



# Food Intolerance 1 Year After Banded Roux-En-Y Gastric Bypass

Renata Cristina Gobato<sup>1,2</sup>  · Everton Cazzo<sup>1</sup> · Letícia Baltieri<sup>1</sup> · Débora Aparecida Oliveira Modena<sup>1</sup> · Elinton Adami Chaim<sup>1</sup>

Published online: 10 October 2018

© Springer Science+Business Media, LLC, part of Springer Nature 2018

## Abstract

The purpose of this study is to evaluate the food intolerance after banded Roux-en-Y gastric bypass (RYGB), correlating the data of food ingestion.

## Methods

This is an observational prospective study, which evaluated the individuals before and 3, 6, and 12 months after banded RYGB. We performed an anthropometric evaluation and an assessment of the habitual food ingestion and applied a food tolerance questionnaire.

## Results

The study group was comprised of 75 individuals, 89% of them female, with a percentual weight loss of  $29.73 \pm 6.79\%$ . The observed results were that food intolerance increased over time and 1 year after surgery, only 2.7% reported to ingest any type of food, while the greatest difficulty was related to red meat (80%). Regarding vomits, after surgery, this proportion significantly increased after 3, 6, and 12 months. Preoperatively, the mean protein ingestion was 98 g, which decreased to 50 g after 3 and 6 months and to 51 g after 12 months. As a conclusion, food intolerance significantly increased following banded RYGB, leading to a crescent dissatisfaction regarding food and an increase in the vomits frequency.

**Keywords** Bariatric surgery · Gastric bypass · Food intake · Vomiting · Obesity

## Introduction

Nutritional deficiencies of macronutrients and micronutrients are common among patients who undergo bariatric techniques which match several degrees of restriction with malabsorption, such as the Roux-en-Y gastric bypass (RYGB). Deficiencies occur due to the malabsorptive traits of the technique as well as due to low ingestion and a tendency to avoid some specific food due to intolerance [1].

Food intolerance is characterized by nausea, regurgitation, and vomiting, and it is more common in the first months after RYGB surgery, but tends to get better with time [2], and after 12 months, its frequency becomes similar to that observed in the general population [3]. There are also some complications associated with the placement of gastric bands, such as band erosion and/or migration/slippage, nausea, vomiting, malnutrition, and dysphagia for solids and liquids [4, 5]. The length of the band is another factor to be considered, since a more frequent

---

✉ Renata Cristina Gobato  
rgobato@gmail.com

Everton Cazzo  
evertoncazzo@yahoo.com.br

Letícia Baltieri  
lbaltieri@yahoo.com.br

Débora Aparecida Oliveira Modena  
de\_modena@yahoo.com.br

Elinton Adami Chaim  
chaim@hc.unicamp.br

<sup>1</sup> University of Campinas (UNICAMP), Campinas, SP, Brazil

<sup>2</sup> Faculdade de Ciências Médicas, Departamento de Cirurgia, Universidade Estadual de Campinas, Rua Tessália Vieira de Camargo, 126, Cidade Universitária Zeferino Vaz, CEP, Campinas, SP 13083-887, Brazil

occurrence of vomiting is expected as the diameter of the gastric lumen is reduced, as a result of compression by the band [6]. Therefore, an excessive food restriction worsens the patients' quality of life and may increase the risk of nutritional deficits, such as acute neuropathy due to the deficiency of thiamine, excessive vomiting [7], and reduced intake of protein sources [8] such as red meat [9], eggs, and dairy products [10], also leading to iron and B12 vitamin deficiencies [1, 11], besides the reduction of lean body mass [12].

Hence, it is essential to evaluate food tolerance, nutritional status, and possible deficiencies among bariatric individuals, even before surgery, as a way to avoid inappropriate associations of previous food intolerances with the procedure itself. This study aims to evaluate food intolerance after banded RYGB, correlating the data of food ingestion.

## Methods

This is an analytical observational prospective study between 2014 and 2016, in which the individuals were evaluated in four periods: 1 week prior to surgery and 3, 6, and 12 months after it. All the procedures, including the surgeries, were performed at the same tertiary university hospital and were carried out by the same multidisciplinary team. The protocol underwent evaluation, and it was approved by the local Research Ethics Board under the Unicamp/848.158 reference.

In each period of study, anthropometric evaluation, food ingestion assessment by means of a 3-day diet recall (3DDR), and application of the food intolerance questionnaire proposed by Suter et al. were performed. All patients who undergo bariatric surgery at this institution take part in a preoperative weight loss program, where they have to achieve a minimal of 10% of preoperative weight loss [13], which lasts 4 to 12 weeks, and it is comprehended by weekly consultations carried out by a multidisciplinary team. The individuals follow a hypocaloric alimentary plan comprised of 1279 kcal, 198 g of carbohydrates (53% of the total energy value (TEV)), 92 g of protein (25% of TEV), 36 g of lipids (22% of TEV), and 24 g of fibers, divided into six daily meals, until the surgical procedure. A month before the surgery, it was recommended the use of multivitamin tablets and mineral supplement capsule on a daily basis. Preoperatively, the individuals were instructed on the postoperative diet, when there is a gradual progression of consistency until reaching a general diet.

Bariatric surgery was indicated according to the NIH consensus statement [14]. The inclusion criteria were age above or equal to 18 and less than 65 years old, refractory obesity for at least 2 years, body mass index  $\geq 40$  kg/m<sup>2</sup> or  $\geq$

35 kg/m<sup>2</sup> associated with obesity-related comorbidities, along with an agreement to take part in the study.

The exclusion criteria were vulnerable groups (mentally ill, institutionalized, or aged below 18 years old), recent or previous abuse of alcohol or illicit drugs, uncontrolled mental disorders, and individuals who did not comply with follow-up. Eighty-two individuals were recruited, and seven of them were excluded due to non-compliance with follow-up: three due to a postoperative gestation and four that did not show up.

## Surgical Procedure

The main features of the RYGB were a 30-mL gastric pouch, a 100-cm biliopancreatic limb, a 150-cm alimentary limb, and a common channel consisting of the remainder of the small intestine; a minimum measurement of 150 cm for the common limb was observed in order to avoid severe malabsorption. An inelastic silicon band was fixed around the gastric pouch approximately 2 cm above the gastrojejunostomy, determining a 1.4-cm diameter of circumference. All the procedures were performed by the same surgical team by means of an open approach.

## Dietary Intake

Dietary intake was assessed by means of the 3DDR, in which people registered in detail all the food that was consumed during three days of the week: two working days and one of the weekend, thus indicating the habitual food intake. The consumption was quantitatively assessed through the overall calorie intake, the percent and absolute macronutrient intake, and the fiber absolute intake, calculated by means of the DietBox system.

The daily recommendations of macronutrients and fibers were evaluated through reference values of daily intake [15]. An individual consuming less than 85% of the recommended by the dietary reference intake (DRI) was considered an inadequate nutrient intake [16].

## Food Intolerance

The food tolerance questionnaire applied was the one proposed by Suter et al. The whole questionnaire is evaluated by means of an overall score that varies from 1 to 27 points: the higher the score, the better the food tolerance is [3]. Besides, an extra questionnaire was applied to evaluate the weekly intake frequency of specific types of food (red meat, chicken, fish, eggs, milk, yogurt, fried food, candies, sparkling beverage, pizza, and snacks) [3].

### Statistical Analysis

We used Friedman test, Wilcoxon test, McNemar test, symmetry Bowker test, or Cochran test to compare the variables within the evaluations, according to the type of variable (continuous or categorical) and the number of evaluations (two, three, or four). To compare the variables between the groups, we used Mann-Whitney test, Kruskal-Wallis test, chi-squared test, or Fisher’s exact test, depending on the type of variable (continuous or categorical) and the number of groups (two, three, or more). To assess the connection between continuous variables, the Spearman correlation coefficients were calculated and the level of significance adopted was 5% ( $p \leq 0.05$ ). The statistical analyses were performed through the software named SAS System for Windows (Statistical Analysis System), 9.2 version.

### Results

In the four moments of the study, 75 individuals were followed up; 89% were female, and the mean age was  $38 \pm 10.06$  years old; the mean maximum weight achieved during lifetime was  $125.89 \pm 20.99$  kg, while the weight at the admittance of treatment, before the 10% of preoperative weight loss, was  $116.11 \pm 20.15$  kg. The complete anthropometric description is detailed in Table 1.

There were significant decreases ( $p \leq 0.05$ ) of weight, BMI, neck circumference (NC), and abdominal circumference (AC) from the preoperative to 12 months after the surgery.

Tables 2, 3, and 4 contain detailed results of the food tolerance questionnaire assessed during the study. Regarding the food tolerance questionnaire, 97.3% of

the individuals presented scores equal or above 24 before the surgery; such scores were obtained by 16%, 16, and 13.3%, 3, 6, and 12 months after the surgery, respectively ( $p \leq 0.05$ ). Thus, 2.67% of the individuals presented any type of preoperative intolerance, whereas 84% presented intolerance 3 and 6 months after the surgery, and 86.67% after 12 months ( $p \leq 0.05$ ).

Evaluating the satisfaction associated with food, as assessed by the first section of the questionnaire, 30.67% considered the quality of alimentation excellent during preoperative period, and after 12 months, it decreased to 20% ( $p \leq 0.05$ ).

Table 5 addresses the consumption frequency, in days per week, of some food types. It also relates the percentage of the people to the referred consumption frequency at 3, 6, and 12 months PO (not addressed in the food tolerance questionnaire).

Results show that satisfaction score ( $p \leq 0.05$ ), vomiting score ( $p \leq 0.05$ ), alimentary score (alimentary sum score) ( $p \leq 0.05$ ), and overall food tolerance score ( $p \leq 0.05$ ) at 3, 6, and 12 months had lower values, indicating that these variables got worse. There was also a decrease in red meat intake ( $p \leq 0.05$ ) after 12 months, an increase in sparkling beverage intake ( $p \leq 0.05$ ) after 12 months, and candies ( $p \leq 0.05$ ) after 6 and 12 months.

Correlating the anthropometric data with food tolerance scores, negative correlations were observed: the higher the weight ( $r = -0.280$ ;  $p \leq 0.05$ ) and BMI ( $r = -0.278$ ;  $p \leq 0.05$ ), the lower the alimentary satisfaction after 3 months. Correlating anthropometric variables with food intake, it was observed a positive correlation ( $r = 0.235$ ;  $p \leq 0.05$ ): the higher the NC, the higher the frequency of candies intake after 6 months.

Table 6 details the mean calorie intake of macronutrients and fibers. It also shows that there were significantly lower values after 3, 6, and 12 months for the calorie

**Table 1** Study population anthropometric measurements and comorbidity description in the preoperative and postoperative periods of 3, 6, and 12 months

Variables	Preoperative	Postoperative		
		3 months	6 months	12 months
Weight (kg)	98.54 ± 12.96	81.94 ± 11.32	74.76 ± 10.73	69.10 ± 10.40
BMI (kg/m <sup>2</sup> )	43.94 ± 5.89	31.00 ± 2.79	28.29 ± 2.80	26.15 ± 2.92
%WL	14.44 ± 6.73	16.83 ± 3.88	24.10 ± 4.75	29.73 ± 6.79
AC (cm)	118.15 ± 10.88	104.54 ± 10.07	98.04 ± 9.39	94.57 ± 9.69
NC (cm)	37.32 ± 3.19	35.07 ± 2.78	34.18 ± 2.81	33.37 ± 2.77
Hypertension	35 (46.66%)	10 (13.33%)	9 (12%)	7 (9.33%)
Dyslipidemia	16 (21.33%)	2 (2.66%)	2 (2.66%)	1 (1.33%)
Diabetes (NID)	5 (6.66%)	0	0	0
Diabetes (ID)	2 (2.66%)	2 (2.66%)	2 (2.66%)	2 (2.66%)

%WL percentage of weight loss, AC abdominal circumference, NC neck circumference, NID non-insulin dependent, ID insulin dependent

**Table 2** Results of the satisfaction of food tolerance questionnaire comparing the preoperative and postoperative periods of 3, 6, and 12 months

Satisfaction score	Preoperative	Postoperative			<i>p</i> value
		3 months	6 months	12 months	
Satisfaction 5 (excellent)	23 (30.7%)	12 (16.0%)	11 (14.7%)	15 (20.0%)	$p \leq 0.05^a$
Satisfaction 4 (good)	40 (53.3%)	37 (49.3%)	34 (45.3%)	29 (38.7%)	$p \leq 0.05^a$
Satisfaction 3 (acceptable)	12 (16.0%)	17 (22.7%)	20 (26.7%)	19 (25.3%)	$p \leq 0.05^a$
Satisfaction 2 (bad)	0 (0.0%)	9 (12.0%)	8 (10.7%)	10 (13.4%)	$p \leq 0.05^a$
Satisfaction 1 (too bad)	0 (0.0%)	0 (0.0%)	2 (2.6%)	2 (2.6%)	$p \leq 0.05^a$

*p* values represent differences between the four evaluations by Friedman and Wilcoxon tests for ordinal variables and Cochran and McNemar tests for categorical variables

<sup>a</sup> $p \leq 0.05$  pre vs 3, 6, and 12 months

intake ( $p \leq 0.05$ ), protein ( $p \leq 0.05$ ), fiber ( $p \leq 0.05$ ), and cholesterol ( $p \leq 0.05$ ). The carbohydrate intake (in grams) was lower after 3 and 6 months ( $p \leq 0.05$ ), and the carbohydrate intake (in percentage), total sugar, and trans fat were higher after 3, 6, and 12 months ( $p \leq 0.05$ ).

Table 7 presents the preoperative adequacy of macro-nutrient and fiber intake in 12 months after the surgery. In relation to the recommended consumption levels of protein, carbohydrates, and lipids, the frequency of protein intake, in grams, below 85% of the recommended was higher after 3, 6, and 12 months ( $p \leq 0.05$ ), whereas the frequency of carbohydrate intake, in grams, below 85% of the recommended was lower after 3 and 6 months ( $p \leq 0.05$ ) and the frequencies of percentage of carbohydrate and lipid intake below 85% of the recommended were lower after 3 months ( $p \leq 0.05$ ).

## Discussion

This study showed an increase in food intolerance, along with a decrease in eating satisfaction after banded RYGB. The dissatisfaction is related to the difficulty and limited food intake in terms of quality and quantity when compared to the preoperative period; several patients reported having a will to ingest preparations of lower nutritional value. There was an increase in vomiting episodes throughout time as previously reported [17], which can be related to the presence of the gastric band.

There was an increase in carbonated beverage and candy intake (6 and 12 months) after surgery. Also, the relationship between the NC values and the frequency of candy intake shows that the higher the NC value, the higher the frequency of candies' intake at 6 months after the

**Table 3** Results of the food intake of food tolerance questionnaire comparing the preoperative and postoperative periods of 3, 6, and 12 months

Food intake	Preoperative	Postoperative			<i>p</i> value
		3 months	6 months	12 months	
Eat any food	65 (86.7%)	4 (5.3%)	7 (9.3%)	2 (2.6%)	$p \leq 0.05^a$
Red meat	71 (94.7%)	25 (33.3%)	21 (28.0%)	15 (20.0%)	$p < 0.05^b$
Chicken	75 (100.0%)	38 (50.7%)	33 (44.0%)	28 (37.3%)	$p \leq 0.05^c$
Salad	73 (97.3%)	34 (45.3%)	36 (48.0%)	29 (38.7%)	$p \leq 0.05^c$
Vegetables	73 (97.3%)	65 (86.7%)	65 (86.7%)	59 (78.7%)	$p \leq 0.05^d$
Bread	75 (100.0%)	37 (49.3%)	29 (38.7%)	42 (56.0%)	$p \leq 0.05^d$
Pasta	74 (98.7%)	44 (58.7%)	44 (58.7%)	44 (58.7%)	$p \leq 0.05^c$
Rice	74 (98.7%)	33 (44.0%)	38 (50.7%)	38 (50.7%)	$p \leq 0.05^c$
Fish	75 (100.0%)	50 (66.7%)	48 (64.0%)	45 (60.0%)	$p \leq 0.05^c$

*p* values represent differences between the four evaluations by Friedman and Wilcoxon tests for ordinal variables and Cochran and McNemar tests for categorical variables

<sup>a</sup> $p \leq 0.05$  pre vs 3, 6, and 12 months and 6 vs 12 months

<sup>b</sup> $p \leq 0.05$  pre vs 3, 6, and 12 months and 3 vs 12 months

<sup>c</sup> $p \leq 0.05$  pre vs 3, 6, and 12 months

<sup>d</sup> $p \leq 0.05$  pre vs 3, 6, and 12 months

**Table 4** Results of the vomit episodes and total score of food tolerance questionnaire comparing the preoperative and postoperative periods of 3, 6, and 12 months

Vomit episodes	Preoperative	Postoperative			<i>p</i> value
		3 months	6 months	12 months	
Daily vomiting	0 (0.0)%	9 (12.0%)	8 (10.7%)	10 (13.3%)	$p \leq 0.05^a$
Often (> 2×/week)	0 (0.0)%	13 (17.3%)	11 (14.7%)	12 (16.0%)	$p \leq 0.05^a$
Rarely	0 (0.0)%	19 (25.3%)	28 (37.3%)	30 (40.0%)	$p \leq 0.05^a$
Never	75 (100.0%)	34 (45.4%)	28 (37.3%)	23 (30.7%)	$p \leq 0.05^a$
Score $\geq 24$	73 (97.3%)	12 (16.0%)	12 (16.0%)	10 (13.3%)	$p \leq 0.05^a$

*p* values represent differences between the four evaluations by Friedman and Wilcoxon tests for ordinal variables and Cochran and McNemar tests for categorical variables

<sup>a</sup> $p \leq 0.05$  pre vs 3, 6, and 12 months

surgery; on the other hand, a lower carbohydrate intake at 12 months PO was significantly correlated with lower NC values. The enlargement of NC increases the chance of developing insulin resistance [18], and a positive relationship between NC and the serum levels of fasting blood sugar has been reported [19], that is related to the increased consumption of simple sugars present in candies. It indicates that the increase in simple carbohydrate consumption negatively interferes in the reduction of NC, which is associated with enhanced risk factors related to cardiovascular conditions [20].

The higher the weight and the BMI at 3 months post surgery, the lower the eating satisfaction score was, meaning that a lower body weight could have occurred due to the patients' adaptation to new eating standards, more eating restrictions, and difficulties in the first months,

aside from the diminished consumption of fibers and an increase of liquid form and/or pureed food, rich in carbohydrates. In this study, there had not been a significant correlation between the higher weight loss and the increased eating intolerance, as also observed in Boerlage et al. [21].

There had been a lower eating satisfaction score among those with lower carbohydrate consumption, indicating that the reduction of this macronutrient increases eating dissatisfaction, considering that a low carbohydrate consumption is related to a worsening of the mood [22]. The food intolerance observed by the patients who presented a lower protein intake at 12 months after the surgery may suggest that, as a matter of fact, the difficulty in eating and food intolerance may have influenced the patients' protein intake [23].

**Table 5** Consumption of some foods per week in days at 3, 6, and 12 months PO, not addressed in the food tolerance questionnaire

Food/frequency	Postoperative			<i>p</i> value
	3 months	6 months	12 months	
Red meat/3 days	18 (24.0%)	28 (37.3%)	20 (26.7%)	NS
Chicken/2 days	26 (34.7%)	22 (29.3%)	24 (32.0%)	NS
Fish/0 day	38 (50.7%)	28 (37.3%)	31 (41.3%)	NS
Egg/1 day	23 (28.0%)	23 (30.7%)	20 (26.7%)	NS
Milk/7 days	55 (73.3%)	56 (74.7%)	51 (68.0%)	NS
Yogurt/7 days	32 (42.7%)	35 (46.7%)	31 (41.3%)	NS
Fried foods/0 day	54 (72.0%)	47 (62.7%)	45 (60.0%)	NS
Sweets/7 days	5 (6.7%)	16 (21.3%)	25 (33.3%)	$p \leq 0.05^a$
Carbonated beverage/0 day	68 (90.7%)	61 (81.3%)	59 (78.7%)	$p \leq 0.05^b$
Pizza/0 day	59 (78.7%)	54 (72.0%)	54 (72.0%)	NS
Snack/0 day	66 (88.0%)	62 (82.7%)	69 (92.0%)	NS

*p* values represent differences between the three evaluations by Cochran and McNemar tests for categorical variables

NS not significant

<sup>a</sup> $p \leq 0.05$  3 vs 6 and 12 months and 6 vs 12 months

<sup>b</sup> $p \leq 0.05$  3 vs 6 months

**Table 6** Caloric, macronutrient, and fiber intake average preoperative and 3, 6, and 12 months postoperative (PO)

Nutrients intake	Preoperative	Postoperative			<i>p</i> value
		3 months	6 months	12 months	
Caloric intake (kcal)	1189.1 ± 480.3	845.1 ± 274.5	884.1 ± 228.4	1003.8 ± 323.2	<i>p</i> ≤ 0.05 <sup>a</sup>
Protein intake (g)	98.07 ± 43.99	50.18 ± 19.04	50.54 ± 17.41	51.66 ± 18.98	<i>p</i> ≤ 0.05 <sup>b</sup>
Protein intake (%)	33.07 ± 9.64	23.55 ± 6.01	22.70 ± 5.46	20.59 ± 5.45	<i>p</i> ≤ 0.05 <sup>a</sup>
Carbohydrate intake (g)	127.11 ± 60.43	106.63 ± 40.96	109.44 ± 34.70	140.54 ± 128.37	<i>p</i> ≤ 0.05 <sup>c</sup>
Carbohydrate intake (%)	42.34 ± 9.10	49.81 ± 8.87	49.33 ± 8.94	50.47 ± 9.65	<i>p</i> ≤ 0.05 <sup>b</sup>
Lipid intake (g)	33.22 ± 18.31	26.41 ± 13.10	27.93 ± 11.84	33.37 ± 17.30	NS
Lipid intake (%)	24.59 ± 7.52	26.65 ± 7.65	27.97 ± 8.46	28.95 ± 9.02	NS
Fiber (g)	15.80 ± 7.14	8.95 ± 4.66	11.15 ± 6.60	12.52 ± 7.66	<i>p</i> ≤ 0.05 <sup>d</sup>

*p* values represent differences between the four evaluations by Friedman and Wilcoxon tests for continuous variables. Data are mean and standard deviation

NS not significant

<sup>a</sup> *p* ≤ 0.05 pre vs 3, 6, and 12 months, 3 vs 12 months and 6 vs 12 months

<sup>b</sup> *p* ≤ 0.05 pre vs 3, 6, and 12 months

<sup>c</sup> *p* ≤ 0.05 pre vs 3 months, 3 vs 12 months and 6 vs 12 months

<sup>d</sup> *p* ≤ 0.05 pre vs 3, 6, and 12 months and 3 vs 6 and 12 months

The mean caloric intake observed in the current study was similar to the one reported by Moize et al. [23]. The low preoperative caloric intake, compared to other studies, occurred as the data has been acquired 1 week prior to the surgery, when patients had been advised to follow a hypocaloric plan to lose weight, thus not reflecting the usual ingestion during the preoperative diet.

The mean protein intake was below the recommended values, as found in the literature [6, 23, 24] considering that, during a restrictive weight loss diet, it is recommended a daily protein consumption between 60 g and 120 g [25]. There is an indication that the patients did not reach the recommended protein intake up to 1 year after the procedure, which can lead to a long-term protein malnutrition.

This study failed to approach the intake of leguminous in the food intolerance additional questionnaire, for this class of food reflects the protein intake from a vegetable source. Moreover, since all of the individuals underwent banded RYGB, the results observed shall not be automatically extrapolated for individuals who underwent non-banded bypass. Another point of concern is that diet is hardly controllable in any situation and depends on several psychological, behavioral, and individual patterns; thus, it is not appropriate to consider all the changes observed attributed to the surgical changes alone. Nonetheless, the results were substantial and significant enough to permit valuable conclusions in regard to the influence of the surgery on food tolerance.

**Table 7** Consumption adequacy of macronutrients and fibers before and 12 months after surgery

	Intake ≤ 85%	86–99%	≥ 100%	<i>p</i> value
Protein (g) preoperative	10 (13.3%)	4 (5.3%)	61 (81.4%)	<i>p</i> ≤ 0.05 <sup>a</sup>
Protein (g) 12 months postoperative	37 (49.3%)	14 (18.7%)	24 (32.0%)	<i>p</i> ≤ 0.05 <sup>a</sup>
Carbohydrate (%) preoperative	21 (28.0%)	29 (38.7%)	25 (33.3%)	<i>p</i> ≤ 0.05 <sup>a</sup>
Carbohydrate (%) 12 months postoperative	6 (8.0%)	16 (21.3%)	53 (70.7%)	<i>p</i> ≤ 0.05 <sup>a</sup>
Lipid (%) preoperative	14 (18.7%)	9 (12.0%)	52 (69.3%)	<i>p</i> ≤ 0.05 <sup>b</sup>
Lipid (%) 12 months postoperative	5 (6.7%)	6 (8.0%)	64 (85.3%)	<i>p</i> ≤ 0.05 <sup>b</sup>
Fiber (g) preoperative	61 (81.3%)	8 (10.7%)	6 (8.0%)	<i>p</i> ≤ 0.05 <sup>c</sup>
Fiber (g) 12 months postoperative	67 (89.4%)	4 (5.3%)	4 (5.3%)	<i>p</i> ≤ 0.05 <sup>c</sup>

*p* values represent differences between the four evaluations by Friedman and Wilcoxon tests for ordinal variables

<sup>a</sup> *p* ≤ 0.05 pre vs 3, 6, and 12 months

<sup>b</sup> *p* ≤ 0.05 pre vs 6 and 12 months

<sup>c</sup> *p* ≤ 0.05 pre vs 3 months

## Conclusion

Food intolerance significantly increased following banded RYGB, leading to a crescent dissatisfaction in regard to food and an increase in the vomiting frequency.

**Funding Information** Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES).

## Compliance with Ethical Standards

**Ethical Approval** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**Informed Consent** Informed consent was obtained from all individual participants included in the study.

**Conflict of Interest** The authors declare that they have no conflict of interest.

## References

- Bloomberg RD, Fleishman A, Nalle JE, et al. Nutritional deficiencies following bariatric surgery: what have we learned? *Obes Surg.* 2005;15:145–54.
- Valezi AC, Junior JM, Menezes MA, et al. Weight loss outcome after silastic ring Roux-en-Y gastric bypass: 8 years of follow-up. *Obes Surg.* 2010;20:1491–5.
- Suter M, Clames JM, Paroz A, et al. A new questionnaire for quick assessment of food tolerance after bariatric surgery. *Obes Surg.* 2007;17:2–8.
- Shai I, Henkin Y, Weitzman S, et al. Determinants of long-term satisfaction after vertical banded gastroplasty. *Obes Surg.* 2003;13:269–74.
- Taddeucci RJ, Madan AK, Ternovits CA, et al. Laparoscopic reoperations for band removal after open banded gastric bypass. *Obes Surg.* 2007;17:35–8.
- Faria SL, Faria OP, Cardeal MA. Comparison of weight loss, food consumption and frequency of vomiting among Roux-en-Y gastric bypass patients with or without constriction ring. *Arq Bras Cir Dig.* 2014;27:43–6.
- Capella RF, Capella JF, Mandec H, et al. Vertical banded gastroplasty-gastric bypass: preliminary report. *Obes Surg.* 1991;1:389–95.
- Fobi MA, Lee H. The surgical technique of the Fobi-pouch operation for obesity (the transected Silastic® vertical gastric bypass). *Obes Surg.* 1998;8:283–8.
- Stubbs RS, O'Brien I, Jurikova L. What ring size should be used in association with vertical gastric bypass? *Obes Surg.* 2006;16:1298–303.
- Love AL, Billett HH. Obesity, bariatric surgery, and iron deficiency: true, true, true and related. *Am J Hematol.* 2008;83:403–9.
- Alvarez-Leite JJ. Nutrient deficiencies secondary to bariatric surgery. *Curr Opin Clin Nutr Metab Care.* 2004;7:569–75.
- Faria SL, Faria OP, Cardeal M de A, et al. Diet-induced thermogenesis and respiratory quotient after Roux-en-Y gastric bypass. *Surg Obes Relat Dis.* 2012;8:797–802.
- Chaim EA, Pareja JC, Gestic MA, et al. Preoperative multidisciplinary program for bariatric surgery: a proposal for the Brazilian public health system. *Arq Gastroenterol.* 2017;54:70–4.
- National Institutes of Health. Gastrointestinal surgery for severe obesity. NIH Consens Statement. 1991;9:1–20.
- Institute of Medicine. Dietary reference intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein, and amino acids. Washington (DC): National Academy Press; 2005.
- Marchioni DML, Slater B, Fisberg RM. Application of dietary reference intakes for assessment of individuals. *Rev Nutr.* 2004;17:207–16.
- Magro DO, Ueno M, Coelho-Neto JS, et al. Long-term weight loss outcomes after banded Roux-en-Y gastric bypass: a prospective 10-year follow-up study. *Surg Obes Relat Dis.* 2018;14(7):910–7.
- Stabe C, Vasques ACJ, Lima MMO, et al. Neck circumference as a simple tool for identifying the metabolic syndrome and insulin resistance: results from the Brazilian metabolic syndrome study. *Clin Endocrinol.* 2013;78:874–81.
- Namazi N, Larijani B, Surkan PJ, et al. The association of neck circumference with risk of metabolic syndrome and its components in adults: a systematic review and meta-analysis. *Nutr Metab Cardiovasc Dis.* 2018;28(7):657–74.
- Ben-Noun L, Sohar E, Laor A. Neck circumference as a simple screening measure for identifying overweight and obese patients. *Obes Res.* 2001;9:470–7.
- Boerlage TCC, van de Laar AWJM, Westerlaken S, et al. Gastrointestinal symptoms and food intolerance 2 years after laparoscopic Roux-en-Y gastric bypass for morbid obesity. *Br J Surg.* 2017;104:393–400.
- Wurtman RJ. Food consumption, neurotransmitter synthesis, and human behaviour. *Experientia Suppl.* 1983;44:356–69.
- Moize V, Geliebter A, Gluck ME, et al. Obese patients have inadequate protein intake related to protein intolerance up to 1 year following Roux-en-Y gastric bypass. *Obes Surg.* 2003;13:23–8.
- Gobato RC, Chaves DFS, Chaim EA. Micronutrient and physiologic parameters before and 6 months after RYGB. *Surg Obes Relat Dis.* 2014;10:944–51.
- Heber D, Greenway FL, Kaplan LM, et al. Endocrine and nutritional management of the post-bariatric surgery patient: an Endocrine Society clinical practice guideline. *J Clin Endocrinol Metab.* 2010;95:4823–43.