

# Mental health in obese patients who attend bariatric surgery

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Review article

## ABSTRACT

### Background

The association between obesity and psychopathology is well known. However, the presence of psychopathology in patients with morbid obesity who attend bariatric surgery and its impact in weight loss has been less studied.

### Objective

To perform a topic update about the general context of psychiatric disorders associated with morbid obesity, and to assess the impact of such disorders in patients undergoing bariatric surgery.

### Methods

EBSCO Research Database and PubMed databases were consulted. Articles published between 2011 and today were selected. Key words related to the topic of study were used.

### Results

The studies reviewed showed five psychopathological clinical entities with high prevalence in patients who attend bariatric surgery: Depression and anxiety, attention deficit hyperactivity disorder, disorders of eating behavior, substance abuse, and some dimensions of personality. The presence of these disorders was associated to a poor post-surgical weight loss.

### Discussion and conclusion

Binge eating disorder and substance abuse impact on weight loss after bariatric surgery is controversial. The evaluation of obese patients who attend bariatric surgery must emphasize, according with reported disorders prevalence, the identification of depression, anxiety and attention deficit hyperactivity disorder.

**Key words:** Mental health, morbid obesity, bariatric surgery, weight loss, psychopathology, depressive disorder.

## RESUMEN

### Antecedentes

La asociación entre obesidad y psicopatología es bien conocida; sin embargo, la presencia de esta última en los pacientes con obesidad mórbida sometidos a cirugía bariátrica y su impacto en la pérdida de peso ha sido menos estudiado.

### Objetivo

Realizar una actualización sobre el panorama general de los trastornos psiquiátricos asociados con la obesidad mórbida, y el impacto de éstos sobre la pérdida de peso en pacientes bariátricos.

### Método

Se consultaron las bases de datos EBSCO Research Database y PubMed. Se seleccionaron los artículos publicados de 2011 a la fecha. Fueron utilizadas palabras clave relacionadas con el tema de estudio.

### Resultados

Los estudios revisados mostraron cinco entidades clínicas psicopatológicas con alta prevalencia en pacientes que se encuentran en protocolo de cirugía bariátrica: Depresión y ansiedad, trastorno por déficit de atención e hiperactividad, trastornos de la conducta alimentaria, abuso de sustancias y algunas dimensiones de la personalidad. La presencia de estas condiciones se asoció a una menor pérdida de peso posterior al procedimiento quirúrgico.

### Discusión y conclusión

El impacto del trastorno por atracón y por abuso de sustancias en la pérdida de peso, posterior a la cirugía bariátrica, es controversial. La evaluación del paciente con obesidad candidato a cirugía bariátrica debe enfatizar, de acuerdo con la prevalencia de los trastornos reportados, la identificación de trastornos depresivos-ansiosos y del trastorno por déficit de atención e hiperactividad.

**Palabras clave:** Salud mental, obesidad mórbida, cirugía bariátrica, pérdida de peso, psicopatología, trastorno depresivo.

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## INTRODUCTION

Obesity is a worldwide epidemic that affects the quality of life of those who suffer from it, increases the risk of acquiring diseases, and increases the costs of health care in nearly all countries.<sup>1</sup> The nature of this ailment is generated by the interaction of different factors: genetic, epigenetic, physiological, behavioral, sociocultural, and environmental. This leads to instability, with a coexistence of higher energy intake and lower caloric expenditure for an extended period of time.<sup>2</sup>

In Mexico, surveys show that obesity has displaced malnutrition as the main task to be solved.<sup>3</sup> Data from the 2012 National Health and Nutrition Survey reported that the prevalence of overweight and obesity on Mexican adults over the age of 20 was 71.3% (obesity 32.4% and overweight 38.8%), and also that obesity is higher among women (37.5% vs. 26.8%).<sup>4</sup>

The progressive increase in the prevalence of obesity demands the development of effective strategies for facing it. Preventive measures implemented in schools, workplaces, and communities have had a minor effect,<sup>5</sup> which is why treatment includes in most cases, lifestyle changes, dietary modifications, an increase of physical activity, use of pharmacology therapy, and, on some patients, surgical management.

The main challenge to be beat in obesity treatment is maintaining weight loss for an extended period of time. Behavioral and pharmacological treatment has proven its effectiveness in various studies, but a high percentage regains weight gradually.<sup>6,7</sup> Conservative treatment, based on lifestyle changes and pharmacological interventions on patients with body mass index (BMI) > 35Kg/m<sup>2</sup>, is ineffective for weight loss and as treatment for comorbid phenomena. However, bariatric surgery (BS) has proven greater effectiveness in the treatment of these variables in the long term.<sup>8</sup> In 1991, the National Institutes of Health of the US issued a series of recommendations related to the profile required for patients with morbid obesity in order to become candidates for BS, which include patients with BMI > 40Kg/m<sup>2</sup> or 35Kg/m<sup>2</sup> with diseases comorbid to obesity. This derived from the estimation that for every 5Kg/m<sup>2</sup> increase in BMI, on a 25Kg/m<sup>2</sup> base, there is a gradual increase in general mortality, so that upon arriving to 30-35Kg/m<sup>2</sup> the survival median decreases 2-4 years and upon arriving to a BMI of 40-45 Kg/m<sup>2</sup> it decreases 8-10 years.<sup>9</sup>

By 2003, 2500 bariatric procedures were performed in Mexico each year.<sup>10</sup> The proper selection of patients is essential for achieving the desired objectives and maintaining a permanent change. The process requires a comprehensive and thorough evaluation from a multidisciplinary team including in-depth medical, nutritional, sports, psychiatric, and psychological evaluation. The last one evaluates the patients' awareness about their condition and expectations of

the surgery. Also, the patients must prove their capability and willingness to modify their habits and lifestyle. These aspects are essential during post-surgical stage and for the success of the intervention.

Psychopathology is a factor associated with obesity and although it has not been clearly established if it is a cause or an effect of it, the interaction between emotional symptoms and their impact on the disruption of eating patterns and sedentary lifestyle, both factors identified and associated with obesity, is well known.

Various studies have pointed out the presence of physical and sexual abuse in patients with obesity, as well as a prevalence of psychiatric disorders between 30-60%, considering affective disorders, anxiety disorders, and eating disorders (ED) as the most frequent.<sup>11-13</sup> In relation to physical and sexual abuse, different studies identified the relationship between mistreatment and sexual abuse during childhood with a risk of increasing obesity in relation to amount and forms of abuse,<sup>14,15</sup> which is why some authors have described obesity as an adaptive function of "de-sexualization" as a form of protection.

During the multidisciplinary pre-surgical approach, psychopathological disorders are identified by mental health professionals. There are specific disorders, such as severe major depressive disorder, personality disorders, psychotic disorders, severe learning disorders, and alcohol and drug abuse, whose presence is linked to less weight loss after BS. Based on this, major academic groups have pointed out such entities as contraindications for the surgical treatment for obesity.<sup>16-20</sup>

Because of this, and in terms of a good clinical practice, it is relevant to perform this update about the main comorbid psychopathological entities on bariatric patients, in order to achieve an adequate selection of the ideal candidates.

## OBJECTIVE

To perform a topic update of the general context of psychiatric disorders, their association with obesity, and their impact on the weight loss of bariatric patients.

## METHOD

For the integration of this review, *EBSCO Research Database*, and *PubMed* databases were consulted; a search of original articles was carried out in English and Spanish, published from 2011 to date, except for classic publications on the subject. The key words employed in the search were: "bariatric surgery" "and" the following terms: "attention deficit hyperactivity disorder", "anxiety", "depression", "eating disorders", "personality disorders", "substance abuse", and "mental health". A total 69 articles were identified, out of

which three were eliminated for not having relevant information on the subject. Out of the total of articles reviewed, 66 articles were included due to their importance for fulfilling the objective of the manuscript, 20 narrative reviews were identified, as well as 33 clinical studies (longitudinal, prospective, clinical cases), nine epidemiological reports, and four systematic reviews. Additionally, international clinical practice guidelines and documents for the handling of obesity in Mexico, issued by public policy experts from the National Autonomous University of Mexico and the National Academy of Medicine, were consulted.

Results were grouped into five clinical entities, which are presented according to the prevalence of the disorders grouped into each one. Clinical manifestations from each disorder in the bariatric population and their impact on weight loss were reported.

## RESULTS

### Depression and anxiety

In Mexico, depressive disorder (DD) is one of the most frequent disorders according to the National Survey of Psychiatric Epidemiology (2003), where affective disorders were present in 9.1% of the population.<sup>21</sup> Conversely, in the obese population, a 30% has been reported, that is, three out of each 10 patients, and, like in the general population, it was more frequent within women.<sup>22,23</sup>

The DD-obesity association emerged from the comorbidity with binge eating disorder (BED) observed in obese patients. The greater degree of intensity of DD within binge-eating obese patients, as opposed to non-binge-eating obese patients, was what suggested the DD-obesity association.<sup>23</sup>

Anxiety disorder is present in up to 35% patients with obesity and it has been reported that it frequently coexists with depression.<sup>22,23</sup> Although the anxiety-obesity relationship has been less studied than the depression-obesity one, an explanation for this is the phenomenon described as "emotional eating" derived from poor self-control and a limitation to cope with stressful situations, with eating behavior serving as mediator between these conditions.<sup>23,24</sup>

A study found the following as factors associated with these disorders: having had or begun with obesity in childhood, and having had BMI changes throughout the life.<sup>25</sup> Other studies reported an association between DD and a greater body weight stigmatization frequency.<sup>25,26</sup> And others identified the precedent of sexual or physical violence and other social and work disadvantages as related factors.<sup>14,15</sup>

DD within overweight and obese patients is characterized by a greater number of relapses and a significant component of hopelessness, which is why a study concluded

that their depression is more severe.<sup>27</sup> Although it has been documented that the higher the BMI is, the risk of suicide is lower, it is present in 4% BS patients.<sup>28</sup> Various studies have displayed a high suicide prevalence after the surgery<sup>29</sup> and others have linked this increase to alcohol consumption relapse<sup>30,31</sup> and to the exacerbation of depressive symptoms.<sup>32</sup> One possible hypothesis for this phenomena is the modification in the signaling pathways of ghrelin, an hormone that regulates energy metabolism but also anxiety and depression responses, plays a part in the memory operation, and is a neuroprotector in degenerative and ischemic conditions.<sup>33</sup>

A study ( $N = 531$ ) performed on three groups of obese patients, two of them having had weight loss interventions (standard treatment and surgical treatment) and the third control group without any intervention, reported that depressive-anxiety disorders had a negative influence on weight loss in the intervention groups, and that even the control group, with these comorbidities, displayed weight gain. Upon comparing weight loss between patients with and without these comorbidities, it is proven that the presence of these disorders has a negative influence on the success of these interventions.<sup>23</sup>

### Attention deficit hyperactivity disorder (ADHD)

This disorder has a prevalence of 3-4% in the general population. Although it is usually diagnosed on school children (5-10% prevalence), approximately 60% of them still have symptoms during adult.<sup>34</sup>

The first ADHD-obesity association was reported in 2002<sup>35</sup> and a study performed on adults with ADHD retrospective diagnosis confirmed this association.<sup>36</sup> Its prevalence among the obese population is of 27.4% (although subsyndromal manifestation could be present on 33%) and has been identified on 10.2% BS candidates.<sup>35</sup>

The ADHD-obesity link suggests a genetic regulation mediated by an association between a mutation of the gene that codes the MC4-R protein, present in patients with ADHD and located in single exon 18q of chromosome 22, whose deficit has been associated also to the neural pathways that regulate hunger and satiety.<sup>37-39</sup>

The neurobiological mechanism of this association is the dysfunction of inhibitory control, which alters executive functioning causing distractibility, disorganization, and non-compliance of healthy lifestyle habits.<sup>40</sup> Additionally, ADHD patients show a lower attention to internal signals of hunger and satiety,<sup>41</sup> and, associated with an impulsive component, present substance abuse frequently, as well as poor tolerance to waiting, which causes a greater intake of hypercaloric foods.<sup>44</sup> It has been reported that, when ADHD-obesity coexist, the probability of displaying binge eating increases 3.97 times more than on obese subjects

without ADHD.<sup>45,46</sup> Nowadays, the guidelines of the American Society for Metabolic and Bariatric Surgery propose evaluating impulsiveness as a factor linked to lower weight loss and greater postoperative complications.<sup>17</sup>

ADHD favors a poor capability to adhere to regular eating patterns within this group,<sup>47</sup> which has a greater difficulty to fulfill the objectives of the pre-surgical protocol and less adherence to medical treatment and monitoring.<sup>48</sup> This could account for the greatest relapse of obesity following BS.<sup>49</sup>

Aside from the association between ADHD and BED, it has been proven that it is present alongside other eating syndromes like night eating and emotional eating.<sup>50</sup> Significant associations between ADHD-DD and ADHD-anxiety have been reported among the obese population.<sup>51,52</sup> These comorbidities complicate their approach and represent a bigger challenge for their treatment.

Pharmacological intervention for ADHD had a significant impact upon comparing the weight between patients who received treatment and patients who did not, with a 10.35% loss in those treated and a 7.03% in controls ( $p < 0.001$ ).<sup>36,53</sup>

### Eating disorders (ED)

Obesity is currently not included in the ED group, and, although it has been suggested to consider it as one, these display psychopathological elements not present in obesity, such as body image overestimation, different from body image dissatisfaction (BID). On the other hand, unlike disorders caused by substance abuse, eating is regulated by peripheral homeostatic factors (leptin, ghrelin, insulin), which is why including obesity in the field of addiction is debatable. Lastly, unlike these, food consumption is essential for life.<sup>54,55</sup>

A study performed on Mexican adolescents ( $N = 25056$ ), found that those with overweight and obesity, compared with their normal-weight peers, showed greater possibilities of developing disordered eating behaviors in both categories (OR 2.76, CI 95%, 2.17-3.51 and OR 4.58, CI 95%, 3.47-6.07, respectively).<sup>56</sup>

The prevalence of BED in the general population is between 2-5%; however, in the obese population, this behavior was the most reported (27%) and increased proportionally to BMI.<sup>22,57</sup> BED was reported in 25% of the overweight people who seek weight-loss treatment.<sup>22</sup>

A review made with the objective of exploring the impact of BED on weight changes, eating behavior, and post-surgical results, found a wide variance in the prevalence from 6% to 64%.<sup>58</sup> A study showed that four out of every nine subjects who binged before the surgery continued to do it afterwards. Another follow-up study, a year after BS, reported that 24.2% patients persisted with this behavior.<sup>59,60</sup> A retrospective study reported that 14 out of 38 patients that

recalled having binged before the surgery continued to do it up to 15 years afterwards. The behavior was present mainly on those who had binged previously and 4.5% reported *de novo*.<sup>61</sup> Other behaviors such as *grazing* (eating for extended periods during the day, caused by loss of control) were re-acquired by 80% of the subjects six months after the surgery; many of them, despite identifying their behavior as binge eating, did not meet the DSM-IV criteria due to feeling limited in the amount of food consumed.<sup>62</sup> Various studies in patients with BED reported higher risk of weight increase two and up to seven years after the surgery.<sup>63</sup> One study did not report any differences between the weight of patients with and without BED. However, this work gave a specific treatment to patients with this diagnosis.<sup>64</sup>

A study ( $N = 195$ ) found that subjects with BED reported a greater psychopathology when compared with those without it ( $p = 0.001$ ), as well as a higher percentage of psychiatric disorders throughout life ( $p = 0.007$ ) and a higher frequency of affective ( $p = 0.003$ ) and anxiety disorders ( $p = 0.019$ ). The most frequent diagnoses for groups with and without binge-eating were major depressive disorder and panic disorder without agoraphobia. Sexual abuse history was reported in 22.2% of the subjects with BED and in 7.1% of those who did not, approaching statistical significance ( $p = 0.06$ ).<sup>65</sup>

A study found that women candidates to BS reported higher scores in BID, whereas men reported higher BMI. BID was correlated to a higher binge frequency, more anxiety symptoms, and less self-esteem.<sup>54</sup>

The BED-BID association is explained by food restriction which causes hunger and is followed by excessive eating. Other factors reported to be linked to BED were having obesity, having started dieting at an early age, and a great number of weight loss attempts.<sup>66,67</sup>

One report identified a series of cases after BS, such as: intense food restriction, intense fear of gaining weight, overestimation of body figure or weight on self-assessment, vomiting, excessive exercise, laxatives and diuretics abuse, among other behaviors or symptoms.<sup>68</sup> A follow-up study, which explored the link between eating behavior and the percentage of excessive weight lost, weight regain and perceived quality of life, reported that 49.9% subjects presented loss of control when eating, 27% exhibited a greater intake than that expected for a post-BS person, and 18% reported full criteria for BED diagnosis according to DSM-IV. Associations were reported between loss of control when eating and the percentage of excessive weight lost and regain ( $p < 0.001$ ) and ( $p = 0.013$ ), respectively, as well as between binge eating frequency and weight regain ( $P = 0.006$ ). 46.6% reported "pica" (allotriophagy) behavior, its frequency was correlated negatively with the percentage of weight lost ( $p < 0.001$ ) and positively with weight regain ( $p < 0.001$ ). Participants with BED reported a poor quality of life ( $p < 0.001$ ) similar to those who reported a "pica"

frequency of more than twice a week ( $p < 0.001$ ). Those who regained  $> 10\%$  of the weight lost after BS presented higher frequency of binge eating ( $p = 0.03$ ), "pica" ( $p < 0.001$ ), loss of control ( $p < 0.001$ ), and worse quality of life ( $p < 0.001$ ).<sup>69</sup>

A study performed on BS post-surgical patients with and without BED compared with control groups (without BS) evaluated if subjects with BED would lose significantly more weight 12 months after BS. However, there were no significant differences in the weight lost between surgery patients with and without BED, and neither between those who still binged and those who did not binge anymore. Surgery patients with and without BED showed a significant improvement in cardiopulmonary risk factors. Control groups reported a weight loss of  $10.3 \pm 1.5\%$  at the end of the study with respect to their initial weight ( $P < 0.001$ ). In comparison, BS participants with BED reported a greater weight loss ( $\geq 5\%$ ,  $p = 0.004$ ), ( $\geq 10\%$ ,  $p = 0.001$ ), ( $\geq 20\%$ ,  $p = 0.001$ ). Patients with BED from the surgery group reported an improvement in cardiovascular risk factors, evaluated with homeostatic model assessment of insulin sensitivity (HOMA) and c reactive protein levels, compared with the control group ( $p < 0.001$ ). This data supports the idea that BED does not significantly affect weight loss in BS patients.<sup>70</sup>

### Substance use

Since the report of a case that saw an increase in cocaine use after BS, a review was made on drug use after the procedure. It is frequent for patients who seek surgical treatment for obesity to deny or minimize their substance use. Nevertheless, there are reports about alcohol consumption on 50% obese subjects, ranking third after depressive disorder and panic disorder. On the other hand, between 2-6% subjects who have entered rehabilitation clinics have a BS record. Risk factors identified in a study about the increase of alcohol consumption were: being male, previous history of alcohol consumption problems, young age, and having been subject to a Roux-en-Y intervention.<sup>71</sup>

A prospective study performed with the hypothesis that, after BS, subjects would experience an increase in substance use (alcohol, tobacco, and other drugs), found that it decreased the month following BS ( $p < 0.001$ ), the decrease stopped in the third month, and then it increased progressively up to two years.<sup>72</sup>

It has been suggested that anatomic-functional changes resulting from BS favor an increase in alcohol absorption rate, a decrease in the time needed to reach maximum serum concentration, an increase of these concentrations, and a longer depuration period. It is possible that the decrease in gastric volume is associated with a lower concentration of the alcohol dehydrogenase enzyme, and if the consumption levels prior to the surgery are maintained, the decrease of BMI would have some impact on the serum concentration

of alcohol. That is, a lower BMI for the same amount of alcohol consumed. Additionally, the decrease in B12 vitamin absorption can be and added risk.<sup>72</sup>

A study performed with the alternate hypothesis that a subgroup of subjects with high-risk alcohol consumption (HRAC) would present a decrease in consumption after BS, employing data from The Assessment of Bariatric Surgery Study (ABS) found a prevalence of 19% of HRAC, in BS patients, which persisted through monitoring with 17% one year later and 13% two years later ( $p = 0.01$ ). A greater decrease in the risk of consumption was reported in those subjected to a gastric *bypass* compared with gastric banding, but this difference was not significant after a year of monitoring and disappeared after two years. 7% of the subjects without HRAC in the initial measurements reported to have it after a year of monitoring and 6% reported it in the evaluation after two years; however, most reported an improvement in their consumption pattern.<sup>73</sup> These results must be regarded cautiously, since it is important to consider that aside from the surgery *per se*, diverse factors contribute to alcohol consumption reduction, such as the post-surgical follow-up programs.

As for the use of cannabis, a review performed with the object of proposing preliminary guidelines for its approach in the bariatric population did not obtain information about prior usage and results after BS. Notwithstanding, it specifies that its consumption was associated with harmful effects in the respiratory, cardiovascular, and Central Nervous Systems, which is why the risks and complications are higher for those who consume higher doses and for longer periods of time.<sup>74</sup>

Lastly, according to the *National Institute of Health*, the abuse of any substance is a contraindication for BS. Aside from the aforementioned information about alcohol consumption, smoking has been linked to an increase in risk of death in bariatric patients, as well as post-surgical complications. There is evidence that cocaine can cause vascular ischemic and hemorrhagic cerebral accidents in bariatric patients.<sup>75</sup>

### Personality traits

The personality-obesity association has been studied due to its impact on the cognitive, behavioral, and psychophysiological aspects that contribute to the development and maintenance of the problem among obese people.<sup>76</sup> The main cognitive aspects that favor weight increase are those related with decision making regarding health and the evaluation of risk behaviors.<sup>77</sup> The predominant behavioral aspects are food consumption and lack of physical exercise, and the psychophysiological aspects described make reference to abilities for coping with stress, which are linked to the activity of the hypothalamo-hypophyseal-adrenal axis and visceral fat.<sup>78-80</sup>

The personality construct has been studied from different models and perspectives, which complicates the homogenization of the results of investigations that hope to study the personality-obesity relationship. There are systemic reviews directed towards grouping the established lines regarding the dimensions of personality proposed by some similar models. For example, a review that analyzed 70 studies on obesity and personality employing Cloninger's psychobiological model and the five factor (extraversion, neuroticism, agreeableness, conscientiousness, and openness to experience) model of personality (FFM) found that in obese subjects there is a predominance of the neuroticism dimension and impulsiveness with responses mediating eating restriction and "emotional eating" facing external signals. Cooperation extraversion and dimensions were associated with overweight, although there are discussions about the possibility of people with these dimensions having sought treatment, thus affecting the association. Sensitivity to reward was associated with weight increase among people with normal weight and overweight, although not among those with obesity.<sup>76</sup> The agreeableness dimension and avoidance are controversial, since a previous study correlated them with obesity, while other did not find any association.<sup>78</sup> Another study identified the conscientiousness dimension as protective for overweight and obesity, by defining it as the capacity to make decisions about internal impulses, it was linked to self-control and cognitive regulation of eating.<sup>78</sup>

Studies on the obese population that correlated socio-demographic variables, particularly gender and nationality, with personality characteristics have proved to be of interest. A meta-analysis ( $N = 78\,931$ ) integrated nine cohort studies that employed the FFM and sociodemographic variables, identifying a strong link between the conscientiousness dimension and women, while extraversion was associated with men and Europeans. As in a previous study, this meta-analysis identified only conscientiousness as a protective dimension for obesity.<sup>81</sup> These results coincide with other studies in the association of this dimension with healthy behaviors, such as adherence to medicine, physical exercise performance and healthy dietary patterns.<sup>78</sup>

A study performed with the objective of identifying personality subtypes, employing the FFM and its association with psychopathology, eating disorders, and maladaptive coping styles in a sample of 102 female candidates to BS, suggested that there are two personality subtypes, one low in neuroticism and high in extraversion, openness to experience, conscientiousness, and agreeableness, and the second with an opposite profile. The first subtype was considered resilient, while the second was considered emotionally unstable or uncontrolled. The prevalence of the second subtype was higher (56.9%) and was associated with a greater psychopathology, bingeing, maladaptive coping styles, and a worse intervention prognosis.<sup>82</sup>

## DISCUSSION AND CONCLUSION

A few years back there was no consensus on the impact of psychiatric disorders before the surgery and the subsequent weight loss. However, in the last decade, international clinical practice guidelines suggest detecting the presence of depression and eating disorders on BS candidates.<sup>16-19</sup> The studies included in this review also identified other obesity-related disorders. The results coincide in their high prevalence upon comparing them with the general population, although for some disorders there were no specific prevalence in the bariatric population. We must consider that an obstacle in the evaluation of patients in BS protocol is their perception of the possible risk of being rejected, which causes them to deny the presence of psychopathology. Studies on the DD-obesity association coincide in the factors associated with DD within this population. It was also reported that treatment for depression-anxiety symptoms during the intervention, whether standard or surgical, favors the optimization of other interventions, such as a greater adherence to feeding regime, a greater motivation for implementing physical activity, and overall contributes to a greater weight loss.

It is recommended not to underestimate the ADHD-obesity association, as well as with BED, DD, and anxiety disorder. Although there are few studies on the pharmacological treatment of ADHD and its impact on weight loss, the ones considered in this review reported a significant impact.

Reports on eating disorders in BS post-surgical patients provide relevant data if the diagnostic criterion "a great amount of food" was withdrawn, a greater number of post-surgical subjects would meet BED diagnosis, giving relevance to the construct "loss of control" as a key element of psychopathology. However, although patients considered their behavior as bingeing, since they not met this criterion due to feeling limited in their eating (resulting from gastric reduction), they were reported as not having said disorder. It is recommended to also consider that other behaviors can arise in order to compensate binge eating and contribute to an excessive caloric intake. Among the questions to be solved on further investigations are the following: Why do some subjects experience re-emergence of symptoms of binge eating, binge eating disorder, and loss of control, and other do not? Which are the predictive factors of emergence or re-emergence of these behaviors? Their presence in the pre-surgical stage favors the appearance of other maladaptive eating behaviors such as *grazing*, which have an impact on weight, or rather, these behaviors overlap binge eating, loss of control, and binge eating disorder, creating a greater impact on weight loss or gain? Variability in the results is wide, especially in the long term, and maladaptive eating behaviors can contribute to weight regain.

Although the results support the idea that BED does not significantly affect weight loss in BS patients, this does

not omit its treatment; the study that did not report weight differences in patients with and without BED had provided specific pre-surgical treatment to the subjects identified with the disorder.

Although BS is contraindicated in patients with substance abuse and there are few studies on the subject, these coincide in a high prevalence mainly in alcohol consumption, and it was demonstrated that self-reports for identifying its consumption were not effective.

It is a matter of controversy whether there is an association between the surgical procedure and the increase or decrease of substance consumption. Studies provided contradictory results and some reports present significant limitations, consequently, the impact of BS in this group of patients continues to be studied.

Most studies about the personality-obesity association employed the FFM. The formulation of two personality profiles based on these dimensions and the results of surgical treatment must also be performed on the male population and it must be elaborated on further investigations whether one of these profiles can be predictive for the treatment of obesity.

Lastly, the heterogeneity of some of the results reported in the studies can be attributed to various factors such as the type of surgical intervention, the type of diagnostic evaluation (structured interviews *vs.* self-reports), and memory bias for evaluating behaviors related to eating patterns.

From the results of this review we can conclude that a high prevalence of psychopathology has been reported in the patients who seek surgical treatment for obesity. The presence of psychopathology has an impact on the evolution of the surgical intervention, which is why the interdisciplinary management of the obese patient that includes mental health professionals favors the adequate selection of patients, the identification and treatment of the aforementioned disorder in this population, and, consequently, a greater success in the surgical procedure.

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### Conflict of interest

Authors hereby declare to have no conflict of interest whatsoever.

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