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Dietary, Weight, and Psychological Changes among Patients with Obesity, 8 Years after Gastric Bypass

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ABSTRACT

Background and objective Long-term data on patients with obesity outcome after bariatric surgery are lacking. The goal was to document dietary and anthropometric changes more than 5 years after surgery, as well as patients' eating behavior, psychological state, and quality of life.

Methods A cohort of 80 women (mean age 40±10 years) who underwent a Roux-en-Y gastric bypass between 1997 and 2002 were followed in a Swiss University Hospital for an average of 8±1.2 years. The primary outcome was successful weight loss defined as excess weight loss ≥50%. Body composition was measured by bioelectrical analysis, and diet was assessed via a food diary. Eating disorders, psychological factors, and quality of life were evaluated by questionnaires. Patients' perceptions of difficulties and benefits were explored using semistructured interviewing. Results at baseline and last visit were compared using paired *t* test. Cofactors' means were compared between successful and unsuccessful patients with Student *t* tests and logistic regression.

Results Average weight loss 8 years after surgery was 30.7±13.8 kg. Excess weight loss ≥50% was observed for 47 patients (59%). Between baseline and last visit, relative proportions of fat mass/total body weight decreased, and fat-free mass/total body weight increased. Mean energy intake was 2,355±775 kcal at baseline and 1,680±506 kcal at last visit, with 42% of energy from carbohydrates, 39% of energy from fats, and 19% of energy from protein (0.8 g/kg). At last visit, 41 patients (51%) described episodes of binge eating or night eating syndrome. Factors associated with excess weight loss ≥50% were: younger age at operation, greater number of psychological consultations before the operation, and higher scores on ineffectiveness and social insecurity scales at baseline.

Conclusions More than half of the patients achieved successful weight loss, but disordered eating behavior was frequent. Periodic follow-up screenings and interdisciplinary care are advised. The definition of successful outcome should take into account problematic eating behaviors.

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Obesity affects more than 250 million people around the world, according to the World Health Organization (1). Persons with superobesity, defined as those with a body mass index (BMI) >40, are the most at risk of morbidity, low quality of life, and premature death (2-5). Since the late 1990s, bariatric surgery, and more precisely Roux-en-Y gastric bypass, emerged as the best way to treat morbid obesity (6,7). Usually, the gastric bypass is created by placing three staple lines in a vertical direction, creating a small proximal gastric pouch (15 to 30 mL), with a Roux-en-Y 1-cm gastro-jejunostomy. The small size of the pouch leads to a decreased dietary intake, and the short cut of the duodenum generates nutrient malabsorption. A decreased release of grehlin has also been suggested as responsible for weight loss (8,9).

An abundance of literature supports the short- and medium-term efficacy of gastric bypass surgery in terms of weight loss (10,11), improved health outcomes (12), and quality of life (13). More recently, data reporting on long-term follow-up have been published (14,15). Maximum weight loss occurs usually 1 year after the operation. Weight regain after operation does not seem to follow a predictable pattern, as wide individual variability has been reported. Effect on body composition has not been well described yet, but it seems that both fat and lean mass decrease following bariatric surgery (15). Predictors of successful weight loss are numerous and their interaction makes it difficult to precisely evaluate their effects. However, energy intake (12), preoperative BMI and age (16,17), eating behavior (18-20), depression (21), and sleep patterns (22) seem to be associated with weight changes after bariatric surgery. Long-term data on potential predictors of weight change are scarce.

The primary aim of this study was to document weight and body composition changes among patients more than 5 years after bariatric surgery, and to assess whether dietary, behavior, or psychological factors were associated with long-term weight outcome. The secondary aim was to assess patients' point of view about long-term benefits and difficulties related to the operation. The primary hypothesis was that more favorable food patterns, physical activity, and psychological state would be associated with successful weight loss.

METHODS AND PROCEDURES

In Switzerland, bypass operation and follow-up are normally paid for by mandatory basic health insurance for patients with BMI >40, or BMI >35 with at least one associated comorbidity, when conservative approaches failed previously. Indication for surgery is set by each patient's physician. Severe personality disorders and suicidal ideation are contraindications to this operation.

Patients

All patients who underwent gastric bypass surgery between January 1997 and March 2002 at the University Hospitals of Geneva, Switzerland, and who were followed at the hospital's Service of Therapeutic Education for Chronic Diseases were eligible, unless they were pregnant or had a second surgery after 2002. Written informed consent was obtained from all patients at baseline, before entering the study. The follow-up protocol was approved by the Research Ethics Committee of University Hospitals of Geneva.

Design and Procedures

Before surgery, all candidates participated in a dietary and a psychological assessment. An experienced registered dietitian (RD) explained the postoperation diet, and helped the patient prepare for the changes, symptoms, and potential difficulties expected after surgery. A psychologist assessed and addressed eating behavior and mental state. According to the protocol, patients were followed for at least 5 years after gastric bypass. They visited the RD and the surgeon four times during the first year, and once or twice a year for the remaining 4 years. For this cohort study, two study dietitians who were not involved in the usual care of these patients extracted baseline and 1-year follow-up data from the patients' records. Then they contacted all patients by telephone and asked them to come for a final appointment.

Outcome

Outcome was expressed as successful or unsuccessful excess weight loss. Excess weight loss was computed as ([weight at baseline−weight at follow-up visit]/excess weight at baseline)×100, where "excess weight" was the difference between weight at baseline and weight corresponding to a BMI of 25. Excess weight loss ≥50% was considered as successful (23).

Sociodemographic Factors

Information about sex, age, professional activity (defined as current occupation), marital status (ie, married or living together, single or divorced, or widow), and nationality were extracted from the patients' records.

Anthropometric Measures

Patients were weighed with the same scale (SECA Cosmos, Bienne, Switzerland) to the nearest 0.1 kg, wearing light clothing, without shoes or other heavy items, at baseline, at 1 year and at the last visit. Height was measured at baseline to the nearest 1.0 cm with a scale-mounted stadiometer. One measure of weight and height were taken. BMI was calculated for baseline, 1 year after surgery and during the last visit, according to usual formula: kg/m^2. Weight loss was calculated in kilograms, BMI units, percentage of initial weight, and percentage of excess weight loss.

Body composition calculation was derived from resistance and reactance, measured by bioelectrical impedance analysis (Nutriguard-M, Data Input GmbH, Darmstadt, Germany), at baseline, 1 year, and last visit, following usual procedures (24). The average of three measures was used for calculation. Fat-free mass and fat mass were calculated according to the standard, validated formula (25). All data were adjusted to height, in conformity with standard procedures (25,26), and compared to general population data (26).

Waist and hip circumferences were measured (average of three measures) at baseline, 1 year, and last visit, according to standardized procedures, using a cloth tape. The waist was defined as the midpoint between the highest point of the iliac crest and the lowest part of the costal margin, and the hips were measured at the level of the great femoral trochanters (27).

Dietary Intake and Eating Behavior

Before the operation, patients were instructed by an RD how to record dietary intake over a 4-day period. The RD collected and verified the food diaries on the next visit and calculated energy and nutrient intake using Prodi 4.2 software (1983-2007, Nutri-science GmbH, Freiburg, Germany). The same procedure was followed 1 year postoperation and at last visit and the results were compared to the intake recommendations used in Western Switzerland (28).

Before the operation, a psychologist assessed eating

disorders, using the Eating Disorder Inventory II (EDI-II). This questionnaire was completed again by the patient 1 year after the operation and at last visit. EDI-II is a self-report measure of symptoms frequently related to anorexia nervosa or bulimia nervosa. It provides clinical information regarding the psychological and behavioral dimensions of eating disorders. The EDI-II retains the 64 items grouped into 11 scales: drive for thinness, bulimia, body dissatisfaction, ineffectiveness, perfectionism, interpersonal distrust, interoceptive awareness, maturity fears, asceticism, impulse regulation, and social insecurity. Scores were compared to reference scores of an eating-disorder-free population (29).

During the last visit, an additional systematic 30-minute interview (30) was conducted to screen for eating disorders according to the *Diagnostical and Statistical Manual of Mental Disorders* (31), and nonspecific eating disorders (binge-eating or night eating syndrome).

Physical Activity

Physical activity was estimated using a pedometer (Reductip, Abbott, Baar, Switzerland). This device was carried by the patients for 5 days before the last visit on their waistband or belt between navel and hip. The number of steps recorded by the device was transcribed each day by the patient on a log sheet.

Anxiety, Depression, and Quality of Life

At baseline and last visit, depression and anxiety were screened for with the Hospital Anxiety and Depression Scale, consisting of 14 questions, seven for anxiety and seven for depression. Depression or anxiety was defined at a score >8 (32).

Quality of life was screened with the French version of the Nottingham Health Profile at last visit. It reflects physical, social, and mental functioning (33). Patients rate perceived difficulties across six scales: energy (three items), pain (eight items), emotional reactions (nine items), sleep (five items), social isolation (five items), and physical mobility (eight items). A higher score reflects more health problems.

Patients' Opinion

A semistructured interview was conducted at last visit, to investigate difficulties and benefits of the operation, as well as perceived quality of follow-up. Questions were constructed on the basis of spontaneous remarks made by patients, then tested among 10 patients who underwent gastric bypass surgery during the previous year. First, patients were asked whether they would undergo the operation again if they had the choice today, and why. Then they were asked whether they could name three difficulties they experienced after the operation, and three benefits they experienced as a result of the surgery. Finally, they were asked whether the follow-up had been satisfactory and if they had improvements to suggest.

STATISTICAL ANALYSIS

Descriptive data are presented as mean±standard deviation for continuous data and frequencies for categorical variables. Patients were classified as successful (excess weight loss ≥50%) or unsuccessful (excess weight loss <50%) at last visit. Measures performed at baseline and last visit were compared with paired *t* test. Means of cofactors in each outcome group were compared by using Student *t* test for continuous variables and frequencies of dichotomous variables with Pearson χ^2 (all tests two-tailed, $P<0.05$ considered significant). Effect of macronutrient intake on successful weight loss was adjusted for total energy intake using logistic regression. Significant associations between EDI-II scales and successful weight loss were adjusted for the number of psychological consultations. We did not base the sample size on statistical considerations, but enrolled all available patients. Assuming that half of patients achieved successful weight loss, the sample size of 80 would enable us to detect a mean difference between successful and unsuccessful patients of 0.63 standard deviation on any continuous variable, with power of 80% and a type 1 error probability of 5%. The SPSS statistical software program (version 15.0, 2007, SPSS Inc, Chicago, IL) was used for all analyses.

RESULTS

Baseline Characteristics

Mean weight of the 141 patients (131 women and 10 men) before surgery was 122.8±20.5 kg, for a mean BMI of 46.0±7.0. Patients' mean age was 40±10 years, most were Swiss (60%), married (62%), and professionally active (63%).

Follow-Up Data

Among 141 patients who received the operation, 135 (96%) were contacted for follow-up at 1 year, among which 80 (59%) patients, all female, accepted to come for a last visit, which occurred at a mean of 8±1.2 years since the operation (range 6 to 11 years). Weight change 1 year postsurgery was similar between those who accepted and those who did not (data not shown).

Weight Loss and Other Anthropometric Outcomes

One year after the operation, the 135 patients had lost an average of 38.5±11.5 kg corresponding to a loss of 31.4%±7.6% of their initial weight. They reached a mean excess weight loss of 71.7%±19.1%. Their mean weight was 84.1±17.3 kg, and their mean BMI 31.6±6.2. The 80 patients showing at last visit had lost an average of 30.7±13.8 kg corresponding to a loss of 24.5%±9.9% of initial weight. They reached a mean excess weight loss of 55.6%±22.6%. Their mean weight was 93.7±18.9 kg, for a mean BMI of 34.5±6.2.

Among the 80 patients who came for a last visit, 10 (13%) lost >5 kg since 1 year postsurgery, 20 (26%) patients stabilized their weight in a range of ±5 kg, and 48 (61%) regained >5 kg. Success according to excess weight loss >50% was observed for 47 patients (59%). Among these, 24 had regained some weight after 1-year follow-up. At last visit, 8 years after the operation, 53 patients (67%) had a BMI <40 and 16 (20%) shifted from obesity to the overweight category (BMI <30). A normal BMI (<25) was observed for 1 (1%). Ten (12%) patients still had a BMI >40.

Table 1. Changes in anthropometric, dietary, and eating disorders characteristics of 80 female patients followed for 8 years after Roux-en-Y gastric bypass surgery

Characteristic	Presurgery	Last visit, 8 y postsurgery	*P* for paired comparison
	⟵ *mean±standard deviation* ⟶		
Weight (kg)	124.3±21.5	93.7±18.9	<0.001
Body mass index	45.9±7.6	34.5±6.2	<0.001
Anthropometric measures			
Waist circumference (cm)	125.3±18.4	103.3±17.8	<0.001
Hip circumference (cm)	137.4±13.0	122.2±13.8	<0.001
Body composition[a]			
Fat-free mass (kg)	62.2±10.4	52.3±8.1	<0.001
Fat-free mass (%)	50.6±2.8	57.1±6.7	<0.001
Lean body mass (kg)	16.7±2.8	14.2±2.3	<0.001
Lean body mass (%)	13.6±0.8	15.5±1.9	<0.001
Fat mass (kg)	60.4±14.2	40.5±12.9	<0.001
Fat mass (%)	48.9±5.3	42.7±6.8	<0.001
Dietary intake[b]			
Energy (kcal)	2,271±769	1,680±506	<0.001
Protein (g/kg body weight)	1.5±0.4	0.8±0.2	<0.001
Carbohydrates (% of energy)	41.3±7.2	41.5±9.3	0.5
Lipids (% of energy)	41.8±6.4	39.8±7.8	0.05
Eating disorders[c] **(reference values)**			
Drive for thinness (5.5±5.5)	7.8±4.8	6.3±5.1	0.013
Bulimia (1.2±1.9)	3.4±3.9	2.1±3.2	0.001
Body dissatisfaction (12.2±8.3)	24.4±4.3	17.0±7.9	<0.001
Ineffectiveness (2.3±3.6)	5.0±5.0	4.5±5.5	0.384
Perfectionism (6.2±3.9)	4.2±4.0	3.8±4.5	0.250
Interpersonal distrust (2.0±3.1)	4.0±3.4	3.3±3.4	0.110
Interoceptive awareness (3.0±3.9)	5.6±4.8	5.2±6.0	0.537
Maturity fears (2.7±2.9)	3.4±3.6	2.6±3.3	0.082
Asceticism (3.4±2.2)	5.4±3.8	4.0±2.5	0.002
Impulse regulation (2.3±3.6)	2.9±3.2	2.6±3.2	0.478
Social insecurity (3.3±3.3)	4.3±3.2	4.2±4.1	0.852

[a]Measured by bioelectrical impedance analysis (average of three measures).
[b]Assessed by 4-day food diaries.
[c]Measured by the Eating Disorders Inventory II and reference values from healthy population (29).
NOTE: Information from this table is available online at www.adajournal.org as part of a PowerPoint presentation.

Body composition improved significantly between baseline and last visit (Table 1). Fat-free mass decreased, but stayed within normal (37 to 52 kg) (26). Fat mass decreased in absolute value as well as in proportion of body weight. On average, patients lost 20 kg of fat mass (33% of their baseline fat mass). Lean body mass decreased in absolute value, to a lesser extent than fat mass: minus 15% of the baseline. As a result, the relative proportions of fat mass/total body weight decreased, and fat-free mass/total body weight increased (Table 1). Waist and hip circumferences decreased 17.5% and 11%, respectively, from baseline (Table 1).

Dietary Intake

At baseline, mean energy intake of all 141 patients was 2,355±775 kcal, with 41% of energy from carbohydrates, 41% of energy from fats, and 15% of energy from protein (0.7 g/kg body weight). One year after surgery (n=135), mean energy intake was 1,442±340 kcal with similar distribution of macronutrients as at baseline). At last visit (n=80), mean energy intake was 1,680±506 kcal, with 42% of energy from carbohydrates, 39% of energy from fats, and 19% of energy from protein (0.8 g/kg body weight). Comparison between baseline and last visit for the sole 80 patients seen at last visit is shown in Table 1.

Eating Behavior and Psychological State

At baseline, patients scored high on most EDI-II scores compared to reference values. At last visit, paired comparison showed significantly improved scores for four scales: drive for thinness (P=0.01), bulimia (P=0.001), body dissatisfaction (P=<0.001), and ascetism (P=0.02) (Table 1). Hospital Anxiety and Depression Scale questionnaire results showed unchanged depression and anxiety scores between baseline and last visit: 6.4±3.7 vs 5.5±4.4 for depression (prevalence 27%) and a higher than normal 8.3±3.5 vs 8.8±4.7 for anxiety (prevalence 46%). Results from the systematic interview conducted during the last visit indicated that more than half of patients (n=41, 51%) suffered from irregular episodes of binge eating or night eating syndrome during the previous month.

Table 2. Comparison of characteristics of 80 female patients followed for 8 years after Roux-en-Y gastric bypass surgery, according to excess weight loss (EWL) criteria: EWL ≥50% is successful; EWL <50% is unsuccessful

Characteristic	EWL ≥50% (n= 47)	EWL <50% (n= 33)	*P* value
	← *mean± standard deviation* →		
Age at surgery (y)	37±10	44±9	0.03
Body mass index at surgery	45.1±6.0	47.0±9.4	0.27
EWL 1 y after surgery (%)	76.9±16.2	62.5±20.2	0.001
Body composition 1 y after surgery			
Fat-free mass (%)	64.0±7.2	59.8±7.9	0.04
Lean body mass (%)	17.6±1.9	16.2±2.2	0.01
Fat mass (%)	23.9±6.3	29.8±7.9	0.002
Dietary intake at baseline			
Energy (kcal)	2,569±929	2,238±701	0.14
Protein (g/kg body weight)	0.8±0.3	0.7±0.2	0.33
Carbohydrates (% of energy)	44±7	42±6	0.23
Lipids (% of energy)	40±6	41±6	0.44
Dietary intake 1 y after surgery			
Energy (kcal)	1,448±353	1,505±380	0.6
Protein (g/kg body weight)	0.7±0.2	0.7±0.2	0.87
Carbohydrates (% of energy)	41±7	40±8	0.62
Lipids (% of energy)	42±6	43±8	0.7
Dietary intake at last visit			
Energy (kcal)	1,634±526	1,934±501	0.02
Protein (g/kg body weight)	0.8±0.3	0.7±0.2	0.43
Carbohydrates (% of energy)	45±9	44±9	0.57
Lipids (% of energy)	37±8	37±7	0.97
Eating behavior at baseline[a]			
Ineffectiveness	5.6±5.0	3.1±3.6	0.04
Social insecurity	5.1±3.8	2.5±1.9	0.01
Body dissatisfaction at last visit	15.4±8.4	19.2±7.1	0.05
Physical activity			
Steps per day	6,103±3,628	5,040±2,928	0.24
Depression scores			
Baseline	7.0±3.8	6.3±3.7	0.46
Last visit	4.6±3.9	6.7±5.1	0.05
Anxiety scores			
Baseline	8.4±3.3	8.9±3.7	0.54
Last visit	8.9±4.5	8.5±4.9	0.72
Quality of life			
Pain at last visit	65.2±31.8	81.4±31.4	0.04
Mobility at last visit	71.9±27.1	88.5±16.6	0.003
Psychological consultations (n)			
Before surgery	2.9±5.8	0.04±0.2	0.02
After surgery	7.8±20.2	14.2±27.5	0.32

[a]Measured by the Eating Disorders Inventory II and reference values from healthy population (29).

Factors Associated with Successful Outcome

Younger age at operation was associated with ≥50% excess weight loss at 8 years (Table 2). Neither BMI nor body composition at baseline were predictive of successful weight loss at 8 years, but excess weight loss and body composition 1 year postsurgery were associated with ≥50% excess weight loss after 8 years (Table 2). Neither dietary intake at baseline nor 1 year after surgery were associated with successful weight loss after 8 years. However, energy intake at last visit was significantly associated with successful weight loss (Table 2). When adjusted for total energy intake, none of the macronutrient intakes (in grams) was associated with successful weight loss. Baseline score of EDI-II was not associated with ≥50% excess weight loss, but successful patients reported significantly higher scores on ineffectiveness and social insecurity scales at baseline than unsuccessful ones (Table 2). When adjusted for number of psychological consultations, a 30% increase of successful outcome was observed for each increment on the ineffectiveness scale (odds ratio 1.3; 95% confidence interval 1.0 to 1.6) and the risk for successful outcome increased 20% for each increment on the social insecurity scale (odds ratio 1.2; 95% confidence integral 1.0;1.5). Mean number of steps per day was not associated with successful weight loss, but patients reporting more than 7,166 steps (upper quartile) a day were

Table 3. Patients' (n=80) point of view on postoperation difficulties and advantages, assessed during a semistructured interview, 8 years after Roux-en-Y gastric bypass surgery

Theme	Frequency[a]		Details
	n	%	
Physical			
Difficulties	78	98	Gastric pain, diarrhea, bloating, vomiting, constipation, dumping syndrome. Tiredness. Painful injections (vitamins). Constraints of treatment. Ventral hernia. Anastomotic leak.
Improvements	75	94	Increased respiratory capacity. Improved mobility and sleep. Fewer symptoms in relation to comorbidities.
Dietary			
Difficulties	38	48	Block with pasta, rice, gnocchi, bread, meat. Frustration in relation with dietary restriction. Use alcohol or cannabis as a substitute for food. Difficulties to change dietary habits.
Improvements	34	42	Easier to eat less. Better control on intake frequencies. Emergence of satiety. Decreased consumption of sweets.
Psychosocial and body image			
Difficulties	37	46	Feeling of guilt when weight loss ceases or when weight increases. Lack of support from family. Lack of medical support. Discrepancy between body image and reality. Hanging, redundant skin after weight loss. Scars. Body dissatisfaction.
Improvements	55	69	Impression of a "rebirth". Boosted self-confidence and self-esteem. Improved body image.

[a]Patients reporting at least one of the symptoms or situations.

four times more likely to achieve 50% excess weight loss than the others ($P=0.04$).

A greater number of psychological consultations before the operation was associated with successful outcome (2.9 vs 0.04, $P=0.02$) (Table 2), but depression, anxiety, and quality of life scores at baseline were similar between successful and unsuccessful patients. However, the patients with ≥50% excess weight loss after 8 years had significantly improved depression, body dissatisfaction (EDI-II), pain, and physical mobility scores (Table 2).

Patients' Point of View

Eight years after the operation, the majority of patients (n=68, 85%) declared being satisfied with the operation and would undergo it again. Fifty-nine (74%) were satisfied with postoperation follow-up. Thirty-five patients indicated they would have appreciated a more intensive follow-up, particularly with regard to psychological support. Eleven patients asked for more sustained dietary supervision; eg, cooking classes or group support. Difficulties and perceived improvements stated by the patients are listed in Table 3.

DISCUSSION

Similar to findings from other studies, most weight loss occurred in the short term after surgery (19,34). However successful this result may appear, more than half of patients regained at least 5 kg between the first year and last visit, and they expressed feelings of guilt and shame. This should be addressed early by the team, because the risk of disordered eating patterns could increase in this situation (35-38). As expected, successful and unsuccessful patients differed in their weight and body composition change pattern, according to the physiologic consequences of the gastric bypass described previously (39-41). Similar to Snyder and colleagues' findings (42), no association was found between patients' baseline BMI or body composition and weight loss at 8 years. However, anthropometric results at 1 year were closely related to those observed at last visit.

Dietary intake was suboptimal at the three time points. Energy intake decreased as expected, but carbohydrate intake was below the recommended 50% to 55% of total energy intake (28), whereas fat was above the recommended 30% to 35% of total energy intake (28). The pattern improved little between first year follow-up and last visit, which suggests that even broad dietary changes are difficult to achieve in this population. Dietetics practitioners involved with patients seeking gastric bypass should be aware of these particularities. In the followed cohort, protein intake, expressed as grams per kilogram of body weight, dropped from 1.5 g at baseline to an average of 0.8 g at last visit. This means that 50% of the sample did not reach the recommended 0.8 to 1.2 g protein per kilogram of body weight (28). Insufficient protein intake during weight loss can increase the loss of muscle mass, a common problem after massive weight loss (43,44) and possibly a risk factor for weight regain (44). In this study it was not associated with weight outcome. Similarly, other macronutrient intake was not associated with successful weight loss. It is possible that this lack of association is related to the small sample size, but it is more likely that it is caused by the dietary measure itself. This hypothesis is supported by the wide variance of the data. Moreover, underreporting has been associated with higher BMI (45,46), and it is possible that the persons who did not reach 50% excess weight loss underestimated

their intake. This could have contributed to a smaller difference between the compared groups. Dietetics practitioners involved with patients seeking gastric bypass could help their patients focus on the health benefits of a balanced diet, independent from weight loss. Settings providing bypass surgery should facilitate access to professional dietetic advice, including in the long term (47).

Eating behaviors and psychological state did not improve significantly during follow-up. Successful and unsuccessful patients experienced similar rates of problematic eating behavior, depression, and anxiety. These patterns can be easily ignored by the caregivers if they are not routinely screened for, as weight loss is the usual measure of success (14,48). This could affect patients' quality of life and self-esteem, and give them a feeling of failure despite the objective success in terms of weight loss. As some patients expressed it, they felt "left alone with their new body, their scar, their fears." Patients with superobesity have often been reported to have disturbed eating habits, such as binge eating disorder, night eating syndrome, and frequent snacking or grazing (49). These disorders are also frequent among the bariatric surgery population (50-52), and binge eating has been related to poorer surgical outcomes (50). It has therefore been suggested that patients with significant binge eating should not be treated surgically until the eating behavior has been normalized with specific therapy (34,39). Other authors have argued that there is no reason to deny these patients bariatric surgery, but that adequate pre- and postpsychosocial care should be provided (53-56). The relationship between presurgical depression and weight outcome is debated. Depression severity has been positively correlated with successful weight loss after Roux-en-Y bypass (57), whereas a less-successful outcome was found for patients with depression undergoing gastric restrictive surgery (58). In this study, baseline scores for depression and anxiety were not correlated with outcome. However, patients who reported higher scores on ineffectiveness and social insecurity scales at baseline were more often successful than the others. It could be that patients with less favorable psychological patterns were offered more professional support throughout follow-up. This is suggested by the fact that the association between low social insecurity and successful outcome is not significant after adjusting for the number of psychological consultations.

Despite their difficulties on a physical, dietary or psychosocial level, a majority of patients would undergo the surgical process again if they were given the choice. This is a great incentive for the professionals involved in the follow-up of these persons.

Some limitations should be addressed. First, selection bias cannot be ruled out, as only 80 out of 141 patients, all women, agreed to come for a last visit. However, data measured at 1-year follow-up did not differ between patients who accepted the last visit and those who did not. Second, the diet was assessed by 4-day food diaries. This choice was made because it is a powerful clinical and pedagogical tool during dietetic consultations. However, this dietary measure can be imprecise, and it is possible that oral intake has been underreported in this study. This would explain the lack of relationship between successful weight loss and dietary intake. Finally, physical activity and quality of life were only measured at last visit and no change over time could be observed.

CONCLUSIONS

More than half of patients achieved successful weight loss 8 years after surgery. Factors associated with this outcome were younger age at baseline, a leaner body composition 1 year after surgery, and lower energy intake at last visit. Ineffectiveness and social insecurity scores at baseline were associated with successful outcome, but the latter was not when adjusted for the number of psychological consultations before surgery. The findings of this study reinforce the importance of interdisciplinary care for patients who undergo gastric bypass. Although the operation itself leads to drastic changes in the volume of food consumed, it does not resolve difficulties faced by the patients in terms of choice, texture, and timing of intake. A higher number of psychological consultations seemed to predict success, and the patients had high rates of problematic eating patterns. Therefore, it seems that the usual screening for eating disorders before the operation should be followed by periodic follow-up screenings, as these disorders can occur any time after the operation. It remains unclear whether the operation could trigger these disorders, and more research is needed in this field. Data provide arguments to widen the definition of success after gastric bypass. This definition should include excess weight loss, but also problematic eating behaviors and psychological well-being.

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