

RELATIONSHIP BETWEEN DEPRESSION AND BODY MASS INDEX AMONG ADULTS IN AL-NAJAF CITY, IRAQ: A CASE-CONTROL STUDY

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ABSTRACT

Background: Obesity and depression were common problems and major public health concerns. Both of these conditions are strongly linked to mortality and morbidity, as well as the social and economic effects of cognitive impairment and healthcare costs. Understanding the potential association between depression and obesity is essential for a comprehensive understanding of these health issues and for developing effective prevention and treatment strategies that address the complex interplay between mental and physical health.

Objective: This study aimed to study the association between depression and obesity, also to explore other risk factors like exercise, family history and sociodemographic characteristics in the association between obesity and depression.

Methods: A case-control study was conducted in Al- Najaf Governorate at Al-Sadr Medical City (Diabetes and endocrinology center). The sample size about 300 participants (two control for every case) were separate into two groups, obese group with Body Mass Index (BMI $\geq 30 \text{ kg/m}^2$) and control group with BMI around (18.5–24.9 kg/m^2). All participants were taken randomly from adult individuals ages ranged between (18-60) years in Al-Najaf Governorate. The data were gathered from October to the end of January.

Result: The association between obesity and depression was a significant, this study indicates that mild depression increases the odds of being an obese by more than twofold with an odds ratio of 2.21 (95% CI: 1.17-4.15). Moderate depression has an odds ratio of 2.47 (95% CI: 1.36-4.48), while severe depression has the highest odds ratio of 6.25 (95% CI: 1.49-26.14). Also this study indicating a significant association between obesity and exercise ($p < 0.001$), obesity and family history of obesity ($p = 0.038$) and obesity and family history of depression ($p = 0.014$). The association between obesity and socio-demographics characteristics was only significant with education level ($P=0.03$), while the other characteristics were not significant ($p\text{-value} = >0.05$).

Conclusions: The study concluded that those who had depression symptoms were more likely to develop obesity than those who had a minimal or no depression symptoms.

Keywords--- Depression, obesity, body mass index and case-control study.

Introduction

Both Obesity and depression were prevalent issues and significant public health concerns (Rosas et al., 2020). Both two conditions were highly associated with morbidity and mortality as well as the socioeconomic effect of functional impairment and healthcare costs (Lv et al., 2020). Obesity is defined by the World Health Organization (WHO) as an excessive accumulation of fat that may have negative health effects and is diagnosed at a Body Mass Index (BMI) of $\geq 30 \text{ kg/m}^2$ (Blüher, 2019). In 2013, the American Medical Association (AMA) formally acknowledged obesity and overweight as a complex chronic disease (De Lorenzo et al., 2020). Approximately 1.9 billion, adults are obese or overweight and obesity death among adults are estimated at 2.8 million per year (WHO, 2021). In Iraq, several studies have shown obesity prevalence, in Erbil city (Shabu, 2019), Baghdad (Jasim et al., 2018), and in Basra in Southern Iraq during the period 2003–2010 (Tahir et al., 2023) these studies showed that obesity prevalence (40.9%, 35.2%, and 40.9%) respectively.

Obesity can progressively cause or worsen a number of co-morbidities, such as type 2 diabetes mellitus (T2DM), cardiovascular disease (CVD), hypertension, dyslipidemia, musculoskeletal disorders, sub-fertility, and certain types of cancer, depending on the stage and duration of weight gain (Fruh, 2017). The increasing prevalence of high body mass index and its resulting mortality threaten people's health in many countries. Furthermore, it has a negative impact on people's health and causes an economic burden on society (Dai et al., 2020).

Depression is a major mental illness that affects people all over the world. Its symptoms include a persistently sadness, cognitive decline, lack of interest or pleasure, feelings of guilt or low self-worth, interrupted sleep or food, exhaustion, difficulty concentrating, and even suicidal thoughts (Silva et al., 2020). Depression has a complicated aetiology that includes a number of variables, such as neurology, psychology, and genetics (Read et al., 2017). An estimated 350 million individuals worldwide suffer from depression, making it one of the leading causes of morbidity and disability globally (WHO, 2023). Moreover, depression contributes significantly to early mortality, mostly as a result of suicide (Daly et al., 2021). In the Eastern Mediterranean Region, the prevalence of depression was 9% (WHO, 2021). A recent Ministry of Health (MOH) report from Iraq states that 16.5% of the country's population over the age of 15 is affected by psychiatric disorders (Kathem et al., 2021).

There are numerous potential pathways that could link obesity with depression, including biological and genetic

variables as well as behavioural and dietary factors. Depression can cause people to alter their eating habits and appetite, which can lead to weight gain or loss (Privitera et al., 2013), people more likely to choose foods high in carbohydrates that make them feel good or comfortable (Puhl et al., 2020), are vulnerable to sleeping disorders, and are at greater risk of binge eating (Wadden et al., 2020). These factors may lead to an increased obesity risk. There are also a number of shared biological mechanisms such as inflammation (Doyle et al., 2019), impaired glycemic control (Rensma et al., 2020), and dysregulation of the hypothalamic–pituitary–adrenocortical axis (Ouakinin et al., 2018), that have been implicated in the causes of both depression and obesity. heredity susceptibility may also potentially link both depression and obesity (Harbron et al., 2014).

Methodology

A case-control study was conducted in Al- Najaf province at Al-Sadr Medical City (Diabetes and endocrinology center). The sampling collecting period commenced in October 2023 and concluded at the end of January 2024, as per the designated data collection schedule. The sample size about 300 participants (two control for every case) were separate into two groups, obese group and control group, including 100 obese individuals with Body Mass Index (BMI $\geq 30 \text{ kg/m}^2$) as a cases group and 200 normal weight individuals with BMI around (18.5–24.9 kg/m^2) as a control group. All participants from the same geographical area. Sample selected conveniently from subjects attending Nutrition and Endocrinology Unit were divided according to WHO assessment of the presence of obesity by BMI.

Data Collection

Study data were obtained by using a questionnaire that includes four parts:

1. Socio-demographic characteristics.

The number of questions in this part (7 items) includes age, sex, Residence, marital status, educational level, Occupational property of house and property of car.

2. General characteristics.

This part includes (4 items) physical activity, family history of obesity, family history of depression and medical history of individual.

3. Anthropometric Measurements.

This part includes anthropometric measurements were taken from individuals participating in study.

I- Participants were weighed on a calibrated scale (weighing scale) without shoes and without wearing heavy clothes, and their heights were measured on a calibrated scale (Seca stadiometer).II- **BMI:** Height and

weight were measured to extract the BMI measurement by the equation $BMI = \text{weight kg} / \text{height m}^2$.

4. Beck's depression inventory II

We used an Arabic version of the validated Beck's Depression Inventory-II (BDI-II) for depression assessment. The Arabic version has been previously validated for use in Arab populations (Rudwan, 2003). The BDI-II is self-administered and takes about 5–10 minutes; the recall period is 2 weeks. It includes twenty-one items on a 4-point scale ranging from zero (no symptoms) to 3 (severe symptoms). Scoring is calculated by adding the highest ratings for all twenty-one items. The minimum and maximum scores are zero and 63, respectively. Higher scores reflect greater symptom severity. In non-clinical subjects, scores of zero–13 indicate no depression and 14–19, mild depression. Scores above 20 indicate depression: 20–28 (moderate depression) and 29–63 (severe depression). The validity and reliability of BDI-II across different populations and countries have been examined in many studies, revealing good internal consistency (Cronbach's alpha 0.91) and high test-retest reliability (Pearson $r = 0.93$) (García-Batista et al., 2018).

Statistical Analysis

Statistical analysis was done by using statistical package for social sciences (SPSS) version 28. Frequencies, percentages, and mean with standard deviation were obtained as descriptive statistics. Chi square, t-test, odds ratio and Binary logistic regression used for analysis. The significance level was equal to or less than 0.05.

Results:

Table 1 compares obese group and control group according to sociodemographic characteristics. Most cases were aged between 30-39 years (30.0%). The highest percentage (37.0%) was among control individuals who belonged to the age group under 30 years. Although the mean age of cases was slightly higher than controls (37.1 ± 10.6 years vs. 34.6 ± 11.4 years). Both cases and controls have 48.0% males and 52.0% females. Most cases (77.0%) and controls (69.0%) are married. A higher percentage of cases have lower education levels than controls ($p = 0.030$). Regarding occupation, the highest percentage (31.0%) of cases were housewives compared to control individuals (27.5%) who were self-employed. On the economic level, most of the cases and controls have a moderate- economic level.

Table (1): The distribution of case and control subjects according to socio-demographic characteristics

		Groups				Total		P. value
		Case		Control				
		No.	%	No.	%	No.	%	
Age/years	<30	27	27.0	74	37.0	101	33.7	0.380
	30-39	30	30.0	54	27.0	84	28.0	
	40-49	25	25.0	43	21.5	68	22.7	
	≥50	18	18.0	29	14.5	47	15.7	
		Mean ± SD (Range)	37.1±10.6 (18-57)		34.6±11.4 (18-56)		35.5±11.2 (18-57)	
Sex	Male	48	48.0	96	48.0	144	48.0	1.000
	Female	52	52.0	104	52.0	156	52.0	
Marital	Single	22	22.0	61	30.5	83	27.7	0.274
	Married	77	77.0	138	69.0	215	71.7	
	Divorced	1	1.0	1	0.5	2	0.7	
Residence	Urban	71	71.0	146	73.0	217	72.3	0.715
	Rural	29	29.0	54	27.0	83	27.7	
Education	Illiterate	-	-	-	-	-	-	0.030
	Primary school	15	15.0	42	21.0	57	19.0	
	Intermediate school	28	28.0	33	16.5	61	20.3	
	High school or vocational	21	21.0	52	26.0	73	24.3	
	Diploma (institute)	17	17.0	23	11.5	40	13.3	
	Bachelor degree (college)	19	19.0	41	20.5	60	20.0	
	Master degree	-	-	9	4.5	9	3.0	

	PhD or equivalent	-	-	-	-	-	-	
Occupational	Government employee	26	26.0	46	23.0	72	24.0	0.324
	Private sector employee	6	6.0	20	10.0	26	8.7	
	Self-employed	21	21.0	55	27.5	76	25.3	
	Housewife	31	31.0	43	21.5	74	24.7	
	Student	7	7.0	21	10.5	28	9.3	
	Retired	1	1.0	4	2.0	5	1.7	
	Unemployed	8	8.0	11	5.5	19	6.3	
Economic	Low	30	30.0	49	24.5	79	26.3	0.492
	Moderate	56	56.0	126	63.0	182	60.7	
	High	14	14.0	25	12.5	39	13.0	

Table 2 compares obese and control subjects according to obesity and depression family history and physical activity. Among participants, 37% of cases and 74% of controls reported regular exercise, indicating a significant association ($p < 0.001$) and an odds ratio (OR) of 4.85 (95% CI: 2.89-8.11). 48% of cases and 35.5% of

controls have obesity family history, indicating a moderate association (OR = 1.68 (95% CI: 1.03-2.73) ($p = 0.038$). While 11.0% of cases and 3.5% of controls had previous depression, with a significant association ($p = 0.014$) and an OR of 3.41 (95% CI: 1.28-9.08).

Table (2): The distribution of obese group and control group according to family history and physical activity

		Groups				Total		P. value	OR	95% C. I for OR
		Case		Control						
		No.	%	No.	%	No.	%			
Exercise	No	63	63.0	52	26.0	115	38.3	<0.001	4.85	2.89-8.11
	Yes	37	37.0	148	74.0	185	61.7	R		
Obesity history	No	52	52.0	129	64.5	181	60.3	R	1.68	1.03-2.73
	Yes	48	48.0	71	35.5	119	39.7	0.038		
Depression history	No	89	89.0	193	96.5	282	94.0	R	3.41	1.28-9.08
	Yes	11	11.0	7	3.5	18	6.0	0.014		

In table (7), the results of this study indicates that mild depression increases the odds of being an obese by more than twofold with an odds ratio of 2.21 (95% CI: 1.17-

4.15). Moderate depression has an odds ratio of 2.47 (95% CI: 1.36-4.48), while severe depression has the highest odds ratio of 6.25.

Table (7): Association between obesity and depression

Overall Depression Score	Groups				P. value	OR	95% C. I for OR
	Case		Control				
	No.	%	No.	%			
Minimal or no depression	40	40.0	125	62.5	R		
Mild depression	24	24.0	34	17.0	0.014	2.21	1.17-4.15
Moderate depression	30	30.0	38	19.0	0.003	2.47	1.36-4.48
Severe depression	6	6.0	3	1.5	0.012	6.25	1.49-26.14
Mean ± SD (Range)	16.05±7.21 (5-36)		12.78±7.10 (3-40)		<0.001		

Discussion:

It was found through the results in table 1 of this study of the sample that there was no significant

difference between cases and controls in terms of age, gender, marital status, occupation, and economic status ($P. value > 0.05$). While a higher percentage of cases have lower education levels than controls ($p = 0.030$). In table

2 ours study found there is a significant association between exercise and obesity ($p < 0.001$) and an odds ratio (OR) of 4.85 (95% CI: 2.89-8.11), this explained that those without exercise was nearly five times more likely for developing obesity, this similar to results of Pietilainen in 2008 that found the physical inactivity a strongly predicted the risk for obesity (odds ratio) 3.9 (Pietiläinen et al., 2008). There are other study conducted in london show that high levels of physical activity were associated with a slightly reduced risk of becoming obese after 10 years of follow-up(Bell et al., 2014).

The result of this study found family history of obesity is a significant indicating a moderate association with obesity (OR) = 1.68 ($p = 0.038$), this explained that those have family history of obesity nearly two times more likely for developing obesity, and this agreed with study conducted in Turkey that showed Subjects with a family history of obesity have a greater prevalence of obesity compared with those without a family history (Erem et al., 2004).

Family history of depression also is a significant association ($p = 0.014$) and an OR of 3.41, indicating that those that have family history of depression were more likely to be obese.

In table (7), shows that was significant association between depression and obesity. the results of current study indicate that mild depression increases the odds of being obese by more than twofold with an odds ratio of 2.21. Moderate depression has an odds ratio of 2.47, while severe depression has the highest odds ratio of 6.25.

One of the recent studies conducted in kingdom of Saudi Arabia in 2021 showed a strong association between moderate to severe depression and obesity (Almarhoon et al., 2021). Other study conducted in island to determine the extent of the association between obesity and depression, found a significant association between depression and obesity at (p -value < 0.05) and this result supports the result of our study(Eidsdottir et al., 2014).

Another studies conducted in several countries showed a significant association between obesity and depression also agreed with our results (Mannan et al., 2016), (Xu et al., 2011),(Pereira-Miranda et al., 2017),(BALKOCA et al., 2023),(Blaine, 2008).

In contrast, ours finding disagreed with study on a sample of 400 subjects aged 16-50 including 200 obese individuals and 200 normal weight individuals in Iran that showed there is no a significant difference between obesity and depression (Askari et al., 2013).

For several reasons, depression may be a strong indicator of obesity. First, hypersomnia and hyperplasia are caused by depression (Patist et al., 2018). which as a result raised energy intake and reduced energy expenditure, respectively (Bornstein et al., 2021). Second, depressed patients tend to eat worse than normally healthy people in a dose-dependent manner, which may result in

increased energy intake (Gibson-Smith et al., 2018). Third, atypical major depressive disorder individuals had greater rates of disability days and limited activity days, which may have decreased their energy expenditure (Matza et al., 2003). The elevation in systemic inflammation and metabolic dysregulation that have been linked to depression in obese people is the fourth cause for this relationship(Schachter et al., 2018)

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