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Effects of Continuous Training Programme on Serum Lipids and Lipoprotein of Young Male Adult University Students in Nigeria

Abdul Mohammed PhD
Department of Human Kinetics and Health Education
Ibrahim Badamasi Babangida University, Lapai, Niger State, Nigeria
Email: drabdulmohammed5@gmail.com

ABSTRACT: The purpose of this study was to find out the effects of continuous training on TG, [Triglycerides] TC, [Total Cholesterol] LDL-C [Low Density Lipoprotein- Cholesterol] and HDL-C [High Density Lipoprotein Cholesterol] of healthy young adult male University students. A total of 32 volunteer male subjects were randomly assigned to two groups. Continuous training group with 16 male and the control group with 16 male too. All the subjects were tested for serum TG, TC, LDL-C and HDL-C before starting the training. These tests were repeated on all the subjects after 12 weeks of training. All the subjects were allowed to perform the normal regular activities while the subjects for continuous training groups underwent their respective training protocols for 30 minutes in each training session, 3 training session on alternate days for 12 weeks. The data thus collected were analyzed using t-test for mean differences between male experimental group and male control group and One way Analysis of variance (ANOVA) for the mean effects of the training between the training group and the control group in serum TG, TC, LDL-C and HDL-C. The result showed significant decrease in serum TG, (5.80%) TC (15.9%) and LDL-C(11.4%) due to 12 weeks continuous training. . There was also significant increase in HDL-C as a result of the training programmes in the male subjects (20.0%) It was concluded that, continuous training conducted for 30 minutes or above per session for 3 sessions on alternate days of a week at moderate intensity cause significant decrease in serum TG, TC, LDL-C and significant increase in HDL-C in young male adults. On the basis of the findings, it was recommended that continuous training programme at moderate intensity (30 - 60% vo2max) should be followed at least for 12 weeks to produce desired favourable modification in lipids and lipoproteins of young male adults in Nigeria.

INTRODUCTION

The Cholesterol level in the body of an individual goes a long way to determine the health risk factor it posed to the body. Cholesterol is actually conserved and it is this conserved cholesterol that circulates in the blood stream (Byrne, 1991). Only approximately 7% of the body's total cholesterol (TC) is found in the blood and only this portion of blood cholesterol is potentially harmful (Byrne, 1991). Triglycerides are the body's most concentrated source of energy and are also known as neutral

fats (Lindsay & Gaw, 1997). Cullen, (2000), Levy, Wilson, Anderson, and Casteli, (1990) warned that LDL-C and TG levels should not be lowered simultaneously, and if that happens, atherosclerosis may continue to progress unabated. According to Cullen (2000), Levy, et al, (1990), elevated TG levels are a better predictor of CHD than are LDL-C level. Low Density Lipoprotein Cholesterol or Beta Lipoprotein is the main cholesterol carrying lipoprotein with more than half (60-70%) of serum cholesterol being contained within LDL-C (Brubaker, Kaminsky, & Whaley, (2002), Lindsay, & Gaw 1997). According to Martin, Browner, Hulley, Kuller & Wentworth (1986), should the LDL concentration in the blood rise above 2.6 – 3.36 mmol/L (100 – 130 mg/dl) some of its cholesterol will be deposited into arterial walls as plague.

High density lipoprotein cholesterol (HDL-C) is considered the most potent independent risk factor for coronary heart disease (CHD) and is inversely correlated with CHD. High levels of HDL-C may have a protective role against coronary atherosclerosis (Spate, & Keyser, 1999), because of its role as a lipid scavenger involved in the reverse transport of cholesterol from the peripheral vascular compartment and tissues to the liver for excretion as bile. Though the mechanism for the beneficial roles of HDL-C is yet to be completely elucidated, it is thought that lecithin-cholesterol acyltransferase (L-CAT) and hepatic lipase (HL) facilitate the role of HDL-C in reverse cholesterol transport from the arterial wall (Plowman, & Smith, 2008; Williams, Albers, Krauss & Wood, 1990) stated that HDLC is aptly known as 'good cholesterol' since high levels of it reduces an individual's tendency to develop atherosclerosis by removing some of the deposited cholesterol from the arterial walls by slowing cholesterol entry into tissue. Several previous studies have shown that physical activity as an independent factor induces changes in serum lipids and lipoproteins in adults and may protect the arteries from the formation of plaque rich in triglycerides and cholesterol (Depress, Moorjani, & Lupien 1990). These authors confirmed that plague or atheroma can induce damage in the artery walls and block blood flow. They further added that several restricted blood flow in heart muscle leads to symptoms such as angina pectoris pain while smaller plaque may rupture and trigger the formation of clots on their surface leading to heart attack. Atherosclerosis is the leading cause of CHD in most Western

populations and is associated with an accumulation of cholesterol in the walls of the arteries (Buist, 1995). This finding was substantiated by Lindsay &Gaw (1997) who indicated that nearly half of the variance in CHD rates is due to differences in average blood lipid levels. Cholesterol itself is a fatty substance found in all animal fat (Buist, 1995, Lindsay and Gaw, 1997).

Continuous training includes exercises that use oxygen to keep large muscle group moving continuously at an intensity that can be maintained for at least 20 minutes. Such exercises include walking, jogging, cycling and swimming (Heyward, 1998). Furthermore, Morris, (1984), McNaught, Callender, (1975) in Mohammed, 2013 maintained that continuous activities are those physical activities which cause an increase in the transport and uptake of oxygen by the skeletal muscle. These activities appropriately performed on a regular basis, increase cardio-respiratory fitness and lead to numerous health related benefits. Generally, continuous exercise at low to moderate intensities is safer, more comfortable and better suited for individuals initiating an aerobic exercise programme (Heyward, 1998).

Purpose of the Study

1. The purpose of this study was to find out the effect of 12 weeks Continuous training on TG, TC, LDL-C and HDL-C level of young male adult university students?

Research Questions

To achieve the purpose of this study, an attempt was made to answer the following research questions;

1. Will continuous training programme modify the TG, TC, LDL-C and HDL-C of young male adult university students?

Hypothesis

2. There are no significant effects of 12 weeks continuous training programmes on TG, TC, LDL-C and HDL-C level of young male adult university students?

METHODOLOGY

For the purpose of this study thirty two (32) male undergraduate students of Ahmadu Bello University, Zarai Nigeria were selected on the bases of their willingness to participate in the research. It was ensure that they did not exhibit counter indication to participate in the research. Detail explanation was given to them on the kind of protocols they had to follow and found out from them if they had any illness or injury. The simple random sampling technique was used to classify the subjects into experimental and control groups. Folded papers in which 'EXP' Meaning 'experimental' group and 'CON' meaning 'control' group were given to the subjects in single line to pick (without return). The subjects pick the paper one after the other until all papers were picked Sixteen (16) participants each were assigned to experimental group and the other sixteen (16) to control group on the bases of the group which they picked.

Sequence of Assessment

During the period of the study, the following assessments and sequence were followed

Blood Sample Analysis

All lipid test were carried out in the department of Chemical Pathology, Ahmadu Bello University Teaching Hospital Laboratory. The pre- and post-training venous blood samples were obtained from the participants between 8.00 am and 10.00 am after a 12 hour overnight fast at the A.B.U. gymnasium, Samaru campus, Zaria. A 10 ml syringe was used for blood sample collection using the procedure described by Bachorik (1982) in Mohammed,(2013) In the process a tourniquet was tied around each participant's upper arm to ensure a brief arrest of blood circulation to the forearm, and the participants were instructed to clench their fists to increase the prominence of the antecubital veins from which blood was drawn by the laboratory Scientist at the ABU Teaching Hospital. Blood samples (10 ml) were drawn from the antecubital vein of each subject under strict antiseptic conditions and were allowed to coagulate within 2 hours of venipuncture. Blood samples were stored in ethylene diaminetracetic acid collection tubes in the refrigerator until analysis. The serum was then analyzed within 4 hours for TG, TC, LDL-C and HDL-C values.

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Total Cholesterol (TC)

This was estimated using the method described by Ziakkis and Boyle (1994). The total cholesterol values were estimated using Ferric chloride, acetic acid and sodium tatraoxosulphate as follows;

$$TC\ (mg/L) = \frac{AT}{AS} \times CS(200mg/d)$$

Where AT represents absorbance of test
AS represents absorbance of standard
CS represents concentration of standard 200mg/dl

Serum High Density Lipoprotein Cholesterol (HDL-C)

High density lipoprotein cholesterol was determined using the phosphotungstic acid magnesium chloride ($MgCl_2$) method as described by lopes-Verilla, Stone, and Colwell, (1997). In this method, very – low density lipoprotein cholesterol and low-density lipoprotein – cholesterol values were precipitated in serum by phosphotungstic $Mgcl_2$, after which HDL-C was estimated in the clear supernatant.

Serum Low Density Lipoprotein Cholesterol (LDL-C)

Serum low density lipoprotein- cholesterol (LDL-C) was estimated by the use of Lopes-Verilla, et al, (1997) formula that solely depends on the estimation of total cholesterol (TC), triglycerides (TG) without ultracentrifugation. The low density lipoprotein –cholesterol (LDL-C) was estimated as follows;

LDL-C – TC – TGIS

This formula was applied on the basis that the ratio of TG to that of TC in very low density lipoprotein is relatively constant, while most of TG in plasma is constant in very low density lipoprotein cholesterol when chylomicrones dectectable.

Training Programme and Protocol

A total of 16 apparently healthy young male undergraduate Students of age 20–24 years were selected for the study and were randomly assigned to either experimental or control group.. All the participants of continuous training filled and submitted the informed consent form to participate in the study Participants in the experimental group went through 3 training sessions per week throughout the 12 – week period of

training. The training days were Mondays, Wednesdays and Thursdays respectively.

Continuous Training (Group 1)

Continuous training was done thrice a week for 12 weeks and in each training session, the subjects jogged and walked continuously without any break for 2km which is, 5 laps (round) a 400 metres track at 4 minutes pace per lap. This was followed for the first 3 weeks. During the 2nd three (3) weeks, the intensity was increased by reducing the time for lap from 4 minutes per lap to 3 minutes, 45 seconds. During the 3rd three weeks, the intensity was increased by decreasing the pace from 3 minutes, 45 seconds to 3 minutes, 30 seconds per lap. During the 4th three weeks, the intensity was increased by decreasing the pace from 3 minutes, 30 seconds to 3 minutes, 15 seconds per lap. Throughout the training period, the distance covered was the same. The continuous running/jogging was maintained at an intensity of 35-70 b/m, increase in heart rate during exercise, which is the difference between the resting heart rate and exercise heart rate. This heart rate was determined by training the subjects to measure their heart rate at rest for 5 seconds and measures it again during exercise for 5 seconds. The product was multiplied by 12 to get each subject's heart rate per minute. It was assumed that the subjects would have adapted to the exercise stress by the end of the 3 weeks of training. The reduction in duration after each quarter to cover same distance was meant to increase intensity of the training. Both intermittent and continuous training groups followed 10 minutes of jogging and stretching exercises before the actual training, which constituted the warming up part of the training session. They also followed 10 minutes of stretching exercises which constituted cooling down part of the training session.

CONTINUOUS TRAINING

Weeks	Work Distance	Pace	Total Distance
1 – 3	5 Laps	4 Minutes	2000m
4 – 6	5 Laps	3 min, 45 sec	2000m
7 – 9	5 Laps	3 min, 30 sec	2000m
10 - 12	5 Laps	3 min, 15 sec	2000m

Source: Self Developed Table

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Statistical Technique

The data collected was subjected to computer analysis using the SPSS [Version 23). These include means and standard deviation used to determine the central tendency and variability of the collected data. Changes in selected training and the test of the null hypothesis of the differences between pre- and post-training of the experimental and control groups values was analyzed using t- test statistics to determine differences between the pre-training lipid values and post training values of both continuous traning group and the control group in TG, TC, LDL-C and HDL-C.

RESULTS

Before the results are presented according to the hypotheses, the physical characteristics of the subjects are presented in table 4.2.1.

Table 2: Physical Characteristics of the Subjects

Variables	Group	N	M	SD
Age (yrs)	Experimental	16	21.4	1.44
	Control	16	20.7	0.88
Weight(kg)	Experimental	16	61.0	3.04
	Control	16	61.0	1.69
Height (m)	Experimental	16	1.71	0.03
	Control	16	1.71	0.03
BMI	Experimental	16	20.7	0.74
	Control	16	20.8	0.67

Table 2 shows there were 32 subjects made of 16 experimental and 16 control groups. The mean age of experimental group was 21.4 years and that of the control group was 20.7 years both the experimental and control groups were similar weight 61.0 and height 1.71 the BMI of the experimental group was 20.7 and the control group 20.8. Generally there was fewer differences among the subjects experimental (continuous) training and control group) in age, weight, height and Body Mass Index The descriptive statistics of experimental and control groups regarding the change in biochemical variables of TG, TC, HDL-C and LDL-C in pre and post training are period are presented in table 3

Table 3: Descriptive statistics of pre-test and post- test result of the subjects in biochemical variables

Variables	Groups	N	Pre-test		Pos-test	
			Mean	SD	Mean	SD
TC	Experimental	16	3.933	.1532	3.908	.1595
	Control	16	3.569	.1643	3.100	.1621
TG	Experimental	16	3.600	.0787	3.500	.1279
	Control	16	3.903	.1880	3.901	.0887
HDL-C	Experimental	16	1.302	.1062	1.308	.1880
	Control	16	1.460	.1498	1.461	.1073
LDL-C	Experimental	16	2.266	.0288	2.266	.1497
	Control	16	2.008	.0288	2.008	.0288

A careful observation of table 3 shows a decrease in TG, TC, HDL-C and LDL-C level of the experimental group the mean and standard aviation of the control group tend to remain relatively constant. This investigation is being guarded by the hypothesis that; there is no significant effect of 12 weeks continuous training on TG, TC, HDL-C and LDL-C of young adult university students. This hypothesis was tested by comparing the change in TG, TC, HDL-C and LDL-C of experimental and control group after 12 weeks of continuous training. The result of this is shown in Table 4:

Table 3: **Independent t test statistics for deference between Experimental and Control group of adult university students in lipid and lipoproteins after 12 weeks of Continuous training**

Variables	Groups	N	Mean	SD	DF	t-cal
TC	Experimental	16	4.100	.1595	30	.919
	Control	16	3.908	.1621		
TG	Experimental	16	.9000	.1279	30	.742
	Control	16	.9333	.0887		
HDL-C	Experimental	16	1.408	.1880	30	.933
	Control	16	1.466	.1073		
LDL-C	Experimental	16	2.266	.1497	30	.868
	Control	16	2.008	.0288		

$t(30)=1.96<0.05$

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Table three shows significant difference between experimental and control groups after 12 weeks of continuous training in TC, TG, HDL-C and LDL-C level in young male adult university student in Nigeria because, the calculated t-value .919, .742, .933 .868 are all greater than critical value of 1.96<0.05. Therefore the null hypothesis that states that there was no significant effect of continous training on TC, TG, HDL-C and LDL-C level of young male adult university student is herby rejected

DISCUSSIONS

The results of this study showed significant decrease in TG, TC, and LDL-C for male due to 12 weeks continuous training. It also showed significant increase in HDL-C in the subjects due to 12 weeks continuous training in male subjects. These results are in agreement with those of previous studies. Huttunen, et al, (1997) who reported effects of mild to moderate physical activity on serum lipoproteins on 100 asymptomatic middle aged men, who underwent a four month exercise programme of 3 – 4 times per week. The result of the study showed significant decrease in serum TG from 1.54 to 1.27 mmol (P<O.01) and LDC-C.

Further support to the results of this study may be seen in a review of 66 training studies in which, Trans, et al, (2007) reported a significant reduction in TC of 10ml/dl (P<0.01), TG by 15.8ml/dl (P<0.00) and significant increase in HDL-C by 1.2ml/dl. The decrease in LDL-C was 5.1ml/dl and TC/HDL-C ratio, showed a large decrease of 0.48 (PC0.01). Initial levels of TC, TG, HDL-C, and TC/HDL-C ratio were strongly correlated with the respective changes due to training, regardless of data partitioning. higher initial levels of TC and TG and TG/HDL-C ratio resulted in greater decrease post training and lower initial level of HDL-C resulted in greater post exercise increases (r = 0.50] P<0.01). Overall, the result of the meta–analysis of previous studies showed that physical training seemed to produce beneficial changes in blood lipids and lipoproteins. However, it was cautioned that researchers must be careful when examining the relationship between physical training and serum lipids and lipoprotein because initial levels, age, length of training, intensity, Vo2max, body weight, percent body fat, have been shown in

this meta–analysis to interact with exercise and serum lipid and lipoprotein changes.

Regarding the influence of variation in intensity of training on training induced changes in lipids and lipoproteins, Depress and colleagues (1990) reported significant reduction in TC and LDL-C with low intensity and high volume training regiments. Others have compared the effects of training intensity ranging from 42-85% of Vo2max and did not find an intensity effect on TC and LDL – C. Thomas, et al, (1985) and Stein, et al, (1990) reported greater reduction in TC and LDL-C levels with high vs. moderate intensity training. However, the failure to control for the exercise volume in these studies makes it difficult to interpret these results. In the present study, only moderate intensity of 30 to 60% of vo2max was maintained throughout the 12 week period of intervention. The results of this study showed significant reductions in TG, TC, and LDL – C and increase in HDL-C due to 12 week continuous training. These results are comparable to those of Niaki, et al, (2005) who reported a significant decrease in TG, TC, and LDL-C, TC/HDL-C, LDL-C/HDLC ratio and a significant increase in serum HDL-C after 14 weeks of interval progressive aerobic training. The decrease was from 87.8 to 58.5mg/dl ($P<0.05$) in TG. The increase in HDL-C was from 4.66 to 53.28mg/dl ($P=.05$). Such significant decreases were reported earlier by Farrell and Baboniak, (1980) in Mohammed, (2013) Tassi, et al, (2003),Park et al, (2003) Frey, et al, (2003), Tsai, et al, (2003) and Lemura, et al, (2001) In these studies, aerobic training was conducted 3 days/week for 30 minutes or more per session at 30-60% Vo2max. The findings of this study on the effect of continuous training on lipids and lipoprotein variables are very similar to those just mentioned.

The result of this study is not in complete agreement with those reported by Williams, (1997) where he maintained that cross sectional studies over the last several years provide compelling evidence for the positive influence of physical activity and training on blood lipids and lipoprotein levels. In general, blood lipid and lipoprotein profiles of trained groups reflect a reduced risk for the development of cardiovascular disease when compared with their inactive counterparts. Williams, (1998) further maintained that there is limited evidence to suggest that those who are

physically active or trained exhibit lower levels of total cholesterol (TC) and low density lipoprotein cholesterol (LDL-C) than those who are less active. Other studies with similar results reviewed by (Williams, 1997; Laka, et al, 1992; Kokkinos, 1995) reported a TC and LDL-C values lowered by 14 to 31mg/dl (7 to 21%) in the trained group suggesting that regular physical exertion has a dramatic influence on these lipid variables. Other studies not in complete conformity with these findings are those reported by (Laka and Sakomen, 1992; Williams, 1998) who stated that most cross sectional studies indicate smaller, non-significant differences in TC and LDL-C level between exercise trained and inactive and controlled groups.

CONCLUSIONS

On the basis of this result and in view of the limitations of the study, the following conclusions are drawn;

1. Continuous training conducted for 30 minutes or above per session, for 3 sessions on alternate days of a week at moderate intensity caused significant decrease in TG, TC, and LDL-C and significant increase in HDL-C in young male adults.

RECOMMENDATIONS

1. As the study showed significant reductions in lipids and lipoproteins due to continuous training, it was suggested that training programme at moderate intensity (30 - 60% vo2max) should be followed at least for 12 weeks to produce desired, favourable modification in lipids and lipoproteins of young male adults in Nigeria

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