Applied nutritional investigation

Poor diet quality and postoperative time are independent risk factors for weight regain after Roux-en-Y gastric bypass

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A B S T R A C T

Objective: In this study, multivariate analyses was used to investigate factors associated with weight regain long after Roux-en-Y gastric bypass.
Methods: This retrospective study comprised 80 patients (88.8% female) with at least 24 mo of postoperative time. Weight regain was defined as an increase of at least 10% of the lowest postoperative weight. The following data were collected: demographic characteristics, eating behavior, food intake, diet quality measured by the Healthy Eating Index, level of physical activity, follow-up visit attendance, anthropometric history, and postoperative time. Multivariate logistic regression generated a controlled analysis, followed by calculation of the odds ratio (OR).
Results: The mean postoperative time was 47.0 ± 18.0 mo. The mean pre- and postoperative body mass indexes were 49.8 ± 9.3 kg/m^2 and 33.6 ± 7.2 kg/m^2, respectively. Despite satisfactory postoperative weight loss, 23.7% of the patients regained weight. After controlling for confounders, only postoperative time (OR 1.08; $P < 0.01$) and Healthy Eating Index (OR 0.95; $P = 0.04$) remained associated with weight regain.
Conclusion: Patients with long-term obesity and poor diet quality were at high risk of weight regain. These results suggest the need of nutritional monitoring during the late postoperative period, paying special attention to eating patterns.

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Introduction

Bariatric surgery, particularly Roux-en-Y gastric bypass (RYGB), is an important alternative treatment for morbid obesity. In addition to promoting weight loss, this treatment improves or controls obesity-associated comorbidities and quality of life [1]. Studies have demonstrated that patients lost approximately 60% of their excess body weight in the first 2 y after surgery, and comorbidities remitted in more than 38% of the cases [2].

Despite marked weight loss, significant long-term weight regain is observed in a proportion of patients, possibly compromising the general benefits provided by the surgery [3,4]. The risk of weight regain appears to increase 2 y after surgery and to affect 10 to 20% of the patients [4–6].

Weight regain after bariatric surgery is multifactorial, and patients and professionals strive to understand the associated

risk factors. Studies have shown the influence of eating behavior, lifestyle changes, and postoperative physiological adaptations on weight regain [5,7,8]. Freire et al. [6] found that the risk of weight regain is associated with excessive caloric intake, low diet quality, poor postoperative follow-up attendance, and sedentary lifestyle. However, the influence of each risk factor has not been fully determined by controlled studies.

In a systematic review, Karmali et al. [9], encouraged by the discussion of these factors, suggested a multidisciplinary algorithm to manage weight regain. Since the primary predictors of weight regain long after bariatric surgery are not clear, we used multivariate analysis to investigate the factors potentially associated with weight regain long after RYGB.

Methods and materials

Patients and study protocol

A retrospective study was conducted in 2011 to 2012 with a sample of the participants of a multidisciplinary bariatric surgery program, which uses the surgery criteria established by the National Institutes of Health [1]. All patients who had undergone laparoscopic RYGB at least 24 mo previously were invited to

participate in the study. Those who had become pregnant after surgery or who had been chronically using corticosteroids or other drugs that influence weight were excluded.

The study was approved by the Research Ethics Committee of the School of Health Sciences of the University of Brasilia. All participants signed an informed consent form.

Anthropometry, diet, and clinical assessment

Pre- and postoperative body weight history was collected from the medical records, and the current weight was measured during the interview. Weight history included the percentage of preoperative weight loss, maximum excess weight loss, and current excess weight loss. Patients who regained more than 10% of their lowest postoperative weight were placed in the weight regain group. Weight was considered stable if weight regain did not exceed 10% of the lowest postoperative weight.

The mean energy intake, dietary macronutrient composition, and the Healthy Eating Index (HEI) were calculated from two 24-h food recalls administered on nonconsecutive days. The HEI adapted for the Brazilian population [10, 11] considers the following components:

1. Number of servings: Conversion of the foods reported in 24-h recalls (e.g., grains, fruits, vegetables, legumes, dairy products, meats, sweets and sugars, and fats and oils) into servings according to their energy content and food groups of the Adapted Food Pyramid
2. Nutrients: Determination of fat (total and saturated) and cholesterol contents
3. Variety: Registration of different food items and grading of each component with a score ranging from 0 to 10 to yield a maximum score of 120.

Diet quality was then classified into three categories: poor (score ≤ 70), needs improvement (71 ≤ score ≤ 100), and good (score > 100). Self-reported weekly incidence of vomiting, persistent diarrhea, and food intolerance in the 3 mo preceding the interview were noted.

The level of physical activity was assessed by the International Physical Activity Questionnaire [12]. Patients were considered active if they practiced leisure-time physical activities of mild or moderate intensity for at least 30 min a day at least five times a week, or of high intensity for at least 20 min a day at least three times a week.

Patient eating behavior was determined by the Three-factor Eating Questionnaire (TFEQ-R21) developed by Tholin et al. [13], translated and validated for the Brazilian population [14]. The TFEQ uses 21 Likert-scale questions to assess three dimensions of eating behavior: emotional eating (greater propensity to eat in response to negative emotional status), cognitive restrain (effort to control diet to lose weight), and uncontrolled eating (transgression of rules by overeating). The result is expressed as a score ranging from 0 to 100. Higher scores indicate greater incidence of behaviors in the study dimension.

Follow-up visit attendance was collected from the medical records. Those who attended at least seven nutrition counseling visits in the first 2 y after surgery were considered nutritional counseling regulars. Those who attended more than five psychology group meetings in the past 12 mo were considered psychology counseling regulars.

Statistical analysis

The dependent variable was weight regain, and all other variables were considered independent: Demographic variables, postoperative time, gastrointestinal symptoms, level of physical activity, HEI, energy and macronutrient intakes, TFEQ score, pre- and postoperative anthropometry, and postoperative care attendance. Since weight regain had asymmetrical distribution, the Mann-Whitney test was used for comparing the continuous variables of the two groups. The chi-square or Fisher exact tests compared the qualitative variables. The continuous variables are expressed as means and standard deviations or as medians and interquartile ranges. The categorical variables are expressed as percentages.

The independent variables associated with weight regain in bivariate analysis ($P < 0.1$) were included in a multiple logistic regression model. The odds ratio (OR) was calculated to measure the association of risk factors with weight regain. P values < 0.05 were considered significant. All analyses were conducted by the software SPSS 17.0.

Results

A total of 144 individuals had at least 24 mo of postoperative time; 81 were located, and 80 agreed to participate in the study. Nineteen individuals (23.7%) had regained weight (mean

Table 1
Patients' characteristics according to postoperative weight history

Patients' characteristics	Total (n = 80)	Weight regain (n = 19)	Stable weight (n = 61)	P value
Sex; n/%				0.64
Female	71/88.8	17/89.5	54/88.5	
Male	9/11.2	2/10.5	7/11.5	
Age (y)*	46.0 (16.0)	43.0 (20.0)	46.0 (16.0)	0.74
Education (y)*	11.0 (6.0)	10.5 (4.0)	11.0 (6.0)	0.43
Postoperative time (mo)*	42.0 (13.0)	56.5 (34.0)	39.0 (10.0)	<0.0001
Preoperative BMI*	47.8 (10.8)	50.0 (15.6)	46.9 (10.6)	0.18
%EWL, maximum*	74.5 (27.3)	73.0 (15.4)	76.0 (29.3)	0.85
%WL, preoperative*	6.3 (6.3)	7.4 (8.0)	6.2 (6.7)	0.34
Nutrition counseling attendance (%)†	31.6	27.7	32.8	0.69
Psychological counseling attendance (%)‡	43.8	21.1	50.8	0.02

BMI, body mass index; %WL, percentage of weight loss; %EWL, percentage of excess weight loss

Weight regain: Patients who regained more than 10% of their lowest postoperative weight

Stable weight: Patients who regained less than 10% of their lowest postoperative weight

* Presented as median (interquartile range).

† Prevalence of subjects who attended at least seven nutrition visits in the first 2 y after surgery, presented as percentage.

‡ Prevalence of subjects who attended more than five psychology group meetings in the last 12 mo, presented as percentage.

20.1% ± 11.1%). Of the 61 patients with stable weight, 25% had regained less than 2%, 28% had regained 2.1% to 5%, and 22% had regained 5.1% to 10% of their lowest postoperative weight.

Table 1 presents sociodemographic and surgical data by weight regain status. Patients' ages varied from 26 to 66 y (46.0 ± 9.7 y), most were females (88.8%), all had completed elementary school, and their income was equal to or slightly more than one minimum salary. The mean maximum excess weight loss was 74.5%. Of the demographic and clinical variables, only psychological counseling attendance (21.1% versus 50.8%, $P = 0.02$) and postoperative time (56.5 versus 39.0 mo, $P < 0.0001$) differed between patients with weight regain and those with stable weight. There was a moderate positive correlation between postoperative time and percentage of weight regain ($r^2 = 0.53$, $P < 0.0001$) (data not shown).

Table 2 lists the occurrence of gastrointestinal symptoms. Patients with weight regain had a greater incidence of weekly vomiting (36.8% versus 13.3%, $P = 0.03$), and food intolerance was the most frequent symptom in both groups, affecting 66.3% of the sample.

According to the HEI, only 8.8% of the sample had good-quality diet, namely a score higher than 100 points. The weight regain group had significantly lower HEI score than the stable weight group (72.4% versus 82.6%, $P = 0.005$). Regarding eating

Table 2
Prevalence of gastrointestinal symptoms after bariatric surgery according postoperative weight history

Gastrointestinal symptoms	Total (n = 80)	Weight regain (n = 19)	Stable weight (n = 61)	P value
Food intolerance (%)	66.3	57.8	68.8	0.38
Weekly vomiting (%)	18.8	36.8	13.3	0.03
Persistent diarrhea (%)	8.8	5.2	9.8	0.46

Weight regain: Patients who regained more than 10% of their lowest postoperative weight

Stable weight: Patients who regained less than 10% of their lowest postoperative weight