The effects of acute endurance exercise on visfatin and insulin levels in obese women

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Abstract

Visfatin is a newly discovered adipokine which is highly expressed in visceral adipose tissue that may induces changes in insulin resistance. The aim of this study was to examine the effect of acute endurance exercise on visfatin and insulin levels In obese women. The research is a Quasi-exprimental study that 10 obese women volunteers (age 37±9/89 y, weight 92.18±6.64, body mass index 35.95±4.9Kg/m2, fat percent 42.6±5.74% and waist-hip ratio 1.02±0.06) were chosen randomly and participated in a 30 minutes exercise program with 60-70%Vo2max on a treadmill. Serum glucose, insulin, and visfatin were measured before and immediately after exercise and 1 hour after the activity. Serum visfatin levels were measured by ELISA kit. insulin resistance index was calculated by using HOMA-IR model . Analysis of variance with repeated measures was used to determine base difference and the effect of activity type on blood parameters. The findings showed that Acute endurance exercise increased slightly serum visfatin (pre-test 12.64±3.85, post-test 18.61±15.55) and insulin(pre-test 14.21±4.24, post-test 22.43±14.49), immediately after exercise, but this increase did not show significant changes (visfatin, insulin). Also no significant change was seen in glucose and insulin resistance.plasma visfatin increases along with rising glucose concentration and plasma insulin after exercise, but this increase may be related to exercise intensity.

Keywords: Exercise, Insulin , Obese, Visfatin, Women

Introduction

Today, obesity is most prevalent health problem in many communities. Excess body weight realated to health problems, including increased risk of coronary heart disease, diabetes and hyperlipidemia [1]. Adipokine secreted from fat cells or macrophages in this tissue may induce chronic inflammation Is expected to play an important role in the development of insulin resistance and type 2 diabetes [2]. Visfatin is the new Adipokine which was known as a factor of increasing the cell colony B (PBEF) and has a molecular weight of 55-52 kDa, That Plays an important role in regulating glucose also, it can be stated that visfatin as an intracellular protein called Nicotinamide phosphoribosyltransferase (NAMPT) plays a role as a key enzyme in Nicotinamide Adenine Dinucleotide(NAD) biosynthesis cycle [3]. This protein with insulin-like function, stimulates glucose uptake in adipose tissue and myocit ,also inhibits the release of glucose from the liver [4]. plasma visfatin levels are elevated in patients with type 2 diabets and in obesity [5,6]. Exercise stimulates the secretion of

proteins and cytokines from adipose tissues, including leptin, adiponectin, and intercolin, all of which play an important role in metabolism [7,8]. After supervised endurance training systematic visfatin concentrations were decreased in patients with type 2 diabetes and obesity [9-12]

In a study conducted by Wen and colleagues (2006), showed that transport of glucose into adipose tissue is associated with insulin, It seems that free fatty acids have the significant role in decrease insulin sensitivity or increase insulin resistance. And given that visfatin and insulin have similar performance (store triglycerides in fat tissue and help to transport glucose) Concluded that insulin reduces the efficiency of visfatin but, few studies was done on the effect of acute exercise on visfatin gene expression and its plasma concentration that reported conflicting results [13] For example, Frydlnd and colleagues (2007) showed that visfatin gene expression increase following exhaustive exercise and remain high about 24 hours after exercise. also Ghanbari et al (2010) showed that a anaerobic rapid run training session for 60 young men with high fitness [14] has been assosiated With a significant increase in increase in visfatin and insulin plasma levels, blood glucose levels and insulin resistance index immediately after exercise

the level of metabolic indices, with the exception of lactate, at 45 minutes post-exercise recovery phase dropped to baseline values However, several studies were done about the effects of exercise on visfatin levels and serum insulin levels [15,16] Also, sheikholeslami and colleagues (2012) showed that after acute resistance exercise, aerobic exercise and concurrent exercise on healthy male subjects serum visfatin and insulin level were reduse significantly in response to all exercise protocol and remained unchenged after 30-min recovery [16].

Some studies have reported decrease[16] or increase [16] in visfatin levels after acute exercise. No previous stadies have investigated the acute effects of exercise on visfatin level in obese women since the obesity is associated with numerous side effects in women, and its prevalence is increasing, therefore, the present study was designed to investigate the effects of acute endurance exercise on visfatin and insulin levels in obese women

Method

In a quasi-experimental study, 10 obese women aged 20 to 45 years ,non-smokers, with no history of regular exercise. No change in body weight over 2 kg and with no endocrine disorders, diabetes, cardiovascular diseases and chronic conditions had been invited, and then justified. they written form of consent, then randomly participate in study.

The survey results were confidential, and the result of hormonal studies was given to each subjects. The subjects were asked before running the test, to obsver normal sleep patterns (at least 8 hours of sleep), Patterns of daily activities and diet (12 hour fasting before the test) during the study and refrain Any vigorous physical activity, dietary supplements, drugs, coffee, tobacco and cocoa Up to 48 hours before the test and collect blood samples.

blood samples were obtaiend from an antecubital vein before exercise (at rest and after 12 hours of fasting), Immediately after exercise, and 1 hour following exercise. Weight, body mass index, body fat percentage and proportion of Waist to Hip Ratio(WHR) using body composition anlayzer (In Body system, Model 3, Mark BIOSPACE made in Korea) and height using a wall stadiometer (SECA stadiometer brand made in germany with a sensitivity of 1 mm) were calculated . To determine the Vo2max of subjects Bruce test were used. This test was performed 3 days prior to the original plans [17] Subjects' heart rate per minute is calculated by the treadmill. After these steps, especially the predictive equation was used to estimate the Vo2max:

$Vo2max = 14/8 – (1/379 \times (time)) + (0/451 \times (time)2) - (0 / 012 \times (time)3)$

To determine the intensity as a percentage of Vo2max ,maximum heart rate at the moment of reaching the point of subjects exhaustion was used from Karvnn formula:

heart rate=(maximum heart rate- resting heart rate) +(Resting heart rate) + intensity) One session Endurance activities was included general warm-up (10 minutes), aerobic exercise include running on a treadmill for 30 minutes at 60 to 70% Vo2max and cooling (5 min) Blood samples were kept in room temprature for 1 hour and were centrifugaed at 3000 rpm. After centrifugation serom was frozen and stored at -70° C for subsequent analysis . Serum visfatin levels were measured by ELISA metod by assay kit from company's Glory made in America. The serum glucose level (glucose monitoring kit, enzymatic colorimetric method, Pars test sensitivity 1 mg dl), serum insulin levels (ELISA kit Sandyjy company Mrkvdya, Uppsala, with a sensitivity of 1 mg per liter), the resistance insulin (using a homeostasis formula the based on of insulin and glucose concentrations were measured. Data analysis was performed using spss version 18. The kolmogorov-smirnov test was use to determine the normality of diistribution, and variables were found to be normaly distributed. For data analysis and comparison of the different stages of variance repeated measures test was used. 95 percent confidence level for all tests was considered.

Results

Based on the results of mean and standard deviation of age, weight, height, BMI, WHR, and Participants in the study shows in Table 1. Table 2 shows changes in visfatin, glucose, insulin, and insulin resistance activities immediately before and 1 hour after the operation. The results showed that immediately after the exercise protocol, despite a slight increase in visfatin serum there aren't any significant changes in visfatin serum (P>0.05). Other results showed that type of exercise does not have affect on short-term response of serum glucose, although glucose is increased, but this increase is not significant (P>0.05). Also Insulin serum immediately increased after exercise, whereas this increase was not significant (P>0.05). Insulin resistance does not show significant change. All of these variables will decrease after one hour exercise but this decrease in compared with before and after the activity was not statistically significant (P>0.05).

Tabel 1 *Anthropometric characteristics of subjects*

Characteristics	Mean±SD
Age(year)	37±9/89
Height(cm)	161±5/27
Weight(kg)	92/18±6/64
BMI(kg/m^2)	35/95±4/9
fat Percentage	42/6±5/74
WHR	1/02±0/06

Table 2 *Variables Changes from pretest to posttest*

Statistical Indicators	Pre-test	Post-test immediately after the exercise	Post-test 1 hour after the exercise	P-value
	Mean± SD	Mean± SD	Mean± SD	
Glucose (mg/dl)	84/22±10/50	88/33±10/58	83/55±11/22	0/13
Insulin (mIU/L)	14/21±4/24	14/49±22/43	15/12±4/04	0/08
Visfatin (ng/ml)	12/64±3/85	18/61±15/55	14/89±3/27	0/34
Insulin resistance	2/98±1/12	5/04±3/70	3/15±1/10	0/10

Discussion

Due to The results of this study, insulin and visfatin serum increased after a session of endurance training, but this increase was not significant, also the blood glucose levels and insulin resistance increased, but these changes were not statistically significant.

Although some researchers believe that the role of visfatin in relation to obesity and insulin resistance still remains unknown [18] But since this hormone is mainly exists in visceral fat cell, especially in the secreted in visceral regions, and it is thought that the main components of the metabolic syndrome that are obesity and resistance to be linked to insulin, Because the insulin-like

and plasma concentrations will increase with hyperglycemia, and It has been demonstrated in cultured cells and laboratory animals [19,20]. Visfatin has insulin-like effects and these effects will vary by visfatin [15].

Studies by Rolo et al, 2007 and Elgu et al, 2009 revealed that visfatin by endocrine function and insulin-like effects of their actions Through phosphorylated to the insulin receptor and on the other hand increased gene of glucose transporter proteins (GLUT4) and associated genes with beta cells function are efficient in improving insulin sensitivity. Furthermore, visfatin as regulators of intracellular enzyme biosynthesis Nicotinamide adenine dinucleotide , nicotine amide, Nicotine amide phosphorybzil transferase, and also regulates the affected insulin of glucose [21,22]. As Fridlond - Larsen and colleagues (2007) mentioned that Visfatin gene was increased after an exhaustive exercise and will remain high for about 24 hours after exercise [14]. Also it was showed in the study of Ghanbari et al (2010) that practicing a quick run anaerobic fitness in a session in 60 young men with high fitness and insulin plasma visfatin levels which immediately increased after exercise, although the level of all metabolic indices, with the exception of lactate, at 45 minutes post-exercise recovery phase dropped to baseline values [15]. Although visfatin and insulin levels weren't significantly increased in our study, but our results are consistent with two recent studies. The mechanism of the increase in plasma visfatin levels are associated with increased insulin in the exercise and this increase is probably because it is Visfatin regulates insulin levels immediately after exercise. Insulin and glucose levels after moderate endurance exercise performance have been reported [23,24] . Increase in insulin resistance immediately after exercise may be a compensatory increase mechanism to promote insulin secretion. This mechanism may be necessary to protect normal glucose which stimulated insulin during the metabolic stress secretion [25]. The main reason for visfatin secretion from adipose tissue under these conditions is not known, however, laboratory studies indicate that Visfatin response to glucose which released from fat cells [7] and since the participants in the study were obese, probably saved visfatin in visceral fat deposits were great. Also in studies of Larson and colleagues, visfatin gene in abdominal fat was increased 3-fold in response to exercise [14]. In an experimental model of insulin resistance associated with obesity, circulating visfatin levels are increased with obesity apparently because of secreted by white abdominal of adipose tissue (because visfatin mRNA increased in this tissue not in subcutaneous adipose or liver tissue) [26] , So that visfatin levels in obese is high, maybe they don't have normal visfatin levels not and it cause changes not being significant in visfatin after exercise. Also our results are inconsistent to haider et al (2006), but the changes in visfatin were associated with the corresponding changes in insulin and glucose [27].

Recently sheikholeslami et al (2011) reported that acute exercise resulted in decreased plasma visfatin level, which was accompanied by decreases in insulin concentrations [16]. It is also shown that gender differences in the relative carbohydrate and fat oxidation And response to regulate them are important in sports [28-30] , Thus, since the subjects in this study were obese women, They may respond differently to men, And perhaps because of differences in this study with sheikholeslami's subject is gender.

In general, these studies demonstrated that both acute and chornic exercise affect the regulation of visfatin. Glucose is regulator of -induced insulin secretion by pancreatic beta cells, although the amino acid, Keton, Various foods, Digestive peptide, Neurotransmiter also affects insulin secretion.

Glucose stimulated insulin secretion through a series of regulatory steps that the transfer is initiated by the transfer GLUT4 into beta cells, Glucose levels above 70 mg dl, will stimulate insulin synthesis [31]. Since people in this study were obese, and an endurance activity by intensity of 60 to 70 percent of Vo2Max subjects failed to significantly increase blood

glucose levels, and by considering that glucose is regulated did not significantly increase by insulin levels, but maybe if it was higher exercise intensity increased, it would higher the glucose and insulin levels.

Hormonal regulations of visfatin's research shows that this Adipokin is regulated by many other factors such as growth hormone, glucose and plasma protein or gene expression, and in different tissues respond of Visfatin is different to these factors in order to increase or decrease [27,32]. There is conflict on visfatin gene in visceral and subcutaneous fat. It also showed that the levels of visceral fat than in subcutaneous fat have not been reported [6,33], therefore, further investigation is necessary in these fields and comparing obese, lean endurance, and speed up their response. The limitations of this study were lack of impulse control and lack of control hidden diseases.

Conclusion

Therefore, possible causes in increase of plasma visfatin concentrations increase in plasma glucose and insulin after exercise is consistent, but this increase may be associated with the exercise and gender.

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Contributions

Study design: HE
Data collection and analysis: HN
Manuscript preparation: KB, AVN

Conflict of interest

"The authors declare that they have no competing interests."

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