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Comparing the Effects of 8-Week Combinational and Aerobic Exercises on Serum Visfatin and Insulin Resistance

Mohammad Khazaei, Azadeh Rostami, Ahmad Hematfar, Shahriar Saeidian

Department of Physical Education and Sports Science, Islamic Azad University, Boroojerd Branch, Boroojerd, Iran.

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ABSTRACT

Visfatin is a newly discovered adipokine and it is abundantly found in caul fat. Obesity leads to the increase of plasma visfatin levels. Physical activity is an appropriate method to lose weight and prevent obesity and other obesity-related diseases. The purpose of the present study is to compare the effects of 8-week selective aerobic exercises and combinational (aerobic and endurance) exercises on serum visfatin and Insulin resistance in inactive obese women. In this regard, 24 volunteer obese women with age average of 33.17 years, height average of 92.162 cm, weight average of 70.82 kg, and body mass index of 31.14 kg/m2 were investigated. The subjects were randomly divided into 3 groups of control, aerobic exercise and combinational exercise (8 people in each group). The exercises were performed during 8 weeks, 3 sessions a week and each session 1 hour. Before and after performing the exercises, blood sample was taken from the three groups. To determine within-group (pretest-posttest) effects, dependent t-test was used in each group and to determine between-group effects, independent t-test was used. The obtained data was analyzed using SPSS software. As the research findings revealed, visfatin levels were significantly decreased in the aerobic exercises group ($p = 0.003$) and combination exercises group ($P = 0.013$) while there was no significant difference between the two groups ($P = 0.627$). Moreover, Insulin resistance index was significantly decreased in the aerobic exercises ($P = 0.005$) and combinational exercises ($P = 0.001$); however, there was no significant difference between the two groups. Accordingly, decreasing lipid profile, visfatin levels and Insulin resistance index, aerobic and combinational exercises can prevent obesity and its related complications.

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INTRODUCTION

Obesity is a common problem from which more than one-third of the world's people suffer and curing this health problem has imposed heavy costs to countries in the world. Changing life style and food combination causes the increasing prevalence of obesity. Obesity leads to the increase of some diseases such as Diabetes, hypertension, cardiovascular diseases, and certain cancers. Obesity and overweight in adolescents and adults has been known as a critical factor for health. As the studies reported, losing weight through appropriate diet and exercise is an effective way of preventing obesity and its related diseases. Many researches have focused on nutrition and diet to lose weight among adults. Calorie limitation leads to the weight loss but weight loss often has not been maintained more than one year [13]. Some evidences indicate that regular exercise can lead to the increase of fat metabolism and weight loss through appropriate physiological changes such as lipid profile improvement, the increase of Insulin sensitivity, the decrease of blood pressure, and the increase of consumed energy [14]. Physical fitness accompanied with the physical activities led to cardiovascular resistance may decrease some of health dangers related to obesity and weight loss. In a prospective study, a reverse relation was found between mortality risk and the scores of physical fitness. In the patterns involving deterministic variables for both sizes of body and physical activity, obese individuals with more active body had less mortality compared to those with normal weight and less activity. Lack of activity and low cardiovascular fitness predicted mortality as well as obesity and overweight [8]. Therefore, physical activity is an appropriate method to prevent obesity and its related complications; it is also a good way of losing weight in obese people.

In addition to storing and secreting three glycerin, adipose tissue secretes many proteins. These proteins plays role in cholesterol metabolism, regulating energy cost, Insulin action effect, and body metabolism.

Corresponding Author: Azadeh Rostami, Department of ,Physical Education and Sports Science, Islamic Azad University, Boroojerd Branch, Boroojerd, Iran.

Visfatin is a newly discovered adipokine and it is abundantly found in caul fat. Obesity leads to the increase of plasma visfatin levels. Physical activity is an appropriate method to lose weight and prevent obesity and other obesity-related diseases. Connecting to Insulin receptors, visfatin activates them and facilitates glucose intake and obesity development. Visfatin has some effects similar to Insulin and some studied reported that Visfatin develop metabolic syndrome. Plasma visfatin levels is directly related with Insulin resistance; stimulating Insulin receptors, visfatine influences the improvement of glucose endurance and the balance of Insulin resistance; it also improves lipid disorders with Diabetes through influencing lipids metabolism. With respect to Insulin-like effects of Visfatin and the relation of gene expression of Visfatin with fats metabolism, physical activity may play a regulatory role in controlling plasma Visfatine through improving sensitivity to Insulin and decreasing lipid profile. Plasma visfatin levels is increased in people with Diabetes and obesity and plays an important role in Insulin resistance due to obesity. As reported, plasma visfatin levels is higher in children compared to adults. Studies investigated the effect of physical activity on visfatin levels have mostly considered the effect of aerobic exercises on visfatin levels. Some studies observed that aerobic exercises decrease visfatin levels. Rezaeian *et al*. [3] examined the effect of 10-week swimming endurance exercises on visfatin levels in obese women and reported the decrease of visfatin levels. Faramarzi *et al*. [4] reported the decrease of visfatin levels due to 8 weeks rhythmic aerobic activity. While Jorge *et al*. reported that 12 weeks aerobic, endurance and combinational practices significantly increase visfatin levels in obese men and women with Diabetes. Considering the contrast reported results, the present work attempts to investigate the effect of aerobic exercises on visfatin levels.

There are few studies investigated the effect of combinational exercises on visfatine levels. Jorge *et al*. reported that 12 weeks combinational exercises increased visfatin level in old obese men and women with Diabetes. In this project, the effect of aerobic exercises and combinational exercises on visfatin levels and Insulin resistance as well as Insulin concentration and glucose are compared.

The Research Objective:

The general objective of the study is to compare the effects of 8 weeks aerobic exercises and combinational exercises on visfatin levels and Insulin resistance in obese women.

The Research Hypothesis:

There is no significant difference between the effects of 8 weeks aerobic exercises and combinational exercises on visfatin levels.

Adipose tissue:

Adipose tissue is a complex and necessary organ with high metabolism role; it is also an endocrine gland which has been consisted of fat cells, various immune cells and complex cardiovascular cells, neural tissue, and extracellular matrix. All parts of a fat cell acts as a unit. Adipose tissue not only responses to endocrine glands and neural system, but also it secretes some factors with important hormonal functions. These factors entail leptin, adiponectin, visfatin, resistin, renin-angiotensin system proteins and other adipokines. Being endocrine is a highly important function of adipose tissue to prevent undesirable metabolic performance. Better understanding about endocrine functionality of adipose tissue leads to more rational cure of metabolic disorders [9].

Adipokines:

In addition to storing and releasing three glycerin, adipose tissue can secretes many proteins plying role in cholesterol metabolism, energy cost regulation, Insulin function, and nutrition. Adipokines belong to the spreading family of proteins which are mostly secreted by adipocytes and play role in various types of physiologic or physiopathologic processes such as immune and inflammation. Adipokines has cleared the relation of some feedback rings between adipose tissue and various organs such as brain, liver, skeleton muscle, and pancreas. These homeostasis feedback mechanism are used to maintain normal weight of body. In obesity, the balance between energy and weight maintain retrieving paths are disturbed which can lead to Insulin resistance development.

Insulin resistance is a compensatory response through beta-cells of pancreas to the decrease of target tissues sensitivity (such as liver tissues, adipose tissues and muscle tissues) relative to the metabolic Insulin effects. In Insulin resistance situations, people suffer from hyperinsulinemia. It seems that hyperinsulinemia and the increase of Insulin resistance causes renal sodium retention, increase of sympathetic tone and hypertrophy of endothelial vascular smooth muscles. On the other hand, Insulin causes the change in ionic transmission through cellular wall, increasing the concentration of cytosolic calcium of vascular and renal tissues which are sensitive to Insulin. Insulin resistance should be regarded as a wide concept of mutual interaction between nutrition, glucose, Insulin, adipokines of various tissues in terms of metabolic importance. Adipokines and α-TNF control

every synthesis and other activity in adipose tissue, causing a balanced physiologic status. As shown in Figure 1, interlokin-6 and α-TNF play key role in regulating other adipokines such as leptin, visfatin and resistin.

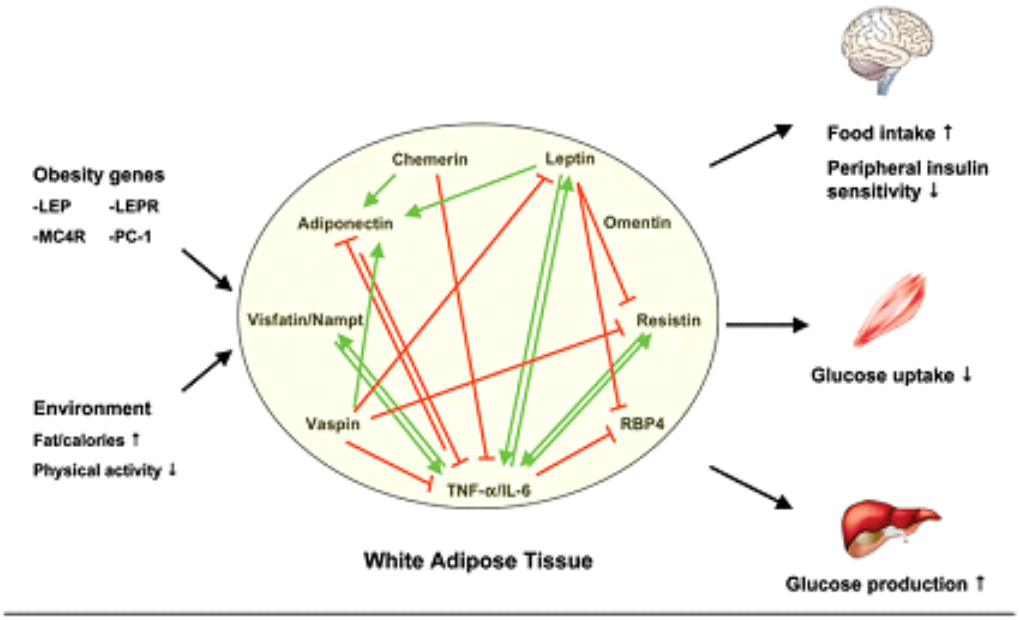

Fig. 1: The Balance between Adipokines, Glucose, Insulin, and Nutrition for Insulin Resistance Regulation.

Visfatin and Metabolism:

Testing various human and animal cells, Fukuhara *et al*. investigated the metabolic effect of visfatin including glucose metabolism, obesity and Insulin-like effect. By 2007, the study of Fukuhara *et al*. regarding visfatin metabolism was acceptable while there was no clear mechanism for this effect. Although Zee *et al*. presented some reports identical to the results obtained by Fukuhara, other researchers could not found such results.

Furthermore, Rol *et al*. found that the relation between visfatin and glucose and other obesity related variables can be determined through the role of visfatin as Nicotinamide phosphoribosyl transferase (Nampt) enzyme. Additionally, they proposed a mechanism regarding Nampt, biosynthesis and NAD metabolism through Necotinamide mononucleotid (NMN, NAD and the activity of factors related with NAD. The path proposed by Rol *et al*. begins by nicotine intake from diet and distribution through body tissues. If nocotineamid of cell is absorbed, it is changed into NMN by Nampt intercellular enzyme; if it is not removed from bloodstream, it is changed into NMN through Nampt extracellular enzyme which can be then transmitted to tissue for intake. Within NMN cell, adenylyltransferase is changed into NAD through NMN enzyme. NAD plays role in body metabolism.

Visfatin gene (PBEF1) is located on chromosome 7q22. As previously reported studies revealed, this region of chromosome is related with Insulin as a response to aerobic activity, Insulin resistance syndrome and body mass index (Woo, 2002). According to chromosome region, gene and visfatine can be a factor influencing glucose metabolism and obesity related variables. Moreover, more than 52 signals derived from PBEF1 have been reported. Signals derived from PBEF1 are related to some diseases such as glucose and obesity related problems. In developed and under development countries, people are involved in inactive life style, leading to cardiovascular diseases and early death. According to the studies, plasma visfatin levels is increased in people with obesity, Diabetes, cardiovascular diseases and metabolic syndrome. Plasma visfatin levels and its gene expression are increased in adipose tissues, indicating the relation between visfatin, fat percentage and body mass index. It was also found that high visfatin levels in obese testess is decreased after stomach surgery and through weight loss and Insulin resistance improvement [3]. Addiotionally, a significant correlation was found between plasma visfatin levels, glucose and variables related with obesity such as fasting Insulin, fasting glucose, Insulin resistance, and body mass index.

Many researches have focused on nutrition and diet to lose weight among adults. Calorie limitation leads to the weight loss but weight loss often has not been maintained more than one year [13]. Some evidences indicate that physical activity and/or physical fitness can reverse the effects of obesity on health in adults [8]. Physical fitness accompanied with the physical activities led to cardiovascular resistance may decrease some of health dangers related to obesity and weight loss. In a prospective study, a reverse relation was found between mortality risk and the scores of physical fitness. In the patterns involving deterministic variables for both sizes

of body and physical activity, obese individuals with more active body had less mortality compared to those with normal weight and less activity. Lack of activity and low cardiovascular fitness predicted mortality as well as obesity and overweight [8]. With respect to Insulin-like effects of visfatin and the relation of gene expression of visfatin with fats metabolism, physical activity may play a regulatory role in controlling plasma visfatine through improving sensitivity to Insulin and decreasing lipid profile. Most of useful physiologic changes such as glucose endurance and Insulin sensitivity are obtained with aerobic activity. Additionally, adipokines such as adiponectin respond to activities. However, few studies has investigated the effect of visfatin response on exercise. Most of studies performed on the effect of exercise on visfatin levels have focused on visfatin levels. Mohammadi and Khaje Landi observed that 8 weeks endurance exercises in middle age healthy men led to the decrease of fat percentage in addition to the decrease of visfatin levels. Although McKenzie *et al*. reported the increase of serum visfatin levels in inactive middle age men and women after participating in 6 months aerobic exercise, Erdem *et al*. revealed that in middle age obese men and women, 6 weeks physical activity caused to the decrease of Insulin resistance, the improvement of physical combination, and blood three glycerin in addition to the decrease of plasma visfatin levels. Comparing the effect of endurance, resistive and combinational exercises on serum visfatin levels, Jorge *et al*. reported that there is no significant difference between the effects of various kinds of exercises on visfatin levels. With respect to a 30% increase of health and care costs in obese people, compared to people with normal weight and a 46% increase of death rate due to cardiovascular diseases in Iran [3] and according to the advice of American Diabetes Association based on implementing at least 150 minutes with average intensity, three days a week with the aim of losing weight, glucose control improvement, and the decrease of cardiovascular disease risk, and assuming that physical activity is effective in improving lipid profile and serum visfatin levels, the present study has investigated the effect of 8 weeks aerobic and combinational exercises on serum visfatin levels and Insulin resistance in obese women.

Mohebbi *et al*. [5] analyzed the effect of 12 weeks intense aerobic exercise on the concentration of adiponectin and Insulin resistance in middle age obese men. To this end, 16 healthy and obese middle age men with age range of 41 years and body mass index of 31/5 kg/m^2 voluntarily participated in this study. The participants were randomly divided into two 8-peple groups of control and exercise. During 4 45-minute sessions, the subjects ran on treadmill with an intensity of 75% to 80% of the maximum consumed oxygen. After 12 sessions, the subjects avoided any intense physical activity for one week to determine the durability of the exercise effects. As it was observed, intense aerobic activity caused a significant decrease of glucose concentration, fasting Insulin and Insulin resistance. On the other hand, the maximum consumed oxygen and plasma adiponectin concentration were significantly increased due to 12 weeks intense aerobic exercise.

Azarbaijani *et al*. [2] investigated the effect of one session endurance, combinational and aerobic exercises on serum leptin concentration and Insulin resistance index in inactive men. In this study, 10 men with the age range of 22.9 years and body mass index of 23 kg/m^2 performed one session combinational exercise including aerobic exercise of running on treadmill for 20 minutes with 60% to 70% of maximum consumed oxygen and endurance exercise with the intensity of 70% of a maximal repeat with 10 repeats in each movement for 2 rounds. The levels of leptin, Insulin and Insulin resistance index were measured before and 24 hours after the activity. As observed, serum leptin concentration and Insulin resistance index were significantly decreased due to one session of combinational activity.

Methodology:

Population:

In this study, the statistical population included obese girl high school students of Kermanshah City. Using simple random convenient sampling method, 24 people were selected as the statistical sample. The subjects were at the age range of 15-20 years, inactive with body mass index of above 30 kg/m^2. The subjects had not the history any diseases, drug consumption and/or smoking; they also did not participated in any regular exercise program. No subject used any diet. To obtain individual information, individual information questionnaire was completed (Appendix 2). A written permission letter was taken from the testess (Appendix 1). Table 1 presents the subjects' descriptive characteristics.

Table 1: The Subjects' Descriptive Characteristics.

	Mean	Minimum	Maximum
Age (year)	33/17±52/1	00/15	00/20
Height (cm)	92/162±02/5	00/156	00/172
Weight (kg)	70/82±24/5	00/75	00/94
Body mass index (kg/m^2)	14/31±86/0	08/30	28/33
Fat percentage	52/29±05/2	20/26	10/33

Procedure:

To select the subjects, invitation announcements were distributed in girl high schools of Kermanshah City and obese students who were willing to perform regular exercise to balance weight and improve their physiologic status were identified and those who had body mass index was above 30 were selected. To prevent the interference of the hours of performing experiment and students' classes, the exercise was performed at 7-8 o'clock. Firstly, total protocol was explained for the subjects to make them familiar with the research objectives. Then, the body anthropometric features such as age, weight, body fat percentage, waist circumference, and hippo circumference were recorded. The subjects were randomly divided into three groups of aerobic, combinational and control. For the aerobic and combinational group, the exercise program included 8 weeks, each week 3 sessions and each session 1 hour. During the 8 weeks, the control group was inhibited from doing any regular exercise. One day before implementing the protocol and two days after implementing the protocol (due to avoiding acute effects of the exercise on blood concentration of hormones), all the subjects were brought to the laboratory and their blood sample was taken by the expert in fasting status.

Aerobic activity Program:

Aerobic exercise program involved 8 weeks aerobic exercise, each week 3 1-hour sessions. Each aerobic exercise session included 10 minutes warm up, 40 minutes running with dynamic stretching movements and dummy exercises and finally, 10 minutes for cooling down. In the first week, the intensity of aerobic exercise was 55%-60% of the maximum heart rate (heart rate will be measured using polar stethoscope. Gradually, the intensity of the exercise was increased such that in the last week, it reached to 70%-75% of the maximum heart rate.

Combinational Activity Program:

The combinational exercise program involved 8 weeks aerobic exercise, each week 3 1-hour sessions. Each aerobic exercise session included 10 minutes warm up and 10 minutes cooling down with the aerobic group, 20 minutes activity with the aerobic group, and 20 minutes endurance exercises. Endurance exercise included horizontal bar in prone position, sit-ups, Swedish swimming, leg squat, and dumbbell exercises for the muscles of the front of the upper arm, chest, shoulder and triceps. During the first week, light endurance exercise was performed and the intensity was gradually increased.

In this research, 24 obese girl participated who were divided into three groups of aerobic, endurance and combinational exercises. Two blood sample were taken from each of the subjects pretest and posttest) and altogether, 48 blood samples were provided and to determine the concentration, visfatin, glucose and serum Insulin were analyzed in the laboratory. To analyze the statistical data, SPSS software was used. Firstly, data was described through descriptive statistics; then, using dependent (correlated) and independent t-test statistical methods were used to test the research hypotheses. In this regard, mean, standard deviation and variance of the subjects (Table 1) and of the research variables in pretest and posttest in the three groups were computed.

The First Null Hypothesis: there is no significant difference between the effects of 8 weeks aerobic exercise and combinational exercise on serum visfatin in the obese women.

To test the hypothesis, the effect of aerobic exercise and combinational exercise on serum vasfitin concentration in pretest and posttest were compared (Table 2). To compare between-group changes, independent t-test was used and to investigate within-group changes, dependent t-test was applied (Table 2).

Table 2: T-Test Results to Compare the Effects of Aerobic and Combinational Exercises on Serum Visfatin (ng/mg).

Group	Pretest	Posttest	T observed	Sig.
Aerobic exercise	96/1±27/0	41/1±49/0	452/4	003/0*
Combinational exercise	89/1±39/0	52/1±35/0	323/3	013/0*
Observed independent t	425/0	-496/0		
Sig.	678/0	627/0		

As shown in Table 2, comparing the means of serum visfatin concentration in the aerobic exercise group and combinational exercise group in pretest indicated the lack of significant difference between the two groups. Also, the difference was not significant in the posttest. Therefore, the null hypothesis is confirmed, indicating that there is no significant difference between the effect of 8 weeks aerobic exercise and combinational exercise on serum visfatin levels.

Conclusion:

Generally, with respect to the conducted studies, it can be stated that aerobic activity causes the decrease of fat percentage, body mass index, visfatin levels, glucose level, Insulin level, and Insulin resistance. Regarding the effect of combinational exercise (aerobic and endurance) on visfatin levels and Insulin resistance, there are few and paradox studies; so, a general conclusion cannot be drawn. Accordingly, the present study attempted to

investigate the effect of combinational exercise on visfatin levels and Insulin resistance. Regarding the simultaneous effect of aerobic and combinational exercises and comparing these two exercises on visfatin levels and Insulin resistance in obese people, no study was found.

Considering the research findings, it can be concluded that 8 weeks aerobic and combinational (aerobic and endurance) exercises performed in 3 one-hour sessions in a week with average intensity caused the decrease of serum visfatin levels and Insulin resistance in obese women. Moreover, there was no significant difference between the effects of 8 weeks aerobic and combinational exercises on serum visfatin levels and Insulin resistance index. Decreasing lipid profile and improving Insulin resistance, aerobic and combinational exercises can prevent obesity and its related complications.

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