

**Research Article****Effect of exercise training on Physical Fitness and Lipid Profile in Healthy Adults****Dr. Suman Bala<sup>1</sup>, Dr. Neeru Gupta<sup>2</sup>, Dr. A.S Bhatia<sup>3</sup>**<sup>1</sup>Demonstrator, Postgraduate Department of Physiology, Government Medical College, Jammu, India<sup>2</sup>Ex-Professor & Head, Postgraduate Department of Physiology, Government Medical College, Jammu, India<sup>3</sup>Head of Department of Biochemistry, Government Medical College, Jammu, India**\*Corresponding author**

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**Abstract:** The objective of study was to evaluate the effects of exercise training on physical fitness and lipid profile in subjects. The present study was conducted on 200 healthy male subjects in age group of 21-30 years. They were divided in two Groups: Group I included subjects from age 21 to 25 years and Group II included subjects from age 26 to 30 years. The physical parameters were noted down and general physical examination, clinical examination of the respiratory system and cardiovascular system was done. Blood samples for lipid profile were taken after an overnight fasting. The initial readings of all the parameters were taken at the start of training and final readings were obtained and recorded after 6 months of the training period. The p value of <.05 was graded as statistically significant. The physical parameters showed a significant correlation with exercise training on physical fitness among the study subjects. The study revealed that a long term exercise programme based on regular daily aerobic exercises has positive impact on anthropometric parameters, cardiovascular system and plasma-lipid levels.**Keywords:** Exercise training; Physical fitness; Lipid profile.

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**INRODUCTION**

Physical exercise is any bodily activity that enhances or maintains physical fitness and overall health. It is performed for strengthening the muscles, cardiovascular system, honing athletic skills or maintenance of weight and for enjoyment. It reduces blood levels of nor-epinephrine which decreases vasoconstriction of arterioles leading to decreased blood-pressure. Physical activity and fitness are important modifiers of mortality and morbidity related to overweight and obesity [1].

The sedentary lifestyle reduces vagal tone, whereas a physically active lifestyle, resulting in enhanced aerobic fitness, increases vagal tone and may have cardiovascular health implications [2].

Exercise has a significant impact on all aspects of breathing. Breathing-rate slows down and breathing muscles, the intercostals and diaphragm become stronger and there is an increase in capillary density at alveoli to allow for greater diffusion of oxygen and carbon dioxide into the blood. Coronary atherosclerosis has its origin in childhood. Though certain factors cannot be controlled such as heredity, sex, race and age, but some other factors can be controlled through formation of positive habits from childhood. Vigorous exercise will serve as a natural defense of the body and protective measure against incidence of coronary heart

disease, through well planned programmes as early as possible [3].

Most important effect of exercise on human beings is on metabolic system especially lipids which includes – cholesterol, phospholipids and triglycerides [4]. It is well accepted that high levels of total cholesterol, triglycerides, LDL-C and low levels of HDL-C are the risk factors for coronary heart disease. Physical exercise performed with sufficient frequency and intensity is effective in lowering the levels of TG and LDL-C and raising the levels of HDL-C [5].

A physically active life-style may help to prevent the age related rise in triglyceride. The participation of male athletes in the sports of wrestling, volleyball, rugby and other fields such as throwing, jumping and running 100 and 200m, shows negative profile in lipids and lipoproteins [6].

Keeping in view the world's progress in this field and how much significance is being attached to physical activity and physical fitness, this study has been undertaken to see the effects of exercise training on physical fitness and lipid profile in subjects between 21-30 years of age.

## METHODS

The present study was conducted on 200 healthy male subjects in age group of 21-30 years. The subjects were taken from Police Technical Training Institute, Vijaypur and Police Training School, Kathua.

The eligibility criteria for the subjects were non-smoker, non-obese, non-alcoholic, and healthy males. All those individuals on hypolipidemic drugs, with history of familial hyperlipidemia, hypertension, diabetes mellitus and chronic obstructive pulmonary disease were excluded from the study.

## PROCEDURE

Two hundred subjects who fulfilled the eligibility criteria were selected for the study. They were divided in two Groups: Group I included subjects from age 21 to 25 years and Group II included subjects from age 26 to 30 years.

All the eligible subjects were interviewed by the investigator herself regarding age, marital status, personal habits, relevant recent or past medical disease, smoking and dietary habits. All participants were volunteers and had been physically rather inactive during the year preceding the study. The physical parameters were noted down and general physical examination, clinical examination of the respiratory system and cardiovascular system was done.

Blood samples for lipid profile were taken after an overnight fasting.

The subjects were given a training programme that consisted of warm up exercises, jogging, athletic games and skilled games for 6 months. The programme included daily training sessions at intensity. The initial readings of all the parameters were taken at the start of training and final readings were obtained and recorded after 6 months of the training period.

## Statistical Analysis

The data was analyzed with the help of computer software MS Excel and SPSS 12.0 software was used to analyze the results. Age, body weight, blood pressure were reported as mean and standard deviation, difference in mean value across the time was assessed using paired 't' test. The p value of <.05 was graded as statistically significant.

## RESULTS

The total number of study participants was 200 and of which 80 (40%) were in Group I (21-25 years) and 120 (60%) in Group II (26-30 years).

Table 1 indicated that in Group I before and after the training mean weight is  $66.86 \pm 5.54$  kg and  $65.02 \pm 4.34$  kg, respectively. In Group II before the training, mean weight is  $69.53 \pm 8.00$  kg and after the training mean weight is  $67.77 \pm 6.37$  kg. The difference in the mean weight in both the groups was also statistically highly significant ( $p = .0001$ ).

The data revealed mean value of Body surfaces area (BSA) of Group I before the training i.e.  $1.82 \pm 0.15$  sq m and after the training is  $1.79 \pm 0.07$  sq m. In Group II before the training, mean BSA is  $1.82 \pm 0.11$  sq m, and it is  $1.80 \pm 0.09$  sq m after the training (Table 2).

Table 3 showed that the mean Systolic blood pressure (SBP) of Group I before the training was  $122.80 \pm 1.05$  mmHg and after the training it was  $120.75 \pm 5.18$  mmHg. While the mean SBP of Group II before the training is  $124.08 \pm 7.37$  mmHg and after the training it is  $119.28 \pm 5.08$  mmHg. It also showed that mean DBP of Group I before the training is  $73.91 \pm 6.89$  mmHg and after the training it is  $71.67 \pm 3.53$  mmHg. While the mean Diastolic Systolic blood pressure (DBP) of Group II before the training is  $74.75 \pm 4.53$  mmHg and after the training it is  $70.86 \pm 2.51$  mmHg.

The study depicted that Group I has the mean value of Total cholesterol (TC)  $131.62 \pm 43.33$  mg% before the training, while the value declined to  $129.3 \pm 35.05$  mg% at the end of training. In Group II, mean value of TC before the training is  $148.98 \pm 30.30$  mg% and after the training it is  $137.38 \pm 24.76$  mg% and the difference in the mean value of TC was statistically significant as mentioned in Table 4.

Table 5 mentioned mean value of Triglycerides (TG) in Group I before the training as  $207.18 \pm 82.30$  mg% while it declined to mean value of  $186.11 \pm 65.07$  mg% after the training. In Group II, mean value of TG is  $210.14 \pm 58.39$  mg% and  $172.27 \pm 48.51$  mg% before and after the training, respectively. This difference in the mean value of TG is highly significant statistically ( $p = 0.0001$ ).

It was found that in Group I mean value of High density lipoprotein HDL before the training is  $55.20 \pm 12.34$  mg% while after the training it is  $58.67 \pm 9.42$  mg%. In Group II, mean value of HDL before and after the training is  $51.10 \pm 8.1$  mg% and  $63.7 \pm 8.83$  mg%, respectively. This difference in the mean HDL after the training is statistically highly significant ( $p = 0.0001$ ) in both the groups (Table 6).

**Table-1: Relationship of mean weight of Group I and Group II during pre-training and post-training periods**

Parameter	Weight Pre-training	Weight Post-training	't' test	'p' value
Group I	66.86±5.54	65.02±4.34	7.71	.0001
Group II	69.53±8.00	67.77±6.37	8.84	.0001

**Table-2: Relationship of mean body surface area (BSA) of Group I and Group II during pre-training and post-training periods**

Parameter	BSA pre-training	BSA post-training	't' test	'p' value
Group I	1.82 ± 0.15	1.79 ± 0.07	3.00	.004
Group II	1.82 ± 0.11	1.80 ± 0.09	5.43	.0001

**Table-3: Relationship of mean values of Systolic blood pressure (SBP) & Diastolic blood pressure (DBP) of Group I and Group II during pre-training and post-training periods**

Parameter	SBP pre-training	SBP post-training	't' test	'p' value
Group I	122.80 ±1.05	120.75 ±5.18	2.64	.010
Group II	124.08 ±7.37	119.28 ±5.08	13.59	.0001
	DBP post-training	DBP post-training	't' test	'p' value
Group I	73.91 ± 6.89	71.67 ± 3.53	2.24	.0001
Group II	74.75 ± 4.53	70.86 ± 2.51	11.86	.0001

**Table-4: Relationship of mean values of Total cholesterol (TC) of Group I and Group II during pre-training and post-training periods**

Parameters	TC pre-training	TC post-training	't' test	'p' value
Group I	131.62 ± 43.33	129.3 ± 35.05	2.15	.034
Group II	148.98 ± 30.30	137.38 ± 24.76	6.29	.0001

**Table-5: Relationship of mean values of Triglycerides (TG) of Group I and Group II during pre-training and post-training periods**

Parameters	TG pre-training	TG post-training	't' test	'p' value
Group I	207.18 ± 82.30	186.11 ± 65.07	7.80	.0001
Group II	210.14 ± 58.39	172.27 ± 48.51	13.20	.0001

**Table-6: Relationship of mean values of High density lipoprotein (HDL) of Group I and Group II during pre-training and post-training periods**

Parameters	HDL pre-training	HDL post-training	't' test	'p' value
Group I	55.20 ± 12.34	58.67 ± 9.42	5.56	.0001
Group II	51.10 ± 8.1	63.7 ± 8.83	14.56	.0001

**DISCUSSION**

“A couplet in the Bhagwad Gita, one of the most ancient Indian scriptures, clearly describes the virtues of healthy lifestyle in prevention of infirmity and ill-health. It states that those who combine a balanced diet, regular physical activity, maintain equanimity, and are

balanced in thoughts and action, are away from infirmity”[7].

The possibility of performing tasks with little energy in modern societies and spending more time in front of television and computer lead this unused energy

to be accumulated as lipids [8]. Therefore, we have to make a conscious effort to exercise.

Positive effects of applied long term regular exercise on physical, physiological, psychological and motoric features has been reported [9]. And one of the most important positive effect of exercise is on blood biochemistry. Regular and well-tuned to intensity aerobic exercise reduces total cholesterol, LDL-cholesterol, triglycerides and increases HDL-cholesterol levels [10]. Exercise activities accelerate body metabolism. 300-500 kilocalories can be spent with an hour of walking [11].

Lipid profiles are blood tests that are used to measure the total cholesterol and triglyceride levels of an individual. The tests provide detailed information on the amount of good and bad cholesterol that is present in the system. Essentially, lipids will adhere to proteins found in the system, creating what is known as lipoproteins. The major classes of lipoproteins are chylomicrons, VLDL-C, LDL-C, and HDL-C. Data obtained from a lipid profile can assist the physician in recommending lifestyle changes to bring the levels back into an acceptable range and thus decrease the chances of heart attacks and strokes. Moreover, it has been determined that in order to find out the effects of regular exercise on the lipoproteins, at least 5-week exercise is required to have positive effects on the lipid metabolism [12].

In the present study, more of subjects had body weight in the range of 60-69 kg in both groups. In Group I, mean weight before and after the training was  $66.86 \pm 5.54$  kg and  $65.02 \pm 4.34$  kg, respectively. In Group II before the training, mean weight was  $69.53 \pm 8.00$  kg, and after the training, mean weight was  $67.77 \pm 6.37$  kg. Exercise has a pivotal role in weight management, optimizing body composition by minimizing fat-free mass losses and maximizing fat mass loss; and, enhancing metabolic fitness.[13] The present findings are in agreement with the study done by Tiernan *et al.* [14] in which a year-long, moderate-to-vigorous intensity exercise intervention produced statistically significant decreases in body weight ( $p=0.008$ ). Colak and Ozcelik [15] mentioned that regular aerobic exercise-training programme in addition to diet and Orlistat therapy (DOE) for 4 weeks caused a significant decrease in total body weight:  $101.5 \pm 17.4$  kg (basal) versus  $96.3 \pm 17.3$  kg.

Similar to our findings, Drustine *et al.*, [16] has also mentioned in their study that body weight loss is associated with the exercise training programme alone or both the exercise and dietary restriction. The mean difference in Systolic blood pressure as well as Diastolic blood pressure of Group I & Group II was significant before and after the training. People who are less active and less physically fit have a 30%-50% greater frequency of hypertension than their more active

peers. The mechanism of change in blood pressure may contribute to loss of sodium in perspiration during exercise condition where sodium losses may exceed normal dietary intake. The reductions on sympathetic drive that follow training are more pronounced in patients with essential hypertension than in normotensive individuals and are likely to underline the antihypertensive effect of exercise [17].

There are other proposed mechanisms accounting for the antihypertensive effects of exercise training; the decrease of plasma nor epinephrine, decrease of endogenous ouabain-like substance, increase of prostaglandin E, or decrease of plasma renin activity were also proposed to play a role [18]. Brett *et al.* [19] reported that change in diastolic blood pressure during exercise is strongly associated with reduction in serum concentration of total-cholesterol and insulin resistance through effects on vascular reactivity. The present results are in agreement with the study of Whelton *et al.*, who showed that aerobic exercise was associated with a significant reduction in mean systolic and diastolic blood pressure ( $-3.84$  mmHg and  $-3.35$  to mmHg, respectively) so they suggested that aerobic exercise is an important strategy for prevention and treatment of high blood pressure [20].

Our observations are in agreement with the study of Tsai *et al.* (2003) in which after 12-weeks of Tai Chi (shadow boxing) training, the exercisers showed significant decrease in systolic blood pressure of  $-15.6$  mm Hg and diastolic blood pressure of  $-8.8$  mmHg [21].

In the present study, there are more subjects with total cholesterol  $<200$  mg% in both the groups. Cholesterol is a fat like substance used to help, to build cell membranes, make some hormones, synthesize vitamin D and form bile secretions that aid in digestion.

As the level of total cholesterol and LDL-cholesterol rises, the risk of coronary artery disease increases. Every 1% decrease in the level of LDL-cholesterol lowers 2% risk of the coronary artery disease occurrence [22]. Leon *et al.* examined the effect of 20 week lasting bicycle ergo meter on plasma lipids using male and female subjects between the age of 17-65 years, and in the end, reduction in total cholesterol was observed [23]. Ghahramanloo *et al.* also observed that total cholesterol significantly improved in all training groups, when a total of 27 subjects were randomly allocated to an endurance training, strength training or control group for 8 weeks [24].

However a study done by Gaesser *et al.* (1984) found no significant changes in total cholesterol in 16 non-obese, non-smoking males aged 20-30 years, who were assigned to exercise on a cycle ergo meter 3 days / week for 18 weeks [25].

In our study, there was more percentage of subjects with triglycerides level 200-400 mg% in Group I and Group II. Larger plasma TG reductions after exercise training are reported for previously inactive people with higher base line concentrations. Subjects with low initial TG concentrations have smaller TG reductions after exercise training [26].

Aerobic training increases lipoprotein lipase activity in skeletal muscle and adipose tissue. Lipoprotein lipase is the key enzyme for the breakdown of triglyceride rich lipoproteins leading to lower triglyceride concentrations in the blood and resulting in transfer of cholesterol and other substances to the HDL-C.

There are some other studies alleging that triglyceride decreases with exercises who reported a significant reduction in triglyceride (91 to 82 mg/dl;  $p=0.01$ ) after the exercise training in women subjects [27,28]. The data showed that more number of subjects in Group I and Group II had High density lipoprotein (HDL) cholesterol levels in the range of 35-59 mg%. HDL is smallest of the lipoprotein particles. It is capable to remove cholesterol from atheroma with in the arteries and transport it back to liver for excretion or reutilization that is why cholesterol carried with in HDL particles, termed HDL-C is called good cholesterol.

Similar to our findings, Stergioulas et al. also observed that HDL-C levels increased significantly ( $p < 0.05$ ) after the eight-week training programme in 18 boys aging 10-14 years [29].

Our results are in disagreement with the study conducted by Savage et al. (1986) in which walk/jog/run programme with 8-9 years old boys resulted in no alterations in HDL-C levels after the 11-week study [30].

## CONCLUSION

The findings of the present study indicates that a long term exercise programme based on regular daily aerobic exercises i.e brisk walk, jogging and athletic games has positive impact on anthropometric parameters, cardiovascular system and plasma-lipid levels. Prolonged exercise was capable of decreasing total cholesterol, triglycerides and increasing HDL cholesterol. Exercise makes the individual to feel psychologically good, healthy and safe, enabling them to escape from atherosclerotic risk factors. Therefore, physicians should encourage Exercise Habits in general population so as to decrease the cardiovascular disease risk.

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