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Addressing nutritional challenges in bariatric surgery patients from preoperative assessment to long-term outcomes

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Abstract Bariatric surgery has emerged as the most effective and reliable intervention for managing morbid obesity, offering sustained weight loss, reduced mortality rates, and significant improvements in overall quality of life. Studies demonstrate a 42% reduction in cardiovascular mortality and a 30% decrease in all-cause mortality following these procedures. Despite its success, bariatric surgery is associated with significant nutritional challenges that must be addressed to ensure long-term patient health and well-being. This review focuses on the critical need for comprehensive preoperative evaluations to identify and manage existing nutritional deficiencies in patients undergoing bariatric surgery. Nutritional deficits, such as deficiencies in iron, vitamin B12, calcium, and fat-soluble vitamins, are common and can lead to severe complications, including anemia, osteoporosis, and neurological impairments. Additionally, post-surgical syndromes like reactive hypoglycemia and dumping syndrome, arising from altered gastrointestinal anatomy and function, require targeted dietary management. The review also examines the differences in deficiency risks across various bariatric procedures, highlighting that malabsorptive procedures, such as Roux-en-Y gastric bypass (RYGB) and biliopancreatic diversion (BPD), pose greater risks compared to restrictive procedures like sleeve gastrectomy (SG). A multidisciplinary approach that includes preoperative nutritional assessments, tailored dietary plans, lifelong supplementation, and regular monitoring is essential to prevent and manage these complications. Ultimately, this review emphasizes the importance of proactive nutritional care in enhancing the outcomes of bariatric surgery and ensuring long-term patient success. Addressing these challenges is crucial for minimizing post-operative risks and improving the quality of life for bariatric surgery patients.

Keywords: gastric bypass, macronutrients, anemia, nutritional management

1. Introduction

Obesity has developed into a global public health challenge over the last two decades. This recent heightened prevalence has also stimulated the spread of several other health epidemics, including type 2 diabetes, insulin resistance, dyslipidemia, and cardiovascular diseases (Blüher, 2019). It also impacts lifespan and quality (Lupoli et al., 2017). As a result, effective treatment and preventative measures are needed (Bray et al., 2016). A combined approach of dietary restrictions and elevated activity levels, along with medications and sometimes surgery, are currently used to treat obesity. A lifestyle change has resulted in a 2%–6% reduction in body weight; however, after 1–5 years, over 90% of patients have either gained some weight back or reverted to their starting weight. Drug therapy often results in a weight reduction of 5%–15% and is to be seen as an additional measure to lifestyle modifications. Unfortunately, medical treatment seldom produces long-term good outcomes regarding lifestyle intervention (Liu et al., 2016).

Bariatric surgery has gained immense consideration as an effective obesity management treatment in recent years (Casimiro et al., 2019). The procedure promotes reliable weight loss maintenance for an individual in the long term and produces significantly higher weight loss compared to other available non-surgical interventions (Wolfe et al., 2016). This has consequently led to the re-evaluation of bariatric surgery as the only feasible approach for individuals with morbid obesity [defined as a BMI (body mass index) ≥ 40 or ≥ 35 kg/m2 with co-morbidities] (Bray et al., 2016). However, nutritional deficits are one of the potential problems that should be carefully considered. Compared to restricted procedures, they are more frequently observed following malabsorptive or mixed operations (Steinbrook, 2004). They might arise from decreased nutritional intake and/or malabsorption. Other contributing factors are pre-surgical deficits, post-operative dietary intolerance, alterations in one’s taste and dietary habits, and disregard for nutritional and supplement guidelines (Fobi, 2004). Many clinical symptoms can be associated with dietary deficiencies, depending upon the minerals or micronutrients implicated, the degree of deficit, and the length of the deficient states. A nutritional evaluation is strongly advised both before and after surgery since the potential consequences might seriously impair patients' daily lives and, in some instances, result in life-threatening problems (Herron, 2004).

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2. Review

Bariatric surgical procedures are commonly categorized into three groups: malabsorptive, in which most weight reduction is due to malabsorption; restrictive, which dramatically reduces the stomach's capacity; or restrictive and malabsorptive (Montastier et al., 2018). However, it has also been evident in the past years that not only a reduced food intake and/or absorption due to changes in intestinal anatomy lead to weight loss but also results from changes in neurohormonal properties responsible for satiety, hunger, diversity of gut microbiome; feeding behavior; and perhaps energy consumption (Miras & le Roux, 2013). Depending on the surgery performed, these weight-independent mechanisms can vary in their contribution to improved metabolism and weight loss (Fobi, 2004).

Laparoscopic adjustable gastric banding (LABG): A 15–30 mL gastric pouch is produced by a fascia-banded gastrotomy of the upper stomach, just beyond the cardia, with an adjustable silicone band. Saline is injected or withdrawn through a port attached to the band and positioned in the subcutaneous tissue to size the diameter of the exit (Lupoli et al., 2017).

Roux-en-Y Gastric Bypass (RYGB): The procedure comprises of a small gastric pouch continuing with a loop of the jejunum (40 cm from the duodenojejunal angle) to anastomose with the esophagus and completely exclude the remaining sections of the stomach and proximal intestine (Lupoli et al., 2017).

Sleeve gastrectomy (SG): During the operation, a vertical incision splits the stomach and reduces it by 75%. Preserving the pyloric valve of the lower stomach helps maintain the natural metabolic rate and prevents issues like pyrosis. This irreversible process might be a preliminary treatment before a duodenal switch or RYGB (Lupoli et al., 2017).

Biliopancreatic diversion (BPD): Distal horizontal gastrectomy leaves 200–250 mL of the upper stomach intact. The remainder is anastomosed to the alimentary limb, which is defined as the distal 250 cm of the small bowel (Sjöström et al., 2012). The biliopancreatic limb is connected to the bile and pancreatic secretions in the distal ileum, with a staple line 50 cm proximal to the ileocecal valve. Protein and lipid malabsorption occurs from the 50-cm common limb, as this is the only site where digestive secretions mix with nutrients (Knight et al., 2015). An international poll found that both SG and RYGB make up 45% and 37% of all bariatric surgeries, respectively. ABG, once used in 10% of surgeries, has declined. BPD and its variation (BPD/DS), which are malabsorptive treatments, have been utilized frequently (< 2%) due to significant nutritional complications (Angrisani et al., 2015).

Nutritional assessment before bariatric surgery: Reducing a patient's calorie intake is the primary objective of bariatric surgery to manage their obesity. Depending on how the calories are restricted, bariatric procedures fall into two categories: malabsorptive and restrictive (Gletsu-Miller & Wright, 2013a). The stomach is made smaller in the restrictive kind, which includes SG, to limit food intake and delay fullness. On the other hand, the malabsorptive form reduces the body's calorie intake by avoiding the food route (Weng et al., 2015). This results in less food coming into contact with the pancreatic digestive fluids. Another tactic involves avoiding the duodenum and the proximal jejunum, the two major nutrient-absorbing sections of the small intestine, to stop the absorption of calories. But overall, gastrointestinal tract alterations also determine how much less energy is consumed and how much nutrition is absorbed (Bjørklund et al., 2020). Therefore, obesity is a consequence of the overconsumption of high-energy and calorie-intense foods and is deeply connected with positive energy balance. It is, therefore, interesting that those who are obese (even very obese) also show signs of malnutrition in diet-related markers (El Ansari & Elhag, 2021). Micronutrient deficiencies have been documented in several scientific research about overweight and obese people (Xanthakos, 2009). The deficiencies are more severe in individuals with extreme obesity (BMI (body mass index) >40 kg/m2) (Gasmi et al., 2022).

It is necessary to clarify that more calories do not mean enough vitamins, minerals, and trace elements if high-energy products are used. Put simply—obese or overweight folks are already getting less nutrition through eating too-low-nutrient diets that contain a lot of processed foods and fewer fruits and vegetables (Xanthakos, 2009). For example, a deficit of nutrients such as vitamin A, vitamin C, and folate has been found to be the result of diets high in fat (Hampl & Betts, 1995). A further observation shows that part of the increase in body fat results in a lower (% of body weight) concentration of serum fat-soluble vitamins such as vitamin D (Gillis & Gillis, 2005). In the same regard, excessive consumption of sugar-laden drinks reduces the intake of milk, which contains essential nutrients for overall growth, such as calcium and vitamin D; therefore, low bone density is prevalent in persons diagnosed with obesity, furthering their consideration for bariatric surgery (Thomas-Valdés et al., 2017). Hence, nutrient deficits must be prevented or promptly treated in the interim because waiting too long could have unfavorable effects. For instance, elevated expression of the systemic iron-regulating protein hepcidin and inflammation of adipose tissue may impact iron status (Lim et al., 2016). Another illustration would be adipose mass, which serves as a storage area for very lipophilic compounds like vitamin D. The variation in 25(OH)D levels between individuals with obesity and those without may be explained by this (Franco et al., 2011). Therefore, it is thought that assessing and improving the nutritional status of BS candidates before the treatment is crucial in preventing post-bariatric complications (Yumuk et al., 2015).

2.1. Deficiencies after bariatric surgery

2.1.1. Macronutrients: Protein

Protein deficiency is a severe macronutrient problem linked to bariatric surgery techniques (Faintuch et al., 2004). The majority of reports of it come from BPD, where it affects 3–21% of patients, according to estimates (Heber et al., 2010). According to the length of the Roux limb, a prevalence of up to 13% has been reported after RYGB (Brolin, 2002). Poor results are linked to complications that arise from protein deficiency, which causes 1% of hospitalizations annually following malabsorptive procedures. Following bariatric surgery, many patients experience impaired protein digestion and absorption due to modified gut structure, reduced stomachs, and changed biliopancreatic activity (Mingrone et al., 2015). These factors combined result in an aversion to foods high in protein. In the early post-surgical phase, the majority of the surgery recipients are not permitted to eat a lot and are primarily restricted to a liquid diet, which can occasionally exacerbate protracted vomiting (Mohapatra et al., 2020). These aspects can result in poor protein intake and absorption, raising the likelihood of protein malnutrition in post-bariatric individuals (Abraham et al., 2016).

2.1.2. Micronutrients: Vitamins

Vitamin D: Among candidates undergoing bariatric surgery, the percentage of patients with vitamin D insufficiency can reach 100% (Parrott et al., 2017). Supplements and food mix with pancreatic enzymes and bile only after bypass surgery when the intestines connect in the downstream single channel. Due to their changed structure, fat-soluble vitamins—like vitamin D—that depend on bile acids and other digestive enzymes are less likely to be absorbed (Jones, 2016).

Vitamin B1 (Thiamine): There have been several reports of non-alcoholic individuals following bariatric surgery experiencing Wernicke's encephalopathy (Singh & Kumar, 2007). Following both restrictive and malabsorptive operations, cases of beriberi have been reported (Fawcett et al., 1984). Another suggested mechanism for thiamine malabsorption is disrupted gut ecology caused by small intestinal bacterial overgrowth, resulting in bacterial production of thiaminases (Lakhani et al., 2008). Thiamine deficiency can also be triggered by periods of excessive carbohydrate consumption, such as those associated with complete parenteral nutrition and nasogastric feeding. For this reason, it is advised that all bariatric patients be screened for thiamine insufficiency before surgery and take thiamine supplements following the treatment (Seehra et al., 1996).

Vitamin B12 and folate: Following combination surgeries, such as RYGB, about one-third of patients experience postoperative vitamin B12 deficiency if an appropriate diet is not offered (Provenzale et al., 1992). The primary mechanism involves decreased intrinsic factor secretion due to parietal cell-containing mucosa loss following a gastrectomy, which impairs the uptake of vitamin B12 (Behrns et al., 1994). Additional factors include an intolerance to foods such as dairy products and meat, which results in a decreased dietary intake of B12, and achlorhydria, which prevents the conversion of pepsinogen to pepsin, which is fundamental for vitamin B12 release from its dietary form bound to proteins (Ponsky et al., 2005). On the contrary, purely restrictive procedures like gastric banding do not result in a substantial folate or vitamin B12 shortage (Alvarez-Leite, 2004). In postoperative bariatric surgery patients, folate insufficiency is not commonly observed in recent research despite the possibility. Most of the time, multivitamin supplements are sufficient to cover the needs. Deficiencies are assumed to arise when dietary consumption is reduced and multivitamin pills are not taken as directed (Boylan et al., 1988).

Biotin: Research has been sparse, but several metabolic processes require the water-soluble vitamin biotin. In addition to acting as a covalently bonded coenzyme for carboxylases, it is involved in cell signaling and gene expression (Zempleni et al., 2009).

Insulin and blood glucose levels while fasting are improved by biotin administration. Supplementing with biotin may have some therapeutic benefits, but there isn't much documentation.

Vitamins A, C, E & K: Vitamins A, E, and K are the fat-soluble substances more readily stored in adipose tissue when a person has more body fat (Boylan et al., 1988).

2.1.3. Micronutrients: Minerals and trace elements

Like vitamin deficiencies, many minerals and trace elements, including calcium, iron, zinc, copper, and selenium, can arise with bariatric surgery. The subsequent sections outline specific deficiencies in minerals and trace elements associated with bariatric surgery (Gasmi et al., 2022).

Iron: Iron insufficiency is one of the most prevalent trace element shortages. Iron insufficiency impacts around 33% of individuals who have bariatric surgeries. Iron absorption is significantly reduced when iron absorption sites in the duodenum and proximal jejunum are bypassed (Gletsu-Miller & Wright, 2013a). Furthermore, after surgery, dietary modifications like cutting back on meat and dairy products with added iron might worsen the iron shortage (Mischler et al., 2018). Moreover, H. pylori infection and chronic gastrointestinal blood loss, which are more prevalent in those who have had bariatric surgery, may potentially be contributory factors (Hershko et al., 2005)

Calcium: Additionally, calcium insufficiency is brought on by bariatric surgery. Calcium is necessary for the health of teeth and bones and is a crucial part of many cell signaling pathways. It is vital to emphasize that low vitamin D might worsen calcium insufficiency since it is necessary for the gut to absorb calcium normally and maintain its homeostasis (Vimaleswaran et al., 2013). People with renal insufficiency or low vitamin D levels and are at risk of developing symptomatic hypocalcemia should be closely watched and follow a program focused on getting enough calcium and vitamin D (Heber et al., 2010).

Copper: Many enzymes linked to different biological processes require copper as a cofactor. Malabsorptive bariatric surgery has been reported to bypass the duodenum, potentially leading to copper deficiency (Alvarez-Leite, 2004). Additionally, by dissolving copper ligands and chemical complexes, stomach acid contributes to an increase in the bioavailability of dietary copper. However, it could take a few years following surgery for symptoms to appear for the body to run out of copper (Mohapatra et al., 2020). The levels of copper in the blood decrease following BPD and RYGB procedures, potentially leading to significant deficiencies in some individuals (Sjöström et al., 2012). Research indicates that copper deficiency impacts 10–15% of people after RYGB surgery (Ernst et al., 2009). Another contributing factor to copper deficiency is insufficient dietary intake of copper (Gletsu-Miller & Wright, 2013b).

Zinc: Zinc is another crucial divalent cation that some have deficiencies after bariatric surgery (Sallé et al., 2010). Poor absorption occurs when the proximal intestine is bypassed during zinc absorption. Notably, within 6–18 months following surgery, 42–65% of patients experience zinc insufficiency, suggesting a clear and substantial correlation between the two. In order to achieve meaningful clinical and echocardiographic improvement following bariatric surgery, zinc supplementation must be started as soon as possible (Yahalom et al., 2019). Nevertheless, research has also demonstrated that zinc levels may occasionally drop following surgery (Gletsu-Miller & Wright, 2013b).

As women of childbearing age are more likely than males to have bariatric surgery, it is crucial to optimize zinc status to lessen the negative consequences of deficiency in this population. Because the needs are more extensive during pregnancy, more active supplementing is required (Castillo-Durán & Weisstaub, 2003). Although women of childbearing age are more likely to undergo bariatric surgery than men, it is even more critical to optimize zinc levels for this group to avert the adverse effects of deficiency. Pregnancy requires higher nutritional needs, and supplementation should be approached more proactively (Troost et al., 2003). It is crucial to remember that iron, copper, and zinc may all affect one another's absorption. Long-term oral zinc supplementation can also cause deficits in copper and iron and reduced intestinal absorption of zinc (Olivares et al., 2012).

Selenium: The duodenum and proximal jejunum are the organs that absorb selenium the most, and postoperative bariatric surgery (RYGB and SG) has been linked to deficiencies in this mineral, which range in frequency from 11 to 46% (Mohapatra et al., 2020). A lack of selenium is exclusively linked to problems from hypothyroidism, myopathy, cardiomyopathy, arrhythmias, and muscular atrophy. Before and after surgery, selenium-level tests should be recommended for individuals with fatigue, unexplained anemia, metabolic bone disease, chronic diarrhea, or cardiomyopathy (Gletsu-Miller & Wright, 2013b). Specific supplementation should then be undertaken.

2.2. Consequences of nutrient deficiencies

2.2.1. Anemia

Following bariatric surgery, vitamin insufficiency most commonly results in anemia (Gowanlock et al., 2020). It arises from a shift in eating patterns that forbids using meat, resulting in a lower iron intake. Another potential cause of decreased iron absorption following bariatric surgery is gastric hypochlorhydria. Additionally, bypassing the duodenum stops iron from being reduced to its primary absorbable form, ferrous iron. As their anemia progresses, patients frequently experience weariness, pallor, and breathlessness with exercise (Gasmi et al., 2022). Furthermore, anemia has been shown to double the likelihood of hospitalizations and the length of hospital stay.

One result of both malabsorptive and restrictive bariatric surgeries is compromised folate and vitamin B12 absorption. Insufficient levels of vitamin B12, for example, might lead to decreased motor coordination, peripheral neuropathy, numbness, and cognitive problems. Leucopenia and macrocytic anemia can also arise from a vitamin B12 deficiency, in addition to folate. Congenital impairments and development retardation in the fetus are possible outcomes for pregnant mothers (Majumder et al., 2013).

2.2.2. Wernicke's encephalopathy

Cancer patients, malnourished people, and drinkers have all been associated with Wernicke encephalopathy (WE). However, after bariatric surgery, people also have WE due to reduced thiamine (vitamin B1) absorption. Among the typical signs of WE are nystagmus, disorientation, and problems with motor coordination. A report indicates that 49% of people had WE symptoms following bariatric surgery (Singh & Kumar, 2007).

2.2.3. Ataxia

A medical disorder known as ataxia is characterized by aberrant eye and body movements and reduced voluntary muscle coordination. Following bariatric surgery, neurological problems might result in ataxia. It is seen in 4.6–16% of patients following weight loss surgery. Peripheral neuropathy, burning foot syndrome, lumbosacral plexopathy, and Wernicke-Korsakoff encephalopathy are a few related medical issues (Gasmi et al., 2022).

2.2.4. Hair loss

A frequent health problem is hair loss, brought on by a lack of certain micronutrients, including iron and zinc. Nevertheless, abrupt and dramatic weight reduction exacerbates hair loss following bariatric surgery (Ruiz-Tovar et al., 2014). When combined, weight reduction, vitamin deficiencies, and dietary modifications can cause several health issues for individuals who go ahead with bariatric surgery. Thus, mitigating the harmful impacts of micronutrient deficiencies on health may be accomplished by consuming multivitamin supplements and maintaining a diet abundant in the necessary nutrients (Heber et al., 2010).

2.2.5. Hypoglycemia and dumping syndrome

Postprandial reactive hypoglycemia is a consequence of BS that is currently underappreciated, although it has produced many positive health outcomes, including the remission of diabetes. According to Whipple's triad (International Hypoglycaemia Study Group, 2017), the diagnosis of postprandial hypoglycemia necessitates the presence of neuro-glycopenic symptoms (flushing, weakness, unconsciousness), a blood glucose concentration that is below 3.0 mmol/L (54 mg/dL), and symptom relief with carbs.

Dumping symptoms, induced by gut hormone production and quick water entry into the intestinal lumen, are characterized as early or late symptoms based on when they appear after eating. Most early symptoms, which include palpitations, flushing, syncope, and gastrointestinal symptoms like bloating, nausea, diarrhea, and abdominal discomfort, appear 15 minutes after eating (Mechanick et al., 2013a).

It's common to use the phrases hypoglycemia and late dumping syndrome interchangeably. Postprandial autonomic symptoms, like palpitations, weakness, and light-headedness, are common in bariatric patients and may be signs of dumping syndrome; however, they also closely resemble the autonomic symptoms of hypoglycemia. Hypoglycemia following BS is exclusively post-prandial (Mohapatra et al., 2020).

2.2.6. Food Intolerance and changes in food-preferences

According to research, postprandial fullness rises, and hunger declines significantly after BS, causing people to eat fewer meals more frequently but in lower portions (Liu et al., 2016). There are several causes why hunger and calorie consumption have decreased. Changes in the structure of the gastrointestinal tract cause neurological and physiological changes that impact gut hormones and hypothalamus signaling (le Roux et al., 2006). Moreover, bariatric surgery impacts food choices by enhancing sensitivity to sweet tastes, decreasing the pleasure derived from sweet and fatty meals, and contributing to greater satiety.(Al-Najim et al., 2018).

2.2.7. Long-term neurological complications

Attention has been drawn to neurological issues following bariatric surgery due to its complexity, variety, and possibly catastrophic outcomes. Long-term neurological consequences from bariatric surgery are possible (Montastier et al., 2018). Patients might not realize that these issues are related to the procedure they underwent, considering how much time has passed. In such circumstances, the diagnosis might be overlooked. Nonetheless, many of these complications can be mitigated through a coordinated, multidisciplinary strategy for post-surgical nutritional management. This approach involves scheduled check-ups, ongoing assessment of essential nutrients, and the incorporation of necessary nutritional supplements (Jumbe et al., 2017).

2.2.8. Long-term psychological effects

Differential changes in the severity of depression, as well as changes in depressive symptoms, observed at 24 and 36 months following bariatric surgery provide further support for considering bariatric surgery as a valuable approach for postoperative mental health benefits. Individuals undergoing bariatric surgery report a significantly better quality of life than those receiving pharmaceutical therapy (Schauer et al., 2017). When compared to lifestyle therapies, longer-term research on psychological outcomes such as depression and changes in body image following bariatric surgery revealed some persistent dysfunction, as recently reviewed by Jumbe et al. This occurred despite improvements in comorbidities related to obesity and weight reduction. There was a general paucity of postoperative psychological follow-up, according to the authors, which indicates that little was known about how bariatric surgery affected patients' psychological results (Jumbe et al., 2017). Numerous psychological effects of the surgical operation include altered perceptions of oneself, fluctuations in mood, tension, relapses in addictions and substance usage, and more (Montastier et al., 2018).

2.3. Early, late, and life-long nutritional management

As previously demonstrated, most bariatric procedures create a small gastric pouch and/or restriction of stomach volume. For the first few days after an operation, it is difficult, or even impossible, for a patient to eat solid food as their stomach has edema and size has decreased. Therefore, most postoperative dietary recommendations generally recommend a liquid or isothermal diet for the first few days after surgery, transitioning to solid diets over the following weeks to channel regurgitation and vomiting (Mechanick et al., 2008). Typically, patients are advised to start a low-sugar, clear liquid diet within 24 hours of the procedure. During the following 2-4 weeks, they should gradually progress from clear fluids to soft, cream-like, and ultimately solid, chewable items (Busetto et al., 2017). All postoperative meal progression should be individualized through counseling by a qualified bariatric dietitian before discharge from the hospital (Mechanick, Youdim, et al., 2013). Following the post-operative diet, patients should receive regular long-term dietary advice from a registered dietitian to help avoid late weight regain and optimize outcomes of bariatric treatment (Mechanick et al., 2008). Dietitian counseling should focus on the behavior changes needed for the surgery and the benefits of high-quality proteins (Allied Health Sciences Section Ad Hoc Nutrition Committee et al., 2008).

One of the most effective treatments for severe obesity in terms of long-term weight loss and metabolic health with decreased mortality rates is bariatric surgery, which results, on average, in a 20–30% reduction in body weight. Reductions in cardiovascular-related deaths show a 42% decrease and overall all-cause mortality sees a 30% reduction. However, these successes come at a cost, with nutritional complications arising from alterations in the anatomy and physiology of the gastrointestinal system post-surgery. If not addressed, these deficits can lead to serious long-term health consequences and affect the patient’s quality of life.

Obese individuals with nutritional deficits require the preoperative period to assess and restore their nutritional status. Obesity can be associated with nutritional imbalances, including vitamin and mineral deficiencies, which may worsen after surgery. Identifying and managing these deficiencies before surgery reduces the likelihood of malnutrition and complications arising from nutrient impairments postoperatively. Preoperative assessments are essential to address these, preventing post-surgery complications. Iron, vitamin B12, calcium, and vitamin D deficiency can lead to anemia and osteoporosis, while neurological symptoms may arise from vitamin deficits, requiring lifelong management. Nutritional syndromes like hypoglycemia or dumping syndrome may also occur, necessitating dietary adjustments. A proactive, multidisciplinary approach ensures better patient outcomes and long-term health.

3. Final Considerations

Supplements among the most commonly deficient post-bariatric surgeries, such as SG and RYGB, have been established for several essential vitamins, minerals, and trace elements (in fact, more frequent in RYGB). Because the proximal duodenum is an absorptive site of great importance, this deficiency is primarily associated with the malabsorption of vitamins, minerals, and trace elements. The absence of essential micronutrients seriously impairs the operation of physiological systems since these trace elements, minerals, and vitamins are involved in several biological functions and cell signaling (Gasmi et al., 2022). Bariatric surgery provides obese patients with a "honeymoon" period in their lives, but additional tools should be added to prolong it. These initiatives involve improved collaboration and communication among the diverse healthcare professionals involved in bariatric surgery, such as family physicians, surgeons, nutritionists, and others. They also include elements like patient education, behavioral therapy, physical activity, and alterations to the post-surgical dietary plan (Montastier et al., 2018).

Therefore, dietary evaluations should be conducted before and after bariatric surgery and last a lifetime. When it comes to follow-ups, the short-term goal should be to prevent potentially fatal complications from severe nutritional deficiencies, while the long-term goal should be to avoid catastrophic repercussions like osteoporosis and malnutrition. Maintaining muscle mass and bone health should be emphasized through a balanced diet and regular exercise (Mohapatra et al., 2020). Comprehensive care in an interdisciplinary environment is the key to successful bariatric surgery.

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Ethical Considerations

Not applicable.

Conflict of Interest

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