

Contributing Roles of Depression, Anxiety, and Impulsivity Dimensions in Eating Behaviors Styles in Obese Individuals Seeking Bariatric Surgery

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Abstract

Background

Even if bariatric surgery appears as the most effective therapeutic approach, it is not equally successful across individuals suffering from obesity. Among the factors that influence postsurgical outcomes, eating behaviors are known to play a key role in relapses. The aim of our study was to assess eating behaviors styles and several modulating psychopathological factors in patients suffering from obesity.

Methods

Patients seeking bariatric surgery (N = 127) completed a set of standardized tools assessing eating behaviors (DEBQ), psychiatric comorbid conditions (MINI), mood (BDI-13, STAI), and impulsivity (UPPS-P).

Results

We found significant correlations between DEBQ Emotional Eating (EmoE) and depression, state and trait anxiety and all dimensions of impulsivity. Significant correlations also occurred between DEBQ External Eating (ExtE) and depression, state and trait anxiety and UPPS-P positive urgency, lack of perseverance and sensation seeking. Regression analyses showed female gender, trait anxiety, and lack of perseverance as explanatory factors in EmoE, and depression severity score and positive urgency in ExtE.

Conclusions

EmoE might be a means of dealing with negative emotions and/or intrusive thoughts, while ExtE may result from a mechanism associated with depression. These results may help to improve patients' outcome by defining specific therapeutic targets in psychological interventions.

Plain English Summary

After bariatric surgery, patients may present a weight regain. This may be due to various factors among whom a return of maladaptive eating styles such as emotional eating (which occurs as a response to negative emotions like depression, anxiety, anger, sadness, and discouragement), external eating (which refers to the tendency to eat in response to positive external cues, regardless of internal signals of hunger and satiety) and restraint eating (implying to make efforts to develop and maintain strategies to control calories intake, associated with weight loss after lifestyle intervention). Our goal in this research project is to explore associated factors (particularly depression, anxiety, and impulsivity) to these eating styles in obese patients prior to bariatric surgery.

Obese individuals seeking bariatric surgery were asked questions about their eating styles, their levels of depression, anxiety, and impulsivity using standardized questionnaires. We found that emotional eating might be a means of dealing with negative emotions and/or intrusive thoughts, while external eating may result from a mechanism associated with depression. Therapies that may improve abilities to regulate negative affects look promising in obese patients seeking bariatric surgery. Well learned, they also may help them to maintain weight loss after surgery by limiting the access to maladaptive eating styles.

Background

Obesity is now recognized as having reached an epidemic level in worldwide, and as one of the most serious diseases in developed countries. In 2014, more than 1.9 billion adult individuals were overweight, and 600 million were obese, defined as those having a body mass index (BMI) greater than or equal to 30 kg/m² [1]. Individuals with BMI greater than 35 kg/m² with obesity-related comorbidity and those with BMI greater than 40 kg/m² with or without comorbidity can benefit from bariatric surgery, which is considered as the most effective weight loss treatment [2]. Indeed, an average 50% of excess weight may be lost in the first few years after bariatric surgery, which secondary improves comorbidities like diabetes mellitus and cardiovascular events [3–6]. However, bariatric surgery is not equally effective in all patients and many factors influencing long-term postsurgical outcome are still to be understood. Among them, eating behaviors styles may play a key role on success after weight loss surgery [7].

In clinical context, the Dutch Eating Behavior Questionnaire (DEBQ) has been used to assess different eating styles [8]. This questionnaire arises from the psychosomatic, the externality and the restraint theories related to three kinds of eating styles: Emotional Eating (EmoE), External Eating (ExtE) and Restraint Eating (RE) [9]. In EmoE, eating occurs as a response to negative emotions such as depression, anxiety, anger, sadness, and discouragement [10]. ExtE refers to the tendency to eat in response to positive external cues, such as the sight or the smell of food, regardless of internal signals of hunger and satiety [9]. RE implies to make efforts to develop and maintain strategies to control calories intake, associated with weight loss after lifestyle intervention [11].

Different factors have been shown to contribute to those eating behaviors styles. In females with morbid obesity, EmoE has been associated with a higher degree of negative affect, more difficulty in identifying feelings [12], neuroticism (which characterizes individuals who experience feelings such as anxiety, anger, guilt, and depression) [13,14], and poor interoceptive awareness, alexithymia or poor emotion regulation strategies [10,15]. ExtE has been associated with neuroticism even if this relation is less strong than for EmoE [13]. RE seems to be influenced by sex, more frequent in females [16] as well as by conscientiousness and neuroticism [17].

A mechanism that may act in combination with or independently of depression and anxiety is that of impulsivity. Even if this mechanism is a complex and multifaceted construct [18], it has been regularly assessed in participants with eating or addictive disorders (see for a review [19]). For instance, authors have shown that EmoE, ExtE and RE are associated with increased impulsivity in overweight and obese individuals [13], even if such association seems to be limited to responsiveness to rewards and reduced response inhibition [20].

Based on these previous theoretical considerations and empirical results, the aim of our work was to assess if depression, anxiety, and impulsivity traits represent important contributors to eating behaviors styles in patients suffering from obesity and seeking bariatric surgery. We expected to find strong links between depression, anxiety and EmoE or ExtE. We also expected to find a relation between impulsivity and EmoE or ExtE given their strong co-occurrence [21]. For RE, expectations are more uncertain given the findings noted above.

Materials And Methods

Participants

A sample of 127 patients, all candidates for bariatric surgery, were recruited. The inclusion criteria were an obesity grade 2 (BMI 35.0 - 39.9 kg/m²) and at least one obesity-related comorbidity or an obesity grade 3 (BMI \geq 40.0 kg/m²), without anorexia nervosa or bulimia. They had to be French-speaking and to be aged from 18 to 65 years. Participants with present or past drug or alcohol abuse or dependence were not included. All study procedures were reviewed and approved by the local Institutional Review Board (Dossier IRB 2016-12). The study was carried out according to the Helsinki Declaration [22], and every patient included in the study provided written informed consent.

Assessments

For all participants, we assessed sex, age, and BMI (kg/m²). We used the Mini International Neuropsychiatric Interview (French Version 5.0.0) (MINI) to investigate past and current psychiatric disorders, including alcohol abuse and dependence, drug abuse and dependence or anxiety disorders.

Depression severity and anxiety

The severity of depression was assessed using the short version of the Beck Depression Inventory (BDI-13) [23,24]. Cronbach's alpha was 0.837. Anxiety was evaluated with the State-Trait Anxiety Inventory (STAI) [25]. Cronbach's alphas were 0.945 for the state scale and 0.933 for the trait scale.

Eating behaviors styles

The Dutch Eating Behavior Questionnaire (DEBQ) was administered to assess Emotional, External and Restraint Eating [8,26]. Cronbach's alphas were 0.959 for EmoE, 0.748 for ExtE and 0.855 for RE.

Impulsivity

We used the UPPS-P Impulsive Behavior Scale [27] to assess the facets of impulsivity, i.e. Negative Urgency, Positive Urgency, (lack of) Premeditation (lack of) Perseverance and Sensation Seeking. This scale has received endorsement from the National Institutes of Health's (NIH) PhenX Toolkit as the recommended self-report measure of impulsogenic traits [28]. Cronbach's alphas in our sample were respectively: 0.796, 0.703, 0.754, 0.738, and 0.623.

Data analytic plan

All variables were screened for extreme outliers using box plot analyses. Descriptive (degree of skewness and kurtosis) and graphical methods were used to examine whether data were normally distributed. The relationships between the eating styles scores, clinical characteristics, and impulsivity dimensions were examined using Pearson's correlation, and separate hierarchical multiple regressions were performed to determine which variables predicted each of the eating behaviors styles as measured by the DEBQ subscales. For all regression models, because DEBQ scores are known to be influenced by age and sex, these variables were forced as covariates in the first step. Then, anxiety, depression severity and the impulsivity scores were entered in the second step with a forward selection. To test for multicollinearity, we examined the variance inflation factor (VIF) and the tolerance values (1/VIF). The tolerance ranged from 0.819 to 0.957 indicating that there was no issue [29]. All the statistical analyses were performed with SPSS® software, version 24.0 (SPSS, Inc., Chicago, IL, USA) and a *p* value < 0.05 was regarded as statistically significant.

Results

Descriptive data

Participants were 69.29% female (N = 88), and ranged in age from 20 to 61, with a mean age of 41.27 (SD = 11.20). Mean BMI was 45.65 kg/m² (SD = 6.72). Twenty-nine participants had an obesity grade 2 (19 females) and 98 an obesity grade 3 (69 females). Eating behaviors, depression, anxiety and impulsivity scores are shown in Table 1 for the overall population and according to sex.

Table 1 Descriptive data for eating behaviors scores, depression and anxiety scores and impulsivity scores in the overall population, in females and males.

	Overall population (N = 127)				Females (N = 88)				Males (N = 39)			
	Mean	SD	Minimum	Maximum	Mean	SD	Minimum	Maximum	Mean	SD	Minimum	Maximum
Emotional Eating	2.38	1.04	0.85	5.00	2.59	1.06	0.85	5.00	1.91	.85	0.92	3.69
External Eating	2.57	.62	1.10	4.20	2.57	.59	1.10	4.20	2.56	.70	1.20	3.90
Restraint Eating	2.77	.77	1.00	4.60	2.78	.78	1.30	4.60	2.74	.76	1.00	4.60
BDI ¹	9.55	6.52	0	31	10.26	6.70	0	27	7.95	5.87	0	31
STAI-A ²	33.76	12.08	20	76	33.82	12.00	20	76	33.64	12.40	20	71
STAI-B ³	37.99	11.76	20	70	30.09	11.96	20	70	35.51	11.05	20	70
UPPS Negative Urgency ⁴	8.53	2.94	4	15	8.56	2.94	4	15	8.46	2.98	4	15
UPPS Positive Urgency ⁴	9.46	2.45	4	16	9.57	2.37	5	15	9.21	2.64	4	16
UPPS Lack of premeditation ⁴	6.62	2.04	4	11	6.69	2.12	4	11	6.46	1.88	4	10
UPPS Lack of perseverance ⁴	6.06	2.07	4	13	6.28	2.16	4	13	5.56	1.77	4	9
UPPS Sensation seeking ⁴	8.49	2.37	4	15	8.49	2.34	4	14	8.49	2.66	4	15

Note: ¹ BDI = Beck Depression Inventory, ²STAI-A = State-Trait Anxiety Inventory (State), ³STAI-B = State-Trait Anxiety Inventory (Trait), ⁴UPPS = UPPS-P Impulsive Behavior Scale.

Bivariate correlations

Among the eating styles scores, EmoE was significantly correlated with ExtE, depression and anxiety scores and all dimensions of impulsivity (Table 2). ExtE was significantly correlated with EmoE, depression and anxiety scores, positive urgency, lack of perseverance, and sensation seeking. Finally, RE was not correlated with any variable (Table 2).

Table 2 Bivariate correlations (eating styles scores, clinical characteristics, and impulsivity dimensions scores).

	1	2	3	4	5	6	7	8	9	10	11
1. Emotional Eating	-	-	-	-	-	-	-	-	-	-	-
2. External Eating	.554**	-	-	-	-	-	-	-	-	-	-
3. Restraint Eating	-.002	-.121	-	-	-	-	-	-	-	-	-
4. Age	-.103	-.121	.038	-	-	-	-	-	-	-	-
5. BDI[1]	.401**	.272**	.026	.258**	-	-	-	-	-	-	-
6. STAI-A[2]	.364**	.206*	.049	-.194*	.664**	-	-	-	-	-	-
7. STAI-B[3]	.407**	.248**	-.049	-.185*	.743**	.790**	-	-	-	-	-
8. UPPS-P Negative Urgency[4]	.256**	.146	.015	.041	.418**	.468**	.517**	-	-	-	-
9. UPPS-P Positive Urgency ⁴	.201*	.219*	.013	.031	.227*	.163	.229**	.650**	-	-	-
10. UPPS-P Lack of premeditation ⁴	.200*	.088	-.117	.052	.207*	.288**	.349**	.299**	.162	-	-
11. UPPS-P Lack of perseverance ⁴	.382**	.220*	.005	-.042	.334**	.320**	.389**	.252**	.232**	.495**	-
12. UPPS-P Sensation seeking ⁴	.204*	.236**	.008	-.004	.306**	.259**	.255**	.451**	.567**	.078	.134

Relative contributions of depression, anxiety, and impulsiveness variables to eating styles scores

The first regression analysis, with EmoE style as the dependent variable showed a significant model in all three steps ($F(2,124) = 6.34, p = .002$ in step 1 including sex and age; $F(3,123) = 12.17, p < .001$ in step 2 including symptoms of anxiety trait; and $F(4,122) = 11.54, p < .001$ in step 3 including UPPS lack of perseverance). R square change was 9.3% in the first step ($p = .002$), 13.6% in the second step ($p < .001$) and 4.6% in the third step ($p = .006$) (Table 3).

The second regression analysis, with ExtE style as the dependent variable, showed a significant model in the two last steps ($F(2,124) = .984, p = .377$ in step 1 including sex and age; $F(3,123) = 3.573, p = .016$ in step 2 including depression severity score; and $F(4,122) = 3.746, p = .007$ in step 3 including UPPS positive urgency). R square change was 1.6% in the first step ($p = .377$), 6.5% in step 2 ($p = .004$) and 2.9% in the third step ($p = .048$) (Table 3).

The third regression analysis, with RE style as the dependent variable, showed a non-significant model ($F(2,124) = .172, p = .842$). No variable contributed significant unique variance to the prediction of restraint eating.

Table 3 Hierarchical linear regressions of anxiety, depression severity, and impulsivity traits in relation to eating behaviors styles.

	DEBQ ¹ EmoE		DEBQ ¹ ExtE	
	Model: R=.52		Model: R=.33	
	Adjusted R ² =.25		Adjusted R ² =.08	
	Bêta	p	Bêta	p
Sex	-.233	.005	Sex	.069 .440
Age	.026	.755	Age	-.089 .334
STAI-B²	.287	.001	BDI³	.221 .017
UPPS⁴			UPPS⁴	
Lack of perseverance	.234	.006	Positive Urgency	.177 .048

Note: ¹DEBQ = Dutch Eating Behavior Questionnaire, ²STAI-B = State-Trait Anxiety Inventory (Trait), ³BDI = Beck Depression Inventory, ⁴UPPS = UPPS Impulsive Behavior Scale.

Note: ¹BDI = Beck Depression Inventory, ²STAI-A = State-Trait Anxiety Inventory (State), ³STAI-B = State-Trait Anxiety Inventory (Trait), ⁴UPPS-P = UPPS-P Impulsive Behavior Scale. * p<0.05; ** p<0.01.

Discussion

The current study aimed to examine the potential contributions of depression, anxiety, and the different facets of impulsivity, as defined by the UPPS-P model, to each of the three eating behaviors styles assessed by the DEBQ in patients suffering from obesity and presenting for bariatric surgery.

Emotional eating style

According to our main hypothesis, we first evidenced significant correlations between EmoE and all dimensions of the UPPS-P. Furthermore, linear regression analysis showed that gender (female), trait anxiety, and lack of perseverance were related to EmoE. In accordance with previously suggested by Gade et al., (2014), this result may emphasize that females are at higher risk than males for developing EmoE. We found significant and positive correlations between EmoE and depression and anxiety levels. Other studies have shown that EmoE would play the role of mediator between depression and weight gain in female but not in male patients [30]. This is in line with previous studies, which found a significantly higher prevalence of negative emotional states [31,32] and anxiety [33] in EmoE. In addition, it has been shown that depressive affects lead to wrong food choices [34], and that chronic stress, by chronically elevating blood glucocorticoid levels, can stimulate overconsumption of food [35,36]. After linear regression, trait anxiety appears as an explanatory factor for EmoE. The variety of affects that may take place in EmoE is a topic recently open to debate [37], and each type of affect, including positive ones, could determine a different subcategory of EmoE. However, EmoE due to anxiety symptoms is demonstrated as less associated with psychopathological phenomena than those due to depression [37]. Thus, the emotional dysregulation known to occur in depression and not negative affects by themselves might be considered as what drives EmoE [37,38].

In our study, lack of perseverance was the only facet of impulsivity found as an explanatory factor in EmoE. This dimension of impulsivity is defined as the difficulty in staying focused on a task, because of the intrusion into memory of thoughts and memories previously useful but irrelevant to the current task [39–41]. It has been linked to executive and decision-making functions [42]. Hence, one of the mechanisms of EmoE would be the existence of intrusive thoughts, despite our study does not allow to determine whether the topic of these thoughts is food, weight, body dissatisfaction, or manifestations of post-traumatic stress disorder, as it has been observed in patients suffering from bulimia [43–45]. The fact that lack of perseverance is found as an explanatory factor for EmoE raises the question of the link between emotions, intrusive thoughts, and food. Canale et al (2017) propose a disruptive role of emotions on the resistance to proactive interference process [46]. Thus, intense emotions would lead to strong intrusive thoughts and then, food intake to try to cope with. This hypothesis is supported by the existence of an increased activity in the orbitofrontal cortex in participants who have received a negative mood induction and have been exposed to images of appetizing foods, reflecting a rise in the value of reward food cues in case of negative affects [47]. The intervention of the reward system further raises the question of potential addictive mechanisms in EmoE. Since the lack of perseverance has been linked to craving [48,49], these difficulties in overcoming proactive interference may reflect difficulties in managing obsessions for food, in connection with a "craving" in EmoE [50].

External eating style

The secondary objective of our study was to investigate the potential links between depression, anxiety, impulsivity and ExtE. This eating behaviour remains associated with unhealthy food intake [13,51,52] and a serious increase in BMI [16,53], even if it is to a lesser extent than EmoE. In our study, depression and anxiety scores were significantly correlated to ExtE. For impulsivity, our results were like those of previous research [13,51,54,55], i.e. a significant and positive correlation between ExtE and urgency and lack of perseverance. In addition, we found an association with the sensation seeking dimension. Regression analysis adjusted for sex and age showed that depression severity and positive urgency predicted ExtE. Few data are still available on the link between depression symptoms and ExtE. In a population of adults from the community, general practice and specialized mental health care, Paans and colleagues (2019) found that depression and unhealthy eating styles contributed independently to poorer dietary quality and

higher intake of sweet foods and fast-food/ savory snacks [56]. These authors also found that the association between depression and higher intake of snack/fast-food was explained by ExtE, suggesting that ExtE cues may be an important mechanism linking depression and obesity. Positive urgency, the tendency to act rashly in response to positive emotion, appears to be less relevant for dysregulated eating [57]. Using the Barratt Impulsiveness Scale [58], Meule & Platte (2015) showed that ExtE acts as a mediator between motor impulsivity and food overconsumption [59]. Kakoschke et al. (2015) showed that motor impulsivity and attentional impulsivity interact and are mutually reinforced in ExtE, while attentional impulsivity moderates the effect of motor impulsivity on food intake [51]. The combination of these two impulsivity dimensions would be required for the development of overeating and overweight, possibly indicating specific cognitive mechanisms in the food domain [60]. Such potentiating effects could explain that results regarding ExtE and its role in obesity are still sometimes contradictory.

Restraint eating style

Regarding RE, no association was found with any of the dimensions of impulsivity, nor depression and anxiety. Available data on the subject are still heterogeneous [13,20,61] and remain to be qualified. Indeed, given the differences between the scales used to identify RE, several types of restrictive eating behaviors could be distinguished, corresponding to different personality profiles, different impulsivity traits, and different levels of success in terms of weight loss [20]. In DEBQ, RE corresponds to the existence of behavioral strategies used to control energy inputs, followed by success or not [8,62]. RE may thus include a broad range of individual profiles. This may explain why results are mixed in the literature, and why our study does not find a correlation with the explored dimensions of impulsivity. More generally, based on our results, we can assume that food restriction in itself, and as defined by the DEBQ, does not necessarily mean a high level of impulsivity and a critical factor of weight regain, as long as some personality traits are not associated with. On the other hand, our study population is likely to display a particular type of DEBQ-RE: their restriction goals were a priori defeated. Moreover, the evaluation mode, by self-reports, is a potential source of response bias (self-complacency or self-handicap bias), because individuals may believe that they have interest in indicating that they have implemented restriction strategies (implying that these alone have not been enough and that surgery is therefore necessary). The exclusion of individuals with eating disorders from our study population may also explain conflict with results of other studies.

Limitations

This study has several limitations. The first one is that the population was limited to only candidates for bariatric surgery, which limits the generalizability of the findings. For instance, moderate obesity was not present in the current sample, in addition to other exclusion criteria, including anorexia, bulimia or and addiction to a psychoactive substance. Our sample is therefore only representative of this specific situation. However, there may be an advantage in having targeted this population, because eating disorders are themselves very strongly associated with impulsivity, with heterogeneous results according to their type. Because explanatory models are probably very different, based on the presence of an eating disorder or not, our results therefore make it possible to study in a more specific way the mechanisms of each eating behaviors in individuals without eating disorders. Our study also makes it possible to focus particularly on people seeking bariatric surgery, to adapt their care, and so, to minimize the risk of relapse. Future studies could be conducted to investigate the effect of focused therapies on relapse in these patients. A second limitation comes from the unbalanced sex-ratio: 69.3% of participants are female. And lastly, we assessed depression, anxiety, impulsivity and eating behaviors styles through self-reports, which are subjects to possible bias. However, the validity of these questionnaires has been well supported in previous studies and our reliability indices were satisfactory. Authors should discuss the results and how they can be interpreted in perspective of previous studies and of the working hypotheses. The findings and their implications should be discussed in the broadest context possible. Future research directions may also be highlighted.

Conclusion

Our results may contribute to improve the understanding of the impact of depression, anxiety, and impulsivity traits on unhealthy eating behaviors observed in patients suffering from obesity and seeking bariatric surgery. EmoE seems to be related to anxiety trait and a lack of resistance to proactive interference in females. This brings to the fore the importance of intrusive thoughts in EmoE and suggests that the lack of inhibition of mental images / thoughts would be responsible for a loss of control of food intake. Eating would be an ineffective and inappropriate means to cope with emotions, which, by force of repetition and mental elaboration, could be automatized and self-sustained, or even be combined with ExtE. Our study may have some clinical implications by highlighting factors associated with eating behaviors in obese individuals seeking bariatric surgery. Therapies that may improve abilities to regulate negative affects and impulsivity look promising and require further studies.

Declarations

Ethics approval and consent to participate

All study procedures were reviewed and approved by the local Institutional Review Board (Dossier IRB 2016-12). The study was carried out according to the Helsinki Declaration, and every patient included in the study provided written informed consent.

Consent for publication

Not applicable

Availability of data and materials

The qualitative datasets (i.e., transcripts, coding, and themes) used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Competing interests

The authors declare no conflict of interest.

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Authors' Contributions

Conceptualization, Farid Benzerouk; Formal analysis, Farid Benzerouk and Fabien Gierski; Investigation, Farid Benzerouk and Sarah Barrière; Methodology, Fabien Gierski; Supervision, Fabien Gierski and Arthur Kaladjian; Validation, Farid Benzerouk, Monique Guénin, Fabien Gierski, Delphine Raucher-Chéné, Sarah Barrière, Eric Bertin and Arthur Kaladjian; Writing – original draft, Farid Benzerouk; Writing – review & editing, Farid Benzerouk.

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