

Are Lipid Profile, Body Mass Index, Waist Circumference, and Blood Pressure of Depressed Elderly Patients Different from Healthy Subjects?

Abstract

Background: Depression and obesity are among the increasingly publicized health problems, both being related to critical complications, and increasing the risk of substantial morbidity and mortality. An increasing number of documents indicate that obesity affects mental status, low serum cholesterol levels, and is related to depressive symptoms. The purpose of the present study was to evaluate the possible significant difference in lipid profile levels, body mass index (BMI), waist circumference (WC), and blood pressure (BP), between depressive and nondepressive older adults. **Methods:** This was a case-control study where 107 patients, over 65-year-old, were enrolled in this study. Serum total cholesterol, high-density lipoprotein-cholesterol, low-density lipoprotein-cholesterol (LDL-C), triglycerides (TG), BP, and fasting blood sugar were measured. Data were analyzed using the statistical SPSS software version 22. Independent *t*-test was used to compare the results between the two groups and the Chi-square test was used to compare categorical variables. In addition, nonparametric Mann-Whitney test was used to evaluate the data. **Results:** The depressive group showed significant lower BMI, WC, LDL-C, and TG ($P < 0.001$, $P < 0.001$, $P < 0.016$, and $P < 0.014$). Furthermore, the findings showed significantly higher systolic and diastolic BP in participants who had shown depressive symptoms ($P < 0.035$ and $P < 0.024$). **Conclusions:** The findings suggest that a low BMI, serum LDL-C, and TG are related to depressive symptoms the Iranian elderly.

Keywords: Aged, blood pressure, body mass index, cholesterol, depression

Introduction

Depression and obesity are among the increasingly publicized health problems, both being related to critical complications, and increasing the risk of substantial morbidity and mortality.^[1,2] Study on the relationships between depressive symptoms and obesity among the elderly has produced conflicting results. Several studies have shown that increased body mass index (BMI) is associated with decreasing depression.^[1-3]

An increasing number of studies indicate that lipid levels affect mental status.^[4] An experimental study illustrated that mouse brain incubation in cholesteryl hemisuccinate increased its viscosity and binding to serotonin.^[5] In another scientific study, the results showed that in participants with continuously low serum cholesterol, plasma serotonin levels were lower than those in the control group.^[6] A number of earlier studies had proposed that lowered or low cholesterol (especially high-density

lipoprotein-cholesterol [HDL-C], which is beneficial cholesterol) had impact on psychological health, and among middle-aged men whose levels of serum HDL-C are persistently low, the prevalence of depression increases.^[4,7,8] However, other studies investigating the relationship between lipid levels and depression, have highlighted contradictory results with a higher prevalence of depressive symptomatology being related to both high,^[9] and low total cholesterol (TC)^[10] or showing no significant dependence.^[11,12] However, some researchers appear to disagree with the “jolly fat” hypothesis^[13,14] and have insisted that elderly with a BMI >30 tend more to develop depression.

In the present case-control study, the authors investigated the relationships between BMI, waist circumference (WC), TC, HDL-C, low-density lipoprotein-cholesterol (LDL-C), triglycerides (TG), blood pressure (BP) and fasting blood sugar

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How to cite this article: Amini S, Shirali S, Jafarirad S, Ehsani H, Mohseni H, Bargard MS. Are lipid profile, body mass index, waist circumference, and blood pressure of depressed elderly patients different from healthy subjects? *Int J Prev Med* 2019;10:185.

Access this article online

Website:
www.ijpvmjournal.net/www.ijpvm.net

DOI:
10.4103/ijpvm.IJPVM_372_17

Quick Response Code:



(FBS), with depressive symptoms among an Iranian elderly population.

Methods

This case-control study was approved by Ethics Committee (REC.1395.52) and was carried out in 2017, at a rural health center in "Seidoon," adjacent to Baghmalek, a city in Khuzestan province, in the southwest of Iran.

The original sample consisted of 141 (80 nondepressed and 61 depressed) men and women, aged over 65 years, who had been referred to the health center. Participants who smoked or consumed antidepressant medication were excluded from the study. Ten participants were excluded due to smoking and substance abuse, whereas six were excluded for consuming antidepressant medication, or concurrent major medical illness, such as renal, cardiovascular, or hepatic diseases. Thus, the final sample included 107 (56 nondepressed and 51 depressed) participants aged over 65 years.

Symptoms of depression were evaluated using the Iranian version of the 15-item Geriatric Depression Scale (GDS-15), being specifically validated for usage in Iranian participants.^[15] In the GDS-15, questions are responded "yes" or "no." The grid sets a range of 0-9 as "normal," 10-19 as "mildly depressed," and 20-30 as "severely depressed." Age, gender, ethnicity, education, physical functional status, the frequency of physical exercise, history of smoking, history of chronic illnesses, history of hospitalization in a recent year, financial capability to pay for medical care, and the history of taking medications that have potential to create depression were determined. To calculate BMI, height (in meters), without shoes with an accuracy 0.5 cm, was measured using a stadiometer, and weight (kg) with an accuracy 0.1 kg, was measured by a calibrated balance. Based on cutoffs for Asian adult society, that proposed by the World Health Organization, BMI (kg/m^2) was classified into four groups: low-weight (BMI <18.5), normal (BMI 18.5-24.9), overweight (BMI 25.0-29.9), and obese (BMI >30).^[16]

WC, with an accuracy 0.5 cm, was evaluated using a measuring tape, between the iliac crest and the ribs. The WC (>80 cm in women and >90 cm in men) were used to describe central obesity.

Blood samples were taken in the morning after an overnight fast for depressive and nondepressive groups. Venous blood samples were gathered inside ethylenediaminetetraacetic acid tubes and were centrifuged at 2500 g and 4°C for 15 min. Serum TC was measured using the cholesterol esterase/cholesterol oxidase method using standard kits (Mannheim, Boehringer, Germany). TG was measured enzymatically (Mannheim, Boehringer, Germany). HDL-C was defined after sedimentation of LDLs by using phosphotungstic reagent (Mannheim, Boehringer, Germany). LDL-C was afterward calculated using the Friedewald formula.^[17]

The data were analyzed using the statistical SPSS version 19.0 (SPSS Inc, Chicago, IL, USA). Independent *t*-test was used to compare the results between the two groups and the Chi-square test was used to compare categorical variables. In addition, to evaluate the data nonparametric Mann-Whitney test was used.

Results

The characteristics of the participants in both case and control groups participants are shown in Table 1. Among the participants, there were 55.2% (59 *n*) of women and 44.8% (48 *n*) of men. Furthermore, 99% (106 *n*) of the participants were uneducated and 98% (104 *n*) had low social and economic support. No significant difference in physical activity and smoking status were observed between the reference participants and participants with depressive symptoms.

A significant difference was found in plasma LDL-C and TG between the control and those who showed depressive symptoms, but the mean of TC and HDL-C did not differ significantly between two groups. Furthermore, BMI and WC in the depressed group were significantly lower than the nondepressed group. When the group with the depressive disorder was compared with the unaffected group, the depressed group had significantly higher BP and lower FBS than the control group [Table 2].

Discussion

Obesity and depression

This study was conducted on the elderly who suffered from depression and compared them with unaffected patients.

Table 1: Baseline characteristics of the nondepressed and depressed subjects (n=107)

	<i>n</i> (%)	Nondepressed, <i>n</i> (%)	Depressed, <i>n</i> (%)	<i>P</i> [†]
Age groups				
65-69	66 (61.6)	34 (60.7)	32 (62.7)	0.84
70-74	19 (17.7)	14 (25)	5 (9.8)	
<75	22 (20.5)	8 (14)	14 (27.4)	
Gender				
Men	48 (44.8)	36 (63)	12 (22.5)	0.07
Women	59 (55.2)	21 (37)	39 (76.5)	
BMI (kg/m^2) [‡]				
Normal	23 (21.4)	11 (19.6)	12 (23.5)	0.43
Overweight	36 (33.6)	22 (39.2)	14 (27.4)	
Obese	48 (45)	23 (41.2)	25 (49.1)	
Physical activity				
Inactive	66 (61.6)	33 (58.9)	33 (64)	0.2
Moderate activity or active	41 (38.3)	22 (39.2)	18 (36)	

[†] χ^2 , [‡]BMI (kg/m^2) was classified into three groups: Normal (BMI 18.5-24.9), over-weight (BMI 25.0-29.9), and obese (BMI >30).

BMI=Body mass index

Table 2: The comparison of age, body mass index, laboratory findings and blood pressure, between depressed and nondepressed subjects (n=107)

	Mean±SD		P [§]
	Nondepressed (n=51)	Depressed (n=56)	
Age (years)	67.01±6.12	67.03±5.63	0.1
BMI (kg/m ²)	30.03±4.13	28.25±4.24	0.001*
WC (cm)	96.65±12.13	92.67±11.45	0.003*
Laboratory findings (mg/dl)			
TC	181.01±13.21	182.23±14.13	0.08
TG	173.21±78.34	154.15±56.42	0.014*
LDL	111.32±49.15	89.52±26.11	0.016*
HDL	45.05±8.62	49.04±10.07	0.06
FBS	131.04±64.16	122.13±54.09	0.001*
Blood pressure (mmHg)			
SBP	124.43±17.19	141.13±25.45	0.035*
DBP	76.09±15.12	83.32±16.34	0.024*

*Significant, §Independent *t*-test. SD=Standard deviation, BMI=Body mass index, WC=Waist circumference, TC=Total cholesterol, TG=Triglycerides, LDL=Low-density lipoprotein, FBS=Fasting blood sugar, SBP=Systolic blood pressure, DBP=Diastolic blood pressure, HDL=High-Density Lipoprotein

The finding revealed a significant difference in BMI and WC between the participants in the control group and those who are suffering from depression. The results of this study confirm the results of several previous studies that suggest increasing BMI is associated with a reduction in the symptoms of depression, independently of confounding risk factors.^[1,3]

The relationship between BMI, central obesity, and mood appears to be rather complex.^[1] Overweight elderly consume more carbohydrates, which may decrease or prevent depression through elevated serotonin levels in the brain.^[1,18] The “jolly fat” hypothesis was first suggested by Crisp and McGuinness.^[19] The researchers proposed that obesity can significantly reduce depression. Ho *et al.* investigated the association between BMI, waist-hip ratio (WHR), WC and symptoms of depression using GDS (15 items, GDS-15) among elderly Chinese. They found an inverse relationship between BMI and depression, but no relationship between increasing WC and WHR and the prevalence of depression.^[1] Li *et al.*, in a cross-sectional study, on elderly Chinese aged 65 or over, revealed that in both obese elderly women and men, the prevalence of depression is lower than those of normal weight.^[3]

Similarly, Carpenter *et al.* examined the relationship between high body weight and depressive symptoms among a population of adult, in the United States. They managed to show inverse relationships between clinical depression and higher body weight in men but not in women.^[20]

In the cross-sectional studies, Ho *et al.*, and Carpenter *et al.*, confirmed the “jolly fat” hypothesis only in

men.^[1,20] Conversely, some of studies, especially in adults and adolescents, have emphasized positive association between being overweight and depressive symptoms.^[21,22] These studies have generally revealed that obese individuals, especially obese adults and adolescents, have more negative self-images, endure lower self-esteem, tend to think that others dislike them, that these factors may be associated with increased depressive symptoms.^[22-25]

Serum cholesterol and depression

In this study, results showed that LDL-C and TG in the depressed group were significantly lower than among the nondepressed group. No association with depressive symptoms was found for TC, although a trend near to significance for HDL-C was established. An association between low levels of LDL-C and depression in previous research was supported only by one study. Aijänseppä *et al.* examined the relationship between LDL-C, HDL-C and depression, in men aged 70–89, during a 30-year follow-up interval across seven countries. Zung self-rating depression scale was applied to determine the depressive status of the patients. They reported lower mean serum of LDL-C among the depressed group, despite a similar energy intake with the nondepressed group. In the Aijänseppä *et al.* study, no association with depressive symptoms were found for HDL-C.^[26] Our findings are in line with the previous study surveying the issue in the elderly by Lehto *et al.*,^[8] but contradicts with Brown *et al.*'s study.^[27] There are several hypotheses to account for the mechanisms probably responsible for the observed results. There is a large body of evidence confirming that cholesterol influences the biophysical attributes of neuronal membranes and thus affecting signal transmission, neurotransmitter reuptake, and receptor function. In animal models of depression, cholesterol in the diet, has been shown to affect membrane properties, and increase serotonin receptor sensitivity.^[4] Furthermore, low levels of cholesterol may lead to a decline in serotonin receptors in membranes and to a decline in levels of serotonin concentration, recognized to be associated with depression.^[28] A population study of 40–70 years old reported lower serotonin concentrations in participants with low cholesterol. Furthermore, an animal study highlighting a decreased serotonin-activity along with a low-cholesterol diet.^[4,28] Depression might be associated with inflammatory conditions through factors such as altered inflammatory system and stress. Another hypothesis of possible relevance proposes that a reduction in cholesterol levels in severe depression is supposedly ascribable to an increase in the concentrations of cytokines. Chronic inflammation and inflammatory cytokine have been reported to increase indoleamine 2,3-dioxygenase activity and the metabolisms of tryptophan, the primary amino acid precursor of serotonin.^[6,12] Furthermore, poor health and weight loss in chronic depression can result in a decreased cholesterol concentration.^[29]

Blood pressure and depressive symptoms

The results showed significant higher systolic and diastolic BP in participants who suffered from depressive symptoms. Conversely, Lenoir *et al.*, in a large community-based study, in elderly patients of mean age 74-year-old, demonstrated that the depressive group had lower SBP and DBP than the nondepressive group.^[30] Conversely, Hildrum *et al.*, in an epidemiological study, reported that low BP was related with increased symptoms of depression.^[31] However, other studies, in broad age range cohorts^[32,33] found no association between BP and depressive symptoms. This inconsistency in results could be assumed to result from the use of different measurement tools or genetic differences. More recognition of this issue requires further rigorous studies.

The strengths of the present study, if any, were the psychiatric workup in individuals who were screened positive on the depression scale. In this study, in addition to, the use of a depression-questionnaire, participants that have >10 score in the GDS-15, psychologist checked the status and severity of depression. Thus, accuracy in identifying people with depression proved of importance. The other merit of this study was that, in the first questionnaire, the history of atherosclerosis and smoking were asked and participant with this confounders, were excluded from the study. Nonetheless, the current study might suffer from a number of limitations. First, in this study, only untreated depressed patients were included. Second, cross-sectional data and case-control findings analysis limit causal conclusion, and evaluation of causality is a challenging task. Low LDL-C may be related to an increase in depression. Depression leads to a reduction in LDL-C concentration levels, through nutritional or other unconfirmed factors. Furthermore, low LDL-C and depression may result from factors, i.e., chronic diseases leading to both depression and a reduction in LDL-C through decreased appetite, weight loss, and/or other mechanisms.

Conclusions

We observed that participants with depressive symptoms have lower BMI, WC, serum LDL-C and TG, and that is different from what was observed among the nondepressed patients. In addition, the depressive elderly group had higher BP values than that of the nondepressive group. The findings make it more credible that low concentrations of LDL-C may have positive effects on depressive symptoms and specific diets might affect one's mood. However, further studies are necessary to survey whether or not dietary changes and consumption of high-fat diet may play a role in the treatment or prevention of depressive disorders in elderly people.

Acknowledgments

This study was approved by Ethics Committee of AJUMS (IR.AJUMS.REC.1395.52) and supported by a

grant (No. 95s36) from the Student Research Committee, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran. Authors greatly appreciate the Vice Chancellor for research affairs of Ahvaz Jundishapur University of Medical Sciences support.

Financial support and sponsorship

This study was approved by Ethics Committee of AJUMS (IR.AJUMS.REC.1395.52) and supported by a grant (No. 95s36) from the Student Research Committee, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.

Conflicts of interest

There are no conflicts of interest.

Received: 01 Sep 17 **Accepted:** 26 Feb 18

Published: 09 Oct 19

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