

Food Tolerance after Laparoscopic Sleeve Gastrectomy in King Saud Medical City, Riyadh, Saudi Arabia

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ABSTRACT

After bariatric surgery the alteration of gastrointestinal anatomy and the physiological changes in postoperative patients may affect the food tolerance. Therefore, the aim of this study was to assess the quality of life and food tolerance level after laparoscopic sleeve gastrectomy (LSG) with monthly follow-ups in Saudi Arabia. This is a cross-sectional study that was conducted on patients aged 18–65 years who underwent LSG during Nov 2016 to Sep 2018 in a tertiary care hospital, Saudi Arabia. Data were collected using the questionnaire “Quality of Alimentation,” which assessed the patient’s satisfaction, time between meals and other food intake, food tolerance level, and vomiting/regurgitation frequency. This study with 110 LSG patients included 28 (25.5%) males and 82 (74.5%) females. The average age was 33.6±9.3 years. Overall, 47 (42.7%) patients reported excellent eating satisfaction whereas 42 (38.2%) reported good eating satisfaction. Additionally, 57 (51.8%) patients reported that they consumed 3–4 meals/day and 23 (20.9%) consumed >5 meals/day. Similarly, 40 (36.4%) patients reported that they could eat everything. Most patients reported that they could eat red meat, white rice, bread, and fish. Seventy-two (65.5%) patients consumed lunch, and this was significantly associated with the number of postoperative months ($p<0.05$). More than 70% of the patients reported that they could easily consume red meat, white meat, vegetables, and fish during the 1-year follow-up period, which was significantly associated with the number of postoperative months ($p<0.05$). Overall, 73.8% of the patients experienced vomiting/regurgitation, and the average food tolerance in all postoperative months was 17.74, which was not significantly associated with the number of postoperative months ($p>0.05$). The intensity of food tolerance and quality of eating habits were very poor among the study sample compared with other studies. The questionnaire provided evidence on food tolerance and quality and was used to compare postoperative results. Prospective and experimental studies should be performed to determine better opportunities for improving patients’ satisfaction and Quality of Life.

Keywords: *Gastrectomy, Bariatric Surgery, Questionnaire, Regurgitation*

INTRODUCTION

Obesity carries a major health risk and is highly associated with morbidity and mortality^{1,2}. It is associated with chronic illnesses, such as hypertension, diabetes mellitus, cardiovascular disease, dyslipidemia, gallbladder disease, and osteoarthritis. It is also frequently accompanied by psychosocial disabilities and poor quality of life^{3,4}. There is an increased concern about obesity and its complications in Saudi Arabia. Its prevalence has been reported to be 24% among males and 44% in females due to a sedentary lifestyle; low consumption of fruits and vegetables; and lack of public awareness regarding healthcare, healthy eating habits and exercise^{5,6}.

There are multiple approaches for weight reduction in morbidly obese patients, including lifestyle modifications and pharmacological treatment (orlistat and sibutramine), which result in 8%–10% reduction in the initial weight⁴. However, pharmacological treatment is associated with possible side effects and does not sustain meaningful weight loss. Therefore, bariatric surgery is the most effective intervention and long-term treatment for morbidly obese patients⁷. There are several types of bariatric surgeries, which can be classified as restrictive, malabsorptive, and mixed. Purely restrictive surgeries include laparoscopic sleeve gastrectomy (LSG) and gastric banding. Biliopancreatic diversion

associated with duodenal switch is a malabsorptive technique, whereas Roux-en-Y gastric bypass (RYGB) is a mixed technique^{7,8}.

LSG has been an effective procedure for >10 years and is a conventional method for inducing short- and mid-term weight loss⁹. It is an effective standalone procedure for the resolution of comorbidities. The main postoperative outcome of successful bariatric surgery is weight loss and the resolution of psychosocial dysfunction. Food tolerance and choices are important factors that have a major influence on Quality of Life (QoL). According to a study that evaluated food tolerance and gastrointestinal QoL for three bariatric procedures (LSG, gastric banding, and RYGB), LSG showed the highest score for both food tolerance and gastrointestinal QoL^{10,11}.

Worldwide obesity prevalence more than doubled since 1990. In 2022, approximately 2.5 billion adults were overweight, and a further 890 million were obese¹². In Saudi Arabia, the prevalence of obesity was found significantly higher among females compared to males (24% and 16%, respectively) according to a study done in 1996. The prevalence of obesity seems to increase with time as another study found it to reach 35.5% in 2005. Moreover, the WHO reported the prevalence of obesity in Saudi Arabia during 2010 as 36% among females and 23% among males^{13,14}.

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After bariatric surgery the alteration of gastrointestinal anatomy and the physiological changes in postoperative patients may affect the food tolerance and can be associated with frequent vomiting, dumping syndrome, that may lead to nutritional deficiencies or weight regain. All these can be modified by the psychological aspect of the individual and change their eating behavior. They have to eat small meals, slowly and to chew food well to avoid problems¹⁰. Laparoscopic sleeve gastrectomy is a restrictive procedure with a low rate of complications and absence of malabsorption, no dumping syndrome occurs and improvement of comorbidities related to obesity^{7,8,13}. Several studies demonstrated that LSG induce a steady weight loss on a short and long-term follow-up visits¹⁰.

A previous study showed that patients with low educational level associated more with low food tolerance due to poor adherence to follow-up visits⁴. Another study was done by D'Hont et al., of 83 patients after LSG and 83 non-obese and it showed that food tolerance was significantly higher in non-obese patients¹³. Dear Karen et al., 2011, conducted a study by dividing the patients into two groups, 83 patients followed regularly postoperatively and 36 irregularly, and it showed better food tolerance in the group with regular consultation¹⁵. After interviewing surgeons, nurses and coordinators working in the general surgery department of King Saud Medical City (KSMC) it was found that in 9 out of 10 surgical interventions to treat obesity the LSG technique was used. Although it is the commonest bariatric procedure done in King Saud Medical City (KSMC) and in Saudi Arabia, there is limited evidence assessing the post-operative food tolerance after LSG in the literature. This research was conducted to shed some light on the effect of LSG procedure on food tolerance in post-operative patients in Riyadh, Saudi Arabia. Hence, this study aimed to determine patients' food tolerance level and Quality of Alimentation after LSG. Besides, to assess health-promoting behavior, food selection and food tolerance level after LSG.

MATERIALS AND METHODS

Study Design: This is a cross-sectional study that was conducted in the outpatient clinic, bariatric surgery department at King Saud Medical City - a tertiary care hospital in the Riyadh central region of Saudi Arabia from November 2016 to September 2018.

Study Population: All male and female patients who underwent LSG (age, 18–65 years) were included in this study and those who underwent gastric banding, RYGB, or biliopancreatic diversion associated with duodenal switch were excluded.

Data Collection: The “Quality of Alimentation” by Suter et al. was used to measure the satisfaction of food quality, time between meals and other food intake, tolerance to different types of food, and vomiting/regurgitation frequency. The questionnaire was translated in Arabic version and tested for its validity. The responses were ranging from 1 to 27, with 27 representing excellent food tolerance. The researcher explained the study to the patients and after their verbal consent, questionnaires were distributed during follow-up visits every week from four clinics, with a maximum of 15 patients per clinic by simple random sampling technique.

Sample Size: The sample size was calculated using the sample size software of prevalence studies considering a 24% overall prevalence of food tolerance and QoL with 8% margin of error and 95% confidence interval, a minimum sample of 110 patients for this study, with a power of 80% to detect a difference at the two-sided level of significance^{10,16}.

Ethical approval: The study protocol was approved by the ethical committee and Institutional Review Board at KSMC [H1RI-12-Jun17-02].

Statistical Analysis: Data were entered and analyzed using statistical package SPSS 22 (SPSS Inc., Chicago, IL, USA). Categorical variables were presented as frequencies and percentages. Continuous variables were expressed as the mean $\pm$ SD. ANOVA test was applied to determine mean significant differences at various postoperative months and food tolerance levels. Pearson's Chi-square test was performed to identify significant difference between the number of months after surgery and study characteristics. A two-tailed P-value <0.05 was considered statistically significant.

RESULTS

Demographic information for 110 participants is provided in Table 1. The study consisted of 82 (74.5%) female patients and 28 (25.5%) males. The average age was recorded as 33.7 $\pm$ 9.3 years. Overall, 47 (42.7%) patients reported excellent eating satisfaction, while 42 (38.2%) had good eating satisfaction. In the same way, 57 (51.8%) patients had 3 – 4 meals per day and 23 (20.9%) patients consumed more than five meals per day.

Table 1. Basic and clinical characteristics of patients (n = 110)

Characteristics	Description	N (%)
Gender	Male	28 (25.5%)
	Female	82 (74.5%)
Age	Mean $\pm$ SD	33.68 $\pm$ 9.31
	≤ 3	36 (32.7%)
Months after surgery (months)	4–6	20 (18.2%)
	7–12	46 (41.8%)
	>12	8 (7.3%)
Current satisfaction regarding eating	Excellent	47 (42.7%)
	Good	42 (38.2%)
	Acceptable	15 (13.6%)
	Poor	6 (5.5%)
Reason for satisfaction level	Limited meals without satiety	24 (22.0%)
	No problem with meals	41 (37.6%)
	Snacks only	14 (12.8%)
	Feel satiated	5 (4.6%)
	Vomiting	13 (11.9%)
	Some difficulties	11 (10.1%)
	Other	1 (0.9%)
	1 meal	7 (6.4%)
Meals consumed in a day	2 meals	23 (20.9%)
	3–4 meals	57 (51.8%)
	≥ 5 meals	23 (20.9%)
Breakfast is considered a meal	Yes	68 (61.8%)
	No	42 (38.2%)
Lunch is considered a meal	Yes	72 (65.5%)
	No	38 (34.5%)
Supper is considered a meal	Yes	67 (60.9%)
	No	43 (39.1%)
Meals consumed	Breakfast	42 (38.5%)
	Lunch	50 (45.9%)
	Supper	15 (13.8%)
	All	2 (1.8%)
Do you eat between meals?	Yes	87 (79.1%)
	No	23 (20.9%)
If yes, when?	Morning	19 (20.7%)
	Afternoon	41 (44.6%)
	Evening	32 (34.8%)
Can you eat everything?	Yes	40 (36.4%)
	No	70 (63.6%)

Red meat	Easily	27 (24.5%)
	With some difficulties	62 (56.4%)
	Not at all	21 (19.1%)
White meat	Easily	58 (52.7%)
	With some difficulties	48 (43.6%)
	Not at all	4 (3.6%)
Salad	Easily	81 (73.6%)
	With some difficulties	20 (18.2%)
	Not at all	9 (8.2%)
Vegetables	Easily	89 (81.7%)
	With some difficulties	12 (11.0%)
	Not at all	8 (7.3%)
Bread	Easily	48 (43.6%)
	With some difficulties	45 (40.9%)
	Not at all	17 (15.5%)
Rice	Easily	40 (37.0%)
	With some difficulties	44 (40.7%)
	Not at all	24 (22.2%)
Pasta	Easily	46 (41.8%)
	With some difficulties	45 (40.9%)
	Not at all	19 (17.3%)
Fish	Easily	80 (72.7%)
	With some difficulties	15 (13.6%)
	Not at all	15 (13.6%)
Cannot eat other types of food	Yes	38 (34.5%)
	No	72 (65.5%)
Do you vomit/regurgitate?	Daily	12 (10.9%)
	Often (<2/week)	22 (20.0%)
	Rarely	47 (42.7%)
	Never	29 (26.4%)
Food tolerance score	Mean $\pm$ SD	17.71 $\pm$ 6.08

Statistically significant ($P = 0.009$) difference were found between lunch constitutes on meal and months after surgery and results shown that 26 (72.2%) patients from ≤ 3 months, 15 (75%) patients from 4 – 6 months, 30 (65.2%) patients from 7 – 12 months and 1 (12.5%) patient from > 12 months after surgery constitutes on lunch. Similarly, another significant ($P = 0.037$) difference were observed between months after surgery and eat between meals. i.e. 23 (63.9%) patients from ≤ 3 months, 17 (85%) patients from 4 – 6 months, 39 (84.8%) patients from 7 – 12 months and 8 (100%) patients from > 12 months after surgery eat between meals. For specific meals, more than 70% of patients are easily eating red meat, white meat, vegetables and fish within the first year which was significantly ($p < 0.001$) associated with a number of months after LSG. However, the figure shows the comparative analysis of average food tolerance level and the number of the month after LSG (Figure 1).

Figure 2 and Figure 3 below presents the mean food tolerance score after LSG stratified by gender and quality of alimentation after LSG.

DISCUSSION

The study outcomes revealed significant findings regarding food tolerance after LSG. QoL includes many factors that affect physical, mental, and socioeconomic status. However, patients' capability to eat multiple foods and its combination with sociodemographic features could certainly affect QoL. The study findings partially matched with the primary hypothesis of this research that low food tolerance level among patients after LSG and the impact on daily life.

Generally, a comparison is made among the number of postoperative months, eating patterns, and food tolerance. The quality of eating is considered good when there are high scores in all the questionnaire items, particularly high satisfaction for eating ability, good food tolerance, and infrequent vomiting/regurgitation. High or good food tolerance is defined in the questionnaire as the ability to easily eat a

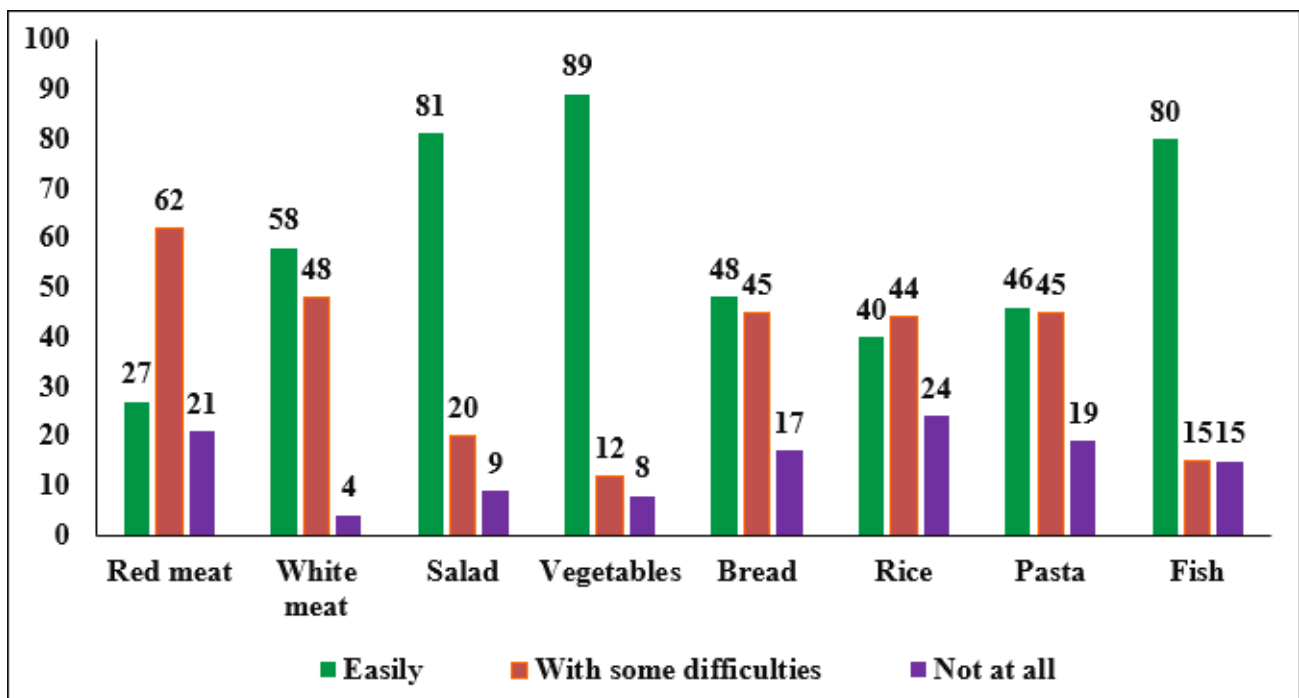


Figure 1. Food tolerance of the patients after laparoscopic sleeve gastrectomy

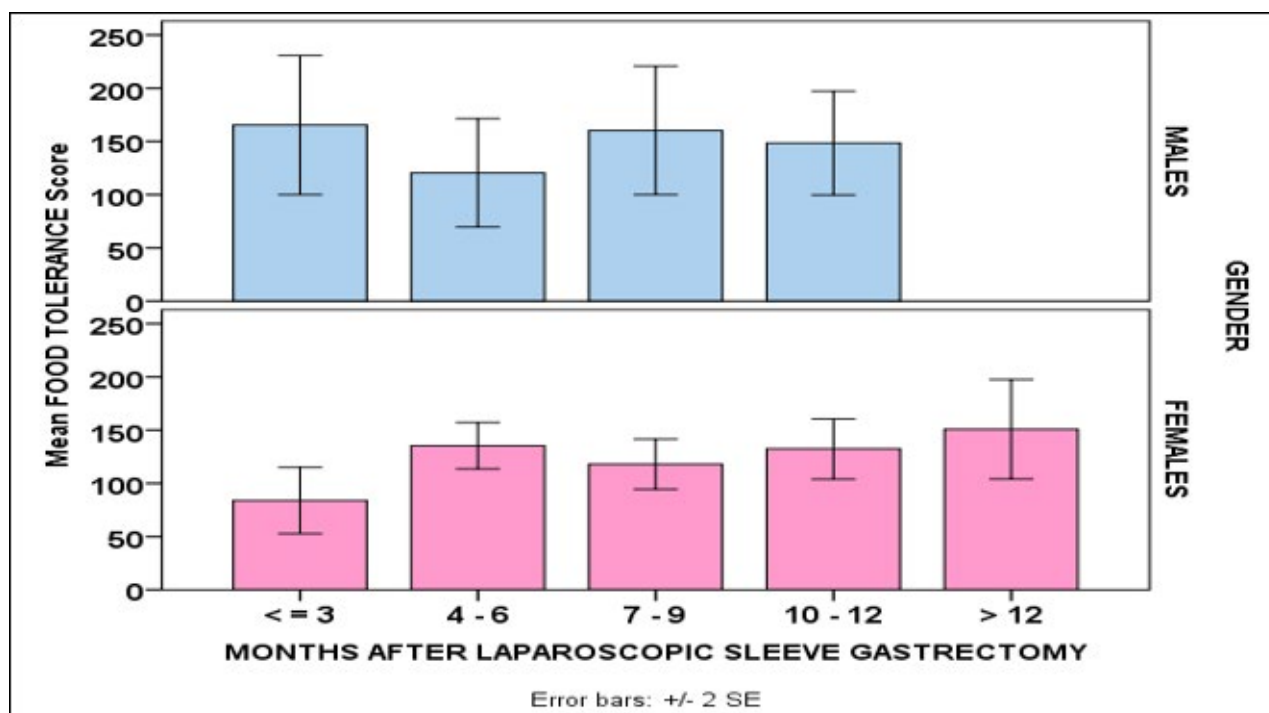


Figure 2. Mean food tolerance score after LSG stratified by gender

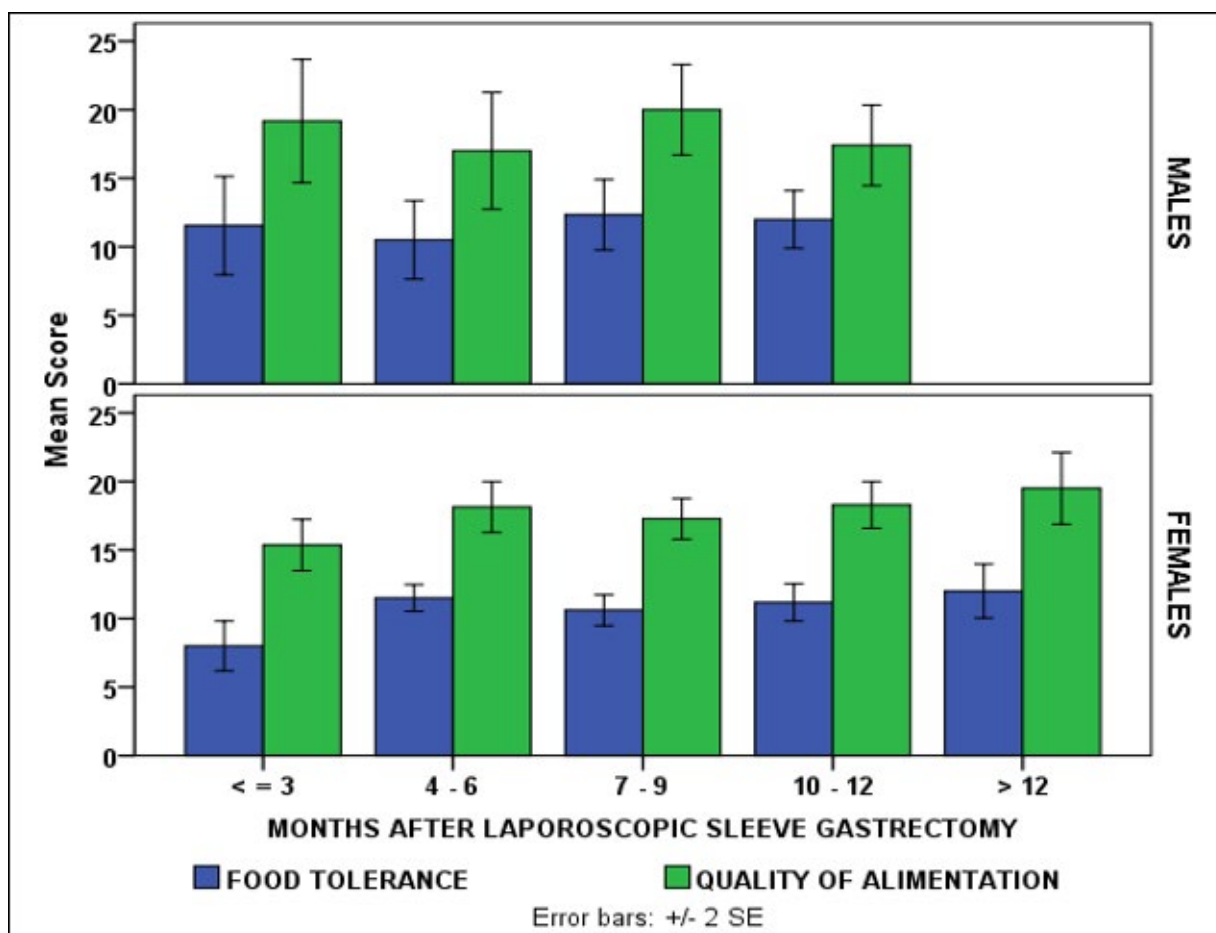


Figure 3. Mean score for food tolerance and quality of alimentation after LSG

variety of foods (red meat, white meat, salad, vegetables, bread, rice, pasta, and fish). However, the most important findings of our study were the low level of food tolerance at different lengths of time after LSG and low level of eating satisfaction among patients. The analysis showed that the total average food tolerance for all postoperative months was 17.74, and only 42.7% of patients reported excellent eating satisfaction, which was considerably low. Similarly, only 37.6% of patients reported that they had no problems consuming meals within 1 postoperative year, 22% consumed limited meals without satiety, and 26.6% had difficulty with satiation and vomiting. Moreover, only 36.4% of patients reported that they could eat everything, whereas 63.6% said they could not eat everything after the surgery. Likewise, 73.8% of patients experienced vomiting/regurgitation after LSG. These outcomes suggest that low scores and percentages reflect all eating habits, vomiting symptoms, and food tolerance level.

Many studies have emphasized that differences among bariatric procedures concerning QoL^{4,17}, vomiting symptoms, and food tolerance level have not been sufficiently evaluated. Suter et al. reported that patients who undergo LSG have a lower food tolerance immediately after the surgery than those who undergo RYGB. The results of this research regarding the lower quality of eating following laparoscopic adjustable gastric banding (LAGB) are in line with the results of a previous study^{16,18}. Food intolerance and difficulty in consuming different types of foods have been previously reported by De Zwaan et al. and further described in 59 patients: 18–35 months after RYGB, 30.5% of patients suffered from constant chewing and spitting of food, and >60% reported vomiting episodes¹⁹. However, this study showed that 73.8% of patients experienced vomiting/regurgitation after LSG, which is a drastically high proportion among bariatric surgery patients. Similarly, the reduction in the quality of eating and food tolerance level was a result of repeated vomiting and avoiding regular meals, which may cause some patients to eat only soft and semi-liquid food and consume a high-calorie diet; thus, patients may be able to consume large amounts and avoid regurgitation/vomiting, particularly when dining in public and at social events²⁰. These activities may cause unexpected weight gain, which leads to nutritional deficiencies, frequent vomiting, and inability to consume different types of foods. However, the consumption of a healthy diet is essential, particularly after a bariatric procedure. Balancing and maintaining a patient's health should be a primary aspect of the procedure²¹. Some investigators have reported that strict surgical procedures (LAGB/vertical banded gastroplasty) can cause food intolerance of different items, which leads to digestive problems, such as gastric reflux, vomiting, and nausea, which can influence food choice and the tendency to consume a healthy diet. Another investigator postulated that RYGB develops a healthier and more balanced diet than LAGB^{22–24}.

Assessing QoL after LSG can help us in monitoring the progress and status of the patient. An unexpected improvement in food tolerance, particularly if conveyed by weight regain, may suggest a leak in the band adjustable system or band erosion. In patients who undergo LSG, an unforeseen reduction in food tolerance may indicate a complication, such as a borderline ulcer or other gastric issues. It is essential to be familiar with all types of clinical procedures to determine whether a random chance may be responsible for the decrease in the quality of eating. Recognizing unavoidable circumstances of different bariatric procedures is important when choosing the appropriate procedure.

Several limitations and strengths were observed in this study. The limitations include the cross-sectional study design, short-term follow-up, and small study population that was further divided by the number of postoperative months. Moreover, the exact food consumption amount was not included in this study. This measure has been defined as a very important constraint of healthy behavior and must be encompassed in

the additional assessment of our patients. Additionally, the data were obtained using self-reported estimations, which could be potentially reporting biased. Furthermore, the present study was conducted in a single center and is thus not representative of all health care patients in the Kingdom of Saudi Arabia. Furthermore, the study results cannot be generalized to the entire Saudi Arabian population. Unfortunately, this research could not determine general factors associated with the consumption of food, QoL, and food tolerance because of the small sample and confounding variables.

CONCLUSION

The results suggest that a good QoL and food tolerance can be maintained via a healthy diet after LSG. However, the fundamental challenges remain as to how to develop and improve behavioral changes over time to achieve and maintain excellent results after LSG. Further prospective studies must be conducted to assess a long-term follow-up and to identify the relationships between quality of eating, nutritional deficiencies, and better compliance toward quality improvement methods for bariatric procedures.

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Potential Conflicts of Interest: None

Competing Interest: None

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