Original Article

Lipid Profile of People Engaged in Regular Exercise

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Abstract

Background and aim: Elevated blood lipids and physical inactivity are well recognized risk factors for atherosclerotic heart disease. The aim of this study was to ascertain the effect of exercise on lipid status of individuals engaged in regular exercise. **Methods:** The lipid profile and anthropometric measurement of 151 apparently healthy subjects engaged in regular exercise (test) and 49 subjects engaged in irregular exercise (control) were analyzed using enzymatic methods. **Results:** There was significant decrease ($p<0.05$) in serum level of Low Density Lipoprotein- Cholesterol (LDL –C), Waist-Hip Ratio (WHR), Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), and Body Mass Index (BMI) in subjects engaged in regular exercise when compared with the control subjects and there was no significant difference in serum level of Total Cholesterol (TC), triglyceride (TG), High Density Lipoprotein (HDL) and Very Low Density Lipoproteins (VLDLs) ($p>0.05$). Comparison of the anthropometric measurement and lipid profile status in different group classification of the regular participants showed a significant decrease in TC, TG, LDL, and VLDL. TC, TG, LDL, VLDL, BMI and SBP significantly decrease with increase in frequency of exercise while HDL –C significantly increases as the frequency of exercise increases. **Conclusion:** Regular exercise improves HDL –C and decreases TG, TC, LDL, VLDL, SBP and DBP which does not predispose one to the risk of coronary heart disease (CHD). Females were less at risk of developing CHD than males.

Keywords: Exercise; Lipid profile; Anthropometric measurement

Introduction

Lipids are small hydrophobic molecules that carry out a multitude of crucial roles; they act as structural elements in biological membranes, they store energy and they function as signaling molecules in cellular response pathways. [1]. Although lipids are highly essential, abnormal levels contribute to the progression of atherosclerosis. [2]. The abnormalities in lipids can be accessed via lipid profile panel which is a panel of blood tests that serves as an initial broad medical screening tool for abnormalities in lipids such as cholesterol and triglycerides. [3]. Exercise is any movement that works the body at a greater intensity than the usual level of daily activity. It is performed for various reasons including strengthening muscles and cardiovascular system. It also improves mental health, helps prevent depression, helps to promote or maintain positive self-esteem, and can even augment an individual's sex appeal or body image, which is also found to be linked with higher levels of self-esteem. [4]. Frequent and regular exercise helps prevent the ''diseases of affluence'' such as heart disease, type 2 diabetes and obesity. [5]. Increased exercise practice, mainly continuous aerobic exercise has been considered one of the best non-pharmacological strategies in preventing and treating cardiovascular diseases. [6]. Numerous epidemiological studies have shown that physically active individuals have a lower incidence of coronary heart disease compared with sedentary people. Exercise induces acute increase in post heparin lipoprotein lipase which in turn leads to enhanced triglyceride clearance and decreases plasma clearance of high density lipoprotein constituents. [7]. Lipoprotein lipase activity is the major enzyme involved in the catabolism of plasma triglyceride and has been found to be increased in the skeletal muscle and adipose tissue as well as in the plasma of people engaged in exercise compared to those not engaged in exercise. The aim of this investigation was to determine the effect of regular exercise on serum lipids level of subjects engaged in regular exercise.

Material and Methods

Study design

This is a randomized-controlled study conducted in Nnewi metropolis, Nnewi North Local Government Area (LGA) of Anambra State, South-East Nigeria involving both genders within the age bracket of 15 – 60 years.

Recruitment of patients

The participants recruited through personal contact consists of 151 apparently health subjects that engage in regular exercise

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(get at least 150 minutes of exercise a week) (test subjects) and 49 apparently health subjects that engage in irregular exercise (get less than 150 minutes of exercise a week) (control). Two kinds of physical exercise: aerobic (walking, swimming, spinning) and anaerobic (sprinting/running) were incorporated in this study.

Inclusion and exclusion criteria

The criteria for inclusion were established as follows: age bracket of 15-60 years, agree to participate in all stages of data collection, resident of Nnewi LGA, have been in active regular exercise for the past 3 months and above, have no history of injury in the past one month prior to the study and healthy individuals that irregularly exercised. The exclusion criteria includes: those with history of diabetes mellitus, high blood pressure, coronary heart disease, individuals on fat free diets, pregnant women and nursing mothers and those on lipid suppressing drugs.

Sample collection

After overnight fasting of about 10-12 hours, about 5 ml of blood was collected aseptically by vein puncture from all the subjects between 8–10 am. The samples were allowed to coagulate and centrifuged to obtain the serum which was stored at -20°C.

Anthropometric measurement

The waist and hip circumference (m) was measured using a measuring tape and the values were used in the calculation of WHR. Height (m) was measured using wall mounted height rod and body weight (kg) was measured using digital bathroom scale and the values were used in the calculation of BMI. Blood pressure (systolic and diastolic) was measured using mercury sphygmomanometer.

Biochemical assays

Serum total cholesterol (TC) was determined by enzymatic (CHOD-PAP) colorimetric method as described by McGowan, et al. [8]. The enzymatic method as described by Tietz [9]. was adopted in the estimation of TG. The estimation of HDL was performed using the method described by Burstein et al. [10] while the method of Assman et al. [11] was adopted in the determination of LDL and VLDL was estimated using the method described by Friedwald et al. [12].

Ethics

The ethical approval for this research was obtained from ethics committee of College of Health Sciences, Nnamdi Azikiwe University Okofia, Otolo Nnewi, Anambra State Nigeria.

Data analysis

All data collected were subjected to statistical analysis using the Statistical Package for the Social Science (SPSS, Version 17.0, Chicago, IL, USA) (SPSS). Chi-square was used to test the significance of proportions, with $p<0.05$ taken as significant.

Results

There was a significant decrease in the mean ± SD serum LDL concentration, WHR, BMI, SBP and DBP ($p<0.05$) in test subjects compared to the control. However, no significant difference was observed in TC, TG, HDL and VLDL between test and control ($p>0.05$) [Table 1].

Table 1: Mean ± SD values of the test and control subjects.

Parameters	Test (n=151)	Control (n=49)	p-value
TC(mg/dl)	4.17 ± 0.89	4.46 ± 1.05	0.06
TG (mg/dl)	1.05 ± 0.62	1.17 ± 0.74	0.252
HDL (mg/dl)	1.51 ± 0.75	1.43 ± 0.56	0.486
LDL (mg/dl)	2.19 ± 0.89	2.50 ± 1.08	0.045*
VLDL (mg/dl)	0.48 ± 0.28	0.53 ± 0.34	0.25
WHR	0.82 ± 0.05	0.85 ± 0.06	0.001*
SBP (mmHg)	122.14 ± 10.09	127.43 ± 10.02	0.002*
DBP (mmHg)	76.93 ± 8.15	79.96 ± 9.47	0.031*
BMI (kg/m^2)	24.00 ± 3.77	26.95 ± 4.84	0.000*

*Significant.

Values of test subjects by sex [Table 2]. shows a significant increase in TC, HDL and BMI and significant decrease in SBP in females compared to males ($p<0.05$). TG, LDL, VLDL, WHR and DBP showed no significant difference between the groups.

Table 2: Mean ± SD values of test subjects by sex.

Parameters	Male	Female	p-value
TC(mg/dl)	4.08 ± 0.88	4.53 ± 0.8	0.012*
TG (mg/dl)	1.09 ± 0.68	0.9 ± 0.26	0.145
HDL (mg/dl)	1.41 ± 0.75	1.91 ± 0.61	0.001*
LDL (mg/dl)	2.18 ± 0.94	2.21 ± 0.71	0.887
VLDL (mg/dl)	0.5 ± 0.31	0.41 ± 0.12	0.136
WHR	0.83 ± 0.05	0.81 ± 0.05	0.17
SBP (mmHg)	123.81 ± 10.04	115 ± 7.1	0.000*
DBP (mmHg)	77.42 ± 8.1	74.93 ± 8.27	0.134
BMI (kg/m^2)	23.51 ± 3.32	25.97 ± 4.76	0.001*

The result of test subjects involved in aerobic and anaerobic exercise [Table 3]. shows a significant increase in the value of HDL –C and significant decrease in WHR in subjects engaged in anaerobic exercise than in aerobic exercise ($p<0.005$) and there was no significant difference in TC, TG, LDL, VLDL, BMI and DBP between groups ($p>0.05$).

Table 3: Mean ± SD values of test subjects involved in aerobic and anaerobic exercise.

Parameters	Aerobic (n = 134)	Anaerobic (n = 17)	p-value
TC(mg/dl)	4.12 ± 0.86	4.48 ± 0.97	0.119
TG (mg/dl)	1.03 ± 0.63	1.16 ± 0.48	0.433
HDL (mg/dl)	1.47 ± 0.73	1.86 ± 0.86	0.047*
LDL (mg/dl)	2.18 ± 0.89	2.11 ± 0.95	0.746*
VLDL (mg/dl)	0.47 ± 0.28	0.52 ± 0.22	0.45
WHR	0.83 ± 0.05	0.79 ± 0.06	0.038*
SBP (mmHg)	122.06 ± 10.42	122.38 ± 7.11	0.907
DBP (mmHg)	77.14 ± 8.45	74.93 ± 5.08	0.308
BMI (kg/m^2)	24.03 ± 3.79	23.18 ± 3.12	0.387

The mean ± SD of test subjects according to age [Table 4]. shows a significant decrease in mean values of TC, TG, LDL, VLDL, WHR, BMI, SBP and DBP in age bracket 15-24 when compared to other age brackets. TC, TG, VLDL, LDL, BMI, SBP and DBP significantly increased with age ($p<0.05$). However, there was no significant difference in HDL among the groups, though there was non-significant increase in HDL in 15-24 years when compared with other age range and it decreases as age increases.

Table 4: Mean ± SD of test subjects according to age.

	15-24 yrs (n=75)	25-34 yrs (n=54)	35-44 yrs (n=17)	45-54 yrs (n=3)	55-64 yrs (n=2)
TC (mg/dl)	3.85 ± 0.76	4.52 ± 0.93	4.35 ± 0.89	4.73 ± 0.49	4.30 ± 0.14
TG (mg/dl)	0.89 ± 0.42	1.20 ± 0.75	1.17 ± 0.77	1.23 ± 0.39	1.46 ± 1.15
HDL (mg/dl)	1.62 ± 0.71	1.47 ± 0.84	1.35 ± 0.54	0.76 ± 0.65	0.86 ± 0.29
LDL (mg/dl)	1.83 ± 0.77	2.51 ± 0.86	2.48 ± 0.94	3.41 ± 0.47	2.77 ± 0.10
VLDL (mg/dl)	0.41 ± 0.19	0.55 ± 0.34	0.53 ± 0.35	0.56 ± 0.18	0.67 ± 0.53
WHR	0.81 ± 0.04	0.82 ± 0.05	0.88 ± 0.06	0.87 ± 0.01	0.87 ± 0.01
Weight (kg)	68.65 ± 8.33	75.35 ± 12.30	84.82 ± 13.98	82.33 ± 9.29	85.50 ± 33.24
BMI (kg/m^2)	22.59 ± 2.93	24.51 ± 3.72	27.60 ± 3.78	27.17 ± 2.60	27.54 ± 8.62
SBP (mmHg)	119.84 ± 7.87	122.72 ± 8.34	125.29 ± 2.57	133.00 ± 9.17	149.50 ± 13
DBP (mmHg)	74.52 ± 8.07	77.96 ± 6.54	81.24 ± 9.35	91.33 ± 1.53	81.50 ± 0.71

Discussion

This present study reveals that regular exercise causes a statistically significant decrease in the mean values of LDL, WHR and BMI [Table 1] in people engaged in regular exercise when compared with the control group. This is in agreement with work done by Ikekpeazu et al. [13]. Aristomenis et al. [14]. who showed a significant decrease in LDL in subjects involved in regular exercise. In this study, there was no statistically significant difference in the mean serum level of TC, TG, HDL and VLDL of irregularly exercised and control. This is in contrast with the work done by Sondergaard et al. [15]. which show a significant decrease in VLDL-TG. This may be due to the fact that they used sedentary individuals while this study used irregularly exercised subjects as control. The decrease in LDL levels could be attributed to the reduction in the activity of hepatic triglyceride lipase enzyme during long term physical exercise. [16].

Frequent and regular aerobic exercise has been shown to prevent or treat life threatening chronic conditions such as high blood pressure. Our study revealed that there was a statistical decrease in blood pressure of subjects involved in regular exercise than the control [Table 1]. Several mechanisms have been suggested to explain the blood pressure lowering effect of regular exercise. Decrease in the activity of the autonomic nervous system and reduction in systemic vascular resistance is most likely involved in the exercise induced reduction of blood pressure. [17]. Decrease in the activity of the sympathetic nervous system caused by regular exercise also affects the kidney, which is the most potent factor in long term blood pressure regulation. [18].

There was significant increase in TC and HDL in female when compare to the male [Table 2]. Despite this, there was no significant difference in LDL in both groups but females showed increase in LDL than males. The significant increase in HDL could be due to the effect of estrogen in females which increases the good cholesterol. [19]. There was significant increase in BMI in female than in male and this could be attributed to high level of body fat found in females. Systolic blood pressure was significantly low while diastolic blood pressure was decreased in female than in male and this could be linked to the fact that the female heart is slightly smaller relative to body size than the male heart.

There was significant increase in HDL, significant decrease in WHR in subjects engaged in anaerobic exercise when compared with aerobic exercise and no significant difference in TC, TG, LDL,VLDL, BMI SBP and DBP, though DBP and BMI was decreased in subjects involved anaerobic exercise [Table 3]. Studies have shown that subjects performing high intensity training burns significantly more body fat and in less time than those who did steady-state aerobic program especially around the abdominal region. [20]. This is now related to the significant low WHR and decreased BMI found in anaerobic group than aerobics. The exercise-induced increase in HDL is strongly associated with changes in body weight. [21].

There was a significant decrease in mean values of TC, TG, LDL and VLDL in age bracket 15-24 when compared to other age range [Table 4]. This study observed that TC, TG and LDL significantly increase with age. The increase in LDL could be attributed to the fact that total and bad cholesterol levels increases with age because the LDL receptors that remove the bad cholesterol from the blood become less active with age. [22]. It could be seen from this study that regular exercise has a beneficial effect on lipid profile and could reduce the incidence of coronary heart disease, obesity and high blood pressure.

Limitations

Although this research was carefully prepared, I am still aware of its limitations and shortcomings. The control (49 subjects) is small compared to the test subjects (151). The study would have involved more control subjects.

Conclusion

Regular exercise improves HDL –C and decreases TG, TC, LDL, VLDL, SBP and DBP which does not predispose one to the risk of coronary heart disease (CHD). Females were less at risk of developing CHD than males.

Conflict of Interest

All authors disclose that there was no conflict of interest.

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