Journal of Physical Activity and Hormones
Vol 4, No. 3, Ser. 15 (September 2020), 033-048

# The Effect of 8-week Resistance Training on Preptin, Irisin and Insulin Resistance in Obese Women

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## Abstract

***Introduction:*** The aim of the present study was to determine the effect of 8-week resistance training on irisin, preptin and insulin resistance in obese women.

***Material & Methods:*** In this quasi-experimental study, 20 obese women aged 30-45 years were selected and randomly divided into two groups of resistance training (n = 10) and control (n = 10). The method of the study was that 24 hours before the beginning of the exercises, the individual characteristics of the subjects and the research variables (insulin resistance, Glucagon-like peptide-1(GLP-1), Dipeptidyl peptidase-4 (DPP-4)) were measured in the pre-

test. Subsequently, the subjects in the resistance training group performed their training program, which was initially 1RM using the Berziki formula. Subjects then began their workouts for 8 weeks, three sessions per week at 40% intensity and 5 repetitions in the first week, and gradually increased intensity to reach 90% at week 8 with 5 repetitions. Paired-sample t-test, two-way ANOVA and Bonferroni post-hoc analysis were used for data analysis.

***Results:*** The results showed that resistance training had an effect on the levels of peptin, irisin and insulin resistance in obese women. Resistance training, time, and the interactive effect of exercises and time have an impact on the levels of preptin, irisin, and insulin resistance in obese women( p=0.01). There was also a significant difference between pre-test and post-test on one hand and exercises and no practice on the other(p=0.01)

***Conclusions:*** According to the findings of this study, it can be suggested that resistance training can be a suitable solution to weight control and obesity and prevent their complications.

**Keywords**: Resistance training, Preptin, Irisin, Insulin resistance, Obese women.

## 1. Introduction

Overweight and obesity are considered as the most important health complications all over the world including Iran (1) that have caused the increased risk of various diseases including cardiovascular disease, high blood pressure, hyperlipidemia, type 2 diabetes, respiratory disease, arthritis, and all types of cancer (breast, uterus, prostate, etc.) (2) and also have considered as an independent risk factor in mortality increase (3). As the mortality rate in obese people is 10 times more than people with normal weight (4). According to the negative effect of diabetes on individual and social life and spending high medical expenses to remove such effects, researchers always try to find the best ways to prevent

overweight. One of these ways which has been considered since old days was exercise and physical activities. So as sport activities have been used to improve physical condition in obese people instead of drugs that each of these activities effect on the improvement of physical condition through various mechanisms (5). The importance of physical activities in obese people is so great that the positive effects of regular physical training in prevention of obesity, diabetes and its complications and health improvement has previously been proved (6), but the molecular mechanisms responsible for these effects are still being discussed.

It seems that a factor that is related to obesity is irisin which is produced during physical activities and causes subcutaneous fat cells to turn brown and produce heat by increasing unpaired protein - (UCP-1)1 levels in both human and animal models (7). Irisin is also involved in the pathogenesis of several metabolic disorders, including obesity, metabolic syndrome, and type 2 diabetes (8). Irisin significantly causes the increase of the cost of the entire body energy, the improvement of insulin resistance related to obesity in mice (9) and also the increase of glucose absorption in skeletal muscles (10). On the other hand, it has been specified that irisin causes the increase of oxygen consumption, weight loss and UCP1 increase (9). Irisin is produced due to the activation of PGC1-α and stimulates NDC5, then irisin is broken and released into the blood (9). Activation of irisin is done through exercises and irisin makes the evolution of white fat to pseudo-brown fat possible, also thermogenic changes in white fat tissue can have therapeutic roles for obesity and type 2 diabetes (9). Generally, it is believed that irisin hormone causes the reduction of fat mass due to the irisin function in the increase of heating (11).

Generally, research has shown that FNDC5 is secreted in response to the muscular activities. In fact, physical activities stimulate the secretion of PGC1-α and PGC1-α acts as PPAR-γ activator (which participates in energy metabolism) and this results in the secretion of FNDC5 that breaking of this protein, irisin hormone which is a part of this protein is released. By releasing of irisin separator protein expression type 1 will be increased. UCP1 prevents the mating of proteins by increasing the permeability of mitochondria inner membrane into the protein and decrease the electrochemical potential and then prevents the formation

of ATP. In this process though the electron transport chain has been done fast but the energy from electron transport is wasted in the form of heat and ATP hasn't been produced and this leads to the induction of properties of brown fat tissue in white fat tissue and increases calorific (12). As a result of all these interactions, white fat tissue which is considered as energy storage changes to the brown fat tissue which spends energy in the form of heat and this action leads to the increase of energy cost and weight loss. This Phenotypic changes of white fat cells into brown fat cells and increase of calorific leads to the improvement of insulin sensitivity, weight loss and improvement of glucose resistance (9). On the other hand, research has reported the decrease of irisin level in diabetic people compared to healthy people (13).

Preptin is another molecule that has a role by interfering with food intake, energy balance and therefore obesity, and stored in pancreatic beta vesicles and secreted with insulin in response to glucose and activates insulin-like growth factor 2, influences protein kinase C and phospholipase C Pathway and induces insulin secretion by a calcium-dependent signal (14). The importance of preptin in obesity is so great that Ozkan et.al.2013, stated in their research that the increase of insulin resistance in obesity may have a relation with preptin (15). The main performance of preptin is to regulate carbohydrate metabolism and inhibit glucose production in the liver. Generally, one can say that preptin has a key role in obesity expansion by the regulation of energy balance and effect on appetite centers in paraventricular and arcuate nucleus. The main function of preptin in this process is to regulate carbohydrate metabolism (16). In general, obesity and adipose tissue accumulation has a direct role in insulin resistance by up-regulating of pre-inflammatory factors especially in abdominal adipose tissue and imbalance in energy absorption and increase of fatty acids oxidation (17).

It seems that irisin and preptin molecules have key roles in energy regulation (10). Beta cells of pancreas secrete insulin and preptin which together with irisin involve in glucose regulation and the interactions between them have important roles in energy metabolism regulation. The amount of irisin and preptin are regulated through nutritional condition and maybe by glucose-influenced insulin. In recent years,

obesity epidemic and the prevalence of disorders and diseases associated with it, has led to an increase in the cost of care and health in obese people (17). Therefore, note the previous literature about the effect of exercise training on irisin and preptin, damage to individual health and life quality have made researchers to investigate involved molecules in energy homeostasis and exercise training, to provide a solution in the treatment of obesity and related metabolic diseases.

Given the contradictory results of previous research in this field and the uncertainty related to the subject of this research, the researcher in this study seeks to determine whether resistance training on perpeptin, irisin and insulin resistance is effective in obese women?

## 2. Material & Methods

The present research methodology was quasi-experimental and applied in a way that first the researcher referred to the health center of Ilam city and explained the purpose of the research and the steps of conducting research to the officials and after obtaining the consent of the officials, eligible people for research (obese women with body mass index above 30, with age range of 30-45 years, also have no kidney, nerve, cardiovascular, joint pain, diabetic foot ulcer, a history of hypoglycemia in the last two months, depression, neoplastic disease and regular aerobic activity) were identified and after explaining the purpose and stages of the research, 30 people were selected from the volunteers and after completing the consent form, they were randomly divided into two groups of resistance training (n=10) and control (n=10). In the next step, the individual characteristics of the subjects including age, height, weight and body mass index and research variables were measured in the pretest and the resistance training group performed their program according to the following instructions and the control group did not perform any exercises. At the end of the eighth week, blood samples including 10 cc of the brachial vein were taken in the fasting state and 48 hours after the end of the protocol. Blood samples were centrifuged at 3500 to 3800 rpm and stored at -20 ° C until the final analysis. Insulin resistance was calculated by the following formula:

$$\text{HOMA-R} = \frac{\text{Fasting Insulin (}\mu\text{U/ml) X Fasting Glucose (mmol/l)}}{22.5}$$

Preptin level was evaluated by ELISA method with a Sun Log Company kit from South Korea with a sensitivity of 1.2 pg / ml with a coefficient of variation of 10%. Also, the amount of irisin was evaluated by ELISA and CUSABIO kit from China with a sensitivity of 0.78 ng / ml and a coefficient of variation of 7.2%.

### *Resistance training protocol*

To perform resistance training, first a maximum repetition of the subjects (1RM) using the Berziki formula was evaluated (18).

$$1\text{RM} = [(0.0278 \times \text{number of repetitions until fatigue (n)}) - 1.0278] / \text{Weight shifted (Kg)}$$

Then the exercises protocol including 8 weeks per week and 60 minutes for each session (Includes movements of: squat, leg press, leg extension, standing calf rises, hamstring with machine, chest press, rowing machine, arm curl, triceps kickback and shoulder press) and 1-3 minutes rest between each set which is designed according to recommendations of the American College of Sports Medicine was done by the subjects in the following way (19). First, the subjects warmed up for 10 minutes using the machines and at the end of the session they did 10 minutes cooling-down.

Table 1. Resistance exercises protocol

| Training weeks | Sets | Repetitions | Intensity (1RM Percent) |
|---|---|---|---|
| **First** | 3 | 15-20 | 40-50 |
| **Second** | 3 | 5-15-20 | 40-50 |
| **Third** | 3 | 12-15 | 60-70 |
| **Fourth** | 3 | 12-15 | 60-70 |
| **Fifth** | 3 | 8-12 | 70-85 |
| **Sixth** | 3 | 8-12 | 70-85 |
| **Seventh** | 3 | 5-8 | 85-90 |
| **Eighth** | 3 | 5-8 | 85-90 |

To analyze data, a descriptive statistic (mean and standard deviation), inferential statistics (Shapiro Wilk, paired sample t-test, two-way analysis of variance and post hoc bonferroni (using SPSS / 21 software at a significant level) were applied.

## 3. Results

Table 1 presents the descriptive statistics of the research variables in pre-test and post-test based on the mean and standard deviation in both resistance training and control groups.

Table 2. Descriptive statistics of research variables in pre-test and post-test based on mean and standard deviation

| group | control | | resistance exercises | |
|---|---|---|---|---|
| Time test | Post-test | Pre-test | Post-test | Pre-test |
| Preptin | 31.55±3.29 | 31.30±2.78 | 27.16±3.14 | 32.84±3.45 |
| Irisin | 91±6.10 | 90.5±4.92 | 108.16±7.49 | 91.83±3.9 |
| Insulin resistance | 70.27±4.48 | 69.92±4.77 | 60.56±3.78 | 68.84±4.61 |

The findings of the present study have showed that resistance exercises have effect on the amount of preptin. The amount of peptin in the post-test exercise group decreased compared to the pre-test. Also, the amount of peptin in the exercise group was reduced compared to the control group, (P=0.001). The amount of irisin in the training group increased in the post-test compared to the pre-test. Also, the amount of irisin in the exercise group was increased compared to the control group, (P= 0.001). And the amount of insulin resistance in the post-test exercise group decreased compared to the pre-test. Also, the amount of insulin resistance in the exercise group was reduced compared to the control group, (P= 0.001). On the other hand, it is found that time (P= 0.001), interaction of training and time (P= 0.001) affect preptin amount in obese women but exercises alone don't have any effects (P=0.166). The results of Bonferoni test also showed that there is a significant difference between pretest and posttest but there is no significant difference between Resistance training and control group (Table 3).

Table 3. The results of Bonferoni related to preptin variable

| Group comparison | Average difference | Sig |
|---|---|---|
| Pretest-posttest | 2.575 | P = 0.007 |
| Training-without training | -1.292 | P = 0.166 |

The results in relationto irisin showed that resistance exercises affect irisin amount (P=0.001) in obese women. On the other hand, it is found that exercises (P=0.001), time (P=0.001) and interactive effect of exercises and time (p=0.001) affect preptin amount in obese women.

The results of Bonferoni test also showed that there is a significant difference between pretest and posttest on one hand and exercise group and without exercise group on the other hand (Table 4).

Table 4. The results of Bonferoni related to Irisin variable

| Group comparison | Average difference | Sig |
|---|---|---|
| Pretest-posttest | -8.417 | P = 0.001* |
| Training-without training | 9.250 | P = 0.001* |

Finally, the results of the present study showed that resistance exercises affect insulin resistance (P = 0.001) in obese women. On the other hand, it was found that exercises (P = 0.004), time (P = 0.001) and interactive effect of exercises and time (P = 0.001) have an effect on insulin resistance in obese women.

The results of Bonferoni test also showed that there is a significant difference between pretest and posttest on one hand and exercise group and without exercise group on the other hand (Table 5).

Table 5. The results of Bonferoni related to insulin resistance variable

| Group comparison | Average difference | Sig |
|---|---|---|
| Pretest-posttest | 10.088 | P = 0.004* |
| Training-without training | -11.928 | P = 0.001* |

## 4. Discussion

The results of the present study showed that resistance training leads to the reduction of preptin amount in obese women. There is also a significant difference between pretest and posttest on one hand and exercises and no exercises on the other hand. Preptin is a new hormone that regulates energy consumption (20). Preptin along with other appetizing peptides can have a significant role in obesity expansion and regulation of energy balance with effect on appetite centers in paraventricular and arcuate nucleus (15). The reduction of preptin amount in obese women after the resistance exercises in the present study is consistent with the results of the study of Nazarali et.al. (2018) and Rahimi et.al. (2019). Rahimi et.al. (2019) in their study investigated the effects of 12 weeks of resistance exercises on preptin serum in obese adults with metabolic syndrome. Preptin reduced after resistance exercises. Preptin as a peptide seems to have a compensatory role in the process of maintaining blood glucose homeostasis along with insulin because of secretion of pancreatic beta cells; therefore, this compensatory need is reduced by increasing the capacity and sensitivity of cells including muscle cells to insulin as a result of resistance training and the production and secretion of preptin occurs to a lesser extent. After doing resistance training and increasing the efficiency of insulin in glucose transfer due to increasing sensitivity to insulin and also the increase of cellular capacity of fat oxidation, there will be no compensatory need for more preptin secretion.

It is identified in the present study that resistance training results in irisin increase in obese women. Irisin is one of the myokines that showed that is increased following the sport activities. In a way that following exercises and physical activities, PGC-1α expression increases as a transcriptional activating molecule and stimulates the expression of FNDC5 membrane protein in muscle cells. Resistance activities can regulate metabolism through the increase of energy cost directly and through affecting secretion of hormones like irisin indirectly. Irisin is a myokine which is known as one of the main factors of relationship between skeletal muscles and fat tissue and it can affect glucose homeostasis, insulin resistance and therefore diabetes by changing white fat tissue which is the energy storage source to brown fat tissue which is

the consumer of energy through heating (21). Irisin may increase UCP1 expression through attaching to the unknown receptors and through increase of PPAR-Y expression and UCP1 leads white adipose tissue to change into brown ones via P38 MARK and ERK pathways. In addition to that irisin transmits GLUT4 to plasma membrane by activating P38 MARK pathway (22). Irisin also affects glucose homeostasis through affecting the expression of PPARA, HK2, GLUT 4 genes which are involved in glucose and lipid metabolism and also involved factors in glycogenolysis or glyconeogenesis (10).

According to the reports of Huh et.al. (2015), irisin concentration increase after resistance training protocol was seen which is consistent with the results of the present study. Studies have shown that the existing irisin in blood circulation has a positive correlation with biceps circumference, body mass index, glucose, endogenous intestinal peptide (inhibitors of insulin secretion) and insulin-like growth factor-1. On the other hand, irisin level has a negative correlation with age, insulin, glyceride, and adiponectin which has shown that irisin may have a role in compensatory mechanisms of metabolic regulation. Researchers have reported that the existing irisin leads to the improvement of insulin activity, reduction of resistance to insulin and optimization of body composition (23).

Finally, the results showed that resistance exercises reduce insulin resistance in obese women. Time, exercises, interactive effects of time and exercise have effects on insulin resistance in obese women. There is also a significant difference between pretest and posttest on one hand and exercise and without exercise on the other hand. The results of the present study based on reduction of insulin resistance after aerobic exercises are consistent with the results of Nikseresht (2016) and Fathi et.al (2014). Nikseresht (2016) showed that non-linear and intermittent aerobic resistance exercises were similarly and significantly effective in reducing insulin resistance. It is stated that young obese men can use exercises to reduce insulin resistance. Fathi et.al (2014) also showed in a research that the index of insulin resistance was significantly reduced in resistance exercise group while this index didn't change in control group.

In addition to endurance exercises, resistance exercises also improve the glucose tolerance and insulin sensitivity in the whole body and generally attributed to the simultaneity of achieving skeletal muscle mass which improves the capacity of the whole body glucose storage. Besides, body fat percentage, weight, BMI may have roles in insulin resistance reduction in the subjects of the present study. There is a need for more research to investigate the weight condition, body composition and their relations with insulin resistance. Resistance exercises increase muscle strength and mass and improve insulin sensitivity and glycemic control this way (24). Resistance training also increase glucose intake by active muscles and stimulation od GLUT-4 and its transmission to cell membrane and also increase fast glucose uptake of active skeletal muscles (25). Therefore, lifestyle changes with a focus on increasing resistance training are one of the main strategies of dealing with cardiovascular risk factors (26). Nevertheless, the results of some research are contrary to the results of the present study in a way that they observed no changes to the insulin resistance after resistance sport exercises. In this regard, Khalili and Nouri (2013) showed that 8-week resistance exercises doesn't make any significant reduction in insulin level and insulin resistance index but they make significant changes in body mass index and body fat percentage. Delouei et al. (2017) also showed that 8-week resistance exercises don't have any significant effect on insulin resistance in obese men. The inconsistency of the obtained results can be due to different applied methods. Even in some case, different situations of the subject in terms of age, gender, and body preparation may be effective in inconsistent results.

## 5. Conclusion:

In general, the results of the present study showed that resistance exercises have significant effects on preptin, irisin and insulin resistance amounts in obese women. Therefore, it is recommended to obese women to use resistance exercises to reduce the negative effects of obesity and their control.

## 6. Conflicts of interest

The authors declared no conflict of interest.

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