An-Najah National University
Faculty of Graduate Studies

The Effect of Basic Military Training Course on selected Physical Fitness and Physiological Measures

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This thesis was defended successfully on **19th June 2001** and Approved by

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Dedication

To my father and mother

To my ever-partner; my wife

To my brothers and sisters

To my colleagues at the preventive security

To my friends

Acknowledgement

I am deeply grateful to Dr. Suleiman Khaleel and Dr. Abdel Naser Qadumi for their continuous encouragement, help, and support throughout my research work. I also acknowledge the great support of Colonel, Adnan Jaber, the commander of Sa'ad Sayel Academy in Jericho. I am also indebted to all of the training department for their help in field tests.

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Abstract

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This study sought to determine the effect of Basic Military Training Courses (BMTC) on some physiological and physical fitness measures. Endurance (1.5mile run), speed (30meter sprint) flexibility (sit and reach), agility (shuttle run), upper body strength (push up), and leg power (vertical jump) were used as physical fitness indicators. HDL, LDL, TC, TG, RBCs, WBCs, RHR, and Hb, were used as physiological indicators for the effect of (BMTC) on the subjects participating in the course.

Twenty eight healthy subjects participated in the course, they were (27.5 ± 4.95) years old, (72.98 ± 7.21)kg mass, (1.74 ±0.05)meter high, and (24.01 ± 2.52) kg/m^2 body mass index.

The course was held in Jericho in the period between (27^{th}) February and (24^{th}) April 2000. For data analysis, (SPSS) statistical program was used using means, standard deviation and paired- T-test for testing hypotheses.

Venous blood samples were taken before and after the course. Enzymatic colorimetric Test with lipid clearing factor was used for determining the

concentration of cholesterol and trigleycerid (CHOD- PAP- method and GPO-PAP method respectively). Cholesterol liquicolor test was used to determine HDL-c concentration. RBCs, WBCs and Hb were measured automatically.

Significant positive differences at (α = 0.05) were seen in all measured physical fitness parameters used in favor of post training vs. pre training. The results for (1.5)mile run, (30)meter sprint, sit and reach, shuttle run, push up, and vertical jump were (9.54 vs. 13.42minutes), (4.80 vs. 5.36 second) 10.27vs 4.56cm), (10.39vs. 11.12 seconds), (48.92 vs 33.17times) and, (44.71 vs 38.64cm) respectively.

HDL, LDL, and RHR were positively affected by BMTC, where HDL concentration increased significantly after the course (52.14 mg/dl) vs. (44.10mg/dl) before the course. LDL and RHR were decreased significantly in favor of post training vs. pre training, the results were (69.42 vs. 76.75 mg/dl) and (68.0 vs 76.07 beats/ minuet) respectively.
TC was negatively affected by BMTC, it's concentration increased significantly at (α = 0.05) in favor of post training vs. pre training (141.25vs 133.53mg/dl) TG, RBCs, WBCs, were not significantly affected by BMTC.

Chapter One

Introduction and Theoretical Background

Chapter One

1.1 Physical Fitness

Physical fitness is one of the basic requirements of life. Broadly speaking it means the ability to carryout our daily tasks without undue fatigue. Physical fitness is difficult to be defined in sporting content, since it can refer to physiological, psychological or/and anatomical state of the body.

The American Academy of physical Education defines physical fitness as the ability to carry out tasks with vigor and alertness, without undue fatigue, and with ample energy to enjoy leisure-time pursuits and to meet the above average physical stresses encountered in emergency situation (Morehous, Miller, 1967)

The concept of physical fitness in general athletic terms, means the capability of the individual to meet the varied physical and physiological demands made by a sporting activity, without reducing the person to an excessively fatigued state. Such a state would be one in which he/she can no longer perform the skills of activity accurately and successfully (Davis et al. 1991).

The Presidents Council on Physical Fitness and Sports defines physical fitness as "the ability to carry out daily tasks with vigor and alertness, without undue fatigue, with ample energy to enjoy leisure time pursuits, and to meet unforeseen emergencies (Clarke, 1971).

Hayward (1991) defined physical fitness as the ability to perform occupational, recreational, and daily activities with out becoming unduly fatigued

Physical Fitness Components:

Clarke (1971) identifies the primary components of physical fitness as; muscular strength, muscular endurance, and cardiovascular "respiratory" endurance. Other physical fitness components identified by the same author are agility, speed, flexibility and balance.

Davis and others (1991) identify the components of physical fitness as, strength, endurance, speed, flexibility and body composition.

However, Hayward (1991) identify physical fitness components as Cardiorespiratory endurance, muscular strength and endurance, body weight and composition, flexibility and neuromuscular relaxation; which refers to the ability to reduce or eliminate unnecessary tension or contraction in a muscle group.

Kirkendall and others (1987) identify physical fitness components as flexibility, power, cardiovascular endurance, muscular endurance and muscular strength.

A - Cardiorespiratory Capacity

Cardiorespiratory capacity can be defined as the functional efficiency of the heart and lungs that is the success of the heart, blood vessels, and lungs in satisfying the oxygen requirements of the body (William, 1982).

Cardiovascular and cardiorespiratory endurance are considered as one of the most important factors in the participation in many sports, and are the corner stone for many physical performances, that need the ability to work for continuous and long intervals like distance running.

Endurance is needed for two types of sport; the first type is that which needs continuous physical performance like marathon running, and the other needs continuous physical performance at intervals like foot-ball. Endurance in each type is different, the first type needs semiregular endurance of both cardiac and respiratory system, whereas on the other type cardiac and respiratory systems have different role, accordingly, they work in limited intervals with irregular size and strength.

The transport of oxygen to the cells maintains life, and increased cardiorespiratory capacity improves the ability to concentrate, in fact Cureton (1947) found that a high state of cardoiorespiratory training may prevent decreases in mental acuity due to aging.

Endurance training adaptations interact to accelerate the adjustment of (O_2) supply to (O_2) demand during exercise (Hickson, et al. 1978) and it is associated with improvement in (O_2) transport to the working muscle, due to greater cardiac stroke volumes (Bevegard,1963) and higher capillary density (Anderson & Henrikssn, 1977).

Cardiorespiratory capacity, also refered to as cardiovascular, circulatory, or circul-respiratory fitness, can be measured in several ways, with a treadmill, 600yard running, a stepping bench or a stationary bicycle. Some of these methods measure oxygen consumption (VO2) which is the best laboratory indicator for cardiorespiratory capacity (Lamb,1984).

Cooper (1982) proposed a 12-minute walking- running test, a 12-minute swimming test and a 12-minute cycling test as field estimates of endurance.

B- Flexibility

Flexibility is the ability of a joint to move fluidly and through its full range of motion; they are two types of flexibility; static and dynamic flexibility.

Static flexibility is a measure of the total range of motion at the joint, whereas dynamic flexibility is a measure of the torque or resistance to movement (Hayward, 1991).

Flexibility is related to age, sex, and physical activity, it is progressively decreased with aging due to changes in the elasticity of the soft tissues and decreased in physical activity level (Hayward, 1991).

Girls were suggested to be more flexible than boys of the same age (Kirchner & Glines, 1957), this difference likely exists throughout adult hood moreover, men generally have larger and more well developed muscles than do women.

It is well documented that inactive persons tend to be less flexible than active persons and that exercise increases flexibility (Hartley, 1980). However inactivity causes loss of flexibility quickly, so it must be worked on throughout the year, on the other hand flexibility can be regained quickly (Jack and David, 1994). Disuse due to lack of physical activity or immobilization produces contraction and shortening of the connective tissue, which restricts joint mobility (Hartley 1980). Reduced flexibility can increase athletes' susceptibility to serious injury.

C- Power

Power, the explosive aspect of strength, is the product of strength and speed of movement, and is the key component for most athletic performances

$$\text{Power} = (\text{force} \times \text{Distance}) / \text{time}$$

Anaerobic power is a primary factor in athletic success (Kraemer, and Fleck 1982), and has been defined as the ability to exert great force in a short time depending on (ATP) and (PC) for providing energy. (Manning et al.1988). Almost all-competitive works other than ultra-endurance events have an anaerobic power component. Therefore the ability to train anaerobic power is important for athletes, and anaerobic capacity has been shown to be trainable in adults within (6) weeks (Mebdo and Burgers, 1990).

It has been reported that athletes with greater anaerobic capacity have more muscle mass or a higher percentage of fast twitch muscle fibers (Cerretelli et al. 1982).

However, it has also been suggested that age related differences in anaerobic power cannot be explained merely by differences in body size or active muscle mass, suggesting that these differences may be explained by qualitative characteristics of the muscle or by the nature of activation of the motor units (Inbar and Bar-Or ,1986). Since strength training result in increased muscle mass and/or for motor unit recruitment, it could be a key component in the development of anaerobic power. For this reason, many coaches encourage their athletes to engage in strength training during the season as well as in preseason and off – season (Gamble, 1988).

It was confirmed that strength and power are both reduced once the athletes stops training, but these changes are relatively small during the first few months, in one study, no strength loss was noted (4) weeks after completion of a 3- week resistance training program, and only (45%) of the original strength gained from a 12-week training program had been lost when the subjects, who did no farther training, were reevaluated one year later (Costill et al.1991).

A number of field tests have been widely used to measure anaerobic power, for example the vertical jump, (40) yard dash, standing long jump and Margaria-Kalamen test (Manning et al. 1988).

D- Strength

Strength is the maximum force a muscle or muscle group can generate. Maximum capacity is defined as the maximum weight the individual can lift just once. This is referred to as the one-repetition maximum or the 1-RM.

It is important to perform strength for a period of time, because of daily needs. The capacity to sustain repeated muscle actions for an extended period of time is termed muscular endurance. It can be determined by assessing the maximum of repetitions you can perform at a given percentage of your 1-RM (Wilmore &Costill, 1994).

Strength gained during training not only depends on the increase in muscle size. Enoka, has made a convincing argument that strength gains can be achieved without structural changes in muscle, but not without neural adaptations (Enoka, 1988). Thus, strength is not only a property of the muscle, rather it is a property of the motor system. Motor unit recruitment is quite important to strength gains. It may well explain most, if not all, strength gains that occur in the absence of hypertrophy, as well as episodic superhuman feats of strength (McDonagh and Davies, 1984).

It was concluded that there is a direct relationship between strength and anaerobic power, this relationship is suggested by the fact that sprint training has been found to increase maximal voluntary contraction of the leg muscle (Thorstensson et al. 1975).

Additionally, Costill et al (1979) studied the effects of isokinetic leg training on a 60-second maximum isokinetic test and concluded that performance gains come from improvement in strength rather than in anaerobic yield of ATP.

Williams (1991) have reported significant increase in children's vertical jump performance due to strength training.

Many tests have been used to evaluate person's strength, cable – tension strength test, weight-lifting strength test (bench press strength test, push ups, sit ups, side leg raise, chest raise, double backward leg raise and /or sitting tucks (KerKendall et al. 1987).

E- Body Composition

Body composition refers to the body's chemical composition (Wilmore & Costill ,1994).Four models are used to illustrate body composition, figure (1) describe these models.

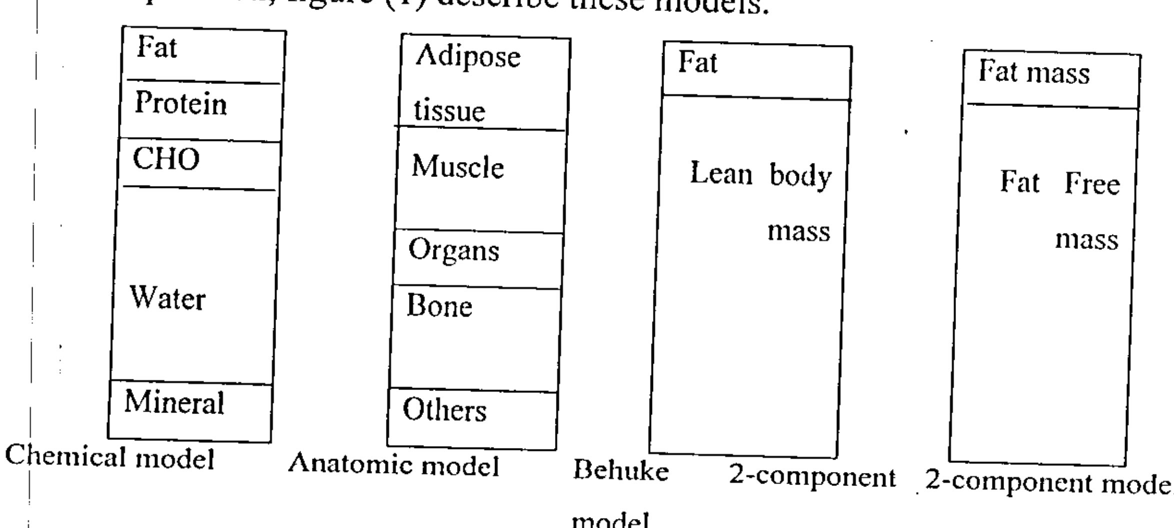


Figure (1)

Body weight and body composition

Adapted from Wilmore (1992)

The later two models in figure (1) are adopted for many scientist, were fat free mass, formerly referred to as the lean body mass (LBM) is composed of all of the body's nonfat tissue. Marley (1981) reported that the acceptable level of fat in women ranges between 15-20% and in 12-15%. Men could be classified according to their fat percentage as.

9.9%	→	suitable
10%-14.9%	→	normal
15%- 19.9%	→	over weighing
> 20%	→	obese

Thus it seems to be clear that there is an end point between obesity and overweighing (Bruce, 1986).

The difference in fat percentage between men and women is due to the hormonal effect between them. Testesterone is responsible for the development of male secondary sex characteristics and spermatogenesis. Another critical role of testesterone is the promotion of skeletal muscle growth, which is important to our understanding of strength training and gender differences. On the other hand, ovaries produce estrogen and progesterone, which are important for female secondary sex characteristics (Lamb, 1984). It is worth noting that the increase in body fat among the two sexes is due to an increase in fat cells number and size under the age of (16) and merely due to an increase in cell size after this age (Stunkard et al,1990).

Another important factor for obesity is heredity; it was shown that there is a direct genetic influence on height, weight, and body mass index (Stunkard et al, 1990). A study from Laval University in Quebec has provided possibly the strongest evidence of a significant genetic component for obesity, (Gortmarker et al, 1987). The investigators took

(12) pairs of twins and housed them for (120) days under the same conditions, they found that the response of both twins in any given pair are quite similar the major variations occurred between different twin pairs.

Over weight and obesity are associated with an increased over all rate of death (Bray, 1985). Causes of mortality associated with obesity include, heart disease, hypertension, and certain types of cancer, gall bladder disease, and diabetes. Upper body obesity is more dangerous than lower body obesity. It is considered as an important risk factor for coronary artery disease, stroke, elevated blood lipids and diabetes (Bjorntop et al. 1988).

Body fat percentage could be estimated by many methods such as hydrostatic weighing; (under water weighing to estimate the specific gravity) "body density", Girth, skin folds methods, (Kirkendall et al. 1987).

1.2 Lipids and Lipoproteins

Blood Lipids are considered as a primary risk factor for coronary artery disease. Lipids by them selves are insoluble in blood, so they are backed with a protein to allow transport through the body.

Two classes of lipoproteins of major concern for coronary artery disease; cholesterol bounded low-density lipoprotein (LDL-c) and cholesterol bounded high-density lipoprotein HDL-C. High levels of LDL-C and low levels of HDL-C place a person at an extremely high risk of having a heart attack at relatively young age- "under the age of 60years".

Numerous epidemiological studies have documented that low levels of HDL-C are associated with increased risk of coronary artery disease in adults (Gordan et al. 1989). The National Cholesterol Education Program (NCEP) (Falkner et al. 1996) recommended that an HDL-C level < 35mg/dl should be considered a risk factor in children and adolescents. Other factors which may be associated with low HDL-C are cigarette smoking and obesity.

Conversely, a high level of HDL-C and low level of LDL-C place a person at an extremely low risk of having coronary artery disease. A third class of lipoproteins called very-low density lipoproteins VLDL-C is becoming increasingly implicated as a risk factor for coronary artery disease (Stampfer et al. 1991) (Austin, 1989).

The obese state has been recognized to accentuate such established risk factors for a therosclerotic disease as dislipidemia, hypertension and insulin resistance. Regular exercise is the corner stone of treatment of many dyslipidemias, insulin resistance, and obesity, specifically, regular aerobic exercise has been shown to lower a therosclerotic risk through an increase in HDL-C and a reduction in triglyceride and body mass (Thompson et al. 1991) (Weintraub et al. 1989), thus merely looking at total cholesterol is not sufficient. A person might have moderately high levels of total cholesterol, yet be at relatively low risk because of high concentration of HDL-C, conversely, a person might have moderately low levels of total cholesterol, yet be at a relatively high risk because of a high concentration of LDL-C and a low level of HDL-C.

LDL-C is known to be responsible for depositing cholesterol in the arterial wall. The HDL-C however is regarded as a scavenger that removes cholesterol from the arterial wall and transports it to the liver to be metabolized. Because of these very different roles, it is essential to know the specific levels of both lipoproteins- HDL-C and LDL-C when determining individual risk for coronary artery disease (Wilmore and Costill, 1994).

The ratio of cholesterol to HDL-C may be the best index of risk for coronary artery disease. Values of 3.3-4.4 place a person at low risk, but values of (11.0) or greater place a person at high risk (Wallach,1992).

Wilmore and Costil (1994) reported that values of this ratio are more important, (> 3) low risk and ($\leq$ 5) high risk.

Lipid and Lipoprotein chemistry:

I- Triglycerides:

Triglyceride molecule composed of one molecule of glycerol and three fatty acid molecules which are usually different, figure (2).

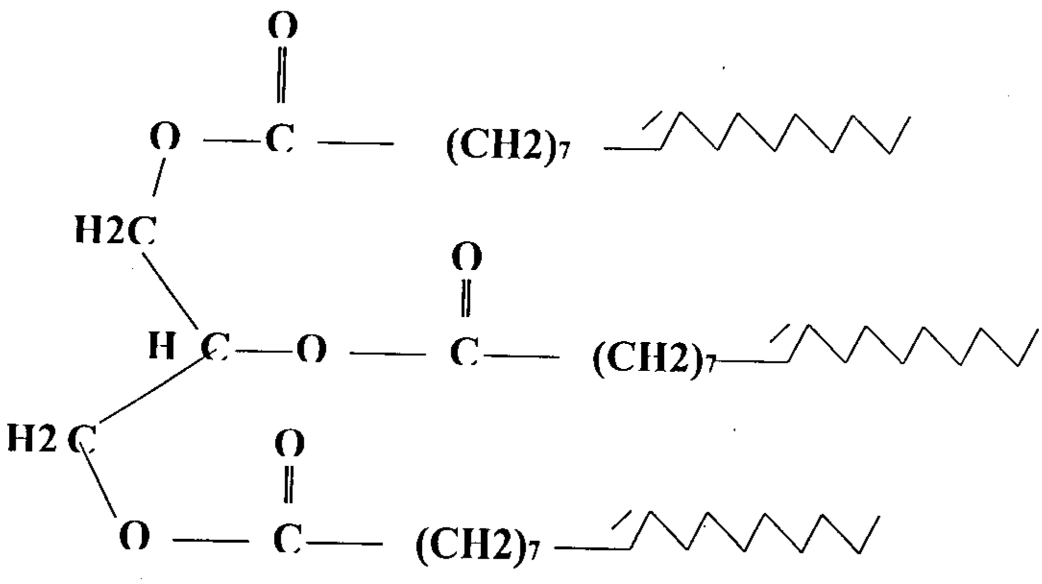


Figure (2)

Triglycerid chemical structure

These fatty acids may be saturated or unsaturated. Triglycerides with it's high energy containing long carbon chains of fatty acids considered as one of the most important sources of energy during fasting. When triglycerides are metabolized their fatty acids are converted into energy and glycerol molecule is recycled into additional triglycerides (Michael et al. 1996)

There are many factors that facilitate triglyceride breakdown, e.g, hormone-sensitive lipase, lipoprotein lipase which is activated by exercise training, epinephrine and cortisol (Tietz,1987).

Triglycerides are transported in plasma mostly in the form of larg triglycerides-rich particles known as chylomicrons and VLDL. Lipoprotein Lipase facilitates triglyceride hydrolysis into glycerol and fatty acids when it is in contact with chylomicrons and VLDL particles.

II- Cholesterol:

Cholesterol is an unsaturated steroid alcohol with a high moleculer weight, it compined from a perhydrocyclopentanthroline ring and aside chain of eight carbon atoms, it contains one fatty acid in it's esterified form, figure (3).

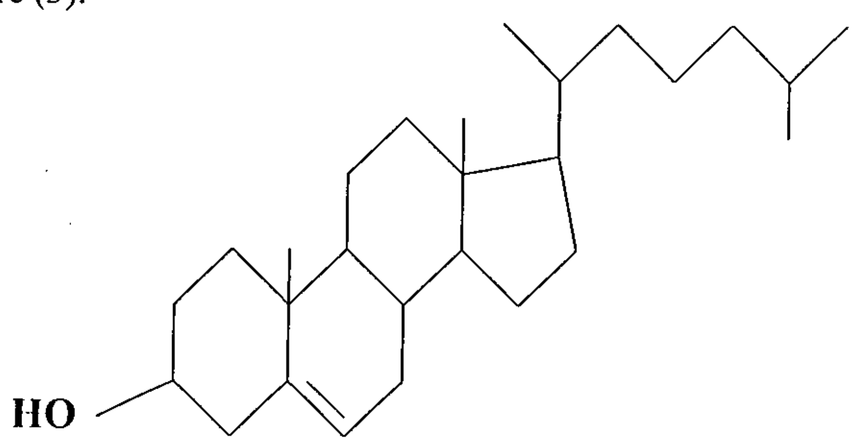


Figure (3)

Cholesterol chemical structure

Cholesterol is a basic building block in cell membrane, vitamin D, progestins, mineralocorticoids, androgens, glucocorticoids and estrogens. So it is found in all body cells and fluids.

Body cholesterol comes from exogenous (dietary) or endogenous "Liver made" sources. Only about 30% of body cholesterol is transported in the form of Lipoproteins and circulates through the Liver, while 70% is in the stationary phase located in the skin, adipose tissue and muscles.

III- Lipoproteins: (Michael et al. 1996)

Lipoproteins could be classified according to their density or their electrophoretic mobility. Lipoproteins also differ in their chemical composition, potential atherogenicity and size.

Four major types of lipoproteins are separated by ultra-centrifugation according to their density; chylomicrons, VLDL, LDL, and HDL .

Lipoproteins contains a hydrophobic "water insoluble" lipid core consisting primarily of cholesteryl esters and triglycerides, this core is surrounded by a hydrophilic "water soluble" apolopoproteins, free cholesterol and phospholipids. This hydrophilic core makes it possible for cholesterol esters and triglycerides to transport through the circulation. Tables (1, 2) Show physical and chemical characteristics of Lipoproteins

Tables (1)

Physical characteristics of Lipoproteins

No	Lipoprotein	Density (g/ml)	Diameter (nm)	Molecular Weight.(10)	Source
1	Chylomicron	0.93	80-1200	50-1.000	Intestine
2	VLDL	0.93-1.006	40-80	10-80	Liver
3	IDL	1.006-1.019	30-40	5-15	Catabolism of VLDL
4	LDL	1.019-1.063	18-30	43	Catabolism of IDL
5	HDL	1.063-1.21	5-12	0.36-0.20	Liver & Intestine
6	Lipoprotein (a)	1.050-1.1	25-36	45	Liver

Table (2)

Chemical composition of Lipoproteins (% by weight)

Lipoprotein	Free cholesterol	Cholesteryle ester	Triglyceride	Phospholipid	Protein
VLDL	4%-7%	8%-14%	50%-65%	12%-16%	5%-10%
LDL	6%-15%	35%-45%	4%	22%-26%	22%-26%
HDL	5%	15%-20%	3%	25%-30%	45%-59%
Chylomicron	1%	2%-4%	90%-95%	2%-6%	1%-2%

1.3 Blood Pressure and Pulse Rate

Blood pressure (BP), is the pressure exerted by the blood on the vessel walls, and the term usually refers to arterial blood pressure. It is expressed by two numbers; the systolic pressure and the diastolic pressure. The higher number is the systolic blood pressure and it represents the highest pressure in the artery and corresponds to ventricular systole of the heart. Ventricular contraction pushes the blood through the arteries with tremendous force, which exerts high pressure on the arterial wall.

The lower number is the diastolic blood pressure and represents the lowest pressure in the artery, corresponding to ventricular diastole when the heart is at rest. Blood moving through the arteries during that phase is not pushed along by forceful contraction.

BP is primarily dependent in body size, so children have lower BP than adults and it is difficult to determine what constitutes BP abnormalities among children, e.g. hypertension; a condition in which BP may elevated to a high level.

Joint National Committee on Detection, Evaluation and Treatment of High Blood Pressure (1988) has established an adult guideline for diastolic and systolic BP. These guidelines are presented in the following table (3)

Table (3)

Blood Pressure guideline for adults

Diastolic BP "mmHg"		Systolic BP "mmHg"	
< 85	Normal BP	< 140	Normal BP
85-89	High normal BP	140-159	Border line
90-104	Mid hypertension		Isolated systolic hypertension
105-114	Moderate hypertension	> 159	Isolated systolic hypertension
> 114	Sever hypertension		

However, BP is higher among men than women, in addition systolic BP increases about (20) mmHg among men between (20-72) years of age while it increases (43) mmHg among women during the same period. On the other hand diastolic BP is more stable (Previte, 1983).

Resistance training plays an important role in BP level, a reduction in BP was seen in both systolic and diastolic BP. Decreases average approximately (11) mmHg for systolic pressure and (8) mmHg for diastolic pressure (Hagberg, 1990) (Tipton, 1991).

Hagberg and others (1984) followed a group of borderline-hypertensive adolescents through (5) months of weight training. The subjects' resting systolic blood pressures decreased significantly.

1.4 Heart Rate

Heart rate reflects the amount of work the heart must do to meet the increased demands of the body when engaged in activity.

Resting heart rate averages (60) to (80) beats per minute. In highly conditioned endurance- trained athletes, resting rates in the range of (28-40) beats per minute have been reported (Stone et al. 1991).

With resistance training the heart rate at sub-maximal rate of exercise is generally reduced, which typically reflects improved cardiorespiratory fitness.

The heart can be enlarged by resistance training, likely because of increases in the thickness "hypertrophy" of the interventricular septum and the left ventricular wall, this can increase the contractility of the left ventricle and enhance stroke volume. These changes in the myocardium of the left ventricle are theorized to be adaptations to the heart contracting against an increased systemic arterial pressure during resistance training. (Stone et al. 1991).

Reduction in heart rate appear to be dependent on the following characteristics of the resistance training program; training volume, training intensity, training duration, length or rest periods between sets and the amount of muscle mass used (Stone et al. 1991).

1.5 Red Blood Cells

Mature red blood cells "RBCs" or " erythrocytes" have no nucleus, so they can't reproduce. When damaged they must be replaced with new cells. The normal life span of an RBC, is only about (4) months. Thus they are continuously produced and destroyed at about equal rates.

RBCs transport oxygen primarily bound to their hemoglobin, each hemoglobin molecule is able to bind (4) oxygen molecules to it's hemeiron. During resistance exercise RBCs count increased because of the increase in it's concentration due to the decrease in plasma volume. Two factors affect the level of plasma volume. As blood pressure increases, the hydrostatic pressure within the capillary increases. Thus the increase in blood pressure forces water from the vascular compartment to the interstitial compartment, also, as metabolic waste products build up in the active muscle, intramusculas osmotic pressure increases, and this attracts fluids to the muscles (Sejersted et al. 1986).

If exercise intensity or environmental conditions cause sweating additional plasma loss can be expected. Although the major source of fluid for sweating is the interstitial fluid, this fluid will be diminished as sweating continues (Collins. et al. 1989).

Later studies reports that the increase in RBCs count not only comes from the decrease in plasma volume, but also from the spleen to facilitate oxygen transport (Flamm et al. 1990).

1.6: Review of Related Literature

There are many research studies which were conducted to determine the effect of exercise on physical fitness and blood biochemistry, these studies are.

Yigit and Tuncel(1998) put a program for comparing the physical and physiological alterations that occur in young men as a result of 6-week endurance training program (51) students were assigned to 1 of 3groups: road (n=14) sand (n=19) or control group (n=18); vertical jump was used as one of physical indicators and VO2 max was used as physiological indicator.

Both treatment groups showed a significant increase in vertical jump, but sand runners showed greater improvement than road runners; this was illustrated by the increased potential energy needed on sand than that needed on a firm surface.

VO2 max increased significantly for sand runners but not for road runners or controls at the end of the program. It is worth noting that VO2 max increased in road runners but not significantly.

Simoneau (1998) made a study to determine which components of anthropometry and leg/back flexibility best contribute to performance of the sit and reach, (34) college women were able to participate in the study aging (20.3 ± 0.9years).

He concluded that sit and reach performance is exclusively determined by hamstring flexibility, and anthropometric proportions have minimal if any effect on sit and reach performance.

Sanborn and others (1999) made a comparison between men and women in the effect of (10) weeks of training on some physical variables.

Results showed that men had a significantly higher body mass and composition, isometric pulls and dynamic pull peak force and power out put, vertical jump, and 1-RM power snatch.

Only body mass showed a gender-time interaction, with men increasing at a faster rate. These data indicate that over a short period, elite college men and women throwers can increase measures of strength, power and throwing ability at similar rates.

Song and Ciprianol (1984) studied the effect of seasonal training on elite varsity wrestlers, he found a significant increase in isometric strength measures throughout the season despite significant decrease in fat free mass when evaluating via skin folds.

Ulter and others (1998) found that the pattern of change of over a season was not significantly different for hydrostatic weighing, % fat or fat mass but there was a significant change in body weight, anaerobic power (vertical jump) and isometric strength.

Taylor (1971) found small but significant decreases in % fat estimated from skin fold thickness of wrestlers undergoing 12 -weeks of training.

McCarger and Crawford (1992) studied the metabolic and anthropometric seasonal change in wrestlers, they reported a loss in subcutaneous adiposity in college wrestlers undergoing weight cycling throughout the season.

Puddey and Beilin, (1995) made comparative study to evaluate pharmacological and physical treatment of hypertensive patients, they found that pharmacological treatments have adverse effects on blood lipids. Non- pharmacological "exercise" treatments for hypertension do not have this disadvantage, and exercise training has been shown to lower blood pressure of rest and during exercise in hypertensive coronary patients and may lessen the need for drug therapy.

Wenger (1995) studied the effect of hypertension and other cardiovascular risk factors on coronary heart disease among women. He found that young to middle aged women have higher serum HDL-c and lower LDL-c and triglycerides than their male counterparts.

Santiago and others (1995) found that after 40-weeks of brisk walking "aerobic training" no changes were seen in HDL-c concentration among normolipomic women.

VuTran and Wiltman (1985) studied the effect of exercise on blood lipids and lipoproteins and their relationship with coronary artery disease and body weight, the results show that exercise play an important role in lowering blood total cholesterol and arising it's high density lipoprotein which is important for the recovery of coronary artery disease. This benefit of exercise is enhanced if the patient can lose weight but is lost if the patient gains weight.

Dean and others (1998) studied the efficacy of a (4) week supervised training program on a group of young people (94male +45female) to evaluate the components of athletic performance, the subjects show significant improvements from pre-training values in vertical jump height and speed after 4-weeks of supervised training.
When the group was divided into 2 subgroups according to gender, it was seen that the girls with the lowest pre-training had the greatest improvements in vertical jump. Generally the boys tended to have a greater increase than the girls do, and the slowest subjects in both sexes have the highest positive effect. However, significant gains in speed, vertical jump and other performance measurements were not gendering specifically.

Fallon and others (1999a) followed the biochemical daily changes in a (1600km) ultra-marathon runners, he found that serum cholesterol was increased in day (4) only and there was no significant change in serum triglyceride.

Fallon and others (1999b) followed the effect of (1600km) foot race among (7) males and (2) females, to investigate hematological variations and iron related changes. Samples were taken before and after (4) days, (11) days of running and at the end of the event.
They found that hemoglobin, and red blood cell count decreased significantly below pre-race values at day (4), and did not change further on day (14) and (17). However when the absolute red cell corrected for plasma volume expansion an increase was found on day (4).
The white blood cell count increased significantly between the start of the race and day (4) and remained unchanged until the end of the run.

These results may be explained by the fact that the sample was taken immediately after running at the time many red blood cells have been destroyed.

Probhokaran and others (1999) studied the effects of supervised intensive (14) week resistance training program on lipid profile and body fat percentage in healthy, sedentary, premenopausal (24) women with mean age of (27) years, they found a significant increase in strength (1-RM) in the exercising group.

A significant decrease in total cholesterol, low-density lipoprotein (LDL) cholesterol, total cholesterol to high-density lipoprotein (HDL) cholesterol ratio and body fat percentage were also seen.

Farther more there was a strong trend towards a significant decrease in the LDL to HDL cholesterol ratio in the resistance exercise training group compared with their baseline values.

On the other hand no differences were seen in triglycerides and HDL cholesterol and no changes were seen in the variables measured in the control group.

Body mass was not significantly changed in either group, control or training group.

George and others (1999) used (18) elite cross-trained males and females in addition to (19) healthy control subjects to assess cardiac structure and function, they found that the absolute left ventricular internal dimension in diastole (ALVIDd), septal and posterior wall thickness and left ventricular mass were large in athletes than controls. Merely locking to the exercise took the researchers to the conclusion that aerobic training resulted in an increase in left ventricular chamber size "eccentric enlargement" whereas power training resulted in concentric enlargement; that is increased wall thickness.

They also found that maximum oxygen uptake was significantly greater in both athlete groups than in control, and resting heart rates were similar in male and female athletes and significantly lower than in the control group. Blood pressures tended to be lower in women, though no difference between groups was significant.

Williamas and others (1990) studied the effect of induced diet and exercise among overweight men on lipoprotein sub-fractions. They found that physical exercise and weight reduction have shown to improve the LDL sub-fraction profile in over weight subjects by reducing the concentration of small dense LDL particles. LDL subfraction was predominantly dependent on weight reduction.

Vergouwen and others (1999) studied the effect of training on haematocrit and it's relationship with altitude, they measured haematocrit of elite athletes (50 men and 41 women) during 43 months and they use 134 men and 144 women as control.

No significant differences in haematocrit were detected between male elite subjects and their references, and female elite subjects and their references. When comparing male high land and male low land data a significant difference was seen, and the same holds for women athletes. They found the higher the altitude the higher of haematocrit level.

Halle, and others (1999) studied the association of physical fitness and body weight with an atherogenic lipoprotein sub-fraction in young healthy men. For this purpose they used (125) aged (26 ± 5) years, all of which were either already regularly exercising or had the intention to start exercise.

Subjects were divided into 4 groups according to VO_2 max (group[1] VO_2 max < 40ml/kg/min, group[2] VO_2 max 40-50,ml/kg/min, group[3] VO_2 max 50-60ml/kg/min and group[4] VO_2 max > 60ml/kg/min.)

An increasing load of 50w every 3 minutes was performed during the test and the results were.

1- Serum triglycerides were the lowest in men with VO_2 max >50ml/kg/min.
2- Men with good physical fitness (VO_2max > 50ml/kg/min) had lower VLDI-c levels than less fit men.

3- Total LDL values were not significantly different between the VO_2 max group.

4- LDL-6 "small, dense particle" was 25% lower concentration in men with VO_2 max >50ml/kg/min.

5- HDL-c and HDL apoA-1 were the highest in well-trained subjects VO_2max>50ml/kg/min.

6- Low BMI has been related (BMI< 25kg/m^2) significantly with more fit men (VO_2max>50ml/kg/min).

Angelopoulos, and others (1998) studied the effects of acute 10-day training program on plasma triacylglycerol and HDL-c in obese sedentary subjects (in the 30 years old) with normal glucose tolerance.

They found no changes in BMI pretest and no changes in haematocrit. Short term exercise induced favorable changes in VLDL-c and TAG, these changes are not related to mass loss but are mediated by favorable changes in glucose tolerance and insulin responsiveness.

There were no significant differences in TC, LDL-c, HDL-c and HDL-c subfractions (HDL_2-c + HDL_3-c).

Tolfrey and others (1999) studied Lipid-Lipoprotein variability from day to day on normal healthy children.

There major finding was that all of the measured blood analysis which were taken 3 times including TC, TG, HDL-c, HDL_2, HDL_3 and LDL-c varied considerably from day to day.

They concluded that when using the 1991 National Cholesterol Education Program (NCEP) guidelines for children and adolescents, true concentrations for TC and LDL-c mainly should be based on the mean of multiple samples. Concentrations for TC ranges from (3.52 to 5.66

mmol-[1]) and for LDL-c from (1.83 to 3.4 mmol -[1]). Low variations were seen for HDL-c.

Preost and others (1999) studied the relationship between homocysteine as a risk factor for coronary artery disease and other risk factors such as physical activity, age, BMI, B-vitamin and folate supplement, HDL, TC, LDL, and TC/HDL ratio among coronary artery diseased men. They found no significant relation ship between those risk factor, and their results support the hypothesis that cysteinaemia is independent of other coronary artery disease risk factors.

Christopher and others (1999) studied the effect of 6-week resistance training on both muscular strength and endurance in young and older men. Knee extensor training was used in progressive manner as overload resistance training, muscular endurance was measured using a 50% isometric holding time task using 50% of each day's maximal torque.

Measurements were taken in two sessions prior to training and following 2 and 6 weeks of training.

After 2weeks of training both young and older men increased their strength, where younger men were more acceptable, on the other hand their muscular endurance was reduced, and younger men lose more than the olders.

After 6 weeks of training the old group continue its decline in endurance, whereas the young group improved its endurance time, both groups showed no significant difference in improved strength. The difference in endurance time may reflect differences in morphological responses, which might change with age.

Edwards and others (1999) studied the effectiveness of pseudo random binary sequence (PRBS) exercise protocol in the differentiation between (VO_2) kinetic among endurance and sprint runners. They found that VO_2 kinetics are differentially faster in endurance runners than in sprinters, this result is consistent with the theory that endurance training adaptations interact to accelerate the adjustment of O_2 supply to O_2 demand during sub-maximal exercise.

Endurance training adaptation, includes, the rate of O2 delivery from the heart to the muscles and the concentration of oxidative enzyme and mitochondria which are greater in endurance training subjects, this may limit the rate of O2 utilization by working muscle which result in more rapid VO2 adjustment to energy requirements.

A farther improvement factor for VO2 kinetics in endurance training subjects is blood flow redistribution to the working muscle due to higher capillary density.

Hetzler and others (1997) studied the effect of 12 weeks of strength training on anaerobic power in 30 prepubescent males. They divide the subjects into 3 geoups; ten for each; experience training group (ETG), novice group (NTG) and control group (Con). 3 tests, vertical jump "VJ", 40-yd dash, evaluated anaerobic power and Wingate test, were used.

It was concluded that strength training increased VJ but did not improve the other measures of anaerobic power.

Statistical analysis indicated a significant increase in the leg press in both experience groups than the control group. In contrast relative peak anaerobic power which was evaluated by 3 test; vertical jump "VJ", 40-

yard dash and Wingatet test; were not affected by 12weeks of strength training.

According to the upper body strength, only the experimental groups increase their bench press. This can be explained by the fact that all subjects received some degree of training by using their legs.

There was no significant decrease in the sum of 7-skin folds for ETG and a significant decrease in NTG. This result indicates to the possibility of muscular hypertrophy due to strength training.

Coterisano and others (1997) studied the effect of a basketball season on selected fitness parameters, they used 17 college men subjects. The subjects were divided into starters and reserves, all of them were assessed for VO_2 max, 1-RM bench press, 1-RM leg press and percent body fat both pre and post the season immediately.

Statistical analysis showed no significant difference in either body weight or body fat percentage in all the subjects all over the course. No significant change in VO_2 max among the starters was seen, but a significant decrease inVO_2 max was seen in reserves because of low activity during the course. VO_2 max among starters increases to 1.1% due to prolonged, high- intensity activity during the games.

Because of the limited time the player spent lifting weights, both groups decreased significantly in upper body strength "1-RM bench press" and starters declined in lower body strength as well.

1.7 Statement of the Problem

The intent of this study was to investigate the effect of Basic Military Training Courses(BMTC) on endurance, speed, flexibility, agility, leg-power, HDL, LDL, TC, TG, RBCs, WBCs, RHR and Hb for the participants in these training courses in preventive security forces in the West Bank in Palestine.

1.8 The Purposes of the Study:

The present study aims to achieve the following purposes:

1- Determining the effect of Basic Military Training Courses(BMTC) on selected physical fitness measures for the participants of the courses.
2- Determining the effect of (BMTC) on selected physiological Measures for the participants in these courses.

1.9 Hypotheses of the Study:

With respect to the experimental conditions of this study (pre and post training) the study was designed to test the following two hypotheses:

1- There are significant differences at (α = 0.05) in selected physical fitness measures between pre and post training in favor of post training for the participants in the Basic Military Training Courses.
2- There are significant differences at (α = 0.05) in selected physiological measures between pre and post training in favor of post training for the participants in the Basic Military Training Courses.

1.10 Significance of the Study:

In spite of the importance of physical fitness and physiological measures in military field, there is a lack of essential information about participants in the Basic Military Training Courses(BMTC) in Palestine. While data are lacking, the need for such information is becoming greater each day.

It is hoped that the results of this study will greatly benefit trainers, researchers, exercise physiologists and others to better understand building training programs and the effect of these programs on physical fitness and physiological measures for the participants in such programs. Generally, we can determine the significance of this study in the following points:

1- The present study is the first study in Palestine that cares about the effect of Basic Military Training Course on selected physical fitness and physiological measures for the participants in such courses.
2- The results of this study help trainers and researchers in knowing the present physical fitness and selected physiological measures state for the participants in understanding the effect of training courses on these variables.
3- Because of the lack of information about participants in military training courses in Palestine, the present study contributes in adding information which can be deemed as basic back ground for trainers and researchers in this area, specially, we cannot depend on other studies of other countries because of differences in training conditions and society characteristics.

1.11 limitations of the Study:

The study was subject to the following limitations:

1- The physical fitness measures were limited to (endurance, speed, flexibility, agility, abdomen strength, and leg power).
2- The physiological measures were limited to (HDL, LDL, TC, TG, RBCs, WBCs, RHR, and Hb).
3- All tests that were used to determine the study variables have established validity and reliability.

Chapter Two

Methodology

Chapter Two

Methodology

The purpose of this study was to investigate the effect of Basic Military Training Courseon selected physical fitness and physiological measures for the participants in these courses. For the organizational purposes, methodology was divided into the following categories:

1- Sample,

2- Experimental design,

3- Training program (treatment),

4- Instruments and procedures of data collection and testing.

5- Analysis data.

2.1 Sample of the study:

The sample of the present study consists of (28) participants in the (BMTC).

The course was hold during the period from 27th, February to the 24th of April 2000 in Jericho

All subjects in this investigation were healthy between the age of (18) and (37) years, and table (4) shows the characteristics of the study sample.

Table (4)

Characteristics of the study sample (N=28)

Variables	**Unite of measure**	**Means**	**Std. Deviation**
Age	Years	27.50	4.95
Weight (mass)	Kg	72.98	7.21
Height	Meter	1.74	0.05
Body mass index	Kg/m^2	24.01	2.52

Table (4) shows that the age, weight, height and body mass index of the study sample are respectively (27.50, 72.98, 1.74, and 24.1).

2.2 Experimental Design:

Experimental pre test- post test- one group design was used. This design labeled as follows: (Thomas & Nelson, 1990, P.310).

01 T 02

Where:

01	=	Pre test
T	=	Basic training course
02	=	Post test

Subject pre-tested on selected physical fitness measures and physiological measures and at the conclusion of eight-week training program all subjects were again tested on the same variables.

2-3: Treatment (The training program):

The course program was divided into three periods of time:

A: In the first two weeks the program focused most of training time in physical exercises, so it was the hardest period, the following table (5) show work:

Table (5)

Daily program distribution in the first two weeks

Time	Content
4:00	Waking up.
4:10 –4:40	Running
4:40 – 5:30	Swedish exercises.
5:30 – 6:00	Room cleaning and coordination.
6:00 – 8:00	Shaving, Shower and any general cleaning.
8:00- 8:30	Searching and sprinting.
8:30 – 9:30	Breakfast.
9:30 – 10:30	Military training "walking".
10:30 – 10:40	Rest.
10:40 – 11:20	Principles of self Defense.
11:20 – 11:40	Rest.
11:40 – 12:30	Class course.
12:30 – 16:00	Lunch and rest
16:00 – 17:00	Fitness training
17:00 – 17:15	Rest
17:15 – 18:00	Military training "walking"
18:00 – 18:15	Rest
18:15 – 19:00	Class lecture
19:00 – 20:00	Dinner
20:00 – 20:45	Military training "walking"
20:45 – 4:00	Sleeping

- During the two weeks some changes were done, these changes were related to the academy commander and related to the course needs, for example in military training if the course was done well, they were allowed to take rest earlier. In other times they were in need for excessive time to do well, this table was applied for (12) days continuously then the subjects were allowed to go home for two days.

- During this period the subjects were forced to wake up at midnight and forced to run for approximately (15-20)km outside the field of training (4) times. In the next day of each of these nights, the first (2-3) hours of the program were canceled.

B. In the second two weeks the program made a balance between physical training and principles of security, the following table (6) shows daily work during this period of time.

Table (6)

Daily program distribution for the third and forth weeks

Time	Content
4:00 – 9:30	As in the first two weeks
9:30 – 10:30	Class lecture
10:40 – 11:20	Principles of self defense
11:40 – 12:30	Class lecture and field application
12:30 – 16:00	Lunch and rest
16:00 – 16:20	Running
16:20 – 16:50	Fitness training
16:50 – 17:15	Rest
17:15 – 18:00	Class lecture
18:15 – 19:00	Class lecture
19:00 – 20:00	Dinner
20:00 – 20:45	Military training “walking”.
20:45 – 4:00	Sleeping

- This table was applied for (12) days continuously then the subjects were allowed to go home for two days.

C. Last half of the course – "Later 4 weeks"

During this period the program lost it's stability so no fixed procedure was used, however, professional lectures were concentrated and less physical lectures were used Generally the following table (7) describe the program at the announced period for some extent.

Table (7)

Daily program distribution for weeks (5, 6, 7, and 8)

Time	Content
4:00 – 9:30	As in the first two weeks
9:30 – 10:30	Class lecture
10:30 – 10:45	Rest
10:45 – 11:30	Field skills
11:30 – 11:45	Rest
11:45 – 12:30	Class lecture
12:30 – 17:15	As in the second two weeks
17:15 – 18:00	Class lecture
18:15 – 19:00	Class lecture
19:00 – 20:00	Dinner
20:00 – 20:45	Military training "walking"
20:45 – 4:00	Sleeping

This table was applied for (20) days and the subjects have (2) days (Thursday and Friday) as a weekend.

2-4: Instruments:

A. Physical fitness measures (parameters):

1- 1.5mile run test:

- Test objective: to measure endurance ability.
- Instruction: participants are instructed to run (1.5) mile in the fastest possible time.
- Test Area: the track of training field.
- Equipment: stopwatch, scorecards, and pencils.
- Scoring: it is scored in minutes and seconds.

2- (30) meter sprint test:

- Test objective: to measure speed.
- Instruction: participants are instructed to sprint (30) meter in the fastest possible time.
- Test area: (50-60) meter flat hard surface.
- Equipment: stopwatch, scorecards, and pencils.
- Scoring: it is scored in seconds and parts of seconds.

3- Sit and Reach test:

- Test objective: to evaluate the flexibility of the lower back and hamstring muscles.
- **Instruction:**

a. Sit on the floor with your knees fixed to each other and your feet flat against a bench turndown its side.

b. With a partner holding your arms fully extended.

c. Measure the distance your fingertips reach on the measuring stick fixed on the bench, figure (4).

Figure (4)

Sit and Reach test for measuring flexibility of lower back and hamstring muscles (From Corbin and Lindsey, 1988)

4- (30) meters Shuttle Run Test:

- Test objective: to measure agility.
- Instruction: the subject stand back the starting line, five parallel lines are marked on the floor, the width between each two lines is seen in figure (5). The subject start running to cross line (3) then go back to line (2), and from line (2) to line (4), then back to line (3) and finally, the subject run from line (3) to line (5).
- Test area: (40) meter flat hard surface.
- Equipment: stopwatch, scorecards, and pencils.
- Scoring: record the time nearest tenth of a second.

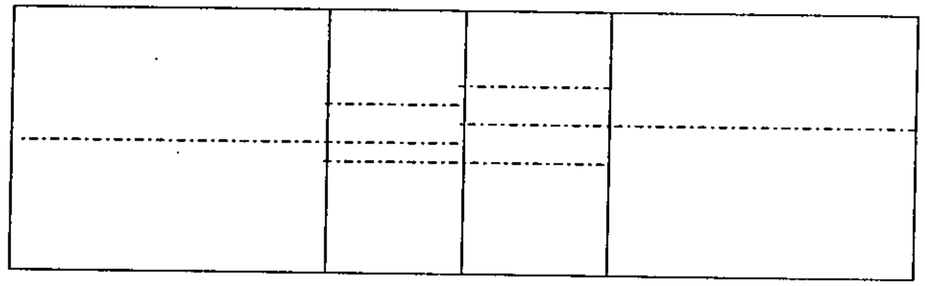


Figure (5)

Shuttle Run Test (From: Hasnen, 1995, P.369)

5- One minute Push-ups Test:

- Test objective: to evaluate muscular strength/ endurance of upper body parts (arms, shoulders, and chest).
- Instruction: participants take front- leaning rest position, arm straight, lower chest to floor, press to beginning position in same manner. Figure (6).

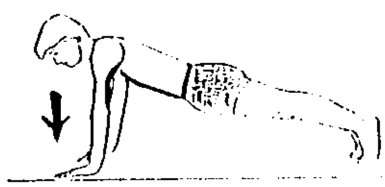


Figure (6)

Push-ups Test

- Test area: flat hard surface place.
- Equipment: stopwatch, scorecards, and pencils.
- Scoring: record the number of correctly executed push- ups that are completed in (60) seconds.

6- Vertical Jump Test:

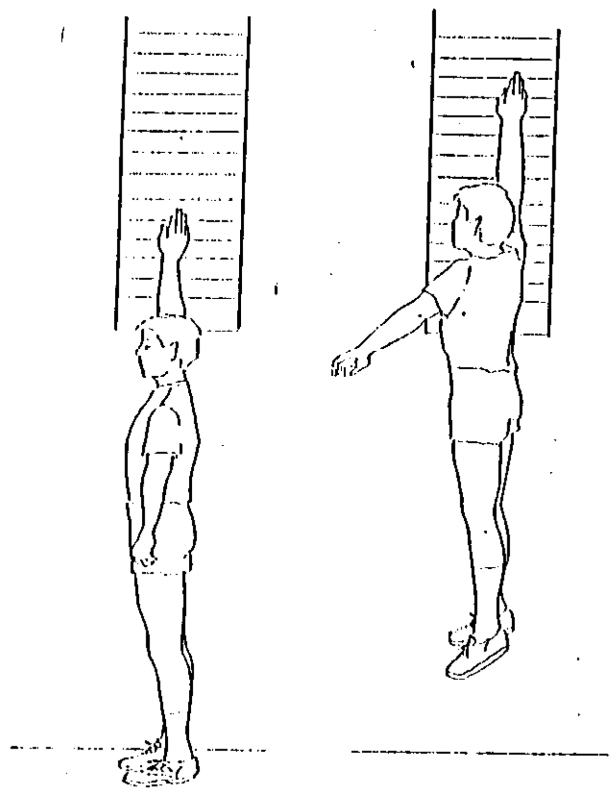
- Test objective: to evaluate leg power.
- Instruction:

a. Standing reach of the subject. Figure (7a), the reach is measured with the subject standing with the dominant side against the wall and the feet together.

b. The subject then reaches as high as possible with the dominant arm so that the palm of the hand is against the measurement scale the higher point is observed and then recorded to at least the closest one centimeter.

c. The subject moves the feet to jumping position the feet cannot change from this position prior to jumping, nor are any preparatory movements other than one jump (dip) of the arm and knee permitted. Figure (7b).

- Equipment: wall flat measuring scale, chalk, chalk dust, scorecards, and pencils.
- Scoring: it is scored by measuring the distance in centimeter between standing reach point and highest point reached after jump.



A B

Figure (7)

The significant positions for the vertical jump: (A) the recorded reach position (B) The preparatory jump position. (Adams, 1990, P.92)

B. *Physiological Measures:*

Sample collection:

All test subjects were fasted for (13 hour) and taking rest on the same period.

1- Each subject was positioned properly and (4)ml venous blood sample was collected.

2- (2)ml blood were evacuated in EDTA tube so for the CBC test.

3- (2) ml blood were evacuated in EDTA tube for the lipid profile tests.

4- The sample were transferred from the camp to Jericho hospital at (8C°).

Test procedure:

A- CBC Determination:

1- The CBC was done using an automated cell counter (*Sysmex Kx -2*).

2- Control blood samples were run for the test.

B-Lipid Profile:

1- The samples were centrifuged at (3000 r.p.m) for 5 minutes using *Heraeus* centrifuge.

2- Plasma was separated for determination of cholesterol, triglyceride, HDL and LDL.

Triglycerides Determination:

Triglycosides are determined after enzymatic hydrolysis with lipases. Indicator is quinoneimine formed from hydrogen peroxide, 4amino antipyrine and 4-chlorophenol under the catalytic influence of peroxidase.

Reaction principle:

Triglycerides $\xrightarrow{\text{lipases}}$ glycerol + fatty acids.

Glycerol + ATP $\xrightarrow{\text{GK}}$ glycerol- 3 phosphate + ADP.

Glycerol – 3 phosphate + O_2 $\xrightarrow{\text{GPO}}$ Dihydroxyacetonephosphate + H_2O_2

H_2O_2 +4 amino antipyrine +4 chlorophenol $\xrightarrow{\text{POD}}$ quinoneimine + HCl + H_2O.

Gk: glycerol kinase.

GPO: Glycerol –3- Phosphate Oxidase.

POD: Peroxidase.

Test procedure:

1- (250)µl of enzyme reagent were added to the Buffer solution and mixed (working reagent)

2- (1) µl of working reagent was added to each test tube.

3- (10) µl plasma were added to each test tube.

4- Control and standard were included in the run.

5- The absorbance of the sample/ standard was measured at 500nm using *Biosystem Spectrophotometer.*

Calculation:

$$\text{triglyceride concentration} = \frac{\Delta\text{ A sample}}{\Delta\text{ A standard}} \times 200 \quad \text{(mg/dl)}$$

ΔA: absorbance.

Triglyceride is assayed with the GPO-PAP Method, Enzymatic Colorimetric Test with Lipid Clearing Factor

- HUMAN standard and reagent were used in the assay.

Cholesterol determination:

Cholesterol is determined after enzymatic hydrolysis and oxidation. The indicator quinoneimine is formed from hydrogen peroxide and 4- aminophenazone in the presence of phenol and peroxidase.

Reaction principle:

Cholesterol ester + H_2O $\xrightarrow{CHE}$ cholesterol + fattyacid

Cholesterol + O_2 $\xrightarrow{CHO}$ cholestene-3- one + H_2O_2

$2H_2O_2$ + 4-aminophenazone + phenol $\xrightarrow{POD}$ quinoneimine + $4H_2O$

CHE: cholesterolesterase.

CHO: cholesteroloxidase.

POD: Peroxidase.

Procedure:

1- One ml of enzymatic reagent was taken for each tube.

2- 10μl of the sample were taken for each tube.

3- (10) μl of standard and (10) μl control were also included.

4- Samples with enzymatic reagent were mixed and incubated at (37c°) for 5minutes.

5- The absorbance of the sample / standard were measured at (500nm) against reagent to blank using *Biosystem Spectrophotometer*.

Calculation:

$$\text{Cholesterol concentration} = \frac{\text{test absorbance}}{\text{Standard absorbance}} \times 200 \quad (\text{mg/dl})$$

200= concentration of standard.

Cholesterol is assayed with the CHOD- PAP- Method. Enzymatic Colorimetric Test with Lipid Clearing Factor.

HUMAN Standard and reagent were used.

HDL Cholesterol:

Method:

The chylomicrons, VLDL and LDL are precipitated by the addition of phosphotungstic acid and magnesium chloride. After centrifugation the supernatant fluid contains the HDL fraction, which is assayed for HDL cholesterol with HUMAN cholesterol liquicolor test kit.

Procedure:

1- Four parts of precipitant were diluted with one part of distilled water.
2- (500) μl of diluted precipitant were added to each test tube.
3- (200) μl plasma were added to each test tube.
4- The samples with precipitant was allowed to stand for (10) minutes then centrifuged at (4000 r.p.m) for (10) minutes.
5- (1) ml of cholesterol reagent were added for each test tube.
6- (100) μl of the supernatant were added.
7- Standard and control were included on the run.
8- Incubation for (5) minutes at (37C°).
9- Measurement of the abaorbance at (500)nm.

Calculation:

$$\text{HDL-c} = 175 \text{ X } \frac{\Delta \text{A Sample}}{\Delta \text{A standerd}} \quad \text{mg/dl}$$

HDL is assayed with the HUMAN Cholesterol Liquicolor test kit.

LDL cholesterol concentration was calculated according to (Friedewald et al. 1972).

$$LDL-C = \text{Total cholesterol} - (HDL-C) - \frac{TG}{5} \text{ mg/dl}$$

2-5: Analysis data:

For analyzing data (SPSS) statistical program was used using means, standard deviation and paired –T-test for testing hypotheses.

Chapter Three

Results of the Study

Chapter Three

Results of the Study

3.1. Results of the First hypothesis:

There are significant differences at ($\alpha = 0.05$) in selected physical fitness measures between pre and post training in favor of post training for the participants in the Basic Military Training Course.

For testing this hypothesis paired T-test was used as in table (8)

Table (8)

Results of paired T-test for the difference in physical fitness measures between pre test and post- test

Physical fitness measures	test	Unit Of measure	Pre-test		Post-test		T*	△ %
			M	Sd	M	SD		
Endurance	1.5mile	Minute	13.42	1.53	9.54	1.22	20.05*	-28.91
Speed	30 M sprint	Second	5.36	0.29	4.80	0.31	8.02*	-10.44
Flexibility	Sit and reach	Centimeter	4.56	3.30	10.27	4.19	11.17*	125.21
Agility	Shuttle-run	Second	11.12	0.72	10.39	0.73	6.47*	-6.56
Upper body strength	Push up	Number	33.17	4.52	48.92	9.91	9.91*	47.48
Leg power	Vertical jump	CM	38.64	4.96	44.71	7.48	6.90*	15.70

*Critical T-test value (1.70) with DF (27). M (means) , SD (standard deviation)

The results of table (8) show that computed T-test values for physical fitness measures (endurance, speed, flexibility, agility arm strength and leg power) are respectively (20.05, 8.02, 11.17, 6.47, 9.91 and 6.90), all of these values are greater than critical T-test value (1.70). this means that there are significant differences at ($\alpha = 0.05$)in physical fitness measures between pre and post training in favor of post training. Such results are clear in figures (8),(9), (10), (11), (12), and (13).

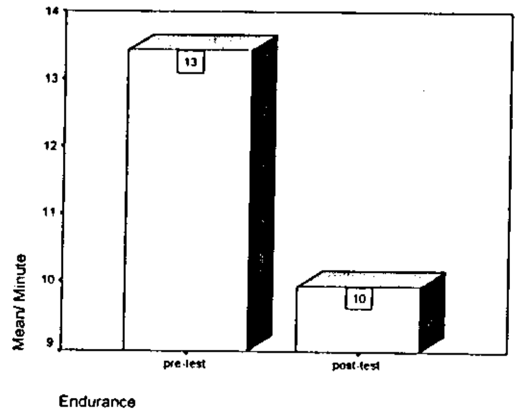


Figure (8)

Means of (1.5) mile run test for pre and post-training

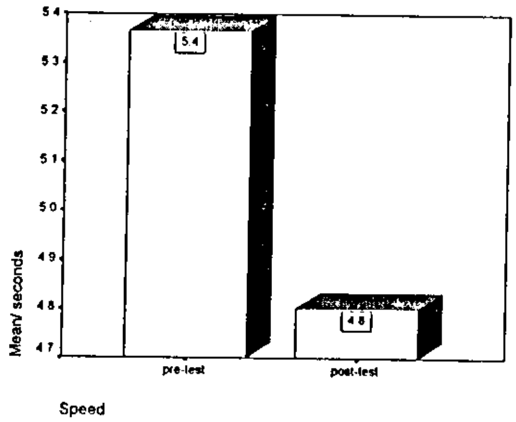


Figure (9)

Means of (30) meters sprint test for pre and post training

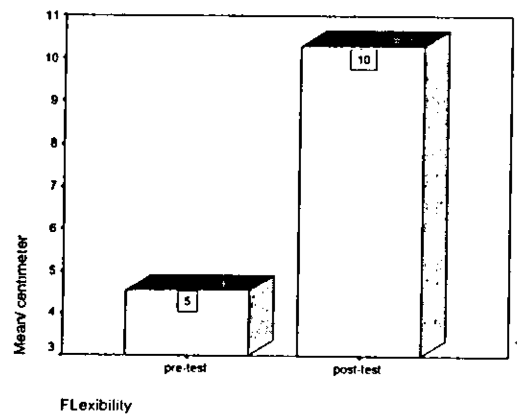


Figure (10)

Means of sit and reach test for pre and post training

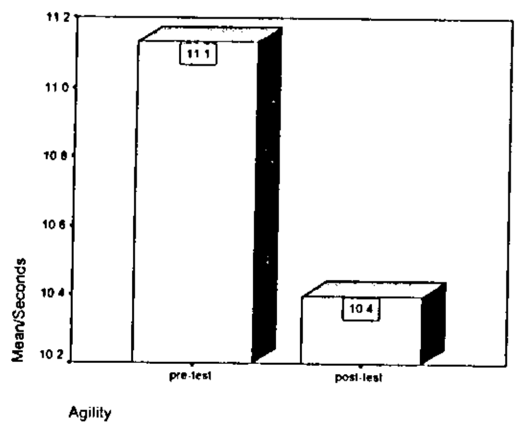


Figure (11)

Means of shuttle run test for pre and post-training

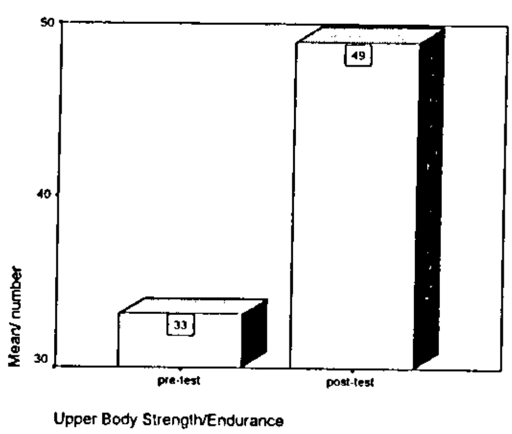


Figure (12)

Means of push-up test for pre and post training

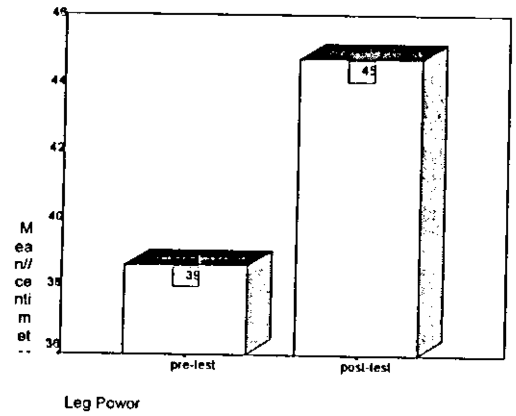


Figure (13)

Means of vertical jump test for pre and post training

3.2. Results of the second hypothesis:

There are significant differences at (α = 0.05) in selected physiological measures between pre and post training in favor of post training for the participants in the Basic Military Training Course.

For testing this hypothesis paired T-test was used as in table (9)

Table (9)

Results of paired T-test for the difference in physiological measures between pre test and post- test

Physiological variables	Unit Of Measure	Pre-test		Post-test		T*	Δ
		M	Sd	M	SD		%
HDL	Mg/dl	44.10	7.36	52.14	10.75	6.08*	18.11
LDL	Mg/dl	76.75	23.77	69.42	19.39	2.35*	-9.55
TC	Mg/dl	133.53	25.83	141.25	24.07	2.33*	5.781
TG	Mg/dl	88	41.71	86.35	41.24	0.30	-1.875
RBCs	Cell/ml	4.87#	9.20	4.86#	1.26	0.04	-0.20533
WBCs	Cell/ml	6.42!	2.02	5.94!	1.776	0.93	-7.47
RHR	Beats/m	76.07	8.27	68	9.69	4.92*	-10.60
Hb	G/dl	14.57	1.27	14.57	1.19	0.03	0.00

*Critical T-test value (1.70) with DF (27).

#: 10^{6}

! : $x10^{3}$

The results of table (9) show that computed T-test values for (TG, RBCs, WBCs and Hb) are respectively (0.30, 0.04, 0.93, and 0.03), all of these values are lower than critical t-test value (1.70). This means that there are no significant effect of the Basic Military Training Course on these variables, while the results revealed a significant effect of (BMTC) on (HDL, LDL, TC, and RHR), where computed T-values on these measure are respectively (6.08, 2.35, 2.33, and 4.92) all of these values are greater than critical T-test value (1.70). This means that there are significant effect of the Basic Military Training Course on these variables, such results are clear in figures (14),(15), (16), (17), (18), (19), (20) and (21).

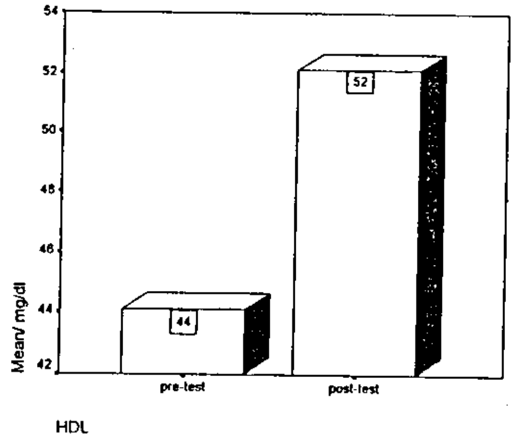


Figure (14)

Means of pre and post training (HDL) level

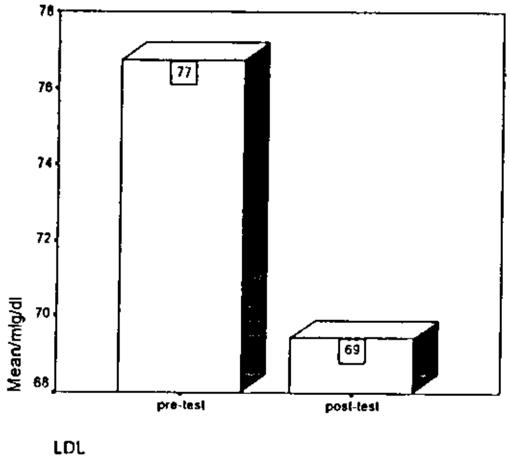


Figure (15)

Means of pre and post training (LDL) level

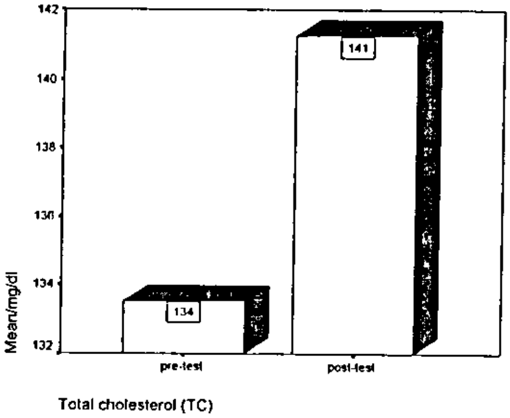


Figure (16)

Means of pre and post training (TC) level

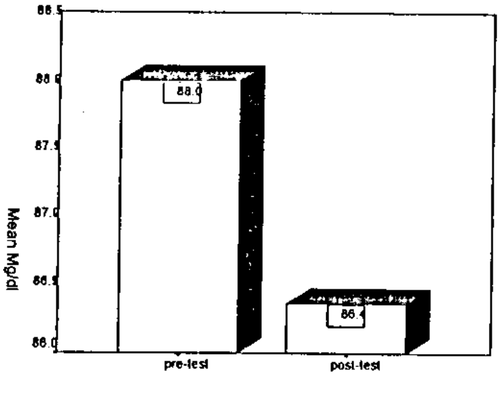


Figure (17)

Means of pre and post training (TG) level

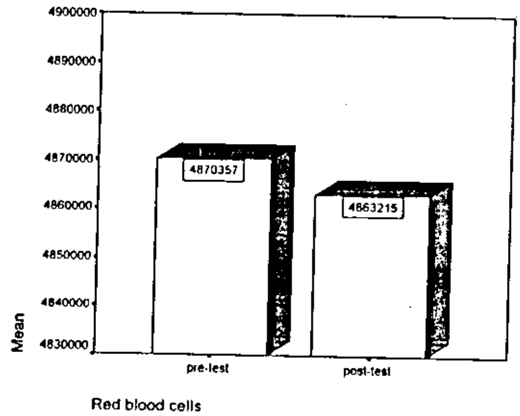


Figure (18)

Means of pre and post training (RBCs)level

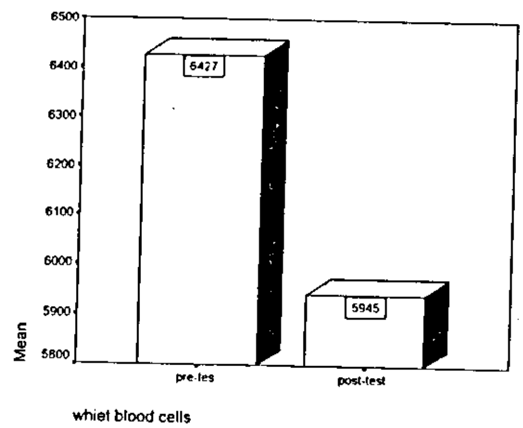


Figure (19)

Means of pre and post training (WBCs)level

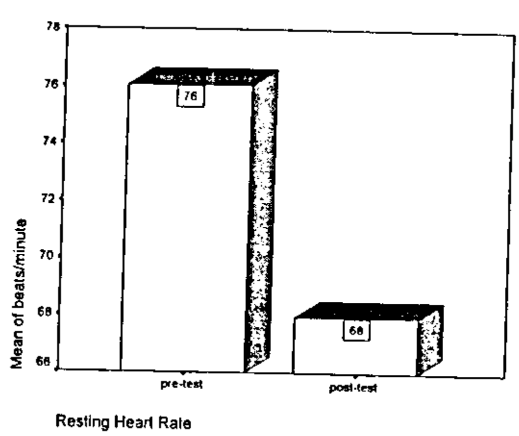


Figure (20)

Means of pre and post training (RHR)

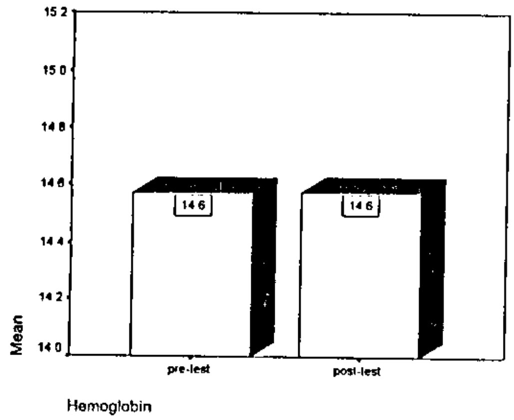


Figure (21)

Means of pre and post training (Hb)

Chapter Four

Discussion and Recommendations

Chapter Four

Discussion and Recommendations

The purpose of this study was to investigate the effects of Basic Military Training Courses(BMTC) on selected physical and physiological measures (parameters). (28) Subjects were utilized in this investigation. The subjects mean age (27.5 ± 4.95). Each of the twenty-eight subjects performed (1.5) mile, (30) meters sprint, sit-and reach., shuttle run, push-ups and vertical jump for measuring physical fitness, and HDL, LDL, TG, TC, RBCs, WBCs, RHR, and Hb, for measuring physiological measures. After (8) weeks of training, a post-test was conducted on the same variables. For the purpose of this discussion, this chapter was organized in such a manner that each hypothesis presented separately.

Discussion of the First Hypothesis:

There are significant differences at ($\alpha = 0.05$) in selected physical fitness measures between pre and post training in favor of post training for the participants in the Basic Military Training Courses.

The results of table (8) and figures (9), (10), (11), (12), (13), and (14) indicated a positive effect of (BMTC) on all physical fitness measures: (endurance, speed, flexibility, agility, upper body strength, and leg power), where the percentages of change on these measures were respectively (-28.91%, -10.44%, 125.21%, -6.56%, 47.48% and 15.70%). Such results are consistent with those studies which were conducted by Kadumi (1996), Saleh (1992), Ayed(1989) and Hayward (1991), Abdul Munem & Kesra (1985), Waleelee (1982), Asker (1980), Abed-Mawla & Kandeel (1985), Kaleelah (1983), and Jerges (1974). Where all of them reported that participation in organized training programs for a duration of (8 to 10) weeks positively increased physical fitness parameters which included in the training program.

The researcher attributed such results to the present training state of all subjects before participating in (BMTC) where all of them are sedentary, such idea confirmed by McArdle & Katch, (1988), where they pointed out that the percentages of changes which are due to participation in organized training programs depend on the present training state of the subjects. The followings are the discussion for each measure separately:

Endurance (1.5)mile run Test:

The results of table (8) and figure (8) show a decrease in (1.5) mile running-time between pre and post training in favor of post-training where the percentage of decrease was (-28.91%), the researcher attributed such change to the development of aerobic power (VO2 max) which is the best predictor of cardiorisparatory function, and successful endurance performance (Fox & Bowers, 1992).

Both central and peripheral effects of circulatory system could increase aerobic fitness. Centrally, ejection fraction and rate, stroke volume, and force of contraction of the left ventricle increase in response to exercise. The heart beats more slowly and empties more completely with a greater reserve and higher potential cardiac out put. Peripherally, blood distribution is more efficiently to the working muscles and muscles extract oxygen more efficient from their blood supply, so, the same amount of activity can be performed for a lower blood flow and a lower cardiac output (Astrand and Rodahl,1986).

Such result agreed with the results of the studies which were conducted by Hickson & Hollozey (1984), Cooper (1982), Hickson

(1985), Hoopler (1985), Olsen et al (1988), and Kadumi (1996), where all of these studies agree that participation in organized training programs can increase aerobic power (VO2max) from (5% to 25%)

Speed; (30) Meters Sprint:

There are many kinds of movement in athletics each requiring a different exertion of force and rate of movement. Speed may be defined as "the rate of motion or the velocity of the body" (Wilmor, 1982, P.93).

The (30)meters sprint time demonstrated a significant difference from pre to post training in favor of the post training, where the percentage of sprinting time decreased (-10.44%). Such result means that there was a positive effect of (BMTC) on speed, this change may be due to the changes of factors which related to anaerobic power like increase in phosphagen (ATP-PC) system (Karlsson et al. 1975), (Eriksson et al. 1973), (Thorstensson et al. 1975), or increase in anaerobic Co-enzymes activity such as phosphofructo Kinase (PFK) (Gollnic et al. 1972), (Kacsowski et al. 1982).

Such result was consistent with the results of the studies which were conducted by Kadomi (1996), Saleh (1992), Ayed (1989), Parnate et al. (1975), and McGown et al. (1990). The results of all these studies showed an increase of anaerobic power from (5% to 16%) after participating in organized training programs.

Flexibility; Sit and Reach Test:

Flexibility is the ability of a joint to move fluidly through its full range of motion (ROM). (Hayward, 1991, P. 216).

The sit and reach demonstrated a significant difference from pre to post training in favor of post training. Where the percentage of increase was

(125.21%). Such change due to the changes of factors affecting flexibility like joint, muscle and its facia, tendons and ligaments and skin (Gohns & Wright, 1962) such result was consistent with the results of the studies which were conducted by (Chapman et al. 1972), (Devries, 1962), (Hrtley – O'Brien, 1980), where the results of these studies showed that exercise increases flexibility.

Agility:

Agility is the ability of subject to change the direction of his movement in a short period of time, agility is closely linked with the speed of subject and with other abilities such as coordination. (Kadomi, 1996).

The result of shuttle run test demonstrated a significant difference from pre to post training in favor of the post training, where the percentage of run time decreased (-6.5%). This change may be due to the change in speed and to anaerobic factors such as (ATP-PC) system (Katlsson, 1972) and anaerobic Co-enzymes like (PFK), (Gollrick et al. 1972). Such results are consistent with the results of Kadomi (1996) study. Where the results indicated a positive effect of exercise on increased agility.

Upper Body Strength (Push-Up):

The strength/ endurance of upper body significantly increased from pre to post training in favor of the post training, where the percentage of change was (47.48%). Such change may be due to an increase in the size of the muscle tissue (hypertrophy) which is due to an increase in the total contractile protein, the number and size of myofibrils per fiber, and the amount of connective tissue surrounding the muscle fibers, (Goldberg et al. 1975; MacDougall et al. 1979). Moreover increase in testosterone hormone secretion, which is related to strength, may be a factor in increasing push-ups count. (Lamb, 1984).

Leg Power: Vertical Jump:

The vertical jump significantly increased from pre to post training in favor of the post training, where its percentage of change was (15.70%). Since jump-ability depends on phosphagen (ATP-PC) system and anaerobic Co-enzymes like (PFK). (Adams, 1990), the researcher attributes the changes of vertical jump to the changes in anaerobic power.

Discussion of the Second Hypothesis:

There are significant differences at (α = 0.05) in selected physiological measures between pre and post training in favor of post training for the participants in the Basic Military Training Courses.

The results of table (9) and figures (15), (16), (17),and (21) showed a significant effect of (BMTC) on (HDL, LDL, TC, and RHR) between pre and post training in favor of post training, where the percentages of change for these measures were respectively (18.11%, -9.55%, 5.78%, and –10.60%). For HDL and LDL cholesterol the results are consistent with the results of the studies which were conducted by Rubinstein et al. (1995); Toth & Poehlman, (1995); Ginsberg et al. (1995); Lavie & Milani (1995); and Dengel et al. (1995). Where all of these studies pointed that aerobic exercise increased (HDL) and decreased (LDL) cholesterol.

Aerobic training play an important role in controlling lipid metabolism, the corner stone in the relationship between aerobic training and lipid metabolism is the fact that working muscles need excessive energy for continuous work. This energy comes from triglycerid hydrolysis by lipoprotein lipase (Eisenberg, 1984).

Depletion of triglycerid from the muscles may results in increased synthesis of lipoprotein lipase in muscle capillaries. HDL_3 is the receptor for cholesterol generated during lipolysis.

Free cholesterol is estirified on the HDL particle by lecithin: cholesterol acyltransferase. (LCAT), which permits cholesteryle ester to enter the HDL core. This process results in the transformation of HDL_3 into the cholesterol enriched HDL_2 particle, this means that greater lipoprotein lipase activity increases triglyceride clearance and HDL-C concentrations due to increased HDL2 subfractions (Harely et al. 1986).

Furthermore, Stubbe et al. (1983), found that there is a decrease in hepatic lipase activity and an increase in LCAT activity, due to endurance training, therefore, HDL-c is catabolized more slowly due to decreased hepatic lipase activity.

The increase in LCAT activity increases the production of HDL_2-C (Frey et al. 1991). Figure (22)

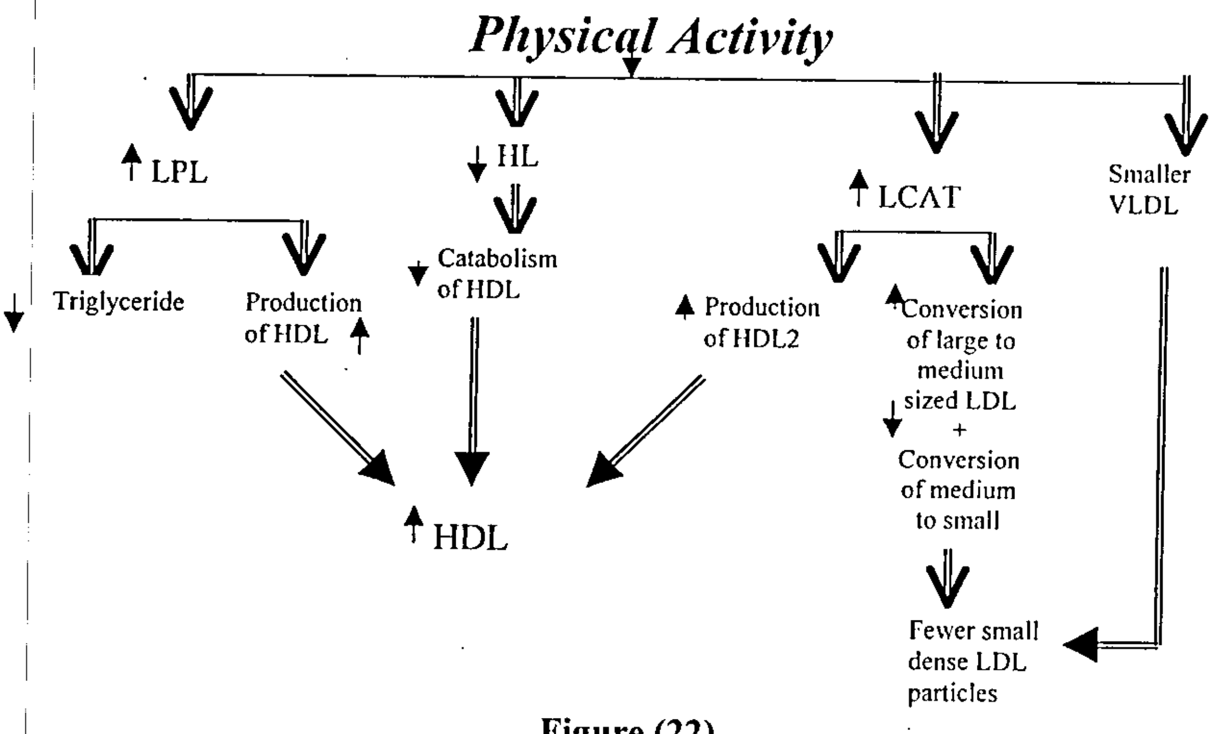


Figure (22)

The effect of physical activity on lipoproteins concentration (Daniels, 1999)

During exercise hepatic lipase activity is reduced and lipoprotein lipase activity is increased. These changes induce the conversion of large LDL particles to medium-sized LDL and delayed conversion of medium-sized LDL to small LDL particles (Krauss, 1991).

Thompson (1990) found that trained individuals have smaller VLDL particles, which are poor in cholesteryl ester and are metabolized to larger LDL particle.

Small dense LDL particles are normally catabolic products of rich cholesteryl ester large VLDL particles, so poor cholesteryl ester VLDL particles will help in decreasing small dense LDL particles.

For total cholesterol the results revealed an increase of (TC) such result may be attributed to an increase in (HDL) since the total cholesterol included both (HDL) and (LDL), or as a result of an increase in cholesterol concentration in daily diet. Diet may contribute up to (700mg) cholesterol per day. Such result is consistence only with one study conducted by Bonetti et al. (1988) which revealed a significant increase of (TC) after playing match of volleyball players.

For the resting heart rate (RHR) the result was consistent with the results of the studies which were conducted by Samuel (1988); Douglas (1984); Hickson (1977); and Subhi (1993). Where all of these studies revealed a significant decrease in (RHR) after participation in aerobic programs. Such change due to the physiological adaptation in the increased stroke volume (SV) "the amount of blood pumped by the heart per beat" and the reduced activity of parasympathic nerovous system, is due to the program (Wilmore & Costill, 1994).

Stroke volume increases results from aerobic training which makes an increase in left ventricular chamber size and power training which increases wall thickness. The two factors; aerobic training and power training make the heart beats more slowly and empties more completely (George et al. 1999).

The relationship between stroke volume, heart rate, and cardiac output is clear in the following formula:

Cardiac out put = stroke volume x heart rate (Fox & Bowers, 1992)

Although there was a decrease in RBCs count, no significant change was recorded. This result does not agree with Fallon (1990b) results, he reported a significant decrease in RBCs count after a 1600km running.

In this study hemoglobin concentration decreased but not to a significant value. The decrease in hemoglobin and RBCs is in agreement with the concept of "sports anemia". Sports anemia is a commonly encountered chronic delusional state in endurance trained athletes (Eachner, 1986).

The results show a decrease in WBCs count but not to a significant value, this result does not agree with other studies (Fallon, 1999b)(Busquet et al. 1996).

Bousquet bound the increase in WBCs count with the increase in monocytes up to three folds during physical activity, in this study the decrease in WBCs count seems to be related to inflammatory effects at the beginning of course due to weather changes since the subjects were transported from their cold cities to the wormest city in Palestine; Jericho..

Recommendations:

Based on the findings of this study, the following recommendations are made:

1- Using the Basic Military Training Course (BMTC) for developing physical fitness measures and increasing HDL concentration.

2- Further study should be carried out to determine the effect of (BMTC) on aerobic and anaerobic powers.

3- Further study should be conducted on females who participate in this (BMTC).

4- Further study should be conducted to determine the effect of (BMTC) on selected enzymes as (LDH),(PFK) and oxidative enzymes.

5- Further study should be conducted to determine the effect of diet and exercise on blood biochemistry for the participant in the (BMTC).

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الملخص

تأثير الدورات التدريبية العسكرية التأسيسية على بعض القياسات الفسيولوجية والبدنية المختارة

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هدفت هذه الدراسة لمعرفة التأثير الذي تتركه الدورات العسكرية التأسيسية على بعض القياسات البدنية والفسيولوجية، وقد تم قياس قدرة التحمل، السرعة، المرونة، الرشاقة، قوة الجزء العلوي من الجسمي، والقدرة العضلية للرجلين كمتغيرات لقياس الياقة البدنية، كما تم تركيز البروتينات الدهنية HDL, LDL ، والكوليسترول وثلاثي الجلسرايد في الدم بالإضافة إلى كريات الدم الحمراء، كريات الدم البيضاء، نبض الراحة والهيموجلوبين كمتغيرات فسيولوجية، قبل وبعد الاشتراك في الدورة.

شارك في الدراسة (٢٨) متدرب وقد كانت أعمارهم تقع ضمن (٢٧,٥ ± ٤,٩٥) سنة، كتلتهم تقع ضمن (٧٢,٩٨ ± ٧,٢١) كغم، وأطوالهم تقع ضمن (١,٧٤ ± ٠,٠٥) متر، وقد عقدت الدورة التأسيسية قيد البحث في مدينة أريحا في الفترة الواقعة بين (٢٧ شباط – ٢٤ نيسان من عام ٢٠٠٠).

واستخدم الباحث برنامج الرزم الإحصائية (SPSS) مع حساب المتوسط الحسابي والانحراف المعياري واختبار (ت) للأزواج لفحص فرضيتي الدراسة.

تم جمع عينات من الدم الوريدي لكل مشترك قبل وبعد الدورة وتم فحص تركيز الكوليسترول وثلاثي الجلسرايد باستخدام Enzymatic colorimetric test with lipid cleaning factor أما كريات الدم الحمراء والبيضاء والهيموجلونين فقد تم إجراء الفحوصات

الخاصة بها أوتوماتيكيا، أما بالنسبة للبروتينات الدهنية فقد تم فحص HDL عن طريق Chpolesterol liquicolor test والـ (LDL) تم إيجاد تركيزه حسابياً.

لقد أثبتت النتائج وجود تأثير إيجابي ذو دلالة إحصائية للدورات لكافة المتغيرات البدنية، فقد كانت نتائج ما بعد الدورة إلى ما قبلها في التحمل (جري ١,٥ميل)، السرعة (٣٠متر)، المرونة (جلوس ووصول)، الرشاقة (الجري الدوراني)، قوة الجزء العلوي من الجسم (الضغط) والقدرة العضلية للرجلين (القفز العمودي) على التوالي (٩,٥٤ مقابل ١٣,٤٢) دقيقة (٤,٨٠ مقابل ٥,٣٦ ثانية) (١٠,٢٧ مقابل ٤,٥٦ سم)، (١٠٣٩ مقابل ١١,١٢ ثانية)، (٤٨,٩٢ مقابل ٣٣,١٧مرة)و (٤٤,٧١ مقابل ٣٨,٦٤سم).

وظهر أيضاً تأثيراً إيجابياً ذو دلالة إحصائية للدورة على كل من نبض الراحة ,LDL ,HDL بينما ظهر تأثيراً سلبياً ذا دلالة إحصائية على تركيز الكوليستيرول في الدم، ولم يظهر أي تأثير ذا دلالة إحصائية على المتغيرات الفسيولوجية الأخرى.