

**WEIGHT MANAGEMENT AFTER BARIATRIC SURGERY: ASSESSMENT OF THE  
DIAMETER OF THE GASTROJEJUNAL ANASTOMOSIS, GASTRIC POUCH SIZE  
AND PREOPERATIVE BMI**

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## **Abstract**

### **BACKGROUND**

The literature shows that 15% of the patients that had submitted to a gastroplasty Roux-en-Y (LRYGB), presented weight regain, returning to obesity range, within five and ten years after surgery. This gain of weight can be related to factors not well defined yet. Thus, the objective of this study is to investigate if there is a relationship in preoperative BMI, gastric pouch size and gastrojejunal anastomosis and the weight regain.

### **METHODS**

In this study, we considered as a gain of weight an increase of more than 15% in relation

to weight loss in a period of 2 to 9 years after gastroplasty. We analyzed 72 patients who underwent surgery between 2007 and 2014.

## **RESULTS**

The 47 patients included in the study, a 100% of them had surgical success. Of these, 36 patients did not regain weight while the other 11 regained weight. All of them had done the upper gastrointestinal endoscopy with the measurement of the gastrojejunal anastomosis and the gastric pouch. After the analysis of the medians between the groups, it was observed that the preoperative BMI (40.1 and 48, respectively, p-value 0.01) showed statistical relevance to weight regain, what did not occur with the other parameters, like the diameter of the gastrojejunal anastomosis (1.5 and 1.5, p-value 0.55) and the gastric pouch size (6 and 6, p-value 0.54).

## **CONCLUSION**

Therefore, the preoperative BMI was the only parameter, in this study, that was correlated with weight regain after gastroplasty.

**Keywords** Roux-en-Y gastric bypass • Bariatric surgery • Weight management • Gastrojejunal anastomosis • Gastric Pouch • Preoperative BMI

## **Introduction**

Obesity is a global public health problem, both developed and developing countries show an increase in their prevalence [1]. In Brazil, the prevalence of obesity has increased rapidly in the last 40 years, reaching 16.9% of the adult male population and 12.4% of the female population in the years 2009/2010 [2]. Given the magnitude of this disease, bariatric surgery, when indicated, is currently considered the most effective treatment for weight reduction.

The treatment of obesity involves several approaches, such as nutritional, drug and physical exercise. However, several patients do not respond to these therapeutic maneuvers, requiring a more effective intervention. Bariatric surgery has been shown to be a great help against obesity[3,4].

The weight loss is considered one of the main parameters to define the success of the operation, being a consensus among researchers that the criteria for this evaluation is the percentage difference of the lost weight (% PEP) in relation to the weight excess, of at least 50%, with weight maintenance after long period [5].

Odom et al; (2010) considered as regimens of significant weight values above 15% in relation to the weight lost and Barham et al; (2011), values above 20% [6,7]. Therefore, there is a divergence of values in the literature related to significant weight-bearing. Thus, in the present study, 15% of weight regimens will be used as reference.

Thus, the literature shows that 15% of patients who underwent LRYGB, presented weight regain, returning to obesity or even severe obesity, between five and ten years after bariatric surgery [7].

The possible mechanisms involved in weight regain are: increased energy consumption and eating disorders, high preoperative BMI, dilated gastric pouch and gastrojejunal anastomosis [8].

However, the real factors involved in significant weight regain in the postoperative period are a subject rarely recurrent in the scientific literature, mainly the national one. The present study aims to investigate some factors such as: high BMI before the surgical procedure; Size of the anastomotic ring and gastric pouch compared to patients who did not regain weight, so as to better understand the reasons that are involved in ponderal regrowth after 2 to 9 years of reducing gastroplasty.

## Methods

A cross-sectional study was carried out, with 72 patients submitted to LRYGB, between 2007 and 2014, who presented surgical success. Of these, 25 were excluded due to gestation, cancer, presence of gastric ring, and lack of postoperative follow-up; Besides those not located and those who do not agree to participate in the research. The 47 patients included in the study were allocated to two groups: those with significant weight regain and the control group, which included patients who did not regain weight.

The data collection was performed through the analysis of medical records, medical consultation, telephone interview, physical and complementary examination in a Private Surgery Clinic of the Digestive System of São José do Rio Preto / SP.

The variables studied in both groups included: postoperative time, preoperative BMI (weight divided by height squared), calculation of weight loss excess percentage, gastric pouch measurements and the diameter of the gastrojejunal anastomosis (both Evaluated by High Digestive Endoscopy by a single endoscopist specialized in endoscopy after bariatric surgery). Thus, the diameter of the gastrojejunal anastomosis, gastric pouch and the preoperative BMI of the patients who regained weight with the control group were compared.

The recommendations of the Bariatric Consortium of the Brazilian Society of Bariatric and Metabolic Surgery and the bibliographical references already cited in this article were used to evaluate surgical success and weight regain.

Surgical success was calculated by:  $(\text{Preoperative weight} - \text{ideal weight}) * 0.5$  with maximum weight loss in the period between 18 and 24 months postoperatively. The ideal weight was used as the equivalent of a BMI of 25 kg / m<sup>2</sup>. The weight regimen was calculated by means of the minimum \* .15 post-surgical weight.

## Statistical analysis

The exploratory data analysis included mean, median, standard deviation and variation for continuous variables. The normal or non-continuous distribution of continuous variables was analyzed by asymmetry, kurtosis and Kolmogorov-Smirnov test. Comparison between groups was performed by the Mann-Whitney test, for variables with non-normal distribution. Statistical analysis was performed using the IBM-SPSS Statistics version 24 software (IBM Corporation, NY, USA). All tests were two-tailed and values of  $P < 0.05$  were considered significant.

## Results

We evaluated 72 patients with a mean postoperative time of 2 to 9 years. In the first moment we identified the patients who had surgical success according to Bastos et al, (2013). Of these, 25 (34.72%) were excluded from the study due to gestation (8%), cancer (4%), presence of gastric ring (4%) and loss of follow-up (84%). The inclusion criteria included a sample of 47 (65.27%) patients, of whom 11 (23.4%) regained weight and 36 (76.6%) had no weight regain. The medians were analyzed between the control and weight groups, respectively, preoperative BMI (40.1 and 48,  $p$  value 0.01), diameter of the gastrojejunal anastomosis (1.5 and 1.5,  $p$  value 0.55), and size of gastric pouch (6 and 6,  $p$  value 0.54) (Table 1). The preoperative BMI had statistical significance ( $p$  value 0.01) and the other parameters analyzed did not present statistically significant differences, corroborating with literary data (Table 2).

Table 1 Baseline characteristics of the sample studied

Characteristic	N = 47
Preoperative BMI, kg/ m <sup>2</sup>	40,4 (34,5 – 56,2)
Diameter of the gastrojejunal anastomosis, cm	1,5 (0,9 – 3,0)
Gastric Pouch, cm	6 (3 – 10)

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Continuous variables are described in median (variation)

Table 2 Comparative analysis between patients with and without weight regain

Characteristic	Without regain (n = 36)	Whith regain (n = 11)	P
Preoperative BMI, kg/m <sup>2</sup>	40,1 (34,5 - 55,5)	48 (35,9 – 56,2)	<b>0,01</b>
Diameter of the gastrojejunal anastomosis, cm	1,5 (1 – 3)	1,5 (0,9 – 3)	0,55
Gastric Pouch, cm	6 (3 – 10)	6 (4 – 9)	0,54

Continuous variables are described in median (variation)

## Discussion

Obesity is a global public health problem. In Brazil, the prevalence of obesity has shown rapid increase in the last 40 years, reaching 16.9% of the adult male population and 12.4% female in the years 2009/2010 [2]. In view of magnitude of this disease, bariatric surgery, when indicated, is currently considered the treatment for weight reduction. However, the literature shows that 15% of patients who underwent DGYR, presented weight regain, returning to the obesity or even severe obesity, between five and ten years after bariatric surgery [9]. In the present study, bariatric surgery promoted satisfactory weight loss in 100% of the cases, considered surgical success. However, more than 20% presented upper to 15% in

relation to the weight lost postoperatively. It was observed in this study that of the 11 patients who regained weight, the mean preoperative BMI was  $48 \text{ kg} / \text{m}^2$  ( $35.9 \text{ Kg} / \text{m}^2 - 56.2 \text{ kg} / \text{m}^2$ ), these data being similar to those found in the study of the Society American Association of Bariatric Surgery, in which the mean pre-surgical BMI among women was  $46.5 \pm 7.1 \text{ kg} / \text{m}^2$  and in men  $50.4 \pm 7.1 \text{ kg} / \text{m}^2$  [10], corroborating with the present study that showed that the only statistically significant parameter (p value 0.01) was the high preoperative BMI.

The size of the gastric pouch, another parameter studied, did not alone in the post-bariatric weight regimen. In patients who did not regain the median weight found was 6 cm (3 - 9 cm) and those that regained were 6 cm (4 - 9 cm), not being statistically significant (p value 0.54). The study by Attila et al confirms the found that the observed weight gain two or more years after the operation is not due to dilation of the pouch and several endoscopic studies have shown that increasing the quantity of ingested foods do not interfere in the increase of the gastric bag in 96 to 98% of the cases [11].

In the present study, the diameter of the gastrojejunal anastomosis did not demonstrate, statistically significant for weight regain, with p value 0.55, presenting a median between patients who did not regain 1.5 cm (1 cm - 3 cm) weight and those who did not regained 1.5 cm (0.9 cm - 3 cm). In the literature there is a shortage of data regarding the weight and the diameter of the gastrojejunal anastomosis being one of the reasons for the choice of this parameter in the current study.

The potential limitation of this study may have been the performance of different surgeons, who have variations in the patterns of confection of the diameter of the gastrojejunal anastomosis.

## **Conclusion**

Although Roux-en-Y reductive gastroplasty is highly effective for the treatment of



morbid obesity and improvement of multiple comorbidities, the ponderal regrowth is not unusual. The present study confirmed that high preoperative BMI is associated with referring to Fig. However, further studies are needed to clarify involved in weight regain. Therefore, the cure of obesity is not limited to the surgical act. On the contrary, it is the beginning of a period of changes that must be auxiliary therapies such as diet re-education, change in lifestyle habits, to avoid factors related to weight regain significant.

**Conflict of Interest:** The authors whose names are listed immediately below certify that they have NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript, configuring, thus, no conflict of interest.

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**Ethical Considerations:** The study was approved by the Research Ethics Committee of the Famerp - São Paulo (48524815.0.0000.5415) on 04/25/2016, under the number 1.511.680. All participants agreeing to participate in the study were first informed of the research objectives and signed a Free and Informed Consent Form according to Resolution (Brazil) 466/12. Participants were assured that refusal to participate would not affect assessment in their disciplines. The information collected was used exclusively in research for academic purposes, and the confidentiality of the information was guaranteed.

**Informed consent form:** Individual informed consent was obtained of all participants included in the study declaration of human and animal rights. All procedures performed in studies involving human subjects were in accordance with the ethical standards of the institutional and national research committee and with the Declaration of Helsinki of 1964 and its subsequent amendments or ethical standards Comparable.

## References

1. Pinheiro AR, et al. Uma abordagem epidemiológica da obesidade. *Rev Nutr.* 2004;17(4): 523-33.
2. Silva FB. Fatores associados ao reganho de peso após 24 meses de gastroplastia redutora em Y-de-Roux. Universidade de Brasília. 2012. [WWW document]. URL [http://repositorio.unb.br/bitstream/10482/11644/1/2012\\_FernandaBassanLopesSilva.pdf](http://repositorio.unb.br/bitstream/10482/11644/1/2012_FernandaBassanLopesSilva.pdf).
3. Fandiño J, et al. Cirurgia Bariátrica: aspectos clínico-cirúrgicos e psiquiátricos. *Rev. Psiquiatr.* 2004;26(1):47-51.
4. Wittgrove AC, et al. Perioperative complications in a single surgeons experience with 1000 consecutive laparoscopic Roux-en-Y gastric by-pass operations for morbid obesity [abstract]. *Obes Surg.* 2002;12(4):457-8.
5. Bastos EC, et al. Fatores determinantes do reganho ponderal no pós-operatório de cirurgia bariátrica. *ABCD, Arq. Bras. Cir. Dig.* 2013;26(1):26-32.
6. Odom J, Zalesin KC, Washington TL et al. Behavioral Predictors of Weight Regain after Bariatric Surgery. *OBES SURG* 2010; 20:349–356.
7. BARHAM K, et al. Gastrojejunal stoma diameter predicts weight regain after roux-en-y gastric bypass. *Clinical Gastroenterology and Hepatology.* 20011;9:228–233.
8. Cummings DE, Overduin O, Fosterschubert K. Gastric bypass for obesity: mechanisms

- of weight loss and diabetes resolution. J Clin Endocrinol Metab. 2010;89(6):2608-2615.
9. Silva RF, Kelly EO. Reganho de peso após o segundo ano do *bypass* gástrico em Y de Roux. Com Ciências Saúde. 2014;24(4):341-350.
  10. Renquist, K. Obesity classification. Obes Surg 1998; 8: 480. 4. Benj
  11. Attila C, et al . Estudos endoscópico e histológico prospectivos e sequenciais da bolsa gástrica em 130 pacientes obesos mórbidos submetidos à *bypass* gástrico em Y-de-Roux. ABCD, arq. bras. cir. dig. 2012; 25( 4 ): 245-249.