

Patients with Binge Eating Disorder and Obesity have qualitatively different interpersonal characteristics: Results from an Interpersonal Circumplex study

Agostino Brugnera^{a*}, Gianluca Lo Coco^b, Laura Salerno^b, Rachel Sutton^c, Salvatore Gullo^d, Angelo Compare^a, Giorgio A. Tasca^c

^a Department of Human and Social Sciences, University of Bergamo, Bergamo, Italy

^b Department of Psychology and Educational Sciences, University of Palermo, Palermo, Italy

^c School of Psychology, University of Ottawa, Ottawa, Canada

^d Department of Psychology, University “N. Cusano”, Rome, Italy

* Corresponding author

Correspondence:

Agostino Brugnera, Ph.D.

University of Bergamo, Department of Human & Social Sciences

P.le S. Agostino 2, Bergamo, 24129, Italy

Email: agostino.brugnera@unibg.it

Phone: +39 3402231353

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Abstract

Background: Patients with Binge Eating Disorder (BED) and obesity experience distressing relationships, which could trigger negative affect and over-eating. To date no studies compared the interpersonal profiles and prototypicality of both groups using the interpersonal circumplex.

Method: A sample of 177 patients with BED (mean age: 41.0 ± 12.5 years; 11.3% males), 321 obese non-BED adults (mean age: 44.5 ± 13.4 years; 28% males), and 108 normal weight adults (mean age: 37.3 ± 9.6 years; 52.77% males) completed the Inventory of Interpersonal Problems (IIP-32), and scales of binge eating and psychological distress at one time-point.

Results: Compared to normal weight and obese participants, those with BED reported higher levels of interpersonal problems on all circumplex dimensions, except for Vindictive, with small to medium effects. All groups had highly prototypical profiles. Both obese and normal weight adults had very similar interpersonal profiles characterized by predominant friendly-dominant themes. On the contrary, those with BED had predominant friendly-submissive themes. Patients with BED reported significantly higher levels of psychological distress and binge eating severity, compared to the other two groups. Greater Domineering, Cold, Socially Inhibited and Non-Assertive scale scores, and lower Vindictive scale scores significantly predicted higher binge eating and psychological distress, regardless of group membership.

Discussion: Findings lend support to an interpersonal model of binge eating and to the presence of qualitative differences between patients with obesity and BED. Finally, results suggest some strategies for the clinical management of BED focused on non-assertion and problems with experiences and expression of anger.

1. Introduction

Interpersonal problems, or difficulties in relating to others, are a common cause of subjective distress and one of the most frequently reported issues among treatment-seeking patients [1]. Pervasive and persistent interpersonal difficulties are considered a distinctive trait of many mental disorders [2-5] including eating disorders [6, 7]. Interpersonal theorists [8-10] argued that dysfunctional interpersonal relationships are a primary expression of adult psychopathology [3, 10].

Interpersonal theory posit that interpersonal behaviors and traits can be conceptualized and represented through a geometric structural model, namely the Interpersonal Circumplex (IPC), which is organized along two orthogonal dimensions of status on the vertical axis and affiliation on the horizontal axis [11, 12] (Figure 1). A commonly-used measure of interpersonal behavior and distress is the circumplex version of the Inventory of Interpersonal Problems [13], which was extensively used to examine the interpersonal profile of patients with mental disorders [5, 14-16]. Previous research analyzed the interpersonal distress associated with anorexia and bulimia nervosa [17-20]. There is also preliminary evidence that individuals with greater severity of interpersonal problems report their first binge eating episode at a younger age [21]. Along with severity, one can also evaluate the prototypicality of interpersonal profiles. Prototypicality refers to whether a single prominent interpersonal theme exists for a group, or whether interpersonal problems around the IPC are heterogeneous for that group. The prototypicality of the interpersonal profile of individuals with binge eating disorder (BED) and those with obesity without binge eating has not been investigated yet.

BED is a common mental health disorder with a lifetime prevalence of 1.9% [22], and is characterized by persistent and recurrent over-eating episodes accompanied by significant distress (i.e. guilt and self-disgust), and a sense of loss of control during the over-eating episode, but with no compensatory behaviors [23]. BED is strongly associated with comorbid

obesity [22], which is a highly prevalent and burdensome health issue [24]. Early debate about whether BED and obesity without binge eating are distinct phenomena [25] has given way to including BED as a separate diagnostic entity in DSM-5 [23], yet the two conditions may share certain characteristics. Previous research suggested that both BED and obese non-BED groups typically experience problematic and distressful relationships [4, 6, 21, 26-30]. Indeed, the interpersonal model of binge eating posits that individuals binge eat to cope with negative affects aroused by difficulties with interpersonal relationships [27]. To date, no previous research examined the characteristics of the interpersonal profile of patients with BED by contrasting them with obese patients without BED and with normal weight participants without BED. In addition, some authors argued that patients with BED have an emotion regulation deficit (i.e., higher proneness to negative affectivity), compared to those with obesity but no BED. Thus, those with BED may overeat as a coping strategy to deal with emotional distress [for a review, see 31].

The aims of this study are twofold. First, we sought to evaluate the severity and prototypicality of interpersonal problems among those with BED and to see if their interpersonal profiles were qualitatively different from those who are obese. To do so we contrasted obese individuals with BED to obese individuals without BED and to normal weight individuals on the IIP circumplex. To the best of our knowledge there is no research on this topic, so we explored the following research question: do BED and obese non-BED groups have consistent, specific and prototypical interpersonal profiles as assessed by the IIP? Research indicates that: i) interpersonal difficulties predict therapy outcome and adherence [28, 32], ii) interpersonal problems predict affect dysregulation and binge-eating [33], and iii) BED and obesity are highly comorbid conditions [34]. A better understanding of the interpersonal factors could help clinicians to deliver more precise interventions for BED by targeting specific interpersonal profiles.

Second, we tested the association between participants' interpersonal profile and their psychological distress and symptoms. Previous research found that the degree of interpersonal problems predicts symptom severity in other clinical populations [5, 35, 36] and in some clinical samples with eating disorders [4]. Hence, we hypothesized that interpersonal problem dimensions will be significantly associated with both binge eating severity and psychological distress over and above variance accounted for by group membership (i.e., BED, obese non-BED, and normal weight adults).

2. Materials and Methods

2.1 Participants

A total of 177 participants with BED (mean age: 41.0 ± 12.5 years; 11.3% males), 321 participants with obesity alone (mean age: 44.5 ± 13.4 years; 28% males), and 108 normal weight adults (mean age: 37.3 ± 9.6 years; 53% males) were enrolled in this study.

Individuals in the BED group had a mean BMI of 36.8 ± 8.2 kg/m²; 56% attended high school, and 62% was married. The obese group had a mean BMI of 38.4 ± 6.5 kg/m²; 48% attended high school, and 68% was married. Finally, the normal weight group (i.e., controls) had a mean BMI of 23.8 ± 2.8 kg/m²; 66% attended high school, and 44% was married.

For the BED group, inclusion criteria included absence of severe psychiatric illnesses (i.e., drug abuse, psychotic disorders); thus, patients with comorbid disorders (e.g. anxiety and mood disorders) were included in the study. For both obese and normal weight control groups, inclusion criteria included absence of any diagnosable psychiatric illness. An additional criterion for individuals with obesity was the presence of a BMI greater than 30 kg/m². All participants had an age between 18 and 65 years.

2.2 Procedure

BED and obese participants were treatment-seeking patients recruited from an Italian public center specialized in eating and weight disorders between September 2012 and April 2015. Normal-weight participants were recruited from general population through a “snowball” procedure (starting from friends of University students attending undergraduate courses at Palermo University) between November 2013 and April 2015.

All participants completed a systematic medical and psychosocial evaluation and a battery of questionnaires soon after their admission and/or consenting to participate in the study. The presence of psychiatric illnesses among the three samples was assessed by expert doctoral-level clinicians through the Structured Clinical Interview for DSM-IV [SCID-I/P; 37], while the diagnosis of BED was performed using the same structured interview, slightly modified to account for DSM-5 criteria for BED [23]. Prior to their enrollment, all participants provided informed consent. The study was approved by the Research Ethics Committee of Palermo University.

2.3 Measures

Interpersonal Problems

The Inventory of Interpersonal Problems – 32 [IIP-32; 13] is a 32-item self-report measure of interpersonal problems and distress. The IIP-32 includes 8 subscales (each composed of 4 items). The 8 IIP subscales are organized as octants around a circumplex representing the combination of two orthogonal dimensions: Dominance on the vertical axis and Affiliation on the horizontal axis. The octants (i.e. IIP subscales) are named Domineering (appearing at 90° of the circumplex), Vindictive (135°), Cold (180°), Socially Inhibited (215°), Non-assertive (270°), Exploitable (315°), Overly-nurturant (0°) and Intrusive (45°) (see Figure 1). Participants rate items on the self-report measures for each subscale on a 5-point Likert-

type scale (0 = not at all; 4 = extremely). Total scores for the subscales range from 0 to 16, with higher scores indicating greater interpersonal problems in that octant or domain. In this study, we adopted the Italian version of the IIP-32 [38], and its coefficient alpha ranged from 0.57 (Exploitable) to 0.85 for each octant, while the inter-item correlation ranged from 0.24 (Exploitable) to 0.58. Inter-item correlation coefficients in the range of 0.15-0.50 indicate good internal consistency of a scale [39].

Binge Eating Severity

The Binge Eating Scale [40] is a 16-item self-report scale of binge eating severity. Items are rated on a 4-point Likert-type scale (1 to 4). Total scores range from 16 to 64, with higher scores indicating higher levels of binge eating behaviors. In this study, the coefficient alpha was 0.92, while the inter-item correlation was 0.42.

Psychological Distress

The Outcome Questionnaire-45 [OQ-45; 41] is a 45-item self-report measure of psychological and interpersonal distress. Items are rated on a 5-point Likert scale (0 = never; 4 = always). Total scores range from 0 to 180, with higher scores indicating greater distress. In this study, the coefficient alpha was 0.93, while the inter-item correlation was 0.23.

2.4 Statistical Analyses

For the first objective of the study, we examined the research question regarding possible significant differences in the interpersonal profile of participants in the three groups (BED, obese non-BED, normal weight non-BED) using a two-step approach: first, we ran a Multivariate Analysis of the Variance (MANOVA) on the eight IIP dimensions followed by Tukey's post-hoc tests. The IIP dimensions were the dependent variables, while group membership was the independent variable. The raw subscale scores were z -transformed using the gender-corrected norms provided in the IIP manual [13]. Effect sizes were evaluated using

Partial η^2 and interpreted according to the guidelines [small > .01; medium > .06; large > .14; 42]. Second, we applied both circular statistics [43] and structural summary methods [44] to the circular profile of the IIP using the procedure suggested by Wright and colleagues [12].

Circular statistics allows one to compute a circular mean (i.e. the average of the angular displacement around the circumplex), a circular variance (i.e. the variance of the angular displacements), and the 95% confidence intervals of the circular mean [12]. The 95% CI were used to test for significant differences between groups on circular means [12]. The structural summary method allowed us to compute three structural parameters, namely Angular location (i.e. angular displacement), Amplitude, and Elevation [45]. Angular displacement is interpreted as an index of the predominant interpersonal problem. Amplitude is the degree of profile differentiation, in which an amplitude value of 0 indicates an undifferentiated profile and high Amplitude indicates a profile with a clear interpersonal peak (significant cut-off value: > 0.15). Finally, Elevation is an index of global level of distress across all types of interpersonal problems (significant cut-off value: > 0.15) [5, 12]. In addition, the structural summary method allows one to compute a goodness-of-fit statistic (R^2), which is a measure of interpersonal prototypicality, so that a high R^2 value (> .80) is suggestive of a consistent or homogeneous interpersonal profile within a specific group [12].

For the second objective of the study, we tested the hypothesis that higher IIP subscale scores will predict greater binge eating severity and psychological distress using hierarchical multiple linear regression. We controlled for the effect of the group by entering this dummy-coded variable in the first block of analysis while the IIP-32 subscale scores were entered in the second block. We controlled for the inflation of Type-I error using a Holm-Bonferroni sequential correction on all the p -values [46]. In addition, the assumption of multicollinearity was assessed computing the Variance Inflation Factor (VIF) and Tolerance in which values above 10 and below 0.1 suggest the presence of strong multicollinearity [47]. All analyses

were performed using Statistical Package for Social Sciences (SPSS) version 25.0. All statistical tests were 2-sided, and a p value < 0.05 was considered statistically significant.

3. Results

3.1 Preliminary Analyses

Preliminary analyses showed that all IIP-32 subscales (except Exploitable) and BES total scores were positively skewed. The violation of normality was corrected through square root or log10 transformations [48]. However, analyses ran with or without transformed variables led to similar results. For ease of interpretation, we reported analyses of untransformed data [48].

3.2 Main Analyses

Means and standard deviation of raw IIP-32 subscale scores for the overall sample and for the three groups are reported in Table 1. Regarding the first objective of the study, we tested if the three groups showed a consistent, specific and prototypical interpersonal profile, using a two-step approach. The multivariate tests evidenced a statistically significant effect of group membership on the linear combination of the IIP subscales, Wilk's Lambda = 0.831; $F(16, 1188) = 7.194$; $p < 0.001$; Partial $\eta^2 = .088$. Univariate tests showed significant differences between groups on all IIP subscales except for Vindictive. Post-hoc tests indicated that those with BED had significantly higher scores on all the z -transformed IIP subscales compared to obese and normal weight participants, with small to medium effects (see Table 2 and Figure 1). No significant differences were found between obese and normal weight participants.

As part of the second step, the circular means [or the "predominant theme of the profile"; 45] indicated that among patients with BED the main interpersonal problem was a mixture of Overly-Nurturant and Exploitable, among individuals with obesity the main

interpersonal problem was Overly-Nurturant, whereas among normal weight participants the main interpersonal problem was a mixture of Overly-Nurturant and Intrusive (see Table 3). By examining the 95% confidence intervals, we note that the BED group's profile theme occupied a significantly different space around the interpersonal circle compared to the obese and normal weight groups who occupied a similar space around the circle. That is both groups were predominantly friendly on the affiliation dimension, but the BED group was significantly more passive on the status dimension.

Regarding the Structural Summary analyses, the Angular location (a measure of the interpersonal theme) was almost identical to the one provided by circular statistics. The BED group's profile was characterized by the highest Elevation index compared to the obese and normal weight control groups, suggesting extreme levels of general interpersonal distress among those with BED. On the contrary, participants in the normal weight control group showed the lowest levels of Elevation. Compared to the interpersonal profile of the obese and normal weight individuals, the Amplitude of the BED group was also the highest, suggesting that patients with BED experience a distinct set of interpersonal problems (i.e., problems with being overly-nurturant and exploitable) compared to other types of interpersonal problems. Finally, the goodness-of-fit test (R^2) evidenced a high prototypicality ($> .80$) in all groups' profiles. The Circular Statistics, the parameters of the Structural Summary Method, and the goodness-of-fit tests are reported in Table 3.

Regarding the second objective of the study, we ran two separate hierarchical multiple linear regression analyses to test the hypothesis that higher scores on the IIP-32 subscales would be associated with greater psychological distress and binge eating over and above variance accounted for by group membership (see Table 4). The descriptive statistics of both the OQ-45 and the BES are reported in Table 1. In both analyses, the assumption of multicollinearity was met (Tolerance = 0.366 - 0.663; VIF = 1.508 - 2.732).

As regards the OQ-45, group membership significantly predicted psychological distress, $F(2,592) = 91.41$; $p < .001$, accounting for 23.6% of the variance in the dependent variable. The BED group had significantly higher OQ-45 total scores compared to the other two groups, followed by the individuals with obesity who had higher OQ-45 scores than normal weight adults. The introduction of the IIP-32 octant scores in the next block explained an additional 21.3% of the variance in OQ-45 total scores. The IIP-32 subscales Domineering (partial r [pr] = .14), Vindictive ($pr = -0.12$), Cold ($pr = .10$), Socially Inhibited ($pr = .15$), and Non-assertive ($pr = .18$) were significant predictors of psychological distress over and above group membership.

Further, group membership significantly predicted binge eating severity, $F(2,595) = 665.72$; $p < .001$, adjusted $R^2 = 69.1\%$. As expected, individuals in the BED group had the highest level of binge eating severity followed by the obese non-BED group which had higher binge eating severity than the normal weight group. The IIP-32 octants entered in the second block accounted for additional 3.6% of the variance in the BES score, and this change in the R^2 was significant though small, F change (8,587) = 9.533; $p < .001$. The IIP-32 subscale Non-assertive ($pr = 0.15$) and Socially Inhibited ($pr = 0.11$) were significant predictors of binge eating severity over and above group membership (see Table 4).

4. Discussion

The present study investigated the interpersonal profile of three groups of participants (treatment seeking patients with BED, obese patients without BED, and normal weight adults without BED) as well as the predictive value of interpersonal dimensions on psychological distress and binge eating severity. Patients with BED reported significantly higher scores in all the IIP domains (except for Vindictive) compared to the obese and normal weight groups (see Figure 1).

Moreover, circular statistics and the structural summary method indicated that the main interpersonal theme in the BED group fell in the friendly-submissive quadrant of the IIP, whilst in both obese and normal weight groups it fell in the friendly-dominant quadrant of IIP. Patients with BED had a mixture of over-nurturance and exploitability, with the latter characterized by an excess of friendly submissiveness, difficulties in feeling and expressing anger, and attempts to please others and win their approval through overly-accommodating and non-assertive behaviors [11, 13]. These scores tended to be in the clinical range. Obese and normal weight individuals tended to be over-nurturant, or the tendency to try too hard to please others, and too caring, affiliative, and permissive in dealing with others [11, 13], although their scores were within a non-clinical range of severity.

These findings are consistent with previous research on individuals with eating problems which showed that treatment-seeking obese individuals reported friendly–dominant or friendly–submissive relational styles [26], whereas patients with eating disorders evidenced a nonassertive interpersonal style, with severe interpersonal distress in the domains of non-assertiveness, over-nurturance and social inhibition [17, 30]. The study by Blomquist et al. [21] suggested that overly-dominant or overly-submissive individuals may be more likely to develop binge eating at a younger age. The findings from the current study and past research indicate that interpersonal submissiveness with its characteristic of low assertiveness and difficulty with experiencing and expressing anger may be specific interpersonal problems that differentiate those with BED, that such interpersonal problems may maintain BED symptoms [27], and perhaps are associated with an earlier age of onset [21].

The current study also found that individuals with BED had a highly differentiated interpersonal profile and reported extreme levels of relational difficulties compared to obese and normal weight individuals. Interestingly, all groups had prototypical profiles, suggesting homogeneous interpersonal functioning. Ung and colleagues [30] found high levels of

prototypicality among individuals with EDNOS, BED and BN; however, other studies on patients with anxiety disorders [5, 15], bulimia nervosa [20] and obesity [26] failed to find a single prototypical profile. Our results provide further evidence on the specific cluster of friendly-submissive or friendly-dominant interpersonal style among patients with BED and obesity. The findings also support the idea that within their respective groups, individuals experience a similar (i.e. homogeneous) set of relational problems though to differing degrees, such that those with BED experience more severe levels of problems with over-nurturance and exploitability.

As regards predicting psychological distress and binge eating, we found that higher scores in the Domineering, Vindictive, Non-Assertive and Socially Inhibited subscales of the IIP-32 significantly predicted psychological distress, and that higher Non-Assertive and Socially-Inhibited scores predicted greater binge-eating severity, regardless the group membership. In their systematic review, Arcelus, Haslam, Farrow and Mayer [6] found a strong relationship between low levels of assertiveness and eating disorder psychopathology. Ambwani et al. [49] showed that the IIP total score was associated with disordered eating in undergraduate students. Ung et al. [30] found that higher levels in the subscale Cold at baseline significantly predicted poor treatment outcomes in a sample of patients with eating disorders. The results of the current study add to this literature to suggest that greater problems with non-assertion (passivity) and socially inhibition subscales may be specific interpersonal problems that set the stage for greater psychopathology.

Our results on the prototypicality of interpersonal problems and their prediction of binge eating and distress have important clinical implications. Indeed, they indicate that patients with BED or obesity have qualitatively different interpersonal characteristics. Even if previous research suggested that obesity and BED lie on a continuum in terms of level of psychopathology [50], our results support the idea that these two commonly-comorbid

conditions are distinct phenomena, at least from an interpersonal point of view. A better understanding of the interpersonal functioning of both disorders could help clinicians to plan more effective intervention programs, especially in the case of those psychotherapies focused on maladaptive relational patterns.

For example, the interpersonal model of binge eating posits that negative affect mediates the relationship between interpersonal problems and binge eating symptoms for both BED and obesity [27, 33]. However, the findings of the current study suggest that obese patients do not appear to have more interpersonal problems than the normal-weight population. Therefore, the impairment due to relational difficulties seem to characterize only patients with BED, suggesting that their treatment may be improved by taking into account the specific interpersonal problems that appear to be prototypical of this disorder. Those with BED may need specific help with over-nurturance and exploitability that likely leads to muted experiences and expressions of anger and non-assertive passivity, which may underlie their binge eating [7].

Finally, it is well known that interpersonal functioning (as assessed by IIP) covary with measures of psychological distress [51], so that those individuals with higher levels of negative affects also report higher levels of interpersonal problems. One could argue that our findings reflect the higher level of distress experienced by patients with BED [i.e., the emotion regulation deficit; see 31]. However, previous longitudinal studies using the IIP [see for example 35, 52] suggested that after a psychological treatment, interpersonal styles tend to remain stable, or to decrease at a slower rate compared to psychological distress. Therefore, our results might indicate longstanding trait manifestations, even if the cross-sectional nature of our data does not allow to draw specific conclusions. Future studies should investigate the IIP circumplex of patients with BED before and after a treatment in order to i) disentangle the effect of interpersonal traits from those of psychological distress, and ii) collect evidence of

the longitudinal changes in interpersonal traits and on their predictive effect on post-treatment outcomes.

This study has certain limitations. The sample of obese and BED patients was mainly composed of women, limiting the generalizability of the present results. Moreover, only self-reported interpersonal problems data were collected, which might be vulnerable to biases (e.g., social desirability). The Cronbach's alpha for the Exploitable scale was low ($\alpha = 0.57$). Lower internal consistency is a common problem among shorter scales (such as the IIP-32), which assess broad constructs using fewer items than the longer versions [53]. However, the mean inter-item correlation of this scale was adequate indicating that, independent of scale length, the items may be internally consistent [39]. Finally, because of the cross-sectional nature of the data, causal inferences cannot be made. Further research with additional time points for assessment is necessary to test the impact of the IIP dimensions on treatment outcome in patients with BED.

In conclusion, the findings of this study suggest that specific interpersonal problems related to over-nurturance and exploitability are prototypical of patients with BED. These problems may lead to psychological distress and binge eating. Future research should focus on these interpersonal problems and specific corresponding negative affect and maladaptive coping styles to further specify an interpersonal model of binge eating. Such a model of BED may result in more effective treatments that target the specific interpersonal problems that are most prototypical of this disorder.

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Table 1. Means and Standard Deviation (SD) for the untransformed IIP-32 scores, BES and OQ-45 in the overall sample and the three groups (BED, Obese and Normal Weight adults)

	All (N = 606)	BED (N = 177)	Obese (N = 321)	Controls (N = 108)
Domineering/Controlling (SD)	3.35 (3.04)	4.30 (3.62)	2.95 (2.62)	3.00 (2.86)
Vindictive/Self-Centered (SD)	2.74 (3.07)	3.05 (3.46)	2.55 (2.98)	2.83 (2.59)
Cold/Distant (SD)	2.53 (3.15)	3.24 (3.58)	2.31 (3.11)	2.03 (2.22)
Socially Inhibited (SD)	3.84 (4.09)	5.68 (4.40)	3.23 (3.84)	2.64 (3.24)
Non-assertive (SD)	5.30 (3.74)	7.29 (3.92)	4.65 (3.33)	3.99 (3.35)
Overly Accommodating (SD)	6.96 (3.38)	8.50 (3.41)	6.49 (3.20)	5.82 (3.00)
Self-Sacrificing (SD)	6.81 (3.54)	8.24 (3.68)	6.23 (3.40)	6.22 (3.05)
Intrusive/Needy (SD)	4.99 (3.45)	6.07 (4.01)	4.63 (3.13)	4.33 (3.02)
* OQ-45 Total (SD)	65.98 (25.86)	84.93 (22.93)	60.42 (22.95)	51.76 (21.20)
** BES (SD)	15.63 (11.13)	29.46 (6.49)	11.38 (11.00)	5.27 (5.46)

Note: BED = Binge Eating Disorder; Obese = individuals with obesity but not BED; Controls = Normal weight individuals; BES = Binge Eating Scale; OQ-45 = Outcome Questionnaire 45. * For OQ-45, All N = 595; BED N = 173; Obese N = 314; Controls N = 108; ** For BES, All N = 598; BED N = 177; Obese N = 313; Controls N = 108.

Table 2. Means, SD, *p* values, Tukey's post-hoc tests and partial eta squared for the *z*-transformed IIP-32 scores, between the 3 groups (BED, Obese and Normal Weight adults). *Z*-scores were computed using gender-corrected norms.

	BED (<i>N</i> = 177)	Obese (<i>N</i> = 321)	Controls (<i>N</i> = 108)	<i>p</i> values	Post-Hoc	Partial η^2
Domineering (SD)	1.01 (1.47)	0.43 (1.05)	0.42 (1.17)	< .001	BED > Obese = Controls	0.05
Vindictive (SD)	0.28 (1.04)	0.08 (0.89)	0.08 (0.85)	.057	\	< 0.01
Cold (SD)	0.16 (1.07)	-0.13 (0.92)	-0.21 (0.64)	.001	BED > Obese = Controls	0.03
Socially Inhibited (SD)	0.78 (1.31)	0.05 (1.13)	-0.13 (0.92)	< .001	BED > Obese = Controls	0.09
Non-assertive (SD)	0.84 (1.08)	0.14 (0.93)	0.03 (0.97)	< .001	BED > Obese = Controls	0.10
Exploitable (SD)	1.19 (1.07)	0.62 (1.00)	0.48 (1.01)	< .001	BED > Obese = Controls	0.07
Overly-nurturant (SD)	1.11 (1.11)	0.56 (1.03)	0.63 (0.95)	< .001	BED > Obese = Controls	0.05
Intrusive (SD)	1.29 (1.45)	0.75 (1.13)	0.61 (1.1)	< .001	BED > Obese = Controls	0.05

Note: BED = Binge Eating Disorder; Obese = obese non-BED; Controls = Normal weight individuals without BED

Table 3. Structural Summary Parameters and Circular Statistics of the three groups (BED, Obese and Normal Weight adults)

	<i>N</i>	Circular Mean	Circular Variance	95% Circular CIs	Angle	Amplitude	Elevation	<i>R</i>²
BED	177	345.00°	59.38°	[353.74°, 336.24°]	347.00°	0.60	0.86	0.88
Obese	321	12.69°	63.43°	[19.63°, 5.75°]	7.34°	0.45	0.32	0.92
Controls	108	29.42°	56.75°	[40.12°, 18.71°]	23.03°	0.45	0.23	0.98

Note: BED = Binge Eating Disorder; Obese = obese non-BED; Controls = Normal Weight individuals; Circular Mean = the average of the angular displacements, in degrees; Circular Variance = the dispersion of the angular displacements, in degrees; 95% Circular CIs = 95% circular Confidence Intervals, in degrees; Angle = circumplex location of the predominant interpersonal problem, in degrees; Elevation = general level of interpersonal distress reported by the group; Amplitude = degree of differentiation of the group's profile; R^2 = fit of cosine curve, a measure of interpersonal prototypicality [5, 12].

Table 4. Standardized Beta scores, *p* values, and partial correlations of the IIP32 subscales scores in the regression models (Block 2).

	BES			OQ-45		
	Beta	<i>p</i>	Partial <i>r</i>	Beta	<i>p</i>	Partial <i>r</i>
	Block 1: $R^2 = .69$			Block 1: $R^2 = .49$		
Obese vs Normal	0.28	< .001	0.34	0.17	< .001	0.14
BED vs Normal	0.99	< .001	0.80	0.58	< .001	0.44
BED vs Obese	0.74	< .001	0.79	0.43	< .001	0.43
	Block 2: $R^2 = .72, \Delta R^2 = .04$			Block 2: $R^2 = .67, \Delta R = .21$		
Domineering	-.003	.915	-.004	.127	.001 *	.138
Vindictive	-.028	.318	-.041	-.111	.005 *	-.116
Cold	-.007	.818	-.010	.110	.012 *	.103
Socially Inhibited	.079	.009 *	.107	.162	< .001 *	.152
Non-assertive	.129	< .001 *	.149	.227	< .001 *	.182
Exploitable	.003	.927	.004	.038	.406	.034
Overly-nurturant	.054	.068	.075	.038	.365	.038
Intrusive	.011	.697	.016	.077	.046	.083

Note: BES = Binge Eating Scale; OQ-45 = Outcome Questionnaire – 45; *p* = *p* value; Partial *r* = Partial correlations. * = significant predictors after the Holm-Bonferroni correction. Total sample size: BES *N* = 598; OQ-45 *N* = 595.

Figure 1. Comparisons between the interpersonal circumplex scores of the three groups (BED, Obese and Control [normal weight] adults). Scores were z-transformed using gender-specific norms (range of scores: -1 to + 2).

