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Original Article

The effect of obesity and components of metabolic syndrome on leptin levels in Saudi women

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ABSTRACT

Background: Leptin levels are reported to be increased with excessive body fat and is a potential determinant of obesity and its complications. Our Objective is to evaluate the relationship between leptin levels and BMI, waist circumference and metabolic syndrome components in normal and obese females classified according to their BMI.

Subjects and methods: A total of 136 female subjects aged between 20 and 60 years were recruited for the current study. Anthropometric measures included body mass index and waist circumference. The blood samples were used for estimation of plasma fasting blood glucose and serum was used for estimation of triglycerides, total cholesterol, low and high density lipoproteins, and total leptin.

Results: Correlation between glucose and lipids profile with waist circumference among the whole study group (obese and non-obese) is reflecting that a strong positive correlation between BMI and blood glucose, serum TGs, cholesterol and LDL, a negative correlation was reported between BMI and serum HDL. Mean of leptin concentrations in two groups were found to be 5.77 ng/ml (±1.00) in non-obese and 28.89 ng/ml (±4.91) in the obese with metabolic syndrome. Leptin had a positive correlations with triglycerides ($r = 0.84$, $p < 0.001$), total cholesterol ($r = 0.77$, $p < 0.001$), LDL ($r = 0.83$, $p < 0.001$), waist circumference ($r = 0.86$, $p < 0.001$) and BMI ($r = 0.72$, $p < 0.001$) in the test group. a negative correlation was reported between BMI and serum HDL ($r = -0.48$, $p < 0.001$).

Conclusion: Leptin levels were high in Saudi women with high BMI and waist circumference. There was a significant correlation between leptin levels and Obesity.

1. Introduction

Leptin is an adipocyte-derived hormone involved in lipid metabolism [1], glucose metabolism, energy expenditure [2], regulation of pro-inflammatory T lymphocyte and anti-inflammatory acute and innate immune responses [3]. Leptin levels are reported to be increased with excessive body fat [4].

Obesity can result from increased energy intake, decreased energy expenditure, or a combination of the two [5]. It is a condition of an abnormal or excessive accumulation of body fat in adipose tissue to the extent that health may be impaired [6]. Previous genetic studies suggests that obesity is a complex of multifactorial disease that develops from the interaction between genotype and the environment, it involves the integration of social, behavioral, cultural, physiological, metabolic, and genetic factors [7]. Obesity is directly or indirectly associated with various diseases [8], especially cardiovascular diseases [9], hypertension, diabetes mellitus, sleep apnea, osteoarthritis, fatty liver disease, gallbladder disease, and certain types of cancer. Therefore, its manifestation poses a real threat to health [5]. In Saudi Arabia the prevalence of obesity among female and, to a lesser extent, male adults has reached epidemic proportions. Obesity can be regarded as a major health problem among the Saudi population. A previous study "date" indicated that in the overall population aged 14–70 years, 13.05% of males and 20.26% of females were obese. This value is higher than that reported in the United Kingdom, Australian, Americans and Italian populations [10].

Globally, obesity has reached epidemic proportions [11], with

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more than one billion adults overweight, at least 300 million of them are clinically obese [12]. It leads to adverse metabolic effects on blood pressure [13–15]. Lipid and glucose metabolism are mediated by insulin, and insulin resistance is a manifestation of the metabolic disturbances in obese subjects [12] leading to the condition of metabolic syndrome [16]. The metabolic syndrome is a constellation of physiological risk factors that occur to a greater degree than expected by chance, as reported in earlier work on clustering of traits [17]. The metabolic syndrome traits, as defined by the National Cholesterol Education Program Adult Treatment-Panel III (NCEP-ATP III) panel, include an increased waist circumference, blood pressure elevation, low HDL cholesterol, high triglycerides, and hyperglycemia [18,19].

The metabolic syndrome is considered present when at least 3 of the 5 traits are present, and affected individuals typically are insulin resistant. The metabolic syndrome is associated with significant increase in cardiovascular morbidity and mortality being the most common cause of death in the Western world [17]. Obese patients develop leptin resistance, and an increased waist circumference (WC) due to deposition of abdominal fat. The prevalence of MS according to the ATP-III criteria was 33.8% and leptin concentrations were 2.5 times higher in women than men. Subjects with MS had higher levels of leptin compared with those without MS. Leptin increased significantly while BMI increased in addition to other variables such as WC, HDL-C, insulin levels, and homeostasis model assessment for insulin resistance index [20].

Based on the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) definition, the largest study, conducted over a 5-year period between 1995 and 2000 and covering different regions of Saudi Arabia, reported the overall MS prevalence in adults aged 30–70 years to be about 40%, with the most common factor being low HDL-C [20]. The prevalence of CVD risk factors is high among women in Saudi Arabia especially in obesity and physical inactivity [21].

The aim of this study was to evaluate the relationship between leptin levels and BMI, waist circumference and metabolic syndrome components in normal and obese females classified according to their BMI.

2. Subjects and methods

This retrospective study was conducted in the Biochemistry laboratory, Department of Medical Laboratories, Faculty of Medicine, Umm Al-Qura University. Saudi Arabia from January 2015 to March 2017.

2.1. Subjects

A total of 136 female subjects aged between 20 and 60 years were recruited for the current study. These were age matched 96 females with body mass index (BMI $\geq$30 kg/m^2 as a study group, and 40 apparently healthy women in normal weight as a control (BMI $<$30 kg/m^2). Those on lipid lowering drugs, hormonal medications, and cardiovascular diseases like stroke and subjects who did not give consent were exempted. Information on age, maternity, menarche and menstrual cycle disturbance were obtained, using a questionnaire.Weight, height, waist circumference, and systolic and diastolic blood pressures (mean of three consecutive measurements) were measured.

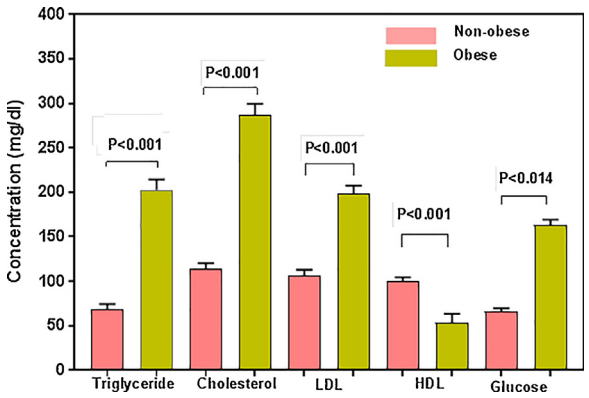

Fig. 1. Glucose and lipid profile levels among study groups.

2.2. Sampling

Following overnight fasting period 5 ml whole venous blood samples were withdrawn from each subject. The sample was divided into two tubes (plain and EDTA tubes) for prepared serum and plasma respectively. The samples were used for estimation of plasma fasting blood glucose. Serum was used for estimation of triglycerides, total cholesterol, low and high density lipoproteins, and total leptin.

2.3. Metabolic syndrome (MS)

These were subjects recruited by consultant physicians from the Clinic and Medical out-patient (MOP) King Adel Aziz hospital. Metabolic syndrome is defined by using NCEP ATP III guidelines. Based on five major components, the metabolic syndrome was diagnosed such as: (i) Hypertriglyceridemia TG $\geqq$150 mg/dL; (ii) Waist circumference $\geqq$102 cm for men and $\geqq$88 cm for women, (iii) Blood pressure Systolic – BP $\geqq$130 mmHg; diastolic BP $\geqq$85 mmHg, (iv) HDL-C = $<$ 50 (v) FPG $\geqq$110 mg/dL. The definition suggested by the Adult Treatment Panel III (ATP III) of the National Cholesterol Education Program [19].

2.4. Bio-chemical investigation

Serum total cholesterol (TC), triglyceride (TG), HDL-C, and LDL-C were estimated by Direct Homogenous method, enzymatic colorimetric test. The kits were provided by HUMAN Gesellschaft-für Biochemica und Diagnostica mbH.

Table 1
Anthropometric data among study females.

Index	Controls n = 47	Obese with MS n = 95	P- value
Age (years)	39.49 ± 10.23	43.49 ± 9.416	0.022
Body mass index BMI(Kg/m^2)	24.53 ± 2.73	41.91 ± 6.08	0.001
Waist circumference(cm)	73.81 ± 13.93	107.46 ± 12.06	0.001
Systolic blood pressure BP (mmHg)	70.19 ± 7.66	106.62 ± 11.67	0.001
Diastolic blood pressure BP(mmHg)	113.27 ± 1.17	134.58 ± 2.08	0.001

Values are mean ± Std. Deviation; n = number of subjects,p = probability; BMI = Body mass index; WC = waist circumference andBP = Blood pressure.

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