Research Article

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The Effect of 6 Weeks of Body weight Exercises on the Respiratory Function of overweight Women

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Abstract

The prevalence of obesity and overweight all over the world due to the mechanization of lifestyle and people's use of ready-made foods is increasing and affecting health and is closely related to major problems. One of the diseases that has a positive and frequent relationship with obesity is a respiratory disease. Obesity weakens people's lung function and respiratory tract through two mechanisms, mechanical and inflammatory. The mechanical effect of obesity is such that it can affect the respiratory mechanics of the lungs and chest wall and cause asthma or pseudo-asthmatic shortness of breath and increase the response of the respiratory tract. In this study, we investigated the effect of 6 weeks of bodyweight training on the respiratory function of overweight women. For this purpose, in this research, 30 obese women aged 25 to 40 years were randomly divided into two control and training groups. The height meter and weight were calibrated with a digital scale and the body mass index was calculated by calculating the height and weight and the corresponding formula. The training program of the experimental group was for 6 weeks, 3 sessions per week and 60 minutes in each session. The training session included a 10-minute warm-up at the beginning of the workout and a 10-minute cool-down at the end of the workout. According to the present study, the percentage of fat in the training group was significantly reduced compared to the control. Also, there was a significant difference between the two groups in the FVC respiratory indices and the FEV1/FVC ratio. This was even though no significant difference was observed in the FEV1 index between the training and control groups. . Resistance training improves body composition by increasing metabolism and energy consumption and reducing fat mass. Research has shown that resistance training is effective in improving body composition due to increasing muscle volume and reducing fat percentage. In the present study, it was observed that resistance training with bodyweight could improve FVC. Resistance training is effective in improving the pulmonary indices of people by improving the skeletal muscle system and posture. The final result of this research showed us that resistance training with body weight in overweight women can improve body composition and respiratory function.

Key Words: Overweight, Body Composition, Pulmonary Function, Intense Interval Training, Resistance Training

Introduction

The prevalence of obesity and overweight is expanding worldwide, obesity is considered as one of the risk factors for respiratory function [1]. Obesity and overweight are a serious problem for public health and an important risk factor for many diseases, especially respiratory problems [2]. Obesity is associated with mortality and prevalence of respiratory diseases. Obesity and overweight is a moderating factor in the development of asthma, sleep apnea, obesity ventilation syndrome, and increased lung pressure. And finally, it may be related to chronic obstructive pulmonary disease [COPD]. It is said that obesity causes an increase in lung infections [3]

Obesity has a negative effect on lung function by reducing the strength of respiratory muscles, increasing airway resistance, reducing lung volume and other factors. This phenomenon also increases inflammation in the body, especially lung tissue. Obesity is likely to cause disturbances in the mechanical function of the airways and the neuromuscular function of breathing, so that the syndrome of decreased respiratory air volume has been observed in these people. In addition, in terms of histology, it has been observed that the deposition of fat in the lung tissue causes a decrease in the alveolar volume and ultimately the lung volume. Also, it has been reported that obese people breathe faster and shallower than people with normal weight [4]. Research has shown that the movement mechanics of the chest and lungs changes due to the accumulation of fat around the abdomen in

overweight and obese people, these changes reduce the reversibility of the lungs [5].

Increasing the hardness of the lungs and reducing the reversibility of the breathing pattern undergoes a fundamental change. Air enters the lungs due to the negative pressure inside the lungs and alveoli. However, the intra-pulmonary and abdominal pressures slowly increase because the downward movement of the diaphragm and the outward movement of the chest are restricted due to the accumulation of fat in the abdominal and dorsal region. Changing the breathing pattern causes a substantial decrease in expiratory reserve volume, the remaining volume of the lung, which is called expiratory reserve volume, a decrease in expiratory reserve volume independent of the asthma phenomenon in overweight people [10%], in obese people [22%] and in people Very obese [33%] have been reported [8]. Therefore, obese people should increase the breathing rate to compensate for this reduction, that's why the number of minute ventilation in these people is more than healthy people [5].

In addition to the scientific research studies and the reported case, the epidemiological studies have also stated that obesity is a risk factor for asthma and respiratory problems, so that the deposition of fat in the abdominal and chest wall of obese people causes limitations in pulmonary indices. to be Therefore, obese people cannot have optimal lung function, this finding has been confirmed by some researchers [6]. If obesity and overweight are the main factors in the destruction of the breathing pattern, then weight loss is the main reason for reversing the effects of obesity. Several studies have investigated and observed the harmful effect of obesity on changing the cellular model in the lungs and found that weight loss restores the normal physiology of the lungs. Many researchers have confirmed the significant and positive effect of weight loss on maximum expiratory flow and spirometric indices after weight loss in obese patients with asthma and non-asthma. [7].

It has been found in various studies that weight loss and improving body composition are directly related to lung function [8]. Today, various invasive and risky methods such as surgery, low-calorie diets, dehydration, and anti-fat absorption drugs are used to lose weight. In addition to the mentioned methods, sports exercises and physical activities are one of the effective ways to increase calorie expenditure and reduce the complications caused by overweight and obesity, as well as physical activity as a non-invasive intervention in the pulmonary rehabilitation program of patients. Patients with lung disorders are very important. Therefore, physical activity has a positive effect on respiratory function both through improving body composition and mechanical changes in chest movement and through strengthening respiratory muscles [9]. Wayne et al. [2018] showed in a study that regular exercise improves lung function, reduces wheezing, improves shortness of breath, shortness of breath, and cough [10].

In fact, obesity and overweight are caused by the imbalance of calories consumed and calories consumed. One of the useful ways to increase calorie consumption is to do regular physical activity programs. Since various training methods are suggested to reduce weight and fat percentage, it seems important and necessary to identify methods that can have an optimal effect on fat metabolism and its reserves [11]. Among the types of exercise methods, resistance exercises are particularly popular among people in the community. Resistance training is a form of physical activity that is effective in increasing muscle strength and volume [12]. It has been seen that resistance exercises, in addition to improving body composition, are effective in strengthening the respiratory muscles, especially the diaphragm. Rinokun et al. [2010] introduced resistance training as an effective factor in improving body composition and announced that it also improves lung capacity [13].

Regarding the effectiveness of resistance training on respiratory function and body composition, several studies have been conducted, for example, Gholami et al. investigated the effect of 8 weeks of resistance training with theraband and dumbbells on body composition and muscle strength in middle-aged obese women. . In this study, 27 women with excess weight were divided into three groups: control, traband and free weight. The results of this study showed that both training methods caused a significant change in fat percentage and an increase in non-fat mass, and in general, resistance training independently of its type was able to improve body composition [14]. Khair Andish et al. [2017] investigated the effect of Pilates exercises [with body weight] on some respiratory indices of inactive obese women. The research results of these researchers showed that Pilates training could increase all factors related to pulmonary function and only had a significant effect on inspiratory reserve volume and tidal volume [15]. Behrad et al. [2010] investigated the effect of a period of periodic and circuit resistance training on respiratory function and body composition of overweight girls. The results of his research showed that the fat percentage decreased significantly in both training groups, the net body mass increased significantly only in the resistance training group, and the vital capacity increased significantly in the resistance training group compared to the baseline state [16].

Pashai et al. [2018] investigated the effect of resistance and aerobic exercises on body composition, physical fitness and pulmonary function of women with asthma. The subjects of this research were 29 women with asthma who were placed in three groups: control, aerobic exercise and resistance exercise. The training groups trained for 8 weeks with 3 sessions. The training sessions consisted of 10 minutes of warm-up, 40 minutes of aerobic or resistance exercises, and finally cooling down. The results of the research showed that resistance training had a more beneficial effect on body composition than aerobic training, but biological performance in both groups was significantly better than the control group, but no significant difference was observed between the two training groups [17]. There are different types of resistance training, free weight training, bodybuilding machines and exercise bands are among the forms of resistance training. Among the different methods of resistance training, body weight training is an example of resistance training that uses the person's own weight as resistance against gravity. These exercises increase a wide range of physical fitness factors including strength, endurance, flexibility, coordination and balance. Currently, this type of training has gained many fans.

Among the advantages of this type of exercises, we can point out that it does not require equipment, requires little space, can be implemented at home and in open spaces and parks. It has also been reported that the injury rate in this type of training is lower than weight training [18].

In resistance exercises, especially exercises with body weight, large muscles are involved in the contraction process, so the number of breaths increases and the respiratory muscles become more active, so it is likely that the strength and endurance of the respiratory muscles increases. Therefore, it is possible that in addition to the relationship between weight loss and lung function improvement, which occurs due to the reduction of fat around the trunk, strengthening the respiratory muscles also acts as a supplement to increase lung function [19]. Research results have shown that resistance training can effectively affect body composition and reduce fat percentage and increase net body mass. However, the researcher did not find a study that investigates the effect of resistance training with body weight on pulmonary function, and this research is to investigate the effectiveness of resistance training on body composition and pulmonary function of overweight women.

Research Methods

The current research is applied and semi-experimental and was designed by pre-test and post-test method. In this research, 30 obese women aged 25 to 40 were randomly divided into two control and training groups. First, a written consent was obtained, and then the training process and general program were explained to the subjects in the familiarization session. The height of the subjects was measured with a height meter, their weight was calculated with a calibrated digital scale, and the body mass index was calculated by calculating the height and weight and the corresponding formula.

During the course, the control group went about their daily life and the experimental group participated in a resistance training program with body weight. The training program of the experimental group was for 6 weeks, 3 sessions per week and 60 minutes in each session. The training session included a 10-minute warm-up at the beginning of the workout and a 10-minute cool-down at the end of the workout.

A body analyzer [Body Composition, made in Taiwan] was used to calculate body fat percentage and net body mass percentage. The function of this system is that the subject moistens his palms and soles and stands on the machine with his bare feet and holds the handles of the machine with his palms. A weak electric current pass through the person's body and the values of body density, fat weight and net body mass are reported separately [organ] and overall. Pulmonary function index was measured by spirometry device made in Italy MIR model. Measurements include FVC [vital capacity pressure, the volume of air that leaves the lungs in 1 to 4 seconds of deep and rapid exhalation], FEV1 [maximum expiratory volume in the first second, includes the amount of air that is expelled after a full breath and forcefully out of the lungs during the first second of exhalation], and FEF [expiratory flow, representing the average forceful expiratory airflow in L/S at 75%–middle 25% of FVC].

The main purpose of this research was to investigate the effect of 6 weeks of body weight exercises on the respiratory function of overweight women. For this purpose, 30 overweight women were selected and a research plan was conducted on them.

Descriptive characteristics of the research

Table 1 shows the descriptive statistics of the subjects' characteristics in terms of mean and standard deviation in the pre-test and post-test.

Table 1: Characteristics of subjects

After the test	pre-exam	group	Variable
45/3±33/162	45/3±33/162	Control	height
18/4±18/161	18/4±18/161	Practice	
46/3±86/76	58/3±40/76	Control	Weight
80/3±20/73	19/4±20/75	Practice	
09/1±17/29	00/1±99/28	Control	BMI
52/0±92/27	54/0±68/28	Practice	
33/1±73/23	64/1±24	Control	fat percentage
95/1±33/21	05/2±33/24	Practice	
20/0±38/3	19/0±42/3	Control	FVC
13/0±58/3	16/0±39/3	Practice	
17/0±73/2	22/0±76/2	Control	FEV1
15/0±78/2	20/0±69/2	Practice	
63/4±22/82	42/3±73/80	Control	FEV1/FVC ratio
58/2±59/72	74/2±31/79	Practice	

Inferential data statistics

First hypothesis: 6 weeks of body weight training has no significant effect on FVC changes in overweight women in order to check the normality of the statistical distribution, the Kolomogorov Smirnov test was used.

Table 2: Checking the normality of the data

meaningful	k-s value	group	
93/0	53/0	Control	FVC pre-test
72/0	69/0	Practice	
89/0	57/0	Control	FVC after the test
62/0	75/0	Practice	

According to Table 2, the value of the Kolomorov Smirnov test in the pre-test and post-test is more than 0.05 and the difference is not significant, that is, the data have a normal distribution.

Table 3: Correlated and independent t test values

meaningful	independent t	meaningful	Correlated t	Variable
003/0	22/3	50/0	52/1	FVC control
		001/0	29/11-	FVC exercise

According to the results of Table 3, there is a significant difference between the training and control groups (p=0.003), so training has been able to significantly increase the FVC variable. Therefore, the null hypothesis is rejected.

Second hypothesis: 6 weeks of body weight training has no significant effect on FEV1 changes in overweight women.

In order to check the normality of the statistical distribution, the Kolomogorov Smirnov test was used.

Table 4: Checking the normality of the data

meaningful	k-s value	group	
91/0	56/0	control	FEV1 pre-test
21/0	05/1	practice	
7/0	7/0	control	FEV1 after the test
38/0	90/0	practice	

According to Table 4, the value of the Kolomorov Smirnov test in the pre-test and post-test is more than 0.05 and the difference is not significant, that is, the data have a normal distribution.

Table 5: Correlated and independent t test values

meaningful	independent t	meaningful	Correlated t	Variable
42/0	78/0	38/0	88/0-	FEV1 کنترل
		07/0	1/3	FEV1 تمرین

According to the results of Table 5, there is no significant difference between the training and control groups (p=0.42), so training could not cause a significant increase in FEV1 variable. Therefore, the null hypothesis is rejected.

Third hypothesis: 6 weeks of body weight training has no significant effect on the ratio of FEV1 to FVC in overweight women.

In order to check the normality of the statistical distribution, the Kolomogorov Smirnov test was used.

Table 6: Data normality check

meaningful	k-s value	group	
99/0	99/0	control	FEV1/FVC ratio
95/0	95/0	practice	
7/0	7/0	control	FEV1/FVC ratio
78/0	78/0	practice	

According to table 6, the value of the Kolomogrof Smirnov test in the pre-test and post-test is more than 0.05 and the difference is not significant, that is, the data have a normal distribution.

Table 7: Correlated and independent t test values

meaningful	independent t	meaningful	Correlated t	Variable
002/0	31/3	16/0	45/1	The ratio of FEV1 to control FVC
		001/0	94/3	The ratio of FEV1 to FVC exercise

According to the results of Table 7, there is a significant difference between the training and control groups (p=0.002), so training has been able to significantly increase the ratio of FEV1 to FVC. Therefore, the null hypothesis is rejected.

Fourth hypothesis: 6 weeks of body weight training has no significant effect on changes in body fat percentage of overweight women.

In order to check the normality of the statistical distribution, the Kolomogorov Smirnov test was used.

Table 8: Checking the normality of the data

meaningful	k-s value	group	
79/0	64/0	control	Pre-test fat percentage
92/0	54/0	practice	
32/0	95/0	control	Post-test fat percentage
79/0	65/0	practice	

According to Table 8, the value of the Kolomorov Smirnov test in the pre-test and post-test is more than 0.05 and there is no significant difference, the data have a normal distribution.

Table 9: Correlated and independent t test values

meaningful	independent t	meaningful	Correlated t	Variable
001/0	56/5	001/0	03/4-	Fat percentage control
		001/0	74/13	Fat percentage training

According to the results of Table 9, there is a significant difference between the training and control groups [p=0.001], so training has been able to significantly reduce the fat percentage variable. Therefore, the null hypothesis is rejected.

Discussion and review

According to the present study, the percentage of fat in the training group was significantly reduced compared to the control. Also, there was a significant difference between the two groups in the FVC respiratory indices and the FEV1/FVC ratio. This was despite the fact that no significant difference was observed in the FEV1 index between the training and control groups.

In relation to improving body composition and fat percentage, research has shown that after resistance training, fat oxidation increases even up to 15 hours later. Resistance training improves body composition by increasing metabolism and energy consumption and reducing fat mass. After resistance training increases growth hormone and affects lipolysis, resistance training can change the body fat mass metabolism of obese and overweight people. Probably, the increase of anabolic hormones such as growth hormone and testosterone, which are important and vital in the growth and regeneration of muscle tissue, increase during and after resistance activity [20]. The findings of the present research are consistent with the results of most researches, including Jafari et al. [2016] and Gholami et al. [2016]. Research has shown that resistance exercises are effective in improving body composition due to increasing muscle mass and reducing fat percentage [21].

Obesity and overweight have a negative effect on lung function by reducing the strength of respiratory muscles, increasing airway resistance, reducing lung volume and other factors. This phenomenon also increases inflammation in the body, especially lung tissue. Obesity is likely to cause disturbances in the mechanical function of the airways and the neuromuscular function of breathing, so that the syndrome of decreased respiratory air volume has been observed in these people. In addition, in terms of histology, it has been observed that fat deposition in the lung tissue causes a decrease in the alveolar volume and ultimately the lung volume. Also, it has been reported that obese people breathe more quickly and shallowly than people with normal weight [22]. Probably, resistance training with body weight has improved breathing efficiency in these subjects due to the improvement of body composition. It has been said that body mass index has a high correlation with air resistance and respiratory function. Salman et al. [2010] stated that the increase in fat tissue causes a decrease in the mechanical efficiency of the respiratory muscles. In general, overweight and obese people have rapid, shallow and superficial breathing [good-minded]. For this reason, overweight people have lower FVC and FEV1 values than healthy people. Any exercise and therapeutic intervention that can improve body composition is probably associated with an increase in breathing efficiency [decrease in chest stiffness and visceral fat] [23].

In the present research, it was observed that resistance training with body weight could improve FVC. This finding is consistent with the results of Chen et al. [2018] and Xavier et al. [2019], but it is inconsistent with the results of Khosravi et al. Subjects The reason for these contradictory results is because the research

conducted by Khosravi et al. [2013] was conducted on non-obese girls with a favorable body mass index [24]. The health condition of people and the basic respiratory condition of people participating in sports activities can be effective in response to exercise. Body posture and dysfunction in central stability muscles, chest and shoulder girdle, which is mainly associated with shortness of muscles and connective tissues. One of the main symptoms is respiratory weakness, which is called chest tightness. Resistance training is effective in improving the pulmonary indices of people by improving the skeletal muscle system and posture [25].

In researches, FVC is usually considered as an index of lung function, which is useful information regarding the strength of respiratory muscles and lung function. Respiratory function depends on many factors including the nervous system, coordination of nerves, muscle and strength of respiratory muscles and lung dimensions. Increasing the strength of the respiratory muscles and reducing the resistance of the airways following resistance exercise is effective in improving lung function. Resistance activity improves the range and depth of breathing by engaging the muscles, which improves FVC and oxygen consumption and the rate of its diffusion into the blood. It is said that increasing the strength of respiratory muscles improves lung function. Probably, resistance training improved FVC by improving the function of the diaphragm and internal intercostal muscles because it is said that diaphragm muscle weakness is associated with a 25% decrease in FVC. [26]

Due to higher oxygen demand and carbon dioxide excretion, exercise causes frequent stimulation of the lungs to breathe, and by reducing the contraction of the smooth muscles of the lungs, it reduces the resistance of the airways and improves the pulmonary function. In the long term, physical exercises reduce the narrowing of the airways and reduce the inflammation of the airways, thus improving the pulmonary symptoms and shortness of breath, reducing the number of breaths in asthma patients. Also, resistance activity by increasing the sympathetic effect of the autonomic system and catecholamines secreted from the adrenal gland can lead to dilation of the airways during exercise [27].

One of the respiratory problems of obese and overweight people is the reduction of vital capacity, which may be caused by the weakness of the respiratory muscles. Like other skeletal muscles, respiratory muscles also respond to exercise stimuli. An increase in the volume and capacity of the lungs and an increase in the expansion of the lungs indicate a better oxygen supply and proper distribution of oxygen to the blood and therefore to the whole body. Respiratory muscles play a very important and fundamental role in the activity process of each person. In such a way that higher breathing capacity and ability leads to better quality and efficiency [28].

Conclusion

Overall, according to the findings, it can be concluded that resistance training with body weight in overweight women can improve body composition and respiratory function. Therefore, it is better for doctors and trainers to use this exercise program during weight loss.

According to the results obtained from the research, the following suggestion can be made:
Given that the results of this research showed that resistance training with body weight can improve body composition and breathing in overweight women. Therefore, it is suggested to use these exercises during weight loss and people who have shallow breathing due to excess weight.

Research proposals

Suggestions based on research

According to the results obtained from the research, the following suggestion can be made:
Given that the results of this research showed that resistance training with body weight can improve body composition and breathing in overweight women. Therefore, it is suggested to use these exercises during weight loss and people who have shallow breathing due to excess weight.

Suggestion for other researchers

1- It is recommended to investigate the effect of this type of exercise on the cytokines secreted from adipose tissue according to the findings of the present research in the field of the effect of resistance training with body weight on the reduction of fat percentage.
2- It is recommended to investigate the relationship between weight loss and improvement of breathing in overweight women.
3- It is recommended that the effect of body weight training with other sports exercises, including aerobics and combined exercises, be done on the variables of the present research.

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