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THE EFFECT OF REGULAR SPORTS TRAINING OF DIFFERENT MODE ON SERUM LIPID PROFILE OF THE INDIAN ATHLETES

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Abstract

Objectives: To obtain an insight into the influence exerted upon serum lipid profile by physical training in different specialties of the Indian athletes.

Methods: Three group of subjects were studied i.e. walkers (n = 11), boxers (n = 11) and sedentary subjects (n = 11). Triglycerides (TG), Cholesterol/ HDL Cholesterol Ratio (C/H Ratio), Total Cholesterol (TC) and its fractions – HDL, LDL and VLDL Cholesterols were determined in serum by an enzymatic/colorimetric method.

Results: Significant difference of C/H Ratio, LDL and of HDL-cholesterol was found in walkers as compared to other groups.

Conclusion: Our findings suggest that endurance directed sports training activity has more favorable effects on serum lipid profile.

Key words: *lipid profile, sedentary, sports training, walkers, boxers*

Introduction

Endurance training shows favorable effects on LDL oxidation, cholesterol, LDL-cholesterol, triglycerides and apo B [1]. Halverstadt et al. [2] showed that 24 weeks of endurance exercise training induced favorable changes in plasma lipoprotein and lipid profiles independent of diet and baseline or change in body fat in older men and women. However, according to study by Kelley and Kelley [3] caution may be warranted in recommending that progressive resistance training improves TC, HDL-C, TC/HDL-C, non-HDL-C, LDL-C, and TG in adults. The main metabolic benefit of regular physical activity are rise in high density lipoprotein cholesterol levels, a lowering of triglycerides, cholesterol, low density lipoprotein and very low density lipoprotein cholesterols levels [4].

Interruption of training (detraining) was associated with potentially undesirable changes in the metabolism of postprandial lipoproteins, such as a reduction in fasting concentrations of high density lipoprotein cholesterol, a reduction in post-heparin lipoprotein lipase activity [5]. A positive effect of exercise training on long-term weight maintenance in weight-reduced men was found [6] however; the study suggests that maintenance of fat loss is extremely difficult. In a study by Anderswn and Haroldsdottir [7] a favorable coronary heart disease risk profile was related to a higher $\dot{V}O_2$max, but not to time spent on physical activity. This suggests that in this age group intensity must be high enough to have an effect on $\dot{V}O_2$max before a preventive effect is present. It appears that weekly exercise caloric expenditures that meet or exceed the higher end are more likely to produce the desired lipid changes [8]. The study of Maso et al. [9] showed a paradoxical decrease in the high-density lipoprotein fraction of cholesterol and in apolipoprotein AI, and an increase in the apoprotein B/apoprotein AI ratio in the sportsmen, compared with the reference group. According to these results, physical activity seems to have only a slight influence on anti-atherogenic serum markers [9].

Leon and Sanchez [10] reviewed papers published over the past three decades pertaining to intervention trials on the effects of 12 wk of aerobic training on blood lipids and lipoprotein outcomes in adult men and women. They found that moderate- to hard-intensity aerobic training inconsistently results in an improvement in the blood lipid profile, with the data insufficient to establish dose-response relationships.

Regular monitoring of these health-related variables of sedentary as well as athletes can provide valuable information about their health, metabolic and cardiovascular status. Atherosclerosis is a multifactorial disease; impaired homocysteine metabolism has been implicated as a factor in atherosclerosis, cerebrovascular disease, and peripheral vascular disease. The causes of hyperhomocysteinemia include genetic causes, vitamin deficiency (folic acid, B_{12}, B_6), the use of certain medications, and impaired renal function [11, 12]. Study suggested that to control homocysteine, increasing physical activity, dietary fiber, and folate intake may be important [13]. There is a strong association between elevated Lp(a) levels and coronary heart disease. Studies indicated that plasma Lp(a) concentration is indeed an independent risk factor for coronary heart disease in both men and women [14]. This conclusion was confirmed by the Prospective Epidemiological Study of Myocardial Infarction (PRIME) [15]. Atherosclerosis represents a chronic inflammatory state, and inflammatory parameters (eg, interleukin-6, tumor necrosis factor-α). Increased baseline levels of high-sensitivity C-reactive protein (hs-CRP) were at increased risk for future coronary heart disease [16]. Regular physical activity have consistently documented a reduced incidence of coronary heart disease events in the more physically active [17] and fit [18] subjects, prevents the development of coronary artery disease and beneficial effects of exercise on atherosclerotic risk factors, myocardial function, coronary artery size and vasodilatory capacity, vascular tone, and vulnerability to ventricular fibrillation. After 20 wk of strength training there were no significant changes in plasma concentrations of triglyceride, total cholesterol, and HDL-C, or LDL-C in untrained males. Additionally, the activities of post-heparin lipoprotein lipase and hepatic lipase did not change with training [19].

Intense physical activity is associated with beneficial changes in the lipoprotein profile in new military recruits during a training period extending over 12 wk [20]. Dose-response relationships between exercise training volume and blood lipid changes suggest that exercise can favorably alter blood lipids at low training volumes with certain exercise thresholds [21]. In a study by Tsopanakis et al. [22] lipoprotein and lipid profiles of elite athletes in nine Olympic sports were revealed. The concentrations of serum cholesterol (TC), total lipids (TL), triglycerides (TG), HDL, LDL, VLDL, and % distribution of HDL, LDL, and VLDL of elite athletes differed with those obtained from a group of selected sedentary controls [22].

The aim of this work was to obtain an insight into the influence exerted upon serum lipid profile by physical training in different specialties of the National level Indian athletes.

Methods

Study participants

Thirty three (N=33) male subjects were studied: sedentary (S, n = 11), and the sporting groups of walkers (W, n = 11) and boxers (B, n = 11). The boxers and walkers were National level Indian athletes.

Study protocol and measurements

The height of all the subjects was recorded by measuring scale and the weight (in light clothing) in kg was recorded. The body mass index (BMI) was calculated. 5ml of venous blood was withdrawn from each subject after an overnight fasting of 12 hours. Triacylglycerol (TG), total cholesterol (TC), HDL-cholesterol in serum was determined by an enzymatic/colorimetric method employing commercial assay kits (Ranbaxy). LDL-cholesterol was determined by applying Friedewald's formula [23]. There are limitations to Friedewald's formula, most notably that samples must be obtained after a 12 to 14 h fast and that LDL-C cannot be calculated if plasma triglyceride is >400 mg/dl.

Statistical analysis

The results obtained by all the parameters were analyzed by one way ANOVA to find out the difference among various groups and if the F-value was found to be significant Scheffe's post hoc test was applied to see the difference between paired means.

Results

Table 1. *Mean and SD values of basic characteristics of subjects of sedentary (S), walking (W) and boxing (B) groups*

	Group S (n =11) Mean± SD	Group W (n =11) Mean± SD	Group B (n=11) Mean± SD
Age (years)	24.55 ± 1.8	24.09 ± 1.64	23.18 ± 1.83
Body Mass (Kg)	63.64 ± 6.27	61.73 ± 5.24	61.27 ± 4.82
Body Height (cm)	170.68 ± 6.99	172.82 ± 4.75	173.73 ± 5.93
BMI (Kg/m^2)	23.33 ± 2.24	21.48 ± 1.84	21.08 ± 1.47
Training Experience (years)	Nil	6.5 ± 3.2	7.5 ± 3.6

Table 1 shows the mean ± SD of age (yrs), body mass (Kg), body height (Cms), BMI (Kg/m^2) and training experience (yrs) variables of the sedentary and athletes belonging to walking and boxing groups. The mean age of subjects of sedentary, walking and boxing groups have been observed 24.55 ± 1.8, 24.09 ± 1.64 and 23.18 ± 1.83 respectively. The mean body mass of subjects of sedentary, walking and boxing groups have been observed 63.64 ± 6.27, 61.73 ± 5.24 and 61.27 ± 4.82 respectively. The mean body height of subjects of sedentary, walking and boxing groups have been observed 170.68 ± 6.99, 172.82 ± 4.75 and 173.73 ± 5.93 respectively. The mean BMI of subjects of sedentary, walking and boxing groups have been observed 23.33 ± 2.24, 21.48 ± 1.84 and 21.08 ± 1.47 respectively. The mean training experience of subjects of sedentary, walking and boxing groups have been observed nil, 6.5 ± 3.2 and 7.5 ± 3.6 respectively.

Table 2. *Mean± SD and F-ratio values of serum lipid profiles of three groups of subjects*

	Group S (n = 11) Mean ± SD	Group W (n = 11) Mean ± SD	Group B (n =11) Mean ± SD	F-ratio Mean ± SD
Triglyceride (mg/dl)	131.55 ± 44.30	108.61 ± 26.85	109.60 ± 36.57	0.276
Total Cholesterol (mg/dl)	204.13 ± 29.37	174.37 ± 27.23	184.94 ± 20.74	0.738
HDL-Cholesterol (mg/dl)	46.03 ± 5.84	70.94 ± 13.68	52.86 ± 11.45	3.104*
C/H Ratio	4.51 ± 0.97	2.54 ± 0.66	3.61 ± 0.68	3.571*
LDL-Cholesterol (mg/dl)	131.79 ± 25.66	81.70 ± 30.40	110.15 ± 18.41	2.168*
VLDL-Cholesterol (mg/dl)	26.31 ± 8.86	21.72 ± 5.37	21.92 ± 7.31	0.276

Table 2 shows the mean ± SD of triglycerides (mg/dl), total cholesterol (mg/dl), HDL-cholesterol (mg/dl), C/H ratio, LDL-cholesterol (mg/dl) and VLDL-cholesterol (mg/dl) variables of the sedentary and athletes belonging to walking and boxing groups. The mean triglycerides of subjects of sedentary, walking and boxing groups have been observed 131.55 ± 44.30, 108.61 ± 26.85and 109.60 ± 36.57 respectively. The mean total cholesterol of subjects of sedentary, walking and boxing groups has been observed 204.13 ± 29.37, 174.37 ± 27.23 and 184.94 ± 20.74 respectively. The mean HDL-cholesterol of subjects of sedentary, walking and boxing groups have been observed 46.03 ± 5.84, 70.94 ± 13.68and 52.86 ± 11.45 respectively. The mean C/H ratio of subjects of sedentary, walking and boxing groups have been observed 4.51 ± 0.97, 2.54 ± 0.66 and 3.61 ± 0.68 respectively. The mean LDL-cholesterol of subjects of sedentary, walking and boxing groups has been observed 131.79 ± 25.66, 81.70 ± 30.40 and 110.15 ± 18.41 respectively. The mean VLDL-cholesterol of subjects of sedentary, walking and boxing groups have been observed 26.31 ± 8.86, 21.72 ± 5.37and 21.92 ± 7.31 respectively.

F ratio was computed to find out the difference of the biochemical variables among the subjects of the sedentary, walking and boxing groups. The F ratio shows that there is significant difference in HDL-cholesterol (3.104*), C/H ratio (3.571*) and LDL-cholesterol (2.168*) variables among above mentioned groups. As the F ratio was significant the Scheffe's Post Hoc analysis for HDL-cholesterol, C/H ratio and LDL-cholesterol components among the three different groups was computed and it was found that the level of HDL-cholesterol between W and B, W and S groups was found significant, while no significant difference was found in HDL-Cholesterol level between the B and S groups. The level of C/H ratio between W and B, W and S, B and S groups were found significant. The level of LDL-cholesterol between W and B, W and S groups were found significant, while no significant difference was found in LDL-Cholesterol level between the B and S groups.

Sedentary subjects have least favorable concentrations of Triglycerides, total cholesterol, LDL-cholesterol, VLDL-Cholesterol, C/H Ratio and HDL-Cholesterol. Significantly best levels of C/H Ratio, VLDL –Cholesterol and HDL-cholesterol were found in walkers.

Discussion

We found higher level of HDL-cholesterol in the Walkers and Boxers as compared to sedentary subjects. The other study compared the lipid profiles of master athletes, recreational athletes and sedentary workers and also concluded that habitual physical training favorably altered the serum lipid and lipoprotein profiles [24]. Our findings show similar patterns of lipid profile. Regular exercise is one of the metabolic adaptations contributing to the reduced risk of coronary heart disease (CHD) observed among physically active and fit individuals [25-27]. In the present study Boxers and Walkers shows decreased level of lipid parameters like triglycerides, total cholesterol, LDL-cholesterol, VLDL-cholesterol and increased level of HDL-cholesterol as compared to sedentary counterparts which was supported by Hezberg study [28], in which it was revealed that regular physical activity induced decreases in the concentrations of triglycerides (TG), total cholesterol (TC) and its LDL-fraction, and an increase in HDL-cholesterol [28]. Our results also revealed that the changes in lipid profile were related to the type of sports activity. The levels of cholesterol, triglycerides, LDL-cholesterol, VLDL-cholesterol and C/H ratio were lower in walkers (aerobic) as compare to boxers (intermittent i.e. aerobic and anaerobic), whereas high level of HDL- cholesterol in Walkers as compared to Boxers. In contrast, it was reported that lower HDL-cholesterol in rugby players than in control subjects although TC and TG were decreased in the former group and LDL-cholesterol did not change [9]. Further, it was observed that there were no differences in lipid profile between control subjects and wrestlers with a 10-year experience and suggested that wrestling training, consisting predominantly of anaerobic and strength exertions, was insufficient to stimulate a rise in HDL-cholesterol level [29]. In this study, an abnormal lipid profiles was found in sedentary subjects; however, regular sport training had beneficial effect on serum lipid profile, especially in Walkers, whose training was more endurance-directed than Boxers. Further investigations into lipids and their lipoparticles of Indian athletes of different sport specializations are warranted.

Conclusion

The results of this study highlight the importance of regular physical activity to provide an advantage in maintaining favorable lipid profile of Indian athletes of different specialties. The results suggest that sporting activity aerobic in nature is most beneficial of improving the lipid profile.

Declaration of interest

The authors report no conflicts of interest.

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