Global Surgery

Research Article ISSN: 2396-7307

Pattern of calorie and macronutrient intake after bariatric surgery in patient with obesity: A clinical trial

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Abstract

Background: There are limited data about daily energy and macronutrient intake after LSG and RNY in the patients with obesity.

Methods: This prospective clinical trial was conducted on sixty patients with obesity (BMI ≥ 35) who had LSG (n = 33) or RNY (n = 27) (2015–2016). Anthropometric and demographic indices (weight, height, body mass index, sex, and age) were recorded. Two 24-h food intake were completed before and 3 months after surgery.

Results: Mean total energy and macronutrient intake decreased three months after surgery in both groups ($P < 0.05$); without significant differences between two groups. The mean energy, protein, fat and carbohydrate intakes were 578.8 Kcal/day, 26.6, 24.5 and 65.4 g/day respectively, three months after surgery. According to the type of surgery, no significant differences were seen in energy, protein, and fat intake during three months after surgery ($p > 0.05$).

Conclusion: The data suggest that amount of calorie and macronutrient intakes are unrelated to the type of surgery and daily protein intake is inadequate in RNY and SLG groups.

Abbreviations: *LSG: Laparoscopic Sleeve Gastrectomy, RNY: Roux-En-Y Gastric Bypass, BMI: Body Mass Index, WHO: World Health Organization, ASMBS: American Society for Metabolic and Bariatric Surgery*

Introduction

According to WHO, the prevalence of obesity and morbid obesity (defined by BMI ≥ 40 kg/m^2 or a BMI ≥ 35 kg/m^2 with obesity-related morbidities) is on the rise globally [1]. It was reported that the number of people who suffered from morbid obesity become four times between 1986-2000, and from 2000-2005 a much faster grow in patient with morbid obesity was seen in the united states, in contrast with obese or overweight population [2,3]. Furthermore, it is estimated that each year, more than 2.6 million people die because of obesity [4]. On the other hand, obesity and especially morbid obesity is closely associated with chronic diseases such as cancers, diabetes and ischemic heart diseases as well as lowering quality of life due to knee pain, imbalance and fear of falling [5-8].

Despite the importance of obesity as the most prevalent metabolic disease in world [9,10], it does not seem that nonsurgical methods can play effective role in treatment of obesity in long-term [11-14] and it seems that the surgical outcomes on quality of life and controlling comorbidities is incomparable to non-surgical treatment methods [15]. Therefore, it can be said that bariatric surgery is the most effective therapeutic method for morbid obesity [16].

The three categories of weight loss surgeries which are recommended to patients with morbid obesity include: mal-absorptive procedures (such as biliopancreatic diversion with duodenal switch), restrictive procedures (such as Sleeve gastrectomy surgery (or combination procedures (roux-en-y gastric bypass surgery) [17]. Total bariatric procedures numbers of ASMBS were 196,000 at 2015 and Sleeve and RNY were the most common methods since 2011 [16].

Multiple factors (surgical and non-surgical) contribute to significant weight loss after the bariatric surgery and it is not limited only to reduced food intake or malabsorption of the consumed food [18,19]; patients experience some major changes in energy and macronutrient intake, eating habits and taste perception which cause some changes in health or patient's lifestyle [20-23]. Severe restriction of energy and especially protein intake post operation could lead to malnutrition and micronutrient deficiencies [24]. As it was assessed before, there was no significant difference in nutritional status and dietary intake after LSG and RYGB [22,25], but bone loss and vitamin (especially B12, D and folate) and mineral (especially iron and zinc) deficiencies were reported after bariatric surgery [26,27].

On the other hand, for maintaining the results of bariatric surgery in long term, healthy eating habits and physical activity are as important as psychiatric and metabolic interventions [19,28].

To the best of our knowledge, this is the first study to discuss energy and macronutrient intake pattern after RNY and LSG in Iran.

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Key words: *bariatric surgery, dietary intake, obesity, Sleeve gastrectomy, gastric bypass*

Received: July 24, 2018; **Accepted:** August 29, 2018; **Published:** September 06, 2018

As previously specified, RNY is associated with greater or comparable weight loss in comparison with LSG [22,29], but our aim was to determine whether there is a significant difference in nutritional consequences of these two surgical methods.

Materials and methods

This clinical trial was conducted on 60 patients aged 20–50 years old with a BMI ≥ 40 kg/m^2 or a BMI ≥ 35 kg/m^2 with obesity-related morbidity who were undergone bariatric surgery at Mostafa Khomeini, Khatam -al Anbiya and Rasool Akram hospital during the period 2015–2016. Twenty-seven patients were scheduled to had RNY and 33 were undergone LSG.

Exclusion criteria were being pregnant or menopause (to eliminate any hormonal changes that could affect the surgery outcomes) for women candidates, having uncontrolled diabetes mellitus or hypertension, severe cardiovascular disease and chronic obstructive pulmonary disease. Furthermore, patients who used any weight loss drugs (or having any medication that affected weight loss process) 6 months prior to surgery, excluded from the study.

Written informed consent was obtained from participants. All protocols for the experiments were approved by the institute of Ethical Committee, Tehran University of Medical Science (TUMS) & Health Services.

The subjects were classified to RNY and LSG group for 3 months. The appropriate surgical procedure was selected by the surgeon for each subject.

Weight and anthropometric indices were calculated by Body Impedance Analyzer in body 370 (Biospace America, Inc) in standing posture, 7 days prior to surgery and 3 months after operation. Standard tape was used for height measuring.

Patients were encouraged to follow a special low calorie – high protein diet which provides 600-800 kilocalorie at the first 4 weeks post-surgery. They were instructed to follow clear liquid diet and full liquid diet at the first 2 weeks after procedure and gradually shift to Pureed diet for the next two weeks. After one month, patients educated to have 800-1000 low fat, protein-rich regular diet and allowed to increase their intake to 1000-1200 kilocalorie per day 3 months after surgery.

A trained nutritionist filled out two 24-h food recall for each patient at baseline and 3 months- follow-up. Dietary intakes were analyzed by the University of Minnesota Nutrition Data System for Research, version 5.0–3.5.

Statistical analyses were performed by Statistical Package for Sciences Software (version 16; SPSS Inc., Chicago, IL, USA). Continues data were reported as mean (SD) and categorical variables were described as numbers (percentile). The results were summarized as mean difference and 0.95 (CI) aligned with *P* value < 0.05.

Results

Sixty participants (45 females and 15 males), aged from 20 to 50 years (mean 35.15) were stratified in the study. The mean weight of patients was 123.92 (20.27) kg before surgery with the mean BMI of 45.85 (6.26) kg/m^2. The patients were divided into two groups based on the type of surgery: LSG (n = 33) and RNY (N = 27). Baseline and 3-month demographics and anthropometric measurements were reported in Table 1.

Daily calorie and macronutrient intakes before and 3 months after surgery were mentioned in Table 2. Mean total energy intake decreased from 1919.5 kcal to 578.8 kcal 3 month after surgery in both groups. The mean protein, fat and carbohydrate intakes in the total participants were 26.6, 24.5 and 65.4 g/day respectively, three months after surgery. Moreover, daily macronutrient intake including fat, protein and carbohydrate decreased significantly during the same period (the smallest reported *P*-value was < 0.001).

According to the type of surgery, no significant differences were seen in energy, protein and fat intake during 3 months after surgery ($p > 0.05$). But the change in daily carbohydrate intake was significantly fewer in LSG patients in comparison to RNY patients.

By dividing participants into 3 age groups (1:20-30, 2:30-40, 3:40-50), it was specified that the total energy intake decreased significantly in group 1 in comparison to group 3 before and 3 months after surgery ($p = 0.045$). Changes in calorie intake were not significant between other age groups ($p > 0.05$). Furthermore, carbohydrate intake was significantly decreased in age group 1 in comparison to age group 3 before and three months after surgery (p = 0.04). Other changes in

Table 1. Demographic and anthropometric characteristics of the study population at baseline and 3 months follow up

Variable	LSG (n=33)	RNY (n=27)
	Baseline	Baseline
Age (year)	35.2 (7.72)	35 (7.72)
Sex (Female)	24 (72.7)	21 (77.8)
Sex (male)	9 (27.3)	6 (22.2)
Height (Cm)	165.1 (9.20)	163.6 (7.67)
Weight (Kg)	120.2 (90.84)	128.4 (20.24)
BMI	44.1 (5.04)	48 (7.0)

The values are expressed as mean (SD) except sex: number (percent), BMI: body mass index, F: female, M: male.

Table 2. Daily calorie and macronutrient intakes at baseline and 3 months follow up, according to the type of surgery

Variable	LSG		Mean diff	RNY		Mean diff	*P** value (diff)	Confidence Interval	
	Baseline	3 months		Baseline	3 months			Lower Bound	Upper Bound
ENERGY Kcal/ day	1876	553.8	1318.7	1972.6	612.5	1304.6	0.103	-3148.02	299.35
PRO (gr)	54.1	26.7	28	62	26.5	32.8	0.118	-135.79	109.53
CHO (gr)	233.6	62.3	171	257.4	69.6	180.5	0.034	-120.08	13.88
FAT (gr)	83.7	23	60.7	80.5	26.5	52.2	0.831	-554.87	-22.16

The values are expressed as mean (SD) PRO: protein, CHO: carbohydrate,*: differences between groups, Statistical difference: $p < 0.05$.

macronutrient intake were not significant between other age groups ($p > 0.05$). According to the type of surgery no significant difference was found between 3 groups ($p > 0.05$).

By dividing participants into 3 BMI groups (1:35-39.9, 2:40-49.9, 3:BMI > 50), we found that the mean changes of total energy, carbohydrate and protein intake in BMI groups was not significant, compared with each other ($p > 0.05$). However, patients in group 1 consumed less fat 3 months after surgery in contrast to group 2 ($p = 0.007$). The same difference was not found between other groups. According to the type of surgery no significant differences were found between 3 groups ($p > 0.05$).

Discussion

In the present study, the mean calorie intake was 578.81 kilocalorie and no significant difference was observed in 24h food record at 12 weeks post operation between two surgery groups. Previous studies reported that operated patients received a 500-1000 kilocalorie diet [30-32] and the intake of macronutrients decreased totally 3 to 12 months after bariatric surgery [20,33-35]. In our study aligned with previous outcomes, energy intake and macronutrient intake (as a percentage of energy consumption) decreased in the two groups.

According to the type of surgery, the mean energy intake was 612.5 Kcal/day in RNY and 553.8 Kcal/day in LSG group. Miller et al. [36] reported that daily energy intake in patients who undergone RYN, decreased 1000 kilocalories approximately, during one year after surgery. They investigated dietary intake of 17 candidates by 4-day food records showed that their protein and carbohydrate intake increased but fat consumption decreased significantly. According to annual review of nutrition in 2009, the average energy intake was 1000-1800 kcal in the first year after surgery [37]. Similarly, Mirahmadian et al. [20] suggested that 3 months after gastric bypass surgery, mean energy intake was decreased to 739.81 (± 376.39) kcal [20]. Also decreased energy intake was reported in LSG patients in the same timeframe. Gjessing et al. [38] analyzed nutritional intake in 150 patients underwent LSG by filling 24-hour recall. They reported that the mean energy intake decreased to 710 kcal at 3 months. These findings are comparable to outcomes in a small study of Almogy et al. [39] which showed that mean daily energy intake in 21 patients decreased to 780 kcal at 3 months. Comparison of energy intake between LSG and RNY group, showed no significant difference at 6 months and 12 months after surgery. However, mean energy intake decreased significantly in two groups from baseline to 6 months and 12 months-fallow up [22].

In some studies, standard low-calorie diets have been given to individuals [20,38] and in some studies, certain diets are not recommended, and subjects were received nutritional counseling [36]. Regardless of whether a low-calorie diet prescribes or not, it seems that people consume fewer calories after surgery, but providing macronutrients especially proteins and micronutrients is important in low calorie diets. It is obviously understood that protein intake has vital impact on preventing FFM loss, promoting weight loss and creating feeling of satiety [40]. Dagan et al. [41] illustrated that receiving more than 60 grams of protein per day is related to losing less fat free mass after bariatric surgery. However, we found that the average protein intake after surgery was less than daily recommended amount (60 g/day) [42], despite educating patients at baseline of the study. The mean protein intake was 26.7 g/day at LSG and 26.5 g/day at RNY group. This issue can be explained on the basis of predominant female gender participants because some studies show that women, like most of our subjects, consume less protein and more carbohydrate [43].

Studies on the effect of type of surgery on protein intake are limited. Patients who underwent restrictive bariatric experience had lower intake of protein more than who had gastric bypass [44]. Similarly, Moizé et al. [22] reported that within 3 months daily protein intake in LSG patients decreased from 0.70 g/kg body weight/day at baseline to 0.66 at six months. At the same time a 0.1 decrease was reported in RNY patients. Nicoletti et al. [45] also reported that mean protein intake in 30 women who had RNY was 47 ± 2 g/day. In contrast, data from Mirahmadian et al. [20] study have found that percent of daily protein intake increased from 18.57% at baseline to 26.24%, three months after RNY surgery, which is aligned with Miller et al. [36] findings for RNY patients.

Although, based on our findings, there was no significant difference in protein intake between two groups, three months after surgery, but because of contradictory results of recent studies, further investigations are needed to assess this effect.

According to our results, amount of calorie and macronutrient intakes were unrelated to the type of surgery. This indicates that postoperative calorie intake decreases on average, and this reduction does not depend on the type of operation.

At last, it should be noted that weight loss surgery is just a way to reduce amount of eating, digesting, and absorbing. Factors like excess calories from snack, sweets, fried or fast food are related with weight regain. Therefore, supporting strategies and educating healthy diet have key role on maintaining weight loss and preventing weigh regain.

Limitation and strength

To the best of our knowledge, it was the first study on Middle Eastern dietary pattern which has been done to assess energy and macronutrient intake after LSG and RNY on nutritional consequence after surgery. The limitations of our study were small sample size, short period of trial and not considering the level of physical activity of the participants as an effective factor on dietary intake and changes in SMM and fat mass. Although there is much work remains to be done specially studying on the differences of dietary intake in youth, middle aged and elderly subjects after surgical induced weight loss. More over due to different eating behavior in each population, further studies are needed to assess nutritional consequence of bariatric surgeries in patient with morbid obesity.

Conclusion

The data suggest that amount of calorie and macronutrient intakes are unrelated to the type of surgery and daily protein intake is inadequate in both RNY and SLG groups.

Acknowledgment

This research has been supported by Tehran University of Medical Sciences and Health Services Grant (No: IRCT201512297903N7).

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