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ORIGINAL CONTRIBUTIONS

Association of Adverse Childhood Experiences and Food Addiction to Bariatric Surgery Completion and Weight Loss Outcome

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Abstract

Introduction/Purpose Adverse childhood experiences (ACEs) are known risk factors for obesity and poor outcomes following weight loss interventions. ACEs are also associated with addictive behaviors and, potentially, food addiction (FA). This study examined the relationship between ACEs and FA, and their association to undergoing bariatric surgery and post-surgical weight loss outcomes.

Materials and Methods Between June 2013 and January 2016, 1586 bariatric-surgery-seeking patients completed a psychological evaluation. During their evaluation, the patients were administered measures including the ACE questionnaire and the Yale Food Addiction Scale.

Results 19.2% of those seeking bariatric surgery reported being the victim of childhood sexual abuse, and 22.1% reported being the victim of childhood physical abuse. An elevated ACE score corresponded to increased likelihood of screening positive for FA and more severe FA. When the type of ACE was analyzed separately, ACE was not associated with bariatric surgery completion or percent total weight loss (%TWL). Screening positive for FA corresponded to less %TWL 1 year post-surgery as the total number of ACEs increased, yet there was no association with %TWL 2 years post-surgery. The participants were classified into two groups, those positive for an ACE or FA versus those negative for both. Those who screened positive were significantly less likely to undergo bariatric surgery.

Conclusion Screening positive for experiencing ACEs was related to severity of FA, and screening positive for being the victim of either childhood abuse or FA reduced the likelihood of completing bariatric surgery. More research is needed to determine how these psychosocial factors might influence bariatric surgery outcomes.

Keywords Food addiction · Adverse childhood experiences · Bariatric surgery

Bariatric surgery, when provided to appropriate patients, is a highly effective obesity intervention with long-term benefits [1–3]. However, some patients will experience negative health and psychosocial outcomes from having bariatric surgery.

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Therefore, how psychosocial factors, such as adverse childhood experiences (ACEs), might contribute to less than optimal bariatric surgery outcomes is an important area for investigation [4]. Unfortunately, a history of ACEs is highly prevalent in the USA [5] and has been associated with both alcohol [6] and drug misuse in adulthood [7], and the development of psychopathology [8, 9]. Many individuals seeking bariatric surgery have comorbid psychopathology [8, 10, 11], and it is possible that survivors of ACEs are at risk for experiencing psychiatric symptoms after having bariatric surgery [4].

In support of this premise, a meta-analysis identified elevated lifetime risk for developing obesity as a result of being the victim of childhood trauma [12]. In general, those presenting for obesity treatment, particularly bariatric surgery, report a higher prevalence of being the victim of childhood maltreatment than community populations. In this study, a history of being the victim of childhood sexual abuse was not associated with post-bariatric surgical psychological functioning [13]. Of note, being the victim of childhood sexual abuse (SA) has been positively associated with increase in body weight [14, 15]. Being the victim of childhood SA is also significantly associated with the development of binge eating disorder and bulimia nervosa [9, 16]. These psychosocial challenges are an important issue as many individuals presenting for bariatric surgery report a history of being the victim of childhood SA [17].

Food addiction (FA) is a relatively new construct gaining increased empirical attention [18–23] in obesity treatment. At present, there is a lack of consensus regarding the validity of the construct of FA, the underlying neurobiological mechanisms, and the similarities and differences between FA and other addictive behaviors [18, 23–26]. However, research on this potential construct is becoming more prevalent, and most frequently, FA is assessed with the use of the Yale Food Addiction Scale (YFAS), designed to assess eating behaviors using diagnostic criteria for substance dependence [20].

Using the YFAS, prevalence estimates for FA in individuals seeking behavioral weight management and bariatric surgery are 15–20 and 14–53%, respectively [27–30]. FA is shown to be associated with obesity, binge eating, impulsivity, medical comorbidities, and poor outcomes following bariatric surgery [27, 31, 32]. One study found that individuals undergoing bariatric surgery who screened positive for FA were more likely to experience disordered eating and psychological concerns yet were as likely to have bariatric surgery and did not experience poorer weight loss outcomes [33]. In addition, prospective studies have not shown a relationship to pre-surgical FA and post-surgical weight outcomes in the short term (12 months or less) [33–35]. There are also well-established links between trauma, post-traumatic stress disorder, and disordered eating including FA [36, 37]. However, a literature search only yielded one study identifying an increased risk for FA as a result of childhood victimization [38]. Further research is needed to understand the potential long-term associations of FA to bariatric surgery outcomes and how ACEs might interact with FA with relationship to bariatric surgery outcomes.

In light of the shortcoming of the current scientific literature, the present study sought to (1) provide evidence for the relationship between ACEs and FA, specifically being the victim of SA or physical abuse (PA) and (2) better understand the association of ACEs and FA to bariatric surgery completion and percent total weight loss (%TWL). Hypotheses included a positive association between ACEs and screening positive for FA. In addition, it was hypothesized that ACEs and FA alone, as well as their interaction, would decrease the likelihood of an individual undergoing bariatric surgery and would have a negative effect on weight loss outcome. It was also hypothesized that a "cluster" of adverse experiences and/or maladaptive behaviors might negatively affect bariatric surgery completion and weight loss outcomes.

Methods

Participants

The participants were all patients who completed a multidisciplinary weight management consultation between June 2013 and January 2016 ($N = 4897$). Inclusion criteria were provision of Minnesota authorization for the use of medical records for research, age 18 or older, indication that they were seeking bariatric surgery, and completion of a psychological evaluation for bariatric surgery with all baseline study questionnaires completed. A total number of 1586 bariatric-surgery-seeking individuals were ultimately eligible for inclusion in the present study.

Procedures

Consecutive patients seeking bariatric surgery at a large academic medical center in Minnesota completed a battery of standardized questionnaires and underwent a structured clinical psychological interview. Questionnaire data were entered into a web-based data management system. Weight outcomes were extracted from the Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program database. This study was approved by the Institutional Research Review Board.

Measures

Adverse Childhood Experience Questionnaire (ACE) The ACE questionnaire [39] includes ten items evaluating ACEs and is empirically validated [40]. For this study, scores on the ACE were examined as a continuous total item count (0–10) as used

in a prior bariatric outcome study [41] and categorical (yes/no) for individual items assessing being the victim of sexual abuse (SA) and physical abuse (PA).

Yale Food Addiction Scale (YFAS) The YFAS [20] is a 25-item measure assessing food addiction (FA) symptoms within the past year. Criteria for a positive screen of FA are based on DSM-IV criteria of substance use disorder and seven behavioral criteria (endorse ≥ 3 symptoms and clinical significance). Dichotomous scoring (positive/negative) is considered indicative of more severe eating pathology and includes a component of clinical impairment or distress related to the symptoms while continuous scoring assesses eating behaviors that may be experienced by individuals that do and do not endorse clinical impairment. The YFAS has been validated for bariatric surgery populations [29, 34, 42]. In this study, FA was identified dichotomously (yes/no). Severity was characterized by endorsement of seven criteria (0–7) with higher scores indicating more severe FA.

Statistical Analyses

Means and standard deviations were calculated for continuous variables, and frequencies and percentages for categorical. Continuous variables were compared using logistic and linear regressions, and *t* tests for parametric data. Mann-Whitney *U* tests were used for non-parametric data. Chi-square and Mann-Whitney *U* tests compared categorical variables for parametric and non-parametric data, respectively.

Results

Participants

The mean age of the patients was 47.97 ± 12.63 years (range 18–79) with a mean body mass index of 47.27 ± 8.81 kg/m^2 (range 35–100.18). The participants were primarily female (73%) and White (87%). Please see Table 1 for study variable descriptive statistics as well as a comparison of bariatric surgery completers versus non-surgery completers. Four hundred twenty-four individuals (26.7%) ultimately underwent bariatric surgery (see Table 2). Individuals who underwent bariatric surgery (between August 2013 and July 2016) experienced a mean of 28.72% ± 8.76% ($n = 250$) and 29.01% ± 10.37%TWL ($n = 124$) for all surgery types at 1 and 2 years post-surgery, respectively.

Association of Trauma to Food Addiction

A logistic regression was significant, *Exp* (*B*) = 1.13 (CI 1.07–1.20), $p < 0.001$, indicating those with an increased number of adverse childhood experiences (ACEs) were more likely to screen positive for food addiction (FA). Regression analyses indicated those with a greater number of ACEs also reported more severe FA, F (1, 1584) = 51.70, $p < 0.001$. A Pearson chi-square indicated no association between being the victim of sexual abuse (SA) and FA, yet a Mann-Whitney *U* test indicated those who were the victim of SA endorsed more severe FA, U (1, 578) = 161,535.0, $z = -4.56$, $p < 0.001$ (mean severity 2.70 versus 2.21). A Pearson chi-square was non-significant for an association between being the victim of childhood physical abuse (PA) and FA, yet an independent-samples *t* test demonstrated those who experienced PA endorsed more severe FA (mean severity 2.56 versus 2.24), $t(1, 581) = -3.12$, $p = 0.002$. This finding should be cautiously interpreted as it might not translate to a clinically meaningful difference in severity of FA between the two groups. Finally, a two-way analysis of variance was conducted to identify any potential interaction effects between each discrete type of abuse (SA, PA) and FA endorsement. All analyses were non-significant.

Association of Trauma Alone to Bariatric Surgery Completion and Weight Loss

Pearson chi-squares were non-significant indicating no association between experiencing SA or PA and bariatric surgery

Table 1 Study variables for all participants and comparison of surgery completers versus non-completers

	All participants ($N = 1586$)	Surgery non-completers ($n = 1162$)	Surgery completers ($n = 424$)	*p* value
Mean BMI (kg/m^2)	47.97	47.22	47.44	$p = 0.670$
Mean ACE total	2.16	2.27	1.85	$p = 0.001$**
SA endorsement	19.2%	19.8%	17.2%	$p = 0.236$
PA endorsement	22.1%	23.1%	19.1%	$p = 0.079$
FA positive	15%	17.0%	9.4%	$p < 0.001$**
Mean FA severity	2.31	2.42	2.00	$p < 0.001$**
Positive for SA, PA, and/or FA	42.2%	45.1%	34.4%	$p < 0.001$**

**$p \leq 0.001$

Table 2 Surgery type by CPT code

Surgery type	Percentage
Roux-en-Y gastric bypass	64.4%
Vertical sleeve gastrectomy	26.4%
"Other abdominal surgery" or "revision"	7.3%
Duodenal switch with biliopancreatic diversion	1.9%

completion. Analyses were non-significant for trauma's association with %TWL 1 or 2 years post-surgery.

Association of Food Addiction Alone to Bariatric Surgery Completion and Weight Loss

A Pearson chi-square was significant, $\chi^2 = 14.09$, $p < 0.001$, demonstrating those who screened positive for FA were less likely to undergo bariatric surgery (16.5% who screened positive for FA compared to 28.5% who did not screen positive for FA). Independent-samples t tests were non-significant showing no association between FA and 1- and 2-year %TWL.

Food Addiction and ACE's Combined Association to Bariatric Surgery Completion and Weight Loss

Those who screened positive for FA ($n = 238$) were isolated for further analyses. Logistic regression analyses were non-significant; those who screened positive for FA were not more or less likely to undergo bariatric surgery as a result of number of ACEs. Yet, a linear regression was significant, $F(1, 19) = 6.91$, $t = -2.39$, $p = 0.022$, indicating those who screened positive for FA and underwent bariatric surgery experienced less %TWL 1 year post-surgery as the total number ACEs increased. Analyses were non-significant for %TWL 2 years post-surgery.

SA, PA, and/or FA's Association to Bariatric Surgery Completion and Weight Loss

This study hypothesized that the presence of any ACE and/or maladaptive behavior might negatively affect outcomes compared to those who did not endorse any of these factors. To better understand the potential of a "cluster" of factors, the patients were classified into two groups: (1) individuals who screened positive for SA, PA, and/or FA (42.2%) and (2) individuals who screened negative for all three (57.8%). A Pearson chi-square was significant, χ^2 (1586) = 14.47, $p < 0.001$. Only 21.8% of patients who screened positive underwent surgery compared to 30.3% who screened negative. All analyses for %TWL at 1 and 2 years post-surgery were non-significant.

Discussion

Nearly 20% of the individuals in the present study reported being the victim of childhood sexual abuse (SA), and approximately 22% reported being the victim of childhood physical abuse (PA). Being the victim of adverse childhood experiences (ACEs) was associated with screening positive for food addiction (FA) and for more severe FA. Moreover, those who screened positive for FA were less likely to undergo bariatric surgery and experienced less %TWL 1 year post-surgery as the total number of ACEs increased. It is important to note that there was no association with FA and %TWL 2 years post-surgery. In classifying patients into two categories, those who endorsed SA, PA, and/or FA compared to those who did not endorse any of these, those classified as positive were less likely to undergo bariatric surgery compared to those who did not endorse these factors.

Similar to other investigations, this study found that patients seeking obesity treatment reported a high prevalence of having been the victim of childhood SA or PA (approximately 20% of patients) [14, 43]. This is important, as being the victim of ACEs is associated with adulthood health problems [44] and the development of several psychiatric disorders [8, 45], and has been shown to be associated with disordered eating and obesity [16]. Yet, how being the victim of childhood SA or PA might influence bariatric surgery outcomes is not well understood. For example, in a sample of bariatric surgery patients, researchers found no association between being the victim of childhood SA and weight loss 2 years post-surgery, yet research has found associations between being the victim of childhood SA and risk of psychiatric hospitalization and depressive symptoms following bariatric surgery [4, 46]. How being the victim of childhood SA might impact bariatric surgery outcome is complex; for example, while patients with a history of being the victim of childhood SA report higher levels of depression 12 months post-operatively compared to those that deny being the victim of childhood SA, these levels of depression in trauma survivors are reduced from their pre-operative levels of depression [13]. In the current study, there was no association between being the victim of childhood SA or PA and completing bariatric surgery or weight loss outcome in the 2-year follow-up. With conflicting findings in the literature, there is a need for further research to investigate any possible associations between being the victim of trauma, psychiatric challenges, weight loss, or medical outcomes following bariatric surgery.

In addition, longer-term follow-up (greater than 2 years post-surgery) might more accurately reflect the possible association between ACEs and post-surgical weight loss outcomes as most individuals find the greatest success in the short term and begin to experience challenges with weight maintenance and regain over the long term [47, 48]. Another clinical possibility is that inconsistent findings are related to history of

having received mental health treatment if a patient has psychosocial issues. In a 2-year follow-up of bariatric surgery patients, those who received mental health treatment (substance abuse or psychiatric) lost more weight compared to those who did not receive mental health treatment [49]. Therefore, clinical practices should conduct screening of a history of victimization, and provide appropriate evidence-based mental health care to those with unmet mental health needs to potentially positively improve bariatric surgery outcomes [50].

The possibility of patients developing addictive behaviors after bariatric surgery has received much anecdotal and some empirical attention [51–53]. In this study, FA was negatively associated with having bariatric surgery. This is in contrast to prior research demonstrating that pre-surgical FA was not associated with decreased rates of surgical completion [33]. However, the findings of the present study are similar to those of short-term studies of binge eating disorder, in that the present study did not find an association between FA alone and weight loss outcomes. Bariatric surgery might help patients improve their FA, or longer follow-up is needed to find an association between FA and weight loss outcome (e.g., prevalence or amount of regain). In the literature, it appears that 3 to 5 years post-bariatric surgery is a high-risk period for development of alcohol use disorders, and perhaps this timeframe is similar to that for finding an association with FA and bariatric surgery outcome [53]. In further support of the premise, in a sample of bariatric surgery patients, investigators found an association between pre-surgical diagnosis of binge eating disorder and higher body mass index (BMI) at the 5-year follow-up [54].

There was a significant association between childhood victimization and both screening positive for FA and severity of FA. Therefore, being the victim of ACEs appears to be related to the development of FA. This finding adds to the body of literature that has identified associations between childhood adversity and poor health outcome, identifying problematic eating behavior as another health risk behavior that could be a pathway from childhood adversity to morbidity and mortality [39]. How timing, type, and severity of trauma interact with eating behaviors and potentially impact bariatric surgery outcomes warrants further investigation.

When examining the association of psychological factors to bariatric surgery outcomes, it remains unclear if the best approach is to examine individual factors, clusters or phenotypes, or number and severity of factors and to which group to make comparisons (i.e., those without a particular disorder or those without any current psychological concerns). In the present study, as in prior studies from our group and others, patients with clusters of symptoms or more severe psychopathology may have lower surgical completion rates and poorer post-surgical outcomes [33, 55–57]. For example, in the current study, FA alone was not associated with outcome yet the total number of ACEs in patients with FA was negatively associated with %TWL in the short term (1 year post-surgery). In addition, when survivors of childhood abuse were compared to those who were not survivors of childhood abuse, there was no association to bariatric surgery outcomes. However, when compared with patients who denied being the victim of childhood SA and PA *and* screened negative for FA, there was a decreased likelihood of undergoing bariatric surgery. The identification of clinically meaningful approaches to examining psychological factors of surgical outcome and appropriate comparison groups warrants further discussion and exploration.

This study has several important limitations. The sample was primarily white; thus, how these findings apply to more diverse or underserved populations is not known. Information was not collected on the patient's reason for not having bariatric surgery, so how insurance coverage or ability to complete requirements prior to surgery might have impacted the results is unknown. Insurance coverage and other potential barriers to bariatric surgery completion should be kept in mind, and these factors should be included as potential variables in future studies to further the depth of understanding of why some patients complete bariatric surgery while others do not. Psychosocial functioning post-bariatric surgery was not assessed, so how FA might change after having bariatric surgery is not known, nor whether post-bariatric surgery FA is related to long-term (> 2 years) weight loss outcomes. In addition, it has been suggested that self-report questionnaires tend to overestimate the prevalence of eating pathology [55]. While this evidence has not been established for measures of FA, this should be considered when interpreting results.

In conclusion, in a large sample of patients seeking bariatric surgery, 19% reported being the victim of childhood SA and 22% reported being the victim of childhood PA. Practitioners and clinicians should be aware of this high prevalence of trauma survivorship and provide appropriate mental health services to patients with unmet mental health needs to improve weight loss outcomes and decrease the likelihood of escalation of untreated mental health concerns after having bariatric surgery. While patients who were victims of childhood abuse were more likely to experience FA, they may still be successful with weight loss in the short term after bariatric surgery. More needs to be learned about how psychosocial factors, in particular trauma survivorship and FA, potentially influence long-term bariatric surgery weight and psychosocial outcomes.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflicts of interest.

Statement of Informed Consent Informed consent was obtained from all individual participants included in the study.

Statement of Human and Animal Rights All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Abbreviations ACE, adverse childhood experience; FA, food addiction; PA, physical abuse; SA, sexual abuse; %TWL, percent total weight loss; YFAS, Yale Food Addiction Scale

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