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Parental obesity compared with serum leptin and serum leptin receptor levels among abese adults in the Gaza Strip

Aims: 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 2 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).

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

Key words: Parental obesity, leptin, soluble leptin receptor, adult obesity, the Gaza Strip

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Introduction

Obesity is a chronic condition that is characterized by long term energy imbalance due to excessive caloric intake with slight 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 a 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 tissue control resulting in an increase fraction of free leptin (10). Moreover, reduction of body weight through diet or surgical procedure significantly increases the concentration of circulating Ob-Re and thus increases the fraction of bound leptin. Thus, Ob-Re

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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 the 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 the Palestinian Ministry of Health for measuring adult 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 adulthood (18), but how parental obesity affects the chance of a child's becoming an 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 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 2 groups, case adults (BMI ≥25 kg/m^2) and control adults (BMI between18.5 and 24.9 kg/m^2).

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 regime 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 were selectively chosen from the same places to match the case group in terms of 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 the 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 fasting blood samples were collected from the cases and controls by well trained and experienced medical technologist. From each individual, 6 ml of venous blood sample was drawn from the median cubital vein. The serum samples were separated by centrifugation for 10 min at room temperature at 3500 rpm. The separated serum was frozen at -70 °C until assaying. 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 SPSS (Version 13.0). Pearson's correlation coefficient (r) was performed at a significance level of 5%, and any correlation between 2 ordinal data was considered statistically significant if $P < 0.05$.

The Chi-square test was also performed in one direction at a significance level of 5%, and any difference between 2 nominal data was considered statistically significant if $P < 0.05$.

Results

Table 1 shows that, age and height did not differ significantly between the 2 study groups. Weight, BMI, and leptin were very significantly higher in the case group than the control group. In contrast, average Ob-Re concentrations in the case group was very significantly lower than the control group.

Table 2 shows significant correlations 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 correlations 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 ± 4.41 ng/ml) was significantly correlated with the age or number of meals. Table 3 shows no significant correlations 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.

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.

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 ($P = 0.88$).

Discussions

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 the number of meals (Table 2). In contrast, Ob-Re for the case group was not heterogeneous (Table1) and significantly correlated with BMI (negative) and age

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

Variables	Case		Control		P value
	Mean	SD	Mean	SD	
Age (years)	36.46	9.58	36.25	9.58	0.18
Weight (kg)	100.28	25.30	62.00	7.95	0.00
Height (m)	1.69	0.10	1.670	0.08	0.10
BMI (kg/m^2)	34.70	7.81	21.91	1.81	0.00
Leptin (ng/ml)	58.74	33.55	13.96	9.80	0.00
Ob-Re (ng/ml)	8.71	2.76	15.47	4.41	0.00

Table 2. Leptin and its soluble receptor compared with ordinal questionnaire variables among the case and control groups.

Variables	Leptin		Soluble leptin receptor	
	Control group r (P)	Case group r (P)	Control group r (P)	Case group r (P)
Age	0.20 (0.08)	0.08 (0.45)	0.25 (0.02)*	0.24 (0.03)*
BMI	0.13 (0.19)	0.64 (0.00)**	0.00 (0.99)	-0.26 (0 0.02)*
Income	0.20 (0.07)	-0.20 (0.07)	-0.18 (0.11)	0.07 (0.53)
# of meals	-0.14 (0.20)	0.27 (0.02)*	-0.25 (0.03)*	0.05 (0.67)

*Significant. **Highly significant. r: Pearson's correlation coefficient.

(positive) (Table2). For the control, it was also correlated with age (positive) and the 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 fat is negatively proportional to OB-Re level. The effect of age and daily energy input on Ob-Re level is 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 the 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 the 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 finding that parental obesity affects the development of obesity is 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 cause of obesity during childhood. On the other hand, Nieman (27) reported that if parents' weights were normal or slightly overweight, there would not be an increased risk of obesity in their children later on. Moreover, he also reported that children between the ages of 1 and 3 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 3 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.

Table 3. Leptin and its soluble receptor compared with nominal questionnaire variables among the case and control groups.

Variables	Leptin		Soluble leptin receptor	
	Control Chi-square (P)	Case Chi-square (P)	Control Chi-square (P)	Case Chi-square (P)
Marital status	1.32(0.27)	2.33(0.13)	0.06(0.82)	2.41(0.13)
Type of food	0.90(0.82)	7.06(0.07)	0.77(0.86)	7.70 (0.06)
Parental obesity	2.11(0.15)	11.57(0.01)	1.83(0.18)	4.35(0.08)

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

Parental body weight	Control group*		Case group*	
	Frequency	Valid %	Frequency	Valid (%)
Over (obese)	30	36.1	57	68.7
Ideal	53	63.9	26	31.3
Total	83	100	83	100

*The frequency distribution among the case and the control group is highly significant ($P < 0.01$)

Table 5. Relationship between parental obesity and serum leptin or soluble leptin receptor levels among obese adults of the case group.

Parental obesity Variables	Present Mean± SD	Normal Mean± SD	P
Leptin (ng/ml)	64.3 ± 7.09	44.8 ± 12.23	0.02
Ob-Re (ng/ml)	10.2 ± 3.83	11.4 ± 5.03	0.88

Finally, Tarquini et al. (30) reported that cord blood leptin concentration is elevated in the presence of the 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 conclusions, parental obesity 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. However, evaluation of the effects maternal or paternal obesity has to be carried out separately. A standard measure of parents' body fat and further biochemical studies are also needed for comparison of body fat and lipid profiles between obese adults and their parents. An examination of leptin and leptin receptor genes of obese individuals and their parents should also be recommended in order to understand the causes of obesity at a molecular level.

Limitations of the study

1- Because the present study was carried out on adult individuals aged about 36, parental obesity indicated throughout this study was reported and 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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References

1. Flier JS. Obesity wars: molecular progress confronts an expanding epidemic. *Cell* 2004; 116: 337-350.
2. Statistics Related to Overweight and Obesity: NIDDK. Weight-control Information Center. U.S. Department of Health and Human Services, National Institutes of Health. NIH Publication; 2003.
3. Zhang Y, Proeca R, Maffei M, Barone M, Leopold L, Friedman J. Positional cloning of the mouse obese gene and its human homologue. *Nature* 1994; 372: 425-432.
4. Bado A, Lavasseur S, Attoub S, Kermorgant S, Laigneau JP, Bortoluzzi MN, et al . The stomach is a source of leptin. *Nature* 1998; 393: 790-793.
5. Smith-Kirwin SM, O'Connor DM, De Johnston J, Lancey ED, Hassink SG, and Funanage VL. Leptin expression in human mammary epithelial cells and breast milk. *J Clin Endocrinol Metab* 1998; 83: 1810-1813.
6. Wang J, Liu R, Hawkins M, Barzilai N, Rossetti L. A nutrient-sensing pathway regulates leptin gene expression in muscle and fat. *Nature*1998; 393: 684-688.
7. Sreenan S, Caro JF, Refetoff S,. Thyroid dysfunction is not associated with alternation in serum leptin levels. *Thyr* 1997; 7: 407-409.
8. Hoggard N, Hunter L, Duncan JS, Williams LM, Trayhurn P, Mrecer JG. Leptin and leptin receptor mRNA and protein expression in the murine fetus and placenta. *Proc. Natl Acad Sci, USA* 1997; 94: 11073-11078.
9. Lammert A, Kiess W, Bottner A, Glasow A, Kratzsch J. Soluble leptin receptor represents the main binding activity in the human blood. *Biochem and Biophys Res Commun* 2001; 283: 982-988.
10. Van-Dielen FMH, Van't-Veer C, Buurman WA, Greve WM. Leptin and soluble leptin receptor levels in obese and weight losing individuals. *J Clin Endocrinol Metab* 2002; 87: 1708-1716.
11. Laimer M, Ebenbichler CF, Kaser S, Sandhofer A, Weiss H, Nehoda H, et al. Weight loss increases soluble leptin receptor levels and the soluble receptor bound fraction of leptin. *Obes Res* 2002; 10: 597-601.
12. Friedman JM, Halaas JL, Leptin and the regulation of body weight in mammals. *Nature* 1998; 395: 763-770.
13. Dudeja V, Misra A, Pandey RM, Devina G, Kumar G, Vikram N K. BMI does not accurately predict overweight in Asia Indians in northern India. *British J. Nutrition 2001;* 86(1): 105-112.
14. Nutrition Department, Directorate General of Primary Health Care and Public Health. The State of Nutrition West Bank and Gaza Strip: A comprehensive review of nutrition situation of West Bank and Gaza strip. UNICEF, WHO, and Palestinian National authority, MOH, Palestine; 2004.
15. National Heart, Lung and Blood Institute, Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults. The evidence report. *Obes Res* 1998; 6: 51S–209S.
16. Kopelman PG. Obesity as a medical problem. *Nature* 2000; 404: 635-643.
17. Kantachuvessiri A. Obesity in Thailand. *J Med Assoc Thai* 2005; 88: 554-562.
18. Whitaker RC, Wright JA, Pepe MS, Seidel KD, Dietz WH. Predicting obesity in young adulthood from childhood and parental obesity. *N Eng Med* 1997; 337: 869-873.
19. The National Academies press. Exploring a vision: Integrating knowledge for food and health; 2005
20. WHO. The World Health Report. Life in the 21st century: A vision for all. Geneva; 1998.
21. Warsy AS. El-Hazmi MAF. Diabetes meletus, hypertension and obesity- Common multifactorial disorders in Saudis. *EMHJ* 1999; 5/6: 1236-1242.
22. Abdul-Rahim HF, Abu-Rmeileh NME, Husseini A, Holmboe-Ottesen G, Jervell J, Bjertness E. Obesity and selected co-morbidities in an urban Palestinian population. *International Journal of obesity* 2001; 25: 1736-1740.
23. Zabut BM, Holi NH, El-Jeesh YI . Leptin and leptin receptor among obese Adults in the Gaza Strip. *The Islamic University Journal* 2007; 15: 127-140.
24. Diagnostic System Laboratories, Inc. Texas, USA. Active Human Leptin ELISA, DSL-10-23100.
25. Diagnostic System Laboratories, Inc. Texas, USA. Active Human Leptin Soluble Receptor ELISA, DSL-10-23200.
26. Willms JD, Tremblay MS, Katzmarzyk PT. Geographic and demographic variation in the prevalence of overweight Canadian children. *Obes Res* 2003; 11: 668-673.
27. Neiman P. Childhood Obesity. Retrieved on September 25th, 2004 from the World Wide Web: http://ditk-kids.com/articles/childhood_obesity.htm.
28. Frisancho AR. Prenatal compared with parental origins of adolescent fatness. *Am J. clin. Nutr* 2000; 72: 1186-1190.
29. Whitaker RC, wright JA, Pepe MS, Seidel KD, Dietz WH. Predicting obesity in young adulthood from childhood and parental obesity. *N Eng J. Med* 2000; 337: 869-873.
30. Tarquini B, Tarquini R, Perfetto F, Cornelissen G, Halberg F. Genetic and environmental Influences on human leptin concentration. *Pediatrics* 1999; 103: 998-1006.
31. Tessitore L, Vizio B, Pesola D, Cecchini F, Mussa A, Argiles JM, et al. Expression and circulating levels of leptin increase in both gynaecological and breast cancer patients. *Int J Oncol* 2004; 24: 1529-1535.
32. Considine RV, Sinha Mk, Heiman ML, Kriangiunas A, Stephens TW, Nyce MR, et al. Serum immunoreactive-leptin concentration in normal weight and obese humans. *N Eng J Med* 1996; 331: 292-295.
33. Popruk S, Tungtrongchitr R, Pongpaew P, Phourat B, Tungtrongchitr A, Tribunyatkul S, et al. Relationship between soluble leptin receptor, leptin, lipid profiles and anthropometric parameters in overweight and obese Thai subjects. *J Med Asso Thai*, 2005; 88: 220-227.