


Psychological Scars Shouldn't be Ignored: Addressing Factors Linked to Depression among Individuals with Laparoscopic Sleeve Gastrectomy

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Abstract

Introduction: Although bariatric surgeries have been linked to improved mental health, yet, some individuals develop depression.

Objectives: The present study aimed to assess the levels of depression and examine factors linked to depression among individuals with laparoscopic sleeve gastrectomy (LSG) in Saudi Arabia.

Methods: A cross-sectional design using a digital online survey was used to collect data. Depression was assessed using the Patient Health Questionnaire among individuals with LSG.

Results: A total of 344 eligible participants were included in the study. A significant percentage of the participants, almost one-third, were suffering from depression 27% ($n = 94$). Moderate to severe depression levels among participants were significantly associated with postoperative complications [odds ratio, OR: 2.92 (95% CI: 1.42–6.01, $p = .003$)] and having preoperative psychological disorders before LSG [OR: 3.68 (95% CI: 1.88–7.26, $p < .001$)]. In contrast, lower levels of depression were significantly associated with believing LSG has achieved its goals [OR: 0.46 (95% CI: 0.22–0.97, $p = .014$)] and recommending LSG to family or friends [OR: 0.15 (95% CI: 0.05–0.44, $p = .001$)].

Conclusion: There is an evident link between depression and experiencing postoperative complications and suffering from psychological disorders before LSG. The findings of the current study would pave the road for the development of psychological strategies designed to break the cyclic pattern of occurrence of depression as well as optimize the success and maintenance of this treatment modality and support recovery for individuals undergoing LSG.

Keywords

depression, bariatric surgery, laparoscopic sleeve gastrectomy, weight loss, mental health

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Introduction/Background

Worldwide, more than 1.9 billion adults are overweight, with over 650 million classified as individuals with obesity. Being overweight means having a body mass index (BMI) of 25 or higher, while obesity is a BMI of 30 or higher (World Health Organization, 2020). In Saudi Arabia, around 24.1% of adult males and 33.5% of adult females are having obesity (Jumbe et al., 2017; Ministry of Health – Kingdom of Saudi Arabia, 2016). Moreover, predictions suggest these rates could rise to 41% for men and 78% for women by 2022 (Al-Quwaidhi et al., 2014).

Obesity acts as a significant risk factor for numerous diseases (Center for Disease Prevention and Control, 2020). Internationally, 4.0 million deaths have been attributed to high BMI levels (GBD 2015 Obesity Collaborators, Forouzan, et al., 2017). Obesity significantly impacts body image, self-esteem, and overall quality of life (Sarwer & Polonsky, 2016). Various psychological disorders are correlated with obesity, encompassing depression, mood disorders, anxiety disorders, eating disorders, and substance use disorders (Simon et al., 2006), with a notable bidirectional relationship with depression (National Health and Medical Research Council, 2013; Rajan & Menon, 2017).

Bariatric surgeries are considered as one of the most effective and sustained weight reduction measures that last up to 10 years (Arterburn et al., 2020; Wolfe et al., 2016). Bariatric surgeries have an evidenced reduction in obesity-related morbidities and mortalities and improvement in quality of life and psychological disorders, including depression (Alabi et al., 2018; Gill et al., 2019; Kalarchian & Marcus, 2019; Wolfe et al., 2016).

Despite the effectiveness of bariatric surgeries, studies about psychopathology following bariatric surgery have shown diverse results (Alabi et al., 2018). Although studies have shown long-term improvement in depression (Gill et al., 2019), short (one year) and medium-term (two to three years) improvements in depression were reported after bariatric surgery and over repeated measures after this procedure. Yet, deterioration or development of depression and increased suicide risk were detected after the surgeries (Kalarchian & Marcus, 2019; Müller et al., 2019).

Review of Literature

Depression after bariatric surgeries was higher in developed countries when compared to low-income countries (Alabi et al., 2018), and long-term follow-up persistence of depression was confirmed postoperatively (Jumbe et al., 2017). Ribeiro et al. (2018) reported that depression improved significantly for approximately two years after bariatric surgery, as it was associated with higher weight loss. Depression worsened for more than two years postoperatively as weight loss gradually decreased (Ribeiro et al., 2018). Similarly, other studies confirmed this shift of

depression over time postoperatively (Brandão et al., 2015; Mitchell et al., 2014). Further, it was found that depression was significantly associated with bariatric surgery with the absence of depression before surgery (Yuan et al., 2019). Accordingly, several studies recommended following up on depression among bariatric surgery patients (Alabi et al., 2018; Brandão et al., 2015; Ribeiro et al., 2018; Schag et al., 2016) as the lack of psychological monitoring after the surgery limits understanding the main reasons for depression and early interventions (Jumbe et al., 2017).

The estimated number of global bariatric procedures was 468,609 (Angrisani et al., 2015). In Saudi Arabia, the approximate number of annual bariatric procedures reached 15,000 in 2014 (Al-Khaldi, 2016), and more than 27,000 in 2019 (Salem et al., 2022). Laparoscopic sleeve gastrectomy (LSG) is the most common and effective bariatric procedure used worldwide and in Saudi Arabia (Mocian & Coroş, 2021; Salem et al., 2022). Its great weight loss success, adequate treatment of comorbidities, and minimal complications has contributed to its current surge in popularity (Garofalo et al., 2018). Laparoscopic sleeve gastrectomy has been recommended for high-risk individuals with super-obesity and weight reduction in morbid obesity (Moy et al., 2008).

Despite the importance of examining the possible associations between depression, weight loss, and LSG, there has been limited empirical nursing literature, as well as a lack of national statistics in Saudi Arabia (Alsubaie et al., 2021; Sait et al., 2019). A key reason for this could be that LSG and its ramifications are still framed primarily through the lens of a surgical perspective, making the psychological outcomes less of a priority (Jumbe et al., 2017).

The association between weight loss and other potentially pertinent psychological changes warrants the vigilance of psychiatric and mental health nurses to monitor psychological outcomes. Hence, the aim of this study is to examine the variables associated with depression among individuals who have undergone LSG. The present study aimed to assess the levels of depression and examine factors linked to depression among individuals with LSG in Saudi Arabia.

Material and Methods

Design

This study utilized a cross-sectional design to assess levels of depression and examine factors associated with depression among individuals with LSG using an online survey. The current study followed the Strengthening of Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines.

Research Question

What are the Factors Associated with Depression among Individuals who Underwent LSG?

Sample. A convenience sampling method was used to eligible recruit participants. Accordingly, an optimal sample size of 324 was calculated based on a depression estimated prevalence of 31% (Sait et al., 2019), a 95% confidence interval, and a margin of error of 5% in this current study. The calculation was performed using the Raosoft sample size calculator (Rao & Rao, 2009).

Inclusion/Exclusion Criteria

Inclusion criteria included adults who underwent LSG for three months or more to ensure individuals had overcome postoperative complications that might compromise their mental health. Responses from participants under 18 years old and having surgeries for less than three months were excluded from the study. An initial sample of 370 participants who had bariatric surgery completed the online survey; out of them, 344 were eligible and were included in the study.

Study Instruments

The current study used an online survey that included socio-demographic and clinical data along with the Patient Health Questionnaire (PHQ-9). Sociodemographic and clinical data comprised of gender, age, marital status, having children, highest educational level, employment, monthly income, date of surgery and postoperative duration, postoperative complications such as vomiting, nausea, bleeding, anemia, B12 deficiency, osteoporosis, hypoglycemia, malabsorption, fistula, hernia, bowel obstruction, and others, satisfaction with bariatric surgery outcomes (i.e., LSG achieved its goals, recommending LSG to family or friends), following a prescribed exercise and dietary regimens, having a family member who underwent bariatric surgery, and psychological disorders before the surgery such as depression, bipolar disorders, schizophrenia, obsessive-compulsive disorders, anxiety disorders, phobias, and others. The researcher developed the sociodemographic and clinical variables after reviewing related literature on the topic and further reviewed by experts in the field to ensure a comprehensive inclusion of all significant clinical data.

The PHQ-9 was used to measure depression among participants. The questionnaire was developed by Spitzer et al. (1999) and it includes nine items: little interest or pleasure; feeling depressed, down, or hopeless; trouble falling, staying asleep, or sleeping too much; feeling tired or having little energy; poor appetite or overeating; feeling bad about yourself, or that you are a failure or have let yourself or your family down; trouble concentrating on things; moving or speaking so slowly that other people could have noticed or the opposite; and thoughts that you would be better off dead or of hurting yourself in some way. Each item is rated on a 4-point Likert scale ranging from 0 to 3

and labeled as not at all, several days, more than half the days, and nearly every day, respectively (Spitzer et al., 1999).

The PHQ-9 screens and classifies depression as major depression, other depression, and no depression. Major depression is diagnosed if five or more items have been rated at least “more than half the days” in the past two weeks, and one of the items is 1 or 2. Other depression is diagnosed if 2–4 items have been present and rated at least “more than half the days” in the past 2 weeks, and 1 of the items is 1 or 2. Additionally, the PHQ-9 assesses the severity of depression based on the total score that ranges from 0 to 27. Minimal depression ranges from 0 to 4, mild depression from 5 to 9, moderate depression from 10 to 14, moderately severe depression from 15 to 19, and severe depression from 20 to 27. The PHQ-9 is a valid and reliable measure of depression with 61% to 75% sensitivity, 90% to 94% specificity, respectively (Maurer, 2012; Spitzer et al., 1999), and excellent internal reliability as Cronbach’s α was 0.89 (Kroenke et al., 2001).

In the current study, we used the PHQ-9 Arabic version to screen depression among participants. The PHQ-9 Arabic version criterion validity; Pearson’s correlation coefficient between the PHQ-9 and Hospital Anxiety and Depression Scale was 0.94 and the Spearman’s correlation coefficient was 0.81. The PHQ-9 Arabic version had a sensitivity of 86.2 and a specificity of 83.8. Reliability was established using intraclass correlation = 0.97, internal consistency reliability, and Cronbach’s α = 0.84 (Belhad et al., 2017). All PHQ-9 screeners and translations are downloadable from the website, and no permission is required to reproduce, translate, display, or distribute them (Spitzer et al., 2011).

Data Collection

The researchers developed a digital form of the survey and sent the relevant link to 10 adults who underwent LSG to pilot the applicability and clarity of the research tools. Participants involved in the pilot study were excluded from the total study subjects. Data collection was online and took over three months, from November 2023 to January 2024. Laparoscopic sleeve gastrectomy participants were sought online through social media such as Twitter and Facebook accounts of the Bariatric Surgery Groups, which included individuals who had undergone bariatric surgeries in Saudi Arabia. The survey link was sent with an invitation, including the study description, aim, and participants’ rights regarding their voluntary participation, the confidentiality of their data, and the informed consent form. If the participants are willing to participate in the study, they will click on the agree option below the informed consent, and survey questions will appear. Only one response was allowed for each participant.

Ethics Approval and Consent to Participate

Before the commencement of this study, Institutional Review Board approval was obtained from the university research

center. This study was conducted according to the World Medical Association Declaration of Helsinki. The aim of the study, participants' rights of confidentiality and voluntary participation, and informed consent were sent to participants along with the online survey. Each participant provided informed consent to be recruited in the study.

Statistical Analysis

Data were cleaned and analyzed using R software version 4.2.2. Categorical data were presented as frequencies and percentages. Chi-square and Fisher's exact tests assessed the association between depression and all other categorical variables. Multiple binary logistic regression analysis was conducted to identify factors associated with moderate to severe depression after LSG and to obtain the adjusted odds ratio. A test was considered significant if p -value $< .05$.

Results

Sample Characteristics

An initial sample of 370 participants (126 males and 260 females) completed the online survey post-bariatric surgery. Twenty-two participants were excluded for having undergone bariatric operations other than LSG, and four were excluded for being under eighteen. A total sample of 344 adult participants who underwent LSG were included in the study. The participants ranged from 18 to 66 years old, with a mean age of 32.0 ± 8.5 years old, and more than half of the participants were female (66.0%). Participants exhibited various anthropometric and weight loss outcomes, including a mean initial BMI of $44.6 (\pm 7.1)$ and a mean current BMI of $31.3 (\pm 7.4)$. The initial weight, current weight, and weight lost were reported as 120.7 kg (± 24.3), 84.3 kg (± 21.2), and 36.4 kg (± 21.5), respectively. Percent total weight loss and percent excess weight loss (% EWL) were 29.4% (± 14.1) and 59.5% (± 28.0), respectively. The majority of participants (62.2%) achieved successful weight loss, defined as %EWL greater than 50%. Nearly half were single or married (45.3% and 47.7%, respectively), and 40.7% had children. The majority had a university degree (56.4%). Regarding employment and income, 52.6% were employed, and over a third had an income below 2,500 SAR (667 USD) per month. More than half of the participants (59%) have undergone LSG for less than one year. Nearly two-thirds are exercising (64.8%), and more than half of them are on dietary regimens (57.3%) and had a family member or a friend who had LSG (52.2%). Most of the participants would recommend LSG to their families and friends (92.4%), and they believe that bariatric surgery has achieved its goals (78.8%). Almost one-fifth of the participants have experienced complications postoperatively (19.8%) and psychological disorders before the surgery (20.1%) (Table 1).

Research Question Results

The percentage of depression among the current study participants was 27% ($n = 94$), with 95% CI = 22.6% to 32.0%. Moderate to severe depression was significantly associated with gender, age, having children, employment, monthly income, postoperative complications, believing that goals were achieved, recommending LSG to others, exercise, and having psychological disorders before LSG operation. Regarding gender, a significant association was observed ($p = .007$), with 77.7% of participants with moderate to severe depression being female compared to 61.6% in the minimal to mild depression group. Moderately to severely depressed participants were, on average, younger than minimally to mildly depressed counterparts ($p = .012$). A lower percentage of participants having children had moderate to severe depression (30.9%) compared to 44% with minimal to mild depression ($p = .031$). Employment showed a significant association with the occurrence of moderate to severe depression ($p = .002$) where a lower percentage of working individuals and higher percentages of students fell in the moderate to severe depression group compared to the minimal to mild depression group (40.4% vs. 57.2%) and (28.75 vs. 13.6%), respectively. Monthly income exhibited significant differences between the two groups ($p = .030$), with higher percentages of lower-income categories in the moderate to severe depression group. Participants who experienced postoperative complications were significantly more likely to be moderate to severely depressed (37.2% vs. 13.2%, $p < .001$), while those believing they achieved their bariatric surgery goals were more prevalent in the minimally to mildly depressed group (83.6% vs. 66.0%, $p = .001$). A notable difference was found in the recommendation of bariatric surgery to family or friends, with a higher percentage in the minimally to mildly depressed group (97.6% vs. 78.7%, $p < .001$). Similarly, a significant association was observed between depression and exercise habits with a lower percentage of moderately to severely depressed individuals engaging in regular exercise (51.1% vs. 70.0%, $p = .002$). Finally, participants who reported having psychological disorders before bariatric surgery were significantly more likely to be moderately to severely depressed (38.3% vs. 13.2%, $p < .001$) (Table 1).

Table 2 shows the severity as well as the classification/diagnosis of depression using PHQ-9 scale. Most of the participants diagnosed with depressive disorders (99.9%) have moderate to severe levels of depression. While those with no depressive disorders, the majority of them (93.3%) had either minimal or mild depression.

According to the multiple logistic regression analysis (Table 3), clinical variables tied to lower depression

Table 1. Depression, Sociodemographic Characteristics and Clinical Profile of Laparoscopic Sleeve Gastrectomy Participants.

Variables	Total (n = 344)		Minimally to mildly Depressed ^b (n = 250)		Moderately to severely depressed ^b (n = 94)		P
	n	%	n	%	n	%	
Gender							
Male	117	34.0	96	38.4	21	22.3	.007*
Female	227	66.0	154	61.6	73	77.7	
Age in years ^a , Mean ± SD	32.0 ± 8.5		32.7 ± 8.5		30.1 ± 8.0		.012*
Anthropometrics and weight loss outcomes							
Height (cm)	164.0 ± 9.5		164.4 ± 10.0		163.1 ± 7.9		.205
Initial weight (kg)	120.7 ± 24.3		120.5 ± 24.3		121.4 ± 24.3		.745
Initial BMI	44.6 ± 7.1		44.3 ± 6.8		45.5 ± 7.7		.182
Current weight (kg)	84.3 ± 21.2		83.7 ± 20.3		86.0 ± 23.4		.398
Current BMI	31.3 ± 7.4		30.9 ± 6.9		32.3 ± 8.6		.142
Weight lost (kg)	36.4 ± 21.5		36.8 ± 20.2		35.5 ± 24.8		.637
%TWL	29.4 ± 14.1		29.9 ± 13.0		28.3 ± 16.6		.420
%EWL	59.5 ± 28.0		61.0 ± 26.1		55.6 ± 32.3		.155
Successful weight loss (%EWL > 50%)							
Yes	214	62.2	160	64.0	54	57.4	.321
No	130	37.8	90	36.0	40	42.6	
Marital status							
Single	156	45.3	106	42.4	50	53.2	.197
Married	164	47.7	126	50.4	38	40.4	
Divorced/widowed	24	7.0	18	7.2	6	6.4	
Children							
Yes	140	40.7	111	44.4	29	30.9	.031*
No	204	59.3	139	55.6	65	69.1	
Highest educational level							
High school or below	124	36.0	96	38.4	28	29.8	.332
Bachelor's degree	194	56.4	136	54.4	58	61.7	
Postgraduate degree	26	7.6	18	7.2	8	8.5	
Employment							
Working	181	52.6	143	57.2	38	40.4	.002*
Not working	102	29.7	73	29.2	29	30.9	
Student	61	17.7	34	13.6	27	28.7	
Monthly income							
<2500 SAR	130	37.8	82	32.8	48	51.1	.030*
2500–<5000 SAR	41	11.9	33	13.2	8	8.5	
5000–<7500 SAR	43	12.5	34	13.6	9	9.6	
7500–<10,000 SAR	48	14.0	35	14.0	13	13.8	
>10,000 SAR	82	23.8	66	26.4	16	17.0	

%TWL = percent total weight loss; %EWL = percent excess weight loss.

^aAge total number = 339 and missing data = 5.

^bDepression was screened using PHQ-9.

^cReflects the number and percentage of participants answering “yes” to this question. LSG = Laparoscopic Sleeve Gastrectomy.

* p value < .05.

comprised bariatric surgery achieved participants' goals (odds ratio [OR] = 0.46, 95% CI: 0.22–0.97, $p = .039$), and participants who would recommend bariatric surgery to a family member or a friend (OR = 0.15, 95% CI: 0.05–0.44, $p = .001$). On the other hand, having postoperative complications after bariatric

surgery was significantly associated with a triple-fold odds ratio of moderate to severe depression (OR = 2.92, 95% CI: 1.42–6.01; $p = .003$). Likewise, experiencing psychological problems before bariatric surgery was significantly associated with moderate to severe depression levels (OR = 3.68, 95% CI: 1.88–7.26; $p < .001$).

Variables	Total (n = 344)		Minimally to mildly depressed ^b (n = 250)		Moderately to severely depressed ^b (n = 94)		P
	n	%	n	%	n	%	
LSG postoperative duration (years)	2.6 ± 1.9		2.5 ± 1.8		2.8 ± 2.1		.224
LSG postoperative duration categories							
<6 months	133	38.7	95	38.0	38	40.4	.202
6 months→1 year	70	20.3	57	22.8	13	13.8	
1 year→<2 years	53	15.4	40	16.0	13	13.8	
2 years→<3 years	44	12.8	31	12.4	13	13.8	
≥3 years	44	12.8	27	10.8	17	18.1	
Did you experience any postoperative complications after LSG?							
Yes	68	19.8	33	13.2	35	37.2	<.001*
No	276	80.2	217	86.8	59	62.8	
Has your LSG achieved your goals?							
Yes	271	78.8	209	83.6	62	66.0	.001*
No	73	21.2	41	16.4	32	34.0	
Do you recommend LSG to your family or friends?							
Yes	318	92.4	244	97.6	74	78.7	<.001*
No	26	7.6	6	2.4	20	21.3	
Do you exercise? ^c							
Yes	223	64.8	175	70.0	48	51.1	.002*
No	121	35.2	75	30.0	46	48.9	
Are you following a dietary regimen?							
Yes	197	57.3	138	55.2	59	62.8	.254
No	147	42.7	112	44.8	35	37.2	
Did any one of your family have bariatric surgery?							
Yes	190	55.2	141	56.4	49	52.1	.556
No	154	44.8	109	43.6	45	47.9	
Did you have any psychological disorders before LSG?							
Yes	69	20.1	33	13.2	36	38.3	<.001*
No	275	79.9	217	86.8	58	61.7	

Table 2. Severity and Classification/Diagnosis of Depression Based on PHQ-9 Scores and Depression Diagnostic Status among Laparoscopic Sleeve Gastrectomy Participants.

Classification/Diagnosis of Depression Severity of Depression	No depressive disorder		Other depressive disorder		Major depressive disorder		p*
	N	%	N	%	N	%	
Minimal depression	157	61.8	0	0.0	0	0.0	<.001**
Mild depression	80	31.5	13	43.3	0	0.0	
Moderate depression	15	5.9	16	53.3	8	13.3	
Moderately severe	2	0.8	1	3.3	17	28.3	
Severe	0	0.0	0	0.0	35	58.3	

* Using Fisher exact test.

**p < .05.

Discussion

The current results showed that most of the study participants achieved significant and effective weight loss after performing LSG and were satisfied with their surgery outcomes.

However, depression was a significant mental health problem amongst LSG participants that was associated with female, younger, and student participants. Moreover, depression was significantly associated with low income, having no

Table 3. Logistic Regression of Depression, Sociodemographic Characteristics, and Clinical Profile of Laparoscopic Sleeve Gastrectomy Participants.

Variables	OR	SE	95% CI		p
			LL	UL	
Gender					
Male	0.71	0.38	0.33	1.49	.376
Female (reference)					
Age in years	1.00	0.03	0.95	1.05	.983
Current BMI	1.02	0.03	0.97	1.08	.358
Marital status					
Single	1.06	0.49	0.41	2.84	.901
Divorced/widowed	0.90	0.64	0.24	2.97	.864
Married (reference)					
Children					
Yes	0.59	0.51	0.22	1.64	.310
No (reference)					
Highest educational level					
High school or below	0.66	0.34	0.33	1.27	.218
Postgraduate degree	1.07	0.60	0.31	3.40	.911
Bachelor's degree (reference)					
Employment					
Not working	1.37	0.48	0.53	3.55	.515
Student	1.60	0.57	0.52	4.90	.413
Working (reference)					
Monthly income					
2500–<5000 SAR	0.49	0.55	0.16	1.41	.203
5000–<7500 SAR	0.67	0.57	0.21	2.00	.480
7500–<10,000 SAR	1.36	0.59	0.42	4.33	.604
>10,000 SAR	0.76	0.57	0.24	2.33	.631
<2500 SAR (reference)					

OR = odds ratio; CI = confidence interval; LL = lower limit; UL = upper limit; LSG = Laparoscopic Sleeve Gastrectomy. * $p < .05$.

Variables	OR	SE	95% CI		p
			LL	UL	
Postoperative duration					
6 months–<1 year	0.76	0.46	0.30	1.85	.546
1 year	1.28	0.52	0.45	3.52	.631
2 years	1.48	0.52	0.52	4.09	.449
≥3 years	2.44	0.54	0.85	7.07	.096
<6 months (reference)					
Did you experience any postoperative complications after LSG?					
Yes	2.92	0.37	1.42	6.01	.003*
No (reference)					
Has your LSG achieved your goals?					
Yes	0.46	0.37	0.22	0.97	.039*
No (reference)					
Do you recommend LSG to your family or friends?					
Yes	0.15	0.56	0.05	0.44	.001*
No (reference)					

(continued)

Continued.

Variables	OR	SE	95% CI		p
			LL	UL	
Do you exercise?					
Yes	0.55	0.32	0.29	1.04	.065
No (reference)					
Are you following a dietary regimen?					
Yes	1.77	0.34	0.92	3.46	.089
No (reference)					
Did any one of your family have LSG?					
Yes	1.03	0.31	0.56	1.92	.920
No (reference)					
Did you have any psychological disorders before LSG?					
Yes	3.68	0.34	1.88	7.26	<.001*
No (reference)					

children, and unemployed participants. LGS postoperative complications and psychological disorders before LSG were significantly and positively associated with depression. In contrast, believing LGS has achieved its goals, recommending LGS to family and friends, which reflect satisfaction with the surgery outcomes and exercise habits, had a significant negative association with depression.

Nowadays, LGS is a fundamental and common treatment for obesity. The superiority of this surgical procedure over alternative weight-loss therapies in improving medical outcomes among individuals with severe obesity is undeniable (Colquitt et al., 2014). Participants elected this surgery to mitigate the adverse obesity-associated psychological impacts such as depression, disturbed body image, social stigma, sense of inferiority, low self-esteem, and poor quality of life (Yates et al., 2020). Yet, a significant percentage of the current participants were suffering from depression even after LGS. This result came in accordance with a previous study in South Africa which reported that the commonest comorbidity among the study group after performing LSG was depression (Sofianos & Sofianos, 2016), and a remarkably similar percentage of depression was found among patients undergoing bariatric surgery compared to the general population (Köhler et al., 2021; Sarwer & Polonsky, 2016) as well as in Saudi Arabia (Alsubaie et al., 2021; Sait et al., 2019). However, in the Tehran Obesity Treatment Study, depression scores fell among the study groups one year after the surgery (Barzin et al., 2020).

The current study highlighted that the female participants recorded significantly higher depressive symptoms in response to the LSG than their male counterparts. Coinciding with the results of a previous study in Saudi Arabia, which reported that patients' age and gender correlated significantly with their mean perceived depression score (Alshammari et al., 2022). It was found that women are nearly twice as likely as men to experience depression at some point in their lives (Kuehner, 2017). The differences

in depression rates between women and men can be attributed to women being more prone to emotional issues, making them more likely to develop depression. This tendency is influenced by biological factors, psychological traits, and certain aspects of the social environment (Tang and Zhang, 2022). It was suggested that gender-specific subtypes of depression exist, with the developmental subtype being the most significant in potentially widening the gender gap. For instance, early puberty among females might contribute to depression development. Similarly, genetics may have a role in explaining the gender difference with scarce evidence. Also, stress plays a major role, as females encounter severe stressors and sexual abuse is a prominent one. Women seem to be particularly vulnerable to normal hormonal changes during the premenstrual, peripartum, and perimenopausal phases, indicating a more uniform, female-specific reproductive pattern of depression (Kuehner, 2017). The World Health Organization (WHO) confirms higher levels of depression among women when compared to men, with no clear explanations (World Health Organization, 2021). Contradictory, Yuan et al. (2019) depicted a higher post-bariatric surgery hazard ratio of depression among males than females (Yuan et al., 2019). However, it seems that the female gender and its linkage to depression need further longitudinal studies that focus on genetic, psychosocial, and environmental factors (Kuehner, 2017). Moreover, depression was significantly prevalent among student participants, which is not surprising due to the highly stressful and demanding environment of universities and colleges (Lane, 2020).

Evidence from previous studies revealed that providing social support lowers the incidence of depression (Conceição et al., 2020; Lent et al., 2016). These results would reinforce the close relationship between lower levels of depression and having children which might be considered as source of support in the present study. In this regard, social support was a protective factor against developing depression

(Tymoszuk et al., 2019). It is reasonable to question whether the quality of social networking could optimize the LSG subjects' psychological state and lower the degree of psychopathology.

According to the present results, exercise habits were significantly associated with lower levels of depression among the studied participants during the postoperative period. It is not surprising that a lower level of physical activity is linked to an increased risk of depression (Gianfredi et al., 2022). The advocacy for global mental health, led by the WHO, prompted that practicing physical exercises improves mood and reduces depressive symptoms (World Health Organization, 2023). Correspondingly, a review of recent meta-analyses revealed that practicing physical activities held a comparable effect on both psychotherapy and antidepressants among individuals who are more susceptible to developing depression (Knapen et al., 2015).

Even though LSG has improved quality of life and depression levels (Mack et al., 2016), the occurrence of postoperative complications deteriorates depression, as evident in the current study and reported by Kheirvari and Anbara (2021). Taken together, the preoperative psychological comorbidities and individuals' anticipation that life will radically change after bariatric surgery can also negatively jeopardize individuals' postoperative psychological health if their expectations are not met (Kubik et al., 2013). This lends further support to the present study findings, in which participants who were suffering from psychological disorders before bariatric surgery were significantly prone to develop depression. In this respect, a recent systematic review using randomized controlled trials found no positive effect of bariatric surgeries on mental health (Szmulewicz et al., 2019). Further, no statistically significant alterations in the anxiety and depression levels of patients following bariatric surgery were reported, regardless of the duration of the postoperative period, although the majority of participants were satisfied with the surgery outcomes (Alshammari et al., 2022). All this mandates the need to pay more attention to LSG candidates (Kheirvari & Anbara, 2021; Kubik et al., 2013; Runkel et al., 2011). It would also be appropriate to involve mental health professionals during the preoperative period and the follow-up care after bariatric surgery (Petasne Nijamkin et al., 2013).

Strengths and Limitations

One of the current study's strengths is the relatively larger sample size. Accessing bariatric surgery individuals was challenging as they were a hard-to-reach population due to the social stigma and embarrassment associated with reporting a history of obesity and bariatric surgery (Chao et al., 2022; Garcia et al., 2023). The online surveys helped to overcome such a challenge. Also, the study addressed significant clinical variables such as satisfaction with the surgery outcomes, social support, exercise, postoperative complications, and

preoperative psychological disorders that were not tackled nationally to our knowledge. The study's limitations included using a cross-sectional design, which restricts the capacity to determine causality and provides merely a snapshot of the association with a lack of follow-ups. Also, depression may be underdiagnosed or misdiagnosed using self-reported surveys when compared with clinical evaluations. Additionally, the study lacks preoperative screening for depression.

Implications for Practice

Existing findings related to the increased risk for the development of depression among individuals who opt for LSG imply the need for special alertness and monitoring of vulnerable individuals pre and post-surgery. Therefore, it mandates integration and collaboration between multidisciplinary teams, including the bariatric teams, mental health nurses, and other mental health professionals, to encompass such psychological problems into their agendas. The proper psychological preparation and detailed information regarding the nature of the surgical procedure, the possible benefits and adverse effects, and the expected change in lifestyle would combat such problems. Presurgical monitoring and postsurgical follow-up of mental health status are highly recommended to target and overcome depression. Mental health screening of LSG candidates, along with a postoperative follow-up, is highly recommended by mental health nurses and clinicians, particularly for individuals suffering from mental health issues and encountering postoperative complications. Taking into consideration verifying the psychosocial aspects and whether depression manifestations are associated with weight loss, candidate satisfaction, and change in diet plans.

Conclusion

Laparoscopic sleeve gastrectomy is an effective and satisfactory weight loss procedure that enhances quality of life. However, there is an evident link between depression and LSG when presented with clinical factors such as postoperative complications and suffering from mental health problems before the surgery. Mental health screening of LSG candidates and postoperative follow-up are highly urged. Furthermore, mental health support, including but not limited to psychoeducation about warning signs of depression, counseling, individual and group brief psychotherapy, physical activity programs, and mental health resources, is required while accommodating the new lifestyles postoperatively and for individuals with mental disorders. Additionally, future research might investigate the role of stigma associated with reducing weight using bariatric surgeries using a qualitative arm.

Authors' Statement

All the listed authors meet the authorship criteria and all of them are in agreement with the content of the manuscript.


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