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Food addiction and preoperative weight loss achievement in patients seeking bariatric surgery

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Abstract

Introduction: Evidence suggests that food addiction (FA) is prevalent among individuals with obesity seeking bariatric surgery (BS), but there is no evidence about whether FA is a predictor of weight loss (WL). We aimed to analyse the prevalence of FA in patients with obesity seeking BS and to examine whether FA could predict WL following dietary intervention before surgery.

Method: The study included 110 patients with obesity who underwent a dietetic intervention. Assessment included endocrinological variables, a semistructured interview to rule out mental disorders, and Yale Food Addiction Scale version 2.0 (YFAS 2.0).

Results: In our sample, the prevalence of FA was 26.4%. Those who met YFAS 2.0 criteria showed less WL after dietetic intervention and regain weight during dietary intervention.

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Conclusions: FA appears to be prevalent in obesity. Our findings confirmed a lower WL throughout dietary intervention before surgery in patients who fulfilled baseline criteria for FA. Future interventions should include multidisciplinary intervention to maximize WL before and after BS.

KEYWORDS

bariatric surgery, dietetic intervention, food addiction, obesity, weight loss

1 | INTRODUCTION

Obesity is currently one of the most relevant public health problems worldwide. It is estimated that almost 5% of the Spanish adult population have a body mass index (BMI) >35 kg/m^2 (Aranceta-Bartrina, Pérez-Rodrigo, Alberdi-Aresti, Ramos-Carrera, & Lázaro-Masedo, 2016). Recent data show that moderate obesity is stabilizing, but the prevalence of Class II (BMI > 35 kg/m^2) and Class III or morbid obesity (MO; BMI > 40 kg/m^2) continues to rise at an alarming rate (Abarca-Gómez et al., 2017). Bariatric surgery (BS) is to date the most effective long-term weight loss (WL) treatment for patients with MO and helps to improve previous comorbidities and quality of life in these patients (Nguyen & Varela, 2017). Although it remains controversial in the literature, a preoperative WL prior to BS is frequently recommended (Gerber, Anderin, & Thorell, 2015), even though current guidelines do not consider it as mandatory (Bray et al., 2018; Mechanick et al., 2013). The procedures will vary from integral lifestyle intervention with hypocaloric diet and exercise (Gerber et al., 2015) to laparoscopic bridge interventions, such as Intragastric Balloon or Endobarrier, suggested by some authors (Quiroz, Peniche, Cuevas, & Farell, 2017; Younus, Chakravartty, Sarma, & Patel, 2018). The rationale behind the achievement of WL prior to BS (generally 5–10% of weight excess) is that it may lead to an improvement in cardiovascular risk factors (Veronese et al., 2016), more optimal laparoscopic approach and operating time (Alami et al., 2007; Edholm et al., 2011), a reduction in postsurgical complications (Anderin, Gustafsson, Heijbel, & Thorell, 2015; Giordano & Victorzon, 2014), and more WL after BS (Alger-Mayer, Polimeni, & Malone, 2008; Alvarado et al., 2005; Gerber, Anderin, Gustafsson, & Thorell, 2016; Steinbeisser, McCracken, & Kharbutli, 2017). In spite of the positive benefits of preoperative WL achievement, there is not sufficient evidence in the literature to make it compulsory (Kim, 2017; Krimpuri et al., 2018). Although several studies have analysed preoperative predictors of WL after BS, detecting personality traits, cognitive function, mental health, and binge eating as negative factors (Agüera et al., 2015; García-Ruiz-de-Gordejuela et al., 2017; Wimmelmann, Dela, & Mortensen, 2014), only few studies have explored predictors of poor WL achievement prior to BS. Predictors for poor WL prior to BS include being female and non-Caucasian (Hutcheon, Byham-Gray, Marcus, Scott, & Miller, 2017), a high snacking frequency (Bergh, Lundin Kvalem, Risstad, & Sniehotta, 2016), the presence of depressive symptomatology (Nicolau et al., 2017), and having a number of comorbidities (Bergh, Kvalem, Risstad, Cameron, & Sniehotta, 2015).

Even though food addiction (FA) is not included as a disorder in the latest Diagnostic and Statistical Manual of Mental Disorders (DSM-5), it shows an increasing interest among the eating disorders and obesity scientific community (Chao et al., 2017; Gordon, Ariel-Donges, Bauman, & Merlo, 2018). FA is generally characterized by the loss of control over the consumption of salty, sugary, and processed foods and continued consumption despite adverse physical and psychological consequences (Gearhardt, Corbin, & Brownell, 2009; Treasure, Leslie, Chami, & Fernández-Aranda, 2018). FA is mainly associated with abnormal eating patterns and eating disorders (Granero et al., 2014; Pedram et al., 2013) and is prevalent among individuals with obesity seeking BS (Meule, Heckel, Jurowich, Vögele, & Kübler, 2014; Meule, Heckel, & Kübler, 2012; Pepino, Stein, Eagon, & Klein, 2014). The prevalence of FA within the obese population is higher than in nonobese (Burmeister, Hinman, Koball, Hoffmann, & Carels, 2013; Eichen, Lent, Goldbacher, & Foster, 2013). Surgery candidates with FA reported lower quality of life and higher prevalence and levels of depression and binge eating before (Brunault et al., 2016), but in most studies, the presence of presurgical FA has not been associated with postsurgical weight outcomes (Ivezaj, Wiedemann, & Grilo, 2017). In patients not seeking BS, FA has been related to less short-term WL with behavioural strategies in some studies (Burmeister et al., 2013) but not in others (Lent, Eichen, Goldbacher, Wadden, & Foster, 2014). However, to date, there is still scarce information about whether FA is predictive of poor prognosis in dietetic treatments.

The aim of our study was twofold: (a) to analyse the preoperative prevalence of FA in a cohort of patients with

MO seeking BS and (b) to examine whether the baseline presence of FA could predict poor WL achievement after a 6-month dietary and lifestyle intervention prior to BS. Thus, we expected that (a) some obesity patients presented FA, (b) we could identify differences in anthropometric, clinical, and comorbidities characteristics in patients with and without FA, and (c) those patients with FA obtained lower WL during dietetic intervention and higher risk of dropout.

Highlights

- The prevalence of food addiction in morbid obese patients seeking bariatric surgery was 26.4% (22.6% females and 38.5% males).
- Baseline food addiction scores predicted poorer weight loss (WL) achievement after a dietary and lifestyle intervention prior to bariatric surgery.
- Although food addiction is related to less optimal response to the WL programme, it does not seem to increase the risk of dropping out.

2 | MATERIALS AND METHODS

2.1 | Participants

This was a prospective single-centre study, including patients with obesity seeking BS that were consecutively admitted for assessment in our Endocrinology Outpatient Clinic at Bellvitge University Hospital (a tertiary and referral medical centre) in Barcelona, Spain. According to NIH Guidelines (1992), the inclusion criteria for BS, and therefore this study, were as follows: (a) BMI $\geq$ 40 kg/m^2 or $>$ 35 kg/m^2 with obesity-related comorbidities such as Type 2 diabetes mellitus, arterial hypertension, dyslipidemia, obstructive sleep apnoea, or severe osteoarthritis; (b) aged between 18 and 65 years; (c) more than 5 years of obesity history and failure in expected WL having undergone a hypocaloric diet; (d) capacity to understand and desire to complete the BS procedure and protocol; (e) patients who have completed group session and have attended at least three individual counselling session; and (f) absence of current diagnosed eating disorder, relevant psychiatric disease such as bipolar disorder and schizophrenia, among other psychotic disorders, active alcohol or substance abuse or the presence of any unstable medical condition. Furthermore, participants who did not meet the inclusion criteria for BS, with a previous BS, taking WL pharmacological treatment, presence of pregnancy, lactation, or that rejected to sign written consent were excluded.

The study was authorized by the Ethics Committee of the University Hospital of Bellvitge (PR146/14), and all patients signed a written informed consent.

2.2 | Study design

Following the centre protocol, BS candidates were initially evaluated by the endocrinologist, between August 2016 and October 2017, and were referred to psychiatric and psychologist assessment. Thereafter, the patients started a group dietetic intervention, and afterwards, each participant received three individual tailored counselling sessions (in the second, fourth, and six months) with a dietician. After 6 months, the patients were re-evaluated by the endocrinologist before being sent to the BS. Patients answered questionnaires shortly after the first endocrinologist visit.

2.3 | Assessment

2.3.1 | Endocrinological evaluation

All participants were evaluated initially and after completion of the dietary intervention by skilled endocrinology specialists at the Department of Endocrinology. The specialists also obtained complete medical history including demographic information, sex, age, and presence of comorbidities. Definition criteria for major obesity comorbidities were as follows: Type 2 diabetes mellitus was considered in patients with at least two fasting plasma glucose $\geq$126 mg/dl (7.0 mmol/L) or plasma glucose $\geq$200 mg/dl (11.1 mmol/L) after glucose load or glicated haemoglobin $\geq$6.5% (48 mmol/mol; American Diabetes Association, 2017) or patients on glucose-lowering drugs. Arterial hypertension was diagnosed in patients with systolic blood pressure $\geq$ 130 mmHg or diastolic blood pressure $\geq$ 80 mmHg or patients under antihypertensive treatment (James et al., 2014). Dyslipidaemia was diagnosed in patients with previous serum lipid profile above normal range (total cholesterol $\geq$5.18 mmol/L; high-density lipoprotein cholesterol $\leq$1.04 mmol/L; low-density lipoprotein cholesterol $\geq$3.37 mmol/L; serum triglycerides $\geq$1.70 mmol/L) or patients undergoing hypolipidemic drug treatment. Disabling osteoarthritis was defined in patients with documented degenerative joint disease and limitations in daily living activities. In all cases, diagnosis of obstructive sleep apnoea was made by pneumology specialists.

At each visit, a physical examination was performed to collect anthropometric data including weight, height, waist and hip circumferences, and blood pressure. Height and weight was measured with patient standing, in light clothes and without shoes. BMI was calculated as body weight (in kilogrammes) divided by height squared (in squared meters).

2.4 | Psychological assessment

All patients were evaluated by experienced psychologists and psychiatrists at the Department of Psychiatry, who conducted two semistructured face-to-face clinical interviews, on the one hand, to assess relevant psychopathology and current mental disorders, and on the other hand, to assess and ruled out eating disorders.

Yale Food Addiction Scale (YFAS) version 2.0 (Gearhardt, Corbin, & Brownell, 2016) consisting of a self-report questionnaire consists of 35 items scored on an 8-point Likert scale (from 0 = *never* to 7 = *every day*) and adapted to assess addictive eating behaviours based on DSM-5, Fourth Edition, Text Revision, substance-related and addictive disorders criteria (American Psychiatric Association, 2013). The Spanish YFAS 2.0 has been validated in a Spanish sample, and the scoring guidelines used in the original validation of the YFAS 2.0 were followed for this study (Granero et al., 2018). These scoring guidelines produce two measurements: (a) a continuous symptom count score that reflects the number of fulfilled diagnostic criteria (ranging from 0 to 11) and (b) a binary classification of FA (present vs. absent), which is based on the number of symptoms (at least two) and self-reported clinically significant impairment or distress. Based on the revised DSM-5 taxonomy, the YFAS 2.0 also provides severity cut-offs: mild (two to three symptoms), moderate (four to five symptoms), and severe (six to 11 symptoms). In our study, we used both dimensional and binary scores to evaluate the presence as well as the severity of FA.

The Spanish version of the YFAS 2.0 has excellent accuracy in discriminating between HC and eating disorder subsamples ($\kappa = 0.75$), and its internal reliability coefficient is excellent ($\alpha = 0.94$; Granero et al., 2018).

2.5 | Procedure

All participants were referred to experienced dieticians with particular expertise in obesity management. Dietary intervention lasted 6 months and included an initial 90-min group session intended to give general information about the benefits of BS, importance of behavioural modifications prior to intervention (diet and exercise), details of the surgery, risk and possible complications, and post-operative lifestyle modifications to achieve a successful WL outcome. After that, each participant received three individual tailored counselling sessions (in the second, fourth, and sixth months). In the first individualized session, the calories goal set were 1200 kcal/day for women and 1500 kcal/day for men. Diet was adapted to each participant work and timetables characteristics. If participants did not lose satisfactory weight, caloric intake was reduced to 1,000 and 1,200 kcal/day, respectively. The composition of diet included a maximum of 30% of total calories from fat and 15% from protein. Participants were encouraged to increase their intake of fruits, vegetables, fish, lean meat, or poultry and limit intake of fatty meats, sweets, pastries, or desserts. All patients were also aided to increase physical activity to a maximum of 150 min/week of moderate or intense aerobic exercise depending on patient's conditions. In each individual session, the dieticians monitored the weight status and the compliance with diet and exercise. This was assessed in each visit trough a 3-day self-reported diet registers completed by the patient and the daily time spent doing exercise. Successful WL prior to surgery was defined as losing ≥5% of the initial weight, mild WL between 2.5% and 5%, and lack of response to dietary intervention in patients with WL <2.5%. Unjustified skipping of any of the appointments with the dieticians was considered drop-out.

2.6 | Statistical analysis

Statistical analysis was carried out with Stata15 for Windows (StataCorp, 2017). The bivariate comparisons between patients who met and did not meet YFAS 2.0 criteria for FA were based on chi-squared tests (χ^2) for categorical variables (such as the presence of obesity comorbidities) and *t* test procedures for quantitative measures.

The predictive capacity of the presence of baseline FA, on the change in BMI and weight during the dietary intervention, was based on mixed 4 × 2 analysis of variance (ANOVA). It was defined as the intrasubject factor the time of the measurement/assessment (at baseline and at each of the three individual counselling sessions) and the between-subject factor the FA group at baseline (absent vs. present). The patients' sex, age, and weight at baseline were considered as covariates.

The predictive capacity of baseline FA on the risk of dropout during the dietary intervention was estimated with logistic regression, whereas the predictive capacity of the presence of FA prior to the surgery on the likelihood of WL at the end of the follow-up was estimated with multinomial regression (this model was employed because the group of WL includes three categories). Both models, logistic and multinomial regression, were adjusted by the patients' sex, age, and the baseline weight.

3 | RESULTS

3.1 | Characteristics of the sample

A total of $n = 110$ participants (76.4% female) were included in the study. The mean age was 47.3 years ($SD = 8.8$), and the mean BMI at time of recruitment was 46.0 kg/m^2 ($SD = 5.8$). Patients suffered from multiple obesity-related comorbidities with the most frequent being arterial hypertension (48.2%) and obstructive sleep apnoea (41.8%), followed by dyslipidaemia (35.5%) and Type 2 diabetes mellitus (27.3%); only 4.5% were under insulin treatment. Baseline anthropometric and clinical characteristics of the patients are presented in Table 1.

3.2 | Prevalence and severity of FA

FA was identified in 29 patients, which represented a prevalence of 26.4% (see first upper block of Table 2). Stratified by sex and age groups (defined for the quartiles in the own sample), point-estimate prevalence of FA for women was lower compared with men (22.6% vs. 38.5%), and point-estimate prevalence also decreased with the patient's age (from 30.8% in the youngest group to 23.1% in the oldest group). However, no statistically significant differences were found based on sex and age.

TABLE 1 Descriptive for the sample ($n = 110$), anthropometric measurement, body composition characteristics and comorbidities prevalence

		Min	Max	Mean	*SD*	*n*	%
Weight (baseline, kg)		79.50	176.30	121.96	20.40		
Height (cm)		143	184	162.67	8.424		
Body mass index (baseline, kg/m^2)		36	62	46.00	5.79		
Abdominal circumference (cm)		103	177	129.09	15.38		
Hip circumference (cm)		42	160	129.60	15.68		
Sex	Female					84	76.4
	Male					26	23.6
Prevalence for baseline disorders							
Hypertension	Yes					53	48.2
Diabetes mellitus	Yes					30	27.3
Insulin treatment	Yes					5	4.5
Dyslipidemia	Yes					39	35.5
Sleep apnoea	Yes					46	41.8

Note. Min: minimum; Max: maximum; SD: standard deviation.

TABLE 2 Prevalence of FA (positive screening score) and severity of FA (dimensional FA score)

	Total sample		Women		Men		Age: 18–40		Age: 41–48		Age: 49–54		Age: 55–61	
	$n = 110$		$n = 84$		$n = 26$		$n = 26$		$n = 29$		$n = 29$		$n = 26$	
Prevalence FA	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
	29	26.4%	19	22.6%	10	38.5%	8	30.8%	8	27.6%	7	24.1%	6	23.1%
95% CI (preval.)	18.1%	34.6%	13.7%	31.6%	19.8%	57.2%	13.0%	48.5%	11.3%	43.9%	8.6%	39.7%	6.9%	39.3%
			$\chi^2 = 2.57$; $df = 1$; $p = 0.109$				$\chi^2 = 0.50$; $df = 3$; $p = 0.919$							
FA total score	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*
	2.9	3.1	2.8	3.0	3.4	3.5	2.9	3.1	3.4	3.5	2.9	3.1	2.4	2.7
95% CI (mean)	2.4	3.5	2.1	3.4	2.0	4.8	1.7	4.2	2.1	4.8	1.7	4.1	1.3	3.5
			$F = 0.71$; $df = 1/108$; $p = 0.402$				$F = 0.49$; $df = 3/106$; $p = 0.688$							

Note. Groups of age have been created based on the quartiles in the sample. SD: standard deviation. 95% CI: 95% confidence interval. *df*: degrees of freedom.

TABLE 3 Prevalence of obesity comorbidities in patients with and without FA

	FA binary screening score						FA dimensional score				
	Negative; *n* = 81		Positive; *n* = 29		Chi-squared		Binary logistic regression				
	n	%	*n*	%	$\chi^2_{(df=1)}$	*p*	*B*	*SE*	*p*	OR	95% CI (OR)
Hypertension	37	45.7	16	55.2	0.77	0.380	0.051	0.062	0.411	1.05	[0.93, 1.19]
Diabetes	22	27.2	8	27.6	0.00	0.965	−0.025	0.070	0.725	0.98	[0.85, 1.12]
Insulin	4	4.9	1	3.4	0.11	0.741	−0.241	0.224	0.280	0.79	[0.51, 1.22]
Dyslipidemia	27	33.3	12	41.4	0.60	0.437	0.120	0.064	0.061	1.13	[0.99, 1.28]
Sleep apnoea	32	39.5	14	48.3	0.68	0.411	−0.004	0.063	0.947	1.00	[0.88, 1.13]

Note. FA: food addiction; SE: standard error; OR: odds ratio.

The mean FA dimensional score (number of YFAS 2.0 criteria met) was 2.9 ($SD = 3.1$) across the whole sample without statistically significant differences based on sex or age (see Table 2).

3.3 | Presence of obesity comorbidities based on the FA presence and severity

The first block of Table 3 contains the prevalence of arterial hypertension, Type 2 diabetes mellitus, insulin treatment, dyslipidaemia, and obstructive sleep apnoea stratified by patients who met and did not YFAS 2.0 criteria for FA, showing no statistical differences based on the presence of FA. The second block of Table 3 shows the results of the binary logistic regressions valuing the contribution of the FA severity level (independent variable: FA total dimensional score) on the presence of the comorbid obesity conditions (defined as criteria in the regressions). No significant association was found in any of the models.

3.4 | Predictive capacity of baseline FA on the evolution of BMI and weight during the follow-up

Results in the mixed ANOVA defined by the time assessment (body measure at baseline and at each dietary intervention measure), the FA group (negative vs. positive) as the between-subject factor, and adjusting by the covariates sex, age, and weight at baseline, showed significant interaction between the intra-by-inter factors (BMI: $F = 6.24$, $p = 0.003$; weight: $F = 6.45$; $p = 0.002$). These results indicate that the presence or absence of FA influences on WL progress, as illustrated in Figure 1 (the first panel contains the mean BMI progress and the second panel the mean weight progress): Although patients with FA at baseline lost weight during Assessments 1 and 2 and regain weight in the third assessment, patients without FA decreased weight during all three intervention assessments.

3.5 | Predictive capacity of the baseline FA on the risk of dropout and WL at the end of the follow-up

The risk of dropout during the follow-up was 27.2% for patients who did not meet FA criteria and 31.0% for patients who met FA criteria (logistic regression adjusted by sex, age, and baseline weight obtained nonsignificant results valuing the predictive capacity of the FA: OR = 1.18, $p = 0.733$).

Regarding the odds of successful WL after dietary intervention (lack of response—decreases lower than 2.5%; mild—decreases between 2.5% and 5%; and successful—decreases higher than 5%), the multinomial regression adjusted by sex, age, and baseline weight showed that patients who did not meet YFAS 2.0 criteria for FA had increased odds of losing weight rather than not responding to treatment compared with being in the lack of response group (OR = 6.1, $p = 0.038$; Table 4). Figure 2 contains the bar chart illustrating the risk of WL outcome depending on the presence/absence of FA, as well as the

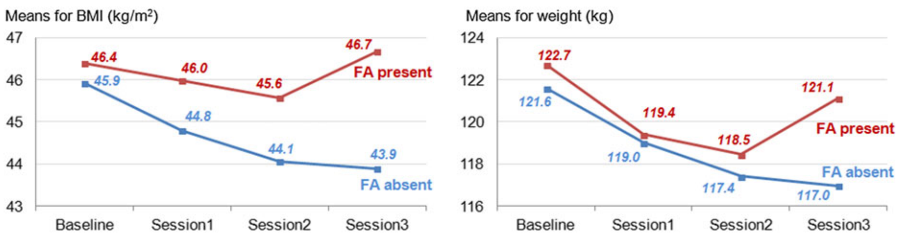

FIGURE 1 BMI and weight loss progress during dietary intervention. Note: results adjusted by sex, age, and baseline weight. BMI: body mass index; FA: food addiction [Colour figure can be viewed at wileyonlinelibrary.com]

TABLE 4 Predictive capacity of FA screening group with the dietetic outcome during the follow-up

Group of weight loss	Estimate risk				Multinomial regression (adjusted by sex, age and baseline weight)					
	FA negative		FA positive							
	n	%	*n*	%	Comparison	*B*	*SE*	*p*	OR	95% CI (OR)
G1 Lack response	25	42.4	11	55.0	G2 versus G1	0.360	0.666	0.588	1.434	[0.389, 5.287]
G2 Mild	15	25.4	6	30.0	G3 versus G1	1.807	0.870	**0.038**	6.093	[1.107, 33.535]
G3 Success	19	32.2	3	15.0	G3 versus G2	1.447	0.915	0.114	4.249	[0.707, 25.548]

Note. G1: weight loss lower than 2.5%; G2: weight loss between 2.5% and 5%; G3: weight loss higher than 5%. Bold: significant parameter (0.05 level). Results obtained for the completers ($n = 79$). CI: confidence interval; FA: food addiction; OR: odds ratio.

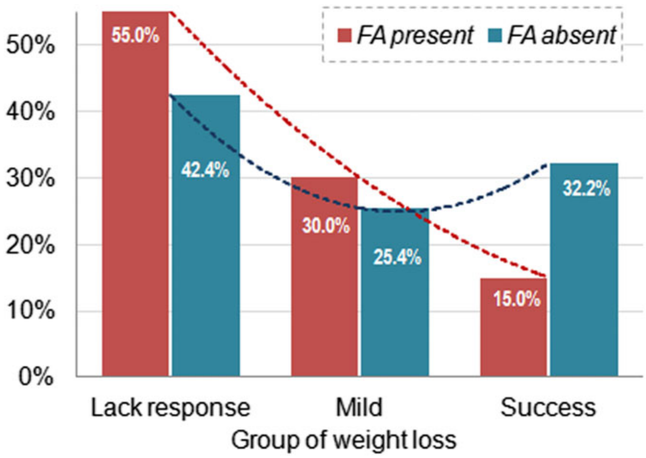

FIGURE 2 Risk of weight loss goals achieved in patients with or without FA. Note: Dash line represents the two-order polynomial trend. FA: food addiction [Colour figure can be viewed at wileyonlinelibrary.com]

order-2 polynomial trend-lines (this trend was selected according to the fluctuations in the risk estimates of the study).

4 | DISCUSSION

To the best of our knowledge, our study is one of the first to analyse WL response to a preoperative dietary intervention in obesity patients seeking BS and to explore the predictive capacity of the FA construct on preoperative WL, after controlling for age, sex, and baseline BMI. Our findings confirmed a poorer WL outcome in patients who fulfilled baseline criteria for FA.

Although BS is a well-established, safe, and effective treatment for patients with MO, it is estimated that approximately 20–30% of these patients have suboptimal long-term WL (Livhits et al., 2012; Puzziferri et al., 2014). Most studies have found preoperative BMI, superobesity (defined as a baseline BMI > 50 kg/m^2), psychopathology, and comorbidity, and also specific personality traits as negative predictors of weight outcomes (Agüera et al., 2015; Wimmelmann et al., 2014). Some studies have also described that the presence of WL with a dietary intervention before BS is associated with a better response after surgery (Ali et al., 2007). In this sense, Still et al. (2007) found that, independently of the type of intervention, patients with more than 10% of WL prior to surgery had a shorter length of hospital stay and were more likely to achieve 70% loss of excess body weight 12 months after surgery. A moderate weight reduction of 5–10% of the initial body weight has also been associated with an improvement in cardiovascular risk factors related to obesity (Klein et al., 2004). In most centres, a WL dietary intervention is implemented before BS with two objectives: (a) to select patients with higher commitment to the programme and (b) to select who will benefit the most from surgery as well as to reduce the high cardiovascular risk of these patients. Therefore, early recognition and selection of patients with greater barriers to WL is very important in this setting in order to design strategies to help achieve the recommended weight outcome and potentially improve surgical results.

In a general population sample, the presence and severity of FA symptomatology has been related to a significantly higher weight, body fat, BMI, and more caloric intake compared with controls (Pedram et al., 2013; Schulte & Gearhardt, 2018). Also, FA has generally been associated with more abnormal eating patterns, greater levels of psychopathology (de Vries & Meule, 2016; Miller-Matero et al., 2014; Wiedemann et al., 2018), more dysfunctional personality traits (Wolz et al., 2016), and more impaired cognitive style (Steward et al., 2018). FA among individuals with obesity has been reported to have a prevalence ranging from 19% to 25%, and even over 50% in BS participants (Koball et al., 2016; Pursey, Stanwell, Gearhardt, Collins, & Burrows, 2014). Confirming previous studies in the literature (Ivezaj et al., 2017), we observed a prevalence of FA in BS patients of 26.4%. Probably, the exclusion of individuals with current eating disorders (namely, binge eating disorder) from the BS process may explain our lower prevalence. Moreover, in contrast with previous investigations (Pursey et al., 2014), FA was higher in men than in women (38.5% vs.

22.6%, respectively) and in younger rather than older participants (30.8% vs. 23.1%, respectively).

In our study, we were not able to identify patients with FA by their initial anthropometric and clinical characteristics such as sex, age, weight, BMI, and waist and hip circumference. Also, comorbid conditions were comparable in patients with and without FA. Similarly as studies found, there was no link between FA and current or previous maximal BMI or any other anthropometric characteristic (Brunault et al., 2016; Meule et al., 2014).

The second main finding in our study was that baseline FA scores predicted WL achievement after a dietary and lifestyle intervention prior to BS. Those patients who had higher FA baseline scores had lower WL, and we detected different trajectories between obesity patients with and without FA. In particular, obesity patients with FA showed WL at start of intervention but regain weight after 6 months of dietetic intervention. It is likely that obesity patients with FA had trouble to compliance with dietary intervention. In these type of patients, problematic eating behaviour (e.g., emotional eating; Meule et al., 2014; Miller-Matero et al., 2014), more severe eating profile (e.g., food craving, overeating, and lower self-efficacy; Meule et al., 2014), more severe psychological profile (e.g., high impulsivity, depression, and anxiety symptoms; Koball et al., 2016; Meule et al., 2014), personality traits (harm avoidance and less self-directedness), and emotion dysregulation (Ouellette et al., 2017) have been detected. Moreover, the exposure to an obesogenic environment with easy access to palatable food on susceptible individuals who experiment negative affect could increase intake palatable food to reduce negative feelings causing weight regain progressively. Further research would examine the role of such aspects in more detail, and the results could help to design tailored intervention to maximize WL maintenance in these subtype of obesity patients.

It is also important to understand whether FA predicts the likelihood of dropping out of weight management programmes. The attrition rate in our study was high (approximately 30%) but similar to other studies with this patient population (Rhodes et al., 2017; Tompkins, Laurent, & Brock, 2017). However, FA and non-FA participants completed the weight intervention programme at similar rates, which is in consistent with other WL treatment studies (Burmeister et al., 2013; Lent et al., 2014). Therefore, although FA is related to less optimal response to the WL programme, it does not seem to increase the risk of dropping out of these types of programmes. However, further studies would be interesting to confirm if dropout in the FA group increases or not at follow-up.

Question arises whether the treatment of FA could improve the response of patients seeking BS. However, the management of this disorder has not yet been defined. It has been suggested that FA could be managed with strategies directed to address addictive-like mechanisms in the context of eating behaviour (Long, Blundell, & Finlayson, 2015). For example, psychological treatments that target craving, impulsivity, compulsivity, and motivation using cognitive behavioural therapy or mindfulness-based approaches to increase emotion regulation and distress tolerance could be useful in patients with FA (Vella & Pai, 2017). Additionally, no prior studies have investigated whether there are effective drug treatments for patients with FA. Thus, the identification of psychological and medication treatments that will improve outcomes for patients with FA is an important future direction.

The current study provides important information regarding how FA may be related to preparation for BS; however, there are important limitations to consider. First, the sample size of our study is modest and replication in larger cohorts of BS patients is necessary to confirm our results. Second, we did not investigate WL trajectories after BS in patients with FA compared with non-FA. Third, FA is frequently related with active substance abuse and eating disorder (e.g., binge eating disorder), so in our study, these patients were excluded because they are not candidates for BS. Fourth, in our study, a self-reported 3-day food diary was used to evaluate compliance to dietetic intervention. However, even though it is considered as a reference method in dietetic studies, it is affected by error and has limitations due mainly to the tendency of subjects to report food consumption close to those socially desirable. Finally, because of the design of clinical study, we had no long-term outcomes and only considered weight outcomes as well as compliance with self-reported data. Further studies should include objective outcomes and psychological (such as depression and anxiety) and follow-up measurement to evaluate the change and confirm our results.

To conclude, FA is a prevalent condition in MO patients preparing for BS. Before starting surgery, FA level at baseline predicts a less optimal WL outcome after a hypocaloric diet and lifestyle intervention in preparation for BS. To identify FA and abnormal eating patterns in BS patients before starting any WL intervention seems to be crucial. This issue is particularly important in some medical centres or when insurance companies require a 5–10% preoperative WL before approval for surgery. These patients should receive a multidisciplinary intervention including a nutritionist, psychologist, and endocrinologist specialist with a better-targeted intervention to maximize WL before and after BS.

CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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