Parental Obesity Compared with Serum Leptin and Soluble Leptin Receptor Levels Among Obese Adults in the Gaza Strip

By

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ABSTRACT

Objective: To investigate whether parental obesity influences serum leptin hormone and soluble leptin receptor (Ob-Re) concentrations among obese adults in the Gaza Strip.

Materials and Methods: A case-control design was used. Sample used was convenient and obtained from two largest obesity clinics in the Gaza strip. It consisted of 83 overweight and obese adults without history of other diseases (case group). Control group consisted of 83 ideal weight adults who were selectively chosen from the same clinics. Self reported structured interviews and serum blood samples were obtained from both groups. Human leptin competitive ELISA kits were used for determination of leptin and Ob-Re concentrations in the blood serum. SPSS system was used to analyze the data.
**Results:** About 69% of the case group was found to have paternal and/or maternal obesity. Moreover, the mean of serum leptin hormone levels for the obese adults with history of obese parents was significantly higher than obese adults without history of obese parents (p= 0.02). No significant correlation was observed between parental obesity and Ob-Re levels among the case group (p=0.88).

**Conclusion:** Parental obesity plays an important role in obesity and serum leptin level during adulthood.

**Keywords:** parental obesity, leptin, soluble leptin receptor, adult obesity, the Gaza Strip.

**INTRODUCTION**

Obesity is a chronic condition that is characterized by long term energy imbalance due to excessive caloric intake with slightly energy expenditure [1]. According to recent National Institutes of Health (NIH) statistics, obese individuals have a 50 to 100% increased risk of death from all causes compared to normal weight individuals. Obesity plays an important role in cardiovascular diseases, diabetes, stroke, hypertension, gallbladder disease, osteoarthritis, sleep apnea and some forms of cancer [2].

Leptin is a polypeptide hormone that inhibits food intake and stimulates energy expenditure. It is encoded by the *ob* gene and is secreted by the white adipose tissue into the circulation. It was first isolated from the mouse *ob* gene by positional cloning. The gene encodes adipose tissue mRNA translated to a highly conserved protein with 167-amino acids [3]. It was reported that a number of non-adipose tissues have been shown to synthesize and secret low level of leptin including the gastric mucosa, mammary, epithelial cells, myocytes, placenta, testes, ovaries and hair follicles [4-8].

Ob-Re makes up the main binding compound of the leptin in the blood plasma [9]. In obesity, level of Ob-Re is decreased compared with lean tissues control resulting in an increase fraction of free leptin [10]. Moreover, reduction of body weight through diet or surgical procedure significantly increases concentration of
circulating Ob-Re and thus increases the fraction of bound leptin. Thus, Ob-Re acts as a regulating factor of leptin action and plays an important role in leptin resistance [11]. However, in the blood stream, leptin circulates attached to the receptors, transported to the hypothalamus, where it stimulates or inhibits release of several neurotransmitters that are involved in energy metabolism [12].

The Body mass index (BMI, Kg body weight/height in meter square) has been commonly used for measuring the percent of body fat. Thus, differences in BMI between people of the same age and sex are usually due to body fat. Its value falls into one of these categories: below 18.5 corresponds to underweight and possibly malnourished, 18.5-24.9 corresponds to healthy normal weight; 25-29.9 indicates overweight, and 30 or above corresponds to obesity. It should be emphasized that, these cut-off values of the BMI are very applicable for Orientals [13], and frequently used in Palestinian Ministry of Health for measuring of adults obesity [14]. Obesity is a complex, multi-factorial disease [15-17]. A parental history of obesity is one of these factors that modifies the percent body fat gain during adulthoods [18], but how parental obesity affects a chance of a child’s becoming obese adult has not been cleared yet. Obesity is increasing worldwide at an alarming rate in both developed and developing countries. Currently in the United States, obesity is associated with about 300,000 deaths per year, and an economic cost of approximately $117 billion [19]. In European countries the prevalence of obesity has increased by about 10-40% in the majority of countries in the last decade [20] In Saudi Arabia, the prevalence of obesity was more than 25 % among all regions at the end of the last century [21]. Although the prevalence of obesity among Palestinian adults aged 30-65 years is high, 30% for men and 49% for women [22], there is a limited information on obesity and its relationship to a number of chronic diseases [14]. Our previous study showed that, in contrast to Ob-Re, leptin had significant positive correlations with percent body fat and lipid profiles among the obese adults in the Gaza Strip [23]. This study, therefore, aims to determine the effect of obesity in one or both
parents on adult obesity and on both serum leptin and Ob-Re levels among the same subjects in the Gaza Strip.

MATERIALS AND METHODS

Study design: The present study involves two groups, case adults (BMI ≥25 kg/m²), and control adults (BMI between 18.5 to 24.9 kg/m²).

Study population: The study population was all adult individuals who have excess body weight from the specialized herbal center and Europe regimen center in North and Mid-Zone Governorates in the Gaza Strip, respectively.

Setting and Study sample: Two largest obesity clinics from the North and the Mid-Zone Governorates in the Gaza strip were chosen in order to collect a representative sample for this study. About 42% of the subjects were recruited from the specialized herbal center (North Governorate) and about 58% of the subjects were from Europe regimen center (Mid-Zone Governorate). Study sample was convenient and consisted of 83 case group adults (40 men and 43 women; mean age was 36.5 ± 9.5) without history of other diseases. Control group consisted of 83 ideal body weight adults (40 men and 43 women; mean age was 36.3 ± 9.5) that selectively chosen from the same places to match case group in age and gender.

Ethical consideration: The study protocol was approved by the local ethics committee (Palestinian National Authority, Ministry of Health, Helsinki Committee).

Questionnaire interview: Face to face structured interviews were used to collect data from all study individuals. The questionnaire included issues about different personal and socio-economic information (age, gender, marital status, weight and height, income, type of food, number of meals and paternal and/or maternal obesity).

Blood sampling and processing: Twelve hours fast blood samples were collected from the cases and controls by well-trained and experienced medical technologist. Six ml of venous blood sample was drawn from each individual from the median cubital vein. The
serum samples were separated by centrifugation for 10 minute at room temperature at 3500 rpm. The separated serum was frozen at -70°C until assay. Determination of human leptin and Ob-Re levels were carried out by competitive enzyme immunoassay (Diagnostic System Laboratories, USA) technique [24, 25].

Data analysis: Data were analyzed using Statistical Package of Social Sciences (SPSS) system (Version 13.0). Pearson’s correlation coefficient (r) was performed at a significance level of 5 %, and any correlation between two numerical data was considered statistically significant if significance value (p) < 0.05 . The Chi-square test was also performed in one direction at a significance level of 5 %, and any difference between two nominal data was considered statistically significant if p < 0.05 .

RESULTS
Table 1 shows that, age and height did not differ significantly between the two study groups. Weight, BMI, and leptin were very significantly higher in the case group than control group. In contrast, average Ob-Re concentrations in the case group was very significantly lower than the control group.

Table 1: Relationship between the case and the control groups with respect of age, weight, height, BMI, leptin and Ob-Re.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Case</th>
<th>Control</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>36.46</td>
<td>36.25</td>
<td>0.18</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>100.28</td>
<td>62.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Height (m)</td>
<td>1.69</td>
<td>1.670</td>
<td>0.10</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>34.70</td>
<td>21.91</td>
<td>0.00</td>
</tr>
<tr>
<td>Leptin (ng/ml)</td>
<td>58.74</td>
<td>13.96</td>
<td>0.00</td>
</tr>
<tr>
<td>Ob-Re (ng/ml)</td>
<td>8.71</td>
<td>15.47</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Table 2 shows significant relationships were found between average leptin concentrations (58.74 ± 33.55 ng/ml) and BMI or number of meals among the case group. The same table also shows observed significant relationships between average Ob-Re concentrations
(8.71± 2.76 ng/ml) and BMI or age among the same group. On the other hand, average Ob-Re concentrations of the control (15.47 ± 4.41ng/ml) was significantly related to the age or number of meals. Table 2: Leptin and its soluble receptor compared with numerical questionnaire variables among the case and the control groups.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Leptin</th>
<th>Soluble leptin receptor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control group r (p)</td>
<td>Case group r (p)</td>
</tr>
<tr>
<td>Age</td>
<td>0.20 (0.08)</td>
<td>0.08 (0.45)</td>
</tr>
<tr>
<td>BMI</td>
<td>0.13 (0.19)</td>
<td>0.64 (0.00)**</td>
</tr>
<tr>
<td>Income</td>
<td>0.20 (0.07)</td>
<td>-0.20 (0.07)</td>
</tr>
<tr>
<td># of meals</td>
<td>-0.14 (0.20)</td>
<td>0.27 (0.02)*</td>
</tr>
</tbody>
</table>

*Significant. **Highly significant.

Table 3 shows no significant relationships were found between the average leptin concentrations and different nominal variables within each study group with the exception parental obesity among the case group (p=0.01). The same table also shows no observed significant relationships between the average Ob-Re concentrations and the same variables among each of the study group. able 3: Leptin and its soluble receptor compared with nominal questionnaire variables among the case and the control groups.
Table 4 shows that about 69% of the case individuals had paternal and/or maternal obesity and about 31% had ideal body weight parents. In contrast, for the control individuals, about 36% had parental obesity and about 64% had normal ideal weight parents.

Table 4: Frequency Distributions of the study individuals by parental history of obesity.

<table>
<thead>
<tr>
<th>Parental obesity</th>
<th>Control group</th>
<th>Case group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Valid percent (%)</td>
</tr>
<tr>
<td>Present</td>
<td>30</td>
<td>36.1</td>
</tr>
<tr>
<td>Normal</td>
<td>53</td>
<td>63.9</td>
</tr>
<tr>
<td>Total</td>
<td>83</td>
<td>100</td>
</tr>
</tbody>
</table>

Results of table 5 show that the mean of serum leptin hormone concentrations of obese adults with parental obesity (64.30 ± 7.09 ng/ml) was more significant than obese adults without parental obesity (44.8 ± 12.33 ng/ml) in the case group (p = 0.02). However, this final result was not observed in the case of Ob-Re among the case group (p = 0.88). Table 5: Relationship between parental obesity and serum leptin or soluble leptin receptor levels among obese adults of the case group.
Parental obesity

<table>
<thead>
<tr>
<th>Variables</th>
<th>Present Mean± SD</th>
<th>Normal Mean± SD</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leptin (ng/ml)</td>
<td>64.3±7.09</td>
<td>44.8±12.23</td>
<td>0.02</td>
</tr>
<tr>
<td>Ob-Re (ng/ml)</td>
<td>10.2±3.83</td>
<td>11.4±5.03</td>
<td>0.88</td>
</tr>
</tbody>
</table>

**DISCUSSION**

The aim of this study was to test whether parental obesity might contribute to adult obesity, serum leptin hormone and its soluble receptor among obese adults in the Gaza Strip. Excessive weight gain during adulthood is well known to be associated with increasing morbidity and mortality. Most studies have concentrated on the role of parental body composition on developing of obesity (26-30).

In the present study, leptin concentrations for the case were found to be very heterogeneous (Table 1) and positively correlated with BMI, and number of meals (Table 2). In contrast, Ob-Re for the case group was not heterogeneous (Table 1) and significantly correlated with BMI (negative) and age (positive) (Table 2). For the control, it was also correlated with age (positive) and number of meals (negative). Thus, level of leptin is a direct function of internal energy stored and amount of daily energy input. In contrast, internal body fats is negatively proportional to Ob-Re level. The effect of age and daily energy input on Ob-Re level are not so clear and requires more investigations. These leptin findings are in agreement with recent studies demonstrating that circulating serum leptin levels in human are positively correlated with the body fat [31, 32]. The reason for these results might be due to decreased sensitivity to leptin among obese subjects [33].

Results of the study also provided very new information about the influence of a history of obesity on serum leptin concentrations (Tables 3 and 4). It was found that adults with obese parents were more likely to have obesity and high leptin level more than adults of non-obese parents. In contrast, according to this study, parental obesity does not affect Ob-Re level of the obese adults (Table 5).
This means that fat cells generated in one or both parents due to genetic factors and family feeding styles contribute to transmission of obesity risk and high leptin level during adulthoods. The findings that parental obesity affects developing of obesity are also in agreement with other studies in the literature [26-30]. Willms et al. [26] reported that parents weight plays an important factor in the causes of obesity during childhoods. On the other hand, Nieman [27] reported that if parents’ weights were normal or slightly overweight, there would not be an increase risk of obesity in their children later on. Moreover, he also reported that children between the ages of one and three years whose parents, brothers and sisters are also overweight had a higher risk of becoming overweight. Frisancho [28] reported that fatness during adolescence is related to parental fatness but not to prenatal fatness. Moreover, Whitaker et al. [29] concluded that obese children under three years of age without obese parents are at low risk for obesity in adulthood, but among older children, obesity is an increasing important predictor of adult obesity, regardless of whether the parents are obese. Finally, Tarquini et al. [30] reported that cord blood leptin concentration is elevated in the presence of a family history of obesity on the paternal side, but not on the maternal side. The present study used a representative sample and gave an indication about the relation of adult obesity with parental obesity at a molecular level in the Gaza Strip.

In a conclusion, parental obesity is more than doubles the risk of adult obesity and significantly increases the serum leptin concentrations among obese adults in the Gaza Strip. Its effect on serum Ob-Re level of obese adults is not observed during this study.

**Recommendations**

In the current study the results showed that parental obesity plays an important role in obesity and serum leptin level among adults in the Gaza strip. A standard measure of parents’ body fats and further biochemical studies are recommended for comparison of body fat and lipid profiles between obese individuals and their parents. An examinations of leptin and leptin receptor genes of individuals and
their parents should be also recommended in order to understand
the causes of obesity at a molecular level.

Limitations of the study
1- Because of the study was carried out on adult individuals (mean
age was about 36 yrs), parental obesity indicated was reported, not
measured.
2- While prevalence of parental obesity was high (69 %), 31 %
prevalence of ideal body weight parents among the case group was
clinically significant as well.

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