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Short Communication

Effect of eight-week aerobic exercises in 10 to 12 years old overweight girls

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ABSTRACT:

Cardiovascular diseases are considered as one of the threats to human health, especially, in individuals with overweight. The aim of this study was to investigate the effect of eight-week aerobic exercises in 10 to 12 years old overweight girls. In this study, 27 overweight female student whit 10-12 years old were selected and were randomly divided into two groups; a) training group (n=17) and b) control group (n=10). Training group participated into the aerobic training for 8 weeks, with 70-85 percent of heart rate reserve maximum, 3 times a week and 60 minutes in each session. The variables such as BF, BMI, WHR and VO_2max, were measured in two groups before and after the training period. The average of variables such as BF, BMI and VO_2max were significantly different between two groups ($P<0.05$). But the average of WHR were not significantly different between two groups. According to these results, aerobic exercise in 10-12 years old overweight girls, can have beneficial effects on some cardiovascular risk factors.

Keywords:
Aerobic exercise, Overweight, WHR and BMI.

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INTRODUCTION

Increasing prevalence of overweight in children is one of the most important public health problems in developed and developing countries that results in various side effects in childhood and adolescence (Dietz, 1998; Stump, 2004). Physically and psychologically negative effects in the child are one of its consequences and particularly increase the possibility of obesity in adolescence leading to increase in the incidence of cardiovascular disease, diabetes, hypertension and even cancer (Stump, 2004). Increase in obesity and overweight among children in developing countries is due to the change in people's lifestyle which somehow is related with urban modern lifestyle such as spending an enormous amount of daily life on watching TV and playing computer games. Fatty diets and inactiveness are the factors accelerating this issue. Studies done in developed countries, particularly in the Middle East and some Asian countries, indicate the prevalence of overweight and obesity in children in the past two decades. Unfortunately, there isn't enough information on the prevalence of obesity and overweight in children. Some studies indicate that its prevalence has increased in the late two decades to the extent that in a survey of primary school students in Tehran, the prevalence of overweight and obesity was 7.7 percent and 3.13 respectively (Mozafary and Nabaie, 2002).

It has recently been clear that although symptoms of some diseases such as coronary obstruction appears in adulthood, the disease starts from adolescence and young ages (Johnson *et al*., 2009). There are many contributing factors to the increase of cardiovascular disease among which unhealthy nutritional habits, sedentary, low aerobic fitness, obesity, overweight, high blood pressure and unfavorable conditions of lipid profiles can be noted (Antal *et al*., 2006). Some of these factors such as increasing prevalence of overweight in adolescents which is associated with reduced physical activity have been known as the main cause of cardiovascular disorders (Ball and Bolhofner, 2008). It is alleged that for every unit increase in body mass index, the risk of cardiovascular disease increases by 8% and, in turn, by increasing physical activity of a Metabolic equivalents, the risk of cardiovascular fitness reduces by 8% that emphasizes the importance of physical activity and being in shape (Fabio *et al*., 2010). Aerobic activities are one of the ways to lose weight and body fat that can improve cardiovascular endurance, abdominal muscle endurance, flexibility and lower subcutaneous fat thickness (Shahana *et al*., 2010). Researchers have suggested that adolescents should participate in varied and enjoyable physical activities ranging from moderate to strenuous at least for 60 minutes or more. Regular physical activity is not only essential for normal growth and development of adolescents, but also leads to an active lifestyle in childhood and adolescence years that results in reducing the risks associated with chronic diseases in later years (Guy and Micheli, 2001).

Aerobic exercise is an aerobic activity through which an individual can consume a lot of energy. Aerobic exercises include various movements in which speed and flexibility are of particular importance. As it's accompanied by music, it would be very fun and exciting increasing calorie burning and has a particular appeal among girls (Patel *et al*., 2007). Regarding this fact, the effect of exercise on improving fitness and reducing body fat percentage can increase adolescent girls' interest in participating in physical activity. Aerobic exercise and variables of Body Fat (BF), Body Mass Index (BMI), Waist-to-Hip Ratio (WHR) and maximal oxygen uptake (VO_2max) have sporadically been studied in various internal and external research. Review of literature points out to the fact that less study has been done on the effect of a period of eight week exercise on variables such as body fat percentage, BMI, waist-to-hip ratio and maximal oxygen consumption (VO_2max) in girls who are overweight with the age range of 10 to 12 years. As mentioned earlier, childhood and adolescence are of

Table 1. Distribution of age, height, weight and body mass index of participants

S. No	Group	Control	Experimental	Total
1	Age (year)	11±0.81	11.05±0.99	11.02±0.9
2	Height (cm)	45.1±4.34	45.1±10.84	45.11±7.59
3	Weight (kg)	57.80±9.38	57.20±10.09	57.50±10.11
4	Body mass index (kg/m^2)	27.04±1.82	26.66±1.68	26.66±1.68

particular importance in the prevention of cardiovascular disease and obesity and by changing lifestyle and increasing physical activity in this period, people can experience a better and healthier adulthood. Therefore, the selection of appropriate age to participate actively in sports and the kind of physical activity is also important because the optional selection of sports and its popularity can be effective to participate in exercises (Gill *et al*., 2002). Therefore, the aim of this study is to examine the effect of eight week aerobic exercise on body composition and VO_2max factors in overweight girls aged 10 to 12 years in Ahvaz.

MATERIALS AND METHODS

This study was a quasi-experimental and applied research aiming to analyze changes in the dependent variables (body fat percentage, waist-to-hip ratio, BMI and VO_2max) in overweight girls aging10 to 12 years by using dependent variable (aerobic exercises) Dhara and Chatterjee (2015).

This research included 10 to 12-year-old girls in elementary schools in Ahvaz. Three elementary schools were randomized to determine a statistical sample. In each school, the third, fourth and fifth grade students with an age range of 10 to 12 years were selected and their weight (average 19.68) and height (average 96.156) were measured. Their body mass index was calculated by the formula (Dhara and Chatterjee, 2015)

$$\text{Body mass index} = \frac{\text{Weight (kg)}}{\text{Height (m)}} \times 2$$

Participants with the body mass index of 25 to 30 were selected and divided randomly into two experimental group (n=17) and control group (n = 10) providing necessary information about research and training situations and completing the consent form.

The dependent variables of the study in both pre-test and post-test were measured in the same conditions. Waist circumference around the waist, in the middle of the last rib and the upper edge of the iliac crest and hip circumference at the largest circumference between the waist and knees with non-elastic tape was measured with an accuracy of 5.0 and the ratio of waist to hip (WHR) was calculated by dividing the waist circumference by hip circumference (Heydari *et al*., 2011). Subcutaneous fat was measured using calipers (Harpenden Skinfold Calipers). Method of measuring body fat percentage is based on Jackson *et al*. (1980) method that is calculated by subcutaneous fat using three parts of arm, above the iliac and femoral front through the following formula (Jackson *et al*., 1980).

BF%=495/(1.089733-(0.0009245rs) + (0.0000025rsrs) – (0.0000979ra))-450

VO_2max was measured using the formula given below. The test was three minutes and the participant had to climb up a 30 to 50 cm stair (height of the step depended on the height of the participant, the step height should be in such a way that when the participant places foot on the stairs, hip flexion angle is 70°) at a rate of 26 times per minute. After the test, participants sit immediately and a technician measures heart rate in a minute after five seconds and it is calculated using the following formula, ie., VO_2max which is for women (Mojtahedi, 2010).

$VO_2max = 65.81 - (Heart\ Rate \times 0.1847)$

The experimental group was supposed to do aerobic exercises with the intensity of 85-70% of maximum heart rate in 24 sessions over 8 weeks (3 sessions per week). Each run consisted of three parts: warm-up, main stage, and cool-down. Stretching, exercising and jogging for 10 minutes was done in warm - up. The main stage included exercises of 20 minutes aerobic movements in the first sessions that lasted 40 minutes at the end of this run. Cooling phase included 10 minutes of both stretching and callisthenics. Main aerobics exercise's included harmonic movements of hands and feet that was provided in the form of blocks. Each block is composed of 32 moves. In this study, 16 beat blocks including moves and four beats suitable for beginners have been used at the first and second weeks. A 32 beat block was prepared by a combination of the blocks of the first two weeks to increase the duration and intensity of exercise in the third week and 32 beat blocks were used by the end of the exercise (Johnson *et al*., 2009). The intensity of exercise was calculated based on each person's maximum heart rate using the formula Karvonen and heart rate was being monitored at each session. It was necessary to ensure that participants in each session did the exercises and the target heart rate was determined based on 70-85% maximum heart rate. During this period, the control group performed their normal activities. In this study, descriptive statistics was used to describe the characteristics of the subjects and inferential statistics was used to analyze the data. In descriptive statistics, mean and standard deviation were used as measures of central tendency and dispersion, respectively. In the inferential statistics, after giving a Shapyr and Wilkes' test to assume normal distribution of data and equality of variances by the Levene test (Mahibbur and Govindarajulu, 1997), analysis of covariance was used to compare the difference in values between the groups and dependent 't' test was used to compare pre-test and post-test. Statistical analysis was conducted at the significant level of $P \leq 0.05$.

RESULTS

Subjects' characteristics of both groups were given in Table 1 and BF, WHR, BMI and VO_2max of experimental group in pre-test and post-test using a dependent t-test were given in Table 2. In Table 3, variables, BF, WHR, BMI and VO_2max at post-test experimental and control groups using analysis of covariance were compared with each other.

As it is clear from Table 2, after eight weeks of training, the average of variables such as BF (P = 0.00), BMI (P = 0.00) and VO_2max (P = 0.00) has significantly changed compared with before but WHR (P = 0.066) has not significantly changed.

By comparing the results in Table 3 related with two groups post-tests, it becomes clear that there was a

Table 2. Comparison of BF, WHR, BMI, and VO_2max changes in experimental group in pretest and post test

S. No	Dependent variable test	Test stage	Mean	Standard deviation	F value	Significance level
1	BF	Pre-test	33.99	1.66	13.92	0.00
		Post-test	30.95	1.89		
2	WHR	Pre-test	0.82	0.06	1.97	0.66
		Post-test	0.81	0.06		
3	BMI	Pre-test	26.66	1.68	8.33	0.00
		Post-test	25.57	1.39		
4	VO_2max	Pre-test	38.70	2.27	-7.87	0.00
		Post-test	40.82	2.24		

significant difference in the variables BF (P = 0.001) and VO_2max (P = 0.024) between the experimental group and the control group after eight weeks of training but there was no significant difference between these two variables WHR (P = 0.83) and BMI (P = 0.64).

DISCUSSION

This study aimed at investigating the effect of aerobic exercise on body composition and VO_2max for a duration of eight weeks among overweight girls with an age range of 12-10 years old. The results of the study showed that eight weeks of aerobic training can significantly increase the mean of variables such as BF and VO_2max compared to before training in the experimental group, but the training had no significant effect on the variable WHR. Also in the tests, two experimental and control groups showed significant differences in the values of variables such as BF and VO_2max in which body fat percentage reduced in the experimental group and VO_2max values was significantly higher for them. However, there was no significant difference in WHR and BMI between the experimental and control groups after 8 weeks of aerobic training.

It is clearly evident that in recent decades in most countries, the daily physical activity among different age groups including children, adolescents and youth have declined, so the increased prevalence of obesity may be a direct result of the decline in their physical activity. Most studies have shown that physical exercise and sport regardless of their type, can reduce body fat and improve body composition of children (Santiago *et al.,* 2015).

People who exercise regularly have a higher percentage of lean body mass than sedentary individuals. A person with a good level of physical fitness has lean body mass with low body fat percentage, sufficient muscle mass, strong and flexible tendons and bones with sufficient mineral content (Corbin and Lindsey, 2007). Exercise, especially aerobic exercises has a positive effect on human health. Aerobic exercises increase cardiovascular endurance and this proper preparation protects people against diseases and deaths from cardiovascular disease (Blair *et al*., 1996).

The results showed that eight weeks of aerobic exercise decreased body fat in overweight girls with an age range of 10 to 12 years. This finding is consistent with results of Lai *et al*. (2013), Davis *et al*. (2012), Lee *et al*. (2012) and Ossanloo *et al.* (2012). All the researchers examined the effect of aerobic exercise on body fat percentage and concluded aerobic exercise has a positive effect on reducing body fat percentage. But Jaywant (2013) did not record any significant effect of aerobic exercise on reducing fat percentage and the

Table 3. Comparison of BF, WHR, BMI, and VO_2max changes in control and experimental group after training period

S. No	Test Lipid profile	Group	Mean	Standard deviation	T value	Significance level
1	BF	Experimental	30.95	1.94	-3.79	0.001
		Control	33.6	1.33		
2	WHR	Experimental	0.81	0.06	-0.21	0.83
		Control	0.82	0.06		
3	BMI	Experimental	25.57	1.44	-1.92	0.06
		Control	26.72	1.6		
4	VO_2max	Experimental	40.81	2.31	2.4	0.024
		Control	38.74	1.89		

reason for this paradox can be explained by different age groups of participants (senior women), fat changes checkpoints (lower body) and the type of aerobic exercise which have been done.

Lai *et al*. (2013) in their study examined the effect of aerobic exercise on heart rate at rest, the percentage of fat and people obesity aged 10 to 16 (48 boys and 40 girls) and concluded that aerobic exercise reduces relaxed heart rate, glucose, fat levels and obesity in these individuals (Lai *et al*., 2013). Lee *et al*. (2012) studied the effect of aerobic and resistance exercises on abdominal fat, liver fat and insulin sensitivity in 45 boys aged 12 to 16 for three months. The results showed that both types of exercise reduce abdominal fat and liver, but only resistance training improves insulin sensitivity (Lee *et al*., 2012). Davis *et al*. (2012) examined the effect of aerobic exercise on BMI and body fat percentage of girls and boys aging 9 and 10 years and concluded that aerobic exercise decreased body fat percentage and BMI in these children. Osanloo *et al*. (2012) investigated the effect of combined aerobic dance, aerobics step-platforms and resistance training on some cardiovascular risk factors and highlighted that aerobic exercise decreases body fat percentage, body mass index and an increased maximal oxygen consumption in healthy middle-aged women with low mobility (Ossanloo *et al*., 2012). Jayvant (2013) in his study investigated dance aerobics' impact on fat distribution and VO_2max and concluded that there are no significant differences in fat distribution in VO_2max and haunch between middle-aged women who have exercised for six months and those who haven't.

Another finding of this study is a significant and positive impact of aerobic exercise on participants' VO_2max that was consistent with results of Ossanloo *et al*. (2012). In this study, although BMI in experimental group was significantly reduced, there was no significant difference between post tests of experimental and control groups; therefore, it can not be said that aerobic exercise has an effect on reducing BMI. This finding was not in line with Davis *et al*. (2012), Ossanloo *et al*. (2012) and Arsalan (2012). This contradiction could be due to differences in the age and gender of participants, type of aerobic exercise or exercise period.

Waist-to-hip ratio, the last variable examined in this study showed that eight week aerobic exercise has no significant effect on reducing this ratio in overweight girls aged 10 to 12 years. The length of training period or type of training done in this study may also be another reason why no significant changes occurred in these variables. One of its reasons may be the replacement of muscle tissue for fat tissue in both the lumbar and hip due to exercises that caused the waist-to-hip ratio not to be changed significantly.

CONCLUSION

Based on the results of this study that has examined the effect of eight weeks aerobic exercise on body fat percentage, body mass index, waist-to-hip ratio and maximum oxygen consumption, in overweight girls with an age range of 12-10 years can be suggested to overweight girls aged 10 to 12 years for reducing body fat percentage and improving aerobic capacity and their cardiovascular endurance through aerobic exercises.

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