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Dietary and psych predictors of weight loss after gastric bypass

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Abstract

Background: Identifying severely obese patients who will succeed after bariatric surgery remains challenging. Although numerous studies have attempted to identify preoperative patient characteristics associated with weight loss, the roles of many dietary and psychological characteristics are unclear. The purpose of this study was to examine preoperative dietary and psychological predictors of successful weight loss after bariatric surgery.

Materials and methods: This retrospective cohort study included all patients who underwent laparoscopic Roux-en-Y gastric bypass from September 2011–June 2013 at a single institution ($n = 124$). Patient demographics, comorbidities, dietary and psychological factors, and weight loss outcomes were extracted from the electronic medical record. Bivariate associations between these factors and successful weight loss ($>50\%$ excess body weight) were examined. Factors significant at $P < 0.1$ were included in a multivariate logistic regression model.

Results: On bivariate analysis, absence of either type 2 diabetes or hypertension, preoperative weight <270 lbs, no intentional past weight loss >50 lbs, no previous purging or family history of obesity, and no soda consumption preoperatively were associated with successful weight loss ($P < 0.1$). On multivariate analysis, successful weight loss was inversely associated with the presence of type 2 diabetes (odds ratio [OR], 0.22, 95% confidence interval [CI], 0.06–0.73), maximum intentional past weight loss >50 lbs (OR, 0.12 [95% CI, 0.04 – 0.43]), and decreasing soda consumption by $>50\%$ (OR, 0.27 [95% CI, 0.08 – 0.99]).

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Disclosure

The authors report no proprietary or commercial interest in any product mentioned or concept discussed in this article.

Conclusions: Patients with type 2 diabetes mellitus, significant previous weight loss, and poor soda consumption habits are more likely to experience suboptimal weight loss after bariatric surgery. Additional preoperative counseling and close postoperative follow-up is warranted for these patients.

Keywords

Bariatric surgery; Roux-en-Y gastric bypass; Health services research

1. Introduction

Bariatric surgery provides significant health benefits and can vastly improve a patient's long-term health [1]. It reduces excess body weight by 50%–80%, resolves obesity-related comorbidities in most patients, improves overall quality of life, and extends lifespan [1–5]. Given these benefits, bariatric surgery is a routinely sought-out treatment option among severely obese patients in the United States. Nearly 180,000 bariatric operations were performed in 2013 [6].

Despite the generally favorable effects on weight loss for patients who undergo bariatric surgery, there is variability in individual response. Previous studies have found that younger age, male gender, lower preoperative weight and body mass index (BMI), and single marital status are associated with greater postoperative weight loss [7–13]. However, the critical dietary and psychological characteristics remain unclear. For example, binge eating, anxiety, and depression have been associated with suboptimal weight loss after bariatric surgery in some studies while others have found them to be positive predictors of successful weight loss [8,10,14–18]. Several others have concluded they have no effect on postoperative weight loss [9,19–22].

Given that most of these reports focused on either socioeconomic, dietary, or psychological characteristics, we sought to investigate each of these domains simultaneously to determine which factors predicted successful weight loss (defined as 50% excess body weight loss [% EBWL]) 1 y after bariatric surgery. This approach provided an opportunity to adjust for potential confounders in each of the critical domains that comprise the preoperative bariatric surgery evaluation. Dietary characteristics included current eating habits and previous dieting attempts, whereas psychological characteristics addressed each patient's mental health history and the health psychologist's initial recommendation regarding the patient's candidacy for surgery. To investigate these factors, we performed a single-institution, retrospective review of severely obese patients undergoing laparoscopic Roux-en-Y gastric bypass.

2. Materials and methods

2.1. Study population

All patients who underwent laparoscopic Roux-en-Y gastric bypass from September 1, 2011–June 1, 2013 at the University of Wisconsin Hospital and Clinics were identified using University of Wisconsin Hospital and Clinics Department of Surgery billing data. Patients

who underwent a sleeve gastrectomy, laparoscopic adjustable gastric banding, or revisional bariatric surgery were excluded. A retrospective review was then conducted using data collected from the electronic medical record (Epic, Verona, WI). Approval from the Health Sciences Institutional Review Board at the University of Wisconsin–Madison was obtained before data collection.

2.2. Patient demographics, obesity-related comorbidities, and weight-related characteristics

Age, race, gender, marital status, work status, highest education achieved, living situation (alone or with someone), and smoking history were obtained from nutritionist and health psychologist preoperative assessments. Six obesity-related comorbidities were obtained from the anesthesia visit on the day of surgery and confirmed with the surgeon's preoperative history and physical, including type 2 diabetes mellitus, hypertension, obstructive sleep apnea, gastroesophageal reflux disease, hyperlipidemia, and coronary artery disease. Five weight-related characteristics were measured as follows: preoperative BMI and weight, which were collected from the anesthesia visit on the day of surgery; family history of obesity, childhood obesity, and maximum past weight loss (greatest amount of weight lost in a previous attempt) were obtained from the preoperative nutritional assessment. Inclusion of each demographic and weight-related characteristic in the analysis was based either on our literature search (i.e., preoperative weight, BMI, maximum past weight loss) or *a priori* hypothesis (i.e., demographics, family history, childhood obesity) that the characteristic was associated with weight loss after gastric bypass. The six obesity-related comorbidities were selected because, in our program, they are typically the most clinically relevant comorbidities when decisions are made about who is an appropriate candidate for gastric bypass surgery.

2.3. Dietary characteristics

Seven dietary variables were collected from the nutritionist's preoperative assessment and the obesity questionnaire that all patients completed on entry into our bariatric surgery program. Patient-reported variables included a history of binge eating (eating an amount of food that is excessive compared with what most people would eat in similar circumstances that may be associated with a sense of lack of control eating during the episode), night eating habits (limited daily eating with concurrent eating of >25% of daily calories after the evening meal), a history of purging (self-induced vomiting or misuse of laxatives, diuretics, or enemas), emotional eating (eating in response to typically negative emotions when not physically hungry) [23–25]. Yo-yo dieting was identified if the patients reported they had lost and regained 20 pounds on two or more occasions or if reported by the nutritionist in their preoperative assessment. A "regular eating pattern" was assigned by the nutritionist if the patient indicated he or she ate a balanced three meals daily on average and refrained from erratic meal times or skipping meals. Soda consumption was categorized as nondrinkers (never consumed soda or had quit by the time of preoperative assessment and surgery date), decreased drinkers (had reduced their daily soda intake >50%), or unchanged drinkers (had not decreased their soda consumption by the time of the preoperative assessment).

2.4. Psychological characteristics

Eight psychological variables were identified and collected from the electronic medical record, including a history of posttraumatic stress disorder (experiencing persistent anxiety, fear, helplessness, recollections, and/or flashbacks after a traumatic event), bipolar personality disorder (experiencing potentially numerous periods of manic, hypomanic, and/or major depressive episodes), past or current mental health counseling, a family history of any mental health disorders, and prior suicide attempts or psychiatric hospitalizations [25]. The Beck Depression Inventory (BDI-II) was administered by our health psychologist to assess patients' depressive symptoms before surgery. The BDI-II is a widely validated instrument consisting of 21 questions that assess the occurrence and severity of depression symptoms [26,27]. Each patient's BDI-II score was converted into a percentile rank to more easily compare the degree of depressive symptoms between patients. Similarly, the State-Trait Anxiety Inventory was used to assess "trait" anxiety or the magnitude of a patient's ongoing, chronic feeling of anxiety recorded as a percentile rank before surgery [28]. The health psychologist's initial recommendation regarding the patient's candidacy for surgery was recorded. Patients who were described by the psychologist as "fair," "questionable," or "needs further preparation" candidates were placed into the "initial reservation" group. Surgical candidates described as "reasonable," "potential," or "appropriate" candidates were placed in the "acceptable" group by our research team, whereas "solid," "good," or "very good" patients were considered "good" surgical candidates in our analysis.

2.5. Weight loss

The 1-y (± 3 mo) postoperative visit with the bariatric surgeon was used to obtain each patient's postoperative weight. This weight was subtracted from the patient's weight on the day of surgery to calculate 1-y weight loss. Successful weight loss was defined as % EBWL of 50% at 1-y follow-up.

2.6. Statistical analysis

Continuous variables were dichotomized at the medians with the exception of age, which was divided into terciles. To assess the relationship between patient preoperative characteristics and successful weight loss (a dichotomous outcome), logistic regressions were performed. Variables with less than 10% missing data, which were significant at $P < 0.1$ in bivariate models, were entered into an adjusted model to assess, which preoperative characteristics were independently associated with weight loss success. All data were analyzed using SAS version 9.3 (SAS Institute, Cary, NC). The study protocol was approved by the Health Sciences Institutional Review Board of the University of Wisconsin.

3. Results

3.1. Patient characteristics

A total of 124 patients underwent laparoscopic Roux-en-Y gastric bypass as their primary bariatric procedure for severe obesity during the study interval. Twenty-two percent ($n = 27$) of patients were lost to 1-y follow-up including one patient who died before their annual visit. These patients were excluded from our subsequent analyses because our primary

outcome (% EBWL 50% at 1-y follow-up) was not available. The remaining 78% ($n = 97$) were included in analyses. The mean preoperative weight and BMI were 278 ± 56 lbs and 45 ± 7 kg/m², respectively. Patients were predominantly female (83%) with a mean age of 49 (± 12 y). Eleven percent were nonwhite (Table 1). Most patients had obstructive sleep apnea (76%), hypertension (75%), gastroesophageal reflux disease (56%), type 2 diabetes (56%), or hyperlipidemia (56%).

3.2. Weight loss

At 1-y follow-up, % EBWL was an average of 59.7% ($\pm 20.2\%$). A majority of 67 patients (69%) had successful weight loss outcomes with a mean % EBWL of 69.0% ($\pm 16.6\%$) and an absolute 1-y weight loss mean of 88 lbs. The remaining 30 (31%) patients had a mean % EBWL of only 39.0% ($\pm 9.4\%$) and an absolute 1-y weight loss mean of 59.5 lbs.

3.3. Bivariate associations between demographic, comorbid and weight-related predictors, and successful weight loss

Table 2 characterizes patient demographics, obesity-related comorbidities, and weight-related characteristics as predictors of weight loss success on bivariate analyses. There were no statistically significant differences in age, gender, race, marital status, highest education achieved, work status, living situation, or smoking history between patients who were successful or unsuccessful with weight loss. Of the obesity-related comorbidities, presence of either type 2 diabetes (odds ratio [OR], 0.33, 95% confidence interval [CI], 0.13–0.85) or hypertension (OR, 0.36 [0.11–1.17]) was inversely associated with successful weight loss. Three weight-related characteristics were inversely associated with weight loss success at a P value of < 0.1 , including preoperative weight > 270 lbs (OR, 0.47 [95% CI, 0.19–1.14]), preoperative weight loss > 50 lbs (OR, 0.16 [95% CI, 0.06–0.46]), and a family history of obesity (OR, 0.17 [95% CI 0.02–1.39]).

3.3.1. Bivariate associations between dietary and psychological predictors and successful weight loss—Of the dietary predictors, only soda consumption habits were associated with weight loss success in bivariate analyses. Compared to patients who did not drink soda preoperatively or stopped by the date of surgery, patients who decreased soda consumption by $> 50\%$ before surgery were less likely to be successful (OR, 0.28 [95% CI, 0.09–0.85] for weight loss success) as were patients who decreased consumption by $< 50\%$ (OR, 0.32 [0.11–0.96] for weight loss success). None of the psychological variables in our bivariate analysis were associated with weight loss success (Table 3).

3.3.2. Multivariate analysis—Seven variables were significant at a P value of < 0.1 on bivariate analyses. Two of these variables were excluded from the multivariate model: “Previous purging” had two cells with extremely small numbers (4 patients with a purging history: 1 successful, 3 suboptimal) and thus wide CIs. “Family history of obesity” was excluded due to excessive missing data (30%). Five variables were thus included in the multivariable logistic regression. Of these variables, successful weight loss was inversely associated with the presence of type 2 diabetes (OR, 0.22 [95% CI, 0.06–0.73]), maximum past weight loss > 50 lbs (OR, 0.12 [95% CI, 0.04–0.43]), and decreasing soda consumption by $> 50\%$ (OR, 0.27 [95% CI, 0.08–0.99]; Table 4).

4. Discussion

This study investigated the prognostic value of preoperative dietary and psychological factors in predicting weight loss success at 1-y follow-up for severely obese patients undergoing laparoscopic Roux-en-Y gastric bypass. After accounting for confounders, the presence of type 2 diabetes mellitus, intentional past weight loss >50 pounds, and poor soda consumption habits were inversely associated with successful weight loss, defined as losing at least 50% of excess body weight.

Our finding that the presence of preoperative type 2 diabetes is independently, inversely associated with suboptimal weight loss outcomes supports the findings from previous investigators. Melton *et al.* [10] concluded that type 2 diabetic patients were three times more likely to experience suboptimal weight loss compared with nondiabetic patients undergoing Roux-en-Y gastric bypass. Campos *et al.* [13] concluded the presence of type 2 diabetes was independently associated with suboptimal weight loss on multivariate analysis, with diabetics having a three times higher likelihood of experiencing unsuccessful weight loss. Carbonell *et al.* found that among diabetic patients undergoing laparoscopic Roux-en-Y gastric bypass, those on insulin lost the least amount of weight after 1 y (57.5% EBWL), followed by diabetic patients treated with oral hypoglycemic medications (60.5%) and patients with diet-controlled diabetes mellitus (63.5%). Nondiabetics had the greatest weight loss at 1-y follow-up (67.6%) [29].

Diabetic patients who continue to require exogenous insulin after bariatric surgery may experience less weight loss due to the anabolic effects of insulin, which promotes lipogenesis and muscle synthesis [13]. Coupaye *et al.* [30] noted that most oral hypoglycemic medications raise circulating insulin levels and thus promote its anabolic effects. Given that insulin may contribute to suboptimal weight loss in diabetics, this patient cohort deserves close monitoring from the bariatric team during the postoperative phase. Although bariatric surgery remains the most effective treatment for severely obese, type 2 diabetics, identifying strategies to improve and maintain weight loss in these patients should be a goal of future studies. Both remission and relapse rates for type 2 diabetes after bariatric surgery seem to be closely correlated with weight loss and weight regain [31,32].

Our finding that a past maximum weight loss >50 pounds independently predicted % EBWL of less than 50% seems somewhat counterintuitive. One might expect patients who were successful with nonsurgical weight loss to also lose more weight after bariatric surgery. We suspect that patients with greater previous weight loss attempts may have been more likely to experience less than 50% EBWL because they were, on average, 30 pounds heavier (which correlated with an average BMI that was three points higher). Thus, they had more weight to lose to meet the 50% threshold. In contrast to our findings, previous studies have not found this to be the case. In their study of 384 patients who collectively averaged a 46.6 ± 31.2 pounds in prior maximum weight loss attempts, Jantz *et al.* [33] found no correlation between a patient's maximum past weight loss and losing 50% EBWL at 1-, 2-, and 4-y follow-up. Jantz concluded that a bariatric patient's weight loss history held little value in predicting successful weight loss postoperatively.

Patients who did not drink soda preoperatively or quit by the surgery date were more likely to experience successful weight loss compared with those who drank soda preoperatively and were not able to quit. Given that all soda drinkers were counseled by our dietitians to quit soda consumption preoperatively, this variable may be a proxy for postoperative dietary compliance. Those who were unable to quit soda consumption preoperatively may have been less likely to comply with our dietary recommendations postoperatively. Furthermore, given that consuming liquid carbohydrates such as soda leads to poorer satiety compared with eating solid foods, caloric intake may have been significantly higher in patients who continued to drink soda postoperatively [34,35]. Given these findings, cessation of soda consumption preoperatively continues to be an important part of our preoperative bariatric patient evaluation process.

Despite the lack of predictive value of the psychological variables, rigorous psychological evaluations continue to be an important component of our bariatric surgery program. Approximately 10%–20% of our patients who are evaluated by our multidisciplinary team (bariatric surgeon, nutritionist, and health psychologist) are deemed to be poor candidates for bariatric surgery and are not offered bariatric surgery. These patients often have active psychological issues or substance abuse problems that compel our team to either recommend against bariatric surgery or recommend delaying it until these issues can be addressed. This cohort of patients was not included in this analysis because they did not undergo bariatric surgery. However, our study suggests that a history of psychological disorders, such as depression, anxiety, or bipolar disorder, should not be viewed as contraindication to bariatric surgery. For instance, 11 of 12 patients who had a diagnosis of bipolar disorder experienced successful weight loss. Importantly, each of these patients had a thorough evaluation by our health psychologist who felt that each patient had well-controlled symptoms at the time of surgery. If a patient was not medically optimized from a psychological standpoint, surgery was delayed until it was addressed.

Our study has several limitations. Our patient population was predominantly white thus limiting the generalizability of our findings. We did not investigate outcomes following other types of bariatric surgery, including vertical sleeve gastrectomy or adjustable gastric banding. Our results are not generalizable to those populations. Additionally, the 22% of patients who did not follow up were likely not randomly distributed and thus our findings may be biased. However, our 1-y follow-up rate is similar to what other investigators have recently published [36]. Furthermore, the selection of 50% EBWL as an indicator of bariatric surgery success is an imperfect proxy for what many patients value most: comorbidity resolution and quality of life. However, previous authors have used this approach, and we felt it was a reasonable marker for success [8,9].

5. Conclusions

Of the 15 dietary and psychological characteristics investigated, only soda consumption predicted weight loss success after laparoscopic Roux-en-Y gastric bypass. Assessments of dietary habits and psychological histories by our multidisciplinary team continue to be a critical part of our preoperative evaluation process given their importance in identifying patients who may be poor candidates for bariatric surgery. Identifying strategies to improve

weight loss after bariatric surgery for patients with type 2 diabetes should be a goal of future studies.

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REFERENCES

- [1]. Schauer PR, Ikramuddin S, Gourash W, Ramanathan R, Luketich J. Outcomes after laparoscopic Roux-en-Y gastric bypass for morbid obesity. *Ann Surg* 2000;232:515. [PubMed: 10998650]
- [2]. Christou NV, Sampalis JS, Liberman M, et al. Surgery decreases long-term mortality, morbidity, and health care use in morbidly obese patients. *Ann Surg* 2004;240:416 discussion 423–4. [PubMed: 15319713]
- [3]. Adams TD, Gress RE, Smith SC, et al. Long-term mortality after gastric bypass surgery. *N Engl J Med* 2007;357:753. [PubMed: 17715409]
- [4]. Buchwald H, Avidor Y, Braunwald E, et al. Bariatric surgery: a systematic review and meta-analysis. *JAMA* 2004;292:1724. [PubMed: 15479938]
- [5]. Chang SH, Stoll CR, Song J, et al. The effectiveness and risks of bariatric surgery: an updated systematic review and meta-analysis, 2003–2012. *JAMA Surg* 2014;149:275. [PubMed: 24352617]
- [6]. American Society for Metabolic and Bariatric Surgery. Estimate of bariatric surgery numbers. 2014; Available from: <https://asmbs.org/resources/estimate-of-bariatric-surgery-numbers>. Accessed August 10, 2014.
- [7]. Lutfi R, Torquati A, Sekhar N, Richards WO. Predictors of success after laparoscopic gastric bypass: a multivariate analysis of socioeconomic factors. *Surg Endosc* 2006;20:864. [PubMed: 16738971]
- [8]. Livhits M, Mercado C, Yermilov I, et al. Behavioral factors associated with successful weight loss after gastric bypass. *Am Surg* 2010;76:1139. [PubMed: 21105629]
- [9]. Ma Y, Pagoto SL, Olendzki BC, et al. Predictors of weight status following laparoscopic gastric bypass. *Obes Surg* 2006;16:1227. [PubMed: 16989709]
- [10]. Melton GB, Steele KE, Schweitzer MA, Lidor AO, Magnuson TH. Suboptimal weight loss after gastric bypass surgery: correlation of demographics, comorbidities, and insurance status with outcomes. *J Gastrointest Surg* 2008;12:250. [PubMed: 18071836]
- [11]. Chen EY, McCloskey MS, Doyle P, et al. Body mass index as a predictor of 1-year outcome in gastric bypass surgery. *Obes Surg* 2009;19:1240. [PubMed: 18839077]
- [12]. Hatoum IJ, Stein HK, Merrifield BF, Kaplan LM. Capacity for physical activity predicts weight loss after Roux-en-Y gastric bypass. *Obesity (Silver Spring)* 2009;17:92. [PubMed: 18997674]
- [13]. Campos GM, Rabl C, Mulligan K, et al. Factors associated with weight loss after gastric bypass. *Arch Surg* 2008;143:877 discussion 884. [PubMed: 18794426]
- [14]. Boan J, Kolotkin RL, Westman EC, McMahon RL, Grant JP. Binge eating, quality of life and physical activity improve after Roux-en-Y gastric bypass for morbid obesity. *Obes Surg* 2004;14:341. [PubMed: 15072655]
- [15]. Herpertz S, Kielmann R, Wolf AM, Hebebrand J, Senf W. Do psychosocial variables predict weight loss or mental health after obesity surgery? A systematic review. *Obes Res* 2004;12: 1554. [PubMed: 15536219]
- [16]. Kinzl JF, Schrattenecker M, Traweger C, et al. Psychosocial predictors of weight loss after bariatric surgery. *Obes Surg* 2006;16:1609. [PubMed: 17217637]
- [17]. Green AE, Dymek-Valentine M, Pytluk S, Le Grange D, Alverdy J. Psychosocial outcome of gastric bypass surgery for patients with and without binge eating. *Obes Surg* 2004;14: 975. [PubMed: 15329189]

- [18]. de Zwaan M, Enderle J, Wagner S, et al. Anxiety and depression in bariatric surgery patients: a prospective, follow-up study using structured clinical interviews. *J Affect Disord* 2011;133:61. [PubMed: 21501874]
- [19]. Jones-Corneille LR, Wadden TA, Sarwer DB, et al. Axis I psychopathology in bariatric surgery candidates with and without binge eating disorder: results of structured clinical interviews. *Obes Surg* 2012;22:389. [PubMed: 21088923]
- [20]. Livhits M, Mercado C, Yermilov I, et al. Preoperative predictors of weight loss following bariatric surgery: systematic review. *Obes Surg* 2012;22:70. [PubMed: 21833817]
- [21]. Steinmann WC, Suttmoeller K, Chitima-Matsiga R, et al. Bariatric surgery: 1-year weight loss outcomes in patients with bipolar and other psychiatric disorders. *Obes Surg* 2011;21:1323. [PubMed: 21380795]
- [22]. Alger-Mayer S, Rosati C, Polimeni JM, Malone M. Preoperative binge eating status and gastric bypass surgery: a long-term outcome study. *Obes Surg* 2009;19:139. [PubMed: 18478306]
- [23]. Colles SL, Dixon JB. Night eating syndrome: impact on bariatric surgery. *Obes Surg* 2006;16:811. [PubMed: 16839476]
- [24]. Fischer S, Chen E, Katterman S, et al. Emotional eating in a morbidly obese bariatric surgery-seeking population. *Obes Surg* 2007;17:778. [PubMed: 17879578]
- [25]. American Psychiatric Association, Diagnostic and Statistical Manual of Mental Disorders: DSM-IV-TR. Washington, DC: American Psychiatric Association; 2000.
- [26]. Hall BJ, Hood MM, Nackers LM, et al. Confirmatory factor analysis of the Beck Depression Inventory-II in bariatric surgery candidates. *Psychol Assess* 2013;25:294. [PubMed: 23088200]
- [27]. Beck AT, Steer RA, Ball R, Ranieri W. Comparison of Beck Depression Inventories-IA and -II in psychiatric outpatients. *J Pers Assess* 1996;67:588. [PubMed: 8991972]
- [28]. Julian LJ. Measures of anxiety: state-trait anxiety inventory (STAI), beck anxiety inventory (BAI), and hospital anxiety and depression scale-anxiety (HADS-A). *Arthritis Care Res (Hoboken)* 2011;63(Suppl 11):S467. [PubMed: 22588767]
- [29]. Carbonell AM, Wolfe LG, Meador JG, et al. Does diabetes affect weight loss after gastric bypass? *Surg Obes Relat Dis* 2008;4:441. [PubMed: 18065289]
- [30]. Coupaye M, Sabate JM, Castel B, et al. Predictive factors of weight loss 1 year after laparoscopic gastric bypass in obese patients. *Obes Surg* 2010;20:1671. [PubMed: 20396991]
- [31]. Arterburn DE, Bogart A, Sherwood NE, et al. A multisite study of long-term remission and relapse of type 2 diabetes mellitus following gastric bypass. *Obes Surg* 2013; 23:93. [PubMed: 23161525]
- [32]. Sjostrom L, Peltonen M, Jacobson P, et al. Association of bariatric surgery with long-term remission of type 2 diabetes and with microvascular and macrovascular complications. *JAMA* 2014;311:2297. [PubMed: 24915261]
- [33]. Jantz EJ, Larson CJ, Mathiason MA, Kallies KJ, Kothari SN. Number of weight loss attempts and maximum weight loss before Roux-en-Y laparoscopic gastric bypass surgery are not predictive of postoperative weight loss. *Surg Obes Relat Dis* 2009;5:208. [PubMed: 18996769]
- [34]. Pan A, Hu FB. Effects of carbohydrates on satiety: differences between liquid and solid food. *Curr Opin Clin Nutr Metab Care* 2011;14:385. [PubMed: 21519237]
- [35]. Pan A, Malik VS, Hao T, et al. Changes in water and beverage intake and long-term weight changes: results from three prospective cohort studies. *Int J Obes (Lond)* 2013;37:1378. [PubMed: 23318721]
- [36]. Coleman KJ, Huang YC, Hendee F, et al. Three-year weight outcomes from a bariatric surgery registry in a large integrated healthcare system. *Surg Obes Relat Dis* 2014;10:396. [PubMed: 24951065]

Table 1 –

Baseline patient characteristics.

Characteristic	%, (n)
Preoperative BMI (mean $\pm$ SD in kg/m ²)	45.2 $\pm$ 7.1
Preoperative weight (mean $\pm$ SD in lbs.)	278.4 $\pm$ 56.3
Demographics	
Mean age (range, y)	48.6 (36.7–60.5)
Caucasian	89 (86)
Female sex	83 (80)
Married	56 (54)
Lives with someone	83 (80)
College experience	72 (68)
Smoking history	57 (55)
Obesity-related comorbidities	
Type 2 diabetes	56 (54)
Hypertension	75 (73)
Obstructive sleep apnea	76 (74)
GERD	56 (54)
Hyperlipidemia	56 (54)
Coronary artery disease	8 (8)

GERD = gastroesophageal reflux disease; SD = standard deviation.

Table 2 –

Bivariate association between patient characteristics and weight loss success.

Characteristic	Successful (<i>n</i> = 67)	Suboptimal (<i>n</i> = 30)	OR (95% CI)	<i>P</i> value
Demographics				
Age (%)				
18–43	77.4	22.6	Reference	Reference
44–55	57.1	42.9	0.39 (0.13–1.14)	0.09
>55	74.2	25.8	0.84 (0.26–2.69)	0.76
Race (%)				
White	68.6	31.4	Reference	0.78
Nonwhite	72.7	27.3	1.22 (0.30–4.96)	
Gender (%)				
Female	70.0	30.0	Reference	0.67
Male	64.7	35.3	0.78 (0.26–2.37)	
Married (%)				
Yes	72.2	27.8	Reference	0.45
No	65.1	34.9	0.72 (0.30–1.71)	
Lives with someone (%)				
Yes	70.0	30.0	Reference	0.56
No	62.5	37.5	0.71 (0.23–2.19)	
Education status (%)				
Attended college	66.2	33.8	0.59 (0.21–1.66)	0.32
Did not attend college	76.9	23.1	Reference	
Work status (%)				
Currently working	67.4	32.6	Reference	Reference
Retired	80.0	20.0	1.94 (0.37–10.2)	0.43
Unemployed/disabled	67.6	32.4	1.01 (0.41–2.51)	0.98
Smoking status (%)				
Never smoked	64.3	35.7	Reference	0.37
Smoking history	72.7	27.3	1.48 (0.62–3.52)	
Obesity-related comorbidities (%)				

Characteristic	Successful (<i>n</i> = 67)	Suboptimal (<i>n</i> = 30)	OR (95% CI)	<i>P</i> value
Type 2 diabetes				
Yes	59.3	40.7	0.33 (0.13–0.85)	0.02
No	81.4	18.6	Reference	
Hypertension				
Yes	64.4	35.6	0.36 (0.11–1.17)	0.09
No	83.3	16.7	Reference	
Obstructive sleep apnea				
Yes	68.9	31.1	0.97 (0.35–2.68)	0.95
No	69.6	30.4	Reference	
GERD				
Yes	70.4	29.6	1.15 (0.48–2.72)	0.76
No	67.4	32.6	Reference	
Hyperlipidemia				
Yes	66.7	33.3	0.77 (0.32–1.86)	0.57
No	72.1	27.9	Reference	
Coronary artery disease				
Yes	50.0	50.0	0.41 (0.10–1.78)	0.24
No	70.8	29.2	Reference	
Weight-related characteristics				
Preoperative body mass index (mean, kg/m ²)				
<45	75.0	25.0	Reference	0.18
45	62.2	37.8	0.55 (0.23–1.31)	
Preoperative weight, lbs				
<270	77.1	22.9	Reference	0.09
270	61.2	38.8	0.47 (0.19–1.14)	
Family history of obesity (%)				
Yes	68.5	31.5	0.17 (0.02–1.39)	0.09
No	92.9	7.1	Reference	
Childhood obesity (%)				
Yes	64.8	35.2	0.55 (0.21–1.44)	0.22
No	77.1	22.9	Reference	

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Characteristic	Successful (<i>n</i> = 67)	Suboptimal (<i>n</i> = 30)	OR (95% CI)	<i>P</i> value
Maximum past weight loss (mean, lbs.)				
<50	86.7	13.3	Reference	<0.01
>50	51.1	48.9	0.16 (0.06–0.46)	

GERD = gastroesophageal reflux disease.

Table 3 –

Bivariate association between dietary and psychological characteristics and successful weight loss.

Characteristic	Successful (n = 67)	Suboptimal (n = 30)	OR (95% CI)	P value
Dietary characteristics				
Binge eating (%)				
Yes	68.4	31.6	0.97 (0.40–2.35)	0.96
No	69.0	31.0	Reference	
Night eating (%)				
Yes	74.4	25.6	1.63 (0.67–3.94)	0.28
No	64.2	35.9	Reference	
Previous purging (%)				
Yes	25.0	75.0	0.14 (0.01–1.39)	0.09
No	70.7	29.4	Reference	
Emotional eating (%)				
Yes	70.4	29.6	1.58 (0.51–4.94)	0.43
No	60.0	40.0	Reference	
Yo-yo dieting (%)				
Yes	64.1	35.9	0.74 (0.25–2.20)	0.58
No	70.8	29.2	Reference	
Regular eating pattern (%)				
Yes	75.0	25.0	1.80 (0.75–4.32)	0.19
No	62.5	37.5	Reference	
Soda consumption (%)				
Did not drink soda preoperatively or stopped by surgery date	81.8	18.2	Reference	Reference
Decreased soda consumption by >50% (but did not quit entirely)	56.0	44.0	0.28 (0.09–0.85)	0.02
Unchanged soda consumption habits or decreased by <50%	59.3	40.7	0.32 (0.11–0.96)	0.04
Psychological characteristics				
Posttraumatic stress disorder (%)				
Yes	80.0	20.0	1.84 (0.20–17.2)	0.59
No	68.5	31.5	Reference	
Bipolar personality disorder (%)				

Characteristic	Successful (n = 67)	Suboptimal (n = 30)	OR (95% CI)	P value
Yes	91.7	8.3	5.70 (0.70–46.3)	0.10
No	65.9	34.1	Reference	
Past or current psychiatric counseling (%)				
Yes	75.6	24.4	1.71 (0.68–4.34)	0.25
No	64.3	35.7	Reference	
Family history of mental health disorders (%)				
Yes	62.5	37.5	0.61 (0.24–1.52)	0.28
No	73.3	26.7	Reference	
Past suicidal attempt or psychiatric hospitalization (%)				
Yes	77.3	22.7	1.70 (0.56–5.14)	0.35
No	66.7	33.3	Reference	
BDI-II score (mean percentile rank)				
<79	73.1	26.9	Ref	0.75
79	78.6	21.4	1.35 (0.39–4.72)	
Trait anxiety inventory score (mean percentile rank)				
<75	69.8	30.2	Reference	1.00
75	67.4	32.6	0.90 (0.36–2.23)	
Psychologist's recommendation for surgery (%)				
Initial reservation	75.0	25.0	Reference	Reference
Acceptable	60.5	39.5	0.51 (0.09–2.88)	0.45
Good	81.1	18.9	1.43 (0.34–8.64)	0.70

BDI-II and State-Trait Anxiety Inventory scores are recorded as mean percentile ranks, indicating a patient's relative depression and anxiety score measured in percent compared with all candidates for bariatric surgery.

Table 4 –

Adjusted odds of 1-y weight loss 50% excess body weight.

Variable	Multivariable OR, (95% CI)	<i>P</i> value
Type 2 diabetes (preoperative)	0.22 (0.06–0.73)	0.01
Hypertension (preoperative)	0.75 (0.19–3.02)	0.69
Preoperative weight >270 lbs	1.15 (0.36–3.65)	0.81
Past weight loss >50 lbs	0.12 (0.04–0.43)	<0.01
Did not drink soda preoperatively or stopped by surgery date	Reference	Reference
Decreased soda consumption by >50% (but did not quit entirely)	0.27 (0.08–0.99)	0.048
Unchanged soda consumption habits or decreased by <50%	0.38 (0.10–1.38)	0.14