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Lipid profiles changes induced by swimming combined training in academic level athlete's women

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ABSTRACT

Sedentary lifestyles, obesity, diabetes and Coronary Artery Diseases (CAD) have been considered as important factors in the start of the 3rd millennium. Increment of age & gender related risk factors such as lipids and lipoproteins disorder, diabetes and obesity accompanied by decrement of physical activity levels in sedentary females. Creating an active lifestyle with regular exercise training is the best prevention of lipids and lipoproteins disorder, obesity, diabetes, CAD and its risk factors. The results of previous study indicated that long-term exercise training has beneficial effects on serum concentration of TC, TG, LDL_C, and HDL_C. There was few study executed considering swimming combined training included aerobic and anaerobic swimming effects on these lipid profiles. Therefore, the purpose of this study was determined and compared of effects of 8 weeks swimming combined training on lipid profiles in academic level athlete's women. Whether, the 8 weeks swimming combined training included aerobic and anaerobic swimming have any effects on serum concentration of TC, TG, LDL_C, and HDL_C in academic level athlete's women? The purpose of this semi quasi study was determined and compared of the effects of swimming combined training included aerobic and anaerobic swimming on lipid profiles in academic level athlete's women. 20 subjects randomly selected from 30 volunteered healthy academic level athlete's women (20-25 years) based on physical activity rating questionnaire in Islamshahr branch of Islamic Azad University (Tehran, Iran). These subjects randomly divided in Exercise (n=10) and Control (n=10) groups. Training program was performed for 8 weeks, 2 days/week and 60 min/ days. Training program was started at 55% of Heart Rates Reserve (HRR) at the beginning and 85% of HRR at last weeks. Subjects eating habits and other daily physical activity in groups didn't change. Fasting blood sample was taken for measuring serum concentration of TC, TG, LDL_C and HDL_C with ELISA method (Pars Azmoon kits, Iran) after 9 to 12 hours of fasting, 7-8 am, from left Antecubital vein at medical diagnosis laboratory. Lipid profiles means compared with two-tailed independent and paired samples t test between and within the exercise and control groups, respectively. Significant levels of all tests were $P \leq 0.05$. Mean differences of serum TC, TG, and LDL_C concentrations between groups in post tests, and mean differences of TC, TG and LDL_C in pre and post tests of exercise group were not significant. Mean differences of HDL_C between groups in post test and mean differences of HDL_C in pre and post tests of exercise group were significant ($p \leq 0.001^{**}$). Swimming combined training included aerobic and anaerobic swimming have beneficial effects on serum concentration of HDL_C in academic level athlete's women; but were not significant effects on TC, TG and LDL_C. Therefore, more studies need to be done to show the optimum levels of intensity, duration and type of swimming combined training for desirable effects on these lipid profiles levels.

Key Words: Lipoproteins, lipid profiles, swimming, combined training.

INTRODUCTION

The prevalence of Coronary Artery Disease (CAD), mortality and financial burden of those in world is growing [1, 2, 11, 17, and 19]. Incidence and mortality from CAD in Iran is increasing [26]. Sedentary lifestyles, obesity and increment of CAD morbidity and mortality have been considered as important factors in the start of the 3rd millennium [1, 11, and 17]. CAD are a number one killer in the world and peoples and governments have to pay a lot of expenses to control, prevention and treatment of them [17]. CAD risk factors are variables that appear to be associated with the development and progression of CAD. Study findings showed that factors such as serum levels of Total Cholesterol (TC), Triglyceride (TG), Low Density Lipoprotein Cholesterol (LDL_C), and High Density Lipoprotein Cholesterol (HDL_C) are also associated with the development and progression of CAD [1, 2, and 17]. Increment of age & gender related CAD risk factors such as lipids and lipoproteins disorder and obesity accompanied by decrement of physical activity levels in sedentary women. On the other hand, increment of physical activity levels and exercise training modified lipids and lipoproteins disorder, obesity and CAD risk factors and decrement of CAD morbidity and mortality and financial burden of those [1, 2, 17, 19, 26]. Creating an active lifestyle with physical activity is the best prevention of lipids and lipoproteins disorder, obesity and cardiovascular disease and its risk factors [2, 11, 17, and 19]. The results of previous study indicated that long-term physical activity and exercise training is the best way in primary and secondary prevention of chronic diseases, especially CAD, obesity and lipids and lipoproteins disorder in men and women with different age ranges [2, 11, 17, and 19]. The results of previous study indicated that long-term exercise training has beneficial effects and relationship with serum concentration of TC, TG, LDL_C, and HDL_C [3-10, 12-14, 16]. Conroy (2007) showed in a 10 years period study about role of sports and physical activity in prevention of CAD risk factor that increased physical activity levels would lead to decrease these risk factor. Active women also have a healthier life, and better risk factors pattern compared to inactive women. LDL_C, TC and %BF are lower in active women compared to inactive women and they also have a higher HDL_C levels in blood serum [7].

Some researchers studied aerobic, anaerobic and combined (aerobic – anaerobic) training on lipid profiles, physical fitness and health related metabolic factors such as blood lipids levels in women. There was a significantly decreased in LDL_C and TC levels in all groups. There was a significantly increased of HDL_C levels in all groups'; but these differences were not significant between training groups. They concluded that aerobic training, anaerobic training and combined (aerobic – anaerobic) training had positive effects on fitness, and lipids profiles in females [3-10, 12-14].

Water exercise or swimming is one of women' most preferred methods of exercise. Swimming is the exercise of choice for many women who decide to start a fitness program. This is a form of exercise that is done in the water involves using rhythmic movement performed at different levels of intensity or difficulty. Swimming increases cardiovascular conditioning and, at the same time, help to tone muscles in the body. Today women make up the majority of swimming participants. It is the women population's increased interest in this form of exercise that has caused the greatest growth in swimming fitness programs. Swimming exercise is a good exercise choice for women. Many women refrain from physical activity because they are afraid of injury. Many women suffer physical impairments that limit their ability to participate in land exercise. There is less chance for injuries to occur when exercising in the water. A swimming workout causes less compression on the joints than is experienced during land exercise. The buoyancy of water reduces the muscular-skeletal stress put on the body. Buoyancy also helps to protect women from dynamic and fast movement. It puts less strain on the body and helps to prevent many of the injuries that women receive during land aerobics that produce jarring and bumping movement. Buoyancy also allows for strengthening and toning in muscles with less fatigue and soreness. These results induced by the use of all the major muscles in the body. In the water, women can perform many exercises that would be impossible for them on the land. Swimming is becoming more and more popular with women and, in the future, many women decide to join this type of fitness program [11, 17, and 19]. Several studies have been conducted to determine whether swimming produces benefits for the women participants. Takeshima et al. (2002) conducted a study on women and reported that swimming helped to improve the cardiovascular fitness, muscle strength, power, agility, flexibility, pulmonary functions, and blood lipids of the women [21]. Wininger (2002) and Wantanabe, Takeshima, Okada, and Inomata (2000) conducted studies on women in water exercise programs and concluded that swimming helped to reduce the rate of obesity among the participants [23, 24]. Swimming trainings would cause decrease in body composition factors such as body mass, body mass index, body fat percent and waist circumference [3, 14]. In conclusion, water exercises, such as swimming, are many positive outcomes that can be attained from this form of exercise, including physiological, psychological, and other benefits. Swimming is a form of exercise that helps to increase strength, endurance, flexibility, and fitness levels.

Therefore, according to the previous studies results, it seems that combination training included aerobic training and anaerobic training has better effects on cardiovascular fitness, aerobic fitness and lipid profiles. Swimming training is also more interesting and easier for women compared to other sports and exercise training methods. On the other hand, exercise training and physical activity modified lipid profiles, but the influences of different types of swimming and combination of them on lipid profiles has rarely been investigated. There was no study executed considering combination of aerobic swimming and anaerobic swimming on lipid profiles. Therefore, the purpose of this study was determined and compared of effects of 8 weeks swimming combined training on lipid profiles in academic level athlete's women. Whether, the 8 weeks swimming combined training included aerobic and anaerobic swimming have any effects on serum concentration of TC, TG, LDL_C, and HDL_C in academic level athlete's women?

MATERIALS AND METHODS

The purpose of this semi quasi study was determined and compared of the effects of swimming combined training on lipid profiles in academic level athlete's women. 20 subjects randomly selected from 30 volunteered healthy academic level athlete's women (20-25 years) based on American College of Sports Medicine and Physical Activity Rating Questionnaire in Islamshahr branch of Islamic Azad University (Tehran, Iran). This subjects randomly divided in two groups such as, Exercise (BMI: 25.2 ± 2.1; n= 10) and Control groups (BMI: 25.6 ± 2.6; n= 10). All the subjects were informed of their rights to anonymity and confidentiality. The Institutional Review Board for Human Subjects at the university approved this study. In order to participate in the study 20 the subjects signed an informed consent form. At the onset of the study, the subjects were informed about the purpose of the study. They were told that the results would help researchers to develop better strategies for improving methods of disease prevention. The research study was conducted at a local indoor swimming pool in the university.

The independent variable was swimming combined training included aerobic and anaerobic swimming based on progressive overload training principal. Training program was based on Association of Sport Sciences guidelines and it was adjusted by subject's physical condition, gender and age. Training program was performed for 8 weeks, 2 days / week and 60 min / days. Total time of training program divided as warming up (15 min), swimming program (40 min) and cooling down (5 min) at the morning of days (8 – 9.30 am). Training program was started at 55% of Heart Rates Reserve (HRR) at the beginning week and 85% of HRR at last week. Subjects eating habits and other daily physical activity in groups didn’t change. Dependent variables included lipid profiles such as TC, TG, LDL_C, and HDL_C measured at beginning and the end of training program in two groups. Fasting blood sample was taken for measuring serum concentration of TC, TG, LDL_C and HDL_C with ELISA method (Pars Azmoon kits, Iran) after 9 to 12 hours of fasting, 7-8 am, from left Antecubital vein at medical diagnosis laboratory. In order to determine whether there were any statistically significant differences in the lipid profiles of subjects during training program, a two-tailed independent samples t test was used for comparing of lipid profiles means between the exercise and control groups. The lipid profiles means in pre test and post test of each group compared with a two-tailed paired samples t test. The normality of the distribution and homogeneity of variances tested with Kolmogorov–Smirnov and Levene's tests respectively. Significant levels in all tests were $P \leq 0.05$.

RESULTS AND DISCUSSION

IN table 1, Means and Standard Deviation (M±SD) of the variables and the results of statistical tests in pre test and post test of groups are presented. Mean differences of serum concentration of TC (E: 165.7 ± 32.1 vs. C: 179.2 ± 30.0 $mg.dl^{-1}$) in post test between groups were not significant (p = 0.135). Decrement of serum concentration of TC in pre test (180.4 ± 30.5) and post test (165.7 ± 32.1) of exercise group were not significant (p = 0.182). Decrement of serum concentration of TC in pre test (182.2 ± 29.8) and post test (179.2 ± 30.0) of control group were not significant. Mean differences of serum concentration of TG (E: 160.0 ± 28.9 vs. C: 163.8 ± 31.8 $mg.dl^{-1}$) in post test between groups were not significant (p = 0.478). Increment of serum concentration of TG in pre test (155.3 ± 26.6) and post test (160.0 ± 28.9) of exercise group were not significant (p = 0.520). Increment of serum concentration of TG in pre test (145.5 ± 30.1) and post test (163.8 ± 31.8) of control group were not significant. Mean differences of serum concentration of LDL_C (E: 83.7 ± 22.8 vs. C: 99.5 ± 24.3 $mg.dl^{-1}$) in post test between groups were not significant (p = 0.275). Decrement of serum concentration of LDL_C in pre test (95.4 ± 25.5) and post test (83.7 ± 22.8) of exercise group were not significant (p = 0.220). Decrement of serum concentration of LDL_C in pre test (107.3 ± 27.1) and post test (99.5 ± 24.3) of control group were not significant. Mean differences of serum concentration of HDL_C (E: 54.4 ± 6.5 vs. C: 42.1 ± 5.3 $mg.dl^{-1}$) in post test between groups were significant ($p \leq 0.001$**). Increment of serum concentration of HDL_C in pre (41.2 ± 5.1) and post tests (54.4 ± 6.5) of exercise group were significant ($p \leq 0.001$**). Increment of serum concentration of HDL_C in pre (40.7 ± 4.9) and post test (42.1 ± 5.3) of control group were not significant.

Table 1. Means and Standard Deviation (M±SD) of the variables and the results of statistical tests in pre test and post test of groups (P≤0.05).

Variables	Groups	Pre test	Post test	% diff	sig
TC ($mg.dl^{-1}$)	E	180.4 ± 30.5	165.7 ± 32.1	-8.1	0.182
	C	182.2 ± 29.8	179.2 ± 30.0	-1.6	
Sig			0.135		
TG ($mg.dl^{-1}$)	E	155.3 ± 26.6	160.0 ± 28.9	3.0	0.520
	C	145.5 ± 30.1	163.8 ± 31.8	12.5	
Sig			0.478		
LDL_C ($mg.dl^{-1}$)	E	95.4 ± 25.5	83.7 ± 22.8	-12.2	0.220
	C	107.3 ± 27.1	99.5 ± 24.3	-7.2	
Sig			0.275		
HDL_C ($mg.dl^{-1}$)	E	41.2 ± 5.1	54.4 ± 6.5	32.0	0.001**
	C	40.7 ± 4.9	42.1 ± 5.3	3.4	
Sig			0.001**		

The results of this study indicated that swimming combined training was significantly increased HDL_C levels. These results indicated that 8 weeks of swimming combined training included aerobic and anaerobic swimming modified lipid profiles and corrected the pattern of these risk factors in academic level athlete's women. The results of previous studies indicated that increment of physical activity levels and exercise training modified lipid profiles and decrement of CAD morbidity and mortality. These results indicated that long-term physical activity and exercise training have beneficial effects on serum concentration of HDL_C [3-10, 12-14, 20, 22]. Increment of HDL_C in academic level athlete's women in this study resulted from aerobic and / or anaerobic swimming or combination of them. Primary levels of lipoproteins and lipid profiles and intensity, duration and types of physical activity and exercise training are important factors that affect lipid profiles. It seems that differences responses of HDL_C in academic level athlete's women in this study were due to primary levels of this lipoprotein and combination of training. Endurance training such as aerobic swimming increase maximum oxygen consumption, number, size and density of mitochondria and oxidative enzymes. On the other hand, anaerobic swimming increased myofibrils proteins and muscle mass. Therefore, endurance training such as aerobic swimming increase the rate of fat aerobic catabolism and anaerobic swimming increase the amounts and duration of fat aerobic catabolism (increased the muscles fiber and fatigue threshold). These structural and functional changes in body systems resulted to increased aerobic energy expenditure and fat born. Some previous studies indicated that serum levels of TC, TG and LDL_C were decreased after aerobic training in sedentary females [3-10, 12-14, 20, 22]; but the results of this study were not supported of them. The results of this study indicated that serum levels of TC, TG and LDL_C were decreased in academic level athlete's women in exercise group; but these decrements were not significant.

CONCLUSION

Therefore, the results of this study indicated that swimming combined training was significantly modified lipid profiles in academic level athlete's women. Swimming combined training included aerobic and anaerobic swimming in this study have beneficial effects on serum concentration of HDL_C in academic level athlete's women; but were not significant effects on TC, TG and LDL_C. Therefore, more studies need to be done to show the optimum levels of intensity, duration and type of combination training for desirable effects on lipid profiles.

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