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Serum Concentration of Ghrelin, Oxidative Stress and Lipid Parameters in Obese Subjects

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ABSTRACT

Objective: Ghrelin is a hormone with peptide structure. It has fatty tissue and increases appetite. Obesity is a multifactorial chronic disease characterized by an increase in fat tissue. Fat tissue, like the endocrine organ, triggers oxidative stress and can lead to the development of obesity-related pathologies. The purpose of this study is to examine the relationship between the ghrelin in blood, and oxidative stress and lipid parameters.

Materials and Methods: The study was conducted with 61 obese and 24 healthy individuals. Ghreline levels were measured using the ELISA method, while total antioxidant status (TAS) and oxidant status (TOS), triglyceride (TG), total cholesterol (TC), HDL-cholesterol (HDL-C) and LDL cholesterol (LDL-C) levels were measured using the photometric method.

Results: A negative correlation was found between body mass index (BMI) and ghrelin levels in the obese group ($p<0.05$). But there was no significant difference of ghrelin levels in obese and control groups ($p>0.05$). TAS was observed to be lower in obese compared to control group, while The Oxidative Stress Index (OSI) was found to be significantly higher than the obese group ($p<0.05$). TG levels were found to be increased in obese; whereas ghrelin, TC, LDL-C and HDL-C levels did not show any difference ($p>0.05$).

Conclusion: Increasing obesity level (BMI) and decreasing ghrelin level were found to be correlated. New studies are needed in order to discover the changes in ghrelin level connected to oxidative stress.

Keywords: Ghrelin, obesity, oxidative stress

INTRODUCTION

Obesity is an increase in the amount of fat in the body, which occurs when energy intake is more than energy spent.

Today fatty tissue is no more regarded as a mere fat storage since its carries an important duty. That is, it affects other organs and carries communication between them, therefore fatty tissue is regarded as an endocrine organ which synthesizes and releases many chemical messengers, the cytokine of fatty tissue (adipokine) (1-3).

In obesity, an increased fatty tissue brings many physical and biochemical pathologies (1,2).

Ghrelin is an acylated peptide which contains 28 amino acids and it is primarily produced in the stomach and the proximal small intestine (4). Ghrelin activates the hypothalamus and other related systems in the brain, therefore increasing gastrointestinal motility and decreasing insulin secretion (5). The growth hormone secretagogue receptor (GHS-R) mediates the different actions of the synthetic growth hormone secretagogues (GHS) and the endogenous ligand of this

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receptor, ghrelin (6). This endogenous ligand for this GHS receptor (GHS-R) was generally identified by Kojima et al. in 1999 and named 'ghrelin' (7). Currently it's the only known oroxigenic hormone (8). Cancer patients with loss of appetite were reported to gain back appetite when administered ghrelin (9).

In healthy cells, oxidation of molecular oxygen is a well-controlled process. However, in cases of cell damage and disease, superoxide radical ($O_2^{\cdot-}$) and hydrogen peroxide (H_2O_2) amounts increase. In the case of increased reactive oxygen radicals (ROS), insufficient antioxidants lead to oxidative stress. In the case of oxidative stress, proteins, lipids and DNA are damaged. Several studies report that increased oxidative stress in obesity contributes to development of atherosclerosis (10-14).

The aim of this study was to investigate the relationship between blood levels of ghrelin hormone, body mass index (BMI), oxidative stress and lipid parameters, which are important in carbohydrate and fat metabolism.

MATERIALS AND METHODS

Study Design and Data Collection

This study includes 24 controls (13 male and 11 female) and 61 obese (37 male and 24 female) who have consulted Mega Medipol Hospital Laboratory of Medipol University between September and October 2015. After taking the approval of ethical committee of Medipol University, all the patients were informed and confirmed consent documents were taken from all them. Groups were classified according to their BMI into two groups: BMI>18.9 and BMI<24.9 kg/m^2 are considered as normal weight and BMI>30 kg/m^2 are considered as obese. BMI values were obtained by dividing the weight (in kg) by the square of height (m^2).

The mean BMI (kg/m^2) in the control group was 23.52±0.89, while in the obese group it was 33.76±6.15.

Exclusion Criteria in the Study

Exclusion criteria in the study was as follows: younger than 18, over 75 years old, smoking habits, hypertension, heart diseases, osteoarthritis, cancer, polycystic disease, inflammation and infectious diseases not included in the study. The study started after the approval of Medipol University Ethics Board. All the subjects were informed about the study and their approved consent forms were received.

Blood Collection and Storage

Venous blood was collected in the early morning before breakfast and after overnight sleep. Blood samples were collected in yellow covered flat tubes and purple covered (EDTA containing) tubes. Yellow covered tubes were centrifuged at 2400 rpm for 10 minutes in the clinical biochemistry laboratory of Medipol University, and blood cells were separated from serum. Separated serums were taken into Eppendorf tubes and kept at -80°C until the analysis.

Methods Used

Following analyses were carried out: Ghrelin, triglyceride (TG), total cholesterol (TC), low density lipoprotein cholesterol (LDL-C), high density lipoprotein cholesterol (HDL-C), total antioxidant status (TAS), total oxidant status (TOS) and oxidative stress index (OSI) levels.

Serum ghrelin levels were determined by using Ray Bio EIA-GHR-1 Elisa kit; TAS and TOS were determined by colorimetric method. OSI was calculated using the formula given below: OSI= [(TOS, μmol H_2O_2 equivalent/l)/(TAS, μmol Trolox equivalent/l)] x100 (15). Serum TC, HDL-C, LDL-C and TG levels were measured with Roche/Hitachi C501 instrument photometrically with the kits recommended by the instrument company.

Statistical Analysis

The Statistical Package for the Social Sciences (SPSS) Windows version 22.0 (IBM Corp.; Armonk, NY, USA) program was used to evaluate the statistical analysis of the study. Variables were defined in ±SD limits. T-test was used for the comparison of measured variable average values that obey normal distribution, in two groups. In order to compare dependent variables paired t-test was applied. Also, Mann-Whitney U-test was preferred to compare the average values obtained that do not obey normal distribution. For all the test $p<0.05$ was considered significant.

RESULTS

As it was shown in Table 1, there was no significant change in the plasma levels of ghrelin ($p>0.05$) in obese and control groups.

Serum TG levels were increased in obese group ($p<0.05$) whereas other lipid parameters such as TC, LDL-C and HDL-C were normal levels ($p>0.05$).

There was a significant decrease in serum TAS in obese group ($p<0.001$), serum TOS were not significantly changed ($p>0.05$) and OSI were significantly high in obese compare to normal subjects.

When correlation analyses were examined, a positive relation was found between TOS and OSI (r: 0.77, $p<0.05$) TOS and TG (r: 0.52, $p<0.05$), a negative correlation was observed between TOS values and HDL (r:-0.34, $p<0.05$). In addition, positive relation was found between OSI and TG (r:0.33, $p<0.05$).

The plasma levels of ghrelin were significantly negatively correlated with BMI (r: -2,65, $p<0.05$).

DISCUSSION

Known as the "orexigenic hormone", ghrelin maintains the energy balance of the organism together with neuroendocrine regulation, intestinal and pancreatic peptides (4,5,16). Despite these systems for protecting the organism, the prevalence of obesity is increasing in the world. Obesity results in insulin resistance, inflammation, oxidative stress in parallel with increasing fat tissue (1).

In this study, we investigated the relationship between ghrelin serum concentration and oxidative stress and lipid parameters

Table 1. Laboratory findings of control and obese group.

	Control group (Mean±SD)	Obese group (Mean±SD)	p*
Ghrelin (pg/mL)	110.78±25.46	110.43±25.43	0.955
TAS (µmol Trolox Equiv./L)	0.92±0.11	0.81±0.13	<0.05
TOS (µmol H_2O_2 Equiv./L)	26.96±5.49	28.26±6.31	0.386
OSI (AU)	2.92±0.62	3.56±0.86	<0.05
HDL (mg/dL)	53.22±17.82	47.65±13.52	0.149
LDL (mg/dL)	119.35±34.45	121.98±37.88	0.768
TG (mg/dL)	126.14±82.92	158.13±85.36	0.033
TC (mg/dL)	195.46±41.36	198.35±40.99	0.771

TAS: total antioxidant response; TOS: total oxidant status; OSI: oxidative stress index value; AU: Arbitrary unit; TC: total cholesterol
*p<0.05 for t test.

in the obese and healthy control group, which increased appetite and food intake.

Mucioli et al. (17) reported that ghrelin, one of the peptides in the appetite center, increases appetite and causes obesity. As reported by Kara et al. (18), Ghrelin injections to mice caused an increase in fat tissue by reducing fat use. Ghrelin's fat tissue and appetite-enhancing effects are independent of GH effects and are thought to be regulated by specific neurons in the CNS where leptin is also a mediator.

Wren et al. reported that when ghrelin is administered intravenously to normal weight healthy people, the desire to eat is increased. Blood levels of ghrelin decrease after fasting and after a sugary and fatty meal (5).

Tschöp et al. (19) reported that ghrelin levels were lower in obese subjects than in weaker subjects. In the Suematsu et al. study, ghrelin was measured in 17 obese and 17 healthy subjects and the ghrelin level was found to be lower in the obese group than in the control group (12). Participants had an increase in serum ghrelin levels as a result of their weight loss after the diet (14,17-19).

In the study of Cinaz et al. (20), hunger and satiety ghrelin levels were measured in 38 obese and 19 healthy children. In both obese and control groups fasting ghrelin levels were higher than satiety ghrelin levels ($p<0.05$). The researchers also showed that the hunger and satiety ghrelin levels of obese children were lower than the control group ($p<0.05$). The study also found a negative correlation between BMI and hunger strike levels in the obese group.

In our study, the ghrelin concentration was not statistically different in the control and obese group ($p>0.05$). However, increased obesity level (BMI) was found to be correlated with decreased ghrelin level (r: -2.65 $p<0.05$). This situation is caused by positive energy balance which suppresses ghrelin secretion in obese people. This finding is consistent with studies suggesting that ghrelin levels are reduced in obese individuals.

In our study, TAS was observed to be lower in obese compared to control group, while OSI was found to be significantly higher than the obese group ($p<0.05$). Obese group with oxidative stress do not differ in terms of ghrelin levels ($p>0.05$). The only study in this area in the literature was reported by Suematsu et al. In their study, free 8-epi-prostaglandin $F_{2\alpha}$ was measured as a systemic marker of oxidative stress and, independently from obesity, it was discovered that increases in oxidative stress decreases ghrelin (12).

In the literature, in general, ghrelin levels were found to be decreased in obese subjects, but the mechanism of this decrease has not been explained (19).

The LDL-C, HDL-C and TC levels did not significantly change when compared to control group and remained within the normal reference limits when the lipid profile in both groups were examined and TG levels were found to be statistically higher in the obese group ($p<0.05$). Positive correlation between TG and TOS and OSI shows the role of TG increase in the formation of oxidative stress.

In conclusion, ghrelin levels did not significantly change in obese group when compared to control group. This situation is caused by positive energy balance suppresses ghrelin secretion in obese people. Understanding obesity and its associated diseases with the appetite hormone ghrelin will help to develop new strategies for the prevention of obesity. New studies are needed for guidance in this area.

Ethics Committee Approval: Ethics Committee Approval was received for this study from the ethics committee of Medipol University.

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – S.Z., T.Y., N.E.; Design – S.Z., T.Y., N.E.; Supervision – T.Y., N.E.; Resource – N.E.; Materials – N.E., G.Ü.; Data Collection and/or Processing – S.Z., G.Ü.; Analysis and/or Interpretation – S.Z., T.Y., N.E.; Literature Search – S.Z., N.E.; Writing – S.Z., N.E.; Critical Reviews – T.Y., N.E.

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