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Comparison of Three Methods of Exercise on Insulin Sensitivity Index of Middle-Aged Men

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ABSTRACT: This study is aimed to compare the efficacy of three exercise methods on insulin sensitivity indexes of middle-aged men. This study was a quasi-experimental and was carried out with field method. To this end, 48 men were selected with an average BMI 0.8 ± 31.4 (range of 30 to 32) and the mean age 0.95 ± 35.9 (range of 35 to 40). Selected patients were divided into 3 groups of low-intensity exercise, moderate and high intensity and a control group. None of participants had a record of specific diseases or record of sports activity. During blood taking time (eight weeks) controls didn't have any specific exercise but the experimental group undergone aerobic exercise on a treadmill with an intensity of 55 to 65 percent, 65 to 75 percent and 75 to 85 percent of maximum heart rate three times a week. Kolmogorov - Smirnov tests were used to determine the normal distribution of samples, and then ANOVA and Tukey tests were used. ANOVA test results showed that there is a difference between the effect of exercises with different intensity levels on blood glucose (P > 0.05). There is a difference between the effect of exercises with different intensity on insulin levels (P > 0.05). There is a difference between the effect of exercises with different intensity levels on insulin resistance (P > 0.05). There is a difference between exercises with different intensity on insulin resistance (p < 0.05). In all these cases, high-intensity exercise was more effective than low and moderate intensity.

Keywords: Glucose, Insulin, Insulin Resistance, Aerobic Exercise, Low-Intensity Exercise, Moderate-Intensity Exercise, High-Intensity Exercise

INTRODUCTION

Obesity and its related diseases is one of the great problems of mankind, as a result of factors such as increasing prevalence of obesity caused by unhealthy urbanization life and increasing aging of societies, the prevalence of diabetes is increasing rapidly in the world and unfortunately this increase in developing countries, including our country is more dramatic. Accumulation of adipose tissue is closely related to obesity, adipose tissue other than the storage of lipids has an important role in the regulation of energy homeostasis, insulin sensitivity and lipid and carbohydrate metabolism. Overweight and obesity, as defined by the World Health Organization (WHO) is abnormal or excessive fat accumulation in the body that impairs a person's health and improper increase of this tissue is along with glucose and fat and insulin resistance and endothelial functional abnormalities and chronic infections. This tissue is one of the largest endocrine organs of the body and is needed for normal body functions, the levels of which are changed in metabolic diseases.

Statement of the problem: Nowadays, adipose tissue of active endocrine organ is known in controlling metabolism of body and simply is a place to save energy. This tissue is an endocrine and a highly active metabolic organ that is not only responsible for producing energy, but it secrets and produces different proteins such as leptin, visfatin, adiponectin and Resist in that is called Adiponectin. These proteins act as real hormones and are responsible for regulating received and consumed energy, and are involved in the inflammatory and insulin sensitivity processes. In addition to releasing fat acids that are the most important factor in the development of insulin resistance associated with obesity, Adiponectins also play a major role in the regulation of insulin sensitivity. Insulin was discovered in 1922 by Banting and Best. Peptide hormone of insulin is excreted from the beta cells of the islets of Langerhans in response to glucose increase in blood. Insulin binds to stimulating cell surface receptors. Insulin is in charge of absorbing glucose by enhancing place transmission of GLUT4 to the plasma membrane.

Insulin stimulates glucose transmission in skeletal muscles. Sensitivity to insulin is as required insulin concentration, leading to 50% of defined glucose transmission. Insulin sensitivity refers to a large extent to skeletal muscle sensitivity to insulin. On the other hand insulin resistance is a characteristic feature of obesity in adults; insulin resistance is defined as a decrease in optimal performance of muscle cells to absorb glucose in response to insulin released from pancreatic beta cells. More than 30 years, acute exercises are known as a strategy for improving insulin sensitivity. The results of the effect of exercise intensity on insulin sensitivity is ambiguous. Gaining knowledge about the effect of exercise on insulin sensitivity is important. Doctors aim to reduce insulin resistance and prevent cardiovascular disease by prescribing exercise protocol. It seems that the beneficial effects of physical fitness on insulin sensitivity are because of increase of the lean body mass and decreased fat. In the present research we are going to compare the efficacy of three methods of exercise on insulin indices to know whether there is any difference between the three methods of exercise on insulin sensitivity index? And in which of exercise group of middle-aged obese men the difference is higher?

The Importance and Necessity of the Research:

One of the most common diseases caused by negligence or endocrine disorder in human being is caused by diabetes in which the insulin production required for the body is reduced or completely cut off. The disease is not only a physical condition in which its disorder does not threat other parts of the body, but by carelessness or lack of attention it can have a very strong influence on other glands and organs, and damage them. So replacing drugs that have minimal side effects for the patient seems obvious and immediate. Obesity is one of the most common metabolic disorders in the industrialized and developing countries; also there is a strong relationship between obesity and insulin resistance in diabetics and non-diabetics. The origin of many diseases is obesity. And so to prevent these unwanted effects people are always looking for ways to reduce this side effects. So one of the best ways to combat this new phenomenon is exercise that can be put in everyday life through right and proper direction and use its health effects. I hope that by using modern scientific methods, experience and guidance of the professors to move a step forward. Therefore, it was necessary to conduct the following research and compare the results. The results will be used by the medical community, middle-aged men, sports clubs, sports administration and diabetic patients.

PURPOSES OF THE RESEARCH

A. The overall goal

Comparing the effect of three types of exercises on insulin index in obese middle-aged men

B. Specific objectives

The effect of three types of exercises on insulin sensitivity of middle-aged men

The effect of three types of exercises on the level of insulin of middle-aged men

The effect of three types of exercises on glucose levels of middle-aged men

The effect of three types of exercises on insulin resistance of middle-aged men

C. Hypotheses of the Research

1) There is a difference between the effect of exercises with different intensity on insulin sensitivity.

2) There is a difference between the effect of exercises with different intensity on insulin level.

3) There is a difference between the effect of exercises with different intensity on glucose levels.

4) There is a difference between the effect of exercises with different intensity on insulin resistance.

RESEARCH METHODOLOGY

Success of any research depends on the planning and its proper orientation just to realize the intended goals. Clear expression of theresearch methods and design, complete introduction of population and statistical sample, the introduction of variables and ways to measure it, the introduction of accurate data collection instrument and proper use of statistical methods of data analysis, can guarantee successful completion of a research.It is hoped that with the accuracy of the investigator to direct this study, he is able to successfully achieve his aims. Given the purpose of this study that is comparison of the effects of three exercises on insulin indices of middle-aged men, in this chapter we will examine the research methods, population and statistical sample, research variables, research instrument, data collection methods and statistical methods.

Statistical Population, Statistical Sample and their Size Determination: After the announcement of research for the participation of men aged 35 to 40 years, over 100 people qualified in terms of age, health and good physical condition, received the questionnaire of participation in the study and health questionnaire, they were also examined by a doctor. All were people living in the city of Mashhad and non-athletes who completely voluntary went to the gym of Pars Hotel in Mashhad. Among these people, those who were qualified for the study were selected and their BMI was between 30 and 32, and 48 subjects were taken as the sample, and that the three groups as experimental groups (travelling a distance with a low intensity - moderate intensity and high intensity) and a control group and after guidance and complete information about exercise protocols and way of research, their physical activity began.

Implementation of Exercises: In low-intensity, moderate-intensity and high-intensity exercises a treadmill was used for running. The participants were taught how to walk faster or slower to control their heart rate. With the Polar clock, the heart rate of subjects was controlled. Exercise program was set so that gradual increase of the intensity of each exercise is maintained.

Data collection tools. Medical record questionnaire to assess illness records of participants

Test of Hypotheses

First hypothesis: There is a difference between the effect of exercises with different intensity on glucose levels of blood. The results of analysis of variance with repeated measures to detect changes in glucose, is presented in Table 1. Due to the significance level of 0.001 which is smaller than 0.50, the null hypothesis is rejected, meaning that there's a difference between the effect of exercises with different intensity on glucose levels of blood. Now to find this issue Tukey's test is used.

Table1: Results of analysis of variance with repeated measures to find the glucose changes.

	The sum of Squares	Degrees of Freedom	Mean of squares	F	Significance level
Interagroup	1647.802	2	549.267	342.787	0.001
Intergroup	70.504	44	1.602		
Total	1718.306	47			

Table 2: Results of Duncan's post hoc Tukey test, results of comparison of glucose between groups.

Groups	Difference from Mean	Standard Error	Significance level
Low intensity-moderate intensity	3.123	0.516	0.001
Low intensity-high intensity	4.743	0.516	0.001
Low intensity-control	-10.323	0.516	0.001
moderate intensity-high intensity	1.620	0.516	0.016
moderate intensity-control	-13.446	0.516	0.001
High intensity-control	2.2289	0.516	0.016

The results of the above tables show that exercises with different intensity have had significant effects on blood glucose levels of participants.

On the other hand, although there are significant differences between the effects of different exercises, but changes in blood glucose suggests that the effect of high intensity exercises was higher.

The second hypothesis: There is a difference between the effect of exercises with different intensity on insulin level. The results of analysis of variance with repeated measures to detect changes in glucose, is presented in Table 3. Due to the significance level of 0.001 which is smaller than 0.50, the null hypothesis is rejected, meaning that there's a difference between the effect of exercises with different intensity on insulin levels of blood. Now to find this issue Tukey's test is used.

Table 3: Results of analysis of variance with repeated measures to find the Insulin changes.

	The sum of Squares	Degrees of Freedom	Mean of squares	F	Significance level
Intera group	985.317	2	328.439	1.459	0.001
Intergroup	9.903	44	0.225		
Total	995.220	47			

Table 4: Results of Duncan's post hoc Tukey test, results of comparison of insulin between groups.

Groups	Difference from Mean	Standard Error	Significance level
Low intensity-moderate intensity	5.329	0.193	0.001
Low intensity-control	-5.195	0.193	0.001
moderate intensity-high intensity	6.012	0.193	0.001
moderate intensity-control	4.458	0.193	0.001
High intensity-control	0.682	0.193	0.001

The results of the above tables show that exercises with different intensity have had significant effects on insulin levels of participants.

On the other hand, although there are significant differences between the effects of different exercises, but changes in insulin suggests that the effect of high intensity exercises was higher.

The third hypothesis: There is a difference between the effects of exercises with different intensity on insulin sensitivity. The results of analysis of variance with repeated measures to detect changes in glucose, is presented in Table 5. Due to the significance level of 0.001 which is smaller than 0.50, the null hypothesis is rejected, meaning that there's a difference between the effect of exercises with different intensity on insulin sensitivity. Now to find this issues Tukey's test is used.

Table 5: Results of analysis of variance with repeated measures to find the Insulin sensitivity changes.

	The sum of Squares	Degrees of Freedom	Mean of squares	F	Significance level
Intera group	4.174	2	1.391	20. 728	0.001
Intergroup	2.953	44	0.067		
Total	70127	47			

Table 6: Results of Duncan'spost hoc Tukey test, results of comparison of insulin between groups.

Groups	Difference from Mean	Standard Error	Significance level
Low intensity-moderate intensity	-0.192	0.105	0.043
Low intensity-high intensity	-0.430	0.105	0.001
Low intensity-control	0.374	0.105	0.001
moderate intensity-high intensity	0.199	0.105	0.043
moderate intensity-control	-0.238	0.105	0.010
Highintensity-control	0.569	0.105	0.001

The Fourth hypothesis: There is a difference between the effects of exercises with different intensity on insulin resistance. The results of analysis of variance with repeated measures to detect changes in glucose, is presented in Table 7. The results of the above tables show that exercises with different intensity have had significant effects on insulin resistance of participants.

On the other hand, although there are significant differences between the effects of different exercises, but changes in insulin resistance indicates that the effect of high intensity exercises was higher.

Due to the significance level of 0.001 which is smaller than 0.50, the null hypothesis is rejected, meaning that there's a difference between the effect of exercises with different intensity on insulin resistance. Now to find this issue Tukey's test is used.

Table 7: Results of analysis of variance with repeated measures to find the Insulin resistance.

	The sum of Squares	Degrees of Freedom	Mean of squares	F	Significance level
Interagroup	2758.364	2	919.455	1.00	0.001
Intergroup	4040.56	44	918.263		
Total	0.428	347			

Table 8: Results of Duncan's post hoc Tukey test, results of comparison of insulin resistance between groups.

Groups	Difference from Mean	Standard Error	Significance level
Low intensity-moderate intensity	0.114	0.123	0.04
Low intensity-high intensity	0.016	0.123	0.001
Low intensity-control	0.225	0.123	0.001
moderate intensity-high intensity	0.221	0.123	0.04
moderate intensity-control	-0.98	0.123	0.01
Highintensity-control	0.115	0.123	0.001

The results of the above tables show that exercises with different intensity have had significant effects on insulin resistance level of participants.

On the other hand, although there are significant differences between the effects of different exercises, but changes in insulin resistance indicates that the effect of high intensity exercises was higher.

CONCLUSIONS

There is a difference between the effect of exercises with different intensities on the level of glucose, and exercises decreased glucose level, but the effect of high-intensity exercises is more effective in reducing glucose levels. The results of this study are consistent with the results of Fallah *et al* who studied the glucose changes in mice with diabetes, Amini and Lari, also witnessed the glucose reduction in obese women with diabetes, the results are also consistent with the studies of Ribs et al, Mother et al, Aniteh Doy, College et al, the results of the present study are not consistent with the research results of Fathi who investigated the effect of low intensity resistance exercise in streptozotocin-diabetic rats, there were no significant changes in glucose, insulin, omentin, and lipid profile, it seems that low intensity exercise and its short period have important role in the absence of significant changes in glucose, insulin and omentin. The reason for the difference between the results of this research with the results of our study can be the type of exercise and the type of subjects. Alice investigated the effectof aerobic exercise in improving insulin sensitivity in obese women, which decreases insulin sensitivity and glucose and the reason of difference can be cited gender of subjects and intensity of the exercises.

There is a difference between the effects of exercises with different intensity on insulin levels. Exercises with different intensity had significant effects on insulin levels of participants. On the other hand, although there are significant differences between the influence of exercises.

The results are consistent with the research of Rice *et al* after 16weeks of aerobic exercise, walking on atreadmill, fixed bicycle orstairwith85% of maximum heart ratefor19 to60 minutes, along with diet, observed a reduction in insulin, the results of the present study are not consistent with the research results of Fathi who investigated the effect of low intensity resistance exercise in streptozotocin-diabetic rats, there were no significant changes in glucose, insulin, omentin, and lipid profile, it seems that low intensity exercise and its short period have important role in the absence of significant changes in glucose, insulin and omentin. The reason for the difference between the results of this research with the results of our study can be the type of exercise and the type of subjects. Loretta et al, began to examined the relationship between exercise and increased insulin sensitivity in elderly women. Groups of high intensity exerciseshad increased insulin inhibition in adipose tissue lipolysis in lower insulin dose. Exercises with higher intensity had better long-term effect on the stability of the insulin activity compared to activities with moderate intensity, which is probably a transient effects. The reason of the differences can be cited gender of the subjects.

Goto *et al* showed that resistance exercise with 80% intensity of one maximum repetition increases norepinephrine, norepinephrine, testosterone, insulin; it also causes no change in growth hormone, and cortisol. These differences with the results of our study can be cited in the type of exercise.

The results showed that there is difference between the effects of exercise with different intensity on insulin sensitivity in which the insulin sensitivity increased that is compatible with the results of Sari et al, who examined the short-term effects of aerobic exercise of walking. They concluded that practice improves insulin sensitivity. Askari investigated the effects ofcombinedexerciseoninsulinsensitivityinoverweightgirlsandconcluded that 12 weeks of combined exercise, resulted insignificant improvement in insulin sensitivity. Izadi investigated the effect of exercise on insulin sensitivity on diabetic patients that the type of short-term exercise in the absence of change in insulin sensitivity, increases serum adiponect in levels in diabetic patients. Hughez *et al*, in 17 old persons, that 9 participants did 55 minutes exercise of 75 percent 4 days a week, and the rest did it with 52 percent intensity exercise which lasted three months and insulin sensitivity increased in both groups. Kang studied the effect of exercise intensity on insulin sensitivity in obese subjects and concluded that insulin sensitivity with high intensity is affected in obese individuals. Meier et al reported that the more intensity of exercise increases insulin sensitivity is exercised more. Rice e*t al* after 16weeks of aerobic exercise, walking on atreadmill, fixed bicycle or stair reduces the intensity of insulin and improves insulin sensitivity in obesemen. The results are also consistent with the results of Houmard *et al*, O. Donovan *et al*, Barbaj *et al*, Sunghwan *et al*, the results are not consistent with the research results of Wing et al, Haghighi.

The results showed that there is difference between the effects of exercises with different intensity on insulin sensitivity and the effect of exercises with high intensity is more. The results of this study are consistent with the studies of Faramarzi who investigated the consumption of fat acid supplementation along with aerobic exercise on insulin resistance in elderly women and concluded that supplementation with exercise decreases insulin resistance. Gharekhani *et al*, investigated the effect of aerobic exercise on insulin resistance in over weight older women's physical compounds and concluded that eight weeks of aerobic exercise reduces insulin resistance in obese women, the results are also consistent with the studies of Rashid Lamir, Nik Seresht, Ranjbar, Piri, Fukuhara *et al*, the results are not consistent with the study of Hemmati who studied the effect of walking activity on adipokines and insulin resistance index in middle-aged men.

The results showed that walking does not have any effect on insulin resistance, the reason of difference between this study with our research is the type of exercise and intensity of exercise.

SUGGESTIONS AND RECOMMENDATIONS

1. According to the results of the study based on the reduction of blood glucose offasting participants, plasma insulin and improvement of insulin sensitivity, people can use exercise to reduce blood glucose.
2. It is better that obese people use high-intensity exercises.

RESEARCH SUGGESTIONS

1. Study be conducted with a larger number of subjects.
2. It is recommended that during the exercise, participants have the same diet so that the exercise effects due to controlled diet plan become more specific.
3. The same study get conducted in two groups of men and women, and the results get compared.
4. The research be conducted for longer periods of time with further tests to gradually determine the variables.

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