Bariatric Surgery and Its Impact on Postoperative Dietary Habits: A Prospective Behavioural Study

Mushtaq Ahmad, Shumaila Bibi, Waqar Ahmad, Maria Alamgir, Mah Noor Dad Khan and Abdul Haseeb Sahibzada

Department of Bariatric Surgery, International Metabolic and Bariatric Centre, Afridi Medical Complex, Peshawar, Pakistan

ABSTRACT

Objective: To assess the impact of bariatric surgery on postoperative eating behaviour and dietary compliance.

Study Design: A descriptive study.

Place and Duration of the Study: Department of Bariatric Surgery, International Metabolic and Bariatric Centre, Afridi Medical Complex, Peshawar, Pakistan, from January to June 2024.

Methodology: The study included patients who underwent bariatric procedures, such as sleeve gastrectomy or gastric bypass. Data were collected after the surgical procedure, and patients were categorised according to anthropometric measurements, including height, weight, and body mass index (BMI). The Adult Eating Behaviour Questionnaire (AEBQ) and Postoperative Dietary Compliance Survey (PDCS) were used. SPSS software was incorporated for data analysis, and the Kruskal-Wallis test was applied to find a significant association.

Results: A total of 168 participants were included in the study, with a mean overall eating behaviour score of 116.21 ± 9.5. A total of 163 (97.02%) participants showed symptoms of moderate eating disorder, while 3 (1.7%) of respondents had severe disturbance, and 2 (1.2%) of individuals rated their eating behaviours as mild. Emotional undereating (EU) had the highest mean score of 17.72 ± 2.75. The findings revealed no statistically significant association between eating behaviour and patients' demographics and anthropometrics, including age (years), gender, weight [kg], type of surgery, postoperative duration, and pre- or post-operative BMI (Kg/m^2; $p > 0.05$).

Conclusion: Bariatric surgery was associated with a moderate disturbance in eating behaviours, and the emotional aspect of eating comprised a significant role. There was no discernible relationship between eating habits and variables such as age, weight, or surgery type. This highlighted the importance of providing patients with continuing behavioural and psychological assistance following bariatric surgeries.

Key Words: *Bariatric surgery, Body mass index, Compliance, Dietary changes post-surgery, Food avoidance, Gastrectomy, Postoperative dietary habits.*

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INTRODUCTION

Globally, obesity represents an important and prevalent issue that causes considerable health issues and national budgets in healthcare systems.[1,2] Substantial evidence indicates that obesity operates as both an independent risk factor for multiple chronic health conditions and a predictor of increased mortality.[3] Despite the available lifestyle intervention programmes and medical treatments for severe obesity, their clinical effectiveness remains limited because non-surgical weight loss approaches produce minimal, sustainable weight reduction outcomes.[4]

Correspondence to: Dr. Mushtaq Ahmad, Department of Bariatric Surgery, International Metabolic and Bariatric Centre, Afridi Medical Complex, Peshawar, Pakistan
E-mail: drmushtaqa728@gmail.com

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Bariatric surgery represents a paradigm shift in the management of severe obesity, as it enables significant weight loss while improving obesity-related medical conditions.[5] In most cases, weight loss outcomes can last for 10 years or more; however, weight regain or recurrence of obesity can occur if dietary recommendations and behavioural changes are not followed.[6] Bariatric surgery is indicated for patients with a body mass index (BMI) >40 kg/m^2 or >35 kg/m^2, with other medical conditions.[7,8]

Nevertheless, there are physiological changes caused by bariatric surgery, such as reduced stomach capacity and altered nutrient absorption, that require a structured dietary pattern to manage nutrition, reduce the risk of complications, and support weight loss in the long-term. Postoperative nutritional guidelines generally follow a stepwise approach, allowing patients to gradually transition from clear liquids to pureed foods, then to soft solids, and eventually to regular foods. This approach facilitates proper healing, reduces gastrointestinal upset, and helps prevent complications.[9]

The patient must limit their calorie intake (900–1,000 calories/day), consume a high-protein diet (65–75 g/day), and avoid foods that may cause intolerance, such as raw vegetables, bread, and carbonated beverages. In addition, patients need to take daily supplementation with a multivitamin, calcium, vitamin D, and iron to prevent micronutrient deficiencies resulting from reduced intake and malabsorption.[10]

Behavioural changes are important in promoting long-term success after bariatric surgery. These include mindful eating practice, portion control (such as limiting to ¼ cup of solids), and regular appointments with dietitians, all of which have been shown to enhance retention and reduce weight regain.[11] In addition, perioperative nutritional counselling has been found to improve postoperative outcomes by addressing both physical and psychological barriers to bariatric surgery.[12] Ultimately, this study aimed to assess dietary habits changes, following bariatric surgery, from a prospective behavioural perspective. Changes to dietary habits, retention rates, and predictability of long-term success will provide evidence-based insights for improving postoperative lifestyle and patient outcomes.[13]

Existing research places significant emphasis on weight loss outcomes and the resolution of obesity-related medical conditions. Despite the impact of dietary habit changes on long-term success, research focusing on these behavioural patterns is limited. Therefore, the primary aim of the current study was to assess the impact of bariatric surgery on postoperative eating behaviour and adherence to dietary compliance. Furthermore, it also aimed to identify the associations between eating behaviour and various risk factors.

METHODOLOGY

This prospective cross-sectional study on patients following bariatric surgery was conducted for six months, from January to June 2024. The research included a total of 168 adult patients with obesity who underwent bariatric surgery in the Department of Bariatric Surgery, International Metabolic and Bariatric Centre, Afridi Medical Complex, Peshawar, Pakistan. Patients were recruited during their regular visit to the bariatric surgery clinic. Ethical approval was obtained from the Institutional Research and Ethical Review Board of Afridi Medical Complex, Peshawar, Pakistan (Ref No: 701/DME/AMC; dated: 28 December 2023).

The study included male and female adult participants aged over 18 years with obesity who were able to understand the study procedure and willing to participate. Individuals under 18 years of age were excluded. Furthermore, patients with cognitive impairments, poor medical documentation, comorbid medical conditions, or those who were unwilling to provide data were not included in the current study.

Data were collected through validated questionnaires to measure postoperative eating behaviour and dietary compliance. The Adult Eating Behaviour Questionnaire (AEBQ) is a 35-item Likert scale that comprises two subscales: food approach and food avoidance; each subscale was further divided into four subdivisions.[14] The Postoperative Dietary Compliance Survey (PDCS) was used to assess adherence to dietary guidelines, including portion sizes, food selection and meal frequency, protein consumption, and vitamin/mineral supplementation. In-person and telephonic surveys were conducted to gather data, and demographics and anthropometric measurements were obtained from patients' medical records.

Statistical analysis was conducted *via* SPSS version 22 to examine both demographic and clinical information, as well as AEBQ and PDCS scores, while handling categorical and continuous variables. The Shapiro-Wilk test was employed to test the normal distribution of the dataset. Since the data were not normally distributed ($p < 0.05$), Kruskal-Wallis, a non-parametric test, was applied to find an association between patients' demographics (age, gender, preoperative and post-operative BMI, type of surgery, and postoperative duration) and eating behaviour. A p-value of <0.05 is consi-dered statistically significant, along with a 95% confidence interval (CI). Missing data were not included in the study.

RESULTS

The current study recruited a total of 168 participants with obesity, consisting of 104 (61.9%) females and 64 (38.1%) males. Among them, 109 (64.9%) underwent *Roux-en-Y* gastric bypass (RYGB) surgery. The average age of these participants was 39.20 ± 11.30 years, with a greater proportion of individuals 53 (31.5%) in 30-39 years, followed by 46 (27.4%) in 40-49 years. Regarding postoperative duration, most participants (96; 57.1%) were assessed 4-6 months after surgery.

In terms of anthropometric measurements, the mean height was 5.31 ± 0.46 ft, with a mean preoperative weight of 123.8 ± 24.74 kg, and a postoperative weight of 93.77 ± 20.17 kg, indicating a significant reduction corresponding to 24.26% of total weight loss (TWL). Moreover, the mean preoperative BMI was 46.87 ± 10.12 kg/m^2, with 137 (81.0%) participants representing severe obesity (obesity III), while the postoperative BMI mean score was 35.77 ± 7.59 kg/m^2, depicting 23.68% of total BMI loss (TBMIL), as shown in Table I.

The mean score of the food approach subscale was 53.75 ± 5.6, with hunger showing a higher score, while food enjoyment (FE) exhibited a lower mean score of 9.63 ± 2.6. In contrast, the food avoidance subscale had an average score of 62.46 ± 6.5, with emotional undereating (EU) demonstrating the highest tendency at 17.72 ± 2.75. These findings showed that participants were more prone to avoid food rather than enjoy food. The overall scores are presented in Table II.

Table I: Demographic characteristics.

Variables	Categories	Frequencies n (%)	Mean ± SD
Gender	Male	64 (38.1)	
	Female	104 (61.9)	
Age (years)	18-29	34 (20.2)	39.20 ± 11.30
	30-39	53 (31.5)	
	40-49	46 (27.4)	
	50-59	23 (13.7)	
	≥ 60	12 (7.1)	
Type of surgery	RYGB	109 (64.9)	
	Sleeve gastrectomy	57 (33.9)	
	Adjustable gastric band	2 (1.2)	
POD (month)	1-3	14 (8.3)	2.36 ± 0.77
	4-6	96 (57.1)	
	7-12	42 (25.0)	
	>12	16 (9.5)	
Preoperative BMI (kg/m^2)			46.87 ± 10.12
25.0-29.9	Overweight	4 (2.4)	
30.0-34.9	Obesity I	9 (5.4)	
35.0-39.9	Obesity II	18 (10.1)	
≥40	Obesity III	137 (81.0)	
Postoperative BMI (kg/m^2)			35.77 ± 7.59
18.5-24.9	Normal	-8 (4.8)	
25.0-29.9	Overweight	29 (17.3)	
30.0-34.9	Obesity class I	48 (28.6)	
35.0-39.9	Obesity class II	34 (20.2)	
≥40	Obesity class III	49 (29.2)	
Anthropometric			
Height (ft)	-	-	5.31 ± 0.46
Preoperative weight (kg)			123.8 ± 24.74
Postoperative weight (kg)			93.77 ± 20.17

n = 168; SD: Standard deviation; POD: Postoperative duration; BMI: Body mass index; RYGB: Roux-en-Y gastric bypass; kg/m^2: Kilogram per metre square; Kg: Kilogram; ft: Feet.

Table II: Mean scores of the subscales of eating behaviour.

Eating behaviour subscales	Frequencies	Total mean ± SD
Food approach, mean (SD)		
Hunger	19.13 (3.04)	53.75 ± 5.6
FR	12.35 (1.5)	
EO	12.64 (3.3)	
FE	9.63 (2.6)	
Food avoidance, mean (SD)		
SR	14.98 (2.14)	62.46 ± 6.5
EU	17.72 (2.75)	
FF	15.16 (1.41)	
SE	14.6 (2.44)	
Total eating behaviour, mean (SD) Food approach and food avoidance	-	116.21 ± 9.5

n = 168; SD: Standard deviation; FR: Food responsiveness; EO: Emotional Overeating; FE: Food enjoyment; SR: Satiety responsiveness; EU: Emotional undereating; FF: Food fussiness; SE: Slow eating.

Table III: Eating behaviour disturbances.

Categories	Percentages	n (%)
Mild disturbances	1-50%	2 (1.2%)
Moderate disturbances	51-75%	163 (97.02%)
Severe disturbances	76-100%	3 (1.7%)

n = 168.

It was found that in portion control, 99 patients (59.0%) strictly followed the recommended portion, while 116 (69.04%) faced challenges in controlling portion. In terms of meal frequency, 141 patients (84.0%) consumed ≥3 meals/day and 127 (75.6%) followed the recommended meal. Further regarding food choices, 148 patients (88.1%) strictly adhered to avoiding sugary and fat intake, while 145 (86.3%) adhered to a protein-rich diet. Moreover, the findings revealed that 136 (81.0%) individuals avoided taking fluid with meals, while 139 (82.7%) followed the recommendation. For the non-adherence rate and overall adherence, a total of 163 (97.02%) participants showed symptoms of moderate eating disorder, while three (1.7%) showed severe disturbance, and 2 (1.2%) reported mild eating behaviours, as shown in Table III.

The subscales of eating behaviour—food approach, food avoidance, and overall eating behaviour score—were statistically non-significant ($p > 0.05$) associated with all the variables, including age, gender, postoperative duration, type of bariatric surgery, and preoperative and postoperative BMI.

DISCUSSION

Bariatric surgery is an effective obesity treatment that produces substantial weight reduction and eliminates obesity-related health problems. Postoperative dietary compliance and behavioural modifications determine the extent of success following bariatric surgery. The research explored the effects of bariatric surgery on dietary patterns after surgery while evaluating how patients control their portions, select food, and manage emotional eating behaviours.

The results of this study showed that a large proportion of participants exhibited moderate eating behaviour disturbances after surgery. Specifically, 97.02% of participants experienced moderate disturbances, and only 1.2% of participants maintained mild behavioural disturbances. These findings align with the work of Jabbour *et al.*, who also found that bariatric surgery leads to challenges in post-surgical eating behaviours, particularly regarding portion control and emotional eating.[15] Their study included data on sociodemographic and anthropometric variables, with a mean duration of 2.4 ± 1.8 years after bariatric surgery, aligned with a mean score in the present study (2.36 ± 0.77 years). The proportion of participants in the severe BES category decreased markedly postoperatively, from 78 to 5% ($p < 0.01$). Food craving followed a similar trend, with scores dropping from 50 ± 36 pre-surgery to 30 ± 25 post-surgery ($p < 0.01$).[15] In another study, the mean Excess BMI Loss (EBMIL) was 63.33%, and TWL at six months was 23.83%, while in the present study, the percentage of TWL at six months was 24.26%, aligned with the previous study. Further inverse link was observed, indicating that higher BMI may be associated with lower percentage weight loss, possibly due to reduced physical activity (PA).

Age was also negatively related to weight loss, with TWL decreasing by 0.1 to 0.12 units per year of age. Although the observed correlations between external eating behaviours across different time points suggest that pre-surgical eating habits persist postoperatively and may influence weight loss outcomes,[16] the current study did not find any significant association ($p > 0.05$). Additionally, in another study, 83.8% were women, with a mean age of 42.7 ± 11 years and a preoperative BMI of 47.3 ± 8.1 kg/m^2; however, the current study included both genders, with a mean age of 39.20 ± 11.30. The previous study found that, at 12-month post-surgery, 71.3% of patients adhered to a dietary protein intake of ≥1 g/kg/d, achieving a mean excess weight loss of 74.9 ± 16.7 kg and a BMI reduction to 29.4 ± 5.4 kg/m^2. Similarly, the current study showed greater BMI reduction to 35.77 ± 7.59, with 86.2% participants adhering to the protein diet; however, no significant association was found between protein intake and weight loss, unlike the previous study (p <0.0001).[17]

A previous study reported that patients who received RYGBP showed improvement in eating behaviour, as its frequency decreased from 75 to 28% at one year and 27% at two years, while patients undergoing sleeve gastrectomy (SG) displayed no such changes. Additionally, SG patients who received more behavioural/dietetic support had better weight loss outcomes.[18] In contrast, the present study's findings were uncertain and remained unclear, as it only reported the frequency of individuals who underwent bariatric surgery.

In 2024, a study conducted found that in patients with obesity who underwent bariatric surgery, emotional and uncontrolled eating significantly reduced after surgery (p <0.001), while cognitive restraint increased temporarily at six weeks (p = 0.011). These findings indicate that RYGB leads to significant and prolonged changes in eating behaviour and meal patterns, contributing to sustained weight loss.[19] While the present study reported increased food avoidance behaviour postoperatively and reduced food approach.

In a previous study, the average intake of fruits, sweetened beverages, and vegetables was 1.51 ± 0.79, 4.28 ± 1.02, and 1.78 ± 0.76 servings, respectively. That study also reported a greater percentage (68.2%) of patients having a family history of obesity, with an average of 2.42 ± 1.64 per family.[20] The present study failed to find an association between a family history of patients and obesity. Further, the present study reported that 134 patients (79.8%) adhered to a fruit/vegetable diet; however, it did not measure the quantity of food or drink consumed, aligned with the previous study.

Another past study assessed and compared the food frequency (FF), food habits (FH), PA, and lifestyle of patients with moderate to severe obesity who underwent RYGB and SG. The PA score improved but not significantly, whereas the smoking habit score did not change at T1 (after 6 months) in either of the procedures, including RYGB and SG. Neither FF nor PA scores correlated with age, gender, weight, or BMI in either RYGB or SG. Although the present study did not assess PA, the FH score was negatively correlated with both weight (RYGB: p = 0.002) and BMI (SG: p = 0.003). The SH score was positively correlated with age in SG procedure (p = 0.002), and the correlation was stronger in females than in males (p = 0.004). In contrast, the present study found a non-significant association between eating behaviour and patients' age, gender, weight, preoperative BMI, and postoperative BMI, whereas the previous study did not have this association.[21]

This study had several limitations, as it was a cross-sectional study with a small sample size, thereby reducing the generalisability of the findings. Besides, its self-reported nature of eating behaviour and adherence rate could induce recall bias. Moreover, only physical aspects of measurement were taken into consideration, lacking psychological, cognitive, and physiological aspects. Among patients' demographics, socioeconomic status and post-surgical complications and their impact on eating behaviours were not analysed. The research findings supported the current academic evidence that shows postoperative behavioural changes lead to sustained success after bariatric surgery. The studies show bariatric surgery produces major weight reduction; however, patients face some difficulties in following recommended diets, particularly when it comes to measuring food portions, regulating emotional eating, and selecting nutritious foods. Additional studies are required to investigate specific patient-level association between psychological services, financial status, and adaptive dietary strategies, to optimise clinical outcomes following bariatric surgery.

CONCLUSION

This prospective study concluded that bariatric surgery affects postoperative dietary habits, causing moderate eating behaviour disturbances and emotional eating. Moreover, no significant associations were found with demographics, anthropometric measurements, and clinical parameters.

ETHICAL APPROVAL:
Ethical approval was obtained from the Institutional Research and Ethical Review Board of Afridi Medical Complex, Peshawar, Pakistan (Ref No: 701/DME/AMC; dated: 28 December 2023).

COMPETING INTEREST:
The authors declared no conflict of interest.

PATIENTS' CONSENT:
Written informed consent was obtained from all participants, and confidentiality and anonymity were maintained throughout the study.

AUTHORS' CONTRIBUTION:
MA, MA, WA: Conception and design of the study, acquisition, manuscript writing, and critical review.
SB: Data analysis, interpretation, and critical review.
MNDK: Data collection and statistical analysis.
AHS: Data analysis and interpretation of data, manuscript writing, and critical review.
All authors approved the final version of the manuscript to be published.

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