Post bariatric surgery complications, nutritional and psychological status

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ABSTRACT

Background and Objectives: Bariatric surgery becomes the final option for managing severe obesity. This study aims to identify the complications, changes in anthropometry, adherence to dietary recommendations, and psychological well-being of post-bariatric surgery patients. **Methods and Study Design:** An observational study was conducted on 63 post-bariatric surgery patients who had undergone bariatric surgery between two weeks and five years after surgery. The participants were assessed for the complications experienced, current comorbidities, anthropometric changes, dietary intake, and psychological well-being. A three-day, 24-hour diet recall was done to assess the dietary intake of the patients. The mean macronutrient and micronutrient intakes were compared to several available recommendations. The DASS-21 questionnaire was administered to determine the psychological well-being of the participants. **Results:** The most common complications experienced by patients after bariatric surgery were hair loss (50.8%), gastroesophageal reflux disease (GERD) (49.2%), and vomiting (41.3%). There were significant differences in mean weight before (129.5 (33.0) kg/m^2) and after (85.0 (32.0) kg/m^2) bariatric surgery (p<0.001). The prevalence of clinically severe obesity declined by 55%. Overall, patients had insufficient intake of some nutrients such as protein, fat, calcium, and iron. Majority of the patients experienced a normal level of stress, anxiety, and depression, but some had mild (3.2%), moderate (4.8%), and severe anxiety (1.6%). **Conclusions:** There were drastic improvements in patients' weight following bariatric surgery. However, there were several complications including nutrient deficiencies. Due to the anatomical changes in the gastrointestinal tract, patients must comply with the dietary and lifestyle changes and follow up with the healthcare professional. A nutrition module will be helpful for patients to prepare for and adapt to the changes after bariatric surgery.

Key Words: bariatric surgery, weight loss, dietary intake, psychological well-being, complications

INTRODUCTION

The World Health Organization (WHO) defined obesity as an 'abnormal or excessive fat accumulation that debilitates health'. An adult is classified as extremely or severely obese when the body mass index (BMI) is greater than or equal to 40 kg/m^2. The prevalence of overweight and obesity has increased dramatically worldwide over the past decade.[1] It has

been estimated that the global prevalence of obesity has tripled since 1975, with a 10-fold increase in men and a 5-fold increase in women in year 2016.[2] In Malaysia, the nationwide survey known as the National Health and Morbidity Survey (NHMS) in 2019 reported that the prevalence of adults who are obese is 19.9%, which has demonstrated a steady increment from 15.1% in 2011 to 17.7% in 2015.[2] High body mass index (BMI) is associated with chronic comorbidities such as type 2 diabetes mellitus, non-alcoholic fatty liver disease (NAFLD), hypertension, cardiovascular diseases, and mental health issues.[3]

Weight loss can be achieved through pharmacotherapy with incretin-based therapies such as liraglutide, dulaglutide, semaglutide, lixisenatide, albiglutide, sitagliptin, saxagliptin, and alogliptin. These drugs are able to improve obesity-related comorbidities such as diabetes, hyperlipidemia, and non-alcoholic fatty liver disease.[4] Despite promising results, some mechanisms of action of these drugs on other organs as well as their long-term health consequences remain unclear. Thus, bariatric surgery is the last option for patients suffering from severe obesity or obesity with comorbidities when other strategies such as dietary control and pharmacotherapy produce no significant improvement in weight loss.[5] A study showed that in the long term, bariatric surgery produces significant weight loss of up to 30%, which continues for at least 20 years.[6] Bariatric surgery changes the anatomy of the gastrointestinal tract. Therefore, the new food pathway restricts motility, allowing only a small volume of ingested food to pass through the gastrointestinal tract, thus impeding the absorption of ingested nutrients.4 Bariatric surgery is also associated with complications such as postoperative gastric edema, vomiting, regurgitation, and dumping syndrome.[7] It may lead to nutritional deficiencies and protein-energy malnutrition due to the nutrient malabsorption. A study showed a significant reduction in the gastric capacity and secretion of hydrochloric acid and digestive enzymes, which increases the risk of nutrient deficiencies.[8] Approximately 30-70% of post-bariatric patients have nutritional deficiencies, especially protein, iron, folate, vitamin D, calcium, vitamin B-1 and B-12.

Besides, over 75% of patients preparing for bariatric surgery present with psychiatric diagnoses, and the most common diagnosis is anxiety disorder9 due to strict and sudden modifications in dietary habits.[4] Therefore, considering the risks of bariatric patients, this research aims to assess the post-bariatric surgery complications experienced by patients, anthropometric changes, psychological well-being, and dietary adherence based on several dietary guidelines, such as the Recommended Nutrient Intake (RNI) of Malaysia, the

American Society for Metabolic and Bariatric Surgery (ASMBS), and the Clinical Practice Guidelines (CPG).

MATERIALS AND METHODS

Study design

This is a cross-sectional study that included patients who had undergone the bariatric surgery procedure in Hospital Universiti Sains Malaysia (HUSM). The inclusion criteria for the study were post-bariatric surgery patients who had undergone the bariatric surgery procedure for a maximum of five years. All the types of bariatric surgery cases were included, and there were no restrictions on gender. Patients with complications after bariatric surgery that required hospitalization in the intensive care unit (ICU) were excluded from the study. The study protocol was approved by the Ethics Committee for Research Involving Humans affiliated with Universiti Sains Malaysia (approval number: USM/JEPeM/21120794). All participants provided written informed consent prior to participation in this study.

Data collection and assessment tools

Participants were interviewed via several platforms such as WebEx Meeting, Zoom Meeting, and Google Meet and the study was explained further. The parameters collected during the interview were sociodemographic data, which consisted of age, family size, race, employment status, and physical activity level. Besides that, medical history data collected in this study included the type of bariatric surgery procedure undergone by the patients, duration after bariatric surgery, number of medications taken, and complications after bariatric surgery such as hair loss, vomiting, diarrhoea, early satiety, gastroesophageal reflux disease (GERD), dental problems, constipation, and many more. Meanwhile, anthropometric parameters assessed in this study were pre- and post-surgical weight, percentage of total weight loss, as well as BMI before and after surgery. In addition, participants' energy, macronutrient and micronutrient intakes were obtained. A 24-hour diet recall was conducted for three days, which included two weekdays and one weekend. The 24-hour diet recall is commonly used as a dietary data collection instrument that provides comprehensive and detailed reports on the types and amounts of food and beverages consumed by an individual in 24 hours.[10]

Besides food, dietary supplement intake was considered during the analysis of macronutrients and micronutrients. Analysis had been done using the Nutritionist Pro software. The researcher recorded each food or beverage consumed by the subjects according

to the meals for each day. Foods that were not available in the Nutritionist Pro were added manually by the researcher referring to the nutrient information in the food label as well as creating standard recipes for cooked dishes. The three-day macronutrient and micronutrient intakes of the patients were presented as the mean intake of each macronutrient and micronutrient for one day. The intakes of the patient were then compared with the recommended intake based on several guidelines, such as the Recommended Nutrient Intake (RNI) 2017,[11] the Clinical Practice Guidelines (CPG),[12,13] the American Society for Metabolic and Bariatric Surgery (ASMBS) Integrated Health Nutritional Guidelines for the Surgical Weight Loss Patient 2016 Update: Micronutrients,[14] and studies by Tabesh et al. (2019, 2023).[8,15] The RNI (2017) provided updated scientific knowledge and practices on the recommended nutrient intake for Malaysians. Meanwhile, the CPG was meant to guide evidence-based clinical practice for managing diseases, including medical nutrition therapy. The guidelines provided by ASMBS were widely used in different journals and hospitals for managing bariatric surgery. Lastly, the review by Tabesh et al. (2019, 2023)[8,15] provided detailed nutrition guidelines for bariatric surgery from different studies.

In addition, the participants' psychological well-being was determined using the Depression Anxiety and Stress Scale (DASS) questionnaire. DASS-21 is a short version of the standardized DASS-42 questionnaire that was used to identify the mental health status of the patients after bariatric surgery. DASS had three self-reported domains that measured the severity of negative emotions, such as depression, anxiety, and stress, experienced over the past week. Each domain consisted of seven items with a four-point Likert scale ranging from 0 (did not apply to me at all–never) to 3 (applied to me very much–always). The total scores for the relevant items were calculated and categorized into normal, mild, moderate, severe, and extremely severe, as shown in Table 1.[16] The DASS-21 has been found to be reliable, with excellent Cronbach's alpha values of 0.81, 0.89, and 0.78 for the subscales of depression, anxiety, and stress, respectively.[17]

Data analysis

The collected data were analysed using the IBM Statistical Package for Social Science System (SPSS) (Version 26). The normality test was performed using the Kolmogorov-Smirnov test. The mean or median differences between a categorical variable (gender) and numerical variables (age, family size, pre- and post-bariatric surgery body weight, percentage weight loss, body mass index, mean macronutrient and micronutrient intakes) were

determined using an Independent-t-test (if normally distributed) or a Mann-Whitney test (if not normally distributed). Median differences in weight before and after bariatric surgery were determined using the Wilcoxon signed-rank test. On the other hand, the Chi-Square test was employed to investigate the association between two categorical variables, such as between genders and employment status, physical activity level, complications after bariatric surgery, and BMI pre- and post-bariatric surgery. The Fisher exact test was used when 20% of the cells had an expected count of less than five. The analysis between mean macronutrient and micronutrient intakes and the duration after bariatric surgery was done using the Kruskal-Wallis test. The significance level was set at $p<0.05$.

RESULTS

Sociodemographic characteristics and physical activity of participants

Table 2 shows that the majority of the study participants were women (68.3%), employed (76.2%), and sedentary (58.7%). The mean age for men was 43.4 ± 9.4 years old and 46.3 ± 9.7 years old for women. The majority of the men (95.0%) were employed, compared to only 67.4% among women ($p=0.017$). There were no significant gender differences for parameters such as age, family size, and physical activity level.

Medical conditions and experiences

Table 3 shows that most participants (71.4%) underwent laparoscopic sleeve gastrectomy and (77.8%) had undergone bariatric procedures for more than a year. Less than one-fifth of the participants had undergone bariatric procedures in less than six months. The median duration after bariatric surgery was 32.0 (32.0) weeks. In addition, participants reported experiencing several complications after bariatric surgery. The three most reported complications were hair loss (50.8%), GERD (49.2%), and frequent vomiting (41.3%). Less than half of the participants had dry skin, anaemia, lethargy, unhealthy nails, nausea, diarrhoea, loss of appetite, constipation, dental problems, infection, leakage at the surgical site, and irregular menses. More women participants significantly reported experiencing hair loss (65.1%) and dry skin (51.2%) when compared to men ($p<0.05$). However, there were no significant differences in the complications experienced by the participants according to the durations after bariatric surgery (Table 4).

Pre- and post-bariatric surgery anthropometric parameters

The percentage weight loss after bariatric surgery was not significantly different between men and women. Men reported to weigh more as compared to women pre- and post-bariatric weight. The median weight after bariatric surgery was 105.5±28.0 kg and 78.0±24.3 kg for men and women, respectively.

Most participants (81.0%), comprising 90% of men and 76.7% of women, were categorized as severely obese before the bariatric procedure. Few of them were categorized as overweight (1.6%), obese class I (4.8%), or obese class II (12.7%). After the bariatric procedure, 37.1% of the participants were in the category of obese class I, and 7.9% had managed to attain a normal BMI. No significant gender differences were observed for the BMI after bariatric surgery. Moreover, the Wilcoxon signed-rank test revealed that there were significant differences between the median weight before (122.0±49.0 kg) and after the bariatric procedure (85.0±32.0 kg) and between the median BMI before (47.7±14.9 kg) and after bariatric surgery (32.9±10.0 kg/m^2), (p<0.001) (Table 5).

Dietary Intake of Post-Bariatric Patients

The nutrient intakes were based on daily food and dietary supplement intake. Patients' average 24-hour diet recalls were analysed using Nutritionist Pro and presented as descriptive statistics. Table 6 shows that there were no significant differences in macronutrient and micronutrient intakes according to gender. The participants met the recommended energy, carbohydrate, fat, vitamin C, vitamin B-2, and vitamin B-3. However, both men and women participants did not meet the recommended intake of fibre, vitamin D, vitamin B-1, vitamin B-9, vitamin B-12, vitamin K, sodium, potassium, calcium, iron, magnesium, zinc, and copper. On the other hand, findings showed that only women participants met the recommended intake of vitamin A, vitamin E, vitamin B-6, vitamin B-5, and manganese. Protein intake was not adequate for women participants.

In addition, Table 7 shows comparison of macronutrient and micronutrient intakes according to the duration after bariatric surgery. The participants met the recommended energy intake only after six months of surgery. Participants had met the recommended intake for carbohydrates, vitamin C, vitamin B-2, vitamin B-3, and vitamin B-6 within three months after bariatric surgery. In contrast, protein, fat, fibre, vitamin B-1, vitamin B-9, vitamin B-12, vitamin K, vitamin D, potassium, iron, magnesium, calcium, and manganese intake did not meet the recommended levels for any duration after bariatric surgery. There were no

significant differences between all macronutrient and micronutrient intakes of participants according to the duration after bariatric surgery (Table 7), tested by the Kruskal-Wallis H test.

The total meals consumed by the subjects were 276 meals with breakfast (81.0%), lunch (82.5%) and dinner (87.3%) being the most consumed meals. Morning and afternoon snacks were consumed by 69.8% and 87.3% of the subjects respectively. Supper was taken by 49.2% of the subjects. From the 276 meals consumed, white rice is the preferred food for almost 23.9% of the meal followed by fried chicken (10.9%), white bread (8.3%) and curry puff (8.3%). Fruits and vegetables were consumed in less than 10% of the meals. Unhealthy food consumption such as fried chips, butter, sweet bread spread, fried fish and fried chicken were reported (Table 8).

Depression, anxiety, and stress levels of participants

Based on the results in Table 9, more than half of the participants had no depression, anxiety, and stress. No participants were categorized as having severe or extremely severe depression and stress. However, 3.2% and 6.3% of participants had severe and extremely severe anxiety, respectively. Participants who had anxiety were referred to healthcare professionals in hospitals for further action. There were no significant gender differences in depression (p=0.162), anxiety (p=0.192), and stress score (p=0.161), tested using the Mann-Whitney test. There were also no significant differences in depression (p=0.418), anxiety (p=0.324), and stress score (p=0.198) between different durations after bariatric surgery (Table 10).

DISCUSSION

Types of bariatric procedures

The findings of this study reported that the most commonly performed bariatric surgery procedure in the hospital was laparoscopic sleeve gastrectomy (SG), a procedure involving removing approximately 80% of the stomach, which leads to a smaller stomach volume for inducing early satiety.[4] SG is a safe procedure for high-risk patients, such as geriatrics and patients with multiple comorbidities.[18] On the other hand, the RYGB is a procedure in which the stomach is divided into small proximal stomach pouches where the larger part of the stomach is bypassed and a Roux-en-Y gastrojejunostomy is done, diverting ingested nutrients from the body of the stomach, duodenum, and proximal jejunum, bypassing the proximal part of the small intestine. Thus, this procedure results in diminished food consumption and malabsorption of nutrients, which leads to significant weight loss.[4] Although RYGB is

considered the gold standard procedure, SG is also one of the most commonly performed procedures due to being less invasive, technically simpler, and not involving surgical removal of the small intestine.[19] RYGB had been reported to have higher post-operative complications such as dumping syndrome, high rates of iron and vitamin D deficiency, lower calcium and phosphorus abnormalities, and bleeding when compared to SG.[20] The SM-BOSS randomized controlled trial involving 217 morbidly obese patients who had undergone either laparoscopic sleeve gastrectomy or Roux-en-Y gastric bypass found no significant difference in excess weight loss five years after surgery. Patients who did both procedures reported improvements in type 2 diabetes mellitus and dyslipidemia.[21]

Complications reported after bariatric surgery

Based on the current study findings, most participants reported having hair loss, GERD, and frequent vomiting. There were no significant differences in the reported complications according to the duration of bariatric surgery. A meta-analysis by Zhang et al. (2021) reported that hair loss occurred in 57% of the patients after bariatric surgery due to zinc, ferritin, and folic acid deficiency.[22] Hair loss is reduced with a longer follow-up duration. Ledoux et al. (2020) demonstrated that the incidence of hair loss declined from 65% at <12 months to 35% at >12 months of follow-up.[23] Other factors that may be associated with hair loss are postoperative excess weight loss (EWL), which depletes the subcutaneous tissue for the scalp to support hair growth.[22] Post-surgical stress as well as a prolonged catabolic state after surgery are some other factors contributing to hair loss due to the surge in cortisol hormone, which accelerates the degradation of vital skin components, namely hyaluronan and proteoglycans.[24]

In addition, bariatric procedures reduce the volume of the stomach, which may lead to postoperative gastric oedema, vomiting, and regurgitation symptoms.[7] Besides, frequent vomiting post-meal indicate symptoms of early dumping syndrome, which is a very common complication after bariatric surgery, especially after RYGB.[25] Dumping syndrome is divided into early and late dumping syndromes. Early dumping syndrome occurs 10 to 30 min after food intake as a result of the rapid transport of hyperosmolar chyme into the small intestine. This leads to an influx of interstitial fluid into the intestinal lumen,[7] resulting in symptoms such as abdominal pain, nausea, diarrhoea, and bloating.[26] On the other hand, late dumping syndrome happens one to three hours after a meal due to reactive hypoglycaemia with symptoms of perspiration, weakness, confusion, palpitations, and tremor.[7]

The current study findings also reported a higher prevalence of GERD as one of the common complications of bariatric surgery. SG is associated with a higher risk of GERD.[26] GERD is the reflux of stomach contents, resulting in symptoms such as heartburn, vomiting, and regurgitation. In the obese population, 40-70% had GERD due to altered lower oesophageal sphincter (LES) competency, hiatal hernia, and increased intra-abdominal pressure. Bariatric surgery, especially RYGB and SG, may resolve GERD symptoms. However, recent studies reported conflicting outcomes of improving and worsening GERD symptoms.[27,28] RYGB offers the best surgical option for obese patients who have GERD, erosive esophagitis, or Barrett's oesophagus (BE).[29] Among the reasons underlying this are the lesser acid-producing parietal cells in the smaller pouch and the longer alimentary limb, which prevent the return of biliopancreatic content. However, long-term follow-up on the reflux symptoms is necessary, considering some patients report reflux symptoms approximately eight years after RYGB.[30]

Weight loss after bariatric surgery

The current study reported significant total weight loss (TWL) from 129.5±33.0 kg before bariatric surgery to 85.0±32.0 kg after bariatric surgery. Most participants (81.0%) were categorized as severely obese before the surgery, while only 35.0% of them were severely obese after the surgery. A small percentage of patients (7.9%) in this study had managed to attain a normal BMI after bariatric surgery. One of the limitations of this study was that it did not compare the weight loss achieved from the different types of bariatric surgery. A 12-year postoperative observational study demonstrated that there was a stable weight loss pattern within two to six years after SG. A greater TWL was observed in patients who consumed more protein and carbohydrates as compared to fat.[31] Another retrospective analysis reported that maximal weight loss was achieved one year post-surgery; however, the risk of weight regain may happen three to five years post-surgery among SG patients.[32] The factors affecting their weight regain in the subsequent years were multifactorial, such as poor diet quality, excessive carbohydrate and fat intake, and poor compliance with post-operative hospital follow-up.[33]

Dietary intake of study participants

Overall, participants in the current study met the recommendation for energy, carbohydrate, protein, and fat intake six months post-surgery. Bariatric patients were at risk of nutrient

malabsorption and food intolerance due to the anatomical changes in the gastrointestinal tract. Moreover, based on the findings in the current study, both men and women participants met the recommended intake of vitamin C, vitamin B-2, and vitamin B-3. However, they did not meet the recommended intake of fibre, vitamin D, vitamin B-1, vitamin B-9, vitamin B-12, vitamin K, sodium, potassium, calcium, iron, magnesium, zinc, and copper. Bariatric surgery may lead to nutrient deficiency due to limited food intake; however, nutrient deficiency may even exist before bariatric surgery. Morbidly obese patients are at high risk of various micronutrient deficiencies, such as iron, due to the chronic low-grade inflammation that activates the synthesis of hepcidin, responsible for inhibiting iron absorption. Moreover, the presence of diabetes alters vitamin D and calcium levels in blood, which induces secondary hyperparathyroidism.[34] Ernst et al. (2009) assessed the micronutrient levels of 232 patients before bariatric surgery and found that 25.4% had vitamin D deficiency, 32.6% suffered from selenium deficiency, 24.6% displayed zinc deficiency, and 18.1% had vitamin B-12 deficiency.[35] Monitoring of blood levels of micronutrients is essential at all stages, from pre- to post-surgery, especially during the first post-operative year. The American Society for Metabolic and Bariatric Surgery recommended testing ten nutrients four times during the first post-operative year, while the British Obesity and Metabolic Surgery Society suggested examining five nutrients three times during the first year.[36]

There are many factors affecting nutrient intake, such as food intolerance, consumption of small food volumes, poor diet quality, and low intake of foods rich in micronutrients.[37] Most micronutrient deficiencies, such as ferritin, vitamin B-12, vitamin D, vitamin A, and selenium, were commonly observed in RYGB patients as compared to SG due to the nature of the surgical technique. SG reduces the stomach volume without affecting the anatomy of the gastrointestinal tract; however, RYGB involves rerouting stomach content directly to the distal jejunum. Bypassing the duodenum and proximal jejunum contributes to the deficit, as most of the micronutrient absorption occurs there.[38] Therefore, vitamin and mineral supplementation and frequent appointments with the dietitian are vital to prevent malnutrition.

The current study findings reported that subjects of this study had unhealthy food choices such as white rice, white bread, fried chicken, curry-puff, butter, sweet bread spread. Some patients experience intense craving that allowed them to expose themselves to sweets, savoury and high fat food.[39] A study exploring patients` perspective on dietary habits after bariatric surgery demonstrated that patients with weight regain after bariatric surgery reported having insufficient nutrition knowledge and lack of moral support for behaviour change.[40]

Weight regain was noted on average of 2.6 years after bariatric surgery. Lowest weight will be achieved 12 to 18 months after bariatric surgery and weight stabilization occurred two years after surgery. Two years post-surgery is the sensitive period for weight regain to begin.[40] Guyot et al (2022) showed that bariatric surgery patients had less preference for high calorie unhealthy food due to the side effect of the surgery especially dumping syndrome which was aggravated with the consumption of carbohydrate rich food or beverages.[41]

Psychological well-being of post-bariatric patients

Based on the current findings, the post-bariatric surgery patients had normal levels of depression, anxiety, and stress scores. Post-operative weight loss, especially during the first year, and improvements in comorbidities resulted in improved self-esteem.[42] However, as the years passed, weight loss plateaued, which required lifelong adherence to a strict diet. Some patients may experience body changes such as loose skin or dry skin, which may increase their stress level.[43] This may lead to post-operative eating disorders such as binge eating, night eating syndrome, excessive dietary restriction, as well as grazing and nibbling.[44] The current study did not assess the depression, anxiety, and stress scores before bariatric surgery. A review showed improvements in anxiety and depressive symptoms in bariatric patients two years after surgery, while another study noted an increased frequency of anxiety treatment after surgery.[45,46]

This study had several strengths, such as exploring the complications experienced by the patients after bariatric surgery and investigating the dietary intake of patients according to the duration of bariatric surgery. However, the limitation of this study was that it involved a relatively small sample size and the same ethnic patients, which might limit the generalizability of the findings to a broader population of post-bariatric surgery patients. Considering these limitations, it is essential to acknowledge potential constraints when interpreting the study's findings and consider them while designing future research or interventions in this field.

Conclusion

In conclusion, more than half of the participants had a sedentary lifestyle, and most of them had undergone laparoscopic sleeve gastrectomy compared to other types of procedures available in HUSM. Besides, the most common complications experienced by participants post-bariatric surgery were hair loss, GERD, and frequent vomiting. Bariatric surgery

produced significant weight loss and changes in participants' BMI categories. Despite the change in food intake post-operatively, participants had achieved the recommended energy and macronutrient intake. However, micronutrient intake was below the recommendation due to anatomical changes in the gastrointestinal tract, limited food consumption, and nutrient malabsorption. The mental well-being of the participants was reported to be in the normal category. Hence, patients undergoing bariatric surgery should be prepared for a lifelong dietary change to achieve both macronutrient and micronutrient requirements. Considering various complications following bariatric surgery due to limited food consumption, it is essential to establish a dietary module to guide post-bariatric surgery patients to consume a well-balanced diet. Frequent follow-up with a dietitian is important to prevent nutrient deficiency and weight regain after bariatric surgery. Further research is needed to find the association between the type of procedures used and the complications experienced by the patients. The factors affecting weight regain after bariatric surgery should be further explored.

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CONFLICT OF INTEREST AND FUNDING DISCLOSURE

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Table 1. DASS score categorization

Categories	Depression	Anxiety	Stress
Normal	0-9	0-7	0-14
Mild	10-13	8-9	15-18
Moderate	14-20	10-14	19-25
Severe	21-27	15-19	26-33
Extremely severe	≥28	≥20	≥34

Table 2. Sociodemographic characteristics of study participants

Variables	Men (n=20)	Women (n=43)	Total (n=63)	*p*-value
Age (mean, SD)	43.4 (9.4)	46.3 (9.7)	45.4 (9.6)	0.261[†]
Family Size (median, IQR)	5.0 (2.0)	5.0 (2.0)	5.0 (1.0)	0.696[‡]
Race (n, %)				NA
Malay	20.0 (100.0)	43.0 (100.0)	63.0 (100.0)	
Working Status (n, %)				0.017[§*]
Government/ private/ Self-work	19.0 (95.0)	29.0 (67.4)	48.0 (76.2)	
Unemployed	1.0 (5.0)	14.0 (32.6)	15.0 (23.8)	
Physical Activity Level (n, %)				0.093[§]
Sedentary	9.0 (45.0)	28.0 (65.1)	37.0 (58.7)	
Light	0.0 (0.0)	4.0 (9.3)	4.0 (6.3)	
Moderate	7.0 (35.0)	8.0 (18.6)	15.0 (23.8)	
Vigorous	4.0 (20.0)	3.0 (7.0)	7.0 (11.1)	

SD: Standard deviation; IQR: Interquartile range; NA: Not available.
[†]Tested using Independent-t-test; [‡]Tested using Mann-Whitney test; [§]Tested using Chi-Square test.
*$p<0.05$ is considered significant

Table 3. Medical condition and post-bariatric complications experienced by participants

Variables	Men (n=20)	Women (n=43)	Total (n=63)	*p-value*
Types of bariatric surgery (n, %)				0.300†
Laparoscopic sleeve gastrectomy	16.0 (80.0)	29.0 (67.4)	45.0 (71.4)	
Roux-en-Y gastric bypass	4.0 (20.0)	7.0 (16.3)	11.0 (17.5)	
Laparoscopic sleeve Plus	0.0 (0.0)	6.0 (14.0)	6.0 (9.5)	
Laparoscopic one anastomosis gastric bypass	0.0 (0.0)	1.0 (2.3)	1.0 (1.6)	
Duration after bariatric surgery, week (median, IQR)	33.5 (42.0)	30.0 (28.0)	32.0 (32.0)	0.674‡
Duration after bariatric surgery (n, %)				0.191†
0-<3 months	4.0 (20.0)	3.0 (7.0)	7.0 (11.1)	
3-<6 months	1.0 (5.0)	1.0 (5.0)	2.0 (3.2)	
6-<12 months	0.0 (0.0)	5.0 (11.6)	5.0 (7.9)	
≥ 12 months	15.0 (75.0)	34.0 (79.1)	49.0 (77.8)	
Medication for comorbidity (n, %)				0.663†
0	11.0 (55.0)	23.0 (53.5)	34.0 (54.0)	
1	3.0 (15.0)	11.0 (25.6)	14.0 (22.2)	
2	3.0 (15.0)	6.0 (14.0)	9.0 (14.3)	
3	1.0 (5.0)	2.0 (4.7)	3.0 (4.8)	
>4		1.0 (2.3)	3.0 (4.8)	
Complications after bariatric surgery				
Dry Skin				0.002§*
No	18.0 (90.0)	21.0 (48.8)	39.0 (61.9)	
Yes	2.0 (10.0)	22.0 (51.2)	24.0 (38.1)	
Anemia				0.149§
No	19.0 (95.0)	34.0 (79.1)	53.0 (84.1)	
Yes	1.0 (5.0)	9.0 (20.9)	10.0 (15.9)	
Lethargy				0.158§
No	16.0 (80.0)	26.0 (60.5)	42.0 (66.7)	
Yes	4.0 (20.0)	17.0 (39.5)	21.0 (33.3)	
Hair Loss				0.001§*
No	16.0 (80.0)	15.0 (34.9)	31.0 (49.2)	
Yes	4.0 (20.0)	28.0 (65.1)	32.0 (50.8)	
Unhealthy nail				0.418§
No	19.0 (95.0)	36.0 (83.7)	55.0 (87.3)	
Yes	1.0 (5.0)	7.0 (16.3)	8.0 (12.7)	
Nausea				0.524§
No	17.0 (85.0)	33.0 (76.7)	50.0 (79.4)	
Yes	3.0 (15.0)	10.0 (23.3)	13.0 (20.6)	
Vomiting				0.172§
No	9.0 (45.0)	28.0 (65.1)	37.0 (58.7)	
Yes	11.0 (55.0)	15.0 (34.9)	26.0 (41.3)	
Diarrhea				0.372§
No	17.0 (85.0)	40.0 (93.0)	57.0 (90.5)	
Yes	3.0 (15.0)	3.0 (7.0)	6.0 (9.5)	
Loss of Appetite				0.309§
No	18.0 (90.0)	33.0 (76.7)	51.0 (81.0)	
Yes	2.0 (10.0)	10.0 (23.3)	12.0 (19.0)	
Constipation				0.401§
No	15.0 (75.0)	27.0 (62.8)	42.0 (66.7)	
Yes	5.0 (25.0)	16.0 (37.2)	21.0 (33.3)	
GERD				0.788§
No	11.0 (55.0)	21.0 (48.8)	32.0 (50.8)	
Yes	9.0 (45.0)	22.0 (51.2)	31.0 (49.2)	
Dental Problem				-
No	20.0 (100.0)	43.0 (100.0)	63.0 (100.0)	
Yes	0	0	0	

SD: Standard Deviation, IQR: Interquartile Range, GERD: Gastroesophageal reflux disease
† Pearson Chi-Square; ‡Mann-Whitney test; § Fisher's Exact Test.
*p<0.05 is considered significant

Table 3. Medical condition and post-bariatric complications experienced by participants (cont.)

Variables	Men (n=20)	Women (n=43)	Total (n=63)	*p-value*
Complications after bariatric surgery				
Infection				0.317§
No	19.0 (95.0)	43.0 (100.0)	62.0 (98.4)	
Yes	1.0 (5.0)	0.0 (0.0)	1.0 (1.6)	
Leakage at the operation site				1.00§
No	20.0 (100.0)	41.0 (95.3)	61.0 (96.8)	
Yes	0.0 (0.0)	2.0 (4.7)	2.0 (3.2)	
Irregular menses				1.00§
No	NA	41.0 (95.3)	61.0 (96.8)	
Yes	NA	2.0 (4.7)	2.0 (3.2)	

SD: Standard Deviation, IQR: Interquartile Range, GERD: Gastroesophageal reflux disease
† Pearson Chi-Square; ‡Mann-Whitney test; § Fisher's Exact Test.
*$p<0.05$ is considered significant

Table 4. Post-bariatric complications according to the duration after bariatric surgery

Complications (n,%)	0-<3 months	3-<6 months	6-<12 months	≥12 months	p-value †
Dry Skin					0.695
No	3.0 (4.8)	1.0 (1.6)	3.0 (4.8)	32.0 (50.8)	
Yes	4.0 (6.3)	1.0 (1.6)	2.0 (3.2)	17.0 (27.0)	
Anaemia					0.574
No	7.0 (11.1)	2.0 (3.2)	4.0 (6.3)	40.0 (63.5)	
Yes	0.0 (0.0)	0.0 (0.0)	1.0 (1.6)	9.0 (14.3)	
Lethargy					0.058
No	2.0 (3.2)	1.0 (1.6)	5.0 (7.9)	34.0 (54.0)	
Yes	5.0 (7.9)	1.0 (1.6)	0.0 (0.0)	15.0 (23.8)	
Hair Loss					0.061
No	6.0 (9.5)	0.0 (0.0)	1.0 (1.6)	24.0 (38.1)	
Yes	1.0 (1.6)	2.0 (3.2)	4.0 (6.3)	25.0 (39.7)	
Unhealthy nail					0.454
No	7.0 (11.1)	2.0 (3.2)	5.0 (7.9)	41.0 (65.1)	
Yes	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	8.0 (12.7)	
Nausea					0.426
No	4.0 (6.3)	2.0 (3.2)	4.0 (6.3)	40.0 (63.5)	
Yes	3.0 (4.8)	0.0 (0.0)	1.0 (1.6)	9.0 (14.3)	
Vomiting					0.375
No	2.0 (3.2)	1.0 (1.6)	3.0 (4.8)	31.0 (49.2)	
Yes	5.0 (7.9)	1.0 (1.6)	2.0 (3.2)	18.0 (28.6)	
Diarrhoea					0.814
No	6.0 (9.5)	2.0 (3.2)	5.0 (7.9)	44.0 (69.8)	
Yes	1.0 (1.6)	0.0 (0.0)	0.0 (0.0)	5.0 (7.9)	
Loss of Appetite					0.595
No	5.0 (7.9)	1.0 (1.6)	4.0 (6.3)	41.0 (65.1)	
Yes	2.0 (3.2)	1.0 (1.6)	1.0 (1.6)	8.0 (12.7)	
Constipation					0.214
No	5.0 (7.9)	0.0 (0.0)	4.0 (6.3)	33.0 (52.4)	
Yes	2.0 (3.2)	2.0 (3.2)	1.0 (1.6)	16.0 (25.4)	
GERD					0.647
No	2.0 (3.2)	1.0 (1.6)	3.0 (4.8)	26.0 (50.8)	
Yes	5.0 (7.9)	1.0 (1.6)	2.0 (3.2)	23.0 (36.5)	
Infection					0.962
No	7.0 (11.1)	2.0 (3.2)	5.0 (7.9)	48.0 (76.2)	
Yes	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	1.0 (1.6)	
Leakage at the operation site					0.164
No	7.0 (11.1)	2.0 (3.2)	4.0 (6.3)	48.0 (76.2)	
Yes	0.0 (0.0)	0.0 (0.0)	1.0 (1.6)	1.0 (1.6)	
Irregular menses					0.899
No	7.0 (11.1)	2.0 (3.2)	5.0 (7.9)	47.0 (74.6)	
Yes	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	2.0 (3.2)	

SD: Standard Deviation, IQR: Interquartile Range, GERD: Gastroesophageal reflux disease
†Pearson Chi-Square

Table 5. Comparison of pre and post bariatric surgery anthropometric parameters

Variables	Men (n=20)	Women (n=43)	Total (n=63)	*p-value*
Weight (kg)				
Before Bariatric Surgery (mean, SD)	154.9 (34.4)	117.7 (24.9)	129.5 (33.0)	<0.001[a*]
After Bariatric Surgery (median, IQR)	105.5 (28.0)	78.0 (24.3)	85.0 (32.0)	<0.001[b*]
Percentage of Total Weight Loss, % (mean ± SD)	29.4 (12.5)	29.2 (10.0)	29.2 (10.7)	0.933[a]
BMI Before Bariatric Surgery (n, %)				0.104[c]
Normal	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	
Overweight	0.0 (0.0)	1.0 (2.3)	1.0 (1.6)	
Obese 1	2.0 (10.0)	1.0 (2.3)	3.0 (4.8)	
Obese 2	0.0 (0.0)	8.0 (18.6)	8.0 (12.7)	
Severe Obese	18.0 (90.0)	33.0 (76.7)	51.0 (81.0)	
BMI After Bariatric Surgery (n, %)				0.192[c]
Normal	2.0 (10.0)	3.0 (7.0)	5.0 (7.9)	
Overweight	2.0 (10.0)	11.0 (25.6)	13.0 (20.6)	
Obese 1	5.0 (25.0)	15.0 (34.9)	20.0 (31.7)	
Obese 2	4.0 (20.0)	9.0 (20.9)	13.0 (20.6)	
Severe Obese	7.0 (35.0)	5.0 (11.6)	12.0 (19.0)	
	Before surgery (n=63)	After surgery (n=63)		
Weight (kg) (median, IQR)	122.0 (49.0)	85.0 (32.0)		<0.001[d*]
BMI (kg/m^2) (median, IQR)	47.7 (14.9)	32.9 (10.0)		<0.001 [d*]

BMI: Body Mass Index, SD: Standard Deviation, IQR: Interquartile Range
[†] Independent t-test; [‡]Mann-Whitney test; [§] Pearson Chi-Square; [¶]Wilcoxon Signed-Rank Test.
*p<0.05 is considered significant

Table 5. Adherence of the energy and nutrients intake to the RNI of Malaysia, ASMBS and CPG according to gender

Nutrients (median, IQR)	Men (n=20)	RNI/ASMBS/CPG/Journals	%Intake	Women (n=43)	RNI/ASMBS/CPG/Journals	%Intake	*p-value* †
Energy (kcal/d)	1234.5 (677.7)	1000.0[a]	123.4	1114.4 (741)	1000.0[a]	114.4	0.303
Protein (g/d)	61.1 (25.5)	60.0-80.0[a]	101.8	46.1 (88.7)	60.0-80.0	76.8	0.068
Carbohydrate (g/d)	140.3 (106.7)	50.0-112.5[a]	280.6	129.9 (80.2)	50.0-112.5[a]	259.8	0.388
Fat (g/d)	40.3 (33.8)	27.8-33.3 (25-30%)[b]	145.0	43.8 (35.1)	27.8-33.3 (25-30%)[b]	157.6	0.801
Cholesterol (mg/d)	141.5 (255.8)	200.0[b]	70.8	130.0 (190.9)	200.0[b]	65.0	0.083
SFA (g/d)	7.0 (7.7)	7.0-10.0%[b]	5.1%	7.3 (8.0)	7.0-10.0%[b]	5.9%	0.945
MUFA (g/d)	9.0 (12.7)	5.0-7.0%[b]	6.6%	10.5 (10.4)	5.0-7.0%[b]	8.5%	0.598
PUFA (g/d)	6.2 (8.3)	12.0-15.0%[b]	4.5%	5.6 (5.1)	12.0-15.0%[b]	4.8%	0.546
Fibre (g/d)	4.2 (5.3)	20.0-30.0[b]	21.0	5.7 (8.1)	20.0-30.0[b]	28.5	0.118
Sugar (g/d)	32.7 (27.6)	<15.0%[b]	10.6%	28.1 (33.0)	<15.0%[b]	10.1%	0.468
Glucose (g/d)	2.6 (7.4)	-	-	2.8 (5.0)	-	-	0.515
Fructose (g/d)	1.7 (4.1)	-	-	4.2 (6.1)	-	-	0.133
Sucrose (g/d)	12.9 (25.4)	10.0-20.0[b]	-	3.7 (10.6)	10.0-20.0[b]	-	0.055
Vitamin A (IU/d)	3276.7 (6735.7)	5000.0-10000.0[c]	65.5	6061.7 (4659.3)	5000.0-10000.0[c]	121.2	0.167
Vitamin C (mg/d)	98.9 (523.7)	70.0[d]	141.3	206.7 (490.1)	70.0[d]	295.3	0.145
Vitamin D (IU/d)	44.0 (211.7)	3000.0[c]	1.5	400.0 (395.0)	3000.0[c]	13.3	0.177
Vitamin E (mg/d)	7.4 (15.8)	15.0[c]	49.3	21.0 (21.0)	15.0[c]	140.0	0.067
Vitamin B-1(mg/d)	1.0 (6.1)	12.0-50.0[c]	8.3	6.5 (5.9)	12.0-50.0[c]	54.2	0.192
Vitamin B-2 (mg/d)	1.6 (8.4)	1.3[d]	123.0	8.9 (8.8)	1.1[d]	809.1	0.296
Vitamin B-3 (mg/d)	17.2 (40.5)	16.0[d]	107.5	62.1 (60)	14.0[d]	443.6	0.141
Vitamin B-6 (mg/d)	1.2 (7.6)	1.3[d]	92.3	8.5 (7.9)	1.3[d]	653.8	0.145
Vitamin B-9 (µg/d)	173.8 (237.6)	400.0-800.0[c]	43.5	243.2 (253.4)	400.0-1000.0[c]	60.8	0.332
Vitamin B-12 (µg/d)	2.9 (10.1)	350.0-500.0[c]	0.8	10.4 (10.6)	350.0-500.0[c]	3.0	0.231
Vitamin B-5 (mg/d)	2.9 (20.2)	5.0[d]	58.0	20.3 (20.0)	5.0[d]	406.0	0.487
Vitamin B-7	173.8 (237.6)	-	-	243.2 (253.4)	-	-	0.199
Vitamin K (µg/d)	7.2 (33.6)	90.0-300.0[c]	8.0	12.6 (24.8)	90.0-300.0[c]	14.0	0.482
Sodium (mg/d)	865.1 (1177.4)	<1500.0[b]	57.7	1000.9 (1112.5)	<1500.0[b]	66.7	0.994
Potassium (mg/d)	1019.6 (903)	4700.0[d]	21.7	1205.4 (1083.6)	4700.0[d]	25.6	0.731
Calcium (mg/d)	379.6 (170.6)	1200.0-2400.0[c]	31.6	358.9 (328.6)	1200.0-2400.0[c]	29.9	0.970
Iron (mg/d)	10.2 (4.1)	60.0-180.0[c]	17.0	11.7 (7.8)	60.0-180.0[c]	19.5	0.243
Phosphorous (mg/d)	724.7 (399.6)	700.0[d]	103.4	696.2 (722.6)	700.0[d]	99.5	0.423
Magnesium (mg/d)	131.3 (107.5)	420.0[d]	31.3	145.7 (111.2)	320.0[d]	45.5	0.849
Zinc (mg/d)	6.6 (8.5)	8.0-22.0[c]	82.5	7.5 (6.6)	8.0-22.0[c]	93.8	0.321
Copper (mg/d)	0.5 (0.9)	2.0-4.0[c]	25.0	0.5 (0.5)	2.0-4.0[c]	25.0	0.562
Maganese (mg/d)	1.0 (0.9)	2.3[d]	43.5	2.0 (2.3)	1.8[d]	111.1	0.112

RNI: Recommended Nutrient Intake, ASMBS: American Society for Metabolic and Bariatric Surgery, CPG: Clinical Practice Guideline, Monounsaturated Fatty-Acid (MUFA), Polyunsaturated Fatty-Acid (PUFA), Saturated Fatty-Acid (SFA)

†Statistical significance: Mann-Whitney test; ‡Tabesh et al., 2019; §CPG; ¶ ASMBS; ††RNI.

Table 7. Comparisons of macronutrients and micronutrients Intake according to the duration after bariatric surgery

Nutrients (median, IQR)	0-<3 months	3-<6 months	6-<12 months	≥12 months	*p-value* †
Energy (kcal/day)	888.4 (70.3)	913.4 (-)	1046.7 (980.2)	1224.8 (717.2)	0.312
Protein (g/day)	49.9 (15.4)	45.2 (-)	40.9 (37.1)	50.7 (32.8)	0.916
Carbohydrate (g/d)	101.5 (59.7)	134.9 (-)	150.6 (139.6)	136.3 (87.2)	0.414
Fat (g/d)	28.9 (11.1)	21.4 (-)	45.8 (39.0)	45.1 (31.5)	0.187
Cholesterol (mg/d)	115.3 (198.3)	170.5 (-)	120.0 (115.0)	136.1 (219.4)	0.949
SFA (g/d)	6.5 (1.9)	3.0 (-)	6.3 (8.4)	8.3 (9.0)	0.216
MUFA (g/d)	9.5 (6.5)	4.6 (-)	11.4 (7.1)	10.3 (10.9)	0.603
PUFA (g/d)	4.2 (3.2)	8.3 (-)	5.4 (7.3)	6.1 (6.1)	0.555
Fibre (g/d)	4.7 (5.1)	4.6 (-)	6.0 (5.4)	4.4 (8.3)	0.606
Sugar (g/d)	30.0 (16.2)	25.5 (-)	30.7 (68.5)	32.0 (5.6)	0.798
Glucose (g/d)	3.8 (5.6)	8.3 (-)	0.1 (5.9)	2.8 (5.0)	0.472
Fructose (g/d)	4.1 (6.7)	3.0 (-)	4.2 (10.6)	3.1 (5.4)	0.919
Sucrose (g/d)	10.0 (15.3)	8.1 (-)	4.6 (7.9)	6.2 (16.3)	0.918
Vitamin A (IU/d)	5554.1 (4237.2)	5127.3 (-)	4760.3 (6355.8)	5709.6 (5619.5)	0.997
Vitamin C (mg/d)	203.5 (77.3)	119.4 (-)	221.5 (524.2)	193.7 (524.2)	0.709
Vitamin D (IU/d)	400.0 (396.3)	296.3 (-)	400.0 (398.6)	91.6 (400.0)	0.292
Vitamin E (mg/d)	21.0 (18.9)	14.2 (-)	21.6 (26.1)	9.8 (20.0)	0.772
Vitamin B-1 (mg/d)	6.4 (6.0)	3.7 (-)	6.5 (6.3)	2.5 (6.3)	0.928
Vitamin B-2 (mg/d)	8.8 (7.7)	5.1 (-)	9.0 (8.7)	3.2 (9.1)	0.940
Vitamin B-3 (mg/d)	62.1 (61.1)	43.1 (-)	65.5 (64.1)	26.1 (57.9)	0.973
Vitamin B-6 (mg/d)	8.4 (8.4)	5.0 (-)	8.7 (6.5)	3.6 (8.2)	0.815
Vitamin B-9 (µg/d)	259.8 (227.3)	204.3 (-)	249.9 (175.5)	199.0 (11.0)	0.985
Vitamin B-12 (µg/d)	10.6 (11.0)	7.3 (-)	10.2 (12.1)	5.8 (11.0)	0.898
Pantothenic acid (mg/d)	20.8 (16.0)	11.3 (-)	20.4 (19.8)	4.3 (21.5)	0.623
Biotin (mg/d)	27.7 (32.2)	20.2 (-)	25.0 (22.1)	18.5 (40.9)	0.971
Vitamin K (µg/d)	13.2 (32.9)	17.9 (-)	12.6 (12.1)	10.0 (27.8)	0.982
Sodium (mg/d)	451.6 (306.4)	1606.2 (-)	1263.8 (1704.6)	1084.2 (1207.8)	0.090
Potassium (mg/d)	1174.4 (1207.8)	885.3 (-)	1286.7 (1123.0)	1205.0 (930.4)	0.732
Calcium (mg/d)	349.8 (124.6)	250.3 (-)	325.2 (450.0)	398.2 (278.7)	0.714
Iron (mg/d)	11.3 (3.5)	6.8 (-)	12.1 (12.7)	10.4 (6.7)	0.468
Phosphorous (mg/d)	708.6 (391.8)	443.9 (-)	517.2 (871.0)	740.9 (628.0)	0.465
Magnesium (mg/d)	124.7 (150.1)	106.5 (-)	108.0 (95.4)	151.2 (113.3)	0.806
Zinc (mg/d)	8.1 (6.7)	5.7 (-)	7.5 (6.1)	7.3 (8.1)	0.768
Copper (mg/d)	0.9 (1.7)	43.6 (-)	0.7 (0.4)	0.5 (0.6)	0.270
Maganese (mg/d)	2.1 (1.9)	1.3 (-)	2.0 (1.5)	1.1 (2.0)	0.308

RNI: Recommended Nutrient Intake, ASMBS: American Society for Metabolic and Bariatric Surgery, CPG: Clinical Practice Guideline, Monounsaturated Fatty-Acid (MUFA), Polyunsaturated Fatty-Acid (PUFA), Saturated Fatty-Acid (SFA)

†Statistical significance: Kruskal-Wallis H Test; ‡Tabesh et al., 2019; §CPG; ¶ ASMBS; ††RNI.

Table 8. Common food consumed based on food group [presented as n(%)]

Food Group	Frequency of food consumption[†]; n(%)
Carbohydrate	
White rice	66(23.9)
White bread	23(8.3)
Noodle soup	17(6.2)
Cream crackers	13(4.7)
Fried noodles	12(4.3)
Porridge	11(4.0)
Protein	
Fried chicken	30(10.9)
Fish dishes (fried/gravy)	18(6.5)
Hard/half boiled egg	12(4.3)
Other chicken dishes	12(4.3)
Fruits	
Red apple	12(4.3)
Banana	11(4.0)
Vegetables	
Stir fried mixed vegetables	16(5.8)
`*Ulam Raja*` (local salad)	8(2.9)
Vegetables soup	7(2.5)
Miscellaneous	
Curry-puff	23(8.3)
Nuts	10(3.6)
`*Keropok lekor*` (fried fish chips)	9(3.3)
Butter	7(2.5)
Pandan coconut milk bread spread	6(2.2)

[†] Frequency of meal consumption was calculated by dividing the frequency of food consumed in a day with the total meals consumed per day by all participants (276 meals per day).

Table 9. Depression, anxiety and stress level of participants [presented as n (%) or median (IQR)]

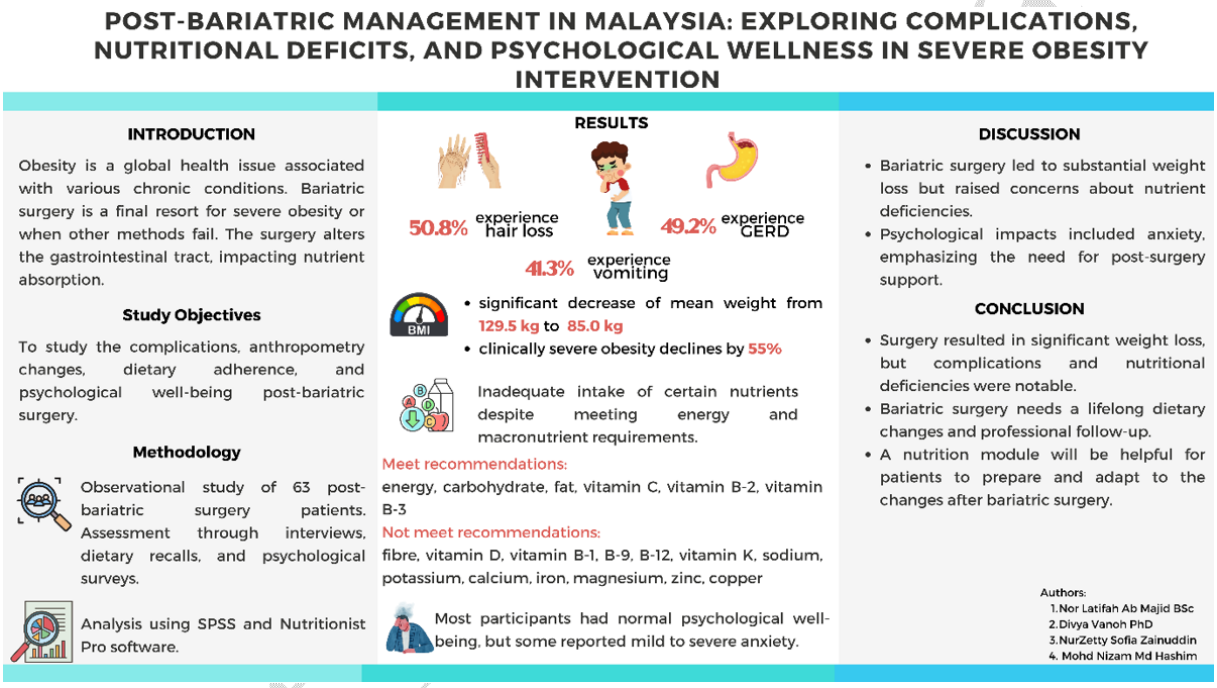
DASS Domains	Men (n=20)	Women (n=43)	Total (n=63)	*p-value*
Depression, n (%)				0.370[†]
Normal	19.0 (30.2)	37 (58.7)	56.0 (88.9)	
Mild	1.0 (1.6)	2.0 (3.2)	3.0 (4.8)	
Moderate	0.0 (0.0)	4.0 (6.3)	4.0 (6.3)	
Severe	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	
Extremely Severe	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	
Anxiety, n (%)				0.464[†]
Normal	16.0 (25.4)	28.0 (44.4)	44.0 (69.8)	
Mild	2.0 (3.2)	4.0 (6.3)	6.0 (9.5)	
Moderate	1.0 (1.6)	6.0 (9.5)	7.0 (11.1)	
Severe	1.0 (1.6)	1.0 (1.6)	2.0 (3.2)	
Extremely Severe	0.0 (0.0)	4.0 (6.3)	4.0 (6.3)	
Stress, n (%)				0.115[†]
Normal	15.0 (23.8)	32.0 (50.8)	47.0 (74.6)	
Mild	5.0 (7.9)	5.0 (7.9)	10.0 (15.9)	
Moderate	0.0 (0.0)	6.0 (9.5)	6.0 (9.5)	
Severe	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	
Extremely Severe	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	
DASS Score (median, IQR)				
Depression	0.0 (3.5)	2.0 (8.0)	2.0 (4.0)	0.162[‡]
Anxiety	3.0 (6.0)	4.0 (8.0)	4.0 (8.0)	0.192[‡]
Stress	2.0 (10.5)	6.0 (12.0)	4.0 (12.0)	0.161[‡]

SD: Standard Deviation, IQR: Interquartile Range
Statistical significance: [†]Pearson Chi-Square; [‡] Mann-Whitney test

Table 10. Comparisons between the depression, anxiety and stress scores according to the duration after surgery

DASS Level (median, IQR)	0-<3 months	3-<6 months	6-<12 months	≥12 months	*p*-value[†]
Depression score	0.0 (1.0)	0.0 (0.0)	0.0 (4.5)	1.0 (3.5)	0.418
Anxiety sore	1.0 (2.0)	0.5 (0.0)	2.0 (2.5)	2.0 (4.0)	0.324
Stress Score	1.0 (3.0)	0.0 (0.0)	1.0 (6.5)	3.0 (5.5)	0.198

IQR: Interquartile Range
[†]Statistical significance (Kruskal-Wallis H Test)



Graphical abstract