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Research article

Which increases depressive symptoms in obese patients; hypertension or diabetes?

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ABSTRACT

Background: Depression and obesity are common disorders. Obesity is also predictive of several chronic diseases like hypertension and diabetes. The aim of this study was to evaluate and compare depression frequency of obese patients with hypertension or diabetes.

Methods: Weight, height and body mass index (BMI) were measured. The definition of obesity was a body mass index (weight (kg)/height (m)^2) $\geq$ 30 kg/m^2. Obese patients with hypertension or diabetes were documented. All participants had a Beck Depression Inventory (BDI) evaluation.

Results: A total of 389 subjects were included, of whom 100, 101, 92, 96 participants were healthy, obese, obese with hypertension, obese with diabetes, respectively. Beck Depression Inventory scores of obese patients, obese patients with hypertension or diabetes were higher compared to the control group. BDI scores of obese patients with diabetes were higher compared to obese and obese with hypertension subjects.

Conclusions: Obesity is a risk for depression and other chronic diseases. Obesity can increase depressive symptoms. The level of depressive symptoms in obese patients varied according to chronic disease type. In the present study, diabetes appears to be more closely related to depression than hypertension.

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INTRODUCTION

Obesity prevalence is increasing rapidly throughout the world. According to the World Health Organization (WHO) report, there are 400 million obese and 1.6 billion overweight individuals around the world. Obesity is also a public health problem due to the related complications. It is strongly predictive of diabetes mellitus, hypertension, cardiovascular disease and other chronic medical conditions.[1]

Furthermore, depression is one of the most common mental disorders. Depressed mood and anhedonia are major symptoms of depression.[2] Increased prevalence of depression has been associated to chronic medical diseases such as diabetes mellitus, hypertension and chronic liver diseases.[3,4,5,6,7] The relationship between diabetes and depression was investigated in several meta-analysis studies. A result of a meta-analysis has shown that type 2 diabetes was a risk factor for incident depression,[8] and that the risk of depression was higher in subjects with diabetes.[9] Additionally, in a study by Tarantino et al., they demonstrated that obese patients with chronic hepatitis C had depression symptoms and treatment with antidepressant drugs was successful.[7]

Correspondingly, we hypothesized that obese subjects experience a higher frequency of psychological distress and depression. Whether obesity predicts psychiatric disorders such as depression has not been established. Several studies reported inconsistent results regarding the association between obesity and depression.[10,11] Some reports indicated no effect of obesity on the risk of depression development,[12,13] whereas others demonstrated that obese subjects were indeed at elevated risk.[14,15] As a comorbidity, chronic diseases can affect depressive symptoms in obese patients.[3,4,5,6] In this study, we aimed to evaluate and compare depression frequency of obese patients with hypertension or diabetes.

MATERIALS AND METHODS

This cross-sectional study was performed in an internal medicine outpatient clinic of a tertiary hospital from October 2010 to July 2011. A total of 389 subjects were included, of whom 100, 101, 92, 96 participants were healthy, obese, obese with hypertension, obese with diabetes, respectively. All groups were separated similarly in terms of demographic characteristics. The institutional review board approved the experiment and informed consent was obtained from all subjects.

Weight, height and body mass index (BMI) were measured. The definition of obesity was a body mass index (weight (kg)/height $(m)^2$) $\geq 30\ kg/m^2$. The blood pressure of patients was measured after a 10 min of rest with periodically calibrated sphygmomanometers (Erka, Germany), twice a day for 7 days. Hypertension was diagnosed by systolic blood pressure ≥ 140 mm Hg or diastolic blood pressure ≥ 90 mm Hg. Patients with high blood pressure were documented. Blood samples were collected after an overnight fasting. Serum glucose was analyzed on Beckman Coulter Synchron LX 20 (Massachusetts, USA) using commercially available kits. Patients with high glucose levels (>126 mg/dl, twice) were accepted and documented as diabetics. Patients with antidepressant medication, a BMI $>40\ kg/m^2$, liver disorders, renal disorders, congestive cardiac failure, other systemic illnesses, pregnancy or alcoholism were excluded from the study.

All participants had a Beck Depression Inventory (BDI) evaluation. The Beck Depression Inventory is a 21-question multiple-choice self-report inventory. It is one of the most widely used instruments for measuring depression severity. A value of 0 to 3 is assigned for each answer and the depression severity is determined by the total score. Higher scores indicate more severe depressive symptoms. BDI scores of 0–9, 10–18, 19–29 and 30–63 are considered as minimal, mild, moderate and severe depression, respectively.[16]

Statistical Package for the Social Sciences (SPSS) 19.0 was used for statistical analyses. Chi-square test was used to compare categorical measures between groups. ANOVA test and Mann Whitney U test were used for comparison between groups. The level of statistical significance was considered as 0.05.

RESULTS

A total of 389 subjects (257 women and 132 men) were enrolled after giving informed consent to be included in the study. We excluded 21 subjects (15 women and 6 men) for comorbidities or antidepressant treatment (1 subject reported chronic renal failure, 2 subjects reported chronic liver disease, 7 subjects reported hearth failure, 2 subjects reported hypothyroidism, 3 subjects reported anemia, 6 subjects reported use of antidepressant drugs). The mean age was 46.6 ± 9.1 years, with a

range of 18–65 years. Demographic characteristics of participants were not significantly different between the control and study subgroups (Table 1). Mean BMI of 389 subjects was 28.4 ± 6 kg/m^2.

Table 1. Demographic characteristics of subjects.

	Control	Obese	Obese + HT	Obese + DM	P
Age	48.4 ± 8.7	45.7 ± 9.9	46.3 ± 9.1	47.2 ± 7.1	0.412
Sex					
Male N (%)	37 (37%)	34 (34%)	29 (30%)	27 (28%)	0.102
Marital status					
Single N (%)	17 (17%)	14 (14%)	15 (16%)	10 (11%)	
Married N (%)	78 (78%)	81 (80%)	74 (80%)	81 (84%)	0.056
Widowed or divorced N (%)	5 (5%)	6 (6%)	3 (3%)	5 (5%)	
Education					
Illiterate	4 (4%)	2 (2%)	5 (5%)	7 (7%)	
Literate	6 (6%)	4 (4%)	3 (3%)	5 (5%)	
Primary education N (%)	34 (34%)	39 (39%)	44 (49%)	48 (50%)	0.071
High school N (%)	35 (35%)	37 (36%)	24 (26%)	27 (29%)	
University N (%)	21 (21%)	19 (20%)	16 (17%)	9 (9%)	
Job					
Unemployed N (%)	32 (32%)	39 (38%)	28 (30%)	38 (39%)	
Employee N (%)	62 (62%)	51 (51%)	56 (61%)	40 (42%)	0.294
Pensioner N (%)	6 (6%)	10 (11%)	8 (9%)	18 (19%)	

HT: Hypertension
DM: Diabetes Mellitus

Mean BMI of obese patients, obese with hypertension, obese with diabetes and control group were 33.1 ± 3.3, 35.2 ± 4.4, 34.1 ± 3.7, 22.6 ± 2.1 kg/m^2, respectively (Table 2).

Table 2. BDI Scores and BMI of all groups.

	Control	Obese	Obese + HT	Obese + DM	P
BDI Scores	6.7 ± 5.7	24.2 ± 9.1	23.1 ± 6.3	30.4 ± 7.1	< 0.001
BMI (kg/m^2)	22.6 ± 2.1	35.2 ± 4.4	33.1 ± 3.3	34.1 ± 3.7	0.031

HT: Hypertension
DM: Diabetes Mellitus

BDI scores of obese patients, obese with hypertension, obese with diabetes and control group were 24.2 ± 9.3, 23.1 ± 6.3, 30.4 ± 7.1 and 6.7 ± 5.7, respectively (Table 2). BDI scores of all groups with obese patients were higher compared to the control group. Obese patients with diabetes were higher than those of obese patients with or without hypertension, the difference was statistically significant ($P < 0.001$, Table 2). BDI scores of obese patients with diabetes were higher compared to obese patients with hypertension, the difference was statistically significant ($P = 0.021$, Table 3).

Table 3. BDI Scores and BMI of obese groups with comorbidities.

	Obese + HT	Obese + DM	P
BDI Scores	23.1 ± 6.3	30.4 ± 7.1	0.021
BMI (kg/m^2)	33.1 ± 3.3	34.1 ± 3.7	0.413

HT: Hypertension
DM: Diabetes Mellitus

DISCUSSION

The prevalence of obesity has been rapidly increasing in adults. Obesity contributes to a variety of medical disorders, such as hypertension, coronary heart disease and diabetes mellitus. Nevertheless little is known about possible link between obesity and mental disorders.[17] In this study, the depression frequency in obese patients with or without comorbidities was higher than the control

group. Depression frequency in obese patients with diabetes was higher than obese patients with hypertension.

Conceivably, obese patients experience a higher degree of psychological distress leading to depression. However, existing information on the correlation between obesity and depression is inconsistent.[10,11,14,18] Whereas some studies demonstrate that obesity increases the risk of depression,[14,15,19] others found no correlation between them.[11,12,13] Murphy et al. reported that depression symptoms among obese patients tend to be more severe than in non-obese.[18] Furthermore, they suggested that weight gain is a marker of depression severity.[18] In another study, depression was increased by 2.29-fold in obese versus non-obese participants.[20] In disagreement with these studies, Crisps et al. found a correlation between obesity and lower levels of anxiety in both middle-aged women and men and to lower levels of depression in men.[21] Correspondingly, no association between obesity and present or past mental illness was detected in 38–54 year-old women[22] We show that depression frequency in patients with obesity was different than in healthy subjects.

Many other studies were conducted to determine correlation between chronic medical diseases and depression. Bisschop et al. reported that atherosclerosis and diabetes mellitus have only weak or no association with depressive symptoms.[23] On the other hand, lung disease, arthritis, cardiac disease, and cancer were positively associated with increased depressive symptoms.[23] Furthermore, the level of depressive symptoms varied according to chronic disease type[23] Similarly, other studies demonstrated an elevated depression frequency in patients with hypertension or diabetes mellitus[3,4,5,6] In the present study depression frequency in obese patients with hypertension was comparable to obese patients without comorbidities. In accordance with our paper, Wiehe et al. detected that hypertension and depression were not associated in adults and their concomitant occurrence in clinical practice might be ascribed to chance.[24] Reinforcing this link, studies with a more precise evaluation of depression or blood pressure have not found an association between depression and hypertension.[25,26] Interestingly, in contrast to hypertensive patients, increased depressive symptoms have found in hypotensive patients in many studies.[27,28]

In the present study, depression frequency in obese patients with diabetes was higher compared to other groups. The result of our study was consistent with the results of other studies in literature. For example, Katon et al, demonstrated an elavation of depression frequency in patients with diabetes.[4,8,9] Anderson et al, decided that depression is associated with hyperglycemia and an improved glycemic control is needed for the relief of depression.[29]

Visceral obesity, strongly associated with hepatic steatosis, is principally related with mild to severe somatic affective-depressive symptom clusters.[30] Increases in visceral adipose tissue and intrahepatic fat correlate with increased gluconeogenesis, increased free fatty acid levels and insulin resistance.[31] Insulin resistance is associated with lower serotonin levels. Tarantino et al reported lower urinary excretion of 5-hydroxy-3-indoleacetic acid in dystimic/depressed, adult obese women.[30] Consequently, diabetes is associated with lower serotonin levels and leads to depression. All these examples are in accordance with our study, depression symptoms were more likely in obese patients with diabetes.

Based on several studies, obesity and its coexisting conditions like insulin resistance, type 2 diabetes, hepatic steatosis (non alcoholic fatty liver disease) are associated with a low grade, chronic inflammatory state. As an inflammatory mediator, interleukin-6 is biosynthesized in the liver and increased in non alcoholic, fatty liver disease patients.[32,33] Therefore, interleukin-6 levels are higher in hepatic steatosis related diseases like obesity and type 2 diabetes. Depression in these diseases may be due to the low grade, chronic inflammatory state and high interleukin-6 levels.

The treatment of diabetes is difficult for patients compared to hypertension treatment. Patients are afraid of insulin therapy and most diabetic patients worry about complications. Diets for diabetic patients are rigid and sufferers should pay extreme attention to nutrition. All these factors can be reasons for depression.

Consequently, we hypothesize that obesity is a strong factor that leads to depression, and diabetes does increase depressive symptoms in patients with obesity.

Lastly, the present study did have some limitations. First, BDI is generally used for screening depression, not as a diagnostic tool. Secondly, the scores of BDI can be exaggerated or minimized by the subjects completing them. Thirdly, it would have been beneficial if the sample size had been larger.

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