

## Prevalence and Association of Obesity, Depression, and Psychological Stress Among the Population of Saudi Arabia

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### KEYWORDS

Depression;  
Psychological Stress;  
Obesity; Prevalence;  
Patient Care

### ABSTRACT

Background: Obesity, stress, and depression are widespread global issues that have a significant impact on people's personal and public health. Studies reveal that the incidence of anxiety and sadness is significantly higher in obese people. Purpose: This study aimed to find the prevalence and association of obesity, depression, and psychological stress among the population of Saudi Arabia. Methods: A cross-sectional study involving the society in general Saudi Arabian population that was conducted. A self-administered questionnaire is disseminated to the populace through an online platform. Results: About 72.1 percent of the 1075 respondents were female, while 52.6 percent were between the ages of 21 and 30. The proportion of obese individuals amounted to 20.6%. In contrast to melancholy (39.4%), psychological tension was present at a prevalence of 77.8%. A statistically significant correlation was observed between stress and depression; however, no such correlation was found between depression and overweight or obesity. Conclusion: Our study indicates that, contrary to what the literature suggests, numerous stressors rather than melancholy may be the cause of obesity rather than a risk factor for the condition. Further investigation is required to ascertain the correlation between psychological tension, obesity, and melancholy.

### 1. Introduction

health. Depression is a common mental disorder characterized by sadness, lack of pleasure, and loss of interest. . Obesity is one of the co-morbidities that often have a relation with depression, it usually define by the body mass index BMI of the patient.(Obesity, n.d.) Studies have established a link between these diseases, as obese patients are twice as likely to experience depression as those of normal weight. (Pereira-Miranda et al., 2017) A study defines this association as bidirectional causality in which the existence of one condition enhance the risk of another.(Milaneschi et al., 2019) Studies impact the health fluctuations have occurred during and after the pandemic 2020-2021 especially in the matter of obesity and depression .The pandemic adds many factors that needed to scientifically investigate about the relationship between obesity and depression.Obesity is the origin of many complex diseases: hypertension, diabetes, heart disorders, and stroke. Moreover, obesity is having a strong effect on the quality of life, cognitive dysfunction, and life expectancy Globally, multiple systematic reviews support the obesity-depression relationship. One systemic review revealed that female sex specifically is more affected. In Saudi Arabia, only two studies discuss these objectives on two different regions and Research found that 41.7% of obese patients have moderate to severe depression particularly in young adults . In Saudi Arabia, there was no a nationwide study that considers a complex variable in obesity-depression relationship. A country with a population of a 34.81 million mostly youth and a diversity of diet patterns must be studied. A better understanding of the complex obesity-depression relationship provide a continues improving healthcare system. A nationwide investigation points directly to the most changing variables across the 13 regions of Saudi Arabia. Therefore, we can orient the management methods and population education.

## Subjects and Methods

This was a cross-sectional research of the society in the general Saudi Arabian population that was conducted. A self-administered questionnaire is disseminated to the populace through an online platform. Age, gender, marital status, and other sociodemographic characteristics were incorporated into the questionnaires, along with the BMI classification, Patient Health Questionnaire (PHQ-9), and ISMA stress questionnaire.

### 2.1 Statistical analysis

The summary of descriptive statistics consisted of numerical values and percentages (%), while continuous variables were described using the mean and standard deviation. Using the chi-square test, the correlation between psychological stress and melancholy in relation to the sociodemographics of the participants was determined. The significant depression outcomes were subsequently incorporated into a multivariate regression model in order to identify an independent predictor of depression that exhibited a 95% confidence interval and odds ratio. A P-value of 0.05 was deemed to be statistically significant. The data were analyzed utilizing version 26 of the Statistical Packages for the Social Sciences (SPSS) from IBM Corp. in Armonk, NY, USA.

## Results

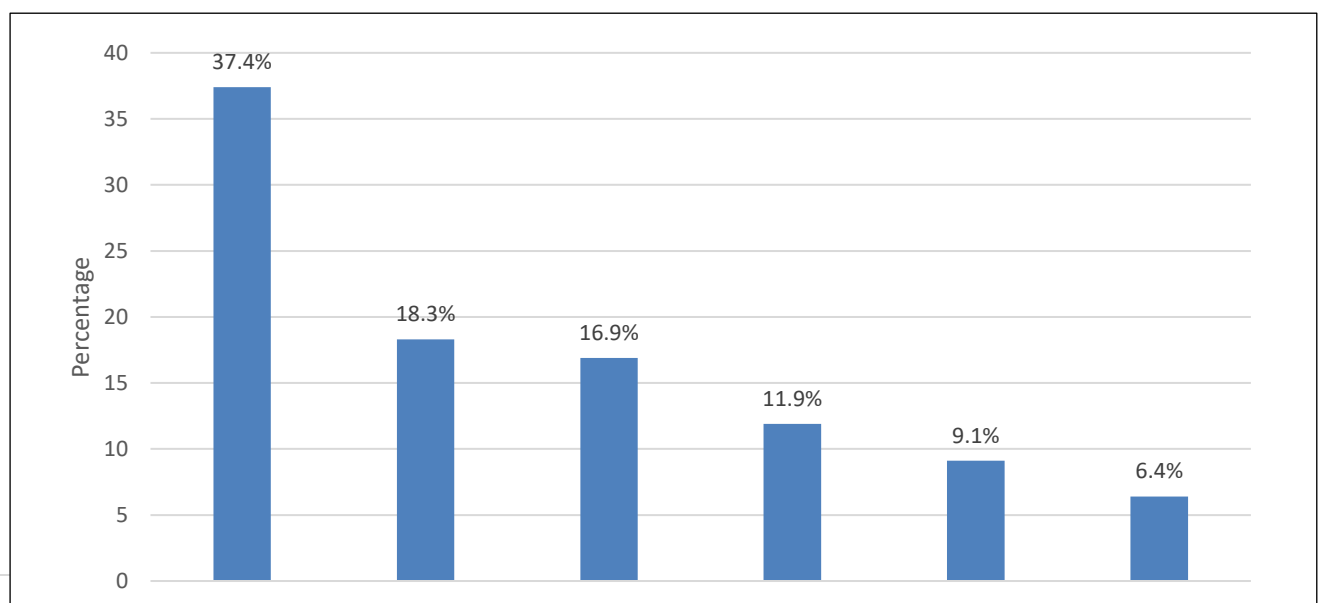
**Table 1:** Socio-demographic characteristics of participants <sup>(n=1075)</sup>

Study variables	N (%)
Age Group	
• ≤20 years	226 (21.0%)
• 21 – 30 years	565 (52.6%)
• 31 – 40 years	134 (12.5%)
• 41 – 50 years	103 (09.6%)
• >50 years	47 (04.4%)
Gender	
• Male	300 (27.9%)
• Female	775 (72.1%)
Nationality	
• Saudi	1029 (95.7%)
• Non-Saudi	46 (04.3%)
Region of residence	
• Western Region	302 (28.1%)
• Eastern Region	102 (09.5%)
• Central Region	257 (23.9%)
• Southern Region	188 (17.5%)
• Northern Region	226 (21.0%)
Marital status	
• Single	727 (67.6%)
• Married	313 (29.1%)
• Divorced or Widowed	35 (03.3%)
Educational level	
• Primary school	08 (0.70%)
• Middle school	20 (01.9%)

• Secondary school	312 (29.0%)
• Bachelor's or above	735 (68.4%)
Average monthly income (SAR)	
• <5,000	635 (59.1%)
• 5,000 – 10,000	202 (18.8%)
• 10,001 – 15,000	132 (12.3%)
• >15,000	106 (09.9%)
Number of dependents	
• One	537 (50.0%)
• Two	67 (06.2%)
• Three	74 (06.9%)
• Four or more	397 (36.9%)
BMI Level	
• Underweight (<18.5 kg/m <sup>2</sup> )	118 (11.0%)
• Normal (18.5 – 24.9 kg/m <sup>2</sup> )	466 (43.3%)
• Overweight (25 – 29.9 kg/m <sup>2</sup> )	270 (25.1%)
• Obese (≥30 kg/m <sup>2</sup> )	221 (20.6%)
Associated chronic disease	
• Yes	219 (20.4%)
• No	856 (79.6%)
Taking medication regularly	
• Yes	187 (17.4%)
• No	888 (82.6%)

A total of 1075 respondents completed the survey. As described in Table 1, 52.6% were aged between 21 to 30 years old with the majority being females (72.1%) and mostly being Saudi nationality (95.7%). Respondents who were living in the Western Region constituted 28.1%. With regards to marital status, 67.6% were single. Respondents who had a bachelor's degree or above were 68.4%. Approximately 59.1% were earning less than 5,000 SAR per month. Half of the participants (50%) were having one dependent. Respondents who were obese constituted 20.6% while 20.4% were having associated chronic diseases wherein 17.4% were taking the medication regularly.

**Figure 1:** Specific chronic disease



In Figure 1, the most common associated chronic disease was anemia (37.4%), followed by diabetes (18.3%) and asthma (16.9%).

**Table 2:** Descriptive statistics of depression and psychological stress (n=1075)

Variables	N (%)
Depression score (mean ± SD)	9.04 ± 5.89
Level of depression	
• Depressed (score ≥10)	424 (39.4%)
• Not depressed (score <10)	651 (60.6%)
Severity of depression	
• Minimal (score 0-4)	246 (22.9%)
• Mild (score 5-9)	405 (37.7%)
• Moderate (score 10-14)	242 (22.5%)
• Moderately severe (score 15-19)	110 (10.2%)
• Severe (score ≥20)	72 (06.7%)
Psychological stress score (mean ± SD)	7.21 ± 3.46
Level of stress	
• Low (score 0-4)	239 (22.2%)
• Moderate (score 5-13)	792 (73.7%)
• High (score ≥14)	44 (04.1%)

Prevalence of psychological stress and depression were given in Table 2. It was observed that the mean score of depression was 9.04 (SD 5.89) with depression found among 39.4% of participants while 60.6% were not depressed. Regarding the severity of depression, 22.9%, 37.7%, 22.5%, 10.2%, and 6.7%, respectively had minimal, mild, moderate, moderately severe, and severe depression. Pertaining to psychological stress, the mean stress score was 7.21 (SD 3.46) with the majority (73.7%) classified as moderate stress, 4.1% were high and 22.2% had low stress.

**Table 3:** Relationship between depression and the Socio-demographic characteristics of participants (n=1075)

Factor	Level of depression		P-value §
	Depressed N (%) (n=424)	Not depressed N (%) (n=651)	
Age Group			
• <30 years	344 (81.1%)	427 (65.6%)	<0.001 **
• ≥30 years	80 (18.9%)	224 (34.4%)	
Gender			
• Male	88 (20.8%)	212 (32.6%)	<0.001 **
• Female	336 (79.2%)	439 (67.4%)	
Region of residence			
• Western Region	120 (28.3%)	182 (28.0%)	0.534
• Eastern Region	40 (09.4%)	62 (09.5%)	
• Central Region	112 (26.4%)	145 (22.3%)	
• Southern Region	69 (16.3%)	119 (18.3%)	
• Northern Region	83 (19.6%)	143 (22.0%)	
Marital status			
• Never been married	325 (76.7%)	402 (61.8%)	<0.001 **

• Been married	99 (23.3%)	249 (38.2%)	
Educational level			
• Secondary or below	151 (35.6%)	189 (29.0%)	<b>0.023 **</b>
• Bachelor or above	273 (64.4%)	462 (71.0%)	
Average monthly income (SAR)			
• <5,000	284 (67.0%)	351 (53.9%)	<b>&lt;0.001 **</b>
• ≥5,000	140 (33.0%)	300 (46.1%)	
Number of dependents			
• One	235 (55.4%)	302 (46.4%)	<b>0.004 **</b>
• More than one	189 (44.6%)	349 (53.6%)	
BMI Level			
• Normal or underweight	218 (51.4%)	366 (56.2%)	0.122
• Overweight or obese	206 (48.6%)	285 (43.8%)	
Associated chronic disease			
• Yes	109 (25.7%)	110 (16.9%)	<b>&lt;0.001 **</b>
• No	315 (74.3%)	541 (83.1%)	
Taking medication regularly			
• Yes	80 (18.9%)	107 (16.4%)	0.304
• No	344 (81.1%)	544 (83.6%)	
Psychological stress			
• Stressed	386 (91.0%)	450 (69.1%)	<b>&lt;0.001 **</b>
• Not stressed	38 (9.0%)	201 (30.9%)	

§ P-value has been calculated using Chi-square test.

\*\* Significant at  $p < 0.05$  level.

When examining the link between depression severity in regard to the socio-demographic characteristics of participants (Table 3), it was found that the prevalence of depression was significantly more common among the younger age group ( $p < 0.001$ ), gender female ( $p < 0.001$ ), being a single ( $p < 0.001$ ), being less educated ( $p = 0.023$ ), earning less than 5,000 SAR per month ( $p < 0.001$ ), having one dependent ( $p = 0.004$ ), having associated chronic disease ( $p < 0.001$ ) and being stressed ( $p < 0.001$ ).

**Table 4:** Relationship between psychological stress and the Socio-demographic characteristics of participants ( $n = 1075$ )

Factor	Level of psychological stress		P-value §
	Stressed N (%) ( $n = 836$ )	Not stressed N (%) ( $n = 239$ )	
Age Group			
• <30 years	598 (71.5%)	173 (72.4%)	0.796
• ≥30 years	238 (28.5%)	66 (27.6%)	
Gender			
• Male	232 (27.8%)	68 (28.5%)	0.831
• Female	604 (72.2%)	171 (71.5%)	
Region of residence			
• Western Region	237 (28.3%)	65 (27.2%)	0.713

• Eastern Region	75 (09.0%)	27 (11.3%)	
• Central Region	205 (24.5%)	52 (21.8%)	
• Southern Region	147 (17.6%)	41 (17.2%)	
• Northern Region	172 (20.6%)	54 (22.6%)	
Marital status			
• Never been married	562 (67.2%)	165 (69.0%)	0.597
• Been married	274 (32.8%)	74 (31.0%)	
Educational level			
• Secondary or below	253 (30.3%)	87 (36.4%)	0.072
• Bachelor or above	583 (69.7%)	152 (63.6%)	
Average monthly income (SAR)			
• <5,000	491 (58.7%)	144 (60.3%)	0.674
• ≥5,000	345 (41.3%)	95 (39.7%)	
Number of dependents			
• One	425 (50.8%)	112 (46.9%)	0.278
• More than one	411 (49.2%)	127 (53.1%)	
BMI Level			
• Normal or underweight	430 (51.4%)	154 (64.4%)	<0.001 **
• Overweight or obese	406 (48.6%)	85 (35.6%)	
Associated chronic disease			
• Yes	171 (20.5%)	48 (20.1%)	0.900
• No	665 (79.5%)	191 (79.9%)	
Taking medication regularly			
• Yes	154 (18.4%)	33 (13.8%)	0.097
• No	682 (81.6%)	206 (86.2%)	

§ P-value has been calculated using Chi-square test.

\*\* Significant at  $p < 0.05$  level.

In Table 4, we tested the relationship between stress (moderate stress + high stress) and not stress (low stress) against the socio-demographic characteristics of participants. According to our results, it was found that only the BMI level showed a significant relationship with psychological stress wherein the prevalence of overweight/obese was significantly more of being stressed ( $p < 0.001$ ). Other socio-demographic variables did not show a significant relationship with the level of stress including age group, gender, region of residence, marital status, educational level, average monthly income, number of dependents, associated chronic disease, and taking the medication regularly (all  $p > 0.05$  level).

**Table 5:** Multivariate regression analysis to determine the independent significant factor associated with depression (n=1075)

Factor	AOR	95% CI	P-value
Age Group			
• <30 years	Ref		
• ≥30 years	0.574	0.348 – 0.948	0.030 **
Gender			
• Male	Ref		
• Female	2.198	1.587 – 3.043	<0.001 **

Marital status			
• Never been married	Ref		
• Been married	0.665	0.415 – 1.066	0.090
Educational level			
• Secondary or below	Ref		
• Bachelor or above	0.810	0.600 – 1.093	0.168
Average monthly income (SAR)			
• <5,000	Ref		
• ≥5,000	0.808	0.579 – 1.129	0.212
Number of dependents			
• One	Ref		
• More than one	0.971	0.708 – 1.331	0.854
Associated chronic disease			
• Yes	1.873	1.328 – 2.643	<0.001 **
• No	Ref		
Psychological stress			
• Stressed	5.017	3.404 – 7.396	<0.001 **
• Not stressed	Ref		

AOR-Adjusted Odds ratio; CI – Confidence Interval.

\*\* Significant at  $p < 0.05$  level.

In a multivariate regression model predicting the effect of depression on certain demographic variables (Table 5), it was found that having been married, having associated chronic disease, and being stressed were the independent risk factors of increased depression while being older was the independent significant predictor of decreased depression. This further indicates that compared to the younger age group, the risk of having depression among the older age group could likely decrease by almost 40% (AOR=2.198; 95% CI=0.348 – 0.948;  $p=0.030$ ). Accordingly, compared to male respondents, female respondents were predicted to increase the risk of having depression by at least 2.198 higher (AOR=2.198; 95% CI=1.587 – 3.043;  $p < 0.001$ ). Respondents who had associated chronic disease were predicted to increase the risk of depression by at least 1.87 times higher compared to healthy participants (AOR=1.873; 95% CI=1.328 – 2.643;  $p < 0.001$ ). Also, stressed participants were 5.017 times higher to be more associated with depression (AOR=5017; 95% CI=3.404 – 7.396;  $p < 0.001$ ). Other variables included did not show a significant effect on depression after adjustment to a regression model including marital status, educational level, average monthly income, and the number of dependents ( $p > 0.05$ ).

This study investigated the prevalence and association of obesity, depression, and stress among the general population living in Saudi Arabia. The findings of this study revealed that among the studied population, the prevalence of obesity was 20.6% while 25.1% were overweight. A slightly higher prevalence of overweight and obese was reported in Abha (Alsalem et al., 2021). According to reports, the prevalence of overweight and obese among male students were 38.4% and 44.2% respectively. Among them, more than half (54%) were detected to have symptoms of depression. This concurred with the report of Wahed & Hassan, (2016) wherein 60.8% of Egyptian students were showing signs of depression. However, in our study, the prevalence of depression was 39.4% slightly lower than the previous reports. Among them, minimal, mild, moderate, moderately severe, and

severe depression were found in 22.6%, 37.7%, 22.5%, 10.2%, and 6.7% of participants, respectively. In contrast, a study conducted among Korean adults (Hong & Hur, 2016) documented the lowest prevalence of depression at 5.7%.

Research findings indicate that obesity and depression are significantly correlated (Baldini, Casagrande & Estadella, 2021; Alsaleem, 2021; Almarhoon et al., 2021; Zhao et al., 2019; Wang et al., 2019; Hong and Hur, 2016). Our findings contradict these results, as we did not observe a statistically significant correlation between adiposity and melancholy. Nonetheless, our findings are virtually identical to those of the research published by Heidari-Beni et al. (2020). Based on the findings, while an inverse correlation was observed between abdominal obesity and severe melancholy in males, no statistically significant association was found between general obesity and psychological distress, anxiety, or depression. Notably, Hong and Hur (2016) established that there existed a correlation between underweight status and elevated susceptibility to melancholy in both males and females. Additional research is necessary to establish a causal relationship between obesity and depression, taking into account the findings presented in this study.

According to the findings of our research, independent risk factors for depression included youth, female gender, comorbid chronic illness, and psychological stress. This finding aligns with the results reported by Almarhoon et al. (2021). Subsequently, they discovered that the incidence of depression was considerably greater among the younger cohort, individuals with psychiatric disorders, marital status, chronic illness, consistent medication usage, the impact of depressive symptoms on daily functioning, and those who had been diagnosed with obesity for an extended period of time. Wahed & Hassan (2016), in contrast to these reports, found that an increase in age was significantly associated with a rise in depressive symptoms, whereas students from other governorates and those with a lower socioeconomic status also contributed to depression. While the previous study did encounter contradictory findings, this could potentially be attributed to the differences in the populations under investigation. Our subject matter pertained to the general population, whereas the latter focused exclusively on students.

In this study, more than three-quarters of the study population was estimated to have psychological stress higher than the report of Alsaleem et al., (2021), as well as the report of Yavari & Tajik, (2021) with 44.4% and 59.1%, respectively. Furthermore, psychological stress was known to be a contributor to various comorbidities including obesity (Tomiyama, 2019). This is also true in our study, as we found that the prevalence of psychological stress was significantly more in the subset of overweight/obese subjects. marital status, education, monthly income, chronic disease, and taking medication regularly ( $p>0.05$ ). In a study conducted by Aldossary et al (2021), psychological distress was also found to be a significant factor in higher BMI. Other known factors of psychological distress being reported were being female, and job status. Our study supports the mounting evidence of the association between obesity and psychological stress. Although, we did not find an association between psychological stress and the socio-demographic variables, however, some studies had proven their association. Thus, future studies are essential to figure out the trend of these associations and to determine the pathways by which these stressors influence the development of obesity.

## **Conclusion**

A significant segment of the populace was afflicted with depression or psychological strain. Our



study indicates that, contrary to what the literature suggests, numerous stressors rather than melancholy may be the cause of obesity rather than a risk factor for the condition. Further, female respondents with underlying diseases who were showing signs of stress were the most depressed among our population. The high prevalence of depression and stress signaled the need for screening and intervention programs directed to the general population to prevent obesity-related diseases. Physical exercise may be the best intervention to reduce weight-related issues that could lead to improving the quality of life among the general population living in Saudi Arabia.

## **Declarations**

## **Acknowledgements**

The authors would like to show sincere thanks to those techniques who have contributed to this research.

## **Consent for publication**

All authors reviewed the results, approved the final version of manuscript and agreed to publish it.

## **Ethical Approval Statement**

Title: " Prevalence and association of obesity, depression, and psychological stress among the population of Saudi Arabia" has been reviewed and approved by the Research Ethics Committee (REC) at University of Hail dated: 12/09/2022 under the reference number **H-2022-311**. We thus consent to the oversight and examination conducted by the Ethics Committee. Moreover, we guarantee the veracity and comprehensiveness of all the information supplied inside this application.

## **Data Availability**

The experimental data used to support the findings of this study are available from the corresponding author upon request.

## **Authors' Contribution**

Conceptualization: N.AL; Methodology: H.AL; Data curation: R.AL; Formal Analysis: L.AL; Writing-Original draft: N.AL. All authors reviewed the manuscript.

## **Conflict of Interest**

All authors confirm that there are no competing interests to declare regarding this work.

## **Funding Statement**

This project received no external funding.

## **Reference**

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