COMPARISON OF LIPID PROFILE AND APOPROTEIN IN SEDENTARY WORKERS AND THOSE INVOLVED IN REGULAR EXERCISE

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Background: One of the important effects of exercise on human body is on the metabolic system especially on lipids; elevated lipids and lipoprotein are risk factors for coronary heart disease. This case-control study was conducted to compare the lipid profile and apo-protein B levels in sedentary workers and subjects involved in regular exercise. **Methodology:** The study was conducted at Women Medical College Abbottabad, from July 2004 to January 2005. Subjects were civilians and army men involved in regular exercise for more than 6 months duration (test group) and sedentary workers (control group). The age, body weight, height, waist hip ratio and other related findings were recorded on a special proforma. Fasting blood samples were taken and were analyzed for lipid profile and apoprotein B levels. Statistical analysis was done by the Chi square and the Student t tests and level of significance was recorded. **Result:** The subjects comprised 29 army men, 24 civilians and 39 sedentary workers. Significant differences were found between the control and test groups for WHR, total cholesterol, HDL, LDL, Triglycerides, Apo B, and Cholesterol/HDL ratio; in addition the civilian group also showed significant differences from the control group in BMI values. Although LDL levels were lower in army than sedentary group, the difference was statistically nonsignificant. Significant differences were found between the army and civilian groups in age, HDL, Triglycerides and Apo B values. **Conclusion:** Long term aerobic exercise has beneficial effects in decreasing Apo- protein B levels, LDL levels and total cholesterol /HDL ratio. Exercise habits should be encouraged in general population to decrease the cardiovascular disease risk.

Key Words: Exercise, lipid profile, apo-lipoprotein B.

INTRODUCTION

Exercise means excessive use of body muscles for a specific time regularly. There are different types of exercises. Exercise is very important for health and fitness. It has multiple beneficial effects on our body. Exercise increases parasympathetic activity with a minor decrease in sympathetic activity so resting heart rate decreases. There is more time for filling ventricles with blood and for delivery of oxygen and nutrients to the body and heart muscles. Exercise reduces blood level of norepinephrine and sympathetic activity which decreases vasoconstriction of arterioles to decrease blood pressure. In exercising individuals body uses fat more efficiently for the same sub maximal task due to increased mitochondrial activity. Exercise boosts the immune system by increasing the levels of interleukin1and interferon so less chances of infection are there. Bone density is more in exercising people due to overactive osteoblastic activity. Exercise decreases stress, anxiety, depression, etc. by increasing oxygen supply to brain tissue and by increasing dopamine, serotonin, norepinephrine and acetylcholine.

Most important effect of exercise on human body is on metabolic system specially lipids. Lipid and lipoprotein are risk factors for coronary heart disease.[1] The primary surface component of LDL is Apolipoprotein B (ApoB). ApoB binds with receptors on liver and peripheral tissue surface membrane for cholesterol delivery.[2] ApoB is thus strongly associated with increased risk for coronary heart disease. HDL is known to be antiatherogenic because of its association with cholesterol removal from peripheral tissues (including arteries) directly to liver by reverse cholesterol transport processes.[3-4] HDL3 (HDL sub fraction 3) assimilates lipids and is converted to HDL2 and decreased level of either sub fraction increases coronary heart disease (CHD) risk.[5-6] Increase in level of HDL surface protein Apolipoprotein A-1 (Apo A-1) reflects more HDL synthesis and conversion of HDL3 toHDL2. Exercise improves lipid profile and decreases CHD risk.[7-11] These responses can be affected by age, sex, ethnicity, steroid hormone, exercise induced plasma volume changes, dietary habits and initial fitness level.[12-13]

Baseline lipid and lipoproteins are affected by hereditary factors.[14] Exercise favorably change serum lipid lipoprotein-cholesterol concentration. There is decrease in total cholesterol triglyceride and ratio of total cholesterol to HDL-cholesterol. Body

weight losses decrease cholesterol and triglyceride level.

Keeping in view the above beneficial effects of exercise we planned our study to examine the effects of exercise on serum lipids in our local population and to compare these changes with sedentary workers.

MATERIAL AND METHODS

This study was carried out at the Department of Pathology Women Medical College Abbottabad from July 2004 to January 2005 involving 92 subjects. Fifty three subjects (24 civilians and 29 army men) who were performing regular exercise (aerobics, jogging, games) for the last six months and 39 sedentary workers (office/business work with no exercise) were included as test and control groups respectively. The detailed history about the marital status, type and duration of exercise, presence of any disease, smoking habits, and dietary habits were recorded on a special proforma prepared for this purpose. Subjects suffering from familial hyperlipidemia and those on hypolipidemic drugs were excluded from the study.

The waist circumference was measured at the level of the umbilicus, whereas the hip circumference was measured at the iliac crest in standing position. The ratio between the two was calculated to provide the Waist-Hip Ratio (WHR). The height of all the subjects was recorded by measuring scale and the weight in kg was recorded by weighing machine. The body mass index (BMI) was calculated by the formula Weight in Kg/Height in meters square.

5 ml venous blood was collected from each subject after an overnight fast of 12-14 hours. Serum was separated within one hour of the blood collection and stored at -20^0C until analyzed for lipid profile. The serum total cholesterol was estimated by enzymatic calorimetric method using kit number 1101092 supplied by Spinreact, S.A. Spain. Serum HDL cholesterol was determined by using kit number 1001095 supplied by Spinreact S.S. Spain. The serum LDL was calculated by Friedwald formula. The serum Apoprotein B 100 was determined using kit supplied by Rondox Kit No OLPO5/234LP.

The results obtained by all the parameters were analyzed by Student's t-test. The mean and standard deviation and standard errors were also calculated.

RESULTS

Ninety two (92) subjects belonging to the control and test groups completed the study; of these there were 78 males (84.8%) and 14 (15.2%) females. The age range of subjects was from 18-75 years with a mean 24.42 of 38.74 ± 13.93. The BMI ranged from 16.1-36 with a mean of ± 4.35, while the WHR was from 0.7-1.0, with a mean of 0.86 ± 0.07. Table 1 shows the basic demographic data of all groups.

In the control group (39) there were 32 (82.0%) males and 7 (18.0%) females, while in the test group (53) there were 46 (86.7%) males and 7 (13.3%) females. The ages of control subjects ranged from 20-75 years, while the ages of test subjects ranged from 18-70 years. In the control group, BMI ranged from 17.3-36, while in the test group it ranged from 16.1-34.1. The WHR ranged from 0.7-1.0 in control subjects and from 0.7-0.98 in test subjects.

Among the test group subjects, there were 29 (54.7%) army men and 24 (45.3%) civilians who performed exercise regularly. Of the army group all 29 subjects were male, while in the civilian group there were 17 (70.1%) males and 7 (29.1%) females. The ages of army group ranged from 21-43 years, while that of the civilian group ranged from 18-70 years. The BMI of the army group ranged from 16.1-28.9, while that of the civilian group ranged from 19.3-34.1. The WHR of the army group ranged from 0.74-0.93, while that of the civilian group ranged from 0.70-0.98.

The mean values of demographic and biochemical variables are given in table 2.

Significant differences were found between the control and test groups for WHR, total cholesterol, HDL, LDL, Triglycerides, Apo B, and Cholesterol/HDL ratio; in addition the civilian group also showed significant differences from the control group in BMI values. Significant differences were found between the army and civilian groups in age, HDL, Triglycerides and Apo B values.

DISCUSSION

The aim of this study was to examine the effects of long term exercise on plasma lipid profile. The results of this study demonstrate that a long term exercise programme based on regular daily aerobic exercise i.e. brisk walk and jogging leads to changes in plasma lipid, lipoprotein and apoprotein levels. Our work shows that prolonged aerobic exercise is capable of decreasing total cholesterol, LDL levels and particularly Apoprotein B levels and increasing HDL levels. The difference between serum levels of Apo B and the ratio of total cholesterol and HDL was highly significant between the test and control groups (table-2).

The findings of our study indicate 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 while

Table 1: Basic demographic data of subjects (n = 92).

Variables	Control (n=39)		Test (n =53)					
			Army (n=29)		Civilian (n=24)		Total (n=53)	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Gender								
Male	32	82.0	29	100	17	70.1	46	86.7
Female	07	18.0	0	-	07	29.1	07	13.3
Ages (yrs)								
15 – 30	13	33.3	09	31.0	07	29.1	16	30.2
31 – 45	11	28.2	20	69.0	04	16.7	24	45.3
46 – 60	13	13.3	0	-	09	37.5	09	17.0
61 – 75	02	5.2	0	-	04	16.7	04	7.5
BMI								
15 – 20	05	12.8	10	34.5	01	4.2	11	20.7
20.1 – 25	14	35.9	17	58.6	07	29.1	24	45.3
25.1 – 30	14	35.9	02	6.9	13	54.2	15	28.3
30.1 – 35	05	12.8	0	-	03	12.5	03	5.7
35.1 – 40	01	2.6	0	-	0	-	0	-
WHR								
0.7 – 0.8	06	15.4	09	31.0	06	25.0	15	28.3
0.81 – 0.9	16	41.0	18	62.1	09	37.5	27	51.0
0.91 – 1.0	17	43.6	02	6.9	09	37.5	11	20.7

BMI=Body Mass Index; WHR=Waist-Hip Ratio.

Table 2: Mean demographic and biochemical values of subjects (n = 92).

Variables	Control Group	Test Group		
		Army	Civilian	Overall
Age (years)	40.50 ± 15.13	31.90 ± 6.13	44.20 ± 15.80***	37.45 ± 12.98
BMI	25.24 ± 4.7	21.63 ± 2.98	26.50 ± 3.60†*	23.83 ± 4.06
WHR	0.88 ± 0.06	0.83 ± 0.05	0.86 ± 0.07	0.85 ± 0.07**†
Biochemical values (mg/dl)				
Fasting Blood Glucose	102.36 ± 38.21	98.60 ± 8.34	104.00 ± 30.52	101.01± 21.40
Total Cholesterol	205.50 ± 51.33	174.80 ± 25.72	191.33 ± 41.51	182.30 ± 34.50*
HDL	41.60 ± 5.25	44.21 ± 6.62	53.10 ± 8.20*†	48.23 ± 8.55**
LDL	125.30 ± 53.97	108.5 ± 24.75	102.5 ± 36.30	105.75 ± 30.35†
Triglycerides	192.62 ± 77.30	127.40 ± 22.61	169.50 ± 80.33*‡	146.50 ± 59.81††
ApoB	132.40 ± 49.63	74.34 ± 29.30	115.10 ± 49.56†‡	92.80 ± 44.35‡
Cholesterol/HDL ratio	5.03 ± 1.47	4.04 ± 0.90	3.77 ± 1.42	3.92 ± 1.16‡‡

*p= 0.011, ** and †*p<0.001, **†p=0.025, †p=0.030, ††p=0.002, ‡and ‡‡p<0.001 for the differences from the control group.
*** and *†p<0.001, *‡p=0.009, †‡p=0.001 for the differences from the army group values.
BMI=Body Mass Index; WHR=Waist-Hip Ratio; HDL=High Density Lipoproteins; LDL=Low Density Lipoproteins; ApoB=Apoprotein B.

increasing HDL levels. This work also shows that strenuous exercise, as in the test army group, is particularly useful in decreasing Triglycerides and Apo B levels as compared to simple walk. Many previous studies have shown that regular exercise is beneficial and increases the HDL level and decreases total cholesterol and LDL levels. [8-15] However there are no data available in our setup showing the effect of exercise on Apo-lipoprotein B level.

Buyukyazi[16] compared the lipid profiles of master athletes, recreational athletes and sedentary workers and concluded that habitual physical training favorably altered the serum lipid and lipoprotein profiles. Similarly, Lippi et al[17] while debating the levels of exercise required to produce beneficial/deleterious alterations in lipid profiles, conclude and recommend regular aerobic exercise as a means of favorably altering lipid profile and reducing risks for cardiovascular disease. Oyeloola et al[18] concluded that exercise appeared to decrease the TC:HDL ratio in athletes by lowering LDL-cholesterol, while the HDL-cholesterol remained unaffected. Marti et al[19] confirm that individually prescribed, unsupervised jogging increased HDL-C levels and improved the serum lipoprotein profile in self-selected nonsmoking males.

Marshall et al[19] in their study showed that ultra low-fat diet as a component of a comprehensive lifestyle intervention induced reductions in HDL-C and the emergence of a dyslipidemic lipid profile and that aerobic exercise only partially mitigated this effect. The findings of decreased HDL levels in the army group in our study may be a reflection of this dietary factor, in that this group may have been exposed to such an intervention in attempts to maintain a healthy life style, whereas the civilian test group may have adopted a lifestyle with a moderate amount of low fat diet plus regular exercise (table 2).

The results of many recent studies have shown that Apolipoprotein B is a better marker of risk of vascular disease and better guide to the adequacy of Statin treatment than any cholesterol index. It may be that the value for Apolipoprotein B is a measurement of the total number of atherogenic particles as compared to LDL which is an estimate of the mass of cholesterol in the LDL fraction in the plasma.[20-24]

Tokmakidis et al[25] however emphasize that although regular exercise training has beneficial effects on blood lipid profiles, a period of detraining as little as three months can offset all the advantages gained during training and reverse the beneficial effects of regular exercise training, thus underscoring the need for uninterrupted regular exercise throughout life.

CONCLUSION

In conclusion, our study shows that regular aerobic exercise helps in decreasing LDL cholesterol, Total cholesterol, Triglycerides and Apo B and in increasing HDL cholesterol. Secondly, Apoprotein B level particularly significantly decreases in subjects who perform exercise of moderate severity. However further larger studies with better standardization; protocols with dietary restrictions are needed to reach a definite conclusion.

Since Apoprotein B is a better predictor of coronary artery disease we propose that measurement of Apolipoprotein should now be introduced broadly into clinical practice.

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