



# Psychological characteristics of patients seeking bariatric treatment versus those seeking medical treatment for obesity: is bariatric surgery a last best hope?

Bulle Gaudrat<sup>1,2</sup> · Séverine Andrieux<sup>2</sup> · Vincent Florent<sup>2</sup> · Amélie Rousseau<sup>1</sup>

Received: 15 May 2019 / Accepted: 18 May 2020 / Published online: 28 May 2020  
© Springer Nature Switzerland AG 2020

## Abstract

**Purpose** Bariatric surgery (BS) is considered the most effective treatment for severe obesity. Nevertheless, long-term studies have identified some concerning issues, such as increased postoperative rates of suicide and substance use disorders. Some investigators have postulated that these postoperative issues might result from differences in psychological characteristics between patients with obesity seeking BS and those seeking non-surgical (medical) care. The aim of this study was to explore the psychological differences between patients seeking BS and those seeking non-surgical care.

**Methods** 151 patients seeking BS (BS group) and 95 patients seeking medical care (non-surgery group) completed questionnaires measuring depression, anxiety, self-esteem, body dissatisfaction, hopelessness and weight-loss expectations (WLE).

**Results** There were no differences between the BS and non-surgery groups in depression, anxiety or self-esteem. Body dissatisfaction and WLE were greater in the BS group than in the non-surgery group. Contrary to our hypothesis, the non-surgery group showed higher levels of hopelessness than the BS group. Correlation analyses revealed very similar associations between psychological characteristics for both groups. Hierarchical regression and moderation analyses identified self-esteem as the factor most predictive of hopelessness in both groups.

**Conclusions** We found few differences in psychological characteristics between groups. The lower level of hopelessness in the BS group might be seen as a form of protection leading up to surgery but may result from the patient's view of BS as their "last best hope". Further studies are needed to understand the evolution of these psychological characteristics after surgery and their possible effects on postoperative outcomes.

**Level of evidence** Level III, case-control analytic studies.

**Keywords** Bariatric surgery · Medical care · Psychopathology · Hopelessness · Suicide

---

This article is part of the Topical Collection on Obesity Surgery and Eating and Weight Disorders.

✉ Bulle Gaudrat  
bulle.gaudrat@ch-arras.fr

Séverine Andrieux  
severine.andrieux@ch-arras.fr

Vincent Florent  
vincent.florent@ch-arras.fr

Amélie Rousseau  
amelie.rousseau@univ-lille.fr

<sup>1</sup> PSITEC Lab EA 4072, University of Lille, Domaine du Pont de Bois, BP 60149, 59653 Villeneuve d'Ascq Cedex, France

<sup>2</sup> Nutrition Department, Arras General Hospital, 3, Boulevard Georges Besnier, CS 90006, 62022 Arras, France

## Introduction

Bariatric surgery is recognized as the most effective treatment for severe obesity [1–3]. Although the benefits of bariatric surgery are well documented, patients who undergo this procedure can also present with postoperative issues that need to be taken into account [4]. In fact, numerous studies have demonstrated a rise in substance use disorders [5, 6], the persistence or emergence of eating disorders [7, 8] and frequent body image concerns [9] after bariatric surgery. Moreover, long-term research has indicated that the psychological improvement after bariatric surgery is only temporary and not maintained in the long-term [10, 11]. For example, Herpetz et al. [10] found that depression, quality of life and self-esteem levels improved initially after bariatric surgery but returned to presurgical levels or below after

9 years. Another concerning issue reported by long-term follow-up studies has been a post-surgical rise in suicide rate. Research conducted in Pennsylvania (USA) by Tindle et al. [12] found that the suicide rate after bariatric surgery (6.6/10,000 persons) was much higher than that in the local general population (2.5/10,000 persons). More recently, a population-based cohort study of more than 8000 patients found that self-harm emergencies occurred 1.54-times more frequently after bariatric surgery than before surgery [13]. A literature review by Peterhänsel et al. [14] confirmed this post-surgical increase in suicide rate and called for urgent research to improve our understanding of possible predictive factors.

It is now clear that people with obesity more commonly report impairments in numerous psychological variables than the non-obese population. Indeed, people with obesity report high levels of depression and anxiety and a low level of self-esteem [15] that might make them psychologically more fragile. In addition to this psychological fragility, some researchers have suggested that the postoperative increase in suicide rate might be explained by certain psychological characteristics that are specific to patients seeking bariatric surgery [16, 17]. Numerous studies have explored differences in psychopathology between patients seeking bariatric surgery and those seeking non-surgical medical care, but the results have been inconsistent. For example, some investigations found that patients undergoing surgery reported more psychological impairments than those seeking non-surgical treatment for their obesity [11, 17–20], others identified no differences between the two populations [21, 22], and one found that patients undergoing bariatric surgery exhibited less depression, a better health status and fewer obsessive–compulsive disorders [23].

Mitchell et al. [24] proposed that the increase in suicide rate after bariatric surgery could be explained by hopelessness, which has been theorized to be the mechanism that slowly leads people experiencing depression to consider death as the only way to stop their suffering [25]. Indeed, hopelessness has been shown to be associated with suicidal behavior and death by suicide [26]. Studies of patients who have undergone surgical treatment for obesity have revealed that any short-term decrease in depressive symptoms is not well maintained, with depression scores tending to return to baseline levels during long-term postoperative follow-up [10, 11, 18]. Mitchell et al. have postulated hopelessness as a central process linking depressive symptoms with a postoperative rise in suicide rate, arguing that the unrealistic expectations reported by patients undergoing bariatric surgery could lead them to be disappointed when experiencing the reality of the postoperative change. They further suggested that the failure to maintain early improvements in several psychological variables, such as depression, body image concerns and

self-esteem, is a sign of postoperative disillusionment. The association of postoperative disillusionment with depression and hopelessness may explain the increase in suicide rate after bariatric surgery. Adamowicz et al. [27] found that hopelessness and depressive symptomatology were predictors of suicidality in candidates for bariatric surgery, suggesting the presence of psychological weaknesses that need to be identified before surgery is undertaken. Some authors [7] have postulated that psychological fragility related to hopelessness could be present before surgery, with many patients considering bariatric surgery to be their “last resort”. It was suggested that this “last resort” perception might reflect higher levels of hopelessness in patients considering bariatric surgery than in patients seeking non-surgical treatment [7]. Furthermore, hopelessness might be an important factor driving patients to seek invasive bariatric surgery rather than participate in classic weight-loss management programs.

Despite the link between hopelessness and depression in the general population and the rise in suicide rate after bariatric surgery, very few studies have explored hopelessness in patients undergoing bariatric surgery. The only study evaluating hopelessness in patients seeking bariatric surgery as a treatment for obesity found a non-pathological mean score on the Beck Hopelessness Scale [28]. As noted previously, some studies have demonstrated higher depression levels in patients seeking bariatric surgery than in those seeking non-surgical medical care, and this could explain the higher post-surgery suicide rate. However, no studies have directly compared hopelessness levels between patients with obesity seeking bariatric surgery and those seeking non-surgical therapy. In view of the possibility that hopelessness may influence outcomes after bariatric surgery [24], it is important to establish whether hopelessness differs between people with obesity who request bariatric surgery and those who seek non-surgical treatment. Furthermore, identifying factors that predict the development of hopelessness in surgical patients might help to optimize the care given to this specific population.

The first aim of this study was to compare the psychological characteristics, including depression, anxiety, body dissatisfaction, self-esteem and weight-loss goals, between patients seeking bariatric surgery and those seeking non-surgical care. The second aim was to test the hypothesis that patients seeking bariatric surgery will present with greater hopelessness than patients seeking non-surgical care. The third aim was to use regression analysis to identify factors that predict hopelessness in the two groups of patients. The fourth aim was to clarify whether the treatment choice (bariatric surgery versus non-surgical therapy) acted as a moderator of the association between hopelessness and its predictors.

## Materials and methods

### Procedure

The Nutrition Department of our General Hospital in France offers two types of obesity care: bariatric surgery and non-surgical medical support. At their first telephone contact, patients were asked if they intended to undergo bariatric surgery or were seeking non-surgical medical care. According to their choice, they attended a meeting at the Nutrition Department that provided information concerning bariatric surgery or the non-surgical program. Although the meeting attended by each patient differed according to their original choice of treatment (surgical vs. non-surgical), all patients were allowed to alter their decision at a later stage if they so wished. Thus, patients initially seeking surgery were able to forego it and benefit from medical (non-surgical) care from the Nutrition Department, while patients initially engaged in medical (non-surgical) care were able to undergo bariatric surgery later if they requested it.

All patients who selected non-surgical treatment attended the non-surgical meeting, and all patients who chose bariatric surgery attended the surgical meeting. The Nutrition Department is accredited to receive patients with obesity who have a body mass index (BMI) greater than or equal to 35 kg/m<sup>2</sup>; patients with a BMI less than 35 kg/m<sup>2</sup> are referred to a local private practice center affiliated to the Nutrition Department. All patients who attended their first surgical or non-surgical meeting (according to their choice of treatment) at the Nutrition Department between June 2015 and December 2016 were approached to participate in the study.

For both groups, recruitment of the patient occurred at the time of their first visit in person to the Nutrition Department. The same investigator recruited all the patients so as not to influence the patients' answers to the items in the questionnaires.

### Bariatric surgery group

At the beginning of their first face-to-face contact with the Nutrition Department, all patients were invited to participate in this study if they met the following inclusion requirements: age > 18 years, BMI > 30 kg/m<sup>2</sup>, and no visual impairment. Although the Nutrition Department is accredited to care for patients with a BMI greater than or equal to 35 kg/m<sup>2</sup>, the meeting was open to all patients seeking information about the eligibility criteria for bariatric surgery. With regard to the BMI criterion for inclusion in the study, a patient was excluded from the analysis after

completion of the protocol when necessary. The first contact for patients considering bariatric surgery was a group meeting that included 6–10 patients. This meeting took place in a meeting room with the patients sat at tables and with adequate spacing between patients to provide them with sufficient privacy to complete the questionnaires. The investigator explained that the study was anonymous and focused on the patient's own experience and that the answers to the questionnaires would not be shared with the nutrition team. Volunteers then completed the study protocol in its entirety before receiving any information concerning bariatric surgery. In fact, the completed questionnaires were collected before any information was delivered at this first meeting to avoid bias due to social desirability.

After the investigator had received the completed questionnaires, the bariatric surgery meeting was led by a surgeon and a nutritionist from the Nutrition team. Information was given regarding the expected results, risks, eligibility criteria and need for preoperative and postoperative care. The Nutrition Department is fully involved in preparing patients for bariatric surgery from the first contact to the day of surgery. The Nutrition Department also helps to provide the patients with postoperative care.

In the bariatric surgery group, 166 patients were invited to participate in the study, and all agreed. Eleven patients (6.63%) were excluded because they had undergone bariatric surgery previously, and four patients (2.41%) were excluded because of incomplete questionnaires (defined as completion of less than half the questionnaire items). The final bariatric surgery group comprised 151 participants.

### Non-surgery group

Patients seeking non-surgical (medical) care attended a meeting led by a nutritionist and a nurse from the Nutrition team. The nutritionist, who delivered the most important part of the information during this meeting, was the same person involved in the bariatric surgery meeting described above. Information was provided regarding possible reasons that might lead people to gain weight, the basis of human eating behavior and its possible malfunction, the mechanisms of weight regulation, the role of hunger and satiety, the dysregulation of these signals and their consequences in terms of weight gain, and the effects of dietary restraint and eating disorders. The meeting ended with a presentation of the multidisciplinary care provided by the service. All the questionnaires were administered and collected before any information was disseminated to the participants. The same meeting room and enrollment procedure were used for the non-surgery group as for the bariatric surgery group. The inclusion criteria for the non-surgery group were also the same as those for the bariatric surgery group (BMI > 30 kg/m<sup>2</sup>, age > 18 years and no visual impairment). However, an

additional exclusion criterion applied to the non-surgery group was the intention to undergo bariatric surgery in the future. This exclusion criterion was evaluated by the inclusion of a yes–no item (“I plan to undergo bariatric surgery”) early in the questionnaire; if the patient answered “yes” to that item, the protocol ended and the patient was not included in the analysis. A total of 22 patients were excluded from the non-surgery group based on this additional exclusion criterion.

The Nutrition Department provides non-surgical medical care to individuals with obesity, including the management of eating disorders, nutritional support and an intuitive eating approach. The care is patient-specific and multidisciplinary, involving aspects such as nutritional support, management of comorbidities, physical rehabilitation and psychological care.

Among 152 patients invited to participate in the study as the non-surgery group, 104 patients agreed to participate. Nine of these patients (8.65%) had incomplete questionnaires, so the final non-surgery group consisted of 95 participants.

## Measures

The participants completed questionnaires containing the following sections:

1. Socio-demographic information such as gender, age, weight and height; family structure (married, partnered, single or widowed); employment status (the patient was asked to describe their job, which was then given its French socio-professional classification from among eight categories); and education level (a 6-point scale ranging from “less than high school” to “master’s degree”).
2. A question asking how many times the patient had tried to lose weight previously (with the help of a medical doctor or on their own). The patient answered using a four-point scale ranging from 0 (“I’ve never tried to lose weight before”) to 3 (“more than 10 weight loss attempts”).
3. An item asking patients their desired weight (“You are planning to enlist in an obesity care program. What is your weight goal?”). The same sentence (not mentioning bariatric surgery) was used for both groups to control for the influence of treatment choice when defining the personal weight expectation.
4. The French version [29] of the Body Shape Questionnaire (BSQ) [30], which includes 34 items measuring body dissatisfaction such as preoccupation with one’s body shape within the previous four weeks. The BSQ gives a score from 34 to 204, with higher scores reflecting greater body dissatisfaction. The BSQ has good reliability and validity [31] and has been widely used to assess body dissatisfaction in people with obesity [31, 32] and particularly patients seeking bariatric surgery [32–36]. The Cronbach’s  $\alpha$  value of the French version of the BSQ has been reported to be as good as that of the original version (all  $> \alpha 0.76$ ). The analyses conducted on our sample determined a Cronbach’s  $\alpha$  of 0.96.
5. The Body Image Assessment for Obesity (BIA-O) [37], which was translated into French for this study. Participants were shown 18 body shapes ranging from extremely thin to extremely fat and asked to select, first, the shape that best depicted their current body size and, second, the shape that best depicted their body size goal. The score was obtained by subtracting the expected shape from the perceived actual shape; the higher the score, the greater the body dissatisfaction. This tool was developed to be more appropriate for patients with obesity than the original Body Image Assessment, which did not contain enough body shapes representing a high BMI. In the original version of the BIA-O, each shape was depicted on a card with a number on it, the patient was asked to select the cards corresponding to his two choices (actual and expected shape), and the experimenter recorded the corresponding numbers on the selected cards. Because this study was self-administered, all the body shapes were depicted on one duplicated page: the patient was asked to circle the perceived shape on the first page and the expected shape on the second page. To translate this tool into French, the instructions of the original version of the BIA-O were translated by a bilingual translator, and this was then back-translated by another bilingual translator who was blinded to the original version. Before the translation process was started, sentences instructing the participant “not to rearrange the cards” were removed as they were not relevant. The BIA-O has been validated in patients with obesity and shown to have good validity and reliability in the assessment of body image impairment in individuals with a BMI up to 50 kg/m<sup>2</sup> [38]. Using the French version of the BIA-O that we developed, the discrepancy between the expected shape and perceived shape was positively correlated with BSQ score ( $r=0.26$ ;  $p<0.001$ ) and BMI ( $r=0.23$ ;  $p<0.001$ ). These results support the concurrent validity of the discrepancy score of the translated BIA-O as a measure of body dissatisfaction.
6. The French version [39] of the Hospital Anxiety and Depression Scale (HADS) [40], which contains 14 items (7 measuring depression and 7 measuring anxiety). For each item, the participant is asked to select an answer that best describes their feelings during the last few days on a 4-point scale ranging from 0 to 3. The overall depression and anxiety scores are obtained by summing the scores of their respective 7 items. The minimum and

maximum score for each subscale is 0 and 21, respectively, with a higher score representing a greater degree of depression or anxiety. The HADS has been judged to be well suited for assessing mood variations in patients with obesity [41, 42] and used in multiple investigations assessing change in mood after bariatric surgery [18, 43, 44]. A recent French study reported Cronbach's  $\alpha$  values of 0.89 overall, 0.82 for the anxiety subscale and 0.83 for the depression subscale [45]. In our sample, the Cronbach's  $\alpha$  values were 0.78 overall, 0.70 for the anxiety subscale and 0.71 for the depression subscale.

7. The French version [46] of the Beck Hopelessness Scale (BHS) [47]. The BHS is a 20-item true–false self-report questionnaire. This tool gives a score between 0 and 20, with higher scores reflecting greater hopelessness. The BHS has been shown to have a satisfactory level of stability ( $r = 0.81$ ) and satisfactory Cronbach's  $\alpha$  values ( $\alpha = 0.97$  for patients with depression and  $\alpha = 0.79$  in a control population) [46]. In the present study, the Cronbach's  $\alpha$  value was 0.82. This tool has been used to evaluate hopelessness preoperatively [48].
8. The French version [49] of the Rosenberg Self-Esteem Scale [50], which contains 10 items. The participant responds to each item on a four-point scale ranging from “strongly agree” to “strongly disagree”, and a higher score indicates better self-esteem. The Rosenberg Self-Esteem Scale is the most commonly used scale to assess self-esteem and has been applied frequently in non-surgical studies of people with obesity [51, 52]. The Rosenberg Self-Esteem Scale has also been utilized in studies of patients with obesity before and after surgery [53, 54] because of its good responsiveness to postoperative change. Among the four French studies that have validated this scale, Cronbach's  $\alpha$  was 0.70 in one study and  $> 0.83$  for the other studies [49]. In our sample, the Cronbach's  $\alpha$  value was 0.83.
9. The French version [55] of the Three Factor Eating Questionnaire-R18 (TFEQ-R18), a shorter version of the Three Factor Eating Questionnaire that originally contained 51 items [56]. The short version assesses the same three eating behavior components as the first version: dietary restraint, emotional eating and uncontrolled eating. A higher score in each subscale indicates a more problematic eating behavior. Previous research found that Cronbach's  $\alpha$  for each of the three scales was greater than 0.70 [55]. In our sample, Cronbach's  $\alpha$  was 0.69 for the dietary restraint scale, 0.88 for the emotional eating scale and 0.85 for the uncontrolled eating scale. This tool has been frequently used in people with obesity for its psychometric qualities [57, 58]

## Statistical analysis

G\*Power 3.1 software [59] was used to estimate the sample size needed to observe an average effect ( $f = 0.5$ ) with  $\alpha = 0.05$  and a power of 0.80. For the main analysis comparing means between two independent groups, the minimum sample size was calculated to be 102 participants, with at least 51 participants in each group. To exceed the minimum requirements, we recruited 246 participants (151 in the bariatric surgery group and 95 in the non-surgery group).

Continuous variables (e.g., hopelessness score) are presented as means and standard deviations (SDs), while categorical variables (e.g., sex and other demographic characteristics) are presented as frequencies and percentages. Each patient stated their weight-loss goal in kilograms, and this was converted into a percentage of excess weight (%EW) value, where excess weight was defined as the weight above that for a BMI of 25 kg/m<sup>2</sup>. The statistical analyses of weight-loss goal were carried out using %EW. Independent *t* tests were used to compare BMI, age, psychological scores and weight-loss goals between the bariatric surgery and non-surgery groups. The distributions of sex and other demographic characteristics were compared between groups using the  $\chi^2$  test. To examine the possible relationships between psychopathological characteristics, numerical variables were subjected to Pearson correlation analysis, and Spearman correlation analysis was used to evaluate the associations with prior weight loss attempts (ordinal variable). The correlations were compared between the two groups using *z*-difference tests.

To determine the relative contributions of each psychological variable on hopelessness, we ran a series of multiple hierarchical regression analyses for each group. In step 1 of each regression analysis, we entered prior weight loss attempts, which was identified as differing between the two groups. In step 2, all psychological measures shown to have significant correlations with hopelessness were entered step-by-step in the order of the strength of the simple correlation.

We used the PROCESS macro [60] for moderation analysis. PROCESS utilizes bootstrapping to assess both direct and indirect effects of variables while maximizing power and minimizing non-normality issues. 95% confidence intervals (CIs) were used to assess the significance of the indirect effect, with CIs resampled 5000 times for each analysis.

All analyses were computed using IBM SPSS Statistics (version 20). We considered *p* values  $< 0.05$  as statistically significant.

## Results

### Patient characteristics

The patients were recruited at their first in-person visit to the Nutrition Department of a French General Hospital between June 2015 and December 2016. The final sample comprised 151 participants in the bariatric surgery group and 95 participants in the non-surgery group.

Table 1 shows the patients' demographic characteristics. The patients in both groups were predominately women: 79.47% in the bariatric surgery group and 78.95% in the non-surgery group. For the bariatric surgery group, mean age was 43.47 years (SD = 10.56 years) and mean BMI was 41.44 kg/m<sup>2</sup> (SD = 4.89 kg/m<sup>2</sup>). For the non-surgery group, mean age was 46.24 years (SD = 14.39 years) and mean BMI was 39.92 kg/m<sup>2</sup> (SD = 7.36 kg/m<sup>2</sup>). The majority of patients in both groups were either married (56.29% in the bariatric surgery group and 55.79% in the non-surgery group) or in a committed relationship (19.87% in the bariatric surgery group and 14.74% in the non-surgery group). An additional 21.19% of participants in the bariatric surgery group and 27.37% of participants in the non-surgery group were single. The most common socio-professional category in both groups was "employee" (40.28% in the bariatric surgery group and 37.50% in the non-surgery group). The "inactive" category (unemployed, retired or student) was also well represented (22.92% in the bariatric surgery group and 30.68% in the non-surgery group). The highest education level attained was bachelor's degree in 23.14% of the bariatric surgery group and 25.00% of the non-surgery group, high school in 25.85% of the bariatric surgery group and 25.00% of the non-surgery group, and below high school in 21.09% of the bariatric surgery group and 11.95% of the non-surgery group. There were no significant differences between the two groups in age, BMI, sex distribution, socio-professional category, educational level or family structure ( $p > 0.05$  for each variable; Table 1).

Patients in the bariatric surgery group reported significantly more prior weight loss attempts than those in the non-surgery group ( $p < 0.001$ ; Table 1). The number of prior weight loss attempts was zero in 4.03% of the bariatric surgery group vs. 17.89% of the non-surgery group, 1–5 times in 36.91% of the bariatric surgery group vs. 48.42% of the non-surgery group, 6–10 times in 30.87% of the bariatric surgery group vs. 18.95% of the non-surgery group, and > 10 times in 28.19% of the bariatric surgery group vs. 14.74% of the non-surgery group.

### Psychological characteristics

The psychological characteristics of the patients in the two groups are shown in Table 2. There were no significant differences between groups in depression, anxiety or self-esteem ( $p > 0.05$  for all comparisons). However, the bariatric surgery group showed a higher level of body dissatisfaction than the non-surgery group: the bariatric surgery group reported higher scores than the non-surgery group for the BSQ (95% CI 4.72–23.74,  $p = 0.004$ , effect size = 0.04) and BIA-O (95% CI 1.18 to 2.21,  $p < 0.001$ , Cohen's  $d = 0.15$ ). Patients in the bariatric surgery group also expressed higher weight-loss goals than those in the non-surgery group (95% CI 14.38–28.08,  $p < 0.001$ , Cohen's  $d = 0.14$ ). In addition, patients in the bariatric surgery group showed less hopelessness than those in the non-surgery group (95% CI – 2.81 to – 0.74,  $p = 0.002$ , Cohen's  $d = 0.05$ ).

### Correlation analyses

Table 3 shows the correlations between the psychological continuous variables for the two groups separately.

#### Bariatric surgery group

Depression was significantly positively correlated with anxiety ( $r = 0.39$ ,  $p < 0.001$ ), hopelessness ( $r = 0.30$ ,  $p < 0.001$ ), emotional eating ( $r = 0.29$ ,  $p < 0.001$ ), uncontrolled eating ( $r = 0.21$ ,  $p < 0.05$ ) and body dissatisfaction measured by the BSQ ( $r = 0.29$ ,  $p < 0.01$ ) and significantly negatively correlated with self-esteem ( $r = -0.52$ ,  $p < 0.001$ ), i.e., a higher level of depression was associated with a lower level of self-esteem. Anxiety level was significantly negatively correlated with self-esteem ( $r = -0.45$ ,  $p < 0.001$ ) and significantly positively correlated with weight-loss expectation ( $r = 0.18$ ,  $p < 0.05$ ), hopelessness ( $r = 0.23$ ,  $p < 0.01$ ), emotional eating ( $r = 0.34$ ,  $p < 0.001$ ) and body dissatisfaction measured by the BSQ ( $r = 0.44$ ,  $p < 0.001$ ). Self-esteem showed significant negative correlations with all the psychological variables ( $p < 0.05$  for all) except dietary restraint ( $r = -0.08$ ,  $p > 0.05$ ), indicating that lower levels of self-esteem were associated with higher levels of depression, anxiety, weight-loss expectation, body dissatisfaction, emotional eating and uncontrolled eating. The BSQ measure of body dissatisfaction was significantly positively correlated with weight-loss expectation ( $r = 0.32$ ,  $p < 0.001$ ), i.e., the greater the patient's dissatisfaction with their body image, the higher their weight-loss expectation. The two measures of body dissatisfaction were inter-correlated ( $r = 0.20$ ,  $p < 0.05$ ): the

**Table 1** Comparison of demographic characteristics between the bariatric surgery group and non-surgery group

|   | Bariatric surgery group |               | Non-surgery group |               | 95% CI <sub>diff</sub> |      | <i>t</i> test/ $\chi^2$ | <i>p</i> value | Cohen's <i>d</i> |
|---|-------------------------|---------------|-------------------|---------------|------------------------|------|-------------------------|----------------|------------------|
|   | <i>n</i>                | Mean (SD)/%   | <i>n</i>          | Mean (SD)/%   | LL                     | UL   |                         |                |                  |
| Age (years)                               | 151                     | 43.47 (10.56) | 95                | 46.24 (14.39) | −6.15                  | 0.60 | −1.62                   | 0.11           | ns               |
| Body mass index (kg/m <sup>2</sup> )      | 151                     | 41.44 (4.89)  | 95                | 39.92 (7.36)  | −0.16                  | 3.21 | 1.78                    | 0.08           | ns               |
| Sex                                       | 151                     |               | 95                |               |                        |      | 0.10                    | 0.92           | ns               |
| Male                                      | 31                      | 20.53         | 20                | 21.05         |                        |      |                         |                |                  |
| Female                                    | 120                     | 79.47         | 75                | 78.95         |                        |      |                         |                |                  |
| Employment                                | 144                     |               | 88                |               |                        |      | 7.84                    | 0.35           | ns               |
| Farmer                                    | 4                       | 2.77          | 0                 | –             |                        |      |                         |                |                  |
| Craftsperson, storekeeper, company head   | 7                       | 4.86          | 1                 | 1.14          |                        |      |                         |                |                  |
| Executive or intellectual profession      | 8                       | 5.56          | 7                 | 7.95          |                        |      |                         |                |                  |
| Intermediate profession                   | 27                      | 18.75         | 16                | 18.18         |                        |      |                         |                |                  |
| Employee                                  | 58                      | 40.28         | 33                | 37.50         |                        |      |                         |                |                  |
| Worker                                    | 7                       | 4.86          | 4                 | 4.54          |                        |      |                         |                |                  |
| Inactive (unemployed, student or retired) | 33                      | 22.92         | 27                | 30.68         |                        |      |                         |                |                  |
| Family structure                          | 151                     |               | 95                |               |                        |      | 1.87                    | 0.60           | ns               |
| Married                                   | 85                      | 56.29         | 53                | 55.79         |                        |      |                         |                |                  |
| In committed relationship                 | 30                      | 19.87         | 14                | 14.74         |                        |      |                         |                |                  |
| Single                                    | 32                      | 21.19         | 26                | 27.37         |                        |      |                         |                |                  |
| Widowed                                   | 4                       | 2.65          | 2                 | 2.10          |                        |      |                         |                |                  |
| Education                                 | 147                     |               | 92                |               |                        |      | 4.71                    | 0.45           | ns               |
| No high school education                  | 31                      | 21.09         | 11                | 11.95         |                        |      |                         |                |                  |
| Some high school education                | 38                      | 25.85         | 23                | 25.00         |                        |      |                         |                |                  |
| Graduated from high school                | 34                      | 23.14         | 23                | 25.00         |                        |      |                         |                |                  |
| At least some college education           | 42                      | 29.92         | 35                | 38.05         |                        |      |                         |                |                  |
| Prior weight loss attempts                | 149                     |               | 95                |               |                        |      | 21.61                   | <b>0.0001</b>  |                  |
| None                                      | 6                       | 4.03          | 17                | 17.89         |                        |      |                         |                |                  |
| Between 1 and 5                           | 55                      | 36.91         | 46                | 48.42         |                        |      |                         |                |                  |
| Between 6 and 10                          | 46                      | 30.87         | 18                | 18.95         |                        |      |                         |                |                  |
| More than 10                              | 42                      | 28.19         | 14                | 14.74         |                        |      |                         |                |                  |

LL lower limit, ns not significant, SD standard deviation, UL upper limit, 95% CI<sub>diff</sub> 95% confidence interval of the difference

**Table 2** Comparison of psychological measures between the bariatric surgery group and non-surgery group

|                                | Bariatric surgery group |                | Non-surgery group |                | 95% CI <sub>diff</sub> |       | <i>t</i> test | <i>p</i> value | Cohen's <i>d</i> |
|--------------------------------|-------------------------|----------------|-------------------|----------------|------------------------|-------|---------------|----------------|------------------|
|                                | <i>n</i>                | Mean (SD)      | <i>n</i>          | Mean (SD)      | LL                     | UL    |               |                |                  |
| Depression (HADS)              | 148                     | 7.11 (3.52)    | 94                | 6.64 (3.61)    | −0.45                  | 1.40  | 1.02          | 0.31           | ns               |
| Anxiety (HADS)                 | 148                     | 10.33 (3.53)   | 94                | 9.96 (3.93)    | −0.58                  | 1.33  | 0.77          | 0.44           | ns               |
| Dietary restraint (TFEQ-R18)   | 150                     | 12.61 (3.19)   | 95                | 12.58 (3.54)   | −0.83                  | 0.89  | 0.08          | 0.94           | ns               |
| Emotional eating (TFEQ-R18)    | 151                     | 14.91 (4.96)   | 95                | 14.83 (5.90)   | −1.35                  | 1.52  | 0.11          | 0.91           | ns               |
| Uncontrolled eating (TFEQ-R18) | 151                     | 20.66 (6.22)   | 95                | 19.94 (6.62)   | −0.93                  | 2.36  | 0.86          | 0.39           | ns               |
| Self-esteem (Rosenberg Scale)  | 147                     | 28.24 (5.09)   | 94                | 28.13 (6.12)   | −1.32                  | 1.54  | 0.15          | 0.88           | ns               |
| Weight loss expectation (%EW)  | 144                     | 98.06 (27.82)  | 94                | 76.83 (23.60)  | 14.38                  | 28.08 | 6.10          | <b>0.0001</b>  | 0.14             |
| Body dissatisfaction (BIA-O)   | 148                     | 6.41 (2.09)    | 92                | 4.71 (1.73)    | 1.18                   | 2.21  | 6.53          | <b>0.0001</b>  | 0.15             |
| Body dissatisfaction (BSQ)     | 147                     | 131.56 (34.49) | 92                | 117.33 (39.03) | 4.72                   | 23.74 | 2.95          | <b>0.004</b>   | 0.04             |
| Hopelessness (BHS)             | 148                     | 5.68 (3.60)    | 91                | 7.45 (4.44)    | −2.81                  | −0.74 | −3.22         | <b>0.002</b>   | 0.05             |

Results are in bold when significant (*p* < 0.05)

BHS Beck Hopelessness Scale, BIA-O Body Image Assessment for Obesity, BSQ Body Shape Questionnaire, %EW percentage excess weight, HADS Hospital Anxiety and Depression Scale, LL lower limit, ns not significant, TFEQ-R18 Three Factor Eating Questionnaire-Revised 18, UL upper limit, 95% CI<sub>diff</sub> 95% confidence interval of the difference

**Table 3** Pearson correlations between psychological characteristics for the bariatric surgery group (top) and non-surgery group (bottom)

|                                | <b>Bariatric surgery group</b> |                  |                  |                         |                   |                  |                  |                   |                  |                     |
|--------------------------------|--------------------------------|------------------|------------------|-------------------------|-------------------|------------------|------------------|-------------------|------------------|---------------------|
|                                | Depression                     | Anxiety          | Self-esteem      | Weight loss expectation | Body dis. (BIA-O) | Body dis. (BSQ)  | Hopelessness     | Dietary restraint | Emotional eating | Uncontrolled eating |
| Depression (HADS)              | –                              | <b>0.39***</b>   | – <b>0.52***</b> | 0.12                    | 0.06              | <b>0.29**</b>    | <b>0.30***</b>   | 0.06              | <b>0.29***</b>   | <b>0.21*</b>        |
| Anxiety (HADS)                 | <b>0.51***</b>                 | –                | – <b>0.45***</b> | <b>0.18*</b>            | –0.05             | <b>0.44***</b>   | <b>0.23**</b>    | 0.13              | <b>0.34***</b>   | 0.10                |
| Self-esteem (Rosenberg Scale)  | – <b>0.59***</b>               | – <b>0.53***</b> | –                | – <b>0.17*</b>          | – <b>0.18*</b>    | – <b>0.40***</b> | – <b>0.41***</b> | –0.08             | – <b>0.41***</b> | – <b>0.22**</b>     |
| Weight loss expectation (%EW)  | 0.15                           | 0.12             | – <b>0.24*</b>   | –                       | –0.01             | <b>0.32***</b>   | –0.02            | 0.09              | 0.11             | –0.03               |
| Body dissatisfaction (BIA-O)   | 0.10                           | 0.12             | – <b>0.31**</b>  | 0.09                    | –                 | <b>0.20*</b>     | 0.05             | –0.06             | 0.12             | <b>0.17*</b>        |
| Body dissatisfaction (BSQ)     | <b>0.28**</b>                  | <b>0.48***</b>   | – <b>0.50***</b> | <b>0.28**</b>           | <b>0.23*</b>      | –                | 0.13             | <b>0.36***</b>    | <b>0.37***</b>   | 0.13                |
| Hopelessness (BHS)             | <b>0.47***</b>                 | <b>0.44***</b>   | – <b>0.56***</b> | –0.02                   | 0.13              | <b>0.24*</b>     | –                | 0.06              | <b>0.19*</b>     | 0.06                |
| Dietary restraint (TFEQ-R18)   | 0.03                           | 0.28             | –0.17            | 0.15                    | 0.10              | <b>0.41***</b>   | 0.12             | –                 | <b>0.17*</b>     | 0.03                |
| Emotional eating (TFEQ-R18)    | <b>0.35**</b>                  | <b>0.49***</b>   | – <b>0.52***</b> | <b>0.30**</b>           | <b>0.31**</b>     | <b>0.51***</b>   | <b>0.27**</b>    | 0.18              | –                | <b>0.55***</b>      |
| Uncontrolled eating (TFEQ-R18) | <b>0.41***</b>                 | <b>0.34**</b>    | – <b>0.41***</b> | 0.12                    | <b>0.22*</b>      | <b>0.40***</b>   | 0.12             | <b>0.27**</b>     | <b>0.72***</b>   | –                   |
|                                | <b>Non-surgery group</b>       |                  |                  |                         |                   |                  |                  |                   |                  |                     |

Results are in bold when significant ( $p < 0.05$ )

BIA-O Body Image Assessment for Obesity, BHS Beck Hopelessness Scale, BSQ Body Shape Questionnaire, HADS Hospital Anxiety and Depression Scale, %EW percentage excess weight, TFEQ-R18 Three Factor Eating Questionnaire-R18

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$



more a patient reported being dissatisfied with their body shape on the BSQ, the higher the gap between the perceived actual body shape and goal body shape. The only other psychological variable significantly correlated with body dissatisfaction measured by the BIA-O was uncontrolled eating ( $r=0.17, p<0.05$ ). Hopelessness was significantly positively correlated with depression ( $r=0.30; p<0.001$ ) and anxiety level ( $r=0.23; p<0.01$ ) and significantly negatively correlated with self-esteem ( $r=-0.41, p<0.001$ ). Among the eating behavior variables, we found a significant correlation between dietary restraint and emotional eating ( $r=0.17, p<0.05$ ). The number of prior weight loss attempts was significantly correlated with emotional eating ( $r=0.17, p<0.01$ ), body dissatisfaction measured by the BSQ ( $r=0.26, p<0.01$ ) and anxiety level ( $r=0.20, p<0.05$ ).

### Non-surgery group

As was the case for the bariatric surgery group, depression was significantly positively correlated with anxiety ( $r=0.51, p<0.001$ ), body dissatisfaction measured by the BSQ ( $r=0.28; p<0.01$ ), hopelessness ( $r=0.47, p<0.001$ ), emotional eating ( $r=0.35, p<0.01$ ) and uncontrolled eating ( $r=0.41, p<0.001$ ) and significantly negatively correlated with self-esteem ( $r=-0.59, p<0.001$ ). Anxiety was related to lower self-esteem ( $r=-0.53, p<0.001$ ) and higher levels of hopelessness ( $r=0.44, p<0.001$ ), emotional eating ( $r=0.49, p<0.001$ ), uncontrolled eating ( $r=0.34, p<0.01$ ) and body dissatisfaction measured by the BSQ ( $r=0.48, p<0.001$ ). Self-esteem showed significant negative correlations with all the psychological variables ( $r<-0.24, p<0.05$  for all) except for dietary restraint ( $r=-0.17, p<0.05$ ), and these associations of lower self-esteem with higher levels of depression, anxiety, weight-loss expectation, body dissatisfaction, emotional eating and uncontrolled eating were comparable to those for the bariatric surgery group. The BSQ measure of body dissatisfaction was positively correlated with weight-loss expectation ( $r=0.28, p<0.01$ ), indicating that the greater the patient's dissatisfaction with their body image, the higher their weight-loss expectation. We found significant positive correlations between body dissatisfaction measured by the BSQ and all the subscales of the TFEQ-R18 ( $p<0.001$  for all). As was the case for the bariatric surgery group, the two measures of body dissatisfaction were positively correlated ( $r=0.23, p<0.05$ ). Body dissatisfaction measured by the BIA-O was significantly correlated with emotional eating ( $r=0.31, p<0.01$ ) and uncontrolled eating ( $r=0.22, p<0.05$ ). We also found that hopelessness was positively correlated with depression, anxiety and emotional eating ( $r>0.27, p<0.01$  for all) and negatively correlated with self-esteem ( $r=-0.56, p<0.001$ ). In contrast to the bariatric surgery group, body

dissatisfaction measured by the BSQ was significantly correlated with hopelessness ( $r=0.24, p<0.05$ ). There was a significant correlation between dietary restraint and uncontrolled eating ( $r=0.27, p<0.01$ ) but not dietary restraint and emotional eating ( $r=0.18, p>0.05$ ). We also found a positive correlation between emotional eating and uncontrolled eating ( $r=0.72, p<0.001$ ). The number of prior weight loss attempts was significantly positively correlated with the three subscales of the TFEQ (emotional eating,  $r=0.41$ ; dietary restraint,  $r=0.31$ ; uncontrolled eating,  $r=0.36; p<0.01$  for all), body dissatisfaction measured by the BSQ ( $r=0.44, p<0.001$ ) and anxiety level ( $r=0.26, p<0.05$ ). Additionally, the number of prior weight loss attempts was significantly negatively correlated with self-esteem ( $r=-0.24, p<0.05$ ), indicating that the lower the patient's self-esteem, the higher the number of prior weight loss attempts.

### Comparisons of the psychological variable correlations between the bariatric surgery and non-surgery groups

We conducted z-difference tests to compare the results of the psychological variable correlations between the two groups. The majority of correlations between pairs of psychological variables did not differ significantly between the two groups. However, when compared with the bariatric surgery group, the non-surgery group exhibited significantly stronger correlations between depression and uncontrolled eating ( $z=-1.663, p<0.05$ ), anxiety level and hopelessness ( $z=-1.762, p<0.05$ ), anxiety level and uncontrolled eating ( $z=-1.897, p<0.05$ ), body dissatisfaction measured by the BSQ and uncontrolled eating ( $z=-2.172, p<0.05$ ), dietary restraint and uncontrolled eating ( $z=1.857, p<0.05$ ) and uncontrolled eating and emotional eating ( $z=-2.176, p<0.05$ ).

### Regression analysis

We computed hierarchical multiple regressions to examine whether the variables identified in the correlation analyses explained the variance in hopelessness in our two groups. We entered prior weight loss attempts score as a covariate in step 1 because the two groups reported differences in this variable that needed to be controlled. In step 2, we entered the variables identified in the correlation analyses as having associations with hopelessness. In both groups, prior weight loss attempts score was not a significant predictor of hopelessness. After controlling for prior weight loss attempts score, self-esteem score was the only significant predictor of hopelessness in both groups, accounting for 17% of the variance in the bariatric surgery group and 32% of the variance in the non-surgery group. The data are summarized in Table 4.

**Table 4** Multiple regression analysis of factors associated with hopelessness in the non-surgery and bariatric surgery groups

|   |             | <i>B</i>  | Std error | <i>R</i> <sup>2</sup> |
|---|-------------|-----------|-----------|-----------------------|
| Hopelessness (BHS) in non-surgery group ( <i>n</i> = 88)        |             |           |           |                       |
| Model 1   | (Constant)  | 18.98***  | 1.82      | 0.32                  |
|   | Self-esteem | − 0.41*** | 0.06      |                       |
| Hopelessness (BHS) in bariatric surgery group ( <i>n</i> = 142) |             |           |           |                       |
| Model 1   | (Constant)  | 13.95***  | 1.55      | 0.17                  |
|   | Self-esteem | − 0.29*** | 0.05      |                       |

BHS Beck Hopelessness Scale

\*\*\**p* < 0.001

### Moderation analysis

In order to confirm the results of the regression analysis and evaluate a model of hopelessness development in the two groups, we performed a moderation model test with self-esteem as the independent variable, hopelessness as the outcome variable and treatment choice (bariatric surgery vs. non-surgery) as a moderator. We observed an effect of self-esteem on hopelessness [ $t(237) = -6.87, p < 0.001, B = -0.41, SE = 0.06, 95\% \text{ CI } -0.53 \text{ to } 0.29$ ] and of treatment choice on hopelessness [ $t(237) = -5.07, p < 0.05, B = -5.07, SE = 0.08, 95\% \text{ CI } -9.71 \text{ to } 0.44$ ]. The interaction between self-esteem and treatment choice was not significant [ $t(237) = 1.47, \text{ n.s.}, B = 0.12, SE = 0.08, 95\% \text{ CI } -0.04 \text{ to } 0.28$ ].

### Discussion

This study compared patients with obesity seeking bariatric surgery and patients with obesity seeking non-surgical medical treatment. Our results showed no differences between these two populations in depression, anxiety or self-esteem, thus confirming previous reports [21, 22]. Furthermore, we found that patients considering bariatric surgery reported more previous weight loss attempts than patients opting for non-surgical therapy, which is consistent with the literature [16].

Patients considering bariatric surgery had a higher level of body dissatisfaction than those seeking non-surgical treatment, and this agrees with studies reporting that an issue with body image is a common motivation for bariatric surgery [61, 62]. In both groups, a greater degree of body dissatisfaction was associated with higher levels of depression and anxiety and poorer self-esteem. Furthermore, patients considering bariatric surgery presented with more ambitious weight-loss goals than patients selecting non-surgical treatment.

Although we observed a difference between the two groups in hopelessness, contrary to our hypothesis the non-surgery group exhibited significantly greater hopelessness than the bariatric surgery group. A possible explanation for this result, which refutes our original hypothesis, may be the “last resort” perspective mentioned by Fischer and colleagues [7]. Patients who sought bariatric surgery reported more hope than those who chose medical care as the weight-loss option for their obesity. Although the perspective of bariatric surgery as a “last best hope” might be protective before surgery, it could also be damaging in the long term after surgery. In fact, patients in the bariatric surgery group reported unrealistic expectations compared to the expected results after bariatric surgery, as has been reported in previous studies [62, 63], as well as a higher body dissatisfaction level than the non-surgery group. The higher levels of expectation and body dissatisfaction could combine to explain why “bariatric patients have [...] a huge propensity for idealizing surgery, i.e., the miracle that will solve all life’s problems” [64], which may be damaging when the patients discover the reality of the postoperative experience. In fact, studies of hopelessness have clearly shown what can happen when a “last resort” solution fails [26].

The psychological variables were strongly inter-correlated within both groups, supporting the hypothesis of very close psychological characteristics in our two populations. However, multiple hierarchical regression and moderation analyses reported self-esteem as the only predictor of hopelessness in both groups. Moreover, self-esteem level and treatment choice predicted the hopelessness level independently, and treatment choice was not a moderator of the association between low self-esteem and hopelessness. These results seem to indicate that the psychological characteristics are similar between patients seeking bariatric surgery and those seeking a non-surgical treatment. It will be important to study the evolution of hopelessness during the postoperative period and identify the factors underlying the development of hopelessness [24]. Although self-esteem was found to be the only predictor of hopelessness in the two groups in our study, this psychological variable seemed to predict hopelessness more strongly in the non-surgery group than in the bariatric surgery group (32% of the variance vs. 17%).

Our findings seem to support the hypothesis of Mitchell et al. [24] concerning the role of hopelessness as a process linking depressive symptoms and suicide. In fact, this overinvestment in a bariatric surgery project could be psychologically damaging in the long term. Testing this hypothesis will require postoperative examinations.

In summary, contrary to much of the published literature we found no differences between the bariatric surgery group and non-surgery group in psychological variables such as depression, anxiety and self-esteem. Nevertheless, patients

seeking bariatric surgery reported greater body dissatisfaction and higher weight-loss expectations. Moreover, we found a difference between the two groups in hopelessness, suggesting more hopelessness in the non-surgery group than in the bariatric surgery group. Overall, our study findings revealed similar associations between psychological factors in both groups and, notably, a major influence of the self-esteem level. These results highlight the importance of focusing on these psychological variables in clinical research and during the follow-up of patients after surgery.

This study has some limitations. First, our bariatric surgery group comprised patients who were seeking bariatric surgery, whereas the literature has tended to focus on patients immediately before bariatric surgery. We studied patients before their eligibility for surgery had been determined so that we could include the full range of patients seeking bariatric surgery, even those who might be excluded from other studies because of demographic or psychiatric considerations [23].

Another limitation concerns the fact that this study was conducted in a French population, and this selection bias could make our conclusions specific only to France because the country has one of the highest rates of bariatric surgery in the world [65] and a very generous health insurance program. Moreover, the participants in this study were recruited from a single health-care center, which could restrict the scope of our conclusions to the geographic recruitment area (especially in terms of demographic characteristics). Our two groups showed no differences in sex, age, BMI or socio-demographic characteristics, but these characteristics could be geographically specific because the region contains substantial numbers of undergraduate students and unemployed, inactive people.

With regard to the assessment tools used, one limitation concerns the BIA-O, which has not yet been validated in French and was translated specifically for this study. We chose to use the BIA-O despite the absence of a validated translation because it constitutes a shape-specific tool, which differs from the questionnaires frequently used when studying body image.

Finally, we considered only the pre-treatment data, so we cannot comment on the long-term trajectory of hopelessness following bariatric surgery. Our central hypothesis clearly needs testing relative to the patients' psychological features after surgery [24].

To conclude, this study has highlighted notable differences between patients seeking bariatric surgery and those seeking non-surgical treatment. Although there were psychological similarities between the two groups, such as comparable levels of depression, anxiety and self-esteem, the patients seeking bariatric surgery reported more hope, a greater level of body dissatisfaction and higher expectations than patients seeking non-surgical treatment. These

preoperative psychological features of patients seeking bariatric surgery could set the scene for postoperative difficulties. In light of the specific features of each population, our results underline the necessity to offer tailored care to patients seeking bariatric surgery and those opting for non-surgical treatment. In addition, these findings support the need for specific psychological care for surgical patients before and after surgery. Further research is required to explore the postoperative evolution of hopelessness to confirm its key role in the appearance of postoperative psychological difficulties.

### What is already known on this subject?

Some studies have postulated that the difficulties experienced by patients after bariatric surgery, notably an increase in postoperative suicide rate, could be due to a psychological profile that differs from that of patients with obesity seeking medical (non-surgical) care. However, the results of published studies are equivocal, and few factors predicting postoperative psychological difficulties have been clearly identified. Moreover, the difference in hopelessness between these two populations has not been evaluated previously, despite this factor being identified as a predictor of suicide risk.

### What does this study add?

This study is the first to identify a difference in hopelessness between patients seeking bariatric surgery and those seeking non-surgical treatment. Self-esteem was the only predictor of hopelessness in our two populations and may be important to target when caring for patients with obesity. The association between low self-esteem and hopelessness combined with the higher levels of body dissatisfaction and weight-loss expectation in patients seeking bariatric surgery may underlie the postoperative development of psychological issues. Our results highlight the need to follow-up patients carefully after bariatric surgery to prevent the possible development of hopelessness when faced with the reality of the postoperative outcome, which may be substantially different from the preoperative expectation.

**Acknowledgements** B. Gaudrat thanks the “Groupement de Reflexion sur l’Obésité et le Surpoids” for its support of this study. She has received support for her work from this foundation. This foundation did not exercise any editorial direction or censorship on any part of this manuscript. The authors thank the Nutrition Department of Arras General Hospital for its help in recruiting participants for this study.

### Compliance with ethical standards

**Conflict of interest** On behalf of all the authors, the corresponding author states that there are no conflicts of interest.

**Ethical approval** This study was approved by the Ethics Committee for Human Sciences of Chambéry University and was performed in accordance with the 1964 Helsinki Declaration and its later amendments [66] or comparable ethical standards. The Ethics Committee for Human Sciences of Chambéry University has been solicited to evaluate the ethical quality of the research because the Ethics Committee for Human Sciences of Lille University was not well established at the time that the authors began their work on this research project.

**Informed consent** Informed consent was obtained from all patients included in the study.

## References

- Adams TD, Davidson LE, Litwin SE et al (2017) Weight and metabolic outcomes 12 years after gastric bypass. *N Engl J Med* 377:1143–1155. <https://doi.org/10.1056/NEJMoa1700459>
- Arterburn DE, Olsen MK, Smith VA et al (2015) Association between bariatric surgery and long-term survival. *JAMA* 313:62–701. <https://doi.org/10.1001/jama.2014.16968>
- Gloy VL, Briel M, Bhatt DL et al (2013) Bariatric surgery versus non-surgical treatment for obesity: a systematic review and meta-analysis of randomised controlled trials. *BMJ* 347:f5934. <https://doi.org/10.1136/bmj.f5934>
- Adams TD, Gress RE, Smith SC et al (2007) Long-term mortality after gastric bypass surgery. *N Engl J Med* 357:753–761. <https://doi.org/10.1056/NEJMoa066603>
- Svensson P-A, Anveden A, Romeo S et al (2013) Alcohol consumption and alcohol problems after bariatric surgery in the Swedish obese subjects study. *Obesity* 21:2444–2451. <https://doi.org/10.1002/oby.20397>
- Conason A, Teixeira J, Hsu C-H et al (2013) Substance use following bariatric weight loss surgery. *JAMA Surg* 148:145–150. <https://doi.org/10.1001/2013.jamasurg.265>
- Colles SL, Dixon JB, O'Brien PE (2008) Grazing and loss of control related to eating: two high-risk factors following bariatric surgery. *Obesity (Silver Spring)* 16:615–622. <https://doi.org/10.1038/oby.2007.101>
- Wood KV, Ogden J (2012) Explaining the role of binge eating behaviour in weight loss post bariatric surgery. *Appetite* 59(1):177–180. <https://doi.org/10.1016/j.appet.2012.04.019>
- Ivezaj V, Grilo C (2018) The complexity of body image following bariatric surgery: a systematic review of the literature. *Obes Rev* 19:1116–1140. <https://doi.org/10.1111/obr.12685>
- Herpertz S, Müller A, Burgmer R et al (2015) Health-related quality of life and psychological functioning 9 years after restrictive surgical treatment for obesity. *Surg Obes Relat Dis* 11:1361–1370. <https://doi.org/10.1016/j.soard.2015.04.008>
- Booth H, Khan O, Prevost AT et al (2015) Impact of bariatric surgery on clinical depression. Interrupted time series study with matched controls. *J Affect Disord* 174:644–649. <https://doi.org/10.1016/j.jad.2014.12.050>
- Tindle HA, Omalu B, Courcoulas A et al (2010) Risk of suicide after long-term follow-up from bariatric surgery. *Am J Med* 123:1036–1042. <https://doi.org/10.1016/j.amjmed.2010.06.016>
- Bhatti JA, Nathens AB, Thiruchelvam D et al (2015) Self-harm emergencies after bariatric surgery: a population-based cohort study. *JAMA Surg* 151(3):226–232. <https://doi.org/10.1001/jamasurg.2015.3414>
- Peterhänsel C, Petroff D, Klinitzke G et al (2013) Risk of completed suicide after bariatric surgery: a systematic review. *Obes Rev* 14(5):369–382. <https://doi.org/10.1111/obr.12014>
- van Hout GCM, van Oudheusden I, van Heck GL (2004) Psychological profile of the morbidly obese. *Obes Surg* 14:579–588. <https://doi.org/10.1381/096089204323093336>
- Kvalem IL, Bergh I, von Soest T et al (2016) A comparison of behavioral and psychological characteristics of patients opting for surgical and conservative treatment for morbid obesity. *BMC Obes* 3:6. <https://doi.org/10.1186/s40608-016-0084-6>
- Castellini G, Godini L, Amedei SG et al (2014) Psychopathological similarities and differences between obese patients seeking surgical and non-surgical overweight treatments. *Eat Weight Disord* 19:95–102. <https://doi.org/10.1007/s40519-013-0058-3>
- Karlsson J, Taft C, Rydén A et al (2007) Ten-year trends in health-related quality of life after surgical and conventional treatment for severe obesity: the SOS intervention study. *Int J Obes* 31:1248–1261. <https://doi.org/10.1038/sj.ijo.0803573>
- Fischer L, Wekerle A-L, Sander J et al (2017) Is there a reason why obese patients choose either conservative treatment or surgery? *Obes Surg* 27(7):1684–1690. <https://doi.org/10.1007/s11695-016-2534-0>
- Bancheri L, Patrizi B, Kotzalidis GD et al (2006) Treatment choice and psychometric characteristics: differences between patients who choose bariatric surgical treatment and those who do not. *Obes Surg* 16(12):1630–1637. <https://doi.org/10.1381/096089206779319509>
- Van Nunen AMA, Wouters EJM, Vingerhoets AJJM et al (2007) The health-related quality of life of obese persons seeking or not seeking surgical or non-surgical treatment: a meta-analysis. *Obes Surg* 17(10):1357–1366. <https://doi.org/10.1007/s11695-007-9241-9>
- Jakobsen GS, Hofsø D, Røislien J et al (2010) Morbidly obese patients—who undergoes bariatric surgery? *Obes Surg* 20(8):1142–1148. <https://doi.org/10.1007/s11695-009-0053-y>
- Rutledge T, Adler S, Friedman R (2011) A prospective assessment of psychosocial factors among bariatric versus non-bariatric surgery candidates. *Obes Surg* 21(10):1570–1579. <https://doi.org/10.1007/s11695-010-0287-8>
- Mitchell JE, Crosby R, De Zwaan M et al (2013) Possible risk factors for increased suicide following bariatric surgery. *Obesity* 21(4):665–672. <https://doi.org/10.1002/oby.20066>
- Beck AT (1963) Thinking and depression. *Arch Gen Psychiatry* 9:324. <https://doi.org/10.1001/archpsyc.1963.01720160014002>
- Wetzel RD, Margulies T, Davis R, Karam E (1980) Hopelessness, depression, and suicide intent. *J Clin Psychiatry* 41:159–160. <https://doi.org/10.1001/archpsyc.1976.01770090059005>
- Adamowicz JL, Salwen JK, Hymowitz GF, Vivian D (2016) Predictors of suicidality in bariatric surgery candidates. *J Health Psychol* 21:1992–1998. <https://doi.org/10.1177/1359105315569618>
- Chen EY, Fettich KC, Tierney M et al (2012) Factors associated with suicide ideation in severely obese bariatric surgery-seeking individuals. *Suicide Life Threatening Behav* 42:541–549. <https://doi.org/10.1111/j.1943-278X.2012.00110.x>
- Rousseau A, Knotter A, Barbe P et al (2005) Validation of the French version of the Body Shape Questionnaire. *Encephale* 31:162–173
- Cooper PJ, Cooper MJ, Cooper Z, Fairburn CG (1987) The development and validation of the Body Shape Questionnaire. *Int J Eat Disord* 6:485–494. [https://doi.org/10.1002/1098-108X\(198707\)6:4%3c485::AID-EAT2260060405%3e3.0.CO;2-O](https://doi.org/10.1002/1098-108X(198707)6:4%3c485::AID-EAT2260060405%3e3.0.CO;2-O)
- Rosen JC, Jones A, Ramirez E, Waxman S (1996) Body shape questionnaire: studies of validity and reliability. *Int J Eat Disord* 20:315–319. [https://doi.org/10.1002/\(sici\)1098-108x\(199611\)20:3%3c315::aid-eat11%3e3.0.co;2-](https://doi.org/10.1002/(sici)1098-108x(199611)20:3%3c315::aid-eat11%3e3.0.co;2-)
- Rosen JC, Orosan P, Reiter J (1995) Cognitive behavior therapy for negative body image in obese women. *Behav Ther* 26:25–42. [https://doi.org/10.1016/S0005-7894\(05\)80081-4](https://doi.org/10.1016/S0005-7894(05)80081-4)

33. Friedman KE, Reichmann SK, Costanzo PR et al (2005) Weight stigmatization and ideological beliefs: relation to psychological functioning in obese adults. *Obes Res* 13:907–916. <https://doi.org/10.1038/oby.2005.105>
34. White MA, Masheb RM, Rothschild BS et al (2006) The prognostic significance of regular binge eating in extremely obese gastric bypass patients: 12-month postoperative outcomes. *J Clin Psychiatry* 67:1928–1935. <https://doi.org/10.4088/JCP.v67n1213>
35. Grilo CM, Masheb RM, Brody M et al (2005) Binge eating and self-esteem predict body image dissatisfaction among obese men and women seeking bariatric surgery. *Int J Eat Disord* 37:347–351. <https://doi.org/10.1002/eat.20130>
36. Rosenberger PH, Henderson KE, Grilo CM (2006) Correlates of body image dissatisfaction in extremely obese female bariatric surgery candidates. *Obes Surg* 16:1331–1336. <https://doi.org/10.1381/096089206778663788>
37. Williamson DA, Womble LG, Zucker NL et al (2000) Body image assessment for obesity (BIA-O): development of a new procedure. *Int J Obes Relat Metab Disord* 24:1326–1332. <https://doi.org/10.1038/sj.ijo.0801363>
38. Beechy L, Galpern J, Petrone A, Das SK (2012) Assessment tools in obesity—psychological measures, diet, activity, and body composition. *Physiol Behav* 107:154–171. <https://doi.org/10.1016/j.physbeh.2012.04.013>
39. Friedman S, Samuelian JC, Lancrenon S et al (2001) Three-dimensional structure of the Hospital Anxiety and Depression Scale in a large French primary care population suffering from major depression. *Psychiatry Res* 104:247–257. [https://doi.org/10.1016/S0165-1781\(01\)00309-2](https://doi.org/10.1016/S0165-1781(01)00309-2)
40. Zigmund A, Snaith R (1983) The hospital anxiety and depression scale. *Acta Psychiatr Scand* 67:361–370. <https://doi.org/10.1111/j.1600-0447.1983.tb09716.x>
41. Pi-Sunyer FX, Aronne LJ, Heshmati HM et al (2006) Effect of rimonabant, a cannabinoid-1 receptor blocker, on weight and cardiometabolic risk factors in overweight or obese patients. *JAMA* 295:761. <https://doi.org/10.1001/jama.295.7.761>
42. Roupa Z, Koulouri A, Sotiropoulou P et al (2009) Anxiety and depression in patients with type 2 diabetes mellitus, depending on sex and body mass index. *Health Sci J* 3(1):32–40
43. Thonney B, Pataky Z, Badel S et al (2010) The relationship between weight loss and psychosocial functioning among bariatric surgery patients. *Am J Surg* 199:183–188. <https://doi.org/10.1016/j.amjsurg.2008.12.028>
44. Osterhues A, von Lengerke T, Mall JW et al (2017) Health-related quality of life, anxiety, and depression in bariatric surgery candidates compared to patients from a psychosomatic inpatient hospital. *Obes Surg* 27:2378–2387. <https://doi.org/10.1007/s11695-017-2629-2>
45. Roberge P, Doré I, Menear M, Chartrand É, Ciampi A, Duhoux A et al (2013) A psychometric evaluation of the French Canadian version of the Hospital Anxiety and Depression Scale in a large primary care population. *J Affect Disord* 147:171–179. <https://doi.org/10.1016/j.jad.2012.10.029>
46. Bouvard M, Charles S, Guérin J et al (1991) Etude de l'échelle de désespoir de Beck (Hopelessness Scale): validation et analyse factorielle. *Encephale* 18:237–240
47. Beck AT, Weissman A, Lester D, Trexler L (1974) The measurement of pessimism: the hopelessness scale. *J Consult Clin Psychol* 42:861–865. <https://doi.org/10.1037/h0037562>
48. Fabricatore AN, Crerand CE, Wadden TA et al (2006) How do mental health professionals evaluate candidates for bariatric surgery? Survey results. *Obes Surg* 16:567–573. <https://doi.org/10.1381/096089206776944986>
49. Vallieres EF, Vallerand RJ (1990) Traduction et Validation Canadienne-Française de L'échelle de L'estime de Soi de Rosenberg. *Int J Psychol* 25:305–316. <https://doi.org/10.1080/00207599008247865>
50. Rosenberg M (1965) Society and the adolescent self-image. *Am Sociol Rev* 31:125. <https://doi.org/10.1126/science.148.3671.804>
51. Gluck ME, Geliebter A, Satov T (2001) Night eating syndrome is associated with depression, low self-esteem, reduced daytime hunger, and less weight loss in obese outpatients. *Obes Res* 9:264–267. <https://doi.org/10.1038/oby.2001.31>
52. Puhl RM, Brownell KD (2006) Confronting and coping with weight stigma: an investigation of overweight and obese adults. *Obesity* 14:1802–1815. <https://doi.org/10.1038/oby.2006.208>
53. Abilés V, Rodríguez-Ruiz S, Abilés J et al (2010) Psychological characteristics of morbidly obese candidates for bariatric surgery. *Obes Surg* 20:161–167. <https://doi.org/10.1007/s11695-008-9726-1>
54. Burgmer R, Legenbauer T, Müller A et al (2014) Psychological outcome 4 years after restrictive bariatric surgery. *Obes Surg* 24:1670–1678. <https://doi.org/10.1007/s11695-014-1226-x>
55. de Lauzon B, Romon M, Deschamps V et al (2004) The Three-Factor Eating Questionnaire-R18 is able to distinguish among different eating patterns in a general population. *J Nutr* 134:2372–2380
56. Karlsson J, Persson L-OO, Sjöström L, Sullivan M (2000) Psychometric properties and factor structure of the Three-Factor Eating Questionnaire (TFEQ) in obese men and women. Results from the Swedish Obese Subjects (SOS) study. *Int J Obes Relat Metab Disord* 24:1715–1725. <https://doi.org/10.1038/sj.ijo.0801442>
57. de Lauzon-Guillain B, Basdevant A, Romon M, Karlsson J, Borys JM, Charles MA, FLVS Study Group (2006) Is restrained eating a risk factor for weight gain in a general population? *Am J Clin Nutr* 83(1):132–138. <https://doi.org/10.1093/ajcn/83.1.132>
58. Angle S, Engblom J, Eriksson T, Kautiainen S, Saha MT, Lindfors P (2009) Three factor eating questionnaire-R18 as a measure of cognitive restraint, uncontrolled eating and emotional eating in a sample of young Finnish females. *Int J Behav Nutr Phys Act* 6:1–6. <https://doi.org/10.1186/1479-5868-6-41>
59. Faul F, Erdfelder E, Buchner A, Lang AG (2009) Statistical power analyses using G\*Power 3.1: tests for correlation and regression analyses. *Behav Res Methods* 41(4):1149–1160. <https://doi.org/10.3758/BRM.41.4.1149>
60. Hayes AF (2013) Introduction to mediation, moderation, and conditional process analysis: a regression-based approach. Guilford Press, New York
61. Libeton M, Dixon JB, Laurie C, O'Brien PE (2004) Patient motivation for bariatric surgery: characteristics and impact on outcomes. *Obes Surg* 14:392–398. <https://doi.org/10.1381/096089204322917936>
62. Wee CC, Hamel MB, Apovian CM et al (2013) Expectations for weight loss and willingness to accept risk among patients seeking weight loss surgery. *JAMA Surg* 148:264–271. <https://doi.org/10.1001/jamasurg.2013.1048>
63. Kaly P, Orellana S, Torrella T et al (2008) Unrealistic weight loss expectations in candidates for bariatric surgery. *Surg Obes Relat Dis* 4:6–10. <https://doi.org/10.1016/j.soard.2007.10.012>
64. Pereira da Silva SS, da Costa MA (2012) Obesity and treatment meanings in bariatric surgery candidates: a qualitative study. *Obes Surg* 22:1714–1722. <https://doi.org/10.1007/s11695-012-0716-y>
65. Angrisani L, Santonicola A, Iovino P et al (2018) IFSO Worldwide Survey 2016: primary, endoluminal and revisional procedures. *Obes Surg* 28(12):3783–3794. <https://doi.org/10.1007/s11695-018-3450-2>
66. World Medical Association (2013) World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects. *JAMA* 310(20):2191–2194. <https://doi.org/10.1001/jama.2013.281053>

**Publisher's Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.