



Bariatric Surgery

An Overview for Dietetics Professionals

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Obesity is a condition associated with high morbidity and mortality affecting a large proportion of Americans. It is estimated that 22 million people in the United States are morbidly obese and medically eligible for bariatric surgery. The increasing prevalence of bariatric surgery makes it likely that dietetic practitioners working in various settings will encounter patients in any stage after weight loss surgery. Research is being conducted, and evidenced-based recommendations are being published. However, many of the currently published guidelines are based solely on expert opinion. This article provides an overview of the critical nutrition-related issues in caring for the weight-loss surgery patient and provides resources for those seeking detailed information. *Nutr Today*. 2011;46(6):264-273

Obesity is a condition associated with high morbidity and mortality affecting a large proportion of Americans. Obesity is defined into 3 classes based on body mass index (BMI)¹: class I, 30 to 34.9 kg/m²; class II, 35 to 39.9 kg/m²; and class III (or extreme obesity), more than 40 kg/m². It is estimated that 22 million people in the United States are medically eligible for bariatric surgery. The American Society for Metabolic and Bariatric Surgery (ASMBS) estimates that in 2008, a total of 220,000 people in the United States had bariatric surgery.²

The increasing prevalence of bariatric surgery makes it likely that dietetic practitioners working in various settings will encounter patients in any stage after weight loss surgery. This article provides an overview of the critical nutrition-related issues in caring for the weight loss surgery patient and provides resources for those seeking more detailed information.

Health and wellness centers, weight loss centers, acute care facilities, cancer centers, skilled nursing facilities, nursing homes/convalescent homes, prisons, and birthing centers will all be seeing bariatric surgery patients. Until recently, there were no published guidelines for the care of bariatric surgery patients. Misinformation or wives' tales need to be separated from evidence-based practice guidelines or at least expert opinion. In 2008, the ASMBS published a comprehensive review article on bariatric nutrition. The diet texture and advancement guidelines in this article are based upon a survey of dietitian members of the ASMBS.³ The ASMBS also collaborated with the American Association of Clinical Endocrinologists and the Obesity Society to publish medical guidelines for the perioperative, nutritional, metabolic, and nonsurgical support of the bariatric surgery patient.⁴ This publication bases its recommendations on evidenced-based and expert opinion (if conclusive clinical evidence was lacking). It grades both the evidence-based and "best evidence" recommendations. In addition, the American Dietetic Association's Evidence Analysis Library is currently working on their Nutrition in Bariatric Surgery Evidence Analysis Project,⁵ and the association has published a *Pocket Guide to Bariatric Surgery*.⁶ The National Institute of Health funds ongoing research through the Longitudinal Assessment of Bariatric Surgery, a consortium of 6 clinical centers that are conducting clinical, epidemiological, and behavioral research in bariatric surgery.⁷ Furthermore, in 2009, more than 100 specialists from various disciplines practicing in bariatric surgery developed evidenced-based recommendations for best practices in weight loss surgery. This guideline includes a review of the safety and efficacy of the different surgical procedures and patient selection.⁸

Bariatric surgery should be performed at a center that provides a comprehensive medical history and physical examination, including blood work. Patients should

have a multidisciplinary assessment to determine the patient's appropriateness for surgery. Medical nutrition therapy and education are crucial to prepare the patient for surgery and to provide ongoing support and education. The Bariatric Center of Excellence is a designation through the Surgical Review Corporation that many insurers require to pay for bariatric surgery. It requires that facilities have a "comprehensive program and meet the established program requirements for providing safe bariatric surgical care with excellent short- and long-term outcomes."⁹ The American College of Surgeons' Bariatric Surgery Center Network also accredits facilities performing bariatric surgery in the United States.¹⁰ The program should provide diet, physical activity, and behavioral therapy in addition to the medical supervision. Regular follow-up visits are important for maintaining nutritional status and successful weight loss.¹¹ Dietitians may not be the only allied health practitioner providing nutrition guidance; clinics may be set up for the nurses or physicians to assist. If insurance does not cover nutrition counseling, other team members may perform nutrition education.

Types of Surgeries

To care for the person who will have or has had bariatric surgery, the nutrition practitioner should be familiar with the different surgical procedures, their effect on nutritional status, and the recommended diet and supplementation regimens. Surgical options for weight loss include restrictive procedures and malabsorptive procedures. Restrictive procedures, such as the adjustable gastric band (AGB), result in weight loss by decreasing the size of the stomach reservoir, thereby limiting food intake. Another purely restrictive procedure is the sleeve gastrectomy (SG), which involves removing the fundus and greater curvature portion of the stomach, leaving the pylorus and part of the antrum. This surgery may be used as a first-step surgery in high-risk patients or those with a BMI of more than 60 kg/m². Once weight loss occurs, a malabsorptive surgery is often performed.¹² Short-term studies suggest safety and efficacy of this procedure, but longer term studies are needed.⁸ Malabsorptive procedures, exemplified by the biliopancreatic diversion (BPD) in which a portion of the stomach is removed and about 60% of the small bowel is bypassed, cause weight loss by decreasing the absorption of food that is ingested. The Roux-en-Y gastric bypass (RYGB) has a component of each of these weight loss strategies and consists of a small gastric pouch and a short segment of bypassed small intestine. This segment of the small intestine is where bile and pancreatic enzymes would usually mix with food passing through the stomach, allowing the

food to be easily absorbed on its passage through the intestinal tract. It is the malabsorptive component of bariatric procedures that is largely responsible for their associated nutritional complications.⁶

Successful weight loss after bariatric surgery is often defined as 40% of *excess weight lost* (EWL). After RYGB, patients generally lose about one-half to 1 lb per day during the first 3 months, 3 to 5 lb per week in the following months for about 60% to 70% of EWL. Weight loss generally plateaus at 12 to 18 months after operation. Patients with AGB generally lose weight at a slower rate, but by 3 years after band procedure, total weight loss is similar to those with the RYGB.¹³ Weight loss after BPD is about 70% EWL,¹⁴ whereas after SG, patients lose about 50% EWL.¹⁵

Preoperative Assessment

Before undergoing surgery, the patient should be evaluated by a multidisciplinary team to determine if they are appropriate candidates for bariatric surgery. The patient should have comprehensive medical, physical, biochemical, and psychological assessments. The patient's weight history, commitment level, and ability to comply should be explored. See Table 1 for examples of screening criteria for potential bariatric surgery candidates.

Patients with a BMI of 35 kg/m² with associated comorbidities (eg, diabetes mellitus coronary artery disease, sleep apnea) and those with a BMI of 40 kg/m² or higher without comorbidities are potential candidates for surgical treatment of obesity.¹ In addition, patients qualifying for bariatric surgery must have attempted weight loss by conventional means and must understand the risks and commitment to lifestyle modification associated with these operations.^{1,3,4}

Patients must be informed about the recommended dietary and behavioral changes after weight loss surgery. Bariatric surgery programs and insurance companies may also have additional requirements such as requiring that patients demonstrate the ability to follow a medically supervised diet for 6 months or make some positive dietary changes. Weight loss or no further weight gain may also be required. It is helpful to show patients a sample meal plan, including a visual of the very small portion sizes. The required vitamin/mineral and protein supplements must be reviewed, and the essential behavioral changes must also be explained. Patients must be taught about the common postsurgical complaints, which may include nausea, vomiting, anorexia, dehydration, halitosis, dumping syndrome, constipation, diarrhea, flatulence, lactose intolerance, and reactive hypoglycemia. Patients must be aware that alcohol, caffeine, carbonated beverages, concentrated sweets, and fried foods should be avoided. Also, some

Table 1. Screening Potential Surgical Candidates⁴

Adults
Body mass index (BMI) ≥ 40 kg/m ² with no comorbidities.
BMI ≥ 35 kg/m ² with obesity-associated comorbidities
Weight loss history
Failure of previous nonsurgical attempts at weight reduction, including nonprofessional programs (eg, Weight Watchers International Inc, Jenny Craig)
Commitment
Expectation that patient will adhere to postoperative care
Follow-up visits with physicians and team members
Recommended medical management, including the use of dietary supplements
Instructions regarding any recommended procedures or tests
Exclusion
Reversible endocrine or other disorders that can cause obesity
Current drug or alcohol abuse
Uncontrolled, severe psychiatric illness
Lack of comprehension of risks, benefits, expected outcomes, alternatives, and lifestyle changes required with bariatric surgery
Caution must be used when language or literacy issues are present
Severe food allergies or intolerances must be addressed before surgery

foods (popcorn, pasta, rice, doughy breads, and dry, tough meats) will be difficult to digest and should be eliminated in the immediate postoperative period.³

Potential Nutrient Deficiencies

Although obese patients are thought to have “overnutrition,” poor-quality diets, fad diets, and lifestyle choices negatively influence the preoperative micronutrient status of the morbidly obese. Studies have shown that 55%

to 80% of the morbidly obese population possibly has a vitamin D deficiency and nearly 50% of patients seeking bariatric surgery have iron deficiency. Vitamin B12 and thiamin deficiencies have also been identified in bariatric surgery candidates.¹⁶ Other nutrient deficiencies have been reported in the literature. A thorough nutrition history, physical examination, and blood work can reveal other potential deficiencies. Any micronutrient deficiencies should be corrected before bariatric surgery is done. Empiric nutritional supplementation is recommended for all bariatric surgery patients (see Table 2). A general multivitamin/mineral preparation containing more than 100% of the daily value for two-thirds of the nutrients is recommended for patients undergoing any of the bariatric surgeries. Patients undergoing malabsorptive procedures require more extensive supplementation. Because of the size and hardness of multivitamin/minerals, patients should be instructed to begin with a chewable, liquid, or powdered form. Because of the drastic reduction in food intake, numerous nutrient deficiencies can occur after bariatric surgery. Adjustable gastric band does not lead to decreased absorption of nutrients; it simply restricts food intake. Thus, the nutrient consumption is limited by the type and amount of foods consumed. The SG removes the parietal cells, so these patients have reduced hydrochloric acid production, which may hinder absorption of some nutrients.¹⁷ However, malabsorptive procedures like the BPD or RYGB further increase the requirement for certain micronutrients. As the names imply, a portion of the small intestine is bypassed, which results in a shortened exposure to absorptive area. Also, the bile and pancreatic secretions meet lower downstream resulting in reduced absorption of many nutrients.⁶

Iron

Iron is normally absorbed in the duodenum, which is bypassed with the RYGB and BPD. Because of their increased losses, menstruating females are considered high

Table 2. Suggested Postoperative Vitamin and Mineral Supplementation^{3,17}

	Adjustable Gastric Band	Roux-en-Y Gastric Bypass	Biliopancreatic Diversion	Sleeve Gastrectomy
Multivitamin (complete)	1	2	2	1
Water miscible form of ADEK	–	–	1	–
Vitamin B12 (oral, μ g/d)	–	350–500	–	500
Or intramuscular, μ g/mo	–	100	–	–
Calcium (mg) with vitamin D	1500	1500–2000	1800–2400	1500
Iron (elemental, mg)	–	–	–	–
Menstruating women	18–27	18–27	18–27	18–27

risk for iron deficiency. The SG may increase the risk of iron deficiency because of reduced hydrochloric acid.¹⁷ As previously mentioned, a significant number of morbidly obese patients have preexisting iron deficiencies. Although the multivitamin/mineral preparation should contain at least 18 mg of iron, supplementation with additional iron is recommended for those at risk of developing iron deficiency anemia, especially those undergoing malabsorptive surgeries. An additional 18 to 27 mg elemental iron is recommended in a non-enteric-coated form. Foods rich in vitamin C and heme iron (eg, red meat, if tolerated) can enhance iron absorption. Patients should be reminded to avoid excessive intake of tea tannins because of interactions. They should also separate iron and calcium supplements by at least 2 hours. For patients with refractory iron deficiency, the clinician should evaluate the dosage, the form, actual compliance, and the consumption of competitors. Occasionally, patients require intravenous iron infusions.³

Vitamin B12

Hydrochloric acid and pepsin help cleave B12 from foods in the distal stomach and duodenum, both of which are bypassed with RYGB. In addition, the parietal cells of the stomach produce the intrinsic factor that permits the terminal ileum's absorption of vitamin B12. Thus, after SG, patients are at risk of vitamin B12 deficiency.¹⁷ Because AGB and the BPD do not have a severe restriction of the parietal cells, the incidence of vitamin B12 deficiency after these procedures is much lower. However, certain medications (eg, proton pump inhibitors and metformin), atrophic gastritis, and deficient diet can increase the risk of vitamin B12 deficiency. Oral absorption of vitamin B12 is poor, but large doses are often successful. Oral supplementation with 350 to 500 µg/day should prevent deficiencies for RYGB³ and SG patients.¹⁷ Routine supplementation of B12 above that found in the multivitamin for the AGB and BPD is generally not indicated. In addition to oral supplementation, vitamin B12 can be administered sublingually, nasally, or intramuscularly. Patient preference, compliance, and insurance coverage influence route of supplementation.³

Thiamin

Thiamin deficiency is not common but can result in permanent disorders in learning and short-term memory and serious and irreversible neuromuscular disorders. In addition, a thiamin deficiency can cause beriberi, coma, and death. Routine supplementation above that found in a multivitamin may not be necessary. Most multivitamins provide more than 100% of the daily value for thiamin, which is generally sufficient to meet

post-bariatric surgery requirements. However, low carbohydrate diet preoperatively may impact a person's thiamin stores. Furthermore, the short half life and small body pool of thiamin can produce deficiency symptoms in a short period. Thiamin deficiency should be suspected in any bariatric surgery patient presenting with persistent vomiting and dehydration. Late development of thiamin deficiency can occur with alcoholism, a poor-quality high-carbohydrate diet, and bulimia. Rehydrating solutions containing dextrose increase the requirement for thiamin and could exacerbate a deficiency. Parenteral supplementation is warranted in cases of persistent vomiting. Any patient presenting with poor intake, vitamin noncompliance or intolerance, persistent vomiting, and/or neurological symptoms must receive supplemental thiamin.³

Folate

Folate deficiencies are generally avoided if the patient is compliant with their multivitamin supplement. However, baseline folate deficiencies may exist because of poor diet.³

B Complex

Some practitioners recommend a B complex in addition to the multivitamin/mineral preparation. There is no known risk of toxicity for the B vitamins, but more than 1000-mg folic acid could mask a vitamin B12 deficiency.³

Fat Soluble Vitamins

Many preoperative patients present with suboptimal vitamin D levels, which should be repleted before surgery. Then the vitamin D provided in the complete multivitamin and the additional calcium supplement are often enough to meet the maintenance needs of bariatric surgery patients. However, patients undergoing BPD should empirically take additional water-soluble forms of vitamins A, D, E, and K.³

Calcium

Calcium is absorbed in the duodenum and proximal jejunum, and it requires vitamin D for absorption. Additional calcium supplementation is essential after any of the bariatric surgeries. Because an acidic environment is required for calcium absorption, calcium carbonate is poorly absorbed after RYGB³ and SG.¹⁷ Also, many bariatric surgery patients take proton pump inhibitors. Thus, calcium citrate is the preferred form of supplementation. Calcium should be taken in divided doses, about 500 mg 3 times daily.

Patients should be encouraged to consume foods rich in calcium in addition to their calcium supplementation. Calcium consumption through diet and supplementation may need to be more than 1700 mg to prevent bone loss during the rapid weight loss phase.³

Patients should be asked about their supplementation regimen at each nutrition visit. As patients lose weight, they require fewer medications and some start to be careless, haphazardly taking nutrition supplements. Patients must be educated on the importance of supplement compliance for optimal health.

Protein and Fat

Protein and fat are 2 nutrients significantly affected by weight loss surgery. After RYGB, animal protein may be poorly tolerated because of its texture and to the restrictive nature of the operation. After BPD, patients have a greater need for protein because of malabsorption. Protein supplementation in the form of liquid supplements is therefore recommended postoperatively. If protein malnutrition after bariatric surgery occurs, it generally results from an inadequate intake. Patients may complain of protein intolerance (eg, vomiting after beef or chicken consumption). Patients should be taught proper cooking methods to ensure that flesh foods are moist and tender. They should always masticate foods well. Low-fat dairy, eggs, and legumes are well-tolerated protein. Protein requirements may be 1.0 to 1.5 g/kg of ideal body weight during the rapid weight loss phase. Patients having had the BPD seem to require about 30% more protein than those who had simply restrictive procedures.³

Recommended Laboratory Monitoring for All Procedures

Often, the physical findings of nutrient deficiencies are not exhibited until late in the course of deficiency. Early detection can be helpful. A thorough nutrition history and physical examination can also provide guidance for blood work. Generally in the first year, blood work should be evaluated every 3 to 6 months and then yearly thereafter. If an abnormal laboratory value is found, treatment is started and monitoring may be more frequent. Malabsorptive procedures (RYGB and BPD) require more comprehensive blood work. This often includes CBC, platelets, electrolytes, glucose, iron studies, ferritin, vitamin B12, liver function, lipid profile, and 25-hydroxyvitamin D.³ A thorough review of the recommended biochemical surveillance and monitoring schedule can be found elsewhere.^{3,4} Patients must be encouraged to take a complete vitamin/mineral

supplement because routine laboratory work does not evaluate every nutrient.

Diet Progression

Evidence-based recommendations for diet advancement after bariatric surgery are limited.^{3,4,6} Postoperative diets vary by procedure and facility. However, several common principles apply to all surgeries. Many programs prescribe a progressive diet to minimize gastrointestinal issues while maximizing weight loss and preserving lean body mass. Generally, diets for all procedures start with low sugar clear liquids on postoperative day 1. A low-fat full-liquid diet generally begins on postoperative day 3 and may be followed for about a week. Protein supplements are added to provide the necessary protein. The diet generally advances to puree for 1 to 2 weeks. A soft diet that incorporates chopped, ground, or mashed foods is then followed for another 2 to 4 weeks. Patients usually progress to a healthy solid food diet at 6 to 8 weeks postoperatively.^{3,4,6} Because of the long surgical staple line, the diet for SG patients may advance slowly.¹⁷ Patients must be reminded to chew food thoroughly and consume only moist foods. After a fill or adjustment, AGB patients revert back to full liquids for 2 to 3 days and then slowly readvance.⁶ Foods that may be difficult to tolerate include tough, fibrous meats; stringy vegetables (eg, celery, pea pods); popcorn; membranes of citrus fruits; doughy breads; undercooked rice and pastas; fried foods; and sweets.³ Some patients develop lactose intolerance after RYGB or BPD.^{3,18}

Protein Supplements

Liquid and powdered protein supplements help postoperative patients initially meet their requirements. Patients usually can consume more liquid protein than solids in the early stages. Patients should be taught to read labels, selecting those without a significant amount of added sugar or fat. Many products are on the market claiming to be a very dense source of protein. When overall protein intake is very low, the protein quality must be a strong consideration. A protein supplement lacking the essential amino acids cannot be used for protein synthesis. The protein digestibility corrected amino acid score evaluates protein quality. As other sources of amino acids increase, the protein quality is not as important. Generally, whey protein is easily digested and provides all of the essential amino acids. Collagen-based supplements may have low protein digestibility corrected amino acid scores.³ Protein supplements can provide a significant amount of calories without inducing satiety in the later stages of surgery. Once patients can consume sufficient solid protein, supplements should be weaned.

Hydration

Not only are patients restricted in the volume of fluid they can consume over a given period but they also should refrain from meal time fluid consumption. In addition, caffeine, carbonation, and calorically dense sweet drinks are discouraged. Patients must sip very often, between meals. Most practitioners recommend that drinking resume between 30 and 60 minutes after meals.^{4,6} Meal time beverages may facilitate rapid gastric emptying with a worst case scenario resulting in dumping syndrome or quicker emptying of the meal resulting in a shorter period after meal satiety. Patients should monitor urine output. Dark, scant urine signifies inadequate fluid intake. Even mild dehydration can contribute to headaches, nausea, and fatigue. Patients must understand that once dehydration occurs, it is tough to “make up” and that maintenance of hydration is easier.

Portions

Initially, patients may be able to consume only one-fourth cup of food per meal, eventually progressing to about

one-half to 1 cup per meal. For the maintenance phase, an appropriate meal plate would consist of one-half lean protein, one-fourth vegetable, and one-fourth fruit or whole grain starch. This differs from the general dietary guidelines for Americans, which recommends a higher amount of carbohydrates. An example of a guidance tool is provided in Figure (Bariatric Pyramid). Daily intake may initially be 500 calories and rising to about 1200 to 1500 per day for maintenance.¹⁹ However, published reports of daily calorie consumption in bariatric surgery patients vary.²⁰ Intakes may need to be higher if the patient is extremely active and weight loss is excessive. The American Dietetic Association’s *Pocket Guide to Bariatric Surgery* provides examples of sample meal plans.⁶ Initially, patients are instructed to eat several small meals. As portions rise and solid food provides satiety, patients may do best with 3 healthy meals and none or 1 planned protein-rich snack. Patients should be taught to “prioritize” what they eat. Practitioners should assist patients to discern between “head hunger” and true physical hunger. To consume enough protein, lean sources of protein should comprise most of their intake, especially at first. However, small amounts of fruits,



PROTEIN	FRUIT	VEGETABLES	GRAIN/STARCHY VEGETABLES	FAT
6-7 Servings	2 Servings	3 Servings	3-4 Servings	3 Servings
1 serving is: - ½ cup cooked beans - 6-8 oz. yogurt - ¼ cup cottage cheese - 1 egg - 1 oz. cooked lean meat, poultry, fish, cheese - 8 oz. non-fat milk - 1 tbsp peanut butter - ½ c tofu	1 serving is: - 1 ¼ cup berries - Small banana - Small orange, apple - ½ cup canned fruit - 17 grapes - 1 cup melon or cantaloupe - ¼ cup dried fruit - 2 tbsp raisins	1 serving is: - 1 cup raw vegetables - ½ cup cooked vegetables	1 serving is: - ¾ cup w whole grain cereal - Small potato - 1 slice w whole grain bread - 1/3 cup w whole grain rice or pasta - ~4 high fiber, low fat crackers - 1 small w heat pita bread	1 serving is: - 1 tsp. oil - 1 tsp. margarine - 1 tbsp lite mayo - 1 tbsp seeds - 1/8th avocado

Figure. Bariatric Food Guide Pyramid (daily maximums).

vegetables, whole grain starches, and fats provide essential nutrients and palatability. The most efficacious long-term diet has yet to be defined.³

Weight Maintenance

Physical activity is pivotal in the lifestyles of bariatric surgery patients. Aerobic and strength training should be encouraged. Patients often need instruction and encouragement. The Department of Health and Human Services recommends 2 hours and 30 minutes of moderate intensity or 1 hour and 15 minutes of vigorous intensity aerobic physical activity per week.²¹ Capitalize on the fact that movement is easier when the weight is off. The National Weight Loss Registry's data point to physical activity being crucial in the maintenance phase after any weight loss.²²

Weight Regain

For RYGB patients, 10% to 20% regain may occur after maximal weight loss.²³ It is also possible to regain all of the lost weight after bariatric surgery. The first goal is to determine why the weight has been regained and then to halt further weight regain. Patients should be reminded that returning to old eating habits can sabotage success. In addition, patients should know that their appetite generally returns around 12 months postoperatively. Patients should be counseled on a healthy lifestyle, which includes food, activity, and psychosocial issues. Many practitioners stress that bariatric surgery is a "tool" but not the cure. As with any weight control venture, self-monitoring with food records can help patients evaluate where problems lie and help provide accountability of food intake. Snacking often adds unwanted calories by providing foods that require little chewing and slip through the pouch quickly, not providing satiety. These foods include crumbly foods like potato chips, crackers, cookies, buttered popcorn, and ice cream. Soups and mashed potato are examples of meal time foods that also do not contribute to lasting satiety. Foods that contribute to satiety include protein and fiber. Patients should be reminded to refrain from drinking with meals. This makes the food more liquid and apt to empty from the pouch sooner, leaving patients hungry between meals. If indicated, patients can be referred back to the bariatric surgeon to evaluate for any anatomical reasons for an ability to eat more food. For gastric bypass patients, stomal stretch (a widening of the gastrojejunal anastomosis and breakdown of the staple line between the pouch and the remnant stomach) may enable the food to empty more quickly from the pouch, providing for less satiety. Physical activity level should also be assessed. Medications should be reviewed as some can contribute to

weight gain. Patients should be encouraged to self-monitor their progress, and frequent follow-ups with nutrition care provider can help patients meet their goals.²³

Nutrition-Related Side Effects

Dumping Syndrome

Dumping syndrome is a common adverse effect after RYGB. Dumping can be early or late. Early dumping syndrome occurs within one-half to 1 hour of eating. Patients can experience nausea, cramping, diarrhea, lightheadedness, tachycardia, sweating, and flushing. Late dumping occurs 1 to 3 hours after eating, and symptoms are that of reactive hypoglycemia (hungry, shaky, sweats, loss of concentration). Dietary modification should include avoidance of fatty foods and refined sugars. Some patients may be sensitive to other high glycemic carbohydrates. Simultaneous drinking with meals should be avoided because it may encourage rapid emptying of food through pouch. If diet manipulation is unsuccessful, medication such as alpha-glucosidase inhibitors or somatostatin may be necessary. If the patient remains symptomatic, neisidioblastosis should be considered.¹⁸ Adjustable gastric band and SG leave the pyloric sphincter intact. Thus, patients undergoing these procedures should not experience dumping syndrome.

Constipation

Because patients undergoing bariatric surgery consume much less food and less fiber, fecal residue is significantly reduced. This can result in constipation for AGB and RYGB patients. In addition, suboptimal fluid intake can exacerbate the problem.¹⁸ Over time, more fruits and vegetables are incorporated into the diet. A fiber powder may be suggested to help, but patients must be able to consume enough fluid (generally 64 oz/day). Stool softeners or milk of magnesia can be recommended for those in the early postoperative phase.

Diarrhea

Although diarrhea may occur after any of the malabsorptive surgeries, it is generally only seen with the BPD. Usually, if the fat content of the diet is controlled, diarrhea is reduced. Cholestyramine can also be considered to bind bile salts. Also, lactose intolerance may contribute to loose stool. As always, if the postoperative patient develops watery diarrhea, foul smelling gas and stool, and abdominal cramps, he/she should be evaluated to rule out infectious diarrhea.¹⁸ Probiotics may be useful in restoring gut flora.¹⁸

Dysphagia

Because of the restrictive nature of bariatric surgery, patients may experience dysphagia. Rapid eating pace, overeating, or ingesting chunks of food may cause food to back up in the esophagus. In addition, dry (eg, dry chicken) or sticky foods (eg, doughy bread) may cause discomfort. Patients with AGB may complain of difficulty swallowing after their band has been filled or tightened. As previously mentioned, patients should return to a liquid diet for a few days after a “fill.”⁶ If the dysphagia is so severe that even liquids are not well tolerated, the band can be loosened. After RYGB, stenosis of the stoma should be suspected if dysphagia makes the consumption of even fluids difficult. Endoscopic dilatation may be required.¹⁸

Nausea and Vomiting

Taking medications on an empty stomach, skipping meals, and overeating can contribute to nausea. Vomiting can also be triggered by overeating, rapid eating pace, concurrent eating and drinking, and eating inappropriate food items. If patients are unable to keep fluids down, they should be referred to their physician. Behavioral tips like eating with a baby spoon and using very small plates may help to control the eating pace. Foods should always be moist, chewed well, and eaten slowly.

Pregnancy and Lactation

Often, obese women are infertile, but as little as 5% to 10% of weight loss can improve fertility. Absorptive changes may also cause oral contraceptive malabsorption. Pregnancy should be discouraged during the rapid weight loss phase (about 12–18 months), and patients should be counseled to use acceptable contraception.²⁴ Women who have lost significant amounts of weight after bariatric surgery often have a lower incidence of gestational diabetes and hypertension and have given births to healthy babies.²⁵ Fetal growth requires sufficient energy, about 300 calories above the guidelines for postsurgical weight maintenance. As stated earlier, the maintenance calorie intake after bariatric surgery is often about 1200 calories per day. So, bariatric surgery patients will probably need to consume about 1500 calories each day during pregnancy. The suggested protein intake is about 1.1 g/kg of ideal body weight or up to 1.5 g/kg of ideal body weight if pregnancy occurs within 6 months of surgery for those with undernutrition or for those who underwent a malabsorptive surgery.²⁴ A prenatal vitamin/mineral is suggested because it contains additional iron and folic acid. Calcium citrate with vitamin D should be considered for AGB patients who

do not consume enough through diet alone. For those patients after RYGB or BPD, additional iron and B12 supplementation may be needed. Omega 3 fatty acids supplementation should be considered for RYGB and BPD patients. Oral glucose tolerance tests may induce dumping syndrome for women who have undergone RYGB. Instead, self-monitoring of fasting and 2-hour postprandial glucose levels can be done to screen for gestational diabetes.²⁴ Ketones should be monitored. In addition to routine pregnancy blood work, certain vitamin levels may require evaluation. Iron studies, thiamin, vitamin B6, vitamin B12, and folate should be checked. For the malabsorptive RYGB and BPD, the fat-soluble vitamins and zinc should be evaluated.⁶ When interpreting the results, remember that volume and metabolic changes of pregnancy impact the “normal” levels.^{6,24} With the AGB, the band can be loosened to allow for improved food intake if necessary. However, for the other procedures, nutritional support may need to be considered if weight loss cannot be stopped or slowed. An excellent review of the nutritional care for the pregnant post-bariatric surgery patient can be found elsewhere.^{6,24} Pregnancy after bariatric surgery is considered a high-risk pregnancy, and patients should seek care from an obstetrician specializing in high-risk pregnancies and the nutrition care should be provided by a dietitian with experience in providing nutritional care to pregnant bariatric surgery patients. Breast feeding should be encouraged and is usually successful after bariatric surgery. Mothers must consume adequate calories, and the infant’s growth must be closely monitored.^{6,25}

Endurance Exercise

After significant weight loss, some people become very active and participate in endurance events like marathon running/walking or cycling. Fueling and hydrating take planning. Patients must be taught how to eat and hydrate before, during, and after their activity. Meeting carbohydrate requirements during activity may be difficult if the patient is prone to dumping syndrome. Patients should be encouraged to practice their eating and drinking plan during training sessions as it may be trial and error.

Alcohol

Alcohol should be avoided in the early postoperative stages. Later, patients should be cautioned about its use. Alcohol provides empty calories, may contribute to dumping syndrome, and alters micronutrient requirements and metabolism. Alcohol is metabolized differently after RYGB, resulting in lower tolerance.²⁶ Further research is

examining if patients may be at greater risk of developing dependence on other things such as alcohol as a replacement for their dependence on food to cope with underlying emotional issues.

Counseling

In addition to diet education and monitoring of nutritional status, behavioral counseling is crucial for short-term and long-term success after bariatric surgery. Goal setting, self-monitoring, problem solving, and self-management are some pivotal techniques for nutrition counseling.⁶ Nutrition visits are more frequent during the first year after surgery to assist with diet advancement, maintenance of nutritional status, and behavioral modification.³ Patients who attend fewer clinic visits are more likely to regain weight.²⁷ Papalazarou et al¹¹ demonstrated that a lifestyle intervention program including nutrition education, physical activity, and behavior modification with frequent dietitian contact resulted in lower body weight at 12, 24, and 36 months. Mental health professionals should be consulted when indicated.⁶ Support group attendance should be encouraged.⁴

Summary

Medical nutrition therapy and nutritional counseling are essential components in the care of bariatric surgery patients. To effectively care for these patients, nutrition practitioners must understand the types of surgery and their nutritional implications. Several resources are now available to assist nutrition professionals.^{3,4,6}

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Replacing Pop With Noncaloric Beverages Alone May Help Health

Replacing calorie-laden beverages with water or diet drinks may be effective at shedding weight and improving other cardiometabolic parameters in the short term, a randomized trial showed. Data from the National Health and Nutrition Examination Survey have shown that about 60% of adults report drinking sugar-sweetened beverages and that adults consume an average of 300 calories per day from such drinks. To see whether substituting noncaloric alternatives for caloric drinks could make a difference in weight loss, researchers conducted the CHOICE (Choose Healthy Options Consciously Everyday) study. Participants were overweight or obese (body mass index, 25 to <50 kg/m²) and aged 18 to 65 years (mean, 42 years). To enter the study, they had to report consuming at least 280 calories per day from caloric beverages at baseline, not counting unsweetened milk. In the 3-arm trial, there were no significant between-group differences in the percentage of weight lost over 6 months, but participants in the combined substitution groups were significantly more likely to lose at least 5% of their body weight than those who were told to make only healthy dietary choices (the control group). Participants in the substitution groups were told to replace at least 2 caloric drinks a day with either water or diet beverages. Those in the water group had significantly greater improvements in systolic blood pressure and fasting glucose compared with the control groups. Through 6 months, participants in the diet beverage group cut an average of 218 drink calories per day, those in the water group cut an average of 148, and those in the control group cut an average of 86 drink calories per day. The differences between the substitution groups and the control group were both significant; food intake decreased slightly in all 3 groups. Looking at the substitution groups individually, only the participants in the diet beverage group were more likely to lose 5% or more of their body weight, likely the result of better adherence to drink replacement compared with the water group. Blood pressure, fasting glucose, and hydration improved in both substitution groups, although the only significant differences versus the control group were in the water group—for systolic blood pressure and fasting glucose. Source reference: Medpage Today, Tate D, et al. Replacing caloric beverages with water or diet beverages for weight loss in adults: results of a six-month randomized controlled trial. *Obesity*. 2011; abstract 97-OR.

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