Nutritional Deficiency After Bariatric Surgery – A Systematic Review

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Abstract

Since obesity is closely linked to metabolic disorders, cancer, and cardiovascular diseases, it poses a threat to public health in Saudi Arabia. Effective methods for managing obesity include a step-by-step strategy that incorporates dietary changes, lifestyle modifications, and pharmaceutical treatments. In certain situations, however, surgical intervention is still required, as recently described in Saudi guidelines for the prevention and management of obesity. The

objective of this systematic review is to evaluate the weight loss and complication rates of various bariatric operations based on reported data from the literature. Such procedures carry the dangers of hormone imbalances, malabsorption, metabolic problems, and procedure-related consequences. Extended follow-up and scientific body advice, however, increased benefits and decreased hazards, according to long-term experience.

Keywords: Obesity, Nutritional Deficiency, bariatric surgery, issues, concerns.

Introduction

Excessive adipose tissue storage is a hallmark of obesity, a chronic illness. Many comorbidities, such as but not limited to type 2 diabetes mellitus (T2DM), hypertension, hyperlipidemia, cardiovascular disease (CVD), cancer, chronic kidney disease, hypoventilation syndrome, debilitating osteoarthritis, steatohepatitis or nonalcoholic fatty liver disease, severe acid reflux, and obstructive sleep apnea, can complicate it. Arterburn et al (2018); Coluzzi et al (2016); Kramer et al (2024) These comorbidities raise health care expenses and have a detrimental impact on a person's quality of life. While obesity is a global problem, recent increases have been greatest in certain lower-income nations. No nation has reported a decrease in the prevalence of obesity among its citizens. Over 4 billion individuals worldwide are predicted to be overweight or obese [body mass index (BMI) > 25 kg/m2] by 2035, up from over 2.6 billion in 2020. nearly the course of these 15 years, the percentage of the world's population that is obese has increased from 38% to nearly 50%. By 2035, about 2 billion adults, children, and adolescents are predicted to be affected by the prevalence of obesity alone (BMI ≥ 30 kg/m2), which is predicted to increase from 14% to 24% during the same time period. English et al (2020) Adult women are more likely than men to be obese, as are those from low-education and socioeconomically disadvantaged backgrounds. It is predicted that children and teenagers, especially boys, would experience the biggest rise in obesity. Elahmedi et al (2017); Andreu et al (2020)

Although the precise etiology of obesity is unknown, elements like genetics, neurohormonal processes, obesogenic drugs, sociocultural practices and beliefs, environmental factors, life experiences, and psychological factors all seem to interact in a complex way. Fernandes et al (2020); Leslie et al (2021); Lewis et al (2023) Obesity rates are also influenced by sedentary behavior, urbanization, food consumption patterns, and other lifestyle choices. Dietary control and behavioral modifications are now the most effective noninvasive therapies. Meaningful weight loss can be achieved by comprehensive, multicomponent therapies that combine pharmacological and behavioral counseling techniques. Himpens (2018); Soliman (2020); Jegatheesan et al (2020) Significant weight loss has been seen with the help of incretin mimetics, such as glucagon-like peptide-1 receptor agonists. Long-term weight loss success is still unknown, though, due to side effects and expense, a gradual decline in compliance, and weight rebound following medication discontinuation. Ben-Porat et al (2015); Thorell et al (2016) Bariatric surgery (BS) is now the most effective long-term weight loss treatment for extreme obesity. It is linked to a 15–30% overall weight loss that is typically maintained over time. Abdeen et al (2016); Courcoulas et al (2018) Numerous studies have shown that BS has a positive effect on quality of life, prevention and remission of type 2 diabetes, incidence of first occurrence of fatal or nonfatal CVD events, and all-cause and cardiovascular mortality.

The pros and drawbacks of BS should be weighed before considering it as a treatment for extreme obesity. Complication rates have significantly decreased as a result of the current laparoscopic method for all BS operations. Cruz-Jentoft et al (2019); Busetto et al (2014)

Presurgical and postoperative variables, surgical technique, postoperative weight loss, and patient adherence to nutritional follow-up all have an impact on potential nutritional and gastrointestinal issues following BS. Huber et al (2023) In order to identify and treat nutritional issues and avoid severe malnutrition or other health concerns, it is essential to educate patients about the importance of lifetime medical follow-up. Calikoglu et al (2021); Jastreboff et al (2022)

Research Process

- Through the use of the US National Library of Medicine-supported medical database MEDLINE/PubMed, a comprehensive online search of published literature addressing bariatric procedures in Saudi Arabia and other western countries was conducted.
- The review was carried out through December 2024. The researcher's approach to the article selection procedure is described in.
- Following a review procedure, the researchers reached a consensus to address the disagreements. Initially, all published papers that used the terms "Bariatric Surgery," "Obesity," and "Saudi Arabia" in their titles, as keywords, or as references in their abstracts were gathered.
- The first search turned up 110 items. Case reports, studies, and non-original papers were excluded from the search results using a set of filtering criteria.
- The final step in the selecting procedure involved a thorough analysis of articles 85.

Reason of Bariatric Surgery

The application of this therapy method for severe and complex obesity has grown as a result of the health benefits of BS. Yet, it is critical to recognize that BS entails dangers, especially with regard to nutritional issues brought on by dietary modifications and structural abnormalities. Carrasco et al (2018); Adams et al (2023) Certain standards for choosing qualified individuals for BS have been created in order to guarantee the best results and reduce surgical problems. Because it is a life-changing intervention for treating obesity, careful planning is required prior to the treatment. The eligibility and safety of potential patients for surgery are assessed by a multidisciplinary review that includes functional, psychological, nutritional, and medical evaluations. Heart, respiratory, metabolic, gastrointestinal, and sleep apnea tests may be part of additional medical assessments. Marshall et al (2020); Aills et al (2018); Krzizek et al (2021)

Patients are advised to engage in behavioral treatments both before and after BS in order to sustain the behavioral improvements. Sherf et al (2017); Sierżantowicz et al (2020) In conjunction with a multidisciplinary team, the type of surgery should be chosen, taking into account the patient's health, expected results, and advantages and disadvantages. Patients who have type 1 diabetes, uncontrolled diabetes, or diabetes treated with insulin should receive

extra care. Aljaaly et al (2016); Von Elm (2018) Determining the chances of both short- and long-term remission (or the lack of it) and managing diabetes throughout the perioperative phase are important. In order to lower the risk of problems following surgery, smoking cessation prior to BS is required and should be maintained throughout one's life. The best course of action for long-term weight loss and the management of chronic illnesses is now BS in conjunction with behavioral therapy for people who are severely obese. Al-Enazi et al (2017)

Related Complications

Nutritional deficits might result from specific consequences associated with each surgical operation. Anastomotic leaks, small bowel blockage, and dumping syndrome are among the early complications of RYGB, SG, and BPD/DS. According to 33,560 persons in the US National Patient-Centered Clinical Research Network, hospitalizations, surgeries, and interventions are rather prevalent following BS. Roust et al (2017); Martínez-Ortega et al (2020) In contrast to SG, incidence rises following RYGB. Complications from staple lines, stomal stenosis, and hernias may arise weeks to months following surgery. Surgical intervention is usually necessary for all of these problems. Revisional surgery is necessary for adverse occurrences like band slippage, erosion, or prolapse, despite the fact that AGB is a less invasive technique. Kim et al (2016)

In a comprehensive study using the US National Patient-Centered Clinical Research Network, the 30-day rates of significant adverse events were 2.9% for AGB, 2.6% for SG, and 5.0% for RYGB. One reason for the fall in AGB in recent years may be because the surgery requires band revision and frequently does not result in weight loss for many patients. Mild to moderate side effects from endoscopic treatments include nausea and abdominal pain. Serious adverse outcomes, however, are possible. Lieske et al (2015) Intraabdominal collection, intervention-needed hemorrhage, and refractory symptoms that need to be reversed are a few examples of ESG consequences. Compared to ESG, IGBs have less significant side effects, albeit there may be more nausea, vomiting, and stomach pain. Maghrabi et al (2019); Lu CW et al (2015)

Nutritional Considerations

Before, during, and after BS, a number of factors affect the likelihood of developing nutritional deficiencies. Metabolic problems and postoperative nutritional deficits are linked to pre-existing inadequate nutritional status. Mahan et al (2017); Alkhaldy et al (2020) Therefore, a complete preoperative intervention should include diagnosing and addressing dietary inadequacies before surgery. Significant alterations to gastrointestinal anatomy brought on by BS have an impact on gut function and nutrition intake. All patients undergo changes in eating habits, such as smaller portions and altered taste preferences, regardless of the surgical treatment. Decreased energy intake and restricted consumption of vital vitamins, minerals, and proteins are caused by the possibility of diarrhea and chronic vomiting. Hakel-Smith et al (2005); Hunt et al (2021)

A nutritional shortage is the result of several forces working together. The size of the stomach pouch, stomach bypassing, changes to the small intestine's structure, and the length of the common channel all affect how much nutrient loss occurs.

a. Malabsorption and Nutrient Deficiencies

Patients who suffer from lipid or fat malabsorption develop a shortage in fat-soluble vitamins. Both RYGB and SG cause very little malabsorption of carbohydrates and less malabsorption of fat than BPD/DS. Studies have revealed comparable micronutrient shortages following the RYGB and SG procedures for the majority of micronutrients, which makes sense given that both treatments have comparable malabsorptive features. de Lima et al (2013) According to these and other research, vitamin D, iron, and vitamins B6, B12, and B1 are the most frequently deficient in this patient population. In contrast to RYGB (and the AGB operation), one study found that individuals with SG had lower levels of folate but increased levels of hemoglobin (but not other iron indicators), magnesium, and zinc. Others, however, have noted decreased iron and vitamin B12 levels following SG. Ahlin et al (2020)

b. Deficiency Vitamin B1

The most prevalent water-soluble vitamin deficiency in the BS population is B1, which is typically brought on by hyperemesis and inadequate dietary vitamin B1 consumption. A vitamin B1 deficiency may cause cerebral, dry, or wet beriberi if treatment is not received. Dry and cerebral beriberi cause neurological consequences ranging from mental confusion to insanity, but wet beriberi is characterized by heart symptoms such as tachycardia and hypertension. It has been noted that females are more likely than males to experience beriberi, which typically appears 1-3 months following BS. Gletsu-Miller (2020); Alkhaldy et al (2019)

c. Anemia

Using malabsorption methods, anemia is documented following BS. It may be connected to the existence of iron deficiency before surgery, but it is probably related to the type of operation and the length of time reported following surgery. Patients who use postoperative proton pump inhibitors (PPIs) often may develop anemia as a result. As reported in patients with laparoscopic SG, the use of PPIs may result in a decrease in the formation of hydrochloric acid, which inhibits the conversion of iron to the absorbable ferrous form. El Chaar (2014); Rachal et al (2015)

d. Dumping Syndrome

Dumping syndrome, which can accompany RYGB or SG, is a common intestinal complication after BS. The rapid movement of stomach contents into the small intestine, known as "dumping syndrome," frequently happens when simple carbohydrates are consumed. It can result in gastrointestinal disorders or postprandial hypoglycemia. McGrice et al (2015); Hampl et al (2023); Jastreboff et al (2023) Although there is presently no approved prescription to treat dumping syndrome-induced hypoglycemia, dietary counseling to reduce rapid carbohydrate consumption and increase fiber and proteins in meals and snacks, as well as the use of acarbose to limit glucose absorption, are treatment options. In order to reduce gastrointestinal problems and avoid hypoglycemia, patients should be closely watched for signs of dumping syndrome after surgery. Aguilera et al (2014)

e. Kidney Stones

Kidney stones are linked to malabsorptive operations. Following BS, there is a lifelong risk of oxalate nephropathy and hyperoxaluria in addition to renal stones. Compared to obese individuals who have not had surgery, the chance of developing kidney stones increases. Gowanlock et al (2020) By implementing dietary modifications as soon as these issues are identified, oxalate excretion and possible stones can be effectively decreased. Significantly, when taking into account the resolution of diabetes and the decrease in pathologic albuminuria, the overall impact on long-term renal health and the risk of chronic kidney disease is frequently favorable following BS.

f. Bone Loss

moderate weight loss causes bone loss, which is more severe following BS treatments. This is due to a combination of factors, including the type of surgery and the degree of malabsorption, as well as the degree of weight reduction. Additionally, teenagers who have sleeve gastrectomy have decreased spinal bone density and strength. Among the causes of bone loss include decreased calcium absorption, increased circulating parathyroid hormone (PTH) and bone resorption, and decreased estrogen. Six months following RYGB surgery, women who consume 1.5 g of calcium per day and 400 IUs of vitamin D experience a sharp 33% reduction in calcium absorption. Gasmi et al (2020) In a later investigation, researchers discovered that Ca absorption significantly decreased even when vitamin D status was optimized, and the outcomes were comparable for individuals' undergoing SG and RYGB surgeries.

Evidences from studies in KSA

Using the Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) system, the Saudi Ministry of Health and McMaster University organized an expert panel in 2015 to create evidence-based practice guidelines. Chaves et al (2022) This sums up the quality of the evidence and the recommendation's strength. Individualized counseling, lifestyle modifications, and physical activity in addition to food were the strongest recommendations. Among the pharmaceutical choices were Orlistat and Metformin. If the BMI was greater than 40 kg/m2 and greater than 35 kg/m2 with comorbidities, bariatric surgery was conditionally advised for the treatment of obesity. Albaugh et al (2019)

The Saudi Arabian society of metabolic and bariatric surgery guidelines for prevention and management of obesity, in addition to the Saudi Ministry of Health's guidelines, extended the consideration of bariatric surgery to include postpubescent adolescents with severe to extreme obesity and severe co-morbidities, as well as adults with a BMI greater than 30 kg/m2 who have poorly controlled type 2 diabetes or who are at increased risk for cardiovascular disease. Georgiadou et al (2014); Jaruvongvanich et al (2019) The metabolic response to food and lifestyle changes, as well as surgical or non-surgical management of obesity, is heavily reliant on metabolic and microbiological phenotypes, which aids in understanding the etiopathology of obesity. Stein et al (2014) Laparoscopic adjustable gastric banding (LAGB) and vertical banded gastroplasties (VBG) are surgical options. Other surgical procedures include laparoscopic sleeve gastrectomy (LSG) and laparoscopic Roux-en-Y gastric bypass (LRYGBP). In mild to moderate cases of obesity, the intra-gastric balloon (IGB) may also be utilized. Taube-Schiff et al (2016)

Flexible esophagogastroduodenoscopy (EGD) was recommended by several authors before any weight-loss surgery. Kong et al (2013) Although the results of such an intervention may not alter the surgical procedure, it is beneficial for individuals with anatomical variations such as situs inversus. For anesthesiologists, morbid obesity presents a significant obstacle to an early and uncomplicated recovery. Jamil et al (2020) Ibraheim O conducted a study at King Khaled University Hospital on 15 patients undergoing LAGB to examine the use of BIS (bi-spectral index) in the administration of sevoflurane. Sevoflurane was given to an additional 15 patients in accordance with routine procedure. The BIS group consumed less sevoflurane and had shorter wake-up and extubation times. Bradley et al (2017)

At Saad Specialist Hospital in Al-Khobar, Al-Momen A and El-Mogy I performed endoscopic placement of intragastric balloons in 44 individuals with a mean age of 31 years and a BMI of 45 kg/m2. Dijkhorst et al (2018); Hegarty et al (2020) The super-obese patients' EWL increased from an average of 13 kg to 33 kg. Vomiting was the most common side effect, occurring mostly in the first week at a rate of 77.2%; it then reverted to occur occasionally for more than three weeks (11.3%). Laferrère et al (2018) Additionally, hypokalemia (6.8%) was seen. In 4.5% of instances, functional renal insufficiency was observed. Additionally, 6.8% reported having GERD and 15.9% reported having stomach pain. There were four cases of intolerance (one of which decided to switch back to LAGB), one case of stomach perforation (which was treated laparoscopically after the BIB was removed), one case of gastric ulcer, and one death (not from the treatment but from other medical issues). Seven extremely obese patients had LAGB at hospitals, and six patients, or 13.6% of the total, were lost to follow-up. Laurenius et al (2012)

Vertical Banded Gastroplasty

39 morbidly obese individuals (80% female) underwent VBG as part of a study conducted by Mofti AB at King Khaled University Hospital. Coimbra et al (2022); Dallal et al (2006) The mean weight loss for males and females in a one-year follow-up of 38 patients was 39% and 33%, respectively. However, 23 patients were monitored for four years, and the mean weight decrease for males and females was 42% and 41%, respectively. The death rate was 2.5% and the failure rate was 13%. Hamdan et al (2011); Elms et al (2014)

Laparoscopic adjustable silicone gastric banding (LASGB)

A single team at King Abdul Aziz University conducted LASGB on 18 morbid and super-obese patients, 11 of whom were male and 7 of whom were female, between October 26, 1995, and January 29, 1996, as part of a brief prospective study by Ashy AA. Fayad et al (2019); Davies et al (2019) Their BMI varied from 36.3-65 kg/m2 with a mean of 49.8 kg/m2, and their mean weight was 138 kg (98-191 kg). Even though the patients were extremely obese, this approach demonstrated no significant surgical challenges and a good recovery after surgery. Arterburn et al (2020)

Laparoscopic adjustable gastric banding (LAGB) vs. Vertical Banded Gastroplasty

A prospective comparative study was carried out by the previous team on 60 patients in order to compare weight loss with LAGB and VBG. With matched age, sex, preoperative weight,

and BMI, 30 patients had VBG and the remaining 30 had LAGB after obtaining informed permission. The VBG group lost 87% of their excess weight at the 6-month postoperative follow-up, but the LAGB group only lost 50%. Batsis et al (2017); Debédat et al (2019)

Swedish adjustable gastric band (SAGB)

Dhafar KO conducted a 4-year study at Al-Noor Specialist Hospital in Makk Ah with the goal of providing an account of weight loss and postoperative complications following the implementation of the SAGB on 97 patients with morbid obesity. Prior to SAGB, the patients' mean BMI was 50.8 kg/m2. Di Palma et al (2019) With a mean postoperative BMI of 35 kg/m2, 94 patients—64 females (68%) and 30 males—benefited from weight loss during the 2-year follow-up. One patient was lost to follow-up, while the other experienced a wound infection, which was deemed a minor consequence. Unfortunately, a pulmonary embolism caused two deaths to occur early. Courcoulas et al (2020)

Measuring the effectiveness or success of the surgery is crucial. The Bariatric Analysis and Reporting Outcome System (BAROS) is an effective method to quantify 3 outcomes, excess weight loss, cure or alleviating comorbidities, and enhancing quality of life. Removal of the IGB has been associated with high rate of weight regain. It has been hypothesized to concomitantly use GLP-1 (Glucagon-like peptide-1) agonists to sustain the weight reduction. Lariglutide was used by Mosli MM in King Abdul Aziz University Hospital on 44 patients out of 108 patients who had IGB. Lariglutide was not found efficient in reducing the weight regain at 6 months. Friedman et al (2018); Gao et al (2023) Occasionally a 2-step surgery is recommended by band removal or repositioning in patients with high BMI. The absence of gastro-gastric suture (GGS) eases this reoperation. The impact of this reoperation and long-term complications were assessed at 17 bariatric centers on 706 patients. It was concluded at 3 years that GGS not only lowers reoperation rates but also prevents band slippage. Fixation in patients with high BMI needs separate assessment. After successful bariatric surgery 89.2% of cases developed sagging skin and thus were dissatisfied with their appearance. Busetto et al (2017) This was depicted in a study by Aldaqal SM in King Abdul Aziz University, in which 64 patients were studied. 51 of them were women. The most common dissatisfaction zones were upper arms (50%) and abdomen (45%). Thus, body contouring surgical procedure must be well-thought-out in managing morbid obesity.

Conclusion

For those who are really obese, BS is a crucial weight-loss aid. This group has a distinct combination of new medical and nutritional needs due to its substantial physiological and nutritional effects. With proper management and monitoring, many dietary deficits and problems can be avoided or resolved. A focus on taste and dietary preferences, gut microbiome, bile acid signaling, strategies to maintain beta cell function, and ways to reduce hepatic glucose output are some potential future nonsurgical approaches for treating obesity. The realm of obesity research is headed toward non-surgical treatments that replicate the metabolic advantages of BS.

Pharmacologic options that can be used in conjunction with lifestyle modifications to target a wider range of BMIs include glucagon-like peptide-1 (GLP-1) receptor agonists, GLP-1 in

combination with glucose-dependent insulinotropic polypeptide (GIP) dual agonists, and GLP-1/GIP/glucagon triple receptor agonists. Although the percentage of weight reduction via these pharmacologic approaches is comparable to that of surgical weight loss, compliance declines over time, therefore a combination of strategies including customized patient care is probably necessary for long-term success. To support all of these measures, nutritional status must be monitored to prevent deficient situations linked to higher and faster weight loss. Health care providers must also be equipped with the tools they need to treat these patients' long-term issues, such as continuing assistance in maintaining a healthy body weight over the course of their lives. To improve our chances of effectively preventing and treating severe obesity, action must be swift, integrated, and people-centered. Obesity is a public health burden in Saudi Arabia, having a detrimental effect on morbidity and mortality outcomes in addition to quality of life. The Saudi Arabian Society of Metabolic Bariatric Surgery and the Saudi Ministry of Health have already provided their guidelines for managing and preventing obesity. Bariatric surgery has been conducted for more than 25 years, and long-term patient follow-ups lasting up to 5 years show that it is a very beneficial strategy when carried out in accordance with national and international norms.

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