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Comparison of the Effect of Three Methods of Endurance, Resistance and Concurrent Training on Aerobic Fitness and Body Composition of Overweight Non-Athlete Male Students

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Abstract
Background: The aim of this study was to compare the effects of three methods of endurance, resistance and concurrent training on aerobic fitness and body composition male students with overweight. **Method:** Forty five overweight male who were resident of Shahed university dormitory were purposefully selected and randomly assigned into following groups: endurance, resistance and concurrent training. Each Group performed their own protocol for 8 weeks, 3 times per week with specified intensity and duration. Before starting the protocol and 24 hours after the last training session, body composition parameters and aerobic fitness were measured at same condition. Data were analyzed using analysis of covariance. **Results:** The findings showed that three methods of endurance, resistance and concurrent training protocol had a significant effects on aerobic fitness and body composition parameters. In comparing the difference between groups of three methods of endurance, resistance and concurrent training on aerobic fitness and body composition parameters were significantly different and the variables of aerobic fitness and body composition parameters of concurrent training was more effective than two other exercises. Innovation this research is identical the work out of training (time) in the 3 protocol that to compare intergroup among the most effective way to same time identification. **Conclusions:** It seems that eight weeks of endurance, strength and concurrent exercise training have effects on aerobic fitness and body composition parameters male students with overweight but all three types of exercise separately with diet modification could be improved aerobic fitness and body composition indices.
***Keywords**:* Endurance training, Resistance training, Concurrent training, Aerobic fitness, Body composition

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INTRODUCTION

Overweight and obesity is a multifactorial disorder that occurs in societies due to energy imbalance due to a significant reduction in physical activity and exercise and changes in dietary patterns. Physical activity can cause significant weight loss in many overweight people. The more active a person is, the more energy will consume daily, and the faster will lose weight and lose body fat. Thus, exercise is an essential part of overweight treatment (Wilmore et al., 2011). Assessing and recognizing the levels of physical activity among different communities and age groups, especially students, is a significant issue. Endurance exercise requires more energy and more oxygen than static and dynamic resistance exercise. Cardiovascular responses to aerobic activity depend on the amount or load, environmental conditions and hereditary factors, and the level of physical fitness of individuals. Sports activities Regular endurance leads to improved performance and cardiovascular health. Although the primary and most obvious goal of adaptation is to maximize oxygen consumption, this adaptation is accompanied and supported by changes in various other physiological variables. The amount of improvement in the exercise program, especially repetition, increased the intensity and duration of the activity and the initial level of physical fitness depend on the individual. The size and mass of the heart increases with endurance training. These changes with high cardiac output are caused by endurance of aerobic activity. Endurance training it exposes the heart to a state of ventricular filling, with a high stroke work out and subsequent cardiac output (Plomen and Smith, 2014). On the other hand, cardiovascular fitness is one of the components of health-related physical fitness, so that there is a significant relationship between low cardiopulmonary fitness and increased risk of premature death due to other causes, especially cardiovascular disease. Also, increase cardiopulmonary fitness with decreased mortality is associated with other causes. Finally, high cardiorespiratory fitness is associated with high levels of habitual physical activity, which in turn is associated with numerous health benefits. Evaluation of cardiorespiratory fitness is an important part of primary and secondary prevention and rehabilitation programs it is considered that can be estimated by measuring the maximum oxygen

consumption and plays an important role in performing sports activities and maintaining physical health (Peskatloo 2014).

Performing resistance training can improve body composition by increasing lean body mass or decreasing fat mass. In other words, resistance training reduces body fat percentage and increases muscle mass by increasing metabolism and consuming more energy. Resistance exercises increases the production of contractile proteins and muscle hypertrophy, especially in fast-twitch fibers. Different patterns of body composition change that occur as a result of adapting to different training methods are associated with hormonal changes that occur during or after exercise. Exercises Resistance increases the secretion of anabolic hormones such as growth hormone and testosterone during and after exercise, which are very important and vital in the growth and formation of muscle tissue (Masta et al., 2007). Although endurance and strength training result in specific, different, and sometimes opposite physiological adaptations within the muscle, for many For competitive athletes, it is essential to do both endurance and resistance training at the same time, which is called concurrent training. Also in health goals, adding resistance training to endurance training is expanding.

Exercise work out is a key factor in changing body composition. Since in previous studies the work out of exercise in concurrent exercises was not more than the work out of exercise in other groups of exercise, and the subjects probably had more positive benefits due to the work out of exercise, Therefore, the present study sought to determine which training method with the same work out is more effective in improving body composition and aerobic fitness of overweight people by equalizing the duration of endurance, resistance and concurrent training?

METHOD

The present study is a quasi-experimental study in which three groups were compared by pre-test and post-test design. The statistical population of the present study was non-athlete male students with overweight living in the dormitory of Shahed University. Research sample of 45 non-male student's athletes ranged in age from 20 to 30 years and had a body mass index between 25 and 30. They were selected by purposive sampling method and randomly divided into four

groups of 15 for endurance, resistance, concurrent and control exercises.

To conduct the research, first qualified individuals were identified in the research. Then, the nature, goals of the research project, method of conducting it, its duration, etc. were explained to them. Then the people who wanted to participate in the research were selected and filled in the required questionnaires and the consent of they obtained that, finally, 45 of those who fully accepted the conditions were randomly divided into three groups of 15 exercise subjects, all of whom were homogeneous in terms of body mass index. Before the start of the training protocol, all subjects were pre-tested and at the end of the training protocol, post-test was taken. Height and weight by meters and scales to calculate body mass index, measure waist circumference and pelvic circumference to calculate waist to pelvic ratio as well as fat percentage of subjects with Using a plastic model MSD fat caliper (to measure the thickness of subcutaneous fat, breast, abdomen and thigh) was measured. The subjects' aerobic fitness was assessed using the 5-minute Forrester step test. Then the three experimental groups (endurance training, resistance training and concurrent training) And after the end of 8 weeks, the measurements were performed again; The control group was advised not to do any sports activities during these 8 weeks and to focus only on their daily activities. At the beginning of the study, subjects were given nutritional recommendations to match nutrition. Nutritional recommendations included scheduling and specifying meal times, and following nutritional principles before and after exercise sessions. To control the effects of nutrition, subjects' nutrition was recorded and controlled for three days. Subjects participated in a protocol training session and finally, after 8 weeks of training, the measured values were retested before the protocol as a post-test. Exclusion criteria for the subjects were absence in more than 4 training sessions. All three training protocols of the present study were approximately equal in terms of average execution time, this program was done to standardize the training work out. That is, the total time the subjects did the exercise in three groups per week at the end of each session was the same, and the difference was in the intensity of the exercise program.

Endurance training program: included endurance stations and games for 8 weeks and 3 sessions per week. The first and second weeks with an intensity of 50% of maximum heart rate for 30 minutes, the third to sixth week with an intensity of 55-65% of maximum heart rate for 35 minutes and the seventh and eighth weeks The intensity was 75-65% of the maximum heart rate for 40 minutes. The maximum heart rate of the subjects was calculated using the formula (age - 220 = maximum heart rate). To determine the intensity of endurance activity, the 10-point Borg scale was used for the first and second weeks, which is 50% the maximum heart rate was equivalent to 3-4 of the pressure perception scale and for the third to sixth weeks the intensity was 55-65% of the maximum heart rate which was equivalent to 5-6 of the pressure perception scale and for the seventh to eighth weeks the intensity was 75-65% of the maximum heart rate. Which is equivalent to the number 8-7 pressure perception scale was considered. Endurance training program of each session: including stations and it was endurance. Muscle fatigue and exercise pressure gradually increased and cooling movements were performed for 5 minutes at the end of each session. Resistance training program: included 10 stationary movements in a circular motion. There were 12 repetitions per station, 30 seconds between each station and 2 minutes rest between rounds. The first and second weeks with an intensity of 50% of a maximum repetition for 30 minutes, the third to the sixth week with an intensity of 55% of a repetition the maximum was for 35 minutes and the seventh and eighth weeks with an intensity of 60% were a maximum repetition of 40 minutes. Resistance training consisted of 10 stationary movements in a circle. Stations in order include: Movements: chest press, side release with dumbbells, opening the front leg, underarm wire, bending They were standing from behind, forearms with barbells, leg presses, rowers sitting, shoulders with barbells and legs. There were 12 repetitions per station, 30 seconds between each station and 2 minutes rest between periods. To calculate the maximum strength of the subjects with the initial estimate of their maximum strength, select a weight and move Performed to the point of exhaustion. Then, by placing the amount of weight and the number of repetitions in the relevant formula, the maximum strength was estimated. In this test, the number of repetitions should not be more than 10 repetitions. Relative

maximum strength was calculated from the maximum power distribution per body mass movement. Resistance training program 4 the first week was measured based on the strength of a maximum repetition of the subjects in the pre-test and the resistance training program. The second 4 weeks were measured based on the strength of a maximum repetition of the subjects at the end of the fourth week.

One maximum repetition = (weight) / ((repetition × 0.0278) - 1.0278)

Concurrent training program: Due to the fact that the duration was the same in endurance, resistance and concurrent exercises, half of the time was devoted to resistance exercises and the other half to endurance exercises. To prevent the effects of fatigue and decreased performance due to endurance training First, resistance training was performed. The training program, the first and second week, 15 minutes to circular resistance exercises with an intensity of 50% of a maximum repetition and the second 15 minutes to endurance exercises with an intensity of 50% of maximum heart rate, the third to sixth week / 30. 17 minutes to circular resistance exercises with Intensity 65-55% of a maximum repetition and 17.30 minutes to endurance training with an intensity of 55% of maximum heart rate and in the seventh and eighth week 20 minutes to circular resistance training with an intensity of 60% of a repetition The maximum and the second 20 minutes were endurance exercises with an intensity of 65-75% of the maximum heart rate. Data were analyzed using the Kolmogorov-Smirnov test to evaluate the normality of the data distribution. For group comparison, ANCOVA test and Banferroni post hoc test were used and the pretest was considered as a covariance factor and a significance level of $p \leq 0.05$.

RESULTS

The descriptive data of the subjects in this research are shown in Table 1. First, the homogeneity of variance of the groups was examined by Levin test. The results confirmed the hypothesis of homogeneity of variance of the groups ($P > 0.05$).

The results of ANKOA test showed that there is a significant relationship between the intervention variable (pre-test) and the dependent variable of aerobic fitness and body composition indices ($P \leq 0.05$). After adjusting the intervention effect, intergroup comparison was performed using ANCOA test and Banferroni post hoc test. Based on The results of Banferroni post hoc test showed a significant

difference between the mean of aerobic fitness in the endurance training group and the resistance training group and also between the resistance training group and the concurrent training group (P≤0.05). Between the mean body mass index in the endurance training group and the concurrent training group and there was also a significant difference between the resistance training group and the concurrent training group (P≤0.05). There was a significant difference between the mean waist index in the endurance training group and the concurrent training group and also between the resistance training group and the concurrent training group (P≤0.05). Among there was a mean difference in the waist-to-pelvic ratio index between the endurance training group and the resistance training group, as well as the endurance training group and the concurrent training group (P≤0.05). There was a significant difference between the mean body fat percentage in the endurance training group and the concurrent training group, as well as the resistance training group and the concurrent training group (P≤0.05).

There was a mean difference in the waist-to-pelvic ratio index between the endurance training group and the resistance training group, as well as the endurance training group and the concurrent training group (P≤0.05). There was a significant difference between the mean body fat percentage in the endurance training group and the concurrent training group, as well as the resistance training group and the concurrent training group (P≤0.05).

Table 1: Descriptive data of the subjects

Variable		Concurrent training group (n=15)	Resistance training group (n=15)	Endurance training group (n=15)
Age (years)	Pre-test	3.01 ± 24.96	1.63 ±24.60	2.15 ±23.06
Height (meters)	Pre-test	0.05± 1.75	0.07 ± 1.75	0.06 ± 1.75
Weight (kg)	Pre-test	6.51 ± 85.13	6.63 ± 85.20	8.06 ± 82.73
Weight (kg)	post test	5.33 ± 81.53	6.52 ± 83.60	7.77 ± 81.40
BMI (kg/m^2)	Pre-test	0.83 ± 27.48	0.92 ±27.63	0.86 ± 26.76
BMI (kg/m^2)	Post test	0.77 ±26.34	0.97 ± 27.11	1.53 ± 26.36
Percentage of body fat (%)	Pre-test	1.53 ± 23.06	1.53 ± 22.93	1.64 ± 23.00
Percentage of body fat	post test	1.35 ±20.53	1.43 ± 21.73	1.35 ±21.40
Waist Circumference (cm)	Pre test	4.67 ± 82.40	4.05 ± 87.80	6.17 ± 85.00
Waist Circumference (cm)	Post test	4.10 ± 80.00	3.43 ± 85.73	5.71 ± 83.66
Waist to pelvic ratio	Pre test	0.03 ± 0.90	0,02 ± 0.90	0.02 ± 0.88
Waist to pelvic ratio	Post test	0.02 ± 0.90	0.02 ± 0.90	0.02 ± 0.89
VO2max	Pre test	2.54 ± 38.73	1.55 ± 39.46	1.75 ± 38.26
VO2max	Post test	1.99 ±41.40	1.42 ± 40.20	1.35 ± 40.53

*Data are expressed as mean and standard deviation.

Table 2: Intensity and duration of training protocols in endurance, resistance and concurrent groups

			Weeks 1 and 2	Weeks 3,4,5,6	Weeks 7 and 8
Endurance training	**Duration (m)**		30	35	40
	Intensity (maximum heart rate)		50	55-65	65-75
Resistance training	**Duration (m)**		30	35	40
	Resistance (1RM percent)		50	55	60
Concurrent training	**Duration (m)**	**Resistance**	15	17.30	20
		Endurance	15	17.30	20
	Intensity	**Resistance (1RMpercent)**	50	55-60	60
		Endurance (maximum heart rate)	50	55	65-75

Table 3: Banferoni post hoc tests to compare aerobic fitness and body composition indices between groups

	Groups		MD	Sig.
Aerobic Fitness	**Endurance**	**Resistance**	1.243	0.0001
		Concurrent	-0.513	0.057
	Resistance	**Concurrent**	-1.756	0.0001
BMI	**Endurance**	**Resistance**	0.217	1.000
		Concurrent	0.827	0.003
	Resistance	**Concurrent**	0.609	0.023
Waist Circumference	**Endurance**	**Resistance**	0.409	0.419
		Concurrent	1.367	0.0001
	Resistance	**Concurrent**	0.958	0.006
Waist to pelvic ratio	**Endurance**	**Resistance**	0.010	0.020
		Concurrent	0.014	0.001
	Resistance	**Concurrent**	0.004	0.785
VO_{2max}	**Endurance**	**Resistance**	-0.387	0.220
		Concurrent	0.920	0.0001
	Resistance	**Concurrent**	1.307	0.0001

DISCUSSION

The aim of the present study was to compare the effect of three methods of endurance, resistance and concurrent training on aerobic fitness and body composition of overweight non-athlete students. The findings of this study showed that there is a significant difference between the groups of endurance, resistance and concurrent training in aerobic fitness. Due to the mean difference values, concurrent exercise is more effective than the other two exercises in the next priority, endurance training has a greater effect and in the last stage, resistance training has been effective on aerobic fitness. These results confirm the

findings of the effectiveness of combined exercises on a significant increase in strength and aerobic fitness and are consistent with previous research (Jafari, Ibrahim, Astorino, Gist, and Hosseini Kakhk). The reasons for the effectiveness of the concurrent training method compared to other methods can be mentioned as follows: 1- concurrent training seems to have a more effective role in non-athletes, because these exercises can also it has the benefits of aerobic exercise and by increasing the strength and work out of the muscle.2- it increases the endurance of the exercise impact work out is reduced.

Other results of the present study indicate that the concurrent training method is more effective than the other two exercises in the variable of body composition and its components (body mass index, fat percentage, waist size and waist to hip ratio). After concurrent training, resistance training had a greater effect and in the last stage, endurance training was effective on body mass index. It seems that performing a combination (concurrent) exercise puts more pressure on the subjects and improves the indicators of physical composition This finding is consistent with the studies (Mohebbi, Nouri, Muzaffar, Santos and Cantrell).

Garzi et al. (2011) in their 10-week study, they reported the positive effects of concurrent exercises on the subjects' body composition, which is consistent with the results of the present study. In contrast, contrary to the findings of the present study, Vosoughi Baneh et al. In their study showed that 4 or 8 weeks of concurrent exercise had no effect on fat percentage and weight of inactive female adolescents Concurrent training in this study was more effective than endurance due to the combination of endurance and resistance training and also the low intensity of resistance exercise (circular exercises) and made concurrent training more effective than the other two exercises. And due to the increase in aerobic capacity of the three exercise groups, it is possible that all three types of exercise programs have provided the necessary stimulation for the lipolysis process, as a result of which a decrease in body fat mass has been observed. On the other hand, exercise increases the activity of the sympathetic system (epinephrine and norepinephrine) and growth hormone, each of which in turn activates lipolysis and leads to a decrease in body fat mass.

CONCLUSIONS

In general, it can be concluded that the three methods of endurance training, resistance training and concurrent exercise have a significant positive effect on aerobic fitness and body composition of overweight non-athlete boys. Also any three types of exercise alone, along with diet modification and nutritional recommendations, can improve aerobic fitness and fitness indicators. This means that these three training protocols can be a good alternative for each other due to their similar effects, and according to the circumstances, each of them can be improved to improve aerobic fitness and body composition. And thus reduced the risk factors for premature death.

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