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Evaluation of Food Tolerance and Change in Taste after Bariatric Surgery: A Pilot Comparative Study

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Abstract

Aim: The aim of this prospective study is to report the short-term results of the change in taste and food tolerance after SG, RYGB and OAGB using a modified Suter Questionnaire and analyze whether these components can affect patient's weight loss, quality of eating, and state of health.

Methods: From May 2017 to December 2017, 81 morbid obese patients were divided into 3 groups: group A (27 patients for SG), group B (26 patients for RYGB), and group C (28 patients for OAGB).

Nutritional assessment and dietary counseling occurred 3 months before the surgery (baseline) and at 1 week, followed by 1, 3, 6, and 12 months post-surgery.

At 6 and 12 months, the quality of food was assessed by a modified Suter Questionnaire, which included additional questions evaluating changes in taste and food choices.

Results: We observed in all the groups an optimal weight loss with no statistical differences at 1 year FU among the groups. Data analysis showed a good food tolerance that improved within the first year after surgery, and there was a progressive enhancement of proper eating habits. We obtained a decrease from 6 to 12 months in the consumption and interest for fatty and sweet foods.

Conclusion: There was a significant reduction in negative habits, which was due to taste change, weight loss and improvement in health conditions.

Our study demonstrates the importance of the nutritionist during the pre-operative period and during the follow up to ensure good nutritional habits and achieve long-term results.

Keywords

Food tolerance; Taste changes; Bariatric surgery; One anastomosis gastric by-pass; Eating behaviors; Weight loss

Introduction

Bariatric surgery is the most effective long-term treatment for morbid obesity compared to non-surgical interventions with effects on eating behavior and food intake [1,2]. Laparoscopic sleeve gastrectomy (SG) and Roux-en-Y gastric bypass (RYGB) are the most commonly performed surgical procedures worldwide [3]. Laparoscopic one anastomosis gastric bypass/Mini gastric bypass (OAGB/MGB) is an emergent bariatric procedure with both restrictive and malabsorptive component and a modulation of intestinal hormones [4,5]. A recent statement of international societies approved OAGB/MGB as a safe and effective standard procedure with a "hypo-absorptive" component [6].

Post-operative changes in subjective appetite, taste, smell, and food preferences are reported in several studies that suggested reducing long-term energy intake [7]. Taste seems to be an important factor that controls the eating behaviour (i.e. change in food preference) by modulating appetite and caloric intake [8]. However, several mechanisms are advocated to explain the reduction in the consumption of high-caloric-density foods, such as malabsorption of nutrients, reduction in gastric volume, compliance to postoperative nutritional counseling, changes in the meal size, an alteration of gastro-intestinal signals (hormones, incretins, etc.), and changes in the perception of taste and food preferences [9-10].

The aim of this pilot study is to report the short-term results of the change in taste and food tolerance after SG, RYGB and OAGB using a modified Suter Questionnaire and analyses whether these components can affect patient's weight loss, quality of eating, and wellbeing.

Methods

From May 2017 to December 2017, 81 morbid obese patients scheduled for bariatric surgery were included in the study. They were divided into 3 groups: group A (27 patients for SG), group B (26 patients for RYGB), and group C (28 patients for OAGB). The following study was approved by the Internal Review Board of the Department of Medical-Surgical Sciences and Biotechnologies, Polo Pontino-Sapienza University of Rome Latina Italy, and No funding was received for this study. Inclusion criteria were: BMI 35-50 (kg/m^2) and age between 18-65 years. In particular, RYGB was indicated for patients that had a symptomatic Hiatal hernia, GERD and/or oesophagitis Los Angeles B or higher; SG for patients that hadn't oesophagitis, reflux and/or large Hiatal hernia and 35-45 BMI range; OAGB for patients that hadn't oesophagitis, reflux and/or large Hiatal hernia BMI>45. However, the patient choice, the eating pattern and the results of dietician and psychological counseling were considered. The exclusion criteria were previous gastro-intestinal surgery need of concomitant procedure (i.e., cholecystectomy, ventral hernia repair), and conversion to open surgery. All patients signed an informed consent approved by the internal ethical committee. Nutritional assessment and dietary counselling occurred 3 months before the surgery (baseline) and at 1 week, followed by 1, 3, 6, and 12 months post-surgery. During each visit, the patients had anthropometric measurements in which, after overnight fasting, the patients were weighed barefoot and in light clothing to the nearest 0.1 kg. Height was measured using a fixed wall stadiometer (model Wunder RH). The height and weight of the patients were recorded and BMI (kg/m^2) was calculated. Waist-hip ratio and blood tests were also evaluated. During the first visit, lifestyle and daily caloric intake were recorded

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by the 24 h recall, while in the following visit a 7-day-dietary-diary was used. Once in a month, the nutritionist evaluated the real food eaten and he decided to improve the food consumption with a hypo-caloric or ketogenic diet. Successively, the nutritionist evaluated the nutritional status, food tolerance, adequacy of intake and diet progression following international guidelines [11]. Pre-operatively, all the patients underwent to upper endoscopy and were tested for Helicobacter Pylori infection by endoscopic biopsy. Before the surgery, all groups were recruited for a last meeting in which the surgeon, the nutritionist and the psychologist discussed the procedures to be undertaken and nutritional-consultation to be consigned. After the surgery, patients followed a sequential diet: liquid (for 2 weeks), pureed (for 2 weeks), soft solid (progress as tolerated), and firmer, regular food following the international nutritional guidelines [12]. After the first months, patients were counseled to meet minimal needs for carbohydrate (130 g/day) and fat (20 g/day). Thus, the nutritionist aimed to (a) give advice on a balanced diet that included adequate servings from all food groups, and in particular, protein that was required at 1.1 g/kg ideal body weight; [12] and (b) limiting or excluding added sugar, concentrated sweets, fruit juice, fried foods, carbonated drinks, caffeine, and alcohol from the diet plan [11,13,14]. At 6 and 12 months, the quality of food was assessed by a modified Suter Questionnaire, which included additional questions evaluating changes in taste and food choices [15]. Therefore, the questionnaire consisted of five parts: 1) satisfaction about the quality of eating; 2) tolerance to eight different types of food (red meat, white meat, salad, vegetables, bread, rice, pasta, and fish); 3) frequency of vomiting/regurgitation per week; 4) change in taste; and 5) altered food choices. The total score ranged from 1 to 27 points, where 27 depicted excellent quality of eating (Appendix 1). This questionnaire has been used and validated in previous study [16].

After 6 and 12 months, the % Total Weight Loss (%TWL) and % Excess Body Mass Index Loss were calculated (according to ASMBS position statement) [17].

Statistical analysis

The sample size was considered according to the draft of the present pilot study. The data analysis was done using the Kruskal-Wallis One Way Analysis of Variance of Ranks, All Pairwise Multiple Comparison Procedures (Holm-Sidak method), and All Pairwise Multiple Comparison Procedures (Turkey test). A p value <0.05 was considered statistically significant.

Results

All the patients completed the follow up (FU) at 12 months.

Table 1 shows % Total Weight Loss (%TWL) comparing SG, RYGB and OAGB at 6 and 12 months of FU.

Results showed no statistically significant differences ($p<0.05$) between the three procedures during the follow-up. At 1st year, all the patients had a % TWL greater than 30%.

Table 2 shows data about mean BMI, % EBMIL, weight and age

Table 1: % Total Weight Loss at 6 and 12 months after RYGB, SG and OAGB.

FU	Group	N	%TWL (mean)	Comparison	p
6 Months	RYGB	26	25.74 (± 8.11)	SG *vs.* OAGB	0.345
	OAGB	28	27.74 (± 6.47)	RYGB *vs.* OAGB	0. 643
	SG	27	27.85 (± 3.86)	SG *vs.* RYGB	0.996
12 Months	RYGB	26	31.88 (± 10.34)	SG *vs.* OAGB	0.769
	OAGB	28	35.50 (± 7.54)	RYGB *vs.* OAGB	0.403
	SG	27	34.14 (± 5.63)	SG *vs.* RYGB	0.509
Note: SG: gastrectomy; RYGB: Roux-en-Y gastric bypass; OAGB: one anastomosis gastric bypass; %TWL: % Total Weight Loss.					

Table 2: % Excess Body Mass Index Loss and anthropometric data at baseline, 6 and 12 months after RYGB, SG and OAGB.

Group	FU (Month)	%EBMIL	BMI (Kg/m^2)	Weight (Kg)	Age (year)	WHR
SG	0	0	42.62 (± 3.98)	120.77 (± 18.83)	47 (± 12)	1.03
OAGB	0	0	46.4 (± 6.95)	124.21 (± 20.86)	45 (± 10)	1.1
RYGB	0	0	41.32 (± 6.68)	114.73 (± 19.31)	46 (± 8)	1.11
SG	6	69.29 (± 12.22)	30.74 (± 3.25)	86.91 (± 12.96)	47 (± 12)	0.99
OAGB	6	62.34 (± 18.06)	33.49 (± 5.19)	89.6 (± 15.97)	45 (± 10)	1.02
RYGB	6	63.32 (± 19.45)	30.46 (± 4.81)	84.42 (± 13.37)	46 (± 8)	1.01
SG	12	84.03 (± 14.00)	28.01 (± 2.93)	79.13 (± 11.83)	47 (± 12)	0.98
OAGB	12	79.73 (± 19.29)	29.84 (± 4.94)	79.6 (± 13.35)	45 (± 10)	0.99
RYGB	12	77.76 (± 21.80)	27.75 (± 3.95)	76.93 (± 11.13)	46 (± 8)	0.98
Note: FU: Follow up; SG: gastrectomy; RYGB: Roux-en-Y gastric bypass; OAGB: one anastomosis gastric bypass; BMI: body mass index; %EBMIL: % excess body mass index loss; WHR: waist-hip ratio.						

Table 3: Suter Questionnaire Results.

FU	Group	N	%TWL (mean)	Comparison	p
6 Months	RYGB	26	21.153 (± 2.34)	SG *vs.* OAGB	0.253
	OAGB	28	21.821 (± 2.94)	RYGB *vs.* OAGB	0.651
	SG	27	20.629 (± 2.95)	SG *vs.* RYGB	0.77
12 Months	RYGB	26	21.461 (± 3.04)	SG *vs.* OAGB	0.546
	OAGB	28	22.535 (± 1.75)	RYGB *vs.* OAGB	0.272
	SG	27	21.814 (± 2.70)	SG *vs.* RYGB	0.868
Note: FU: Follow up; SG: sleeve gastrectomy; RYGB: Roux-en-Y gastric bypass; OAGB: one anastomosis gastric bypass; suter questionnaire results.					

at baseline (t0), 6 months (t1) and 12 months (t2) after surgery. At 12 months, the average BMI was within the overweight range in all the considered procedures. Patients who underwent SG showed better results in terms of %EBMIL.

Table 3 shows results of statistical analysis of Suter Questionnaire Total score for SG, RYGB and OAGB at 6 and 12 months.

The questionnaire total score showed no statistical differences between the groups at every FU, which showed that food tolerance was comparable in all the bariatric procedures considered.

After 6 months, the patients who underwent RYGB, SG and OAGB showed quality of eating considered as "good" in 70%, 50%, and 80% of patients respectively, and "acceptable" in 10%, 30%, and 50% respectively. No patient considered the quality of eating "poor" or "very poor". At 1 year, the quality of eating demonstrated better results. Ten percent of the patients who underwent RYGB, SG and OAGB improved their food tolerance to "excellent", 60% of patients in all the procedures described it as "good", and 20% with SG and RYGB and 30% with OAGB evaluated it as "acceptable".

We tested the possible differences related to RYGB, SG and OAGB in food consumption. In Figure 1, we assessed the tolerance regarding red meat, which was less tolerable for the patients in the immediate post-operative period. We also evaluated the possible improvement of consumption during the FU.

All the groups showed a reduced appetite for foods like red meat, especially during the first months. At 6 months, red meat was "easily" tolerable in 36%, 35%, and 52% of RYGB, OAGB and SG patients, respectively. At 12 months, we had a progressive improvement of red meat tolerance with 75%, 67% and 54% of the patients stating the red meat as "easily" tolerable.

During the FU, the test showed results close to the maximum score, demonstrating that in all the procedures there was good food tolerance.

In the unrated section of Suter Questionnaire estimating taste changes, the results obtained in the various timing of FU have been reported in Figure 2.

The results showed an important change of taste in all the groups with a significant binding effect even on weight loss. At 6 months 65% of patients after RYGB reported a reduced interest for fats, 57% after OAGB and 74% after SG; After 12 months, 69%, 57% and 70% showed reduced interest respectively.

The same trend was observed for alcoholic and sweet food. We reported a reduced interest for alcoholic in 73% of patients after RYGB, in 64% after OAGB, and 59% after SG at 6 months. At 12 months, we observed similar results (77% after RYGB, 71% after OAGB, and 56% after SG).

Similarly, patients experienced a reduced interest for sweet food. At 6 months (73% post RYGB, 71% post OAGB and 67% post SG), and (77% post RYGB, 71% post OAGB, and 70% post SG) after 1 year FU.

In Table 3 there are no reports of other data concerning additional food intake. In general, there is an increase in consumption of all foods, such as pasta, bread, rice, fish, vegetables and white meat in all the groups.

During the postoperative period, there was a progressive improvement in the tolerance for different foods. White meat was moderately tolerated at 6 months by 52%, 71%, and 58% of RYGB, OAGB and SG patients, but after 1 year it showed improvement at 73%, 80%, and 76%, respectively. At 6 and 12 months, salad, pasta, vegetables and rice were easily tolerable for 75%, 83%, and 62% of patients.

We also observed reduction of vomiting/regurgitation episodes that passed from 36%, 57%, and 30% of patients after 6 months to 31%, 28%, and 19% after 12 months in all the groups.

Discussion

This is a pilot study reporting the food tolerance and eating

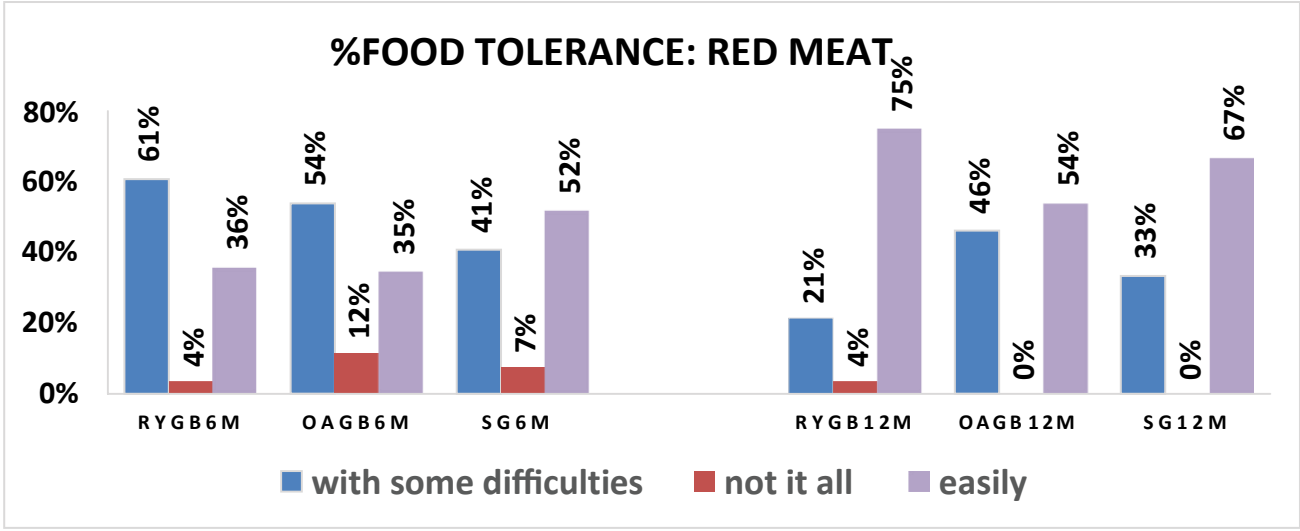

Figure 1: Sleeve Gastrectomy (SG), Roux-en-Y gastric bypass (RYGB), one anastomosis gastric bypass (OAGB)- Red Meat Food Tolerance at 6 and 12 months.

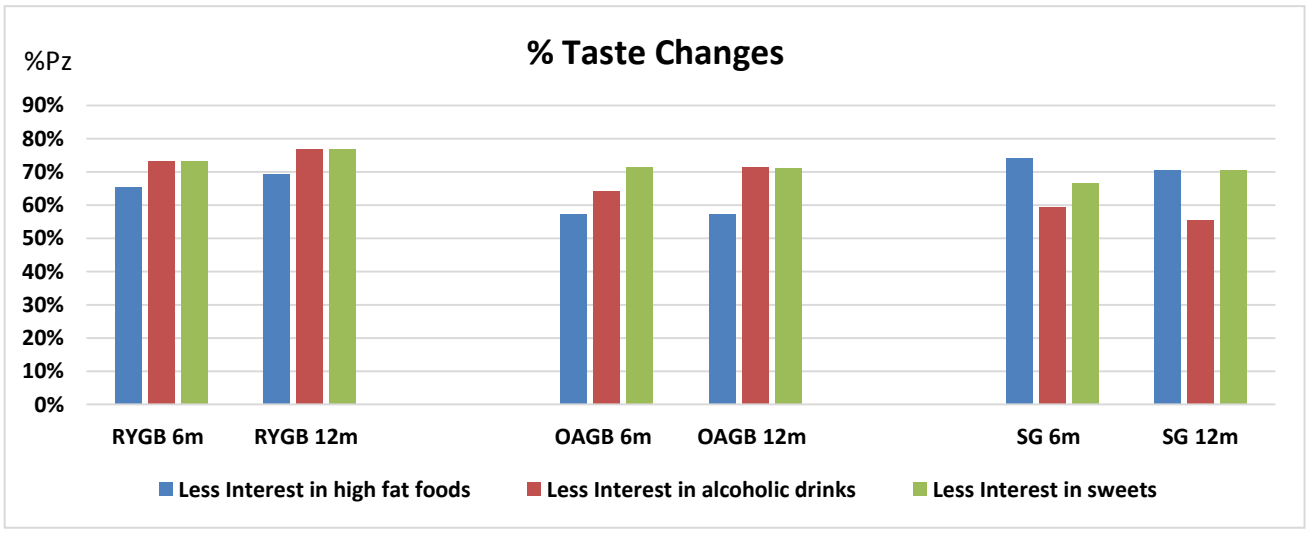

Figure 2: Sleeve Gastrectomy (SG), Roux-en-Y gastric bypass (RYGB), and one anastomosis gastric bypass (OAGB) taste changes at different timing of follow up.

behavior modifications in three groups of patients who underwent to RYGB, SG and OAGB in 1 year.

However, the study has certain limitations. It is a single centered study, has a small group dimension and shorter follow-up period and designed as pilot prospective study.

We observed in all the groups an optimal weight loss with no statistical differences at 1 year FU among the groups. We demonstrated that a strict and structured nutritional FU is essential during the pre-operative period. In fact, the Data analysis showed a good food tolerance pre and post-operatively, that improved within the first year after surgery, and there was a progressive enhancement of proper eating habits, right quality and quantity of foods eaten.

All the patients didn't complain vomiting before the surgery.

Miras et al. stated that RYGB produced a decrement in desire to consume sweet/fatty candies, but did not alter the desire to eat vegetables products [12].

At 6 months after RYGB, Molin Netto et al. reported a decrease in frequency in the consumption of unhealthy foods (from 15.4% to 5.1% for pizza and from 18% to 0% for hamburger) and an increased consumption of healthy foods (from 0% to 5.1% for fish and from 0% to 25.6% for yogurt) [18].

In previous study, the effects on the desire to eat specific foods using a modified Suter Questionnaire have also reported. The results showed the reduction in the preference of foods rich in fats, sugars and in complex carbohydrates after SG at 6, 12 and 24 months. This beneficial change in food preferences showed a reduction at 24 months [16].

Our results confirmed the trend described in the literature. A very interesting data pattern has been represented by no statistical differences observed between the three different surgical procedures. Considering that all the surgical interventions have been performed by the same team, as the nutritional counseling is important in managing the eating pattern changes (good chewing, small bites, avoiding drinking during the meals and devoting the right length to the meal), and contributing to avoid a possible long-term weight regain. Supporting the patients during the pre- and post-operative period allowed obtaining vomit and regurgitation reduction and consequently a good absorption of different micro and macro nutrients.

Modified Suter Questionnaire (original) results showed how the majority of patients had a good food tolerance with a mean total score that improved till getting close to the maximum score. These outcomes demonstrated how bariatric surgery could determine difficult consumption of food only in the first post-operative period. Other studies that used the Suter test to evaluate food tolerance and eating behavior after bariatric surgery demonstrated an improvement as compared to the results of the present study [16,19].

The improvement of food tolerance after RYGB, SG and OAGB is an important factor in increasing Suter questionnaire total score. Red meat is usually not tolerated, especially during the first post-operative period. The reason is not only related to surgery; red meat muscular fibers result in improper chewing with bites usually bigger than other foods. The improvement of red meat consumption can be related to the efficacy of a customized nutritional FU that allows the patients to take right quantity of meat based on their sense of hunger-satiety. Other studies confirmed how this food is difficult to be consumed, with patients referring that they avoid red meat especially when nutritional recommendations are not given [15,19,20].

We also obtained a general improvement in the food tolerance level for other kinds of food like pasta, bread, rice, fish, and vegetables during the FU.

As in other studies, we experienced an important taste change after bariatric surgery. Two case control studies compared the effect of SG and RYGB on changes in appetite, taste, sense of smell and aversion to food and evaluated its association with weight loss. Both studies demonstrated that most of the patients showed a decreased appetite, with new aversion to food and taste changes (commonly for sweets and fats), with no differences between SG and RYGB [7,21].

No studies have shown the effect of food tolerance and taste changes in OAGB.

In our study, considering OAGB, we obtained a decrease from 6 months to 12 months in the consumption and interest for fatty and sweet foods, and also for alcoholic drinks. In this case, our results confirm the findings of other studies dealing with SG and RYGB [7].

Mechanisms involved in changes in food preference and eating behavior are not fully understood and new studies with longer FU will determine what patterns are involved with these changes. Our study results showed how essential is a protracted nutritional work that evaluates and respects the patient's food tolerance ability and taste change as well as tries to follow the health nutrition principles.

Conclusion

The results of our pilot study showed good weight loss in all the groups with %TWL range of RYGB, OAGB and SG as (21.34-42.22%), (27.96-43.04%), and (28.51-39.77%), respectively. All the patients got out of their obesity conditions within 12 months after surgery regardless of the surgical procedures.

RYGB, SG and OAGB determined an important effect on taste change and food tolerance, which was not correlated to the procedures. There was a significant reduction in negative habits, which was due to taste change, weight loss and improvement in health conditions, especially during the first postoperative period.

Our study confirms the importance of the nutritionist during the pre-operative period and during the FU to ensure good nutritional habits and achieve long-term results.

It will be important to evaluate these groups of patients for a longer follow-up period to better understand the food tolerance, taste modifications and their relationship with the patient's weight loss pattern. These observations need to be confirmed in a multicenter prospective study with long term follow up.

Conflicts of Interest

The authors declare that they have no conflict of interest.

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