

Swimming combined training in academic level athlete's women decrease fasting blood sugar

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ABSTRACT

Sedentary lifestyle and increment of diabetes prevalence has been considered as important factors in the start of the 3rd millennium. The prevalence of diabetes, mortality and financial burden of those in world is growing. Incidence and mortality of diabetes in Iran is increasing. Increment of age & gender related risk factors such as hyperglycemia accompanied by decrement of physical activity levels in sedentary females. Exercise training and physical activity reduced blood glucose, but the influences of different types of swimming and combination of them on Fasting Blood Sugar (FBS) concentration has rarely been investigated. The purpose of this quasi-experimental study was determined and compared of the effects of swimming combined training on fasting blood sugar concentration in academic level athlete's women. 20 subjects randomly selected from 30 volunteered healthy academic level athlete's women (20-25 years). 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 ; $n = 10$). Training program was performed for 8 weeks, 2 days / week and 60 min / days. Swimming training was started at 55% of Heart Rates Reserve (HRR) at the beginning week and 85% of HRR at last week. Fasting blood sample was taken for measuring of FBS 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. Between groups differences of fasting blood sugar concentration were analyzed by two-tailed independent samples *t* test. Within groups differences of fasting blood sugar concentration were analyzed by two-tailed paired samples *t* test. Significant levels in all tests were $P \leq 0.05$. Mean differences of fasting blood sugar concentration (Exercise: 85.7 ± 12.5 vs. Control: 95.8 ± 14.2 mg.dl⁻¹) between groups in posttest were significant ($P = 0.0001^{**}$). Decrement of fasting blood sugar concentration in pretest (100.2 ± 14.3 mg.dl⁻¹) and posttest (85.7 ± 12.5 mg.dl⁻¹) of exercise group were significant ($P \leq 0.0001^{**}$). The results of this study indicated that 8 weeks of combined swimming training included aerobic and anaerobic swimming decreased fasting blood glucose levels and corrected pattern of diabetes in academic level athlete's women. The results of previous studies indicated that increment of physical activity levels and exercise training modified diabetes risk factors and decrement of diabetes morbidity and mortality. Decrement of fasting blood glucose in this study resulted from increased glucose utilization, increased insulin sensitivity and muscles glucose intake and decrease of insulin resistance; which led to increase in muscle glucose metabolism and decrease in blood glucose levels. These results indicated that moderate intensity combined swimming have positive effect on FBS in women.

Key words: Swimming, Combined Training, Academic Level Athlete's Women, Fasting Blood Sugar.

INTRODUCTION

The prevalence of diabetes, mortality and financial burden of those in world is growing [1, 2, 11, 15, 17, and 22]. Incidence and mortality of diabetes in Iran is increasing [24]. Sedentary lifestyles and increment of diabetes morbidity and mortality has been considered as important factors in the start of the 3rd millennium [1, 11, and 15].

Diabetes is a major killer in the world and peoples and governments have to pay a lot of expenses to control, prevention and treatment of them [15]. Study findings showed that factors such as serum levels of Fasting Blood Sugar (FBS) are also associated with the development and progression of diabetes [1, 2, 15, and 17]. Increment of age & gender related risk factors such as hyperglycemia accompanied by decrement of physical activity levels in sedentary females [2, 15, 17, and 22].

On the other hand, increment of physical activity levels and exercise training modified FBS and decrement of diabetes morbidity and mortality and financial burden of those [2, 15, 24]. Creating an active lifestyle with physical activity is the best prevention of diabetes and its risk factors [2, 11, 15, and 17]. 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 diabetes in men and women with different age ranges [2, 11, 15, 17, and 22]. The results of previous study indicated that long-term physical activity and exercise training have beneficial effects and relationship with serum concentration of fasting blood sugar [3-10, 12-14, 16].

Conroy (2007) showed in a 10 years period study about role of sports and physical activity in prevention of cardiovascular diseases risk factor that increased physical activity levels would lead to decrease these risk factor. Active women also have a healthier life, lower body mass and better risk factors pattern compared to inactive women. It is also shown that average and high intensity training and resistance training would increase insulin sensitivity level, decrease insulin resistance and blood glucose levels. These increases are reported independently free from weight or body fat mass loss [7].

Some researchers studied aerobic, anaerobic and combined (aerobic – anaerobic) training on health related metabolic factors such as glucose and insulin level in women. Results showed that there were a significantly decreased in blood sugar levels in all groups. They concluded that aerobic training, anaerobic training and combined training have positive effects on metabolic risk factors related to diabetes 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 and 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 20]. 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, blood lipids and blood sugar of the women [19]. Winger (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 [21, 23]. 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 combined training included aerobic and anaerobic training have a better effects on cardiovascular fitness, aerobic fitness and body composition. 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 diabetes risk factors, but the influences of different types of swimming and combination of them on diabetes risk factors has rarely been investigated. There was no study executed considering combination of aerobic swimming and anaerobic swimming on diabetes risk factors. Therefore, the purpose of this study was to determined and compared of effects of 8 weeks swimming combined training on diabetes risk factors in academic level athlete's women. Whether, the 8 weeks combined swimming

included aerobic and anaerobic swimming have any effects on Fasting Blood Sugar concentration in academic level athlete's women? Whether, an active lifestyle can be reducing the diabetes risk in females?

MATERIALS AND METHODS

The purpose of this quasi-experimental study was determined and compared of the effects of swimming combined training on fasting blood sugar concentration 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 diabetes interventions. 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 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 variable included Fasting Blood Sugar concentration (FBS) measured at beginning and the end of training program in two groups. Fasting blood sample was taken for measuring of FBS 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 FBS of subjects during training program, a two-tailed independent samples t test was used for comparing of FBS means between the exercise and control groups. The FBS 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

Mean differences of fasting blood sugar concentration (Exercise: 85.7 ± 12.5 vs. Control: 95.8 ± 14.2 mg.dl⁻¹) between groups in posttest were significant ($P=0.0001^{**}$). Decrement of fasting blood sugar concentration in pretest (100.2 ± 14.3 mg.dl⁻¹) and posttest (85.7 ± 12.5 mg.dl⁻¹) of exercise group were significant ($P \leq 0.0001^{**}$). Decrement of fasting blood sugar concentration in pretest (99.5 ± 14.5 mg.dl⁻¹) and posttest (95.8 ± 14.2 mg.dl⁻¹) of control group were not significant.

The results of this study indicated that 8 weeks of combined swimming included aerobic and anaerobic swimming based on progressive training principal were significantly decreased fasting blood glucose levels and corrected pattern of diabetes in academic level athlete's women. The results of previous studies indicated that increment of physical activity levels and exercise training modified diabetes risk factors and decrement of diabetes morbidity and mortality. These results indicated that long-term physical activity and exercise training have beneficial effects on fasting blood sugar concentration [3-10, 12-14, 18, 20]. Decrement of fasting blood glucose concentration in academic level athlete's women in this study resulted from aerobic and anaerobic swimming. It is shown that there was a significant decrease in fasting blood glucose levels after aerobic training, resistant training, and combination of them. Decrement of fasting blood glucose in academic level athlete's women in this study resulted from increased glucose utilization, increased insulin sensitivity and muscles glucose intake and decrease of insulin resistance; which led to increase in muscle glucose metabolism and decrease in blood glucose levels.

CONCLUSION

Therefore, the results of this study indicated that 8 weeks of combined swimming included aerobic and anaerobic swimming based on progressive training principal were significantly modified fasting blood sugar in academic level athlete's women. Combined swimming has beneficial effects on fasting blood sugar concentration in academic level athlete's women.

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