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Exploring the Relationship Between Obesity and Depression: A Cross-Sectional Study at Jinnah Postgraduate Medical Center (JPMC), Karachi.

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Abstract: Objective: Obesity and depression are highly prevalent and have a significant effect on morbidity and mortality worldwide. This study aimed to evaluate the relationship between obesity and depression at Jinnah Postgraduate Medical Center (JPMC), Karachi, from January 23 to June 23. **Materials and Methods:** A cross-sectional study was conducted with 157 obese and 157 non-obese participants, aged 18 to 70, selected using non-probability consecutive sampling. Data collection included demographic variables and the Beck Depression Inventory-II questionnaire. Data was analyzed using the SPSS version 20, employing the Chi-square test to examine associations with depressive episodes. Statistical significance was established with a p-value of < 0.05. **Results:** The study found that 43.31% of obese participants suffered from depression, with varying frequencies of depression, compared to 5.73% of non-obese individuals. A significant association was found among obese and non-obese individuals and their BIDS scores with p-values < 0.005 and < 0.001, respectively. BIDS score indicated a high prevalence of borderline clinical depression among obese individuals compared to non-obese. Age, gender, education, marital status, occupation, and socioeconomic status were also assessed, revealing a significant association with obesity status except for marital status (p-value = 0.249) with p-values 0.001, 0.041, 0.002, 0.249, and 0.049, respectively. In addition, obesity was more prevalent among alcohol consumers 11 (07.01%) compared to smokers 28 (18.47%). **Conclusion:** A significant association was found between obesity and depression. This association persisted even after considering factors like age, gender, education, marital status, occupation, and socioeconomic status. Furthermore, alcohol consumers were more prone to obesity.

Keywords: Jinnah Postgraduate Medical Center; Karachi; Obese; Non-obese; Beck Depression Inventory Scale; Mental Health.

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Introduction

The relationship between overweight, obesity, and mental health is intricate and interrelated, forming a complex tapestry in the realm of health and well-being. The correlation between body weight and emotional well-being is complex, as studies explore the complicated links between obesity and mental health difficulties. Examining the complex relationship between overweight, obesity, and depression uncovers a subtle and intricate terrain where the cause-and-effect relationship is not always straightforward. Research has examined the correlation between obesity and depression, the impact of depression on weight gain, and the reciprocal nature of this connection, providing insight into the complex interaction between the physical and mental

aspects of a person (Sumińska et al., 2022). An analysis of a comprehensive database of inpatient records across the country revealed that the connection between obesity and depression is influenced to some extent by the individual's metabolic health state. The study revealed that both obese and metabolically unwell people have the highest chance of developing depression (OR = 1.442; 95% CI = 1.432, 1.451) (Wang et al., 2022).

The increasing global incidence of overweight and obesity, especially among women in their reproductive years and middle age, has significant implications for mental health and overall well-being. Studying these connections requires large-scale, long-term investigations due to the chronic nature of both depression and obesity. Overweight and obesity among women in their reproductive years have become increasingly commonplace worldwide, affecting sizable proportions of the population in nations like the United States, the United Kingdom, and Australia. Pregnancy-related excess weight increases the chance of obesity and long-term weight gain, which has serious health consequences for moms and healthcare systems (Tan et al., 2023; Weinberger et al., 2017). Additionally, research on female adolescents discovered a weak but continuous correlation between being obese and having a bad mood; the rates of obesity and overweight in adolescents range from 7–11% and 9–12%, respectively (Boutelle et al., 2010).

Furthermore, the prevalence of overweight and obesity in middle-aged women, especially after menopause, is alarmingly high and continues to rise globally. This contributes to various health problems such as dyslipidemia, metabolic conditions, heart diseases, osteoporosis, cancer, and increased mortality. A study on obesity and depressive symptoms in mid-life found that obesity, in turn, affects the long-term risk of depressive symptoms in women but not in men, independently of concurrent depressive symptoms (Mulugeta et al., 2018). Obesity also places a significant economic burden on individuals and healthcare providers, particularly during pregnancy, where managing and treating obesity-related complications require substantial resources. A study estimated that the annual medical cost of obesity in the USA was $147 billion in 2008, with medical costs for obese individuals being $1429 higher than those of normal weight (Bailey, March 6, 2024).

In addition, obesity is associated with poorer mental health, including depression and a poor sense of well-being (Simon et al., 2008). Mental stress is a critical aspect of this complex relationship, encompassing emotional, social, cognitive, and environmental stressors. Various tools and techniques have been developed to measure mental stress, including parenting stress, social support, parental concerns, and real-life events. These stressors are linked to both mental and physical health issues, such as depression, anxiety, and even chronic diseases like diabetes (Xu et al., 2011). The relationship between obesity and depression is complex and influenced by various factors, including stigma and discrimination, social and physical factors, and genetic and environmental factors (Huang et al., 2023). Therefore, measuring body fat is crucial for assessing obesity-related risks. While methods like Magnetic Resonance Imaging and Computed Tomography are accurate, they are invasive and expensive. Non-invasive methods have been developed based on measurements or ratios of different body parts and are more suitable for large-scale epidemiological studies. Body Mass Index (BMI) is a widely used indicator, with cut-off values defining overweight (BMI 25-30) and obesity (BMI $\geq$ 30) (Abou Abbas et al., 2015; Jung et al., 2017; Pereira-Miranda et al., 2017). However, it may not be accurate for certain populations, especially those with unusual body fat distribution.

Moreover, the relationship between obesity and depression has been surprisingly underexplored in Pakistan. Therefore, this study aims to examine the intricate correlation between obesity and depression at Jinnah Postgraduate Medical Center (JPMC), Karachi, Pakistan. The research emphasizes the significance of precise body fat and stress assessment, recognizing the constraints of existing techniques in certain groups. The primary objective is to facilitate the development of more efficient therapies and customized techniques for individuals dealing with the complex relationship between obesity and mental well-being.

Methodology

Study design

This cross-sectional study recruited 157 obese and 157 non-obese aged 18 to 70 from Jinnah Postgraduate Medical Center (JPMC) in Karachi, Pakistan, from January 2023 to June 2023. Data collection involved recording demographic variables and administering the Beck Depression Inventory-II questionnaire, which is a 21-item self-report inventory that measures the severity of depression in adolescents and adults (Steer et al., 1999).

Sampling

Non-probability consecutive sampling was employed to select adult patients who met the predefined criteria. The sample size was determined using a formula (N = (Z^2 × P (1 - P))/e^2) (Pourhoseingholi et al., 2013), considering a 72.5% frequency of depression in both groups and a desired margin of error of 5.0%.

Statistical analysis

Data were analyzed using the SPSS ver 20. The chi-square test was computed to examine the associations between various factors and depressive episodes. Results were considered significant at p-value < 0.05.

Results

The data regarding the relationship between several sociodemographic characteristics (including age, gender, education, marital status, occupation, and socioeconomic status) among the 157 obese and non-obese participants and obesity status (obese vs. non-obese) among the patients is enlisted in **Table 1**. The p-values obtained from chi-square tests assessed the association between each demographic variable and obesity status. The asterisk (*****) next to some p-values typically denotes statistical significance, suggesting a significant association between the demographic variable and obesity status if the p-value is < 0.05.

Table 1. Sociodemographic characteristics and their association with obesity status

Variables	Characteristics	Obese	Non-obese	P- value
Age	<40	102 (64.97%)	127 (81.52%)	0.001*****
	>40	55 (35.03%)	30 (19.74%)	
Gender	Male	84 (53.50%)	96 (61.15%)	0.041*****
	Female	73 (46.50%)	61 (38.85%)	
Education	Intermediate	12 (07.64%)	04 (02.55%)	0.002*****
	Bachelor	109 (69.43%)	141 (89.81%)	
	Post-Graduation	36 (22.93%)	12 (07.64%)	
Marital Status	Married	126 (80.26%)	59 (37.58%)	0.249
	Unmarried	31 (19.74%)	98 (62.42%)	
Occupation	Faculty Member	56 (35.67%)	26 (16.56%)	0.001*****
	IT Staff	33 (21.02%)	14 (08.92%)	
	Laboratory Staff	26 (16.56%)	08 (05.09%)	
	Student	42 (26.75%)	109 (69.43%)	
Socioeconomic Status	Low	18 (11.46%)	43 (27.39%)	0.049*****
	Middle	108 (68.79%)	96 (61.15%)	
	High	31 (19.75%)	18 (11.46%)	

Regarding weight, among the obese participants, 141 had a weight above 110 kilograms, while 16 had a weight between 91-110 kilograms. In contrast, among the non-obese participants, 121 had a weight between 50-70 kilograms, 33 between 71-90 kilograms, and 3 had a weight between 91-110 kilograms.

In terms of smoking and alcohol consumption, among obese participants, 29 (18.47%) were smokers, and 11 (07.01%) consumed alcohol. Among non-obese participants, 48 (30.57%) were smokers, and 3 (1.91%) consumed alcohol as shown in **Table 2**.

Table 2. Distribution of obese and non-obese participants according to their smoking status

Smoking status	Obese	Non-obese
Smokers	29 (18.47%)	48 (30.57%)
Alcohol consumer	11 (07.01%)	3 (1.91%)

The study also assessed the status of depression among participants. Among obese individuals, 68 (43.31%) were found to be suffering from depression, with 42 (61.76%) of them reporting feeling depressed 4 to 5 times a week and 26 (38.24%) individuals feeling depressed 6 to 10 times a week. Among non-obese individuals, 9 (5.73%) were suffering from depression, with 6 (66.67%) of them reporting feeling depressed 4 to 5 times a week and 3 (33.33%) individuals feeling depressed 6 to 10 times a week as depicted in **Table 3**.

Table 3. Distribution of obese and non-obese participants according to their depression status

Depression Status	Obese	Non-obese
Depressed	68 (43.31%)	9 (5.73%)
Feeling depressed 4-5 times a week	42 (61.76%)	6 (66.67%)
Feeling depressed 6 to 10 times a week	26 (38.24%)	3 (33.33%)

The data regarding the relationship between the Becky Inventory Depression Scale (BIDS) score (1-10=Normal, 11-16=Mood disturbance, 17-20=Borderline clinical depression, >20=Moderate/Severe/Extreme depression) among obese and non-obese participants and obesity status is presented in **Table 4**. The p-values from chi-square tests assessed the association between BIDS score and obesity status. The asterisk (*****) next to p-values typically denotes statistical significance, suggesting a significant association between the BIDS score and obesity status if the p-value is < 0.05.

Table 4. BIDS score and its association with obesity status

Obesity status	BIDS Scale	Frequency (%)	p-value
Obese	1-10	34 (21.7%)	<0.005*****
	11-16	79 (50.3%)	
	17-20	37 (23.6%)	
	>20	07 (4.4%)	
Non-Obese	1-10	40 (25.5%)	<0.001*
	11-16	97 (61.8%)	
	17-20	12 (7.6%)	
	>20	08 5.1%)	

These findings indicate a higher prevalence of depression among obese participants compared to non-obese individuals, with modifiable factors potentially contributing to depression in both groups.

Discussion

Obesity is widely recognized as a significant health concern due to its adverse effects on overall well-being. Researchers have undertaken extensive audits and investigations to thoroughly assess how obesity affects health, shedding light on its multifaceted consequences for physical and mental health (Yu et al., 2022).

Sociodemographic factors and obesity status

In this study, a significant association between age and obesity status was observed with a p-value = 0.001, which is < 0.05. It was found that obesity is more prevalent among older patients aged > 40 years, accounting for 55 (35.03%). These findings are aligned with the study conducted in Saudi Arabia, which reported a significant increase in the prevalence of obesity and overweight with age in Saudi males and females with a p-value < 0.05. Moreover, it was observed that the obesity prevalence was higher in the 40-49 years age group compared to other groups in both genders, accounting for 19.2% and 36% of males and females, respectively (El-Hazmi & Warsy, 2002). One of the primary physiological processes behind this could be increased ceramide levels in response to a high-fat diet, which has been linked to aging in humans; older people accumulate more ceramide in their muscles than younger people {Abildgaard, 2014 #9(Tardif et al., 2014)}. Among Pakistanis, a high-fat diet is ubiquitous. In addition, a significant association between gender and obesity status was found with a p-value = 0.041, less than 0.05. It was observed that the prevalence of obesity is higher in females compared to male patients, representing 73 (46.50%). The findings are similar to the study conducted by El-Hazmi et al., 2002, who computed significantly higher obesity prevalence in females with a p-value < 0.001 (El-Hazmi & Warsy, 2002).

Among other sociodemographic factors' correlation with obesity status, education showed a significant association with a p-value = 0.002, which is less than 0.05, indicating a low prevalence of obesity among individuals holding a Bachelor's degree 109 (69.43%). These findings are aligned with the study among the Turkish population, in which p-value < 0.0001 also suggested a significant correlation and concluded the inverse relationship between education and obesity status. The prevalence was highest in illiterates and lowest in university or college graduates. As education levels increased, the prevalence of obesity decreased (Erem et al., 2012). Furthermore, p-value = 0.249, greater than 0.05, suggested no significant association between marital and obesity status. Contrary to this finding, a positive association between obesity and marital status was computed in a study among the Turkish population with a p-value < 0.0001; low obesity prevalence was observed among unmarried people (Erem et al., 2012).

Moreover, occupation was significantly associated with obesity status, depicting p-value = 0.001, and less prevalence of obesity was seen among students 42 (26.75%). Similarly, in the Turkish population, a significant association was found between occupation and obesity, p-value < 0.0001, and the lowest obesity prevalence was observed among unemployed people (Erem et al., 2012). In addition, socioeconomic status showed a significant association with obesity status with a p-value = 0.049; obesity was more prevalent among individuals with high socioeconomic status 31 (19.75%). These findings are also similar to the study among the Turkish population, p-value < 0.0001 suggesting a significant relationship with obesity, but in this study, prevalence was higher in low-income level individuals (Erem et al., 2012).

Smoking and obesity status

In this study, obesity was more prevalent among alcohol consumers 11 (07.01%), while it is less prevalent among smokers 28 (18.47%). These findings are in line with the study conducted by Courtemanche et al., 2018 on the effect of smoking on obesity, observed that smokers do not gain weight while smoking cessation increases obesity prevalence by 1.5-1.7 BMI units or 10-11 pounds (Courtemanche et al., 2018). This is due to the nicotine, which acts as an appetite suppressor and metabolic stimulant. Another study reported similar findings and observed no significant association between smokers and the prevalence of obesity, while a significant correlation was observed between smoking cessation and obesity prevalence. A significant association was observed between alcohol consumption and obesity prevalence with a p-value <0.0001 (Erem et al., 2012). Similarly, another cross-sectional study in the UK general population reported that there was less obesity prevalence in current smokers than never smokers (adjusted OR 0.83 95% CI 0.81-0.86), and there was highest obesity prevalence among former smokers

compared to current smokers (adjusted OR 1.33 95% CI 1.30-1.37) and never smokers adjusted (OR 1.14 95% CI 1.12-1.15) (Dare et al., 2015). Another study reported similar findings conducted at Umm Al-Qura University, Makkah, Saudi Arabia, observed that obesity prevalence was high among smoking quitters compared to smokers (Dahlawi et al., 2024).

Moreover, regarding alcohol consumption and obesity status, the results of this study are aligned with the study conducted by Traversy & Chaput, 2015, who reported that heavy drinking is more consistently related to weight gain. (Traversy & Chaput, 2015) This is due to the reason that alcohol consumption stimulates appetite, unlike smoking and energy consumed, as alcohol is additive to that from other dietary sources (Yeomans, 2010). Another study among Chinese adults further supported these findings and reported that the obesity proportion was higher in heavy drinkers, and the earlier drinking started, the higher the risk for obesity was (Xu et al., 2019).

Depression and Obesity

In this study, depression was more prevalent among obese individuals compared to non-obese 68 (43.31%) and 9 (5.73%), respectively. In addition, a significant correlation was found between obese individuals and their BIDS score with a p-value < 0.005; similarly, a significant association was found between non-obese and their BIDS score with a p-value < 0.001. BIDS score indicated that borderline clinical depression was more prevalent among obese individuals. The findings are contradictory to the study conducted by Askari et al., 2013, which reported no significant difference in depression prevalence among obese and non-obese (Askari et al., 2013). The findings are aligned with another study, including 18 articles (9 cross-sectional studies, 6 longitudinal studies and 3 clinical trials), which concluded a significant association between obesity and depression (Blasco et al., 2020)—similarly, supported by another study, which systematically reviewed and meta-analyzed 15 articles and concluded that depression was 1.38 times more prevalent among obese compared to non-obese (OR 1.38 95% CI, 1.22–1.57) (Xu et al., 2011).

Conclusion

This investigation reveals a modest link between obesity and depression while presenting data on the occurrence of depression among individuals in both obese and non-obese categories. This connection remained significant even after adjusting for variations in age, gender, education, marital status, occupation, and socioeconomic status. Furthermore, obesity was more prevalent among alcohol consumers than smokers. The results support promoting a more physically active and less sedentary lifestyle, aligning with the principles advocated by the active living movement. To establish a causal relationship between obesity and depression, further studies are warranted, especially in Pakistan.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

HUMAN AND ANIMAL RIGHTS

No animals were used in this study. The study on humans was conducted in accordance with the ethical rules of the Helsinki Declaration and Good Clinical Practice.

CONSENT FOR PUBLICATION

Not applicable.

AVAILABILITY OF DATA AND MATERIALS

The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request.

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None.

CONFLICT OF INTEREST
The authors declare no conflict of interest, financial or otherwise.

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