ORIGINAL ARTICLE

THE ASSOCIATION OF INSULIN RESISTANCE WITH BODY MASS INDEX AND BODY FAT PERCENTAGES IN NON-DIABETIC OBESE WOMEN

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Abstract

Objective: Obesity is an important risk factor for cardiovascular diseases. The present study is aimed to evaluate the association of insulin resistance with body mass index (BMI) and body fat percentage (BFP) in obese female.

Methods: Female participants aged 18 years or older, with a BMI ≥ 30 kg/m2, visited the obesity outpatient clinic between January – July 2015, were enrolled into the study. BMI and BFPs of all participants were assessed by bioimpedance analysis. Besides, fasting insulin (FI) and fasting plasma glucose (FPG) levels were measured and HOMA-IR was calculated using the formula; "FPG (mmol/L) x fasting insulin (uIU/mL) / 22.5". Participants with a HOMA-IR level of 2.5 and above were considered to have insulin resistance.

Results: One hundred and seventy females were included in the study and the mean age was40.53 ± 10.12 years. While there was a positive correlation between HOMA-IR and BMI, no significant relationship was observed with BFP (p=0.01 and p=0.523, respectively). There was a significant relationship between BMI and BFP (p<0.001).

Conclusion: While there was a relationship between HOMA-IR which is the indicator of insulin resistance, and BMI, no relation was found with BFP.

Keywords: Obesity, Insulin Resistance, Body Mass Index, Fat Body.

Introduction

Obesity which defined as a localized or wide spread fat mass increase, has been getting a global public health issue and an economic problem with an increasing frequency all over the world (1). According to the The Organisation for Economic Co-operation and Development's (OECD) data for Turkey in 2017, obesity prevalence was determined as 53.9% and appears to be more common in women than men (2). Although many methods are used for diagnosis and classification of obesity, body mass index (BMI) is the one commonly used (1). Obesity is one of the most important risk factors for insulin resistance, which is defined as non-responsiveness to endogenous or exogenous insulin (3). Insulin resistance has a role in etiopathogenesis of type 2 diabetes mellitus, metabolic syndrome and cardiovascular diseases (4). Many methods are used to evaluate insulin resistance but Homeostasis Model Assesment (HOMA-IR) is the most commonly preferred method (4). The present study is aimed to evaluate the association of insulin resistance with BMI and body fat percentage (BFP) of obese individuals.

Method

Study Population

Female participants aged 18 years or older, with a BMI ≥ 30 kg/m2, followed and monitored at the obesity outpatient clinic of Kartal Dr. Lutfi Kirdar Training and Research Hospital between January 2015 and July 2015, were included into the study. All the records of participants were evaluated retrospectively. Participants were divided into groups by the BMI levels and grouped as class 1obesity with a BMI between 30.00 and 34.99 kg/m2, class 2 obesity with a BMI between 35.00 and 39.99 kg/m2 and morbid obesity class with a BMI ≥40 kg/m2 (1).

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The study was approved by the local Ethical Committee of Kartal Dr. Lutfi Kirdar Training and Research Hospital (Protocol No: 2016/514/83/1).

Measurements in the Study

All participants' BFP were measured with an empty bladder and on a fasting state over an 8-hours-night rest, by bioelectrical impedance analysis method (BIA) (JAWON Medical GAIA 359 PLUS). Additionally, fasting blood glucose levels after 12-hours fasting by hexokinase method (Olympus AU2700) and fasting insulin levels by immunoassay method (Abbott Diagnostics, USA) were evaluated. Afterwards, HOMA-IR levels were calculated by the formula "fasting insulin (uIU/mL) x fasting glucose (mmol/L) / 22.5" and the participants who have a HOMA-IR ≥2.5 were accepted as insulin resistance present (5).

Exclusion Criteria

Participants with Type 1 diabetes mellitus, Type 2 diabetes mellitus, chronic liver disease, chronic kidney disease, Cushing syndrome or pregnancy were excluded from the study.

Statistical Analysis

SPSS-17 (Statistical Package for Social Sciences) for Windows 10.0 software was used to evaluate the study data. The numerical variables were expressed as mean, standard deviation, median and range (minimum-maximum) and the categorical variables were expressed as number and percentages. The Spearman correlation test was used for the comparison of continuous variables with abnormal distribution. In addition, One-way ANOVA test and Student-t test were used to analyze continuous variables with normal distribution. A p value <0.05 was considered statistically significant.

Results

A total of 170 female were included in the study and the mean age was determined as 40.53±10.12 years. When they were divided into groups by their BMIs; of the participants, 42 (24.71%) was determined as class 1 obesity, 69 (40.59%) as class 2 obesity and 59 (34.70%) as morbid obesity group. Measurements of BIA and laboratory results of participants were summarized on Table 1.

Insulin resistance was determined in 96 (56.47%) participants. Measurements of BIA and ages related to presence of insulin resistance were summarized on Table 2. A relation was determined between BMI with HOMA-IR and fasting insulin (r=0.260, p=0.01 for HOMA-IR and r=0.292, p<0.001 for fasting insulin). No significant relation was observed between BFP with fasting insulin levels and HOMA-IR (p=0.977 and p=0.523 respectively). But a significant relationship was determined between BMI and BFP (r=0.656, p<0.001).

According to the obesity groups, fasting insulin levels were found 12.52±8.33 uU/ml in class 1 obesity group, 12.36±5.16 uU/ml in class 2 obesity group and 15.92±9.7 uU/ml in morbid obesity group (p=0.022). Additionally, when presence of insulin resistance was examined according to the obesity classification, insulin resistance was identified as 21 (12.35%) in class 1 obesity group, 38 (22.35%) in class 2 obesity group and 37 (21.76%) in morbid obesity group.

Discussion

The present study is aimed to evaluate the association of insulin resistance with body mass index and body fat percentages in obese women. As a result of the study, a relationship between fasting insulin and HOMA-IR with BMI was determined, but no similar

Table 1. Measurements of BIA and laboratory results

	n (%)	Mean ± SD
BMI (kg/m²)	170 (100.00)	38.32 ± 5.31
BFP (%)	170 (100.00)	41.87 ± 9.55
Glucose (mmol/L)	170 (100.00)	96.22 ± 10.64
	n	**Median (Minimum-Maximum)**
Insulin (uIU/mL)	170 (100.00)	11.60 (1.00-52.00)
HOMA-IR	170 (100.00)	2.80 (0.19-11.68)

BFP; Body fat percentage, BMI;Body mass index

relation was observed with BFP. Additionally, BMI in the group with insulin resistance was significantly high, but no significant difference was determined for BFP.

Obesity has an important role on developing insulin resistance and hyperinsulinemia, but pathogenic mechanisms are not yet completely defined (3). In some studies, a relation between waist circumference and waist-to-hip ratio with insulin resistance was determined (6-9). But in different studies, a relationship between BMI and insulin resistance was determined (9-12).

In a study, a relationship was observed between obesity and insulin resistance in both individuals with or without diabetes mellitus; and an increase by 11 times in risk of diabetes mellitus with a rise from 20 kg/m2 to 30 kg/m2 in BMI (13). Levels of HOMA-IR were also determined high among obese people in other studies (14,15). A relation between BMI and insulin with HOMA-IR levels was also determined in the studies held in Turkey (16,17). In the present study, similarly, a significant relationship between BMI and insulin resistance with HOMA-IR levels was determined. In both studies by Charbonneau-Roberts et al. and Porchia et al., it's observed that BMI and BFP are effective on insulin resistance, but the effectiveness of BMI is superior to BFP (10,11). There are a limited number of studies held on the relationship between BFP and insulin resistance. Memili et al. determined a low level relation between BFP with HOMA-IR and fasting insulin (18). In another study by Sasaki et al., a significant relation was observed between HOMA-IR and BFP in patients with a BMI level, normal or below normal (19). But in the present study, no significant relation was observed between BFP with fasting insulin and HOMA-IR. The reason of this result might be that our study population had a higher mean BMI than the other studies and also had a higher percentage of morbid obese participants. Correlatively with the study by Atar in 2005, a significant relation was observed in this study (20). Because it was held in only one center, the present study results do not reflect the community, and this was one of it's limitations. Using HOMA-IR measurement to evaluate insulin resistance in this study was another limitation. HOMA-IR is an easily applied method to evaluate insulin resistance, and although frequently used for especially epidemiological studies, the golden standart method for diagnosis is euglycemic insulin klemp test (21). In conclusion, a relationship was determined between BMI with fasting insulin and HOMA-IR levels, but no relation was observed with BFP. There is a need for other prospective studies to be held especially among obese individuals, to evaluate the relationship between insulin resistance with BMI and BFP.

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Table 2. Measurements of BIA and ages related to presence of insulin resistance

	Presence of insulin resistance		p*
	No	Yes	
Age (year)	42.34 ± 8.77	39.18 ± 10.92	***0.036***
BMI (kg/m^2)	37.12 ± 4.03	39.17 ± 6.04	***0.021***
BFP (%)	43.18 ± 9.50	40.82 ± 9.44	0.115

BFP; Body fat percentage, BMI;Body mass index
** Student t Test*

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