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Examining Emotion-, Personality-, and Reward-Related Dispositional Tendencies in Relation to Eating Pathology and Weight Change Over Seven Years in the Longitudinal Assessment of Bariatric Surgery (LABS) Study

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Abstract

This study examined dispositional emotion-, personality/temperament-, and reward-related variables in relation to post-surgery eating pathology and weight-change among 107 adults who underwent Roux-en-Y gastric bypass (RYGB) or laparoscopic adjustable gastric banding (LAGB). As part of a prospective cohort study, annual post-surgical assessments were conducted to evaluate eating pathology, using the Eating Disorder Examination-Bariatric Surgery Version, and percent weight change from pre-surgery. Dispositional measures were administered at the 6- or 7-year assessment and included the Affect Intensity Measure, Difficulties in Emotion Regulation Scale, UPPS-P Impulsive Behavior Scale, Adult Temperament Questionnaire-Effortful Control Scale, and Sensitivity to Punishment/Sensitivity to Reward Questionnaire. Results from a series of linear

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mixed models revealed significant associations of emotion dysregulation, affect intensity, positive and negative urgency, effortful control, and reward sensitivity with eating pathology severity across 7 years; additionally, all but two of the subscales comprising the total scores were also significantly associated. Fewer statistically significant results were found in relation to weight change; emotion dysregulation and affect intensity (along with several subscales) were significantly associated with lower percent weight change (i.e., less weight loss), but of the reward-related and personality/temperament variables, only total effortful control emerged as significant. However, the associations of the other variables with both outcomes were consistently in the expected direction. Associations also appeared consistent across surgical procedures. Taken together, findings suggest that certain dispositional tendencies may relate to less optimal long-term outcomes following bariatric surgery and thus may be useful to assess in pre-surgical or early post-surgical evaluations to inform targeted recommendations.

Keywords

bariatric surgery; disordered eating; temperament; emotion regulation; affect; impulsivity

1. Introduction

Rates of obesity among adults in the U.S. and worldwide continue to rise (Hales et al., 2018; Inoue et al., 2018), prompting concerns over increasing risk for numerous obesity-related consequences to physical health (e.g., cardiovascular disease, hypertension, type-2 diabetes; Dixon, 2010; Guh et al., 2009) and psychosocial functioning (e.g., reduced quality of life; Kolotkin and Andersen, 2017; Luppino et al., 2010; Puhl and Heuer, 2010). Bariatric surgery has been demonstrated as the most effective treatment for individuals with severe obesity, with sustained weight loss and substantial rates of remission or improvement in obesity-related chronic diseases (Buchwald et al., 2004; Gloy et al, 2013). However, there is clear variability in long-term outcomes, even among patients who undergo the same surgical procedure (Courcoulas et al., 2018). As such, studies have also examined various pre-surgical and early post-surgical predictors of bariatric surgery outcomes in an effort to identify variables that may have prognostic value (Courcoulas et al., 2015).

Studies of behavioral and psychosocial variables among bariatric surgery patients have identified numerous factors that are either positively or negatively associated with weight loss, such as psychiatric comorbidities (especially depression), certain disordered eating behaviors, and adherence to dietary and physical activity guidelines (e.g., Livhits et al., 2012; Mitchell et al., 2016, Kalarchian et al., 2016; Sheets et al., 2015; Wimmelmann et al., 2014). Unfortunately, mixed findings complicate efforts to synthesize across investigations. One issue that may contribute to inconsistencies is the fluctuating nature of certain predictor variables (Mitchell et al., 2016). For constructs that are more transient and variable, duration and timing may be particularly important to consider, which can be problematic if assessments do not address chronicity or focus only on recent experiences (e.g., past week). For example, the effects of certain disordered eating behaviors (e.g., uncontrolled eating) on weight change may differ if they occur over a time-limited versus prolonged period. Similarly, a brief depressive episode may have less effect on relevant outcomes compared to

an extended bout of depression. Another factor that may influence discrepancies across studies is the complexity of the constructs. For instance, the polythetic criteria sets comprising psychiatric disorders include an array of interrelated but distinct symptoms (e.g., in major depression: fatigue, feelings of worthlessness, apathy). As such, focusing investigations on complex, heterogeneous variables such as comorbid psychiatric diagnoses may mask important associations that are evident when examining specific symptoms but not the overall syndrome (Fried and Nesse, 2015).

Given the limitations described above, recent conceptual approaches and research initiatives have highlighted the utility of focusing on basic and dispositional variables that are often conceptualized as comparatively static over time in relation to clinical and behavioral outcomes (Insel et al., 2010; Marek et al, 2016; Sarwer et al., 2019). A number of dispositional domains have been studied in bariatric surgery candidates, including emotionality and affect, personality and temperament, and reward processing (e.g., Claes et al., 2012; Claes and Muller, 2015; Schäfer et al., 2019; Zijlstra et al., 2012). These variables may have important associations with disordered eating and could play an important role in behavior change that impacts long-term eating and weight-related outcomes following bariatric surgery (Sarwer et al., 2019). For instance, greater dispositional affect intensity and difficulties regulating emotions are associated with greater eating pathology (Lavender et al., 2015; Markey and Vander Wal, 2007; Whiteside et al., 2007), including uncontrolled eating behaviors that may involve increased food intake. These emotional vulnerabilities could also influence adherence to other post-surgical guidelines (e.g., dietary recommendations, self-monitoring, physical activity). Further, personality and temperamental features such as elevated impulsivity or reduced inhibitory control may contribute to multiple forms of dysregulated food intake associated with eating pathology and suboptimal weight outcomes (e.g., Marek et al., 2015; Sarwer et al. 2019). In contrast, greater self-directedness and self-regulatory control could facilitate adaptive behavioral changes (e.g., Claes and Müller, 2015). Finally, a tendency to display greater reward sensitivity may impact the extent to which an individual perceives food intake as rewarding (e.g., Brockmeyer et al., 2017; Loxton, 2018, Vainik et al., 2013), with potentially salient consequences in terms of modifying eating patterns and implementing recommended post-surgical dietary guidelines.

Studies have also begun to directly examine dispositional characteristics in relation to bariatric surgery outcomes, particularly personality/temperament variables related to impulsivity and inhibitory control (Sarwer et al., 2019). For example, one study found that improved inhibitory control from pre- to post-surgery was associated with greater weight loss over six months (Kulendran et al., 2017). Similarly, patients with pre-surgical personality features characterized by uncontrolled behavior and poor impulse control were at greater risk for suboptimal weight loss and poor adherence to recommended guidelines at one-year post-surgery (Marek et al., 2015). Another study demonstrated that patients scoring lower in persistence (i.e., ability to remain goal focused despite frustration) exhibited less post-surgical weight loss after one year (De Panfilis et al., 2014). Regarding reward-related dispositions, a study using an empirical approach to derive distinct one-year weight loss trajectory groups found that the most optimal group demonstrated the lowest scores on novelty seeking (i.e., tendency for approach behavior oriented toward novel/rewarding stimuli), whereas the least optimal group exhibited the highest scores (García-Ruiz-de-

Gordejuela et al., 2017). However, limitations of existing research include the scarcity of data relating to long-term post-surgical outcomes, as well as the limited scope of studies focusing on only one dispositional construct versus considering variables across multiple salient domains. Dispositional affective domains in particular have received less attention in prior research, and few studies have investigated other salient outcomes (e.g., disordered eating) in addition to weight loss.

The purpose of this study was to investigate the associations of theoretically important dispositional variables representing multiple domains (affect, personality/temperament, and reward sensitivity) with long-term outcomes following bariatric surgery. Specifically, given their potential influence on eating pathology and various behaviors that may affect body weight over time, these dispositional variables were examined in relation to both eating pathology and pre- to post-surgery weight change over seven years of post-surgical follow-up.

2. Method

2.1. Participants and Procedure

The current investigation is part of the National Institutes of Health (NIH)-funded Longitudinal Assessment of Bariatric Surgery-3 (LABS-3) Psychosocial Study (Mitchell et al., 2012) and the broader LABS consortium (Belle et al., 2007). A total of 202 individuals participated in the LABS-3 Psychosocial Study, which utilized a prospective cohort design and was conducted at three sites: Columbia/Weill Cornell Medical Centers in New York, NY, the Neuropsychiatric Research Institute in Fargo, ND, and the University of Pittsburgh/Duquesne University in Pittsburgh, PA. The research was approved by Institutional Review Boards at each site, and all participants provided written informed consent. Assessments of eating pathology and weight were conducted within 30 days prior to surgery and annually post-surgery up to 7 years, except for Year 6 when eating pathology was not assessed. The present data were drawn from a subset of participants (n=107; 53%) who underwent Roux-en-Y gastric bypass (RYGB) or laparoscopic adjustable gastric banding (LAGB) surgery (n=194 of 202) and completed the dispositional measures (administered at either the Year 6 or 7 post-surgery assessment) that were the focus of the current investigation.

2.2. Measures

2.2.1. Dispositional Variables—The Affect Intensity Measure (AIM; Larsen and Diener, 1987) is 40-item self-report, temperament-based measure of emotional intensity and reactivity, with evidence supporting its reliability in adults with obesity (Kass et al., 2019). The measure provides a total score, and consistent with research suggesting the multidimensional nature of the scale (Bryant et al., 1996; Weinfurt et al., 1994), 3 subscale scores reflecting negative intensity, negative reactivity, and positive affectivity. Items are rated on a Likert-type scale from 1 (never) to 6 (always), with higher scores indicating greater affective intensity/reactivity.

The Difficulties in Emotion Regulation Scale (DERS; Gratz and Roemer, 2004) is a 36-item self-report measure of emotion dysregulation, with evidence supporting its reliability and

validity in bariatric samples (e.g., Schäfer et al., 2019; Shakory et al., 2015). The DERS provides a total score and 6 subscale scores: nonacceptance (nonacceptance of emotions), goals (difficulty maintaining goal-directed behavior when distressed), impulse (difficulty controlling behaviors when distressed), strategies (limited access to adaptive emotion regulation skills), clarity (lack of emotional clarity), and awareness (lack of emotional awareness). Items are rated on a 5-point Likert-type scale from 1 [almost never (0-10%)] to 5 [almost always (91-100%)], with higher scores indicating greater emotion dysregulation.

The UPPS-P Impulsive Behavior Scale (Cyders and Smith, 2007; Lynam et al., 2006; Whiteside and Lynam, 2001) is a self-report measure of multiple facets of impulsivity, with evidence supporting its reliability and validity among adults across the weight spectrum (e.g., Kenny et al., 2019; Mobbs et al., 2010; VanderBroek-Stice et al., 2017). In this study, two subscales (which assess negative and positive emotion-based dispositions to rash action) were administered: negative urgency (tendency to become impulsive in the face of intense negative emotions; 12 items) and positive urgency (tendency to become impulsive in the face of intense positive emotions; 14 items). Items are rated on a 4-point Likert-type scale from 1 (agree strongly) to 4 (disagree strongly), and coded such that higher scores indicate greater emotion-based impulsiveness.

The Adult Temperament Questionnaire-Short Form (ATQ; Evans and Rothbart, 2007) is a self-report measure of dispositional affective and behavioral tendencies, with evidence supporting its reliability and validity in bariatric samples (e.g., Nielsen et al., 2017; Schäfer et al., 2019). In this study, the 19-item Effortful Control Scale (ECS) was administered, which provides a total score and 3 subscale scores: attentional control (ability to focus and flexibly shift attention), inhibitory control (ability to resist maladaptive approach behavior), and activation control (ability to engage in action despite avoidance tendencies). Items are rated on a 7-point Likert-type scale from 1 (extremely untrue) to 7 (extremely true), and higher scores reflect greater effortful control.

The Sensitivity to Punishment/Sensitivity to Reward Questionnaire (SPSRQ; Torrubia et al., 2001) is self-report measure of the behavioral inhibition and activation systems, with evidence supporting its reliability and validity among adults across the weight spectrum (e.g., Davis et al., 2007 Mobbs et al., 2010). In this study, only the 24-item sensitivity to reward subscale was administered. Item responses are dichotomous (yes/no) and higher scores are reflective of greater reward sensitivity.

Prorated scores (i.e., mean of completed items multiplied by number of items in a score) were generated when participants answered ≥ 75% of items; otherwise scores were set to missing.

2.2.2. Outcome Variables—The Eating Disorder Examination-Bariatric Surgery Version (EDE-BSV; de Zwaan et al., 2010), a modified version of the EDE (Berg et al., 2002; Fairburn and Cooper, 1993), is a semi-structured interview that assesses eating disorder symptomatology. The interview produces four subscales (restraint, eating concern, shape concern, weight concern) that are averaged to form a global score, which was used in this investigation. Items reference the previous 28 days and are rated using a Likert-type

scale from 0 to 6, with anchors varying across items. Higher scores indicate more severe eating pathology (i.e., dietary restraint/concerns).

The assessment of weight in LABS has been described elsewhere (Christian et al., 2013). Change in weight was calculated as a percentage of pre-surgery weight: [100*(post-surgery weight minus pre-surgery weight)]/pre-surgery weight. Thus, a negative number indicates weight loss.

2.3. Statistical Analysis

Analyses were conducted using SAS version 9.4 (SAS Institute, Cary, NC). Reported p values are two-sided with < 0.05 considered statistically significant.

Descriptive statistics, including frequencies and percentages for categorical variables and range, medians, and $25^{th}/75^{th}$ percentiles for continuous data, were calculated to characterize the sample. Participants excluded due to lacking dispositional measure data were compared to participants in the analysis sample using Pearson's chi square test and Fisher's Exact test for categorical variables, Cochran-Armitage test for ordinal variables, and Wilcoxon rank sum test for continuous variables. Additionally, percent weight change was compared between these groups using a linear mixed model (LMM) fit using maximum likelihood with a person-level random intercept, a group indicator (i.e., included or excluded) as a discrete fixed effect, controlling for pre-surgery and surgical factors related to missing weight data (i.e., pre-surgery smoking status, site, surgical procedure) and time since surgery as a continuous fixed effect.

Pearson's correlations were calculated to demonstrate the strength of the linear association between each pair of subscale and total scores on the dispositional measures (AIM, DERS, UPPS-P, ATQ-ECS, and SPSRQ). LMMs were used to test and estimate associations of the dispositional subscale and total scores with the EDE-BSV global score and percent weight change across 7 years of follow-up, with time since surgery entered as a continuous fixed effect, controlling for pre-surgery and surgical factors related to missing weight at follow-up. Due to collinearity, particularly between total and subscale scores, each score was evaluated in a separate model. Beta coefficients and 95% confidence intervals (CIs) for each dispositional measure with each outcome are reported. To facilitate comparisons between total and subscale scores within measures, beta coefficients (indicative of the magnitude of association) are reported per a number of points representing an equivalent difference in the each score's range. For example, the DERS total score ranges from 36-180, the DERS nonacceptance subscale score ranges from 6-30, and the DERS goals subscale score ranges from 5-25, thus beta coefficients are reported per 36 DERS total, 6 DERS nonacceptance, and 5 DERS goals score points.

Surgical procedure (RYGB or LAGB) and an interaction term with the dispositional measure score of interest were added to each model to evaluate potential moderation. Because interactions were not significant and associations stratified by surgical procedure appeared similar, results from models without an interaction term are reported.

3. Results

3.1. Participant Characteristics

A comparison of pre-surgery sociodemographics, body mass index (BMI), and EDE-BSV global score between those included (n=107) versus excluded (n=87) from the final analysis sample is provided in supplemental material (see Table S1). No significant differences were found, although a slightly smaller percentage of included participants were white (89.6% vs. 96.6; p=.16) and included participants had a somewhat lower BMI (median 44.3 kg/m^2 vs. 46.4 kg/m^2; p=.13). A comparison of percent weight change revealed that those included lost less weight versus those excluded [e.g., Year 7: mean −19.5% (95%CI, −20.5, −18.4) vs. −26.8% (95%CI, −28.6, −25.0); p=0.008].

Among the final sample of 107 participants, 58 underwent RYGB [median age 47.5 years (IQR, 38-55); 84.5% female; 89.6% white] and 49 underwent LAGB [median age 46 years (IQR, 40-52); 83.7% female; 89.8% white]. Additional pre-surgery characteristics are reported in Table 1.

Table 2 reports scores on the dispositional measures, and Pearson's correlations for every combination of subscale and total scores are reported in supplemental material (see Table S2). The majority (~85%) of these correlations were significant with medium-to-large effect sizes. Finally, EDE-BSV global score and percent weight change from pre-surgery across assessment time points are provided in supplemental material (see Table S3).

3.2. Associations of Dispositional Variables with Eating Pathology

Table 3 reports the modeled associations between each dispositional measure score and the outcome variables (i.e., EDE-BSV global score, percent weight change) across post-surgery assessments (1-7 years). For eating pathology, all but 2 of the 18 dispositional measure scores demonstrated significant associations with post-surgery EDE-BSV global score, in the anticipated direction. Specifically, higher scores (i.e., greater affect intensity/reactivity) on the AIM total and subscales (except positive affectivity), higher scores (i.e., greater emotion dysregulation) on the DERS total and subscales (except awareness), higher scores (i.e., greater emotion-based impulsiveness) on the UPPS-P positive and negative urgency scales, and higher scores (i.e., greater reward sensitivity) on the SPSRQ reward sensitivity scale were associated with a higher EDE-BSV global score (i.e., more severe eating pathology) across follow-up. Also in the anticipated direction, higher scores (i.e., greater effortful control) on the ATQ-ECS total and subscales were associated with a lower EDE-BSV global score across follow-up. Beta coefficients of the DERS total and ATQ total scores were larger than their respective subscale scores, whereas the AIM negative intensity score had a larger beta than the AIM total score. Further, negative urgency had a larger beta coefficient than positive urgency.

3.3. Associations of Dispositional Variables with Percent Weight Change

Seven of the 11 emotion-related dispositional variables (i.e., scores from the AIM and DERS) were significantly associated with percent weight change from pre-surgery across follow-up, in the anticipated direction. Specifically, higher scores for the AIM total and two

subscales (negative intensity, positive affectivity) and the DERS total and 3 subscales (nonacceptance, goals, strategies) were significantly associated with less weight loss. Also in the expected direction, a higher ATQ-ECS total score was significantly associated with more weight loss from surgery. Consistent with the findings for eating pathology, of the subscale scores, the AIM negative intensity score and the DERS strategies score had the largest beta coefficients in relation to percent weight change, suggesting they were more strongly associated with weight change versus the other respective subscale scores. Although none of the betas coefficients for the other impulsivity-oriented personality/temperament variables (i.e., ATQ-ECS subscale scores, UPPS-P score, and SPSRQ Sensitivity to Reward score) in relation to percent weight change reached statistical significance, the associations were in the expected direction (i.e., less weight loss with higher urgency and sensitivity to reward, and more weight loss with higher effortful control).

4. Discussion

The present investigation is one of the first to investigate associations of a range of theoretically salient dispositional affective, personality/temperament, and reward-related domains in relation to long-term outcomes following bariatric surgery. The majority of the dispositional variables were found to be associated with pathological eating-, weight-, and shape-related attitudes and behaviors across seven-year post-surgical follow-up, as assessed by the EDE-BSV global score. Regarding weight change, the majority of the findings mirrored those found for eating pathology, although fewer achieved statistical significance, potentially due in part to issues of power related to the modest sample size. Specifically, the dispositional affective variables demonstrated numerous significant associations with weight change, whereas only one of the personality/temperament variables achieved statistical significance in relation to weight change. However, it is noteworthy that the non-significant associations of these variables with weight change were consistently in the expected direction, and generally demonstrated similar effect sizes to those variables that did reach significance. Finally, associations with dispositional variables did not appear to differ by surgical procedure.

Results indicating that greater total emotion dysregulation and greater total affect intensity were associated with less weight change and greater eating pathology suggest that intense emotions and difficulties with relating/responding to emotions may promote less effective post-surgical behaviors and/or interfere with adaptive adherence to recommendations and guidelines. Compared to findings for eating pathology, fewer scores from the affective measures (i.e., AIM, DERS) reached statistical significance in relation to percent weight change, although the non-significant associations were in the anticipated direction. For example, whereas difficulties maintaining behavioral control when distressed (DERS impulse) and lack of emotional clarity (DERS clarity) were significantly associated with eating pathology, these subscales were not significantly related to weight loss. However, difficulty engaging in goal directed behavior (DERS goals) when distressed was significant for both outcomes, consistent with prior research (e.g., De Panfilis et al., 2014). Further, both nonacceptance of emotions (DERS nonacceptance) and lack of adaptive strategies (DERS strategies) were significant for both of these outcomes. It is also notable that even the emotion variables that were non-significant in relation to percent weight change generally

demonstrated comparable effect sizes to those that were significant, with the exception of emotional awareness (DERS awareness), which had the smallest effect size for both outcomes.

Results for the impulsivity-oriented personality/temperament (i.e., UPPS-P and ATQ-ECS) and reward-related (SPSRQ reward sensitivity) measures varied between outcomes. Regarding eating pathology, as expected, greater impulsivity and reward sensitivity were associated with higher eating pathology, whereas greater effortful control was associated with less eating pathology. In contrast, only total effortful control (ATQ-ECS total) was significantly related to percent weight change. The finding that higher total effortful control related to greater weight loss is consistent with findings from previous research demonstrating a link between impulsivity-related constructs and weight-related outcomes. Although the other variables did not achieve statistical significance in terms of association with percent weight change, the effect for the non-significant variables were consistently in the expected direction. Notably, the present study included outcomes over a period of seven years, whereas previous research was based on shorter-term follow-ups (e.g., often only one to two years). It is possible that impulsivity- and reward-related dimensions have a larger impact on weight loss in the early post-surgical period when most weight loss occurs, although future research with multiple assessments of the dispositional constructs over time will be needed to address this issue. Given the size of the current sample, is also possible that the slightly smaller effect sizes for these variables would have been significant with greater statistical power provided by a larger sample.

The time point at which the dispositional measures were administered is an important consideration in the interpretation of the current findings. Although eating pathology and weight were assessed prospectively from pre-surgery to seven years post-surgery, measures of the dispositional variables were added to the study later and were administered in either the sixth or seventh year of post-surgical follow-up. Although the constructs assessed by these measures are typically conceptualized as dispositional (i.e., relatively unchanging over time), the associations examined here are not prospective in nature, and it is possible that pre-surgery scores on the measures would differ. As such, causality and directionality of influence among the associations cannot be definitively inferred. It is possible that certain tendencies within these domains affect eating pathology and behaviors that influence weight change over time, or alternatively it may be that disordered eating and changes in weight impact functioning in these domains. It is also possible that there are bi-directional influences over time.

4.1. Strengths and Limitations

Primary strengths of this study include the multi-center sample, post-surgical follow-up across seven years, evaluation of interactions with surgical procedure, and use of well-validated measures. However, limitations should be noted. First, as addressed above, the dispositional measures were administered in post-surgical follow-up years six or seven, and the associations were thus not prospective. However, the nature of the variables suggests the potential for significant prospective relationships that should be investigated in future studies. Second, as only a subset of LABS-3 Psychosocial Study participants completed the

dispositional measures, the sample size within the current study was modest, limiting statistical power. Third, given issues related to multi-collinearity, investigating associations of the dispositional variables with the outcomes independent of the other dispositional variables was not feasible. Fourth, given that the use of certain dispositional measures in this study was relatively novel within a bariatric sample, there is a need for more thorough psychometric evaluation of the measures to further establish their reliability and validity in this population. Finally, although there were no significant differences by surgery type in this study, it should be noted that the frequency of specific bariatric surgical procedures has shifted since participants were recruited (Khorgami et al., 2017). However, RYGB remains a commonly performed procedure, and although LAGB is no longer performed as frequently, a substantial number of adults who have undergone this procedure still require ongoing follow-up care.

4.2. Conclusion

The present findings suggest that individuals who display certain affect-, temperament-, or reward-related tendencies may be at greater risk for less optimal outcomes following bariatric surgery. As such, there may be benefit in assessing these dispositional domains during pre-surgical and/or early post-surgical evaluations, in addition to those psychosocial and behavioral variables that are already commonly assessed. Further, it is possible that interventions or targeted recommendations addressing these dispositional tendencies may be beneficial for patients who display such propensities. For instance, differential eating-related and physical activity guidelines and recommendations, or increased support and follow-up, may be useful for individuals prone to difficulties with affective or behavioral control. Alternatively, providing training in emotion regulation (e.g., Sloan et al., 2017; Valentine et al., 2015) or inhibitory control (Eichen et al., 2017) may have utility for patients exhibiting emotional and/or behavioral dysregulation. However, future research will be needed to further support the predictive value of these dispositional tendencies in relation to post-surgical outcomes, and to directly evaluate the potential utility of any interventions targeting these tendencies.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Highlights

- Dispositional variables may be associated with bariatric surgery outcomes
- Emotion, personality, and reward variables related to eating pathology over 7 years
- Primarily emotion variables related to post-surgical weight change over 7 years
- Pre-surgical or early post-surgical assessments of these constructs may be useful

Table 1.

Sociodemographic characteristics of adults prior to bariatric surgery among the total sample and by surgical procedure

	Total (N=107) No. (%)[a]	RYGB (n=58) No. (%)[a]	LABG (n=49) No. (%)[a]
Age, years			
Median (25th -75th %-ile)	46 (38, 54)	47.5 (38, 55)	46 (40, 52)
Range	24-68	24-68	26-64
Female	90 (84.1)	49 (84.5)	41 (83.7)
Race	(n=106)	(n=57)	
White	95 (89.6)	51 (89.5)	44 (89.8)
Black	10 (9.4)	6 (10.5)	4 (8.2)
Other	1 (0.9)	0 (0.0)	1 (2.0)
Hispanic ethnicity			
No	101 (94.4)	52 (89.7)	49 (100.0)
Yes	6 (5.6)	6 (10.3)	0 (0.0)
Married or living as married	(n=104)		(n=46)
No	39 (37.5)	24 (41.4)	15 (32.6)
Yes	65 (62.5)	34 (58.6)	31 (67.4)
Education	(n=103)		(n=45)
High school or less	17 (16.5)	10 (17.2)	7 (15.6)
Some college	42 (40.8)	25 (43.1)	17 (37.8)
College degree	44 (42.7)	23 (39.7)	21 (46.7)
Employed for pay	(n=104)	(n=57)	(n=47)
No	25 (24.0)	13 (22.8)	12 (25.5)
Yes	79 (76.0)	44 (77.2)	35 (74.5)
Household income, US $			
Less than 25,000	17 (16.5)	12 (21.1)	5 (10.9)
25,000-49,999	31 (30.1)	17 (29.8)	14 (30.4)
50,000-74,999	24 (23.3)	15 (26.3)	9 (19.6)
75,000-99,999	17 (16.5)	8 (14.0)	9 (19.6)
>100,000	14 (13.6)	5 (8.8)	9 (19.6)
Body mass index, kg/m^2			
Median (25th -75th %-ile)	44.3 (42.0, 48.2)	45.6 (42.5, 49.0)	43.9 (41.1, 46.9)
Range	35.5-64.5	36.1-64.5	35.5-62.3

Note: LAGB, laparoscopic adjustable gastric banding; RYGB, Roux-en-Y gastric bypass.

[a]Unless otherwise indicated.

Table 2.

Dispositional measure scores among the total sample and by surgical procedure

	Total (N=107) No. (%)[a]	RYGB (n=58) No. (%)[a]	LABG (n=49) No. (%)[a]
Affect Intensity Measure (AIM) [a]			
AIM Total			
Median (25th -75th %-ile)	3.3 (2.8-3.9)	3.1 (2.7-3.8)	3.4 (2.9-3.9)
Range (1-6)	1.7-5.0	1.7-4.8	1.9-5.0
Negative Intensity			
Median (25th -75th %-ile)	2.7 (2.2-3.3)	2.7 (2.0-3.3)	2.7 (2.3-3.3)
Range (1-6)	1.0-4.8	1.0-4.8	1.0-4.7
Negative Reactivity			
Median (25th -75th %-ile)	3.8 (3.3-4.7)	3.5 (3.3-4.3)	4.0 (3.5-4.7)
Range (1-6)	1.8-5.7	2.2-5.7	1.8-5.7
Positive Affectivity			
Median (25th -75th %-ile)	3.3 (2.7-3.9)	3.3 (2.6-3.8)	3.3 (2.8-4.1)
Range (1-6)	1.5-5.7	1.5-5.4	2.1-5.7
Difficulties in Emotion Regulation Scale (DERS) [b]			
DERS Total			
Median (25th -75th %-ile)	62 (49-78)	60 (49-77)	63 (52-78)
Range (36-180)	36-131	36-99	38-131
Nonacceptance			
Median (25th -75th %-ile)	10 (7-12)	10 (7-12)	10 (7.2-12)
Range (6-30)	6-27	6-19	6-27
Goals			
Median (25th -75th %-ile)	10 (7-13)	10 (7-13)	11 (8-13)
Range (5-25)	5-23	5-20	5-23
Impulse			
Median (25th -75th %-ile)	8 (7-11)	8 (7-11)	8 (7-12)
Range (6-30)	6-24	6-19	6-24
Awareness			
Median (25th -75th %-ile)	13 (10-16)	13 (10-16)	13 (10-17)
Range (6-30)	6-26	6-26	6-23
Strategies			
Median (25th -75th %-ile)	11 (9-15)	11 (9-17)	11 (9-15)
Range (8-40)	8-30	8-24	8-30
Clarity			
Median (25th -75th %-ile)	7.5 (6-10)	8 (6-10)	7.5 (6-10)
Range (5-25)	5-20	5-20	5-20
UPPS-P Impulsive Behavior Scale [c]			
Negative Urgency			

	Total (N=107) No. (%)[a]	RYGB (n=58) No. (%)[a]	LABG (n=49) No. (%)[a]
Median (25th -75th %-ile)	21.5 (17-27)	22 (17-30)	21 (17.5-25.5)
Range (12-48)	12-43	12-43	12-38
Positive Urgency			
Median (25th -75th %-ile)	16 (15-21)	16 (14-24)	16 (15-18)
Range (14-56)	14-43	14-43	14-31
Adult Temperament Questionnaire- Effortful Control Scale (ATQ-ECS) [d]			
ATQ-ECS Total			
Median (25th -75th %-ile)	4.9 (4.4-5.5)	5.0 (4.4-5.7)	4.8 (4.4-5.4)
Range (1-7)	3.2-6.7	3.3-6.6	3.2-6.7
Activation Control			
Median (25th -75th %-ile)			
Range (1-7)	2.3-7.0	2.3-6.9	3.3-7.0
Attentional Control			
Median (25th -75th %-ile)	5.2 (4.2-5.8)	5.2 (4.6-6)	5.0 (4.0-5.6)
Range (1-7)	1.8-7.0	2.2-7.0	1.8-7.0
Inhibitory Control			
Median (25th -75th %-ile)	4.7 (4.1-5.4)	5.0 (4.0-5.6)	4.6 (4.1-5.1)
Range (1-7)	2.7-6.6	2.7-6.6	2.7-6.4
Sensitivity to Punishment/ Sensitivity to Reward Questionnaire [e]			
Sensitivity to Reward			
Median (25th -75th %-ile)	5 (3-8)	5.5 (3-9)	5 (3-8)
Range (0-24)	0-17	0-17	0-15

Note.

[a] Higher scores indicate greater intensity and/or reactivity.

[b] Higher scores indicate greater difficulties.

[c] Higher scores indicate more impulsive behavior.

[d] Higher scores indicate greater control.

[e] Higher scores indicate stronger reward sensitivity.

Table 3.

Associations of dispositional scores with eating pathology and weight change across 7 years of follow-up (N=107)

	EDE-BSV global score (0-6 [a])		% weight change from surgery [b]	
	Beta (95%CI)[c]	p	Beta (95%CI)[c]	p
Affect Intensity Measure (AIM) [d]				
AIM Total (1-6), per 1 point	0.20 (0.04-0.36)	0.01	2.65 (0.77-4.52)	0.006
Negative Intensity (1-6), per 1 point	0.26 (0.13-0.39)	<0.001	2.64 (1.11-4.18)	0.001
Negative Reactivity (1-6), per 1 point	0.20 (0.06-0.34)	0.007	1.48 (−0.20-3.15)	0.08
Positive Affectivity (1-6), per 1 point	0.07 (−0.06-0.21)	0.28	1.68 (0.11-3.24)	0.04
Difficulties in Emotion Regulation Scale (DERS) [e]				
DERS Total (36-180), per 36 points	0.56 (0.36-0.76)	<0.001	2.95 (0.38-5.51)	0.02
Non-acceptance (6-30), per 6 points	0.40 (0.26-0.55)	<0.001	1.90 (0.01-3.78)	0.04
Goals (5-25), per 5 points	0.31 (0.18-0.43)	<0.001	2.03 (0.46-3.60)	0.01
Impulse (6-30), per 6 points	0.45 (0.26-0.64)	<0.001	1.91 (−0.46-4.28)	0.11
Awareness (6-30), per 6 points	0.12 (−0.04-0.29)	0.13	0.40 (−1.49-2.29)	0.67
Strategies (8-40), per 8 points	0.49 (0.32-0.67)	<0.001	2.66 (0.41-4.91)	0.02
Clarity (5-25), per 5 points	0.19 (0.02-0.36)	0.03	1.41 (−0.56-3.39)	0.15
UPPS-P Impulsive Behavior Scale [f]				
Negative Urgency (12-48), per 6 points	0.22 (0.14-0.31)	<0.001	0.96 (−0.13-2.05)	0.08
Positive Urgency (14-56), per 7 points	0.17 (0.05-0.29)	0.008	1.21 (−0.21-2.64)	0.09
Adult Temperament Questionnaire Effortful Control Scale (ATQ-ECS) [g]				
ATQ-ECS Total (1-7), per 1 point	−0.24 (−0.38--0.11)	0.001	−1.70 (−3.35--0.05)	0.04
Activation Control (1-7), per 1 point	−0.18 (−0.30--0.06)	0.003	−1.24 (−2.65-0.16)	0.08
Attentional Control (1-5), per 1 point	−0.16 (−0.26--0.06)	0.002	−1.04 (−2.19-0.11)	0.08
Inhibitory Control (1-7), per 1 point	−0.17 (−0.31--0.04)	0.01	−1.18 (−2.79-0.43)	0.15
Sensitivity to Punishment/Sensitivity to Reward Questionnaire [h]				
Sensitivity to Reward (0-24), per 4 points	0.19 (0.09-0.30)	0.001	1.06 (−0.24-2.37)	0.10

Note. EDE-BSV = Eating Disorders Examination-Bariatric Surgery Version.

[a] Higher scores indicate more severe eating pathology (i.e. dietary restraint/concerns).

[b] A negative number indicates weight loss.

[c] A separate linear mixed model tested and estimated associations with each dispositional variable, with time since surgery entered as a continuous fixed effect, controlling for pre-surgery smoking status, site and surgical procedure.

[d] Higher scores indicate greater difficulties.

[e] Higher scores indicate greater intensity and/or reactivity.

[f] Higher scores indicate more impulsive behavior.

[g] Higher scores indicate greater control.

[h] Higher scores indicate stronger reward sensitivity.