{01}) was rejected and alternative hypothesis number (H_{11}) was accepted because skeletal muscle include in the body composition variables. Whilst the control group of the respective study observed a negative significant decrease ($P=0.006$) in skeletal muscle, in this case null hypothesis number (H_{12}) was rejected and alternative hypothesis number (H_{12}) was accepted because skeletal muscle include in the body composition variables. Also, (Kirkendall et al 1998) in the studied "The Effects of Aging and Training on Skeletal

Muscle” reported Aging results in a gradual loss of muscle function, the typical adult will lose muscle mass with age; the loss varies according to gender.

Another recent research which was done by (Lemmer et al., 2001) in the study “Effect of strength training on resting metabolic rate and physical activity: age and gender comparisons” reported absolute significant increase ($P < 0.01$) in resting metabolic rate after training in young age. In the experimental group of this study showed that a significant increase ($P = 0.01$) in resting metabolism, In this case null hypothesis number (H_{01}) was rejected and alternative hypothesis number (H_{11}) was accepted because resting metabolism is included in the body composition variables. Where as the control group of the present study observed a significant decrease ($P = 0.01$) in resting metabolism, in this case null hypothesis number (H_{02}) was rejected and alternative hypothesis number (H_{12}) was accepted because resting metabolism is included in the body composition variables.

The experimental group of this study showed a decrease in visceral fat, but statistically no significant difference ($P = 0.18$) was observed. In this case null hypothesis number (H_{01}) was accepted and the alternative hypothesis number (H_{11}) was rejected because visceral fat is included in the body composition variables. Another research which was done by (Giannaki et al., 2015) in the study “Eight weeks of a combination of high intensity interval training and conventional training reduce visceral adiposity and improve physical fitness: a group-based intervention” reported both exercise programs were effective in reducing total body fat and visceral adiposity ($p < 0.05$), It may be due to the different type intensity in training has an effect on visceral fat. Also in a control group of the present study showed that increase visceral fat, but statistically no significant difference ($P = 0.19$) observed, in this case null hypothesis number (H_{02}) was accepted and alternative hypothesis number (H_{12}) was not rejected because visceral fat is included in the body composition variables.

Lipids and lipoprotein profile indicate the cardiovascular and the metabolic status of the athlete (Kelley & Kelley, 2009; Alena et al., 2006). Activity levels have a

significant impact on the lipids and lipoprotein levels of the athletes (Kelley & Kelley, 2009; Alena et al., 2006). In the present study of experimental group significant decreased ($P=0.01$) of total cholesterol significantly decreased ($P=0.01$) of triglyceride, In this case null hypothesis number (H_{01}) was rejected and alternative hypothesis number (H_{11}) was accepted because total cholesterol, and triglyceride is included in the lipid profile variables. It indicates that as the training load and performance level increases, the level of total cholesterol, and triglyceride level decreased gradually. The possible reason for the reduction in total cholesterol, and triglyceride level is exercise training (Kelley & Kelley, 2009; Alena et al., 2006; Wilmore and Costill, 2005). However, no significant difference has been noted in HDL level ($P=0.86$) and LDL level ($P=0.06$) after the post-test. This may be due to the short duration of the training or improper optimization of the training load. The findings are supported by observations of other researchers in their recent studies (Kelley & Kelley, 2009; Alena et al., 2006). Another research finding showed significant difference in total cholesterol, and triglyceride level after training which was done by (Manna et al., 2009), in the study, “Training induced changes on physiological and biochemical variables of young Indian field hockey players”. The control group of this study showed a negative increase of total cholesterol level ($P=0.34$), a negative increase in triglyceride level ($P=0.34$), a negative increase of LDL ($P=0.55$), therefore a decrease in HDL level ($P=0.86$) In this case null hypothesis number (H_{02}) was accepted and alternative hypothesis number (H_{12}) was rejected because total cholesterol, and triglyceride HDL and LDL are included in the lipid profile variables.

6. CONCLUSION AND RECOMMENDATIONS

6.1. Conclusion

1. The present study observed that the youth player is more interested in recreational games and practice games more than training.

2. Cardio-respiratory endurance is an important part of overall physical fitness. An increase in the number of shuttles during 3 minutes after training reflects improved cardio-respiratory endurance capacity and aerobic capacity. It will help the physical educator and coaches to apply technical and tactical plan faster during the match and competition, especially this finding is important for midfield football players to do more about running in tactical plans in the middle of the ground.

3. Regular measurement of blood lactate level and maximum heart rate are important to determine optimum intensity in the training and in the different phases of training.

4. Reduction of body mass, body fat, visceral fat are important for player's performance as well as it helps in minimizing the risk factor for cardiovascular disease among the players, especially for older adults.

5. Aerobic training can improve the aerobic capacity of muscle, and anaerobic training can improve central nervous system recruitment of muscle and increase skeletal muscle mass. Therefore, building and increasing skeletal muscle are much important to prevent injuries.

6. Measurement of resting metabolic rate is important for determining the optimum number of calories for players to burn it at rest, during training, and vital function of the human body.

7. Regular monitoring of lipids and lipoprotein profiles of the football players is essential to optimize their health and minimizing risk factor for cardiovascular disease among the players especially for older adults. Lipids are also important to store energy, especially triglycerides, therefore to see which has a direct effect on the performance of the players.

8. The focus should be directed to the education of young people, because they can easily adopt healthy habits that they should maintain for life. These results point out the necessity of an integrated approach to prevention and control of risk factors, particularly among youth.

9. Training effects were reflected on various parameters like body mass index, body fat, and visceral fat, skeletal muscle, resting metabolism, blood lactate, maximum heart rate and lipid profile of the football players. These profiles should be taken into consideration while administering training to the players. As the studies on football players are limited in this aspect in Kurdistan region-Iraq, the data of the present study can be a handy tool and can act as a frame of reference for monitoring of training of football players particularly of under 20 years old group. This would enable the coaches to assess the current status of an athlete and the degree of training, adaptability and provide an opportunity to modify the training schedule accordingly to achieve the desired performance.

6.2. Recommendations

1. The kind of the present study would have better results if it performs with the research group, if it consisted a physical educator, physiologist, biologist and biochemist. It would be better if researchers met all the aspects of the study.

2. Weather and environment are different between hot and cold in some countries; this aspect has an effect on the results and subjects during tests. To controlling

this problem all physical tests must be done indoors in regulating temperatures and humidity.

3. Activity of daily living has an effect on the blood lactate level on the day of tests, for example working and participation in physical education lesson in the school. It is recommended to other researchers to be aware about this point.

4. It is recommended to physical educator and coaches trying to input recreational games and practice games into every training sport units in the program to encourage players towards participating in the training.

5. The Similar present research can be studied on under 20 years of age female players.

6. The Similar present research can be studied on the different game team players like volleyball, handball, and basketball players.

7. Comparison research can be a study between male and female football players.

8. The Similar present research can be studied in the different age groups.

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ATTACHMENTS

Appendix 1: schedule of 12 weeks of training program

MACRO PLAN												
MONTH	OCTOBER				NOVEMBER				DECEMBER			
PERIOD & Meso	PREPARATORY PHASE I				PREPARATORY PHASE II				PRE-COMPETITION PHASE III			
Micro/weeks	1	2	3	4	5	6	7	8	9	10	11	12
Days	3	3	3	3	3	3	3	3	3	3	3	3
Hours	3	3	3.5	3.5	4	4	4.5	4.5	5	5	5.5	5.5
Physical fitness	10 hours 12 minutes				10 hours 12 minutes				10 hours 12 minutes			
	Aerobic and anaerobic training				Aerobic and anaerobic training				Aerobic and anaerobic training			
Recreational game & Practice game	2 hours 48 minutes				6 hours 48 minutes				10 hours 48 minutes			

PERIOD	PREPARATORY PHASE								PRECOMPETITION PHASE			
MESO	MESO CYCLE -I				MESO CYCLE -II				MESO CYCLE -III			
Weeks	1	2	3	4	1	2	3	4	1	2	3	4
Number of minute	180 m	180 m	210 m	210 m	240 m	240 m	270 m	270 m	300m	300 m	330 m	330 m
Warm up	24	24	24	24	30	30	30	30	30	30	30	30
3 minutes running	60	60	60	60	60	60	60	60	60	60	60	60
50 meter dash sprint & 30 meter dash sprint	45	45	45	45	45	45	45	45	45	45	45	45
Recreational game & Practice football game	36	36	66	66	81	81	111	111	141	141	171	171
Cooling down	15	15	15	15	24	24	24	24	24	24	24	24

Appendix 2: variables, Purpose of measurements, Equipment

S.No.	Variable	Purpose of measurements	Equipment, Test Administration & methods
1	Body Mass index	To measure body mass index	Full body sensor body composition monitor and scale tools, Omro model HBF-514, USA. bioelectrical impedance method was Using for measurement
2	Body Fat	To measure body fat percentage	
3	Skeletal Muscle	To measure body fat percentage	
4	Visceral Fat	To measure visceral fat percentage	
5	Resting Metabolism	To measure the obtained number of calories for energy is required for vital function	
6	Cardio-respiratory endurance	To measure indirect cardio-respiratory endurance by Counting number of shuttles	(3 minute 20-m multi-stage shuttle run test) was using for indirect measure Cardio-respiratory endurance , also Cone, stop watch and clapper was using for measurement in this test
7	HRmax	To measure the highest number of heart beats	After (3 minute 20-m multi-stage shuttle run test) Polar RS 400 heart rate monitor (USA) Was using
8	Blood Lactate	To measure blood lactate level	After (3 minute 20-m multi-stage shuttle run test) Lactate pro 2 test meter, lactate pro 2 strips Arkary model (Japan) was using for measurement

S.No.	Variable	Purpose of measurements	Equipment, Test Administration & methods
9	Total Cholesterol	To measure the total cholesterol level	Full automatic biochemistry analyser model number (bt35i-Turkey) was using for analysing Total Cholesterol by GOD-PAP method Triglycerides by TRINDER method HDL by DIRECT method LDL by DIRECT method
10	Triglycerides	To measure Triglyceride level	
11	HDL	To measure the HDL level	
12	LDL	To measure the LDL level	