

Medical Nutrition Therapy for Gastric Bypass Surgery

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Abstract

Obesity has become a major public health concern in the United States, and cost of treatment is rising. The available non-surgical interventions such as diet, physical activity, behavior therapy, and pharmacology, show minimal long term benefit for weight reduction. Non-surgical interventions used individually or together rarely produce long term weight loss above 15 lbs. For example, the average weight loss attributed to drugs is reported to range between 4 and 22 lbs with most of the weight loss being limited to the first 6 months of treatment. Patients who are obese (Body Mass Index ≥ 30) need more drastic methods to achieve significant weight loss. Many obese patients elect weight loss surgery, specifically Roux-en-Y gastric bypass surgery. Roux-en-Y is the preferred surgery and is commonly performed in the United States. Other surgical procedures have not suggested the same amount of weight loss, long term maintenance, and health outcomes that Roux-en-Y has.

Weight reduction statistics for bariatric surgery, including Roux-en-Y, are impressive, averaging close to 100 lbs over 5 years post-operatively. In addition, co morbidity improvement has been shown with bariatric surgery. Literature confirms that diabetes resolution occurs in over 80% of patients, hyperlipidemia improvement occurs in over 95% of patients, and hypertension/sleep apnea improvement is demonstrated in over 70% of patients. Gastric bypass surgery, including Roux-en-Y, has its risks and the patient should be closely monitored. The gastric bypass surgical candidate should be screened by the interdisciplinary team, including the Registered Dietitian (RD). Dietetic professionals must be familiar with the anatomical changes after gastric bypass surgery, as well as with the pre- and post-operative medical nutrition therapy. The RD should be

involved in follow-up care to ensure optimal weight loss results with minimal nutrition risk. There is a need for standardized nutrition protocols to monitor and treat bariatric surgery patients.

Chapter 1

Introduction

The National Health and Nutrition Examination Surveys (9), data has shown that, over the past few decades among US adults ages 20 to 74, prevalence of overweight and obesity has increased from 15% (1976-1980) to 32.9%, (9). The increasing prevalence of overweight and obesity has many health implications, including increased risk of hypertension, Type 2 Diabetes, dyslipidemia, Coronary Heart Disease, stroke, gallbladder disease, osteoarthritis, sleep apnea, and certain cancers (breast, colon, and endometrial).

Table 1 illustrates the increase in prevalence of certain chronic conditions with obesity (9). There is an increased prevalence of high total cholesterol, low levels of High Density Lipoprotein, and high blood pressure in those individuals with a Body Mass Index greater than 30. Research suggests that life expectancy could be increased by up to 0.93 year for white men, up to 0.81 year for white women, up to 1.08 year for black men, and up to 0.73 year for black women if obesity was non-existent (28).

Annual medical spending due to health complications resulting from a BMI greater than 25 was suggested to be as much as 92.6 billion dollars in 2002 – 9.1% of US Health Expenditures (12). With the continued rise in obesity, this estimated cost will continue to increase.

Table 1. Prevalence of Selected Chronic Conditions According to Body Mass Index (BMI). Data based on NHANES III (1988-1994)

Condition	Percent Prevalence of Conditions according to BMI	
	Normal weight (BMI <25)	Obese (BMI >30)
	%	
High Blood Pressure - Male	18.3	39.2
High Blood Pressure - Female	16.2	32.4
High Cholesterol – Male	14.7	20.2
High Cholesterol - Female	14.6	24.3
Low HDL - Male	9.3	31.5
Low HDL - Female	16.3	42

Healthy People 2010 objectives (33), define three goals for reducing prevalence of obesity: 1) To increase the proportion of adults aged 20 and older who are at a healthy weight to 60% from a baseline of 42%. 2) To reduce the proportion of obese adults aged 20 years and older to 15% from a baseline of 23%. 3) To reduce the proportion of children and adolescents, age 6 to 19, who are overweight and obese to 5% from the current baseline of 11%. Unfortunately, data indicate that the levels of overweight and obesity in the U.S. are still headed in the opposite direction.

A sleuth of dietary and behavioral programs and aids have been developed to assist individuals lose weight. For the most part, many of these weight loss programs and weight loss medications have not produced significant losses in the majority of individuals. As a result, many obese individuals turn to surgery, currently the most effective solution to shed extra pounds.

The purpose of this review is to examine medical nutrition therapy for weight loss surgery, including defining the role of the registered dietitian (RD). The review begins by defining overweight and obesity. A discussion of current treatment methods such as diet therapy, physical activity, behavioral therapy, pharmacology, and weight loss surgery follows. Nutritional concerns and complications that accompany weight loss surgery, specifically Roux-en-Y surgery, will be examined including medical nutrition therapy recommendations and the role of the RD. Roux-en-Y surgery will be examined in particular because it is the most widely performed procedure due to its safety and effectiveness.

1.1 Definition and Classification of Overweight and Obesity

While overweight is an excess accumulation of energy that leads to increased weight, obesity is overweight accompanied with increased adiposity. In 1998, a National Institutes of Health (NIH) panel of experts recommended the use of the Body Mass Index (BMI) to define and classify obesity (26). BMI is calculated using height and weight of an individual and is based on the following formula:

$$\text{BMI} = \text{weight (kg)} / (\text{height (m)}^2)$$

BMI may be reported in pounds (lb) using the following conversion:

$$\text{BMI} = \text{weight (lb)} / ((\text{height (in)}^2) \times 703)$$

Although BMI represents a crude measurement of obesity, it correlates well with the amount of body fat in the majority of individuals (9). In addition, it is an inexpensive, easy to use formula for clinicians that has been widely adopted. The BMI cut-offs defined by NIH are shown in Table 2.

1.2 Treatment Options for Obesity

The National Heart Lung and Blood Institute (NHLBI) reports goals for weight loss and maintenance for adults who are overweight and obese (BMI 25 and over). The goal of treatment is to, at minimum, prevent further weight gain while ideally promoting gradual weight loss and long term maintenance of a healthy weight to decrease chronic disease

Table 2. Body Mass Index Classifications

BMI (Kg/m²)	Weight Classification
>18.5	Underweight (thin)
18.5-24.9	Normal weight
25-29.9	Overweight
30-39.9	Obesity
> 40.0	Morbid Obesity

risk. Initial weight loss goal should be a 10% reduction in weight from baseline, achieved within approximately six months. To achieve the 10% weight loss in a 6-month period, those with a BMI of 27-35 are to decrease caloric intake by 300-500 calories per day, promoting a ½ to 1 pound weekly weight loss. Those with a BMI over 35 are to decrease caloric intake by 500 to 1,000 calories per day, promoting a 1-2 pound weekly weight loss.

Strategies for weight loss include dietary therapy, physical activity, and behavior therapy. In addition to the aforementioned, pharmacotherapy and surgery may be appropriate in carefully selected patients. Each of these strategies will be discussed in the sections below.

Chapter 2

Non-Invasive Weight Loss Methods

The most popular non-invasive weight loss methods mainly include dietary therapy, physical activity, behavior therapy, and pharmacotherapy. Each will be discussed in this Chapter.

2.1. Diet Therapy

Diet therapy involves decreasing caloric intake over a period of time to promote weight loss. A plethora of diet therapy programs have been promoted, including low-fat diets, low-carbohydrate diets, and very low calorie diets. Diet therapy programs typically promote low calorie diets (LCD), approximately 500 to 1,000 kcal/day deficit (26). The LCD is achieved by reducing carbohydrates and fats (especially saturated fats) in the diet. Various diet therapies available in the United States utilize the LCD to elicit weight loss, including Weight Watchers, Optifast, Take Pounds Off Sensibly (TOPS), eDiets.com and Health Management Resources. Success of weight loss is measured by percent body weight loss achieved and ability to maintain the loss long term (more than one year). Table 3 reviews popular diets in the United States, treatment modality, and maximum/long term weight loss for each diet.

As illustrated in Table 3, long term weight loss with popular diets produces minimal weight loss, if not weight gain as seen with Weight Watchers and TOPS . The average long term weight loss is often less than 10% of initial body weight. While this modest weight loss may produce a decrease in health risks, it is not motivating to the

Table 3. Systemic Review of Major Commercial Weight Loss Programs in the US

Program	Diet	Physical Activity	Behavior Modification	Maximum weight change (% initial body weight lost)	Long term weight change (% initial body weight lost)
Weight Watchers	Low-calorie exchange diet (points); self-prepared meals	“Get Moving” booklet provided	Behavioral weight control methods discussed	5.3 % at 26 weeks	3.2% at 2 years
Health Management Resources	Low-calorie or very low-calorie diet provided via meal replacements	Walking and calorie charts provided in lifestyle classes	Included in lifestyle classes; accountability and skill acquisition emphasized	-19.2% at 15.5 weeks	-7.3% at 3.4 years
Optifast	Low-calorie diet provided through meal replacement	Physical activity modules provided in lifestyle classes	Included in lifestyle classes; stress management and social support emphasized	-19.9% at 26 weeks	-4.7% at 4.5 years
eDiets.com	Low-calorie diet provided through “virtual dietitian” ; client prepares meals	Physical activity seminar through eDiets.com University	Included in eDiets.com University; stress management emphasized	-0.9% at 16 weeks	-1.1% at 1 year

Table 3 (Continued). Systemic Review of Major Commercial Weight Loss Programs in the US

Program	Diet	Physical Activity	Behavior Modification	Maximum weight change (% initial body weight lost)	Long term weight change (% initial body weight lost)
Take Off Pounds Sensibly (TOPS)	Low-calorie diet exchange plan	Members plan with their health care provider	Included in curriculum	0.4% at 12 weeks	1.6% at 1 year
Atkins	Very low-carbohydrate diet, no caloric restriction, 1 hour class with Registered Dietitian, copy of book (Dr. Atkins new diet revolution)	As presented in book	As presented in book	-6.7% at 6 months	-5.5% at 1 year
Zone	Low carbohydrate diet, caloric restriction, 1 hour class with Registered Dietitian, copy of book (Enter the Zone)	As presented in book	As presented in book	-2.7 % at 2 months	-1.9% at 1 year

**subjects reviewed in these studies had mean BMI's >30, greater than 35 in most cases. (Adopted from: Tsai & Wadden, 2005, Gardner, et al. 2007)

morbidly obese, who may have to lose 50% of their body weight to reach overweight status. In addition, lack of success of these weight loss programs tends to promote a sense of failure in the dieter which may impact future attempts to lose weight.

Many health professionals and scientists maintain that including lifestyle changes, such as exercise, and behavior modification result in more successful weight loss that can be maintained over time as opposed to diet therapy alone. The following sections explore the benefits of adding physical activity and behavior modification to a weight loss program.

2.2. Physical Activity

Physical inactivity and poor diet have been identified as a leading cause of death in the United States (25). Health benefits of physical activity include increased physical fitness, maintenance of healthy bones, muscles, and joints, weight management, controlled blood pressure, lower risk of cardiovascular disease, colon cancer, and type 2 diabetes, reduction of depression and anxiety, and increased self-esteem. Chronic positive energy balance leads the body to store excess as fat. Regular physical activity is known to elicit metabolic changes in muscle and fat tissue that promote fat usage instead of storage (20).

Hansen et al. (17) conducted a comprehensive meta-analysis of endurance training and resistance training and their effect on fat mass loss. Studies were selected in which subjects were obese (BMI >30) and 19 years of age or older. Twenty-one studies were reviewed to determine the effect of endurance training in addition to caloric restriction. Four of the 21 studies suggested greater fat mass (adipose tissue mass) loss

among obese subjects, primarily women, who expended 105-288 calories daily via endurance training for a period of 5 to 14 weeks. Nineteen studies were reviewed to determine the influence of various training modalities on fat mass loss during caloric restriction. Two of 19 studies suggested greater fat mass loss with high levels of training (session volume 400 minutes per week and caloric expenditure of 2500 kcal per week) as opposed to moderate level of training (session volume 210 minutes per week and caloric expenditure of 1000 kcal per week) at 12 and 18 months. Endurance and/or resistance training did not have a statistically significant effect on reducing fat mass. Fat mass lost with strength training, though not significant, was central adipose as opposed to visceral adipose, a valuable observation since central adiposity is predictive of cardiovascular disease. The authors concluded that resistance training is beneficial as it maintains lean body mass and metabolic rate, whereas low caloric intake alone produces a decrease in lean body mass as well as metabolism. At 30 months, participants who engaged in high levels of exercise (2500 kcal/wk expenditure) were able to maintain a significantly higher weight loss [15.4 pounds (7 kg) average] than subjects in the standard behavioral therapy group at 30 months ($p < 0.001$) (31) suggesting that a high level of physical activity is beneficial in maintaining weight loss.

Further research is ongoing to determine the role, if any, of physical activity in appetite suppression and food intake, beneficial effects of endurance and resistance training, and impact of level of exercise and effect on weight loss/maintenance.

Cucurioni & Laurenco (10) reviewed nine studies to determine the effectiveness of diet and exercise vs. diet alone in overweight and obese individuals. Studies considered were randomized, controlled clinical trials of diet (defined as any type of

caloric restriction), exercise (quantifiable activity), or diet and exercise with subjects having a BMI greater than 25 (overweight and obese). Studies were excluded if follow up period was less than one year, medications were used, or if behavior therapy was the only intervention used. The sample size of studies examined ranged from 40 to 127 subjects. Age ranged from 21 to 65 years old, with primarily women subjects. Length of treatment ranged from 10 to 52 weeks, and follow up ranged from 12 to 24 months. Results are shown in Table 4 and indicate that diet and exercise produce a 20% greater weight loss (initial and at one year) than diet alone, which the study found to be significant by z values greater than 1.5.

Changes in body composition after a three week weight reduction program were examined in inpatient obese men and women (23). Seventy obese volunteers were referred to the Third Division on Metabolic Diseases (Italian Institute) by physicians for in-patient treatment of obesity. Volunteers were selected based on age (over 18 years old), BMI (greater than or equal to 35), absence of major disease, and motivation to take part in a structured weight loss program. Six participants (one male, five females) dropped out for various reasons throughout the weight reduction program and follow-up, leaving sixty-four participants for analysis. The body weight reduction program was a combination of an energy restricted diet, nutrition education, psychological counseling, and moderate physical activity (five training sessions per week consisting of aerobic (30 – 40 minutes) and strength training (15 repetitions on three machines) coordinated by the appropriate professionals (dietitians, exercise physiologists, physicians, etc.). At the end of the three week inpatient program, fat mass was reduced by an average of 7.1 kg. At

Table 4. The Effect of Diet and Exercise on Short and Long-term Weight Loss (N= 9). Initial weight loss is defined as weight loss immediately after intervention (10-52 weeks). Standard deviations (SD) are presented in parentheses.

	Initial Weight Loss in Kg (10-52 weeks)	Weight Loss after One Year in Kg
Diet and Exercise	-13.0 (10.4)*	-6.7 (8.3)**
Diet Alone	-9.9 (9.6)	-4.5 (11.3)

* z=1.86 (z>1.5 is significant)

**z=1.89 (z>1.5 is significant)

follow-up (approximately 11 months later), no significant changes in fat mass reduction was noted, and participants were broken down into a weight regain and a weight loss group. Those in the weight loss group were analyzed, and the correlation was made that they had higher physical activity levels. The study shows that with the use of strength training, restricted caloric intake, and nutritional and psychological counseling, an appropriate weight loss may be achieved for the short term. Unfortunately, this is yet another study that is unable to show significant weight loss over a long period of time, especially in the obese population, despite the addition of physical activity. Moreover, interventions in this study occur in an inpatient setting, unrealistic for the general population.

While dieting and exercise together produce more weight loss than dieting alone, the additional weight lost caused by the incorporation of exercise is minimal, amounting to about only 2 lbs after one year (Table 4). Again, this small amount of weight loss may work for mildly overweight individuals but not for the obese who have significantly more pounds to lose. Table 5 presents the weights in pounds of a 5'3" woman with varying BMI levels. The table illustrates the amount of weight that needs to be lost to achieve a normal BMI of 24 or 10% of body weight. As shown, a person with a BMI of 27 or above has over 15 pounds to lose to achieve 10% weight loss. To reach a normal BMI more pounds need to be shed. This weight is significantly higher than the 6 pound average weight loss typically achieved at one year with exercise and diet (See Table 5). Exercise and diet alone are not sufficient to achieve the 10% weight loss or the normal BMI for anyone with a BMI of 27 or more. These numbers are magnified for taller individuals.

Table 5. Weights of a 5'3" and 5'10" Persons with Varying BMI Levels.

BMI	5'3" Height			5'10" Height		
	Weight in lb	Weight Loss to reach Normal BMI*	10% weight Loss	Weight in lb	Weight Loss to reach Normal BMI*	10% weight Loss
22	120	-	-	153	-	-
24	131	-	-	167	-	-
26	142	11	11**	181	14	14**
27	148	17	15	188	21	19
30	164	33	16	209	42	21
40	219	88	22	279	112	28
50	273	142	27	349	182	35

*Normal BMI is calculated as BMI =24

** 10% weight loss (14 lb) is not necessary since it exceeds the pounds needed to achieve normal BMI.

Despite the incorporation of physical activity, diet and exercise does not work for most people. This section is not attempting to minimize the value of exercise in a sensible weight management program. While physical activity may not lead to substantial losses in weight, it is essential to preventing weight regain and needs to be combined with diet therapy to produce optimal results, especially for marginally overweight individuals. Unfortunately, the majority of individuals do not adhere long enough to the regimen of diet and exercise and often revert to their old habits of sedentary lifestyle and overeating. In addition, the weight loss achieved is minimal when considering obese individuals with a substantial amount of pounds to lose.

It is evident that, for obese individuals, more drastic measures need to be undertaken to achieve more significant weight loss. The next section explores the addition of behavior modification to a diet and exercise regimen and investigates the role of accountability in achieving long term weight loss.

2.3. Behavior Therapy

Behavior therapy comprises a variety of concepts including self-monitoring of caloric intake and physical activity, stress management, stimulus control, problem solving, contingency management, cognitive restructuring, and social support. These concepts may be used in combination with each other or independently based on the individual.

Self-monitoring, by recording daily intake and antecedents of eating, helps individuals keep track of their calories and slow down or stop their intake when caloric intake approaches daily recommendations. Energy expenditure should also be recorded in those who self-monitor. Behavioral goal setting should include realistic and challenging goals to keep the client motivated. Stimulus control involves identifying cues for undesirable behavior and reducing them while increasing cues for desirable behavior (11). Problem-solving can be helpful to work through a particular barrier. It includes: identifying the problem, evaluating the chain of events leading to the problem, and identifying a link to change in order to prevent the outcome. Cognitive restructuring attempts to increase motivation by enhancing positive thoughts and replacing negative thoughts. Social support can increase adherence to a lifestyle change. Stress management can prevent emotional eating and resulting increased caloric intake if non-food behaviors are substituted for food related behaviors.

The importance of self monitoring was demonstrated by Baker and Kirschenbaum (3) who followed 56 participants for 18 weeks enrolled in a long term cognitive behavior treatment program (The People at Risk (PAR) weight control program). Cognitive therapy uses psychosocial therapy with a focus on changing thoughts (cognitive patterns) to solve problems. At the initiation of this investigation, or sub-study, participants had already been enrolled in the PAR weight control program approximately 40 weeks and had lost approximately 21 lbs (9.5 kg). The average weight of participants was 246.5 lbs (112 kg). Subjects were provided a self-monitoring book to record all food and beverages consumed daily. Weekly weigh-ins and self-monitoring books were reviewed

at weekly sessions. Individual (15 participants) and group (45 participants) behavior contracting and training programs during weekly meetings focused on decision making, planning, and relapse prevention. Self-monitoring records of each participant were rated and separated into quartiles based on monitoring consistency. Results indicated that participants who monitored intake more than 76% of the days achieved a mean weight loss of 15kg (33lbs) whereas the lowest quartile of monitoring (fewer than 25% of the days) achieved a 4kg (8.8lb) weight gain. The weight loss is particular to the sub-study, and would be additional to the PAR weight loss obtained prior to initiation of the sub-study. The sub-study confirms the authors belief that participants who self-monitor intake regularly achieve the highest weight loss, and those who do not regularly monitor intake achieve the lowest weight loss (or experience weight gain, as in this example).

The general population underestimates caloric intake by 8-34% and for those reporting an inability to lose weight, up to 50% underestimate their energy intake (11). The discrepancy may be up to 34% for the general population, and up to 50% for people who report that they cannot lose weight. Thus, close monitoring of one's intake may help dieters be more aware of actual intake and possibly limiting overeating.

A controlled trial of very low calorie diet and behavior therapy examined 59 men and women who responded to a newspaper advertisement seeking subjects at least 25 kg overweight. Subjects underwent medical evaluation and were stratified into three treatment conditions by random assignment: very low calorie diet alone, behavior therapy alone, and very low calorie diet plus behavioral therapy (combined). Subjects were treated weekly for 90 minutes, and the programs lasted 4 to 6 months. Post treatment, those on combined therapy lost 5.2 kg and 5 kg more than those on diet alone or

behavior alone, respectively ($p < 0.5$). At one year follow-up, the combined therapy group lost 12.9kg as opposed to diet alone (4.6 kg), or behavior along (9.5 kg) ($p < 0.5$) (34).

The National Heart, Lung, and Blood Institute (NHLBI) Obesity Education Initiative Task Force convened an expert panel of members with expertise in cardiovascular disease and body weight, including primary care practitioners, nutritionists, and exercise physiologists. The expert panel, comprised of 33 members, including an executive committee of five members, set out to provide primary care practitioners with strategies to evaluate and treat overweight and obesity in adults.

The panel focused on research studies that examined overweight and obese adults with BMI's greater than 25, inclusive of those with cardiovascular risk factors, and exclusive of those with genetic or hormonal abnormalities, or with medication induced obesity. Therapeutic evaluations examined included diet, physical activity, behavior therapy, pharmacological therapy, and surgery. Diagnostic measures focused on readily available information, such as weight, height, and BMI.

Literature was reviewed by establishing eligibility for inclusion of studies, reviewing titles and abstracts to select articles, reviewing full articles, and compiling evidence tables to summarize articles that met criteria for inclusion. Parameters for the literature search, set by the panel, included year of publication, country, language, study design, length of study, outcome measures, and patient characteristics. The search was limited to English language studies and randomized controlled clinical trials that were foreign studies that included an English abstract. Human studies published in MEDLINE from January 1980 to September 1997 were included. The initial search revealed 43,627 titles, with 18,217 duplicates, leaving 25,410 titles. After several reviews and checks for

quality of screening, 2,440 possible abstracts were extracted of which 394 articles were randomized controlled trials.

Inclusion criteria included a minimum time frame of four months, and approximately one year if used to reflect long term outcomes. Excluded were studies which used self-reported weight as the only measurement. No exclusions were made for study size. Ultimately, 236 articles were reviewed and compiled into evidence tables to address questions relative to treatment.

These studies showed that behavioral therapy provides additional benefits in short term weight loss; however no long term benefits were identified after one year (26). The above statement is considered evidence Category B, indicating the source is randomized control trials with limited data available.

The NHLBI panel also reached the conclusion that using a combination of various behavioral therapy strategies promotes weight loss with no one particular behavioral strategy having the greatest efficacy (26). The preceding statement is evidence category A, which indicates the 19 pieces of literature reviewed were randomized control trials with a good body of evidence to support the conclusion.

A combined therapy including a LCD, increased physical activity, and behavior therapy is the most successful therapy for weight loss and maintenance aside from medication and surgical intervention. However, making lifestyle changes in food choice and physical activity can be very challenging and often leads to modest weight loss. Overweight and Obese patients may turn to other methods such as medication or surgery after being frustrated with low calorie diets not working and with weight cycling leading to minimal motivation.

2.4. Pharmacotherapy

Pharmacotherapy includes the use of FDA-approved weight loss drugs with combined therapy. Pharmacotherapy is recommended for those with a BMI greater than or equal to 30, or a BMI greater than or equal to 27 with concomitant risk factors or disease, such as hypertension, dyslipidemia, coronary heart disease, type 2 diabetes, and/or sleep apnea.

Pharmacologic treatment of obesity includes four medications currently approved by the Food and Drug Administration (FDA). These include Sibutramine, Orlistat, Phentermine, and Diethylpropion.

Sibutramine, or Meridia, was approved by the FDA in 1997. Sibutramine works as a serotonin and norepinephrine reuptake inhibitor, decreasing food intake and promoting weight loss. Increased concentrations of serotonin and norepinephrine have an anorectic effect, reducing hunger in the body. Sibutramine is taken 6-7 hours prior to the individual's highest risk time for overeating. Dosing is available in 5, 10, and 15 mg. and the drug is to be taken once daily. Side effects include increase in blood pressure, increase in pulse, insomnia, constipation, and dry mouth. Zhaoping, et al (35) conducted a meta-analysis of 23 random clinical trials that assessed efficacy of sibutramine. Studies examined sibutramine 10-20mg dosage in adults (18 years or older) with a BMI of 25 or greater and treatment duration of at least 8 weeks. Studies were analyzed in three strata based on trial duration. Five trials with a duration of 44-54 weeks had an average weight loss of 4.45kg (9.8 lbs). The meta-analysis also noted that patients taking sibutramine had

up to 30% greater likelihood of losing at least 5% of their body weight than placebo.

Efficacy and safety of sibutramine beyond two years of treatment are unknown.

Orlistat, or Xenical, was approved by the FDA in 1999. Orlistat acts as a gastric and pancreatic lipase inhibitor to reduce the absorption of dietary fat. Fat soluble vitamin supplementation is recommended. Dosage is 120mg three times daily at meals. Side effects include decrease in absorption of fat soluble vitamins, fecal incontinence, oily stools, and flatulence. Zhaoping et al (35) reviewed a meta-analysis of 29 studies that examined weight loss with Orlistat. Subjects had an average BMI of 36.7 and average age of 48 years. Twelve studies reviewed found total weight loss at 6 months to be 5.39 kg (11.9 lbs), and twenty two studies found total weight loss at 12 months to be 8.13 kg (17.9 lbs). Long-term data for loss and maintenance was not available.

Phentermine , also known as Ionamin, Adipex-P, and Obephen, decreases appetite by changing brain levels of serotonin. Phentermine is approved by the Food and Drug Administration (FDA) for short term use (a few weeks). Dosage ranges from 15 – 30 mg/day. Six randomized clinical trials, mainly women subjects with a duration of 2-24 weeks produced an average weight loss above placebo of 3.6 kg (7.92 lbs) Phentermine can be habit forming, and should be used only as prescribed by a physician. No data on long term effects are available, and the last study available on phentermine was published in 1999. (35).

Diethylpropion, or Tenuate, decreases appetite by stimulating the central nervous system. Diethylpropion is a norepinephrine reuptake inhibitor. The FDA has approved diethylpropion for short term use (a few weeks). Dosage is either 25mg 3 times per day or 75 mg once a day. One meta-analysis reviewed 13 randomized control trials published

between 1965 and 1983. Of the thirteen, 9 placebo controlled studies were analyzed. Treatment duration varied from 6 to 52 weeks and included lifestyle modification treatment. The average weight loss was 3 kg compared with placebo with a 75mg dosage (15). As with Phentermine, Diethylpropion can be habit forming and should be used only as prescribed by a physician.

Mazindol is another norepinephrine reuptake inhibitor also approved for short term use by the FDA. Ultimately, more research is needed to establish safety and efficacy for pharmacologic treatment of obesity. Fenfluramine and dexfenfluramine, a component of the popular weight loss drug “Phen-fen,” increases the release of serotonin in the brain. There are no studies to establish efficacy of fenfluramine or dexfenfluramine, and reports of valvular heart disease have caused the FDA to take the products off the US market based on findings that 30% of patients taking the aforementioned drugs had abnormal echocardiograms.

In sum, Pharmacotherapy for weight reduction produces modest improvements in weight loss over placebo when used as directed with a low-calorie diet and increased physical activity. The weight loss, while significant, may still not be sufficient to reduce health risks in the morbidly obese. When a patient has more than 200-300 lbs excess body weight, a 5-10% weight loss does not place them within a normal BMI.

All methods of weight loss reviewed thus far produce a weight loss average of less than 10 lbs/year, not sufficient to provide the obese and morbidly obese an improved quality of life and/or significant improvement in disease states. Due to poor success rates with diet therapy, physical activity, behavioral therapy, and pharmacology, many seek more drastic measures, such as weight loss surgery. Chapter 3 reviews various weight

loss surgery methods available, and specifically nutrition complications of surgery and recommendations post-surgery.

Chapter 3

Weight Loss Surgery

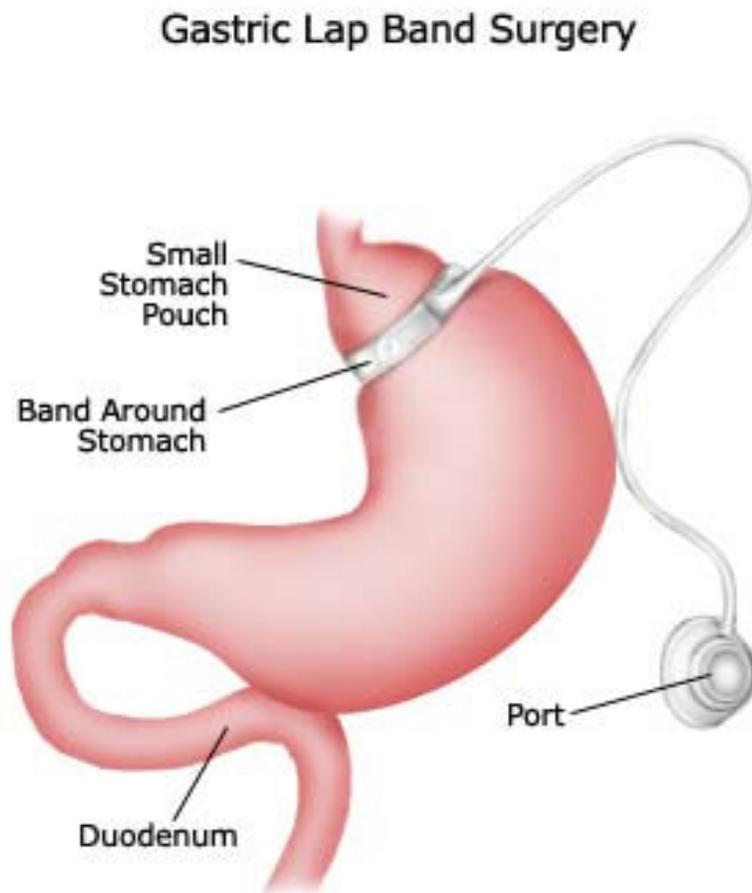
Weight loss surgery is reserved for patients who have failed at other weight loss programs and are suffering from medical complications of obesity. Weight loss surgery, also known as bariatric surgery, is surgery on the stomach and/or intestines to help a person with obesity lose weight. Those eligible are severely obese (BMI greater than or equal to 40 or BMI greater than or equal to 35 with comorbidities) (4). Surgical intervention for obesity will be discussed at length in the remainder of this paper.

Weight loss surgery began in the 1950's with the jejunoileal bypass (an operation that kept the stomach intact, yet bypassed most of the intestine – the jejunum and ileum – reconnected at the colon). Due to minimized absorption, weight loss occurred. However, severe metabolic and nutritional complications (Vitamin A and D deficiencies, protein-calorie malnutrition, kidney stones, toxic overgrowth of bacteria leading to problems such as liver failure) led to alterations of the surgery to safer procedures, including laparoscopic banding, vertical banded gastroplasty, duodenal switch, and Roux-en-Y gastric bypass (2).

3.1 Laparoscopic Banding

The laparoscopic adjustable gastric band (LAGB) has been approved for use in the United States since 2001. The LAGB is a restrictive procedure, meaning the size of the stomach is restricted to promote increased fullness and decreased ability to overeat (See Figure 1). The human stomach has the capacity to fit about one quart (946 mL) of

Figure 1. Laproscopic Banding Surgery



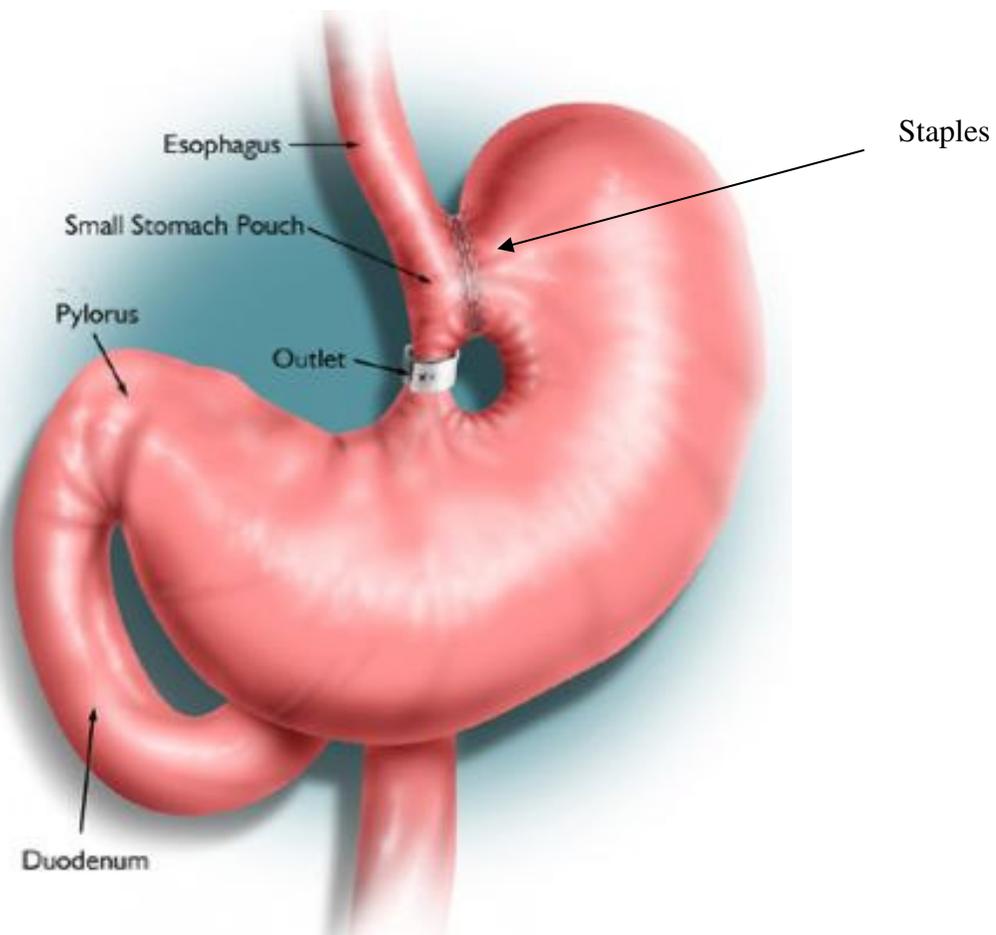
<http://www.surgicalbariatrics.com/uploads/UserFiles/Image/img-gastric-banding.jpg>

fluid and is surgically reduced to approximately a 15 mL capacity. Adjustments to the surgically placed band are made by injecting saline into the port on the surface of the skin. Saline is injected into the port approximately every 6 weeks to ensure that the saline band remains properly inflated and the resident will continue to benefit from the surgery. Peak weight loss occurs 2-3 years post-operatively, and averages 47.5% excess body weight (8). Benefits include lower perioperative risk and reversibility. Potential disadvantages include inferior weight loss, and long term band complications including erosion and band slippage.

3.2 Vertical Banded Gastroplasty

Vertical Banded Gastroplasty (Figure 2) was initially designed to avoid the complication of Roux-en-Y gastric bypass (RYGB) (see below) by stapling a small pouch on the stomach to create a restricted volume with a band placed below the new pouch (between the upper and lower stomach). Food is delayed in passing from the upper to the lower stomach, creating a feeling of fullness quickly. The band can be tightened if the client feels hungry and/or begins taking in excess food. Early weight loss seemed promising, however at 2 years excess weight loss was 64% as opposed to 84% with RYGB (27). Poor long term results and increased complication rates (gastroesophageal reflux and stomal stenosis, narrowing of duct or passage) had led most bariatric surgeons to stop offering this procedure.

Figure 2. Vertical Banded Gastroplasty (VBG)



http://www.weightlossurgery.com.au/p29_Vertical-Banded-Gastroplasty.html

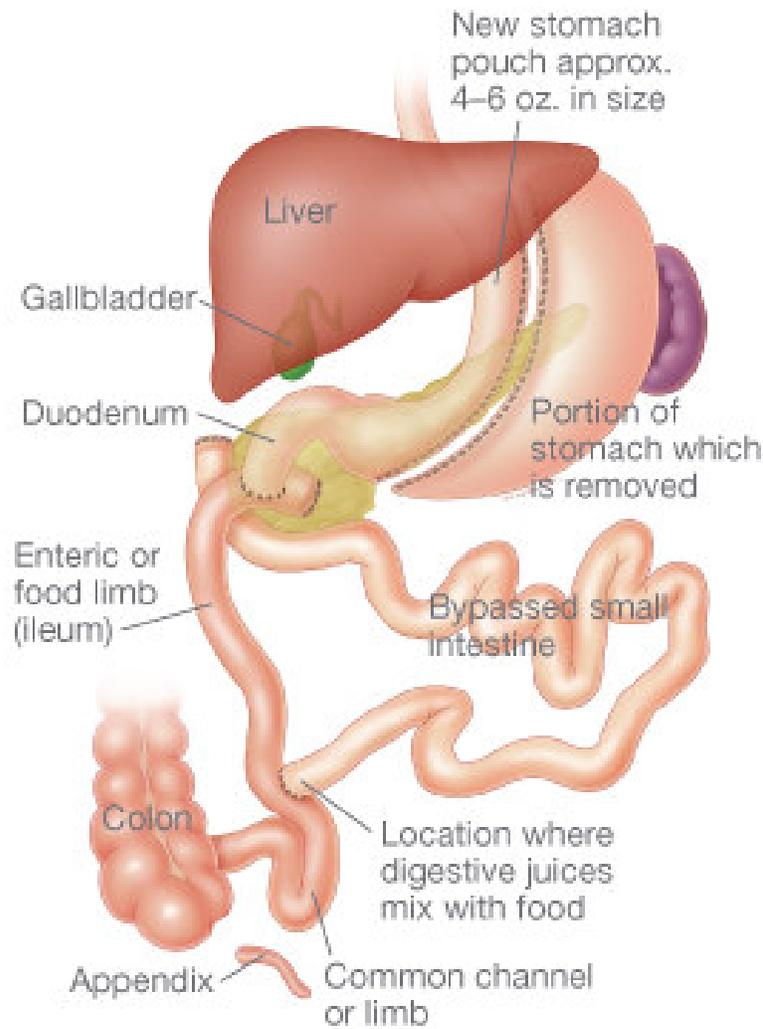
3.3 Duodenal Switch

The duodenal switch (Figure 3) transects the first part of the duodenum and resects the large curve of the stomach making the stomach smaller and intestine length shorter. This leaves a gastric sleeve with intact pylorus and antrum. The proximal ileum is divided from the ileocecal junction, and the biliopancreatic limb is anastomosed to the distal ileum, and finally a duodenoileostomy attaches the roux limb to the gastric sleeve. This procedure is often combined with biliopancreatic diversion, as seen above, and can produce excess weight loss of up to 70% as reported in one study (8). Advantages include increased weight loss and increased reduction in comorbidities, and disadvantages include increased malabsorption (risk for vitamin and mineral deficiencies) and technical difficulty of procedure for surgeon.

3.4 Roux-en-Y Gastric Bypass (RYGB)

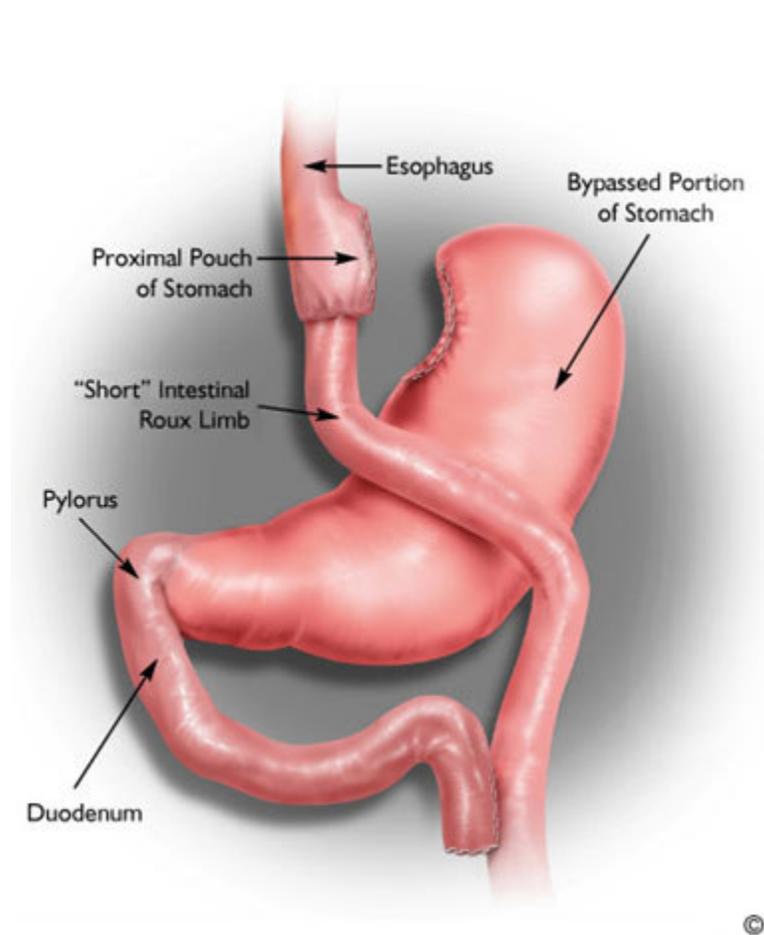
The Roux-en-Y gastric bypass surgery is a restrictive, malabsorptive (the impaired absorption by the intestines of nutrients by food) surgery for weight loss in obese patients. The procedure was first defined in 1967 and has been modified several times since, to reduce complications. A small pouch (approximately 10-30mL) is created at the proximal stomach, connected to a Roux limb (the extension from the gastrojejunostomy to the jejunojejunostomy) with a varying length (usually 75-150cm). The gastrojejunostomy can be constructed by stapling or hand-sewing (Figure 4). In patients with a BMI greater than 50, a longer Roux limb (150 cm) can result in an increased weight loss without increased risk of nutrition complications. In patients with a BMI of less than 50, no difference in weight loss was observed between 50 cm and

Figure 3. Duodenal Switch Procedure



www.cpmc.org/advanced/obesity/ds.html

Figure 4. Roux-en-Y Gastric Bypass Procedure



<http://www.overcomingobesity.net/images/roux-en-y-gastric-bypass.jpg>

150 cm limb, and there is an increased risk of internal hernia with the longer limb (21). Advantages of the procedure include a sustained weight loss, dumping syndrome to prevent maladaptive eating, and marked improvement in reflux symptoms. Disadvantages include possible complications such as anastomosis (in which the intestine may abnormally connect with another area of intestine or skin), obstruction, and other stomal (surgically created opening) complications, as well as dumping syndrome (rapid gastric emptying). Complications with Roux en Y can occur at different phases. Early complications (occurring during the healing period) include leaks at the junction of the stomach and small intestine, gastric dilation, roux-y obstruction, and wound infection. Late complications (occurring after the incision is healed) include stomal stenosis (a narrowing between the stomach pouch and intestine due to scarring), anemia due to inadequate iron absorption, vitamin B12 deficiency, and hypocalcemia (2).

Pories (29) studied approximately 600 subjects in which gastric bypass surgery was performed from 1980-1995. Subjects were between the ages of 14 and 65 with qualifying BMIs. The study chose subjects who were screened, educated on the surgery and its consequences, underwent extensive blood work and psychological evaluations. If subjects were deemed appropriate, baseline weights were obtained. Patients then underwent Roux-en-Y gastric bypass surgery, and were monitored closely in the hospital. Patients were NPO (medical abbreviation meaning nothing by mouth) until day 3, followed a full liquid diet of Ensure Plus half strength (gradually increasing to full strength) for two weeks. Patients then progressed to a regular consistency diet, avoiding simple sugars, slowly over the next four weeks. Patients were followed for 14 years after Roux-en-Y and weight loss and disease improvement were evaluated. Weights were

obtained at follow-up visits (frequency not specified in study). Attrition rate was low where at fourteen year follow up 96.3% of the original subjects remained in the study. Excess weight loss averaged 50% or more after 14 year follow-up. Patients mean weight preoperatively was 304.4 pounds (198-615lbs), 192.2 one year post operative, 205.4 at 5 years, and 204.7 (158-270lbs) at 14 years post operative.

Weight reduction is only one aspect of the success of bariatric surgery. Pories (29) followed 608 patients who underwent Roux-en-Y gastric bypass surgery for a time period of 14 years. The subjects' weight, lab parameters, and disease states were followed for weight loss, improvement of disease, and improvement in lab values. Results indicate that in addition to weight loss, Type 2 diabetes was eliminated in 82% of patients after RYGB. Disease improvement was also noted in Buchwald et al (8). Diabetes resolution occurred in 83.7% of subjects, hyperlipidemia improvement occurred in 96.9% of subjects, and hypertension/sleep apnea improved in 74% of subjects. With improvement of medical conditions, patients are able to decrease or eliminate medication usage.

Weight loss benefits of Roux-en-Y surgery are also described by Buchwald et al (8). The meta-analysis consisted of 136 articles after Medline search, two level screening, and study selection for reported outcomes. A total of 2,738 study abstracts were screened (level 1) for exclusion criteria including small number of subjects, short follow-up time, appropriate surgical intervention. Level 2 screening (961 articles) examined full articles for efficacy/disease impact. Study selection was made based on having at least 10 participants, at least 50% follow-up, and outcomes reported for comorbid conditions or health care economics. A meta-analysis of the literature revealed excess weight loss for RYGB to average 61.6% of original body weight over various lengths of time,

confirming the superior ability of bariatric surgery to provide weight loss far exceeding that obtained with other treatment modalities, such as exercise, diet, behavior modification, and pharmacology

After surgery, patients typically lose weight in the following manner: ½ pound – 1 pound per day the first three months, ¼ to ½ pound daily during months three through nine, ¼ pound daily for up to twelve subsequent months (24).

Review of the procedures, mechanisms, advantages and disadvantages of the various types of weight loss surgery discussed is found in Table 6. Excess weight loss for the procedures as described by meta-analysis (8) are as follows: laproscopic banding excess weight loss 47.5%, Roux-en-Y gastric bypass 61.6%, vertical banding gastroplasty 68.2%, and biliopancreatic diversion/duodenal switch 70.1% (p<.001) The weight loss achieved with weight loss surgery is significantly higher than other methods available.

While gastric bypass surgery is quite effective at shedding pounds, it is accompanied with many short term and long term complications. Complications with gastric bypass surgery, and specifically Roux-en-Y, can occur at different phases. Early complications (occurring during the healing period) include leaks at the junction of the stomach and small intestine, gastric dilation, roux-y obstruction, and wound infection. Late complications (occurring after the incision is healed) include stomal stenosis (a narrowing between the stomach pouch and intestine due to scarring), anemia due to inadequate iron absorption, vitamin B12 deficiency, and hypocalcemia. The following section will discuss various nutritional concerns and recommendations after RYGBS.

Table 6. Overview of Operations Performed for the Treatment of Obesity

Procedure	Mechanism	Advantages	Disadvantages
Laposcopic banding	Restrictive	No anastomosis Low perioperative risk Adjustable Reversible	Inferior weight loss Inappropriate requests for adjustment Long term band complications
Vertical banded gastroplasty	Restrictive	No anastomosis Low perioperative risk	Stomal complications Frequent gastroesophageal reflux Frequent revision necessary Inferior weight loss
Roux-en-Y gastric bypass (RYGB)	Restrictive, Maldigestive	Sustained weight loss Antireflux anatomy Dumping symptoms (avoids maladaptive eating)	Anastomosis Dumping Syndrome Obstruction Stomal complications
Distal RYGB	Restrictive, Malabsorptive	Improved weight loss in superobese patients (BMI greater than 50)	Malabsorption Dumping Syndrome Diarrhea Stomal complications
Duodenal switch	Restrictive, Malabsorptive	Avoids dumping physiology Improved weight loss Improved reduction in comorbidities	Malabsorption Increased technical difficulty

(Kendrick & Dakin, 2006)

RYGB surgery is commonly performed in the United States and has been studied and found to provide a permanent way to promote weight loss and improve comorbidities in obese individuals. Other surgical procedures have not suggested the same amount of weight loss, long term maintenance, and health outcomes that RYGBS has. This surgical procedure is performed increasingly by surgeons, and more obese individuals are turning to the surgery as a last hope after diet and exercise, behavioral intervention, and medication has not been effective. For the following chapters, nutritional recommendations for weight loss surgery will concentrate on RYGB surgery. The role of the Registered Dietitian before and after RYGB surgery, as well as guidelines for nutrition care are summarized below.

Chapter 4

Nutritional Concerns Pre- and Post- Roux–en–Y Gastric Bypass

Surgery

There are many nutritional concerns for patients undergoing gastric bypass surgery. This section will concentrate on the concerns and recommendations for Roux en Y only. The nutritional status of patients prior to surgery is critical to continued good health post-surgery.

Pre-operative testing is recommended to identify pre-existing nutrition deficiencies that may be exacerbated by surgery. In a retrospective review of 379 who were undergoing RYGB between August 2002 and February 2004 from a computerized database Flancbaum (13) examined various pre-operative nutritional deficiencies. Significant pre-operative deficiencies for Iron (43.9%), ferritin (8.4%), hemoglobin (22%), thiamin (29%), and 25 OH Vitamin D (68.1%) were reported. Though a possible deficiency post-operatively, B12 levels were usually normal prior to surgery. Correction of deficient nutrients prior to surgery is ideal, as these deficiencies may be more exacerbated by the surgery and become difficult to correct after surgery due to malabsorption issues.

Post-operative macro- and micro-nutrient deficiencies have also been reported (6,18,24) and are described below.

4. 1 Macronutrients:Post-operative Deficiencies

Protein - Protein deficiencies may be caused by a reduction in absorption, intake deficiency related to aversion of meat, protein intolerance or difficulty chewing, decreased enzyme secretion of pepsinogen and pancreatic enzymes, and/or reduced contact time with digestive enzymes and decreased protein bolus. (6). Though protein deficiencies are rare, prevention and nutritional follow up is essential to forestall deterioration of health, muscle weakness, loss of muscle mass, anomalies of skin, mucosa, and nails, and edema.

Carbohydrates - After RYGB, carbohydrate digestion is altered. Polysaccharides pass through the gastric pouch intact, reaching pancreatic amylase after the jejunum-jejunal anastomoses, breaking down to oligosaccharides, which are absorbed in the remaining portion of the intestine. The reduction in dietary absorption stems from the decreased absorption surface, decreased pancreatic enzyme secretion, and limited interaction between the polysaccharide and amylase. This process creates malabsorption, leading to decreased absorption of calories, vitamins, and minerals.

Lipids - More research is needed on the altered metabolism of lipids after RYGB. Biliary salts and lipolytic enzymes are decreased, and since lipids pass directly into the jejunum, there is a decrease in lipid absorption due to the decreased hydrolysis. Lipid deficiencies have not been reported in literature. However, lipid intake and absorption are of concern for the long term, as fat soluble vitamins may become deficient if not adequately supplemented.

4.2 Micronutrients: Vitamins Post-operative Deficiencies

Water-Soluble Vitamins - Thiamin (Vitamin B1) is usually absorbed in the duodenum, making deficiencies attributable to decreased gastric acid secretion and decreased intake of food sources such as pork, cereal, fish, eggs, fruits, vegetables, and dairy products. The average prevalence is 1% at the end of year one (6). Excessive vomiting increases risk of deficiency, which can lead to polyneuropathy and Wernicke's encephalopathy. Administration of 50 – 100mg parenteral B1 is shown to correct the deficit. Flancbaum et al (13) recommended peri-operative replacement of B1 100mg intramuscularly.

The average prevalence of B9 (folate) deficiency is 20% at the end of year one (6) deficiencies are usually due to a decreased dietary intake of fruits and vegetables, as folate is absorbed in the intestine rather than due to malabsorption of folate. Individuals should ensure they are taking a multivitamin with folic acid, and those of childbearing age may need to take additional supplementation to prevent birth defects associated with deficiency of folic acid.

B12 is primarily absorbed in the terminal ileum. For B12 to be absorbed, the parietal cells in the stomach produce intrinsic factor that must be linked to B12 and cleaved in the presence of hydrochloric acid and pepsin in the distal stomach and duodenum (13). Without intrinsic factor B12 absorption is markedly decreased. B12 deficiency is present in only about 25% of post-operative patients in the first two years (22) most likely due to adequate body reserves prior to surgery. B12 is one of the few water soluble vitamins that is stored in the body. After two years post-operatively, once

body reserves are depleted, an increased incidence of B12 deficiency (36-70%) is observed (1,7,16,30). Earlier deficits are possible in patients who have RYGB performed after having prior bariatric surgery. Consequences of B12 deficiency include severe and irreversible brain and central nervous system damage, especially if treatment is not initiated promptly. As the deficiency has been found in a significant amount of patients and has severe consequences, physicians and other health care professionals should be aware of signs and symptoms (including loss of feeling in extremities, irritability, fatigue, depression) and provide immediate treatment.

Lipid-Soluble Vitamins - Lipid soluble vitamins A, E, and K do not appear to be significantly affected in relation to RYGB, despite poor lipid absorption. Lipid soluble vitamins are stored in the body and deficiency may take years to manifest. Patients on anticoagulants who need to monitor intake of Vitamin K rich food, should be monitored for K deficiency.

Lipid soluble vitamin D may occur in some patients due to lipid malabsorption in the duodenum and jejunum. As vitamin D and calcium work together to promote health bone mass, deficiencies may lead to accelerated bone loss and increased fracture rates. These deficiencies can also lead to hyperparathyroidism and eventually osteomalacia, especially in post-menopausal women. Further research is needed to determine dosage requirements to avoid decreased bone mass. It is essential that calcium, phosphorus, parathyroid hormone (PTH), alkaline phosphatase, and 25 OH Vitamin D be monitored after RYGB.

4.3 Micronutrients: Minerals Post-operative Deficiencies

Calcium deficiencies have been shown in RYGB patients and are usually due to decreased dietary intake, possible lactose intolerance, and decreased absorption (which usually occurs in duodenum and proximal jejunum). Potassium deficiencies can be seen in patients on diuretics. These deficiencies are corrected with oral supplementation.

Iron deficiency is most likely caused by decrease dietary intake of red meat. The decreased level of hydrochloric acid in the stomach also lowers transformation of ferric iron (from plant products) to ferrous iron (absorbable form), further decreasing the absorption of iron from plant foods (legumes, certain vegetables and whole or enriched grain products). Iron deficiency is present in an average of 33% of patients after RYGB, with more than 50% of deficiencies in women of childbearing age. Women of childbearing age are at a higher risk for iron deficiency due to blood loss during menstruation. Iron deficiency is easily corrected with oral supplementation.

Other minerals may also be at risk with weight loss surgery, but the field is still at its infancy and few have been examined in depth. More research is needed to investigate potential Zinc, Selenium and Magnesium deficiencies.

Chapter 5

Nutrition Recommendations Pre- and Post- Roux-en-Y Gastric Bypass

Surgery

The Registered Dietitian (RD) plays an important role in the interdisciplinary team before and after weight loss surgery is performed. The RD is responsible for providing patients with accurate nutrition information to improve nutritional status, develop positive eating habits and lifestyle changes to promote positive outcomes, and improve nutrition-related comorbidities by enhancing diet quality. The RD will participate in the patients' care by documenting appropriate nutrition information (anthropometrics, diet history), encouraging dietary compliance, providing recommendations to improve eating habits and nutrition quality, and continual assessment, monitoring, and evaluation of nutritional status and interventions.

5.1 Pre-surgical guidelines

Weight loss prior to surgery is recommended and mandated by some insurance companies. Weight loss may decrease the risk of surgical complications and may lead to earlier behavior changes, such as decreased caloric intake, improved dietary quality, and portion control (5). Biochemical data should be reviewed to identify existing deficiencies, and addressed prior to surgery to improve outcomes. Patients should be counseled on diet guidelines (see below), and barriers to adherence should be identified and addressed. The RD assessment should be discussed with the interdisciplinary team prior to surgery.

The RD should work with the patient to develop a realistic weight loss plan that facilitates behavior change. Each plan should be individually tailored to the patient and interventions should be monitored and updated as indicated. Total ideal weight loss is dependent upon the time frame prior to surgery, with a goal of one to two pounds per week. The RD should encourage the patient to contact him/her with any nutrition-related questions or concerns prior to surgery.

Eight weeks prior to surgery, the client should discuss immediate pre-operative recommendations with his/her surgeon. The surgeon may recommend a full liquid diet for a time frame of two to six weeks prior to surgery date, and/or a clear liquid diet for a time frame of three to one day prior to surgery date to promote further weight loss and prepare for surgery.

5.2 Post-Surgical Guidelines

To date, there are no standardized diet guidelines for post-surgical clients. Facilities currently utilize diet instruction set forth in written material developed by the interdisciplinary team at each institution. The diet recommendations below are created based on professional opinion after extensive review of literature, existing post-operative bariatric diet information, and experience. The recommendations are separated into two sections: Diet concerns and nutrition concerns.

Table 7: Post-Operative Diet Guideline Summary

Time (weeks)	Stage	Diet Summary
1-2 weeks	I	<ul style="list-style-type: none"> • <i>In hospital (initial 3 – 5 days):</i> sips of liquids (water, diluted juice, broth) as tolerated • <i>Home:</i> Protein shakes three times/day, sips water between meals*
3 – 8 weeks	II	<ul style="list-style-type: none"> • Slowly increase to 4 tablespoons soft proteins (eggs, tofu, fat-free cottage cheese, yogurt) as tolerated; • add soft fruit (applesauce, canned peaches, canned pears, seedless watermelon) as tolerated; • add soft vegetables (potatoes, carrots, seedless squash, pumpkin) as tolerated. • total volume not to exceed ½ cup; • maintain 4 tbsp protein; • chew food until pureed in mouth prior to swallow. • Sips of water between meals*
8 weeks +	III	<ul style="list-style-type: none"> • Regular consistency, high protein, low fat, low sugar diet with limited portions (1/2 cup). • Food items introduced as tolerated. • May try ground beef, chicken, fish, pork. • Maintain 4 Tbsp protein. • Chew food until pureed in mouth. • Sips of water between meals*

**Water is the preferred beverage, however products with artificial sweetener (Splenda, etc), diluted juice, and low fat beverages (fat free milk) may be used to supplement.*

Post-Surgical Dietary Concerns

Post-surgery, the patient should not consume anything by mouth until the Gastrografin (a high osmolality, soluble contrast material known as meglumine diatrizoate) swallow is performed to ensure there is no leakage or blockages.

Once test results are confirmed, Stage I diet is initiated. The Bariatric Stage I diet includes water, low sodium/low fat broth and low sugar/sugar free juices. The patient is directed to sip slowly on water (or other approved liquids) without gulping. Gulping leads to an excess of air/fluid that fills the small pouch and causes discomfort. The appropriate amount to sip is approximately one ounce per 30-60 minutes.

Once patients are discharged from the hospital, usually 2-5 days after surgery, they may begin a full liquid diet (limited to protein shakes) for 2 weeks, with clear, low sugar, low fat liquids between meals. Protein Shakes selected should have more than 15 grams of protein per 8 ounces and less than 10 grams of sugar and fat per 8 ounces, and may be powdered or ready made. The protein shake should be consumed slowly, approximately 4 ounces over half an hour to begin. The patient is to stop drinking when fullness is achieved. No solid or pureed food should be consumed during this time to ensure minimal caloric intake to expedite weight loss and produce minimal pressure on the healing sites.

When given clearance by the surgeon, the patient may advance to Stage II Diet which allows the introduction of soft/pureed food into the diet. Protein should be consumed first, to ensure the patient is consuming adequate amounts of the macronutrient. Soft proteins include tofu, eggs, fat-free cottage cheese, and fat free yogurt. Up to 4 tablespoons of high protein foods may be consumed per meal. Once high

protein foods are tolerated, soft fruits and cooked vegetables may be introduced. Soft fruits include applesauce, canned peaches in their own juice, canned pears in their own juice, and seedless watermelon. Soft vegetables include potatoes, carrots, seedless squash, and pumpkin. Up to 4 tablespoons of fruits and vegetables (combined) may be consumed per meal after completing 4 tablespoons of protein. Meals are not to exceed half of a cup. Hydration must be maintained with water and low-sugar, low-fat beverages. The fluid goal should be 64 ounces per day. Fluids are to be consumed between meals, with no beverages consumed an hour prior to a meal and an hour after meals. This stage may last six weeks to three months, depending on how the patient tolerates the feedings.

After healing has occurred, approximately eight weeks after surgery, the patient is advanced to Stage III Diet. Stage III Diet is a regular consistency, high protein, low-fat, low-sugar diet with small portions. Three meals per day should be consumed as tolerated, with one high protein snack if needed. Meals should continue to be approximately ½ cup and consist of four tablespoons of protein and two tablespoon of vegetables, fruits, and/or carbohydrate. Low sugar, low fat beverages must continue to be consumed between meals (no beverages one hour before and one hour after meals), with a fluid goal of 64 ounces.

A chewable multivitamin and calcium supplement, as directed by the surgeon, should be consumed daily. Patients are advised against chewing gum (causes blockage), drinking caffeinated (results in dehydration) or carbonated (leads to excess gas) beverages, and against consuming high sugar and/or high fat foods (provide excess calories with no nutritive value). The post-surgical bariatric diet poses some challenges to patients who are unable or unwilling to follow the prescribed guidelines of the

restrictive diet described above. When patients do not follow the guidelines, nutritional complications may develop. The following section will discuss the nutrition concerns after surgery.

Post-Surgical Nutritional Concerns

Several nutritional complications are of concern for the RYGB patient and are discussed in this section.

Hydration status – Patients may indicate difficulty consuming adequate liquid, related to the increased length of time it takes to consume liquid and limited beverage choices. Constipation may also indicate inadequate fluid intake. Patients are advised not to consume caffeinated beverages to reduce risk of dehydration. The RD should assess fluid intake as concerns arise.

Food Tolerance – Patients commonly report intolerance to various food items. Nutritional causes include eating or drinking too quickly, not chewing food adequately, and/or eating or drinking too much. Food may get stuck, and the client would feel the discomfort and regurgitate the food item. Food that gets stuck is usually not chewed well enough prior to swallowing. Dry meats, such as beef, chicken, and turkey, are most commonly identified as intolerable foods. Gum is not to be chewed, if swallowed, may produce a blockage. Continual education should be provided to chew foods well, eat and drink slowly, and monitor portions.

Flatulence/Eructation – Patients who consume carbonated beverages, chew gum, or chew with an open mouth may allow excess air into the body, increasing the risk for flatulence and/or eructation.

Diarrhea – Loose stools have been reported by RYGB patients and may be caused by lactose intolerance or dumping syndrome. Dumping syndrome is a food intolerance caused by consumption of concentrated sweets and sugars (candy, chocolate, high sugar beverage, ice cream, etc). Dumping syndrome can occur in varying severities, depending upon the patient, and may happen over the initial year or permanently. One may never experience dumping while one may with a small amount of sugar have severe symptoms. Symptoms of dumping syndrome include sweating, rapid heart rate, dizziness, shaking, and many times severe diarrhea. These symptoms are caused by rapid fluid shifts from the blood to the intestine as undigested food passes rapidly through the GI tract. The experience is unpleasant enough that it may act as a motivator for patients to make more appropriate food choices. Natural sugars are usually well tolerated, unlike concentrated sweets to which patients exhibit different tolerance thresholds.

Protein Status – Patients are encouraged to consume adequate protein to maintain lean body mass, prevent hair loss, and meet macronutrient needs (60 – 80 mg/day). As indicated in the diet recommendations above, protein should be consumed first at every meal.

Vitamin/Mineral Status - a chewable multivitamin should be taken daily, as nutrients are unable to be obtained in adequate amounts with decreased intake. The multivitamin should contain adequate iron (ferrous form – fumarate or sulfate). Calcium supplements in the form of calcium citrate should also be taken daily, however if a chewable calcium caltrate must be taken initially due to availability, a citrate form should be used long term due to improved absorption. Continued monitoring of vitamin and

mineral biomarkers should occur, especially long term as many deficiencies don't manifest until several years post-operatively.

Adherence – Patients should continue to follow-up with the RD to promote healthy eating habits, prevent relapse, and attain/maintain weight loss goals. Patients may experience weight regain, and the issue may be identified and addressed prior to the client completely returning to previous eating patterns. Snacking is undesirable because it may lead to excessive calorie intake, causing inadequate weight loss and/or weight gain

The post-surgical diet is intense, and entails many modifications to the patient's current dietary regime. With continued monitoring and evaluation by the RD, the patients outcomes will improve, and weight loss goals will be achieved.

Chapter 6

Summary

Average weight loss with diet programs, which include dieting, physical activity, and behavior modification have minimal weight loss effects. Medications also produce limited amounts of weight loss, and no long term studies on their effectiveness are available. Gastric bypass surgery, such as the Roux-en-Y, has been shown in many studies to be effective in weight loss and to improve disease states associated with obesity.

Bariatric surgery appears to be the most effective treatment available for weight loss in the morbidly obese population. The surgery is a tool to help patients adapt to a healthy nutritional lifestyle. There is a need for standardized nutrition protocols and increased long term research, as evidenced by this literature review.

Gastric bypass surgery requires strict adherence to the diet plan to achieve optimal results. When the patient follows the diet as indicated, disease can be resolved, and long term weight loss can be achieved. Prevention remains key, however we have identified a new, effective treatment method that will change many lives.

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