Health Science Monitor
2025; 4(1): 23-28
Published online (http://hsm.umsu.ac.ir)

Original Article

Comparison of fasting blood sugar and lipid profile in obese/overweight patients with and without depression

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Abstract

***Background & Aims*:** Obesity and depression have a two-way relationship, but the association remains inconclusive. Hyperglycemia and dyslipidemia may be a possible explanation for these inconsistencies. Accordingly, this study aimed to compare fasting blood sugar (FBS) and lipid profiles in obese/overweight patients with and without depression.

***Materials & Methods*:** This case-control study was conducted on 260 obese/overweight patients with (case: 130) and without depressive symptoms (control: 130). Beck's depression questionnaire was used to determine the depression status of the participants. High-density lipoprotein (HDL) and triglycerides (TG) were measured using a spectrophotometric method. FBS was measured using the glucose oxidase method. All variables are expressed as means ± SD. Comparisons between the study groups were carried out using the Independent-Samples t-test.

***Results*:** There was no statistically significant difference in body mass index (BMI) ($p > 0.360$), waist circumference (WC) ($p > 0.140$), systolic blood pressure (SBP) ($p > 0.672$), diastolic blood pressure (DBP) ($p > 0.757$), HDL-CC ($p > 0.223$), or TG ($p > 0.658$) in obese/overweight patients with and without depression. After adjusting for age, BMI, sex, marital status and educational level obese patients with depression had significantly higher FBS compared to obese patients without depression ($p < 0.03$). However, more and larger studies are needed to examine the relationship between depression and FBS.

***Conclusion*:** The association between FBS and the two-way relationship between obesity and depression may be explained by metabolic factors.

***Keywords*:** Depression**,** Fasting blood sugar, Lipid profile, Obesity

Received 05 August 2024; accepted for publication 09 December 2024

Introduction

Depression is a major public health issue characterized by sadness or irritability, often accompanied by constipation, sleep disorders, lack of concentration, loss of interest in work, difficulty in making decisions, feelings of guilt, and suicidal thoughts for at least two weeks (1).

[DOI: 10.61186/hsm.4.1.23]

The American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5), classifies depressive disorders into five categories, including mood disorders, major depression, persistent depression (dysthymia), premenstrual dysphonia, and depression due to another medical disease (2).

Meanwhile, major depression is known as the most common mental health disorder (3) and the main cause of disability worldwide (4, 5). According to available documents about 16.1 million adults had a history of major depression during the last year (3). Approximately one out of every five people experience a period of major depression in their life (6). Also, according to the predictions by the World Health Organization (WHO), this disease will create the largest global burden by 2030 (5). This disease increased by 18.4% between 2005 and 2015. In terms of geographical distribution, half of the affected people live in Southeast Asia and the Western Pacific region (4).

Obesity is defined as a body mass index (BMI) of 30 or higher, which is seen in people who have less physical activity and higher caloric intake (7,8).

According to the results of studies, obesity, and depression have a two-way relationship. Obese people have a 55% higher chance of developing depression; on the other hand, depressed people also have a higher chance of developing obesity (9-11). In addition to being able to affect the possibility of depression in people (12), obesity increases the risk of developing lipid disorders, diabetes mellitus, and insulin resistance, and these disorders can be a double risk factor for causing depression in obese and overweight patients (10).

It has been shown that blood sugar levels are directly related to the severity of depression in patients with diabetes (13). The prevalence of depression in patients with type 1 and 2 diabetes mellitus compared to healthy people in the community is three times and two times, respectively, on the other hand, depression increases the risk of type 2 diabetes by 60% (14, 15). Based on the results of previous studies, triglycerides (TG) levels are higher in people with major depressive disorder (MDD) than in healthy people (16) however, in another study, it was reported that the level of high-density lipoprotein (HDL) is significantly higher than that of healthy people (17).

Although current evidence suggests that obesity is likely to have important impacts on the occurrence of depression (9), the results of these studies were inconsistent (14, 16-18), and not all obese patients have depressive symptoms. Furthermore, mechanisms for the obesity-depression relationship remain under discussion. The present study aimed to compare fasting blood sugar (FBS), TG, high-density lipoprotein cholesterol (HDL-C) and waist circumference in obese patients with and without depressive symptoms.

Despite the widespread prevalence of obesity and depression and the known relationship between depression and obesity, limited studies have investigated the etiology of depression in obese patients, and the reason why obese patients are more prone to depression remains unknown. Our study tried to determine the etiology of depression in obese people and we want to answer the question of why the prevalence of depression is higher in obese communities. The answer to this question can have beneficial effects in reducing the costs of health organizations.

Materials & Methods

The present case-control study was conducted on 130 adult obese/overweight subjects with depressive symptoms (cases; Beck Depression Inventory (BDI) > 10) and 130 obese/overweight subjects without depressive symptoms (controls; BDI < 10) (BMI > 27 kg/m^2) (aged > 20 years). Obese/overweight subjects were recruited from patients who were referred to the Endocrinology and Metabolism Research Center (EMRC), Vali-Asr, Imam Khomeini Hospital in Tehran. Having any history of neurological and medical conditions, as well as regular intake of antidepressant medicines (in the preceding 3 months), blood sugar lowering drugs, medications for dyslipidemia, hypertension, breastfeeding, pregnancy, post-menopause, smoking, prescribed diets by the clinic dietitian, and taking nutritional supplements were considered as exclusion criteria. Participants' body

[DOI: 10.61186/hsm.4.1.23]

weight was (in kilograms -kg) measured using a calibrated Seca scale (Model 700, 136 USA) in light clothing and unshod. Standing height was measured to the nearest 1 mm using a Seca stadiometer (Model 700, USA) while subjects were barefoot, and their shoulders were in a normal position. BMI of each participant was calculated as body weight divided by height squared (kg/m^2) to the nearest 0.01kg and 0.1 cm. Waist circumference (14) was measured between the lower rib margin and the iliac crest using a flexible tape measure after normal expiration. Blood pressure was measured twice separately over a 5-minute interval by a professional nurse. The average of the two measurements was considered as blood pressure value.

To assess serum FBS, TG, and HDL-C levels, blood samples were obtained after a 12-hour overnight fast. All blood samples were centrifuged for 10 minutes; the serum was separated into clean tube aliquots and stored at -80°C until analysis. HDL and TG were measured using a spectrophotometric kit (Pars Azmoon, Iran). FBS was measured by the glucose oxidase method. For this study, the BDI-II was used to investigate depression symptoms (19). To calculate the sample size, we used the standard formula suggested for case-control studies. Using Jaharami et al.'s study, considering the type one error level of 0.05, and statistical power of 90%, 130 subjects were included in each study (20). The research protocol of the study was reviewed and approved by the scientific research committee of Larestan University of Medical Sciences (IR.LARUMS.REC.1401.00).

Analysis was done using SPSS version 14.0 for Windows (Chicago, Illinois, USA). All variables are expressed as means ± SD. Comparisons between the study groups were carried out using the Independent-Samples T-Test. Linear regression was used for assessing the association between FBS, TG, HDL-CC, WC and BDI score. For all analyses, a two tailed $p < 0.05$ was considered statistically significant.

Results

General characteristics of the study population are reported in Table 1. Most subjects in both groups were (82.8%) men and (17.2%) women. There was no statistically significant difference between the study groups in terms of weight, height, BMI, blood pressure, and WC (Table 1).

Table 1. Demographic characteristics of participating according to the studied groups

	Case (130)	**Control (130)**	***P* value***
Age (Year)	38/6 ± 44/92	37/7 ± 28.54	0.195
Height (cm)	170.08	173.08	0.228
Weight (kg)	87.15 ± 48.48	89.14 ± 63.50	0.902
Depression score (Beck questionnaire)	19.6 ± 24.77	4.3 ± 77.10	0.000
WC (Cm)	103.8 ± 73.58	103.10 ± 92.31	0.140
SBP	120.13 ± 48.14	118.16 ± 34.16	0.672
DBP	80.10 ± 83.50	78.13 ± 79.21	0.757
BMI (Kg/m^2)	29.3 ± 80.79	29.4 ± 94.10	0.360

* Values are analyzed by Independent-Samples t-test, values are mean ± SD

The mean serum level of TG in the case group was (130.157 ± 99.89) and in the control group (120.174 ± 72.07), which had no significant difference ($p > 0.658$) (Table 2). The average serum HDL level in the case group was (9.52 ± 39.37) and in the control group (8.50 ± 93.47), which had no statistically significant difference ($p > 0.223$) (Table 2). These finding remained unchanged after adjustment for age, BMI, sex, marital status and educational level. The average FBS in the case group was (35.106 ± 36.89) and in the control group (18.97 ± 42.28), which had a statistically significant difference ($p < 0.003$) (Table 2). After

[DOI: 10.61186/hsm.4.1.23]

adjustment for age, BMI, sex, marital status and educational level obese patients with depression had significantly higher FBS compared to obese patients without depression ($p < 0.001$).

Table 2. Comparison of FBS and lipid profile between study groups

	Case (130)	Control (130)	*P* value*
FBS	97.18 ± 28.42	106.35 ± 89.36	0.003
TG	174.120 ± 07.72	157.130 ± 89.99	0.658
HDL	50.8 ± 47.93	52.9 ± 37.39	0.223

* Values are analyzed by Independent-Samples t-test, values are mean ± SD.

Discussion

This study aimed to compare the serum level of FBS, TG, and HDL-C, between depressed obese/overweight subjects and age and sex-matched healthy control group. The present study is based on the conflict between the results of previous findings and the high prevalence of depression in the obese population. The current study shows that obese/overweight subjects with depression had a higher serum level of FBS than obese/overweight subjects without depression subjects; however, based on current research there was no significant difference in serum TG and HDL between study groups.

According to the study by Enko et al.(16), the average serum level of TG in depressed patients (108 mg/dl) was significantly higher than in the control group which included non-depressed people (84 mg/dl), this finding is in contrast with the results of our study. While in line with the findings of the present study the serum levels of HDL in this study did not differ significantly between the case and control groups.

Consistent with the findings of the present study, the study by Ong et al. which was conducted prospectively on 4938 participants from 6 American states with an average age of 62 years, observed that the serum levels of HDL cholesterol, and TG do not have a significant relationship with depression (18). Olusi et al. compared the serum lipid concentrations in 100 subjects with depression and 100 subjects without depression. It was shown that the serum level of HDL was significantly lower in the healthy group than in the patient group, but the serum level of TG did not show a significant difference in the two groups (17). The study by Behnampour et al. in Gorgan, consistent with the findings of the present study, shows a statistically significant relationship between FBS levels and depression (14). It was also stated that serum levels of TG, and HDL have no significant relationship with depression, which is in line with the results of the present study. However, the findings of Enko et al.'s study show a statistically significant difference in the serum TG level between the two groups of diabetic patients and healthy individuals, which is in contradiction with the findings of the present study (16). Also, Olusi et al.'s study shows a statistically significant difference in the serum TG levels of depressed and non-depressed individuals, while there was no significant difference in serum HDL levels between the studied groups (17). No significant difference in serum TG and HDL between study groups may be explained considering the effect of obesity on the development of dyslipidemia, since in this study all participants were obese and the serum levels of these factors were compared between obese subjects. Therefore, it is advised to compare the lipid profile in obese and normal weight subjects.

Hypothalamic-pituitary adrenal axis dysfunction may be considered as an explanation for the increased risk of depression among obese subjects with hyperglycemia. Hypothalamic-pituitary-adrenal axis dysfunction results in dysregulation of cortisol which contributes to glucose dysregulation, and insulin resistance (12). More studies with a larger statistical population are needed to determine the relationship between serum blood sugar levels, lipid profile, and depression symptom in obese people.

[DOI: 10.61186/hsm.4.1.23]

This study had some limitations. We did not assess low-density lipoprotein (LDL-C) and total cholesterol. In addition, the number of women participating in the study was limited. Given this issue, more and larger studies are needed to examine the relationship between depression and FBS. Accordingly, further studies are needed to establish.

Conclusion

The current research demonstrated that in obese subjects, FBS status rather than obesity is associated with depression symptom. Interventions targeting mental health may play a crucial role in managing and preventing metabolic complications in this population. Further research is needed to explore the causal pathways and long-term effects of this relationship.

Acknowledgments

Our research group would like to thank all subjects who took part in the current study.

Authors' Contributions

Methodology, sampling and data curation: Somaye Yosaee; statistical analysis: Fatemeh Zare and Razieh Zolghadr; writing the original draft: Maedeh Abyar and Ali Simakanpour and Mohammad Amin Atazadegan; review, editing, investigation and resources: Somaye Yosaee and Mohammad Amin Atazadegan.

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Data Availability

All the data obtained from this study are included in the text of the article.

Conflict of Interest

The authors have no conflicts of interest associated with the material presented in this paper.

Ethical Statement

The study protocol was approved by the institutional ethics committee of Larestan University of Medical Sciences, Larestan, Iran (Code: IR.LARUMS.REC.1401.003).

Funding/Support

The project was financially supported by the Larestan University of Medical Sciences, Larestan, Iran.

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[DOI: 10.61186/hsm.4.1.23]