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Original Research Paper

Physiology

COMPARISON OF LIPID PROFILE AND BMI IN PHYSICALLY TRAINED ADULTS AND SEDENTARY ADULTS

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ABSTRACT

INTRODUCTION: The incidence of diseases like angina pectoris, myocardial infarction, hypertension and cerebrovascular accidents is increasing nowadays. The high blood lipid level is found to be the main cause of atherosclerosis. This study is undertaken with the aim to evaluate the effect of physical training onBMI, and lipid profile.

MATERIALS AND METHODS: The study was conducted on 50 male physically trained adults and 50 male sedentary adults in the age group between 21-30 years.

Following parameters were evaluated: BMI, totalcholesterol, triglycerides, High density lipoprotein cholesterol,Low density lipoprotein cholesterol (LDL- C),BMI

RESULTS: There is statistically highly significant decrease in BMI, total cholesterol, triglycerides, LDL- C, VLDL- C, and highly significant increase in HDL- C in physically trained adults as compared to sedentary adults.

CONCLUSION: Combination of aerobic exercise and games causes highly significant decrease in total cholesterol, TG, LDL- C,VLDL-C,BMI increase in HDL-C.thus combination of aerobic exercise and games is more beneficial instead of only aerobic exercise and hence should be recommended.

KEYWORDS :

BACKGROUND:

The incidence of diseases like angina pectoris, myocardial infarction, hypertension and cerebrovascular accidents is increasing nowadays. The high blood lipid level is found to be the main cause of atherosclerosis. Obesity is one of the major health problems in our society. BMI is a measure which takes into account a person's weight and height to gauge total body fat in adults.(1) This study is undertaken with the aim to evaluate the effect of physical training on lipid profile and BMI.

AIM:

To assess and compare lipid profile and BMI in physically trained adults and sedentary adults

Objectives:

1) To measure lipid profile and BMI in physically trained adults.
2) To measure lipid profile in sedentary adults.
3) To compare lipid profile between physically trained adults and sedentary adults.

The main patho-physiological change in most of these diseases is atherosclerosis of blood vessels which leads to further complications(2) It is accepted that high levels of total cholesterol (TC), total triglycerides (TG), low density lipoprotein (LDL-C) and low level of high density lipoprotein cholesterol (HDL-C) are the risk factors for coronary heart disease which in turn depends upon intrinsic factors such as age, genetic heritage, gender and other factors such as diet, overweight, obesity, smoking, psychological stress and sedentary life style(3)

Obesity is one of the major health problems in our society and its prevalence is rising worldwide, reflecting increased consumption of energy dense diets high in fats and sugars, compounded by declining levels of physical activity. It is measured either as body mass index (BMI) Central obesity and overweight are the other risk factors for coronary heart disease and so exercise should ideally help to reduce central obesity and overweight (4)

BMI is measure which takes into account a person's weight and height to gauge total body fat in adults. Physically trained adults means subjects who are doing exercise daily for half an hour at least for six months and sedentary adults are office, buissness workers who are not doing any active exercise.

The present study is undertaken with the aim to evaluate the effect of physical training including aerobic exercises and games on body mass index and lipid profile.

This study has done to know what is effect of physical training on lipid profile and BMI and Waist-hip Ratio and lipid profile in central india which is unfocused part of india regarding such study.

METHODS- cross sectional study

SAMPLE SIZE – The study was conducted in 50 physically trained adults and 50 sedentary adults.

Statistical Technique: Purpose Random Sampling.

EXPERIMENTAL PROTOCOL

This study was conducted in the department of biochemistry at Government Medical College Miraj.Institute ethical committee approval was obtained.volunteers who wished to participate in the study reported to Biochemistry department.informed written consent was taken from volunteers. It was conducted from January 2011 to December 2011. All the subjects who participated in this study ware selected by certain inclusion and exclusion criteria.

Physically trained adults means subjects who are doing exercise daily for half an hour at least for six months. they had undergone 6 months of physical training for 45 minutes daily. the training were taken in morning time from 6 a.m. to 6.45 a.m. it included warm up section, running and any 2 games from various games like volleyball,football,cricket,handball,basketballetc.sedentary adults means they are not doing any physical exercise e.g. office,buissness workers

INCLUSION CRITERIA

1) Age groups:

a.Males between 21 to 30 years of age performing physical training.
b.Males between 21 to 30 years of age not performing any type of physical training or exercise.

2) Diet: Vegetarian (diet affects lipid profile.)

3) Occupation: Physically trained student's means subjects doing exercise daily for half an hour at least for 6 months. and sedentary office / business workers and medical college students

4) **Socioeconomic status:** Upper middle and lower middle socioeconomic class

EXCLUSION CRITERIA

Subjects with history of

a) Smoking, drinking alcohol, tobacco chewing.
b) Diabetes mellitus, hypertension or family history suggestive of coronary heart disease.
c) Any major illness.
d) Taking drugs which are known to affect lipid metabolism.

An evaluation of the following parameters was done in physically trained adults and sedentary adults.

A) Anthropometric measurements:

Measurement of height and weight

Standing heights of subjects were recorded using stadiometer with heels together and heels, calf, buttocks and preferably back touching the stadiometer. The height was measured, without footwear, to the nearest one centimeter.

The weight was measured to the nearest 0.1 kg, in standing position; subjects were wearing light clothes and were bare footed.

Body mass index (BMI):

It is also known as Quetelet index(5) calculated by formula

$$BMI = \frac{Weight\ (kg)}{[Height\ (m)]^2}$$

BMI of 30 is the most commonly used threshold for obesity both in men and women. At a similar BMI, the women have more body fat than men. Large scale epidemiologic studies suggest that morbidity due to metabolic diseases. Cancers and cardiovascular diseases begins to rise when BMI >25

Lipid profile-

Total cholesterol, Total triglycerides, HDL Cholesterol, LDL Cholesterol,VLDL Cholesterol Erba Cholesterol kit was used manufactured by Transasia Bio-medicals Ltd.

Various reagents were supplied in the kit that involvedCholesterol reagent was prepared by dissolving reagent 1 into 10 ml of Aqua-4. The composition of cholesterol reagent after reconstitution.

For taking readings, first blank was aspirated followed by standard tests. Absorbance of standard and each test tube was recorded against blank at 505nm or 505/670 nm. It directly displayed results. The color developed at the end of the test was stable for 30 minutes when protected from light and contamination.

Method of estimation of HDL Cholesterol (Phosphotungstic acid method, end point)

Liquixx HDL Cholesterol Kit was used manufactured by Transasia Bio-medicals Ltd.

In the kit, Reagent 1 and HDL-C standard was provided.

Mixture was mixed well and incubated for 10 minute at 37°C. Readings were taken of standard and each test at 505 nm or 505/670 nm with semi-auto analyzer against reagent blank.

Method of estimation of Triglycerides (Enzymatic calorimetric method)

Autopaktriglyceride kit was used manufactured by Bayer diagnostics India Ltd.

TG reagent was reconstituted by dissolving the contents of one bottle of reagent 1 with one bottle of reagent 1A.The mixture was incubated for 5 minutes at 37°C. The readings were taken with the semi-autolyser.

Estimation of LDL-Cholesterol

By using Friedwald formula (8)

LDL-C = Total Cholesterol-[(HDL-C) – (Triglycerides/5)]

It is valid for triglycerides level < 400 mg/dl. When > 400 mg/dl the calorimetric enzymatic method is used.

Estimation of VLDL- Cholesterol

By using the formula (9)

VLDL=Triglyceride/5

Normal values:

Total Cholesterol 140- 250 mg/dl
Triglycerides (Males) 60- 165 mg/dl
(Females) 40- 140 mg/dl
HDL Cholesterol (Males) 30- 65 (Females) 35- 80 mg/dl
LDL Cholesterol 80- 170 mg/dl

TABLE:1: Comparison of anthtropometric parameters in physically trained adults and sedentary adults

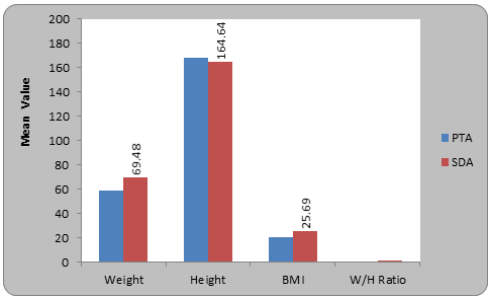
	Physically trained adults		Sedentary adults		t 'test'	SIGNIFICANCE
	MEAN	S.D.	MEAN	S.D.		
Body weight (kg)	58.94	6.70	69.48	6.69	7.87	P<0.001 **Highly significant**
Height (cm)	168.46	7.98	164.64	4.61	2.93	P<0.004 **Highly significant**
BMI (kg/sqm)	20.80	1.97	25.69	2.13	11.91	P<0.001 **Highly significant**

TABLE: 1shows statistically highly significant(P< 0.01)decrease in body weight, height, BMI, Waist-hip ratio in physically trained adults as compared to Sedentary adults.

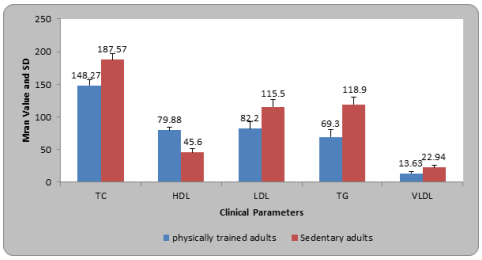
TABLE: 2: Comparison of Lipid profilein physically trained adults and sedentary adults

	Physically trained adults		Sedentary adults		't' test	Significance
	MEAN	S.D.	MEAN	S.D.		
Total cholesterol (mg/dl)	148.27	8.22	187.57	9.92	21.57	P<0.001 **Highly significant**
HDL-C (mg/dl)	79.88	4.74	45.60	5.78	32.41	P<0.001 **Highly significant**
LD L-C(mg/dl)	82.2	10.6	115.5	11.3	15.20	P<0.001 **Highly significant**
TG	69.3	11.0	118.9	11.6	21.7	P<0.001 **Highly significant**
VLDL-C	13.63	2.16	22.94	2.82	18.43	P<0.001 **Highly significant**

TABLE: 2Shows statistically highly significant (P< 0.01) decrease in Total cholesterol, TG, LDL-C, VLDL-C and increase in HDL-C in physically trained adults as compared with that of sedentary adults.



Graph 2: Multiple Bar diagram showing comparison between mean Lipid Profile parameters between physically trained adults and sedentary adults.



DISCUSSION

In our study it was found that in physically trained adults there was decrease in total cholesterol, TG, LDL-C, VLDL-C and increase in HDL-C as compared to that with sedentary adults.These changes in values are statistically highly significant (P<0.001) Analysis of other parameters in physically trained adults showed decrease in body weight, BMI, waist-hip ratio as compared to those with sedentary adults. This decrease in values in physically trained adults is statistically highly significant (P< 0.001)

Lhamo Y. Sherpa et al studied that there is high prevalence of hypertriglyceridemia in males, higher prevalence of low HDL-C in females and high hypercholesterolemia prevalence in both genders (10).canoy D noted that waist circumference and waist-hip ratio as indicators of abdominal adiposity are positively related to coronary heart disease in men and women independently of BMI and conventional coronary heart disease factors (11)

Abdus Salem et al found that regular aerobic exercise (brisk walk and jogging), as in the test civilian group, is by itself capable of decreasing total cholesterol, LDL, Triglycerides,Apoprotein B, Cholesterol/HDL ratio whileincreasing HDL levels. This work also shows that strenuous exercise, as in the test army group, isparticularly useful in decreasing Triglycerides andApo B levels as compared to simple walk.The study shows similar finding with our study

in our study Apoprotein B level is not estimated. Paul D et al had estimated Total cholesterol, TG, LDL, HDL, lipoprotein lipase level, body weight and % body fat in sedentary males before and after exercise training. They estimated the values of above parameters at 14 weeks, 32-48 weeks of exercise training.

They found that there was average of 13% increase in HDL, 16% reduction in TG levels and 19% increase in lipoprotein lipase activity and the change in the values was statistically significant.

jussiK Hutten studied the effect of moderate physical exercise on serum lipoprotein. He found that there was decrease in total cholesterol, TG, LDL, VLDL which was statistically highly significant and increase in HDL which was statistically highly significant after 4 months of moderate exercise[6].also they found no change in TC or LDL. All these changes were seen after 14 weeks of aerobic exercise and did not change further with prolonged training. Body weight and percent body fat did not show statistically significant decrease after exercise training of the subjects (12)

All these changes are to the lesser extent as compare to our study possibly because in their study only aerobic exercise were included, while in our study combination of aerobic and anaerobic types of exercise are included. In our study % body fat is not estimated.the findings of decreased HDL levels in the study of the army group may be a reflection of thisdietary factor, in that this group may have beenexposed to such an intervention in attempts tomaintain a healthy life style, whereas the civilian testgroup may have adopted a lifestyle with a moderateamount of low fat diet plus regular exercise (13)The study shows similar finding with our study.in our study Apoprotein B level is not estimated.

James A Blumenthal et al,Gerhard Schuler and Kayatekin et al in also studied the effect of regular physical exercise on lipid profile. They also found decrease in TC, LDL-C, VLDL-C and increase in HDL-C levels in exercising groups (14)

Gerhard schuler et al studied the effect of regular physical exercise and low fat diet on CHD patients. They found that in patients participating in this study, coronary artery disease progresses at a slower pace compared with a control group on a usual care(15) Wood P D et alfound that the runners had significantly decreased mean plasma triglyceride total plasma cholesterol and low-density lipoprotein (LDL) Cholesterol concentrations which was statistically highly significant and a higher mean level of high-density lipoprotein (HDL) cholesterol than the comparison group which was statistically highly significant (16).the study shows similar finding with our study.So the present study shows comparable results with those of Jussi k Hutten, J A Blumenthal, Gerhard Schuler,Wood P D.

Contradictory results are obtained as an effect of exercise on serum cholesterol. Carlson and Mossfeldtare of the opinion that severe exercise does not bring about any change in serum cholesterol (17) Good et al have reported progressive decrease in serum cholesterol with exercise (18) our results does coincide with these findings.

Our results are also supported by Campbell (20) Malinow et alMalinow et alfox and spinner**.** They have reported lowering of serum cholesterol and reduction of incidence of atherosclerosis as a result of doing exercise. The generally accepted view about lowering of serum total cholesterol is due to exercise there is increased oxidation of cholesterol and increased uptake by the tissuesMalinow et al further state that liver and adrenals are mainly responsible for catabolism of cholesterol during exercise.(21)

However, literature does not clarify the role of increased levels of catecholamines in the cholesterol metabolism of a sportsman.

EFFECT OF EXERCISE ON LIPID PROFILE:

Combustion of fat produces energy 9.4 cal/g. free fatty acids are the main source of energy during the exercise. Glucose contributes only 10-15% while fatty acids about 70-90%. Fat stores have enough potential energy to keep a sportsman to continue physical activity. Fats are used to spare the available glucose rather than to form glucose. The greater energy yield of fats (double that of glucose-4 cal/g) ensures that it can meet the demands of exercising muscles. (22)

The energy from the phosphagen system (the combined amounts of cell ATP and cell phosphocreatinine are called phosphagen energy system) is used for maximal short bursts of muscle power. This provides maximal muscle power for 8-10 seconds. Glycogen-Lactic acid system provides 1.3-1.6 minutes of maximal muscle activity in addition to the 8-10 seconds provided by the phosphagen system.Aerobic system is the oxidation of foodstuffs in the mitochondria to provide energy. This system is required for prolonged athletic adults.The triglycerides transported from intestine (as chylomicrons) and liver (as VLDL) are stored in the adipose tissue and they are also utilized by the muscles, liver, heart etc, for energy as the needs of the body.

Thus in sportsman due to the regular training and exercise sympathetic activity is increased and there are high levels of circulating catecholamines in the blood. This is responsible to cause increased in lipolysis of triglyceride in the adipose tissue to supply more fatty acids for working muscles (23). The activity of this enzyme is found to be increased causing increased breakdown of triglycerides from blood which is reflected as reduction in triglyceride level of the blood of a person performing regular exercise(24)

Cortisol secretion is significantly elevated during exercise. It mobilizes fats and promotes lipolysis. Glucagon stimulated by prolonged exercise, also mobilizes fatty acids from adipose tissue for fuel(25) The influence of physical exercise on serum TG level has been consistently favorable

Adrenal cortical hormones are also increased significantly during exercise mainly glucocorticoids (especially if exercise is prolonged and heavy.) This glucoticoids decrease cholesterol synthesis as glucocorticoids favor the formation of inactive HMG CoA reductase which is rate limiting enzyme in cholesterol synthesis (26) VLDL is synthesized mainly from liver and small amount from intestine. The large triglyceride rich VLDL particles emerging from the liver are acted upon by lipoprotein lipase as they pass through the capillary bed.

Adrenal cortex and the gonads are extremely active in LDL degradation, as adrenal cortical hormones increase significantly during exercise; they also contribute to decrease in VLDL level (27).In our study it was found that there was increase in HDL-C in physically trained adults as compared to sedentary adults.

The HDL may operate to protect against atherosclerosis in two ways

1. To carry cholesterol away from the arterial wall for the degradation to bile in the liver and subsequently excretion by the intestine.
2. To compete with the LDL fragments for entry into the cells of arterial wall.

The probable mechanism for increased HDL cholesterol is

a. Reducedapoprotein catabolism rather than increase synthesis (28)

b. Resistance training and moderate aerobic exercise increase serum

Testosterone levels of untrained subjects after 15 to 20 minutes. Testosterone increases the formation of HDL (29).In our study it is observed that in physically trained adults there is highly significant decrease in body weight, BMI, W/H ratio. During exercise there is more lipolysis as result of release of different hormones. Because of more lipolysis more free fatty acids are now available to supply energy for exercising muscles. So, there is reduction in body weight, BMI, W/H ratio.

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