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HIGH INTENSITY EXERCISE;

EFFECTS OF SHORT DURATION (12WEEKS) ON BLOOD PRESSURE, BODY WEIGHT AND LIPID PROFILE IN YOUNG HYPERLIPIDEMIC ADULTS WITHOUT DIET RESTRICTION

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ABSTRACT… Objectives: To clarify the interrelationship of high intensity exercise and duration of time on lipid profile, blood pressure and, body weight in young hyperlipidemic adults and to evaluate the beneficial effects on health in possible shorter duration of time. **Study Design:** Case control study. **Setting:** Department of Physiology, BMSI, JPMC, Karachi. **Period:** January 2012 to April 2012. **Methods:** Total numbers of 60 volunteers moderately active, young hyperlipidemic adults, aged 30 to 50 years, thirty for each A (control), and B (high intensity exercise) group respectively were assigned to participate for 12 weeks exercise program without restricted caloric diet at pre–identified track of specific time. Lipids profile and age, sex, weight, BMI, blood pressure, and lab investigations like serum Total cholesterol, Triglycerides, LDL, and HDL, of each participant were recorded at baseline (0 day) and similarly on day 30, 60 and 90 respectively. **Results:** At the end of the 12 weeks program in high intensity exercise group significant effects have been observed by lowering the level of total cholesterol, triglyceride ($p < 0.05$) and lipoproteins variables, with increasing the level of HDL-c. While no significant change in blood pressure and weight reduction was observed between indicial and final measurement in control and high intensity exercise groups ($p<o.o5$). **Conclusion:** Finding of this study suggest that, high intensity exercise has positive effects on lipid profile by lowering the level of total cholesterol(TC), triglycerides(TGs) low density lipoprotein (LDL-c) and increasing the level of high density lipoprotein (HDL-c) in hyperlipidemic adults rapidly in short duration of time, thus have beneficial effects by reducing the cardiac risk factors, chronic metabolic disorders and improving the cardio respiratory fitness but reduction in blood pressure body weight can be achieved in short time by combination of high intensity exercise and nutritional guidance of caloric restriction.

Key words: Hyperlipidemia, Cholesterol, Triglycerides, LDL-c, HDL-c high intensity exercise.

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INTRODUCTION

Hyperlipidemia has significant direct association with coronary artery pathology leading to development of cardiovascular diseases which might be due to elevated levels of LDL and lower levels of HDL.[1] The regular daily exercise has beneficial effects on health by bringing the lipid levels till normal values and keeping the blood pressure and body weight under desirable healthy limits. The National program for prevention and control of diabetes and cardiovascular disease recommends high intensity physical exercise (mild to severe) for at least 4-6days in one week duration.[2]

Hyperlipidemia has key role in pathogenesis of atherosclerosis leading to coronary artery diseases and this condition is aggravated by sedentary lifestyle and excess adipose tissues of body.[3] The duration and intensity of exercise responsible for changes in the lipid parameters are yet to be determined.[4]

Sedentary habits/physical inactivity are a major cause of life threatening medical illnesses for example metabolic syndrome, hyperlipidemia, diabetes mellitus and high blood pressure. Daily high intensity physical activity has been suggested as a major lifestyle contributing factor

leading to good health outcomes by bringing about the alterations in lipid profile. The important parameters in exercise sessions for example intensity and duration have pivot role in enhancing health benefits.[5,6] In modern era, high intensity physical activity has been recommended for reducing body mass index and atherogenic index of plasma.[7] The major advantage of high intensity physical activity is that regular and shorter duration exercise will result in good everlasting adherence programme, as depicted by Abby et al.[8] Controversial researches with their outcomes exist in literature: some scientists recommend vigorous physical activity while others suggest mild to moderate aerobics for normalizing the deranged lipid parameters, body weight and hypertension.[4]

Hyperlipidemia refers to higher levels of lipids and cholesterol in the blood. Elevated LDL-c is thought to be the best indicator of atherosclerosis risk[9] and it is assumed that lowering the serum LDL-c level by dietary modifications will have same good health benefits as by drugs. But the issue is that dietary therapy for reducing LDL-c cholesterol may also cause reduction in HDL-c cholesterol levels to same equal extent.[10]

For physical, mental and cardiovascular fitness, regular mild to moderate exercise is strongly recommended for example daily and periodic walking for 30 to 4o minutes and gradual increases in exercise upto 30-60 minutes on most days, if not all days of the week. This task needs to be individualized.[11] High intensity exercise can be performed at 75%-84% of maximum heart rate reserve.[4]

In our study, maximum heart rate (HRmax) was measured by the formula: HRmax = 220-age in years.[12] For measurement of heart rate, the participants were provided a wrist heart rate monitor with wireless chest band (Model Anova AS-H28). In present study, the exercise program was given to all participants at a pre-identified jogging track, at specific time period and their exercise program was monitored by the researcher. The total duration of exercise was 45 to 60 minutes. Five to ten minutes warm up period; normal routine walk at low intensity. Started by walking, jogging or running at an easy pace and gradually increasing the exercise intensity uptill desired heart rate of high intensity, Cool down with 5 to 10 minutes of lower intensity. End exercise with gentle stretching of muscles.[13]

The Study was Case control study.

The objectives of present study were to evaluate the beneficial lipid lowering effects of high intensity exercise in young hyperlipidemic adults in possible shorter duration of time as early as possible and also to achieve the healthy effects on blood pressure and body weight.

METHODOLOGY

All participants had their blood pressure, weight, and lipid profile measured on base line day 0, 30, 60, and 90respectively by enzymatic reaction method. All the participants were volunteers and selected from general population of Karachi. A written informed consent was taken before enrolment; the entire two groups were oriented on whole experimentation and its importance. Exercise group followed the respective exercise protocols; where as the control group remained without physical activity for the entire period. The researcher took all the necessary precautions to see that all the subjects comply with the experimentation environment. All participants were selected according to the following criteria:

INCLUSION CRITERIA

Young hyperlipidemic adults of both sexes were included in present study. Their ages range from 30 to 50 years. All the participants were able to qualify cardio-respiratory fitness test (Rockport 1 mile walk test), 70th percentile for age and sex.

EXCLUSION CRITERIA

- Any cardiac or physical problem contraindicated to exercise i.e. coronary artery disease, arrhythmias, valvular cardiac disease, cardiomyopathy and physical problem/disability.
- Chronic medical conditions like chronic renal

failure , psychiatric illness, diabetes mellitus, cancers, liver diseases like cirrhosis
- Pregnancy / Lactation.
- Drugs affecting serum lipid levels i.e. Estrogen, antihyperlipidemic drugs.
- Individuals currently on an energy-restricting diet or exercise program.

STATISTICAL ANALYSIS

Data feeding and analysis was done on SPSS (Statistical Packages of Social Sciences) version 16.0. The result was given in the text mean and Standard error of mean (SEM) for quantitative variables i.e. age, height, weight, BMI, blood pressure and lipid profile. Comparison of categorical variables between groups A, and B, was performed by Analysis of Variance (ANOVA) with tukey test. In all statistical analysis only p-value <0.01 will be considered significant.

RESULTS

Table-I show Mean±SEM of age, height, weight, BMI, Blood pressure and lipid profile. No statistically significant variations in age, height, weight and BMI, arterial Blood pressure and lipid profile between group A, B (p>0.05) was observed except cholesterol levels.

Table-II describes Mean ± SEM of weight, blood pressure and lipid profile in group A (controls) at baseline day 0, 30, 60 and 90. No significant difference was observed from base line day 0 to day 90 (p>0.05).

Table-III shows that Mean ± SEM of weight, blood pressure and lipid profile in group B (high intensity exercise) at baseline day 0, 30, 60 and 90. No significant difference (p>0.05) was observed from base line day 0 to day 90 on weight and blood pressure.

	Group A (n=30) Controls/Non exercising	Group B (n=30) Vigorous intensity exercise	P-value
	Mean ± SEM	Mean ± SEM	
Age (years)	42.1 ± 0.78	41.2 ± 1.14	0.843
Height (meter)	1.66 ± 0.02	1.71 ± 0.02	0.107
Weight (kg)	74.7 ± 1.85	75.1 ± 1.61	0.925
BMI	27.0 ± 0.50	25.6 ± 0.38	0.127
B.P. (Systolic)	130.2 ± 2.22	129.8 ± 1.93	0.690
B.P. (Diastolic)	83.3 ± 1.50	85.0 ± 1.17	0.692
Total Cholesterol	244.8 ± 3.71	241.9 ± 5.51 ◊	0.054
Triglycerides	212.7 ± 13.76	214.6 ± 8.62	0.641
LDL	192.1 ± 8.84	190.5 ± 8.41	0.780
HDL	35.8 ± 0.51	35.9 ± 0.77	0.316

Table-I. Baseline Characteristics of Participants
Statistical significant as compared to
*** Group A (controls)**
◊ group B (high intensity exercise)

	Baseline (Day 0)	Day 30	Day 60	Day 90	P-value
	Mean ± SEM	Mean ± SEM	Mean ± SEM	Mean ± SEM	
Weight (kg)	74.7 ± 1.85	74.6±1.84	74.6±1.82	74.7 ± 1.83	1.000
Blood pressure					
Systolic	130.2 ± 2.22	130.0±2.22	130.5±2.28	130.0 ± 2.20	0.998
Diastolic	83.3 ± 1.50	83.7±1.38	84.8±1.74	84.7 ± 1.48	0.873
Total Cholesterol	244.8 ± 3.71	242.4±3.28	241.9±3.08	244.0 ± 3.67	0.924
Triglyceride	212.7 ± 13.76	212.8±13.41	209.9±13.06	210.9 ± 13.39	0.998
LDL	192.1 ± 8.84	192.7±9.05	192.6±9.08	193.5 ± 9.02	1.000
HDL	35.8 ± 0.51	35.5±0.50	35.6±0.55	35.9 ± 0.55	0.935

Table-II. Weight, blood pressure and lipid profile on day 0, day 30, day 60 and day 90 in group a (controls/non exercising) (N=30)
No significant difference was observed p>0.05

	Baseline (Day 0)	Day 30	Day 60	Day 90	P-value
	Mean ± SEM	Mean ± SEM	Mean ± SEM	Mean ± SEM	
Weight (kg)	75.1 ± 1.61	74.5 ± 1.64	73.2 ± 1.59	72.5 ± 1.63	0.657
Blood pressure					
Systolic	129.8 ± 1.93	128.7 ± 1.79	125.7 ± 1.53	124.7 ± 1.57	0.114
Diastolic	85.0 ± 1.17	84.3 ± 1.04	82.5 ± 0.95	82.2 ± 1.04	0.167
Total Cholesterol	241.9 ± 5.51	206.2±5.18*	182.3 ± 5.39 *□	170.4±5.74*□	0.001
Triglyceride	214.6 ± 8.62	192.3 ± 8.26	171.3 ± 7.37 *	158.1±7.30*□	0.001
LDL	190.5 ± 8.41	171.0 ± 8.00	153.7 ± 8.08 *	136.5± 7.94*□	0.001
HDL	35.9 ± 0.77	40.9 ± 0.56*	42.8 ± 0.88 *	41.9 ± 0.93 *	0.001

Table-III. Weight, blood pressure and lipid profile on day 0, day 30, day 60 and day 90 in group b (high intensity exercise) (n=30)
*** Statistically significant as compared to day 0,**
□ Statistically significant as compared to day 30

Total cholesterol were significantly decreased on day 30 (206.2 ± 5.18) gradually on day 60 (182.3 ± 5.39) and day 90 (170.4 ± 5.74) as compared to day 0 (241.9 ± 5.51) $p<0.05$.

Triglyceride were significantly decreased on day 60 (171.3 ± 7.37) gradually on day 90 (158.1 ± 7.30) as compared to day 0 (214.6 ± 8.62) $p<0.05$.

LDL were significantly decreased on day 60 (153.7 ± 8.08) as compared to day 0 (190.5 ± 8.41) $p<0.05$ and further decreased on day 90 (136.5 ± 7.94) as compared to day 0 (185.2 ± 5.64) and day 30 (171.0 ± 8.00) $p<0.05$.

HDL were significantly increased on day 30 (38.8 ± 0.67), day 60 (39.4 ± 0.65) and day 90 (40.2 ± 0.660 as compared to day 0 (36.2 ± 0.61) $p<0.05$.

When we compared the readings with the two groups control (A) and high intensity exercise (B) and with base line readings, we found statistically significant reduced levels of total cholesterol (TC), triglyceride (TG) low density lipoprotein cholesterol (LDL-c) and raised levels of high density lipoprotein (HDL-c) in high intensity exercise group as the period of high intensity physical training progressed without significant change on blood pressure and body weight.

CONCLUSION

The results of present study suggested that high intensity exercise plays an important role to control the elevated lipid levels in young hyperlipidemic adults within shorter period of time by bringing the lipid deranged parameters within normal limits but weight reduction and blood pressure control might be achieved by dietary caloric restrictions in combination with exercise. It has also been concluded that exercise alone should not be expected to change global risk factors for health.

DISCUSSION

Sedentary lifestyle/habits lead to dramatic reduction in physical activity that increases risk of chronic artery diseases in both males and females. Obesity and weight gain in terms of body mass index (BMI) are consequences of physical inactivity leading to the development of chronic metabolic disorders like hyperlipidemia, hypertension and insulin resistance: major risk factors for cardiovascular diseases (Kordi et al., 2013).[14] Females are more prone to have cardiovascular diseases as compared to males. Obesity and its related metabolic derangements are major causes of death in industrialized and third world countries and are integral component of metabolic syndrome which leads to increase in body adipose tissue percentage particularly in visceral areas.[15,16]

Increased physical activity reduces the risk of cardiovascular diseases and coronary risk factors possibly by improving lipoproteins profile (Kraus et al., 2002).[17] Hyperlipidemia is a major risk factor for coronary artery diseases (CAD) due to raised values of LDL-c and low values of HDL-c McNamara Jr (1992).[18] Researchers have shown

that long-term exercise programme has profound effect in improving blood vessel endothelial function, increases production of nitric oxide (NO) which leads to decrease in blood pressure in patient with coronary artery dieseases (Kingwell, 2000, Higashi and Yoshizumi, 2004).[19,20] Exercise also leads to increased production of anti-inflammatory mediators and antioxidants in the blood vessel wall that might directly haults phenomenon of atherosclerosis (Wilund, 2007).[21]

The aim of present study was to observe the effects of high intensity exercise in 12weeks short duration program on blood pressure, body weight, lipid and lipoproteins levels (which normally are considered as risk factors in middle aged men), in 60 hyperlipidemic adults. The selected subjects were divided in two groups A, ad B with thirty (n-30) members in each group of either sex between the ages of 30 to 50 years without restriction of diet. The selected subjects were supervised and advised not to change their dietary and exercise habits.

The base line characteristics of all participants showed there is no difference between the groups regarding variables e.g. Height, weight, arterial blood pressure and other anthropoetric easurements or risk of dyslipidemia and hypertriglyceridemia. BMI (Body Mass index), systolic and diastolic blood pressure and total lipid, triglyceride, LDL-c and HDL-c in groups A, and B ($P > 0.05$). The subjects of group A which is control group, did not show any change in blood pressure weight and in lipids profile on base line to end of the training program for 12weeks ($P > 0.05$)

The findings of our study support that high intensity exercise, without restriction of diet (group B) has no major roles in reducing the body fat mass and arterial blood pressure in 12weeks period of time. Madden et al (2009)[22] also observed no significant reducing effects on Weight, body mass index, hip waist ratio and oral glucose tolerance test and blood sugar level in fasting condition in short period of 12 weeks aerobic exercise program.

This study does not correlate with the study conducted by Wong et al (2008)[23] of their 12-weeks exercise training program, in which they observed significantly improvement in BMI and systolic blood pressure and do not match with results of study done by Ohkubo et al (2001)[24], as they concluded that regular physical activity through exercise at the level where they provide beneficial health effects i.e the upper range of blood pressure by 8mmHg and lower range of blood pressure by 5mmHg at rest or normal posture.

Previous Studies of life style choices have shown that intensity, duration of exercise and nutritional treatment has significant effects on lipid profiles and weight status of the groups caused by changes in lipid profile. (Archer et al 2003, Sharman et al 2004, Devoe et al 2009,).[25,26] Good cholesterol and atherosclerosis have significant and significant association. Increase levels of good cholesterol after aerobic physical activity may prophylactic ally protect from coronary heart illnesses and myocardial infarction. (Kokkinos and Fern hall, 1999).[27]

This study has a strong correlation with the previous study don by Shirazi (2006)[1], in his study he observed overall 40%reduction in total cholesterol and16% elevation in HDL-c and HDL-c gives protection against CAD irrespective of the level of the other cholesterol. Increased level of HDL-c more than 40mg/dl is cardio protective and prove significant protection against CAD.

The results of present study suggest that high intensity exercise program of 12weeks duration has a mild or negligible effects in reducing blood pressure and body weight, perhaps significant change require sufficient duration and high energy consumption with restricted caloric diet. The findings of this study do not support that high intensity exercise without diet restriction is an effective measure in lowering the body weight and blood pressure. It may be due to the reason that-the duration of the exercise was brief i.e., 45 to 6omin, 5days/week for 12weeks without diet control.

The current study was done to evaluate the effectiveness of short duration of high intensity exercise on yang hyperlipidemic adults and to conform, that how shortly the high intensity exercise can be beneficial by binging the lipids profile under desirable limits. The results of this study suggest that high intensity exercise is much more effective and beneficial in lowering total cholesterol, triglyceride LDL-c and is very much effective in increasing HDL-c

Previous studies show that exercises increase HDL- c in the body system. HDL-c is identified good cholesterol in the blood stream, as HDL cholesterol remove cholesterol from the blood, body tissue cells. One of the important feature of HDL-c is that it has ability to provide medium or ideal place to trap more fats from plaque leading to prevention of risks of cardiac problems (Parthiban et al 2011).[28]

Our study correlates with the study of Kraus et al (2002)[17] in which they documented that that physical activity on regular basis leads to changes in reduction of weight and improvement in lipid profile. The fate of biological association between duration, type of exercise and extent of good effects of lipid profile is clear as compared to reduced duration and less intensity exercise. An other study done by Swain (2006)[29] illustrated that most clinical tails usually observed that higher intensity exercise culminate in significant improvement in physical fitness especially in specific coronary artery diseases.

Leon and Sanchez[30], observed reduction in total cholesterol, bad cholesterol and triglyceride which may be brought about by proper training programme and similar response between men and women and he also noticed that sex and age are not the predictor of lipids responsiveness to exercise and the most frequent change was rasised levels of HDL-c, a safety factor against CAD. It has been calculated that for each 0.026mmol/L (1 mg/dl) rise in good cholesterol, the hazard for a cardiovascular disease is minimized by about 2% in males and 3% in females.[27] Conventionally speaking, 1% reduction in bad cholesterol (LDL) is coupled with 2-3% lower risk of CHD (national education program).

In this study there was a profound decrease in various fractions of serum lipids, in subjects of group B (high intensity exercise group) such as triglycerides, total cholesterol, serum LDL-c, but there was tremendous progressive increase in serum HDL-c (15.1%, 20.2% and 17.2% on day 30, 60 and 90).

The study of Kraus et al[17] in which they demonstrated that regular increase in physical activity brings about beneficial changes in the lipid levels, with the higher duration of exercise having a significant improvements on lipids profile compared to lower duration of activity. Another study done by Swain and Franklin[29] illustrated that most clinical trials usually found that increased relative intensities result in better improvement in physical fitness and in selected CHD risk factors.

In the view of present study high intensity exercise is much more beneficial and effective in bringing lipid and lipoprotein levels towards the lower limits in young hyperlipidemic adults in such a short duration but no significant effects on blood pressure and body weight.

- We recommend that regular activity should be adapted as lifelong strategy for better health outcomes.

High intensity exercise of 30-60 minutes for 5 days a week regularly may be recommended to get favorable changes and beneficial lipid lowering results in hyperlipidemic adults in short duration of time but reduction in weight and blood pressure could be achieved by restricted caloric diet control and high intensity exercise.

High intensity exercise 30-60 minutes, 5days per week regularly may be recommended to get favorable changes and beneficial results in hyperlipidemic adults and most of the CHD risk

factors could be controlled in local population.

The most effective regimens for coronary heart disease risk factors reduction include high intensity exercise with nutritional education for caloric diet control.

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"Dream as if you'll live forever, live as if you'll die today."

Lebron James

AUTHORSHIP AND CONTRIBUTION DECLARATION

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