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Title: Food Addiction and Preoperative Weight Loss Achievement in patients seeking Bariatric Surgery.

Short running title: Food Addiction and Weight in 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 isn't 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 semi-structured interview to ruled out mental disorders, and Yale Food Addiction Scale (YFAS-2.0). **Results:** In our sample, the prevalence of FA was 26.4%. Those who met YFAS 2.0 criteria, showed less weight loss after dietetic intervention and regain weight during dietary intervention. **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 weight loss before and after BS.

Highlights:

- The prevalence of Food Addiction (FA) is the 26.4% in our obesity and morbid obesity sample.
- The results suggests that obesity patients who meet criteria for FA shows less weight loss after dietetic intervention and regain weight throughout dietary intervention.
- FA does not seem to increase the risk of dropping out of the programs to lose weight.

Keywords: Food addiction; bariatric surgery; obesity; dietetic intervention; weight loss.

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) >35kg/m2 (Aranceta-Bartrina, Pérez-Rodrigo, Alberdi-Aresti, Ramos-Carrera, & Lázaro-Masedo, 2016). Recent data shows moderate obesity is stabilizing but the prevalence of class II (BMI > 35kg/m2) and class III or morbid obesity (MO) (BMI > 40kg/m2) 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 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 pre-operative weight loss (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 weight loss 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 non-obese, (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 pre-surgical 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 weight loss 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 pre-operative prevalence of FA in a cohort of patients with MO seeking BS; b) to examine whether the baseline presence of FA could predict poor WL achievement after a 6 months dietary and lifestyle intervention prior to BS. Thus, we expected that: (1) some obesity patients presented food addiction, (2) we could identify differences in anthropometric, clinical and comorbidities characteristics in patients with and without FA and (3) those patients with food addiction obtained lower weight loss during dietetic intervention and higher risk of dropout.

MATERIALS AND METHODS

Participants and inclusion criteria

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 bariatric surgery, and therefore this study, were as follows: (1) BMI≥ 40 kg/m2 or > 35 kg/m2 with obesity related comorbidities such as type 2 diabetes mellitus, arterial hypertension, dyslipidemia, obstructive sleep apnoea or severe osteoarthritis; (2) aged between 18 and 65 years old; (3) more than five years of obesity history and failure in expected WL having undergone a hypocaloric diet; (4) capacity to understand and desire to complete

the BS procedure and protocol; (5) patients who have completed group session and have attended at least three individual counselling session; (6) absence of current diagnosed eating disorder, relevant psychiatric disease such as bipolar disorder, 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 bariatric surgery, taking weight-loss pharmacological treatment, presence of pregnancy, lactation, or that rejected to sign written consent were excluded.

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

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 bariatric surgery. Patients answered questionnaires shortly after the first endocrinologist visit.

Assessment

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 ≥ 126mg/dl (7.0mmol/l) or plasma glucose ≥ 200mg/dl (11.1mmol/l) after glucose load or glicated haemoglobin ≥ 6.5% (48mmol/mol) (American Diabetes Association, 2017) or patients on glucose lowering drugs. Arterial hypertension was diagnosed in patients with systolic blood pressure ≥ 130 mmHg or diastolic blood pressure ≥ 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 ≥ 5.18 mmol/l; HDL cholesterol ≤ 1.04 mmol/l; LDL cholesterol ≥ 3.37 mmol/l, serum triglycerides ≥ 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 kilograms) divided by height squared (in squared meters).

Psychological Assessment

All patients were evaluated by experienced psychologists and psychiatrists at the Department of Psychiatry, who conducted two semi-structured face-to-face clinical interviews. On the one hand, to assess relevant psychopathology and current mental disorders, and 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 eight-point Likert scale (from 0=never to 7=every day) and adapted to assess addictive eating behaviours based on Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR) substance-related and addictive disorders criteria (American Psychiatric Association, 2000). 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 produces 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 versus absent), which it is based on the number of symptoms (at least 2) and self-reported clinically significant impairment or distress. Based on the revised DSM-5 taxonomy, the YFAS 2.0 also provides severity cutoffs: mild (2-3 symptoms), moderate (4-5 symptoms), and severe (6-11 symptoms). In our study we used both dimensional and binary scores to evaluate the presence as well as the severity of food addiction.

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

Procedure

All participants were referred to experienced dieticians with particular expertise in obesity management. Dietary intervention lasted 6 months and included an initial 90 minute 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, as well as post-operative lifestyle modifications to achieve a successful weight loss 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 per day for women and 1500 kcal per 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 1000 and 1200 kcal per 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 minutes per 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 three-day self-reported diet registers completed by the patient and the daily time spend doing exercise. Successful weight loss prior to surgery was defined as losing $\geq$ 5% of the initial weight, mild weight loss between 2.5-5% and lack of response to dietary intervention in patients with

weight loss < 2.5% . Unjustified skipping of any of the appointments with the dieticians was considered drop-out.

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 was based on chi-square tests ($\chi 2$) 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), define as the intra-subject factor the time of the measurement/assessment (at baseline and at each of the 3 individual counselling sessions), as the between-subject factor the FA group at baseline (absent versus present) and including the patients' sex, age and weight at baseline.

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

RESULTS

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 old (SD=8.8) and mean BMI at time of recruitment was 46.0 kg/m2 (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.

--- Insert Table 1 ---

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 by for the quartiles in the own sample), point-estimate prevalence of FA for women was lower compared to men (22.6% versus 38.5%), and point-estimate prevalences 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. 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).

--- Insert Table 2 ---

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.

--- Insert Table 3 ---

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 versus 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=.003; weigh: F=6.45; p=.002 for the weight). These results indicate that the presence or absence of FA influences on WL progress, as illustrated in Figure 1 (first panel contains the mean BMI progress and second panel the mean weight progress): while 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.

--- Insert Figure 1 ---

Predictive capacity of the baseline FA on the risk of dropout and weight loss 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 non-significant results valuing the predictive capacity of the FA: OR=1.18, *p*=.733).

Regarding the odds of successful weight loss after dietary intervention (lack of response -decreases lower than 2.5%-, mild –decreases between 2.5% to 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 to being in the lack of response group (OR=6.1, p=.038) (Table 4). Figure 2 contains the bar-chart illustrating the risk of weight loss outcome depending on the presence-absence of FA, as well as the order- 2 polynomial trend-lines (this trend was selected according to the fluctuations in the risk estimates of the study).

--- Insert Table 4 and Figure 2 ---

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, super-obesity (defined as a baseline BMI > 50kg/m^2), psychopathology, and comorbidity, but 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 weight loss prior to surgery had a shorter length of hospital stay and were more likely to achieve 70% loss of excess body weight twelve 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 weight-loss dietary intervention is implemented before bariatric surgery with two objectives: (1) to select patients with higher commitment to the programme and (2) 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 weight loss 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 to 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 relatively 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, 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 life style 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 six months of dietetic intervention. It is likely that obesity patients with FA had trouble to compliance with dietary intervention. In these type of patients, it has been detected 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). Moreover, the exposure to an obesogenic environment with easy access to palatable food on a susceptible individuals which 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 maximise weight loss maintenance in these subtype of obesity patients.

It is also important to understand whether FA predicts the likelihood of dropping out of weight management programs. 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 program at similar rates, which is in consistent with other weight loss treatment studies (Burmeister et al., 2013; Lent et al., 2014). Therefore, although FA is related to less optimal response to the weight loss program, 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 FA group increase 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 been yet 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. Firstly, the sample size of our study is modest and replication in larger cohorts of BS patients is necessary to confirm our results. Secondly, we did not investigate weight loss trajectories after bariatric surgery in patients with FA compared to non-FA. Thirdly, 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. Fourthly, in our study, a self-reported three-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 not long-term outcomes and only considered weight outcomes as well as compliance with self-reported data. Further studies should include objective outcomes, 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 insurances companies require a 5-10% preoperative weight loss 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 weight loss before and after bariatric surgery.

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.

Financial support

This manuscript and research was supported by grants from Instituto de Salud Carlos III (ISCIII) (FIS PI14/00290, FIS PI17/01167, FIS 14/01997 and FIS 17/01556) and co-funded by FEDER funds /European Regional Development Fund (ERDF), a way to build Europe. CIBER Fisiopatología de la Obesidad y Nutrición (CIBERobn), CIBER Salud Mental (CIBERsam), CIBER Diabetes y Enfermedades Metabólicas (CIBERdem) and CIBER Enfermedades Respiratorias (CIBERes) are an initiative of ISCIII. The funders had no role in the study design, data collection and analysis, decision to publish, or preparation of the manuscript.

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Table1. Descriptive for the sample (*n*=110), anthropometric measurement, body composition characteristics and comorbidities prevalence.

		Min	*Max*	*Mean*	*SD*
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
		n	*%*		
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 apnea	*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 *n=110*		Women *n=84*		Men *n=26*		Age: 18-40 *n=26*		Age: 41-48 *n=29*		Age: 49-54 *n=29*		Age: 55-61 *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%
			χ^2=2.57; df=1; *p*=.109				χ^2=0.50; df=3; *p*=.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*=.402				F=0.49; df=3/106; *p*=.688							

Note. SD: standard deviation. 95% CI: 95% confidence interval. df: degrees of freedom.

Groups of age have been created based on the quartiles in the sample.

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-square		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	.380	0.051	0.062	.411	1.05	0.93	1.19
Diabetes	22	27.2%	8	27.6%	0.00	.965	-0.025	0.070	.725	0.98	0.85	1.12
Insulin	4	4.9%	1	3.4%	0.11	.741	-0.241	0.224	.280	0.79	0.51	1.22
Dyslipidemia	27	33.3%	12	41.4%	0.60	.437	0.120	0.064	.061	1.13	0.99	1.28
Sleep apnea	32	39.5%	14	48.3%	0.68	.411	-0.004	0.063	.947	1.00	0.88	1.13

Note. SE: standard error. OR: odds ratio.

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

Group of weight loss	Estimate risk FA negative n	%	FA positive n	%	Multinomial regression (adjusted by sex, age and baseline weight) Comparison	*B*	*SE*	*p*	*OR*	*95%CI (OR)*	
G1 Lack response	25	42.4%	11	55.0%	G2 versus G1	0.360	0.666	.588	1.434	0.389	5.287
G2 Mild	15	25.4%	6	30.0%	G3 versus G1	1.807	0.870	**.038***	6.093	1.107	33.535
G3 Success	19	32.2%	3	15.0%	G3 versus G2	1.447	0.915	.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%.

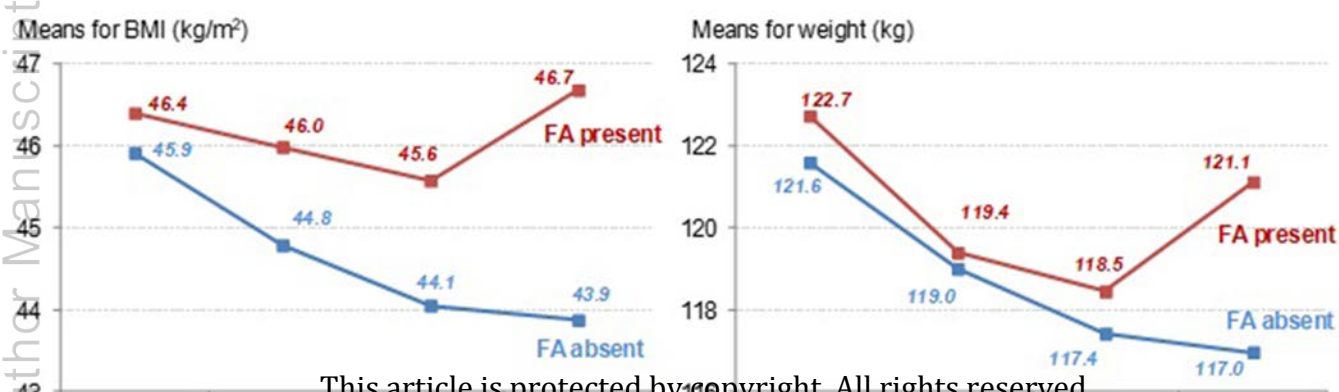
*Bold: significant parameter (.05 level). Results obtained for the completers (n=79).

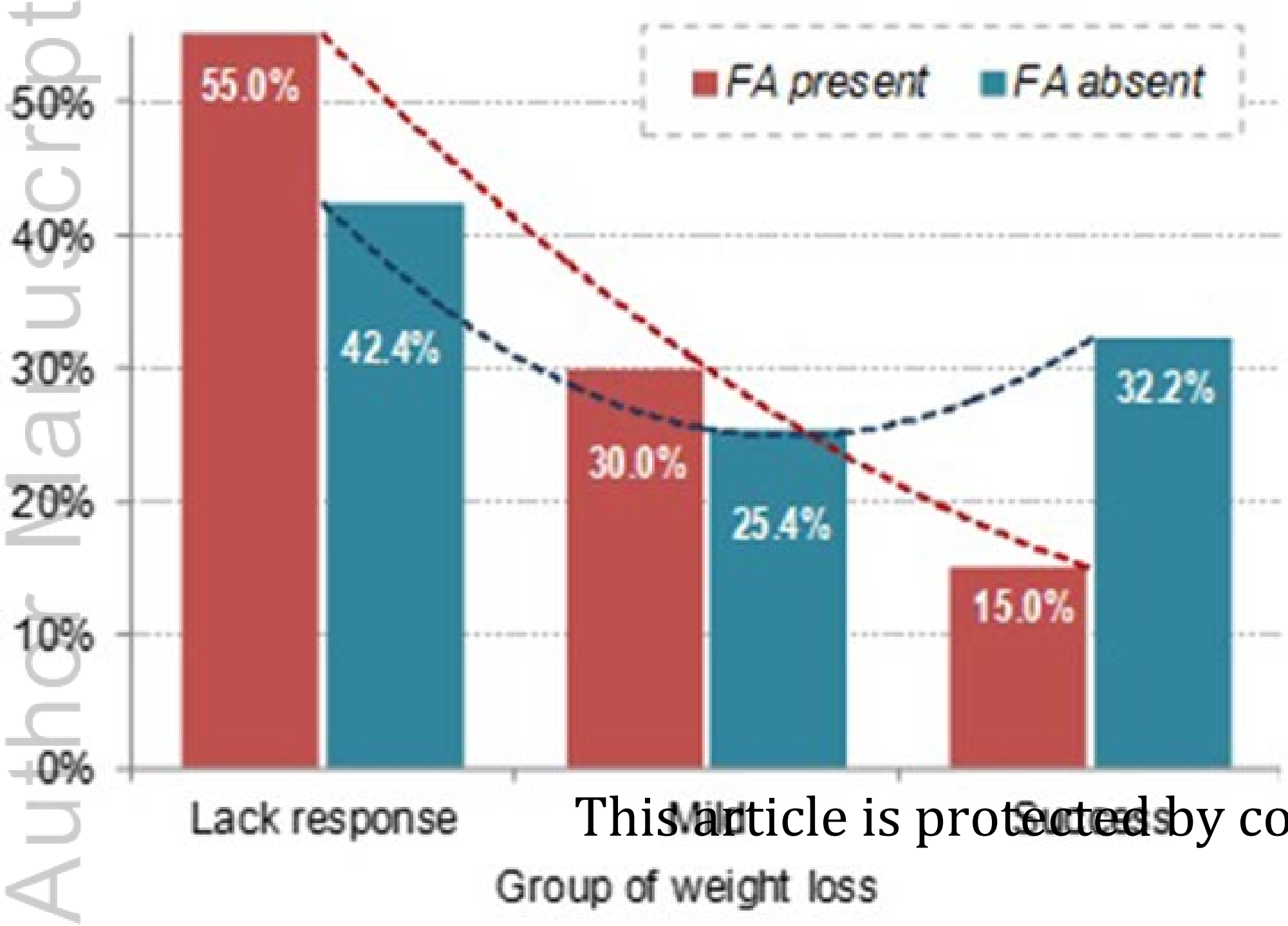
Figure 1.BMI and weight loss progress during dietary intervention.

Note: results adjusted by sex, age and baseline weight.

Figure 2**. Risk of weight loss goals achieved in patients with or without FA.**

Note. Dash line represents the 2-order polynomial trend





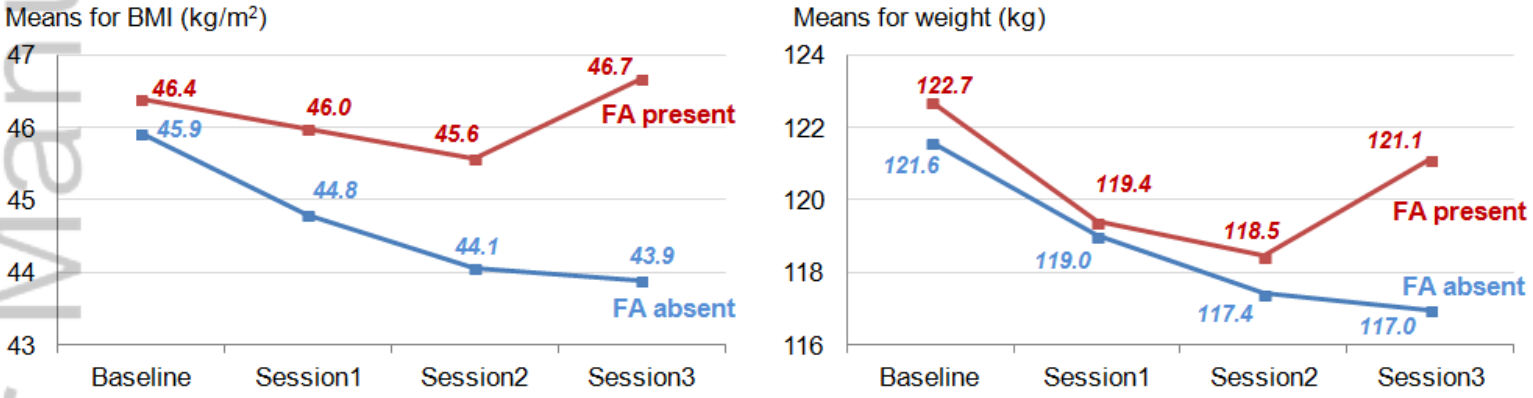


Figure1.tiff

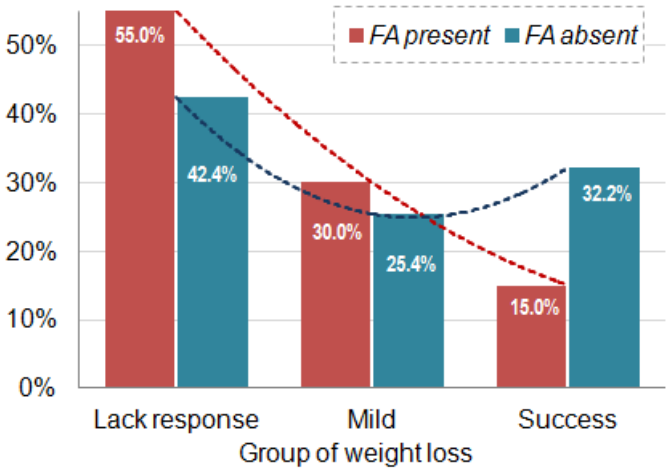


Figure2.tiff