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# Intuitive eating is associated with weight loss after bariatric surgery in women

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## ABSTRACT

**Background:** Although the data on eating behavior after bariatric surgery are substantial, data on “intuitive eating” are lacking.

**Objective:** The aim of this study was to evaluate the link between intuitive eating and weight loss after bariatric surgery.

**Methods:** This cross-sectional study used a self-administered questionnaire freely available on social networks and targeted women who had undergone bariatric surgery. Intuitive eating was evaluated with the Intuitive Eating Scale-2 (IES-2). The 3 questionnaire subscores (Eating for Physical Rather than Emotional Reasons, Reliance on Hunger and Satiety Cues, and Unconditional Permission to Eat) were also analyzed. The relation between IES-2 scores and the relative variation in body mass index [BMI (in kg/m<sup>2</sup>)] was assessed with linear regression models. Adjusted  $\beta$  ( $\beta_{\text{Adj}}$ ) and standardized  $\beta$  ( $\beta_{\text{Adj}}^{\text{STD}}$ ) were reported.

**Results:** We analyzed the responses of 401 women with a mean age of  $39 \pm 11$  y, a mean preoperative BMI of  $45.5 \pm 7.9$ , and a mean current BMI of  $30.5 \pm 7$ . The mean relative BMI loss was  $32.7 \pm 12.9\%$ , and the mean IES-2 score was  $3.3 \pm 0.6$ . The total IES-2 score was associated with the relative BMI loss, with  $\sim 2.6\%$  BMI loss for each 1-point increase in the IES-2 score [ $P_{\text{Adj}} = 0.007$ ;  $\beta_{\text{Adj}} = -2.57$  (95% CI:  $-4.44, -0.70$ );  $\beta_{\text{Adj}}^{\text{STD}} = -0.12$ ] after adjusting for elapsed time since surgery and type of surgery. Eating for Physical Rather than Emotional Reasons was the subscore most strongly associated with BMI change after adjustment [ $P_{\text{Adj}} = 0.002$ ;  $\beta_{\text{Adj}} = -2.08$  (95% CI:  $-3.37, 0.79$ );  $\beta_{\text{Adj}}^{\text{STD}} = -0.14$ ].

**Conclusions:** This study highlights a significant association between intuitive eating and BMI decrease after bariatric surgery. Furthermore, eating behaviors changed with increasing time since surgery. An intuitive nutritional approach may be complementary with bariatric surgery in the postoperative phase, which should prompt complementary prospective studies to evaluate the effectiveness of therapeutic education programs centered on intuitive eating in the postoperative period. *Am J Clin Nutr* 2019;00:1–6.

**Keywords:** bariatric surgery, intuitive eating, weight loss, obesity, Intuitive Eating Scale-2

## Introduction

The rise in the prevalence of obesity and overweight during the past several decades has become a worrisome problem in many countries (1–3). WHO has reported that worldwide obesity prevalence doubled from 1980 to 2014 (1), with 39% of today’s adults being overweight and 13% being obese. The continuing rise in obesity (4) has prompted the development of management strategies to better prevent and control comorbidities (5–7) and reduce mortality (8–10). Obesity management currently revolves around nutritional, pharmaceutical, and surgical treatments, in addition to global patient support. Nutritional management has been revolutionized in the past few years, with changes made to the classic restrictive diets (11) and an orientation toward more behavioral therapies centered on intuitive eating (12–15). Intuitive eating is an adaptive eating style characterized by eating in response to physiological cues (hunger and satiety) rather than emotional cues and by not forbidding certain foods, as seen in cognitive restraint (16). The main advantage of this intuitive therapy is its adaptability to the patient-specific physiological or pathological characteristics that have accumulated during life, without the adverse metabolic and psychological effects of restrictive diets. Bariatric surgery, however, is recommended as the last option for patients suffering from severe obesity after failure of medical care (17, 18). Nevertheless, in the latter case, nutritional management remains essential in both the preoperative and postoperative phases. The benefits of bariatric surgery have been well described in terms of weight loss (19, 20), improved comorbidities, and decreased mortality (21). However,

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although data on eating behavior after bariatric surgery are available, to our knowledge no data on intuitive eating have been reported.

Therefore, the objective of this study was to evaluate the link between intuitive eating and weight loss after bariatric surgery, with the relative variation in BMI (in kg/m<sup>2</sup>) as the primary outcome and excess weight loss (22) as the secondary outcome.

## Methods

### Study design and participants

We designed a cross-sectional study that was carried out between May and September 2016 using an anonymous self-administered questionnaire with free access circulating on French-speaking social networks, especially discussion groups dedicated to bariatric surgery. These groups are not physician supervised, and women comprise the majority of participants, as previously reported (23). The prevalence of women is in large part due to the fact that >86% of the people who benefit from bariatric surgery in France are women (24), but it was also because men show less of a tendency to be present in such groups. We therefore limited our study to individuals who claimed to be women and aimed the questionnaire at all women who had undergone bariatric surgery, whatever the time since surgery. The volunteer women could access the questionnaire by clicking on a direct link after reading a clear explanation of the study. No financial compensation was proposed. According to French law (Law 88–1138 relative to Biomedical Research of 20 December 1988 modified on 9 August 2004), this noninterventional study did not require approval by an ethics committee or informed signed consent from patients (CPP Sud-Méditerranée 1: RO-2016/40).

Data collected in the questionnaire included declared anthropometric parameters such as weight (preoperative and current) and height. The Intuitive Eating Scale-2 (IES-2) is a validated 3-subscale tool that measures the degree of adherence to intuitive eating principles. We used the French-validated version of the IES-2 (25, 26), which demonstrated adequate internal consistency and test–retest reliability. Construct validity was confirmed by the significant associations between intuitive eating and psychological and eating-related variables. Intuitive eating was negatively associated with eating disorder symptomatology and food and weight preoccupation, and it was positively associated with body esteem and well-being. The French IES-2 was also able to discriminate between genders and BMI categories (26). This 18-item questionnaire evaluates intuitive eating overall and in its 3 components: Eating for Physical Rather than Emotional Reasons, Reliance on Hunger and Satiety Cues, and Unconditional Permission to Eat. The total score and each of the 3 subscores can range from 1 to 5, with higher scores indicating higher levels of intuitive eating, corresponding to more positive behavior. Weight loss after bariatric surgery was assessed using the relative BMI variation, which was the primary outcome and calculated using the formula  $100 \times (\text{preoperative BMI} - \text{current BMI})/\text{preoperative BMI}$ . BMIs were calculated from the patients' declared weights. Excess weight loss was the secondary outcome. The surgical results were evaluated according to the Reinhold classification (22), which considers a <25% loss of excess weight as failure, between 25% and 50%

as moderate success, and >50% as success. Data regarding year and type of surgery [adjustable gastric banding (AGB) and sleeve gastrectomy (SG) or gastric bypass (GB)] were also collected.

### Statistical analysis

We obtained an overall description of the sample by relating the associated numbers and frequencies for the categorical variables and the mean  $\pm$  SD or median with the interquartile range (25th and 75th percentiles) and the minimum and maximum values (min–max) for the continuous variables. The responses to the IES-2 were analyzed following the model proposed by the authors of the baseline study (13): We described the total IES-2 score and the 3 subscores of our population according to the quartiles of the IES-2 score from the general population (13). Relations between outcomes and associated variables were investigated using parametric or nonparametric tests as appropriate. The impact of diet as assessed by the IES-2 on the relative variation in BMI was determined by linear regression analysis. We used a backward selection of covariates that were clinically relevant and significantly associated in the univariate analysis with an  $\alpha$ -to-enter and an  $\alpha$ -to-exit set at 0.15 and 0.05, respectively. Adjusted  $\beta$  ( $\beta_{\text{Adj}}$ ) were reported with their 95% CIs and their standardized  $\beta$  ( $\beta_{\text{Adj}}^{\text{STD}}$ ). Our model used the 3 IES-2 subscores instead of the total score. The same approach was used to assess the relative variation in excess weight loss. Missing data were not replaced. SAS software (version 9.4; SAS Institute) was used for statistical analysis.

## Results

### Description of the population

A total of 401 women answered the questionnaire (**Supplemental Figure 1**). Their characteristics are shown in **Table 1**. Mean age was  $39 \pm 11$  y, with a mean preoperative BMI of  $45.5 \pm 7.9$  and a mean current BMI of  $30.5 \pm 7.5$ . Mean weight loss was  $76.0\% \pm 30.3\%$  of excess weight, and mean relative BMI loss was  $32.7\% \pm 12.9\%$ . Regarding the surgical procedure, 57.1% had undergone AGB (6.8%) or SG (50.3%), whereas 42.9% had undergone GB. Surgery had been performed within 6 mo of responding to the study questionnaire in 19.7% of the cases, 6–18 mo in 32.4%, 18–66 mo in 39.2%, and >66 mo in 8.7%.

In terms of excess weight loss, surgery was considered successful in 81.5% of the cases, moderately successful in 13.3%, and failed in 5.1%, with no obvious relation with excess weight before surgery ( $P = 0.15$ ). Characteristics of the participants according to the type of surgery are shown in **Supplemental Table 1**. As expected, median relative loss of excess weight was greater in the GB group compared with the AGB/SG group [ $-86.2\%$  (25th percentile; 75th percentile:  $-103.9$ ;  $-68.9$ ) and  $-73.9\%$  (25th percentile; 75th percentile:  $-97.4$ ;  $-50.3$ ), respectively,  $P < 0.001$ ]. The majority of the participants (95.0%) with a failed surgery were in the AGB/SG group. In addition, 89.7% of the patients in the GB group were considered to have had successful surgery compared with 75.5% in the AGB/SG group ( $P < 0.001$ ).

The IES-2 was fully completed by 379 (94.5%) participants. The mean total score was  $3.3 \pm 0.6$ . The distribution of



**TABLE 1** Characteristics of the women in the study

Characteristic	<i>n</i>	Mean ± SD [min–max] or <i>n</i> (%)
Obesity onset, y	394	17.5 ± 10.3 [0.0–57.0]
Preoperative BMI, kg/m <sup>2</sup>	394	45.5 ± 7.9 [31.9–103.8]
Excess weight before surgery, kg	394	55.7 ± 22.1 [18.8–225.2]
Profession, <i>n</i> (%)	384	
Working		292 (76.0)
Student		9 (2.3)
Unemployed		71 (18.5)
Retired		12 (3.1)
Age, y	395	39.4 ± 10.6 [20.0–70.0]
BMI, kg/m <sup>2</sup>	398	30.5 ± 7.5 [18.4–81.0]
Current excess weight, kg	398	14.8 ± 20.1 [–19.8–145.2]
Relative change in BMI, %	393	–32.7 ± 12.9 [–71.7–5.2]
Relative change in excess weight, %	393	–76.0 ± 30.3 [–149.6–12.2]
Surgical procedure, <i>n</i> (%)	396	
Adjustable gastric banding		27 (6.8)
Gastric bypass		170 (42.9)
Sleeve gastrectomy		199 (50.3)
Time since bariatric procedure, <i>n</i> (%)	401	
0–6 mo		79 (19.7)
6–18 mo		130 (32.4)
18–66 mo		157 (39.2)
>66 mo		35 (8.7)
Surgical results, <i>n</i> (%)	390	
Failure		20 (5.1)
Moderate success		52 (13.3)
Success		318 (81.5)

participants according to the quartiles of the IES-2 score used in the baseline study was similar to that of the general population (**Table 2**). The total IES-2 score was not influenced by age ( $P = 0.47$ ) or weight status ( $P = 0.21$ ) at the time of the study. Median subscores for Eating for Physical Rather than Emotional Reasons, Reliance on Hunger and Satiety Cues, and Unconditional Permission to Eat were 3.7 (25th percentile; 75th percentile: 2.5; 3.9), 3.7 (25th percentile; 75th percentile: 3.2; 4.2), and 2.8 (25th percentile; 75th percentile: 2.3; 3.5), respectively. Correlations between total IES-2 score and

subscores are presented in **Figure 1**. Eating for Physical Rather than Emotional Reasons was the subscore most associated with the total IES-2 score ( $r = 0.82$ ).

### BMI change and IES-2 scores

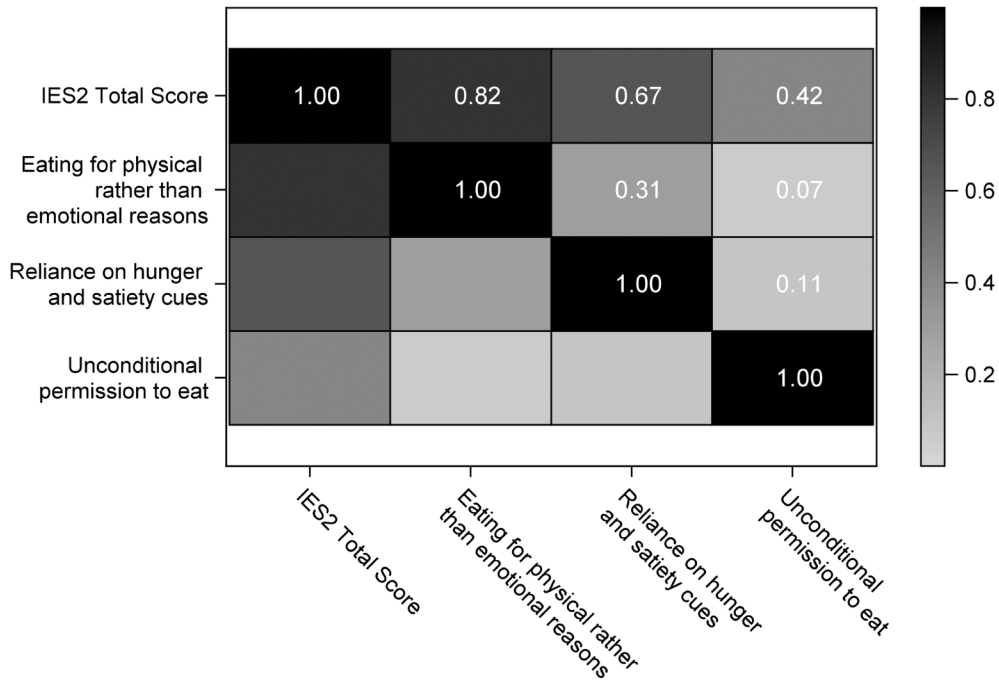
The association between the total IES-2 score and the relative change in BMI was significant, with a relative BMI loss of ~2.6% for each 1-point increase in the IES-2 score ( $P_{\text{Adj}} = 0.007$ ;  $\beta_{\text{Adj}} = -2.57$ ;  $\beta_{\text{Adj}}^{\text{STD}} = -0.12$ ) after adjusting

**TABLE 2** Subscore of IES-2 and characteristics of participants according to the quartiles of IES-2 adapted from NutriNet Santé ( $n = 379$ ) (13)<sup>1</sup>

	Q1 <sub>NutriNet</sub> , <i>n</i> = 79 (20.8%)	Q2 <sub>NutriNet</sub> , <i>n</i> = 116 (30.6%)	Q3 <sub>NutriNet</sub> , <i>n</i> = 91 (24.0%)	Q4 <sub>NutriNet</sub> , <i>n</i> = 93 (24.5%)	<i>P</i>
IES-2 score, median [min–max]					
Total score	2.56 [1.72–2.78]	3.06 [2.83–3.28]	3.5 [3.33–3.67]	4.06 [3.72–4.83]	
Score: Eating for Physical Rather than Emotional Reasons	2.25 [1.13–4.13]	2.88 [1.50–4.50]	3.50 [2.38–5.00]	4.13 [2.88–5.00]	<0.001 <sup>2</sup>
Score: Reliance on Hunger and Satiety Cues	3.00 [1.00–4.33]	3.67 [1.50–5.00]	4.00 [2.67–5.00]	4.17 [3.00–5.00]	<0.001 <sup>2</sup>
Score: Unconditional Permission to Eat	2.50 [1.00–5.00]	2.50 [1.00–5.00]	2.75 [1.00–5.00]	3.75 [2.00–5.00]	<0.001 <sup>2</sup>
Characteristics					
Age, y (mean ± SD)	38.8 ± 9.8	39.7 ± 10.4	39.5 ± 10.6	37.6 ± 10.3	0.47 <sup>2</sup>
BMI, kg/m <sup>2</sup> (mean ± SD)	31.6 ± 8.6	30.1 ± 6.4	31.7 ± 8.7	28.8 ± 6.1	0.07 <sup>2</sup>
Weight status, <i>n</i> (%)					
BMI <25	18 (22.8)	23 (20.0)	20 (22.2)	32 (34.8)	0.21 <sup>3</sup>
BMI 25–30	22 (27.9)	41 (35.7)	26 (28.9)	25 (27.2)	
BMI ≥30	39 (49.4)	51 (44.4)	44 (49.9)	35 (38.0)	

<sup>1</sup>IES-2, Intuitive Eating Scale-2.<sup>2</sup>Wilcoxon–Mann–Whitney test.<sup>3</sup>Chi-square test.





**FIGURE 1** Spearman correlations between IES-2 total score and subscores. IES-2, Intuitive Eating Scale-2.

for elapsed time since surgery and type of surgery (**Table 3**). When we replaced the total IES-2 score by the 3 subscores in the multivariate model, only Eating for Physical Rather than Emotional Reasons remained significantly associated with relative BMI change [ $P_{Adj} = 0.002$ ;  $\beta_{Adj} = -2.08$  (95% CI:  $-3.37, 0.79$ );  $\beta_{Adj}^{STD} = -0.14$ ] after adjusting for elapsed time since surgery and type of surgery (data not shown).

These positive associations were also noted for excess weight loss, with a relative excess weight loss of  $\sim 6.95\%$  for each 1-point increase in the IES-2 score ( $P_{Adj} = 0.003$ ;  $\beta_{Adj} = -6.95$ ;  $\beta_{Adj}^{STD} = -0.14$ ) (**Supplemental Table 2**) and  $4.61\%$  for a 1-point increase in Eating for Physical Rather than Emotional Reasons [ $P_{Adj} = 0.004$ ;  $\beta_{Adj} = -4.61$  (95% CI:  $-7.72, -1.49$ );  $\beta_{Adj}^{STD} = -0.13$ , data not shown].

Furthermore, the total score and the Eating for Physical Rather than Emotional Reasons subscore were significantly lower in patients in the AGB/SG group compared with the GB

group ( $P = 0.001$  and  $P = 0.002$ , respectively; **Table 4**). The subscores were also significantly different according to elapsed time since surgery (all  $P \leq 0.006$ ). The total IES-2 score did not significantly change with time elapsed since surgery, whereas the Unconditional Permission to Eat subscore increased and the Eating for Physical Rather than Emotional Reasons subscore decreased with elapsed time since surgery (**Table 4**).

## Discussion

Our study showed that more intuitive eating behavior, particularly eating for physical more than emotional reasons, was related to a greater relative BMI loss after bariatric surgery. Indeed, we found that a 1-point increase in the IES-2 score was associated with a relative BMI loss of  $\sim 2.6\%$  after adjusting for elapsed time since surgery and type of surgery. In addition, our study showed that eating behaviors

**TABLE 3** Factors associated with the relative variation in BMI ( $n = 368$ )<sup>1</sup>

Factor	Univariate model			Multivariable model		
	$\beta_{Crude}$ (95% CI)	$\beta_{Crude}^{STD}$	$P_{Crude}$	$\beta_{Adj}$ (95% CI)	$\beta_{Adj}^{STD}$	$P_{Adj}$
IES-2 total score	$-1.88 (-4.12, 0.36)$	$-0.09$	0.103	$-2.57 (-4.44, -0.70)$	$-0.12$	0.007
Duration since surgery			$<0.001$			$<0.001$
6–18 vs. 0–6 mo	$-18.06 (-21.20, -14.92)$	$-0.66$	$<0.001$	$-17.94 (-21.01, -14.88)$	$-0.66$	$<0.001$
18–66 vs. 0–6 mo	$-18.98 (-22.04, -15.93)$	$-0.72$	$<0.001$	$-18.95 (-21.98, -15.92)$	$-0.72$	$<0.001$
> 66 vs. 0–6 mo	$-16.66 (-21.25, -12.07)$	$-0.35$	$<0.001$	$-16.63 (-21.13, -12.14)$	$-0.35$	$<0.001$
Surgical procedure			$<0.001$			0.002
AGB and SG vs. GB	$5.46 (2.84, 8.07)$	0.21		$3.54 (1.33, 5.76)$	0.14	
Age, y	$0.09 (-0.04, 0.22)$	0.07	0.174			

<sup>1</sup>AGB, adjustable gastric banding; GB, gastric bypass; IES-2, Intuitive Eating Scale-2; SG, sleeve gastrectomy;  $\beta_{Adj}$ , adjusted  $\beta$ ;  $\beta_{Adj}^{STD}$ , standardized adjusted  $\beta$ ;  $\beta_{Crude}^{STD}$ , standardized crude  $\beta$ ;  $P_{Adj}$ , adjusted  $P$  value;  $P_{Crude}$ , crude  $P$  value.

**TABLE 4** Crude association of IES-2 score/subscores with time since bariatric surgery and surgical procedure<sup>1</sup>

	IES-2 total score	IES-2 subscore: Eating for Physical Rather than Emotional Reasons	IES-2 subscore: Reliance on Hunger and Satiety Cues	IES-2 subscore: Unconditional Permission to Eat
Time since surgery	$P = 0.065^2$	$P = 0.002^3$	$P < 0.001^3$	$P = 0.006^3$
0–6 mo	3.39 (3.17–3.78)	3.50 (3.00–4.00)	3.83 (3.50–4.33)	2.50 (2.00–3.25)
6–18 mo	3.39 (2.94–3.78)	3.25 (2.50–3.88)	4.00 (3.33–4.33)	2.75 (2.25–3.50)
18–66 mo	3.11 (2.83–3.56)	3.00 (2.38–3.75)	3.50 (3.17–4.00)	3.00 (2.50–3.75)
>66 mo	3.28 (2.78–3.61)	3.13 (2.63–3.88)	3.67 (2.33–4.17)	3.50 (2.50–4.00)
Surgical procedure	$P = 0.001^2$	$P = 0.002^3$	$P = 0.208^3$	$P = 0.164^3$
AGB and SG	3.19 (2.78–3.56)	3.13 (2.50–3.75)	3.67 (3.17–4.17)	2.75 (2.25–3.50)
GB	3.42 (2.94–3.83)	3.38 (2.63–4.00)	3.83 (3.33–4.17)	3.00 (2.25–3.75)

<sup>1</sup>Values are median (first quartile – third quartile). *P* values indicate whether the IES-2 score or subscores significantly differ according to the different times since surgery and the surgical procedures. AGB, adjustable gastric banding; IES-2, Intuitive Eating Scale-2; GB, gastric bypass; SG, sleeve gastrectomy.

<sup>2</sup>Student's *t* test.

<sup>3</sup>Wilcoxon–Mann–Whitney test.

changed with increasing time from surgery, notably with an increase in the Unconditional Permission to Eat subscore in association with a decrease in the Eating for Physical Rather than Emotional Reasons subscore and a nonlinear decrease in the Reliance on Hunger and Satiety Cues subscore. This increase in emotional eating with lengthening time from surgery suggests that nutritional behavior is improved soon after surgery but that the changes are not maintained over time. We also showed that eating behavior differed with the surgical procedure, with more intuitive and less emotional eating after GB compared with AGB/SG.

No data are available regarding intuitive eating after bariatric surgery. However, Camilleri et al.'s (13) study of the general French population showed an inverse correlation between this way of eating, as evaluated by the IES-2 score, and weight status, with the strength of this association being greater in women than in men (13, 15). The findings seem to suggest that intuitive eating might be relevant for obesity prevention and treatment. Mindfulness-based interventions based on behavioral eating therapy (mindful eating, intuitive eating, meditation, etc.) have been shown to improve well-being and reduce emotional eating after bariatric surgery. However, their impact on weight loss after bariatric surgery (27) remains unknown due to patient difficulties in adhering to regular follow-up, which is nevertheless essential.

The mean weight loss in our study appears to be higher than that observed in most studies (20). This might be due to the self-selection of our participants: it is likely that they were interested in participating because their surgery had been successful and they were thus more willing to share their experiences in discussion groups. However, the intuitive eating scores of our population were comparable to those of the general female population, with a similar mean total score ( $3.3 \pm 0.6$ ) and a comparable distribution (13).

Numerous studies have highlighted various parameters concerning diet after bariatric surgery, such as daily calorie intake, taste preferences (28–30), quality of life (31, 32), and the evolution of eating disorders (33, 34). No studies, however, have evaluated the intuitive component of diet after bariatric surgery. One of the main risks of bariatric surgery is weight regain, usually observed between years 2 and 10 after surgery (20), because it disrupts the benefit–risk balance of the therapeutic procedure.

Our study revealed changes in eating behavior in the 18- to 66-month period that may contribute to weight regain, notably indicated by the decrease in the subscores for Reliance on Hunger and Satiety Cues and Eating for Physical Rather than Emotional Reasons. Therefore, behavioral eating should perhaps be taken into consideration to improve the long-term bariatric surgery effect on weight loss.

In addition, the questionnaire was distributed through social networks, and we were thus able to obtain responses from throughout France. Also, because it was anonymous, the participants probably felt more freedom to be honest in completing it.

This study has several limitations. First, our results are only valid for women who have benefited from bariatric procedures. In addition, using an online questionnaire available on social networks may have resulted in the self-selection of the youngest individuals. However, the mean age of our population was similar to that of the population that benefits from bariatric surgery in France (39.4 compared with 40.1 y, respectively) (24). Furthermore, posting the questionnaire in discussion groups may have selected those individuals specifically searching for nutritional advice. Moreover, all data were self-reported, including sex identification and presurgical and current weight values, and this may have been an important limitation of our work. This study used a short questionnaire and was designed to provide a preliminary overview of intuitive eating after bariatric surgery. As such, other dimensions of eating behavior, such as emotional eating or restrictive eating, were not explored. Because data on food intake and physical activity were not collected, we also could not conclude whether weight loss was linked to “more intuitive” diets; healthier, less energetic diets; or increased physical activity. Last, we were not able to evaluate the mechanical restriction by residual gastric volume, and we did not investigate the mechanisms through which the 3 procedures might have affected eating behavior.

In conclusion, this is the first study to explore the intuitive component of eating behavior after bariatric surgery. We observed an association between an intuitive eating style and greater loss of excess weight. This finding should prompt complementary prospective studies to evaluate the effectiveness of therapeutic education programs centered on behavioral therapies and intuitive eating in the postoperative period. In this way, medical care and surgical care, which have long been



dichotomized in obesity treatment, may finally be viewed as complementary in cases of recourse to bariatric surgery, at least in postoperative phases.

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The authors' responsibilities were as follows—MN and AA: conceived and designed the study; MN: acquired the data; MN, EN, NM, VM, AA, and AS: analyzed and interpreted the data; MN, VM, and AS: wrote the manuscript; and all authors: read and approved the final manuscript. None of the authors reported a conflict of interest related to this study.

## References

1. WHO. Obesity and overweight. Geneva (Switzerland): WHO; 2018.
2. Lobstein T. Prevalence and costs of obesity. *Medicine (Baltimore)* 2015;43(2):77–9.
3. ObEpi 2012. Enquête épidémiologique nationale sur le surpoids et l'obésité [Internet]. Paris: Inserm/Kantar Health/Roche; 2012 [date cited 20 May, 2019]. Available from: <http://www.roche.fr/innovation-recherche-medicale/decouverte-scientifique-medicale/cardio-metabolisme/enquete-nationale-obepi-2012.html>.
4. Stevens GA, Singh GM, Lu Y, Danaei G, Lin JK, Finucane MM, Bahalim AN, McIntire RK, Gutierrez HR, Cowan M, et al. National, regional, and global trends in adult overweight and obesity prevalences. *Popul Health Metr* 2012;10(1):22.
5. Guh DP, Zhang W, Bansback N, Amarsi Z, Birmingham CL, Anis AH. The incidence of co-morbidities related to obesity and overweight: a systematic review and meta-analysis. *BMC Public Health* 2009;9:88.
6. Pi-Sunyer X. The medical risks of obesity. *Postgrad Med* 2009;121(6):21–33.
7. Poirier P, Giles TD, Bray GA, Hong Y, Stern JS, Pi-Sunyer FX, Eckel RH. Obesity and cardiovascular disease: pathophysiology, evaluation, and effect of weight loss: an update of the 1997 American Heart Association Scientific Statement on Obesity and Heart Disease from the Obesity Committee of the Council on Nutrition, Physical Activity, and Metabolism. *Circulation* 2006;113(6):898–918.
8. Calle EE, Thun MJ, Petrelli JM, Rodriguez C, Heath CW. Body-mass index and mortality in a prospective cohort of U.S. adults. *N Engl J Med* 1999;341(15):1097–105.
9. Pischon T, Boeing H, Hoffmann K, Bergmann M, Schulze MB, Overvad K, van der Schouw YT, Spencer E, Moons KGM, Tjønneland A, et al. General and abdominal adiposity and risk of death in Europe. *N Engl J Med* 2008;359(20):2105–20.
10. Sun H, Ren X, Chen Z, Li C, Chen S, Wu S, Chen Y, Yang X. Association between body mass index and mortality in a prospective cohort of Chinese adults. *Medicine* 2016;95(32):e4327.
11. French Agency for Food, Environmental and Occupational Health & Safety. Health risks linked to diet. Maisons-Alfort Cedex (France): French Agency for Food, Environmental and Occupational Health & Safety; 2010.
12. Anglin JC. Assessing the effectiveness of intuitive eating for weight loss—pilot study. *Nutr Health* 2012;21(2):107–15.
13. Camilleri GM, Méjean C, Bellisle F, Andreeva VA, Kesse-Guyot E, Hercberg S, Péneau S. Intuitive eating is inversely associated with body weight status in the general population-based NutriNet-Santé study. *Obesity* 2016;24(5):1154–61.
14. Cummings S, Parham ES, Strain GW; American Dietetic Association. Position of the American Dietetic Association: weight management. *J Am Diet Assoc* 2002;102(8):1145–55.
15. Herbert BM, Blechert J, Hautzinger M, Matthias E, Herbert C. Intuitive eating is associated with interoceptive sensitivity: effects on body mass index. *Appetite* 2013;70:22–30.
16. Camilleri GM, Méjean C, Bellisle F, Andreeva V, Kesse-Guyot E, Hercberg S, Péneau S. Intuitive eating dimensions were differently associated with food intake in the general population-based NutriNet-Santé study. *J Nutr* 2017;147(1):61–9.
17. National Institute for Health and Care Excellence. Obesity: identification, assessment and management. London (UK); 2014.
18. Ryan DH. Guidelines for obesity management. *Endocrinol Metab Clin North Am* 2016;45(3):501–10.
19. Chang S-H, Stoll CRT, Song J, Varela JE, Eagon CJ, Colditz GA. Bariatric surgery: an updated systematic review and meta-analysis, 2003–2012. *JAMA Surg* 2014;149(3):275–87.
20. Sjöström L. Review of the key results from the Swedish Obese Subjects (SOS) trial—a prospective controlled intervention study of bariatric surgery. *J Intern Med* 2013;273(3):219–34.
21. Sjöström L. Bariatric surgery and reduction in morbidity and mortality: experiences from the SOS study. *Int J Obes* 2008;32(Suppl 7):S93–7.
22. Reinhold RB. Critical analysis of long term weight loss following gastric bypass. *Surg Gynecol Obstet* 1982;155(3):385–94.
23. Martins MP, Abreu-Rodrigues M, Souza JR. The use of the internet by the patient after bariatric surgery: contributions and obstacles for the follow-up of multidisciplinary monitoring. *Arq Bras Cir Dig* 2015;28(Suppl 1):46–51.
24. Debs T, Petrucciani N, Kassir R, Iannelli A, Amor IB, Gugenheim J. Trends of bariatric surgery in France during the last 10 years: analysis of 267,466 procedures from 2005–2014. *Surg Obes Relat Dis* 2016;12(8):1602–9.
25. Camilleri GM, Méjean C, Bellisle F, Andreeva VA, Sautron V, Hercberg S, Péneau S. Cross-cultural validity of the Intuitive Eating Scale-2: psychometric evaluation in a sample of the general French population. *Appetite* 2015;84:34–42.
26. Carbonneau E, Carbonneau N, Lamarche B, Provencher V, Bégin C, Bradette-Laplante M, Laramée C, Lemieux S. Validation of a French–Canadian adaptation of the Intuitive Eating Scale-2 for the adult population. *Appetite* 2016;105:37–45.
27. Chacko SA, Yeh GY, Davis RB, Wee CC. A mindfulness-based intervention to control weight after bariatric surgery: preliminary results from a randomized controlled pilot trial. *Complement Ther Med* 2016;28:13–21.
28. Holinski F, Menenakos C, Haber G, Olze H, Ordemann J. Olfactory and gustatory function after bariatric surgery. *Obes Surg* 2015;25(12):2314–20.
29. Primeaux S, Tzeng T, Allerton T, Chiang M, Cosentino G, Dubin R, Varughese A, Moore R, Geiselman P, Greenway F, et al. Differences in short-term food preferences following vertical sleeve gastrectomy and Roux-en-Y gastric bypass surgery. *Obes Res Clin Pract* 2014;9(6):628–32.
30. Thirlby RC, Bahiraei F, Randall J, Drewnoski A. Effect of Roux-en-Y gastric bypass on satiety and food likes: the role of genetics. *J Gastrointest Surg* 2006;10(2):270–7.
31. Overs SE, Freeman RA, Zarshenas N, Walton KL, Jorgensen JO. Food tolerance and gastrointestinal quality of life following three bariatric procedures: adjustable gastric banding, Roux-en-Y gastric bypass, and sleeve gastrectomy. *Obes Surg* 2012;22(4):536–43.
32. Schweiger C, Weiss R, Keidar A. Effect of different bariatric operations on food tolerance and quality of eating. *Obes Surg* 2010;20(10):1393–9.
33. Kofman MD, Lent MR, Swencionis C. Maladaptive eating patterns, quality of life, and weight outcomes following gastric bypass: results of an Internet survey. *Obesity* 2010;18(10):1938–43.
34. Melero Y, Ferrer JV, Sanahuja A, Amador L, Hernando D. Psychological changes in morbidly obese patients after sleeve gastrectomy. *Cirugia Espanola* 2014;92(6):404–9.