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The effect of eight weeks of resistance training on serum levels of Chemerin and body composition of overweight disabled males

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ABSTRACT

Chemerin is a pro-inflammatory cytokine that is newly discovered and plays an important biological role in fat tissue formation. The aim of this study was to investigate the effect of eight weeks of resistance training on serum levels of Chemerin and body composition in overweight men with disabilities. This study was quasi-experimental with pre-test, post-test, and a control group. Twenty disables people from Zahedan aged 25±3 and body mass index (BMI) 25±2 kilograms per square meter were purposefully selected and randomly assigned into control (n=10) and control (n=10) groups. The experimental group started to exercise in a circuit resistance training for eight weeks, each week three sessions with 60 to 65% intensity, and 1 maximum repetition and finished it with a gradual increase to 70 to 80% one maximum repetition in final sessions. Before and after training, chemerin values and anthropometric indices were calculated. Kolmogorov-Smirnov test was used for testing the normality of data distribution. Parametric paired t-test was used to study variables changes within a group. Moreover, independent t-test at the significant level $\alpha<0.05$ was used to study the significance of inter-group differences in the changes in pre-test and post-test of experimental and control groups, and they were analyzed with SPSS software. Intragroup changes showed that eight weeks of resistance training has had significant effects on decreasing chemerin level, body weight, BMI, body fat percentage, and waist-to-hip ratio ($p<0.05$). Moreover, in inter-group changes, a significant decrease was observed in waist-to-hip ratio ($p<0.05$). In other variables, differences in changes between the experimental group compared to the control group were not significant ($p>0.05$). Eight weeks of resistance-training for the experimental group compared with the control group has no effect on the chemerin level and body composition of the overweight people with disabilities. It seems that these exercises should be performed for longer duration and with more intensity for effective utilization of resistance training.

Key words: Chemerin, body composition, disabled people, overweight.

INTRODUCTION

Disability as a social phenomenon has existed in communities from the past. It has always been a problem in terms of understanding the existence and social relationship, and there has been no fixed relationship between social and scientific development of human on the one hand, and social status of people with disabilities on the other hand [1]. With the advent of lesions and the signs of physical weakness, self-reliance of disabled people weakens and the need for others and dependence on them emerge and become strong by pass of time. Reduced self-esteem, negative personality, feelings of inadequacy, and being a burden overshadow the remaining abilities in the disabled person and the feeling of sadness and confusion appear.

Besides this change in the appearance, the prevalence of overweight and obesity caused by inactivity fuel the worsening conditions of these people, as overweight or obesity is a risk factor for many serious chronic diseases in the world and as an independent factor increases morbidity and mortality. Currently, obesity is the main nutritional problem in the world and Iran [2].

Obesity is derived from the Latin word Obesus (stout and plump) that is indicative of the excessive accumulation of white adipose tissue (WAT) in the body. The prevalence of this disease is increasing in an alarming situation. Recent estimates indicate that around 1.4 billion people in the world have excessive weight or obesity. This increase has created considerable concern regarding obesity and its communication with a diverse range of secondary disorders such as chronic low-grade inflammation, hypertension, hyperlipidemia, cardiovascular disease (CVD), and Diabetes Type II (T2D). WAT is mostly composed of fat cells and some types of endothelial cells, fibroblasts, and leukocytes that are available in a loose connective tissue network.

Moreover, adipose tissue is as a storage reservoir of energy, acts as a very active gland, and secretes hormones that are collectively called adipokine [3]. Recently, chemerin has been introduced as adipokine secreted mostly from T3-L1 cells, WAT, and liver. At first, it is an immature and non-active polypeptide with 163 amino acids and 18-kDa molecular weight secreted from WAT and liver as Pro Chemerin. Then its six amino are removed from carboxyl polypeptide sign terminal by serine protease enzyme, and it changes to mature and active chemerin with 143 amino acids with 16-kDa weight, which is found in plasma and serum [4, 5]. Due to the role of chemerin in the differentiation of fat cells, this protein is classified in adipokines group [5]. The first treatment or prevention for obesity and its related diseases is always setting lifestyle, and it seems that biological activity of chemerin can be modified through exercise and nutrition. Sports activities can be considered as a novel therapeutic target or a preemptive action for obesity and other obesity-related disorders. Probably, several factors affect the secretion of adipokines including chemerin, and the intensity and duration of exercise is one of those factors. Sports activities can have several benefits including a reduction in visceral fat mass and waist circumference adipose-tissue reduction [6]. In a study by Askari et al. reported on plasma concentrations of chemerin following 12 weeks of combined training (aerobic and resistance) and some adipokines and insulin sensitivity indices in obese people, there was no significant reduction [7]. In the study by Ghanbarzadeh et al., the results showed that with eight weeks of parallel training, chemerin levels, body fat percentage and waist to hip ratio (WHR) did not change significantly, but a significant reductions in weight and BMI was observed [8]. Jafari et al. studied the effect of two types of endurance and resistance training on plasma chemerin and factors related to obesity in overweight and obese girls and showed that chemerin plasma levels significantly decreased after eight weeks of training in the endurance group, but no significant changes were found in the resistance group [9]. Results of the study by Khademosharie et al. on the effects of two type aerobic exercise protocols- daily exercise for five weeks and every other day10-week exercises-on chemerin levels in women with Diabetes Type II showed no significant effects on body weight, body fat percentage, and BMI. However, it caused a significant decrease in the concentration of chemerin [10]. In another study, Fathi et al. reported a significant decline in the chemerin levels after eight weeks of resistance training of two groups of healthy male rats and male mice resistant to insulin [11]. However, other researchers have observed a significant reduction in the levels of chemerin. A significant decrease was reported in plasma concentration of chemerin in the study by Saremi et al. in obese men with metabolic syndrome following aerobic exercise, and also in their other study following strength training [12].

Very few studies are conducted on adipokines, and these few studies have achieved contradictory results. Moreover, the impact of optimum activity in terms of type, intensity, length, and duration of exercise in obese men with disabilities, especially in relation to body composition parameters, is not clear. Thus, the purpose of this study is to examine the effects of eight weeks of circuit resistance training on serum levels of chemerin and body composition in overweight men with disabilities.

MATERIALS AND METHODS

This study was quasi-experimental with pre-test, post-test, and a control group. First, by hanging a research call, overweight and obese men with disabilities in Zahedan who wished to do physical activity to adjust their weight and improve their physiology were identified by the researcher. Inclusion criteria included bring male, age range of 25±3, BMI 25±2, without medication and physical disability type. The exclusion criteria included history of cardiovascular, kidney, lung, and diseases, diabetes, smoking and engaging in regular physical activity at least in the past six months, and attending less than 80 percent of the training sessions. The individuals listed were evaluated using medical questionnaire and physical activity readiness questionnaire (PAR-Q) [13]. Twenty subjects met the highest inclusion criteria to enter the study, and were randomly placed in two groups of 10 subjects in the experimental group and 10 subjects in the control group after completing the written consent form. Selecting this number of subjects has been based on the features, facilities, and research team factors. In this study, precise control of factors affecting the results was not possible, but in order to control confounding variables, the participants were asked not to use drugs, cigarettes, alcohol, caffeine, and to avoid strenuous physical activities during the period of study. To remove the effects of circadian rhythm on hormonal changes, all tests, and sampling was performed at a specified time for both groups.

The method of measuring anthropometric parameters
Measuring anthropometric indices including height, weight, BMI, body fat percentage, and WHR was conducted with minimal clothing and no shoes.

Measurement of height and weight was in stood up position using wall stadiometer made of metal meter mounted on the wall (with an accuracy of 1 mm) and weighing digital scales (with an accuracy of 0.1 kg). BMI was calculated by dividing body weight (kg) by the square of height (square meters). Skin fold thickness in chest, abdomen, and thigh was measured by caliper of harpenden model made in English (with an accuracy of 1 mm). Percentage of body fat was measured by measuring the three-point subcutaneous fat of Jackson and Pollock (J-P) [14, 15].
Pollock and Jackson's three-point equation for men [14]

Body density (Db) = 1.1093800-(0.0008267×S) + (0.0000016×S2) - (0.0002574×subject age)

S = Total thickness of fat under the skin in the chest, abdomen, and thigh

Then body fat percentage was calculated using a Siri formula [14].

Percentage of body fat= (Db/495)-450

WHR was calculated by non-elastic tape measure and without bearing any pressure on the body (with an accuracy of 0.1 cm) by measuring the lowest lumbar environment in the area between the iliac crest. If the narrowest part of the lumbar region was not detectable, measurements was made in horizontal circumference in this area and dividing it by the size of the pelvis in the seat shell and relax [16]. After eight weeks of circuit resistance training, all indicators were re-measured.

The method of measuring biochemical variables
For the biochemical variables to be were measured in both groups, 10 ml of blood was taken from all subjects in 12 hours of fasting, 48 hours before the exercise program and 48 hours from the right brachial vein by the laboratory scientist.

Subjects were asked to avoid engaging in any hard exercise training during the 48 hours before the first exercise session and after the last training session. Blood samples were stored at -70°C after clotting, centrifuge, and separating the serum to be analyzed along pre-test and post-test blood samples. ELISA method using Biovender kit made in Germany with sensitivity of 0.01 ng per ml was used to evaluate serum levels of chemerin.

Training program
In the experimental group, circuit resistance training was performed for eight weeks, three sessions per week. Subjects participated in two sessions of resistance training to be familiarized with safety tips on how to use bodybuilding machines and principles of weight training. Then the value of one maximum repetition of the six intended exercises used in the study was determined with maximum repetition to exhaustion. To use this method, the subjects performed lifting resistance under maximum weight until exhaustion, so that repetition to fatigue is less than 10 reps.

Then, according to equation Brzycki (1998), maximum power (1 Repetition Maximum) of the subjects was estimated for that movement [17, 18].

$$1RM = \frac{w}{[1.0278 - (0.0278r)]}$$

r= the number of repetitions to fatigue
w= resistance weight in kg
1RM =Maximum power

Resistance training program included training with eight fitness machines and free weights, where eight different moves were performed. After training on how to use the machines, three sets of 12 repetitions were performed in each machine and after the first four weeks of exercise program, a maximum repetition was re-determined. Resistance training program began with 60 to 65% intensity with one maximum repetition and with a gradual increase to 70 to 80% with one maximum repetition in the last sessions (Table 1).

The time at each station for move was 60 seconds, the rest time between two stations was two minutes, and rest between each set was considered one minute. Each workout session was 60 minutes, including warm-up (6 minutes jogging and 4 minutes of stretching and exercise), resistance training with machines and free weights (40 minutes) and cooling down (5 minutes jogging and 5 minutes stretching without pressure). During the study, the control group did not participate in any exercise-training program.

Table 1: Exercise protocol

The number of sessions	Warm up (10 minutes)	The principle of progressive overload and increasing pressure and relax			Cool off (10 minutes)
		Number of sets	Percentage of one maximum repetition	The number of repetitions with weights calculated for each station	
First and second sessions (familiarity)	Jogging and stretch movements	3	60%	15-20	jogging and stretching without pressure
The third to the seventh session		3	65%	12	
The eighth to the twelfth session		3	70%	12	
The thirteenth to the eighteenth session		3	75%	10-12	
Nineteenth session to the end		3	80%	10-12	

Statistical Analysis

Kolmogorov-Smirnov test (K-S) was used to verify the normal distribution of data. Descriptive statistics were used to describe data (mean ± SD) to assess variable changes within the group, parametric paired t-test was used.

Moreover, in order to assess the significance of differences in inter-group changes in pre-test and post-test of the experimental and control groups, independent t-test was used. In all tests, significance was considered at $\alpha<0.05$ level. Data analysis was performed using SPSS version 20.

RESULTS

Control and experimental subjects had an average age of 25.33, and 25.50 years and average height of 169.60 and 174.51 cm. Normal distribution of data was determined using K-S test. Independent t test showed no difference between the two groups in baseline demographic characteristics (p>0.05) (Table 2).

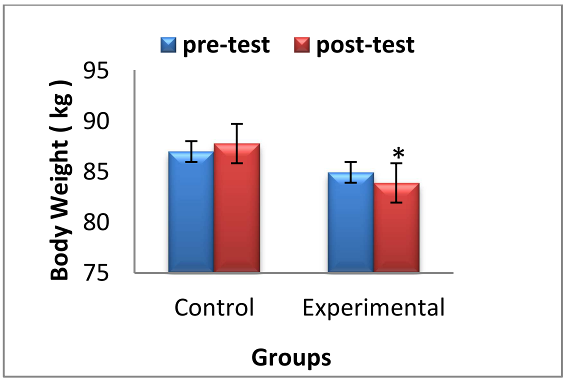
Table 2: Demographic characteristics of subjects at baseline

Variable	Control group (n=10)	Experimental group (n=10)
Age (years)	25.50±3.24	25.33±3.02
Height (cm)	174.50±4.24	169.60±1.95
Weight (kg) P value	87.00±4.66 0.153	84.95±5.32 0.010*
BMI (kg/m^2) P value	24.91±0.98 0.158	25.03±1.37 0.010*
Waist / hip circumference (WHR) P value	0.83±0.02 0.213	0.83±0.02 0.015*
Percent body fat (% F) P value	32.60±2.17 0.193	32.20±3.08 0.019*
Chemerin (μu / ml) P value	840.20±646.02 0.678	594.36±284.21 0.037*

Values are shown as mean ±SD.

** Paired t-test t-test (between pre and post-test for each group) at significance level of 0.05 is significant (p<0.05).*

Using dependent t-test in the experimental group a significant reduction was observed in weight values (p=0.010) (Figure 1), body mass index (p=0.010) (Figure 2), waist to hip ratio (0.015) (Figure 3), body fat percentage (p=0.019) (Figure 4) and chemerin (p=0.037) (Figure 5). In the control group all variable values were over 0.05 and not significant for people in the control group (p<0.05). This result was expected, because the control group did no exercise.



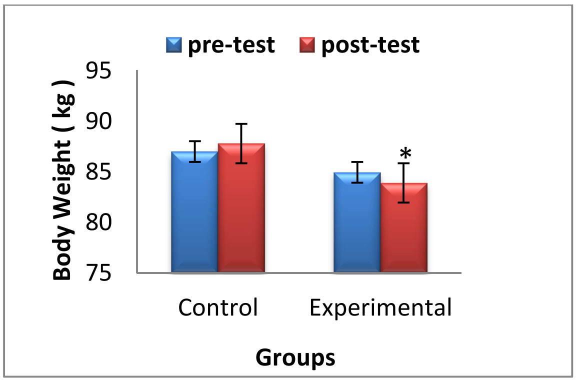


Figure 1: The amount of body weight, pre-test and post-test in both groups **Figure 2: BMI, pre-test and post-test in both groups**

** Indicates a significant difference in both groups before and after 8 weeks*

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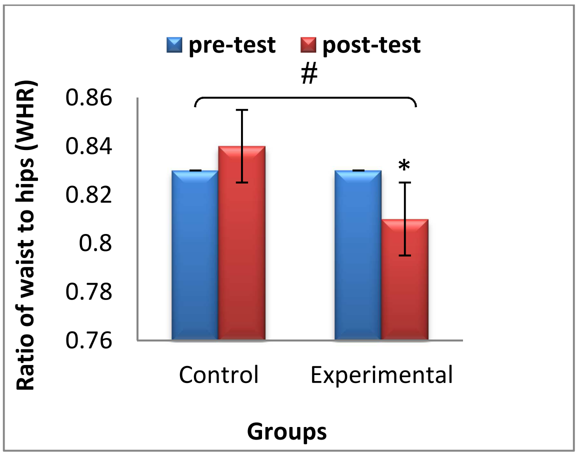

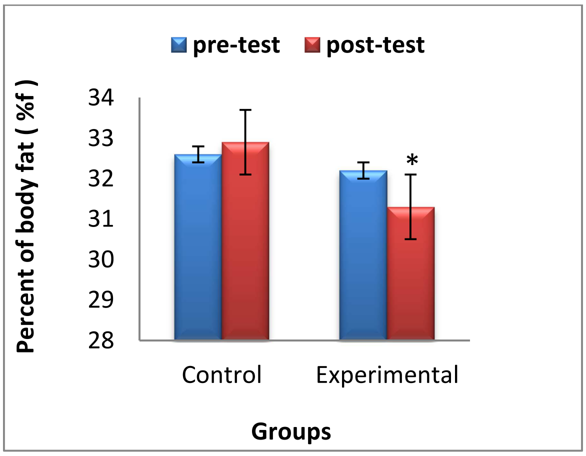

Figure 3: Ratio of waist to hips, pre-test and post-test of both groups **Figure 4: Percent of body fat pre-test and post-test of both groups**

** Indicates a significant difference in both groups before and after 8 weeks*

** Indicates a significant difference in both groups before and after 8 weeks*

 # Indicates significant differences between pre and post-test changes of the two groups

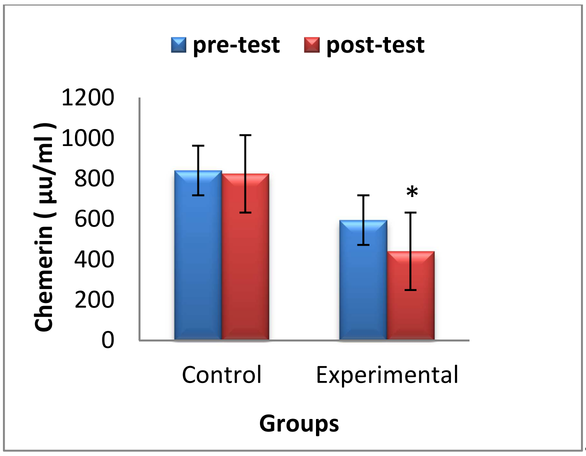

Figure 5: Chemerin levels, pre-test and post-test in both groups

** Indicates a significant difference in both groups before and after 8 weeks*

In this study, pre- and post-test rates of changes are calculated, and then the mean change of the two groups is evaluated by independent t test. According to independent t-test, in pre- and post-test changes in the experimental group compared with the control group, only the values of waist to hip circumference (p=0.027) were significant

(Figure 3), and no significant changes were observed in weight (p=0.096), BMI (p=0.426), body fat percentage (p=0.125), and chemerin (p=0.095) (Table 3).

Table 3: Statistical results of anthropometric variables and chemerin in experimental and control groups in pre-test and post-test

Variable	Stage	Control group (n=10)	Experimental group (n=10)
Weight (Kg)	Pre-test	87.00±4.66	84.95±5.32
	Post-test	87.80±5.05	83.91±4.83
	Changes	-0.80±2.17	1.04±2.27*
BMI(kg/m^2)	Pre-test	24.91±0.98	25.03±1.37
	Post-test	25.14±1.01	24.37±1.24
	Changes	-0.22±0.44	0.30±0.02*
Waist / hip circumference (WHR)	Pre-test	0.83±0.02	0.83±0.02
	Post-test	0.84±0.02	0.81±0.01
	Changes	-0.005±0.01	0.01±0.009*#
Percent body fat (% F)	Pre-test	32.60±2.17	32.20±3.08
	Post-test	32.90±2.23	31.30±2.21
	Changes	-0.30±0.98	0.90±1.20*
Chemerin(µu/ml)	Pre-test	840.20±646.02	594.36±284.21
	Post-test	823.16±633.36	440.19±189.48
	Changes	17.04±286.09	154.17±108.01*

Values are shown as mean ±SD.
** Paired t-test (between pre-test and post-test for each group) is significant at 0.05 level (p<0.05).*
 # Independent t-test (between changes in pre-test and post-test in experimental and control groups) is significant at the level of 0.05 (p<0.05).

DISCUSSION AND CONCLUSION

In addition, chemerin role in regulating insulin sensitivity, cardiovascular disease, chemerin nature, and effects in physical activity that leads to an increase or decrease in fat tissue should be known. Moreover, it should be made clearer that what effects changes in chemerin due to physical activity have on the body fat tissue and body composition. There are very few studies concerning the effects of resistance training on chemerin levels.

The main finding of this study was chemerin serum levels within the experimental group significantly decreased, while in comparison between groups, pre- and post-test changes in the values of chemerin in the two groups were not significant. These results are in line with findings of the studies by Askari et al., Jaffari et al., and Ghanbarzadeh et al. Few studies have been carried out regarding the effect of circuit resistance training on chemerin serum levels, but more studies are done in relation to the effects of aerobic and combined exercise on adipokine. In studying plasma levels of chemerin, Pazoki et al. observed that six weeks of combined training causes significant reduction in the levels of chemerin in obese men [19].

In another study, Pahlavani et al. observed significant differences in chemerin levels after eight weeks of aerobic exercise, but no significant difference was observed in anaerobic group [20]. This study was inconsistent with the studies by Khademosharie (10), Fathi et al., Saremi et al., and some other researchers who observed a significant reduction in chemerin levels. Little research is done regarding the effect of resistance training on serum levels of chemerin. Inconsistent results may be due to differences in the timing of taking blood sample, diversity in training protocols, and different populations.

In this study, weight, body mass index, body fat percentage, and waist-to-hip ratio had significant reduction in the experimental group. However, in pre-test and post-test changes in the experimental group compared with the control group, it was shown that these changes are significant only in waist to hip ratio values. This result is inconsistent with the findings of Pourvaghar et al. where the results of three months of high-intensity intermittent exercise of running had significant intergroup changes in the levels of chemerin, body weight, body fat percentage, BMI, and waist-to-hip ratio in the experimental group compared to the control group [20]. In the study by Khademosharie, the effects of two types of aerobic exercise protocols on chemerin were not significant on body weight, body fat percentage, and BMI [10]. In the findings of Ghanbarzadeh et al. in reviewing eight weeks of parallel training, chemerin levels and body fat percentage did not change significantly that is consistent with the intergroup findings of the study, changes of pre- post-test with control group. The difference observed between the results may be due to differences in age and gender of statistical samples, differences in the type, duration, and intensity of exercise, and the exercise period.

Higher prevalence of overweight and obesity in the disabled could be due to various factors. In addition to the general factors including automotive and industrial life and prevalence of carbohydrate foods in the daily diet of people [21], lack of physical activity of the disabled due to illness, sleep disorders, depression [22, 23], and drugs can cause high prevalence of overweight and obesity in them. In the disabled people, the most common cause of mortality has been reported to be diseases, especially cardiovascular ones [24]. Given that obesity is a major risk factor for cardiovascular disease, weight control in these patients can be effective in reducing mortality. After all, due to various problems associated with obesity and physical activity limitation due to obesity, using different strategies for weight loss in people with disabilities and veterans seems necessary.

Overall, eight weeks of circuit resistance training in the experimental group decreased chemerin serum levels and anthropometric parameters (body weight, body mass index, body fat percentage, and waist to hip ratio). Moreover, in pre- and post-test changes, a significant difference existed only in the ratio of waist to hip in the experimental group compared with the control group. Results of this study showed that doing resistance training has a very important role, and by controlling weight, daily exercise, and healthy diet, people can avoid the serious chronic diseases of overweight and obesity. Therefore, obese, overweight, and normal disabled people are recommended using resistance training as a preventive method of for weight loss, obesity, and later diseases. This study also faced limitations, of which inability in exact controlling of diet, alcohol, and tobacco consumption, motivation level of the subjects, lifestyle, and mental stress can be noted.

Since the present study is of the first research conducted on the effects of circuit resistance training on serum levels of chemerin in overweight men with disabilities, more research is needed to study effective mechanisms of nutrition and changes of adipokine related to anthropometric measurements after exercise with higher intensity and longer training period more precisely.

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