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(Article begins on next page)



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# An Exploratory Study to Subtype Obese Binge Eaters by Personality Traits

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**Key Words:** Obesity; Binge eating disorder; Personality; Temperament ; Character

## Abstract

**Background:** Obesity and binge eating disorder (BED) are prevalent conditions that severely affect the quality of life of many people in developed countries, but an effective treatment remains elusive. Personality traits have been studied extensively in this population, leading to different, and at times conflicting, results. Subtyping BED people along these features could add to our knowledge of the disorder.

**Methods:** We applied a two-step cluster analysis, followed by bootstrapping validation, to the Temperament and Character Inventory scores of 462 subjects affected by obesity and BED or subthreshold BED.

**Results:** We found two clusters of subjects; however, the categorization in clusters 1 and 2 did not appear to strictly overlap with the distinction between BED and subthreshold BED. The first cluster showed higher harm avoidance and a lower self-directedness. Cluster 1 patients had higher depression, higher eating impulsivity, greater problems with their body image and poorer quality of life than cluster 2 patients.

**Conclusions:** Our results seem to confirm the heterogeneity of the binge eater population and suggest the importance of harm avoidance and self-directedness to subtype these subjects. These results could generate exploratory works regarding personality in obese people with BED to discover more targeted treatments.

## Introduction

The comorbidity of obesity, defined by a body mass index (BMI) of 30 or more, with binge eating disorder (BED), as defined in the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR) [1], has steadily risen during the previous years [2]. These disorders cause substantial impairment and suffering [3], but an effective treatment remains elusive, especially for weight loss and long-term outcomes [4]. It is unlikely that a polymorphic disorder such as BED reflects a single process. An effort to subtype BED may address the problem, which, without good diagnostic criteria, is difficult to treat, as has been suggested for major depression [5,6].

During the previous decade, two different conceptual models were proposed. In the first one, Stice et al. [7,8] suggested subtyping BED according to dietary habits and to the processes of regulating negative affect, and it has been found that a mixed dietary-negative affect subtype is a more pathological variant of BED [8]. The second model [9,10,11] suggests subtyping BED according to the extent of overvaluing the importance of body shape or weight on one's self-evaluation. An excessive influence of shape or weight on

self-evaluation is considered a core feature across eating disorders; however, Grilo et al. [9] suggested considering it as an important diagnostic specifier for BED.

Another approach to subtyping BED is based on identifying personality traits that are associated with binge eating or with treatment outcome [12,13]. Various psychometric tools were used: the Minnesota Multiphasic Personality Inventory [14,15,16,17,18,19], the Karolinska Scale of Personality [20,21,22,23,24], the NEO Five-Factor Inventory [25,26], and the Dutch Personality Inventory [27,28,29]. Although these studies confirmed that severely obese people have heterogeneous personality traits, they arrived at conflicting results [12,13]. The Temperament and Character Inventory (TCI) has also been used, and it led to interesting preliminary findings for predicting treatment outcome [12,13].

While determining the prevalence of BED, Grucza et al. [30] administered the TCI to a community sample. They identified distinct personality traits in people with BED, hypothesizing that people with BED have heterogeneous traits with respect to the extent of impulsive behavior and comfort eating. However, to the best of our knowledge, the TCI has not been reported in an effort to cluster BED patients. Therefore, the first aim of our study was to apply a cluster analysis to the TCI scores of obese binge eating subjects to find which clusters emerged, and to test the hypothesis of Grucza et al. [30]. The second aim was to describe clinical features of emerging clusters.

## Methods

### Subject Selection

Subjects for this cross-sectional study were recruited among those who were consecutively referred to the outpatient service of the Center for Eating Disorders at the University of Turin due to overweight problems from 2000 through 2009. During their first visit, patients underwent a psychiatric assessment, and a battery of psychometric tests were administered. Then, prospective subjects underwent assessment consisting of a medical evaluation (including history, physical examination, and laboratory studies) by a medical team that was separate from the study investigators.

Inclusion criteria were: age 18-65 years; BMI  $\geq 30$ ; full DSM-IV criteria for BED or a diagnosis of eating disorder not otherwise specified (with bingeing) with a Binge Eating Scale (BES) score  $\geq 17$ . The patients with this latter condition were defined as having subthreshold BED (s-BED) [31,32]. Exclusion criteria were: a comorbid, full-syndrome axis I disorder (psychosis, mania, organic dementia, alcohol or other drug abuse, and suicide risk) other than depression, and obesity secondary to endocrinologic or metabolic disorders. Institutional ethics committee approval was obtained, and all subjects signed approved informed consent forms after the study procedures had been fully explained.

### Psychometric Battery

The psychometric battery was comprised of a personality inventory (TCI) and tools to assess psychopathology and quality of life.

*Temperament and Character Inventory.* The TCI is a 240-item self-report questionnaire that assesses individual differences in temperamental and character aspects of personality, both in psychiatric patients and in the general population [33,34,35]. It has already been used for assessing obese and BED patients [12,13,36,37]. 'Temperament' comprises automatic emotional responses to experiences that are thought to be heritable and stable throughout life. The TCI measures four dimensions of temperament: novelty

seeking (NS), harm avoidance (HA), reward dependence (RD), and persistence (P). 'Character' can be defined as a style of self-control that develops and matures over time. The TCI measures three dimensions of character: self-directedness (SD), cooperativeness (C), and self-transcendence (ST). Also, although TCI means are stable over short time periods, they vary over the years [33]. Accordingly, our statistical analyses of TCI scores were divided into age groups. According to a recent meta-analysis [38], HA and RD were further considered separately by sex.

*Binge Eating Scale.* The BES is a self-administered questionnaire comprised of 18 items that are specifically designed for the assessment of eating behaviors and psychological features related to binge eating in obese patients [39]. The questionnaire has been validated in a number of studies and can be used for recording repeated measures to investigate the response to treatment. A cutoff of 17 can be used for BED screening in obese patients.

*Body Shape Questionnaire.* The Body Shape Questionnaire [40] is a 34-item self-report questionnaire that is designed to assess concern about weight and body shape.

*Beck Depression Inventory.* The Beck Depression Inventory (BDI) [41] is a self-report questionnaire with 13 items that is primarily used to assess the severity of symptoms of depression. The BDI scores a limited range of symptoms, which do not include symptoms of anxiety. It shows reliability and internal consistency that are similar to the original 21-item version [42], and it has already been used [43] in a population similar to the one in this study.

*36-Item Short Form Health Survey.* The Short Form Health Survey (SF-36) [44] is a 36-item self-administered questionnaire that measures health and well-being on 8 multi-item dimensions.

## **Statistical Analysis**

A two-step cluster analysis (TSCA), which can analyze data from categorical and continuous variables and can automatically select the number of clusters, was used to subgroup the subjects into clusters based on their TCI profiles. A bootstrapping technique was applied to derive robust estimates of the standard errors and the confidence intervals for the mean values of the TCI scores in the clusters that were identified by cluster analysis. The TCI was then chosen as the classification variable, and bootstrapping was performed on 1,000 samples with a confidence interval of 95%. Bootstrapping was also used to calculate regression coefficients in the regression analyses that were performed within the subgroups. Differences between the identified clusters were evaluated with an ANOVA for continuous variables and with the  $\chi^2$  test for categorical ones. All statistical tests were two-tailed, and alpha was set at 0.05. Data were analyzed with the SPSS 17.0 package (SPSS, Inc., Chicago, Ill., USA).

## **Results**

### **Study Sample**

Of the 1,920 patients who applied consecutively for care at the Center for Eating Disorders, 330 subjects had a BMI <30; 198 were out of the age range; 784 were not classified as having BED or s-BED, and 111 had an axis I disorder. Of the remaining 497, 34 refused to participate and 463 were enrolled. 405 (88%) subjects were women (age  $43 \pm 13$  years; BMI  $37.9 \pm 16.6$ ) and 57 (12%) were men (age  $42 \pm 14$  years; BMI

39.1 ± 6.4). 209 subjects had BED (189 females and 20 males) and 253 had s-BED (216 females and 37 males).

### Differences in Personality Traits in Clusters Identified by the TSCA

The TSCA identified two clusters based on TCI scores of personality traits into which all 463 subjects could be subgrouped (table 1). Cluster 1 had a notably higher HA score and lower SD than cluster 2.

**Table 1.** Characteristics of the two clusters based on TCI scores (mean ± SD)

	Cluster 1	Cluster 2
NS	21.6±6.4	19.9±5.3
HA	26.9±6.7	18.6±4.9
RD	16.2±4.8	15.1±3.2
P	3.7±2.5	4.6±1.7
SD	15.7±5.2	28.2±5.3
C	28.5±7.1	32.2±4.8
ST	14.7±6.3	15.4±6.0

### Characteristics of the Two Clusters

Cluster 1 subjects were significantly younger than cluster 2 subjects, although the clusters were not significantly different in height, weight, BMI, and age at onset of binge eating. Cluster 1 subjects had higher educational attainment and occupational status, and they desired to have a body weight significantly lower than that desired by cluster 2 (table 2).

**Table 2.** Demographic, eating psychopathology, depression and quality of life of the two clusters

	Cluster 1	Cluster 2	F	p		Cluster 1	Cluster 2	F	p
<i>Categorical variables</i>					<i>Continuous variables</i>				
<b>Sex</b>					<b>Age at 1st contact, years</b>	40.7±12	45.6±13	17.6	<0.001
Males	22 (9.4)	35 (15.3)			<b>Weight, kg</b>	101.9±58	101.06±19	0.5	0.8
Females	211 (90.6)	194 (84.7)		0.056	<b>Desired weight, kg</b>	65.9±10	69.5±12	8.9	0.003
<b>Schooling</b>					<b>Height, m</b>	1.62±0.08	1.77±2	1.2	0.2
5 years	7 (3.0)	21 (9.2)			<b>BMI, kg/m<sup>2</sup></b>	38.6±21.1	37.6±6.7	0.6	0.4
8 years	92 (39.5)	92 (40.2)			<b>BES score</b>	28.0±8	21.9±9	52.9	<0.001
13 years	115 (49.4)	91 (39.7)			<b>BDI score</b>	17.0±6	10.5±7	89.3	<0.001
16 years	4 (1.7)	6 (2.6)			<b>BSQ score</b>	141.5±30	120±30	51.3	<0.001
18 years	15 (6.4)	19 (8.3)		0.031	<b>SF-36 score</b>				
<b>Working status</b>					PA	20±4	23±6	6.8	0.01
Student	12 (5.2)	7 (3.1)			RP	5.5±2	6.3±1	3.4	0.06
Housewife	21 (9.0)	47 (20.5)			BP	6.3±2	7.0±2	1.8	0.17
Employee	137 (58.8)	118 (51.5)			GH	13.2±4	15.0±3	5.2	0.02
Self-employed	14 (6.0)	18 (7.9)			V	10.6±3	12.7±4	7.1	0.009
Retired	22 (9.4)	22 (9.6)			SA	5.2±1	6.5±2	10.8	0.001
Unemployed	27 (11.6)	17 (7.4)		0.009	RE	3.8±1	4.5±1	6.8	0.01
<b>BED status</b>					MH	15.2±4	18.0±4	8.8	0.004
BED	116 (49.7)	94 (41)			HC	3.2±1	3.2±1	0.01	0.9
s-BED	117 (50.3)	135 (59)		0.123					
<b>Age at onset</b>									
Childhood	49 (21.0)	45 (19.7)							
Adolescence	56 (24.1)	41 (17.9)							
Adulthood	128 (54.9)	143 (62.4)		0.243					
<b>Total</b>	233	229							

Values are n (%) or mean ± SD. p values in italics are significant. BSQ = Body Shape Questionnaire; PA = physical activity; RP = role-physical; BP = bodily pain; GH = general health; V = vitality; SA = social functioning; RE = role-emotional; MH = mental health; HC = health change.

The two clusters were not significantly differently distributed between binge eaters and subthreshold binge eaters. However, cluster 1 participants experienced greater psychological distress about their body shape (Body Shape Questionnaire), and had higher psychopathology scores both in mood (BDI) and in the degree of the loss of control over eating (BES). Subjects in cluster 1 had significantly lower scores in all SF-36 dimensions except for 'role-physical' and 'bodily pain' (table 2).

### **TCI Dimension Scores Compared between Binge Eaters and Subthreshold Binge Eaters**

The binge eaters had significantly higher TCI scores on the HA dimension than the subthreshold binge eaters ( $23.95 \pm 7.7$  vs.  $18.08 \pm 6.4$ ;  $p < 0.001$  two-tailed). Subthreshold binge eaters had higher scores on SD ( $28.71 \pm 7.5$  vs.  $21.83 \pm 7.7$ ;  $p < 0.001$  two-tailed) and C dimensions ( $14.02 \pm 6.3$  vs.  $13.79 \pm 6.0$ ;  $p < 0.002$  two-tailed) than the binge eaters.

### **Comparison between Cluster and Normative TCI Dimension Scores**

In all except for five comparisons, the values of TCI dimensions in the two BED clusters were significantly different from their corresponding normative values. For both clusters, scores for TCI dimensions HA, RD, and NS were mostly higher compared with normative values, whereas scores for dimensions P, SD, C, and ST were mostly lower. Details about these comparisons are available for the interested reader.

## **Discussion**

To our knowledge, this is the first study to apply the TSCA to TCI scores in obese subjects with binge eating followed by bootstrapping validation.

The main finding of this study is the characterization of two distinct personality clusters, which both significantly differ from the general population. Both clusters are characterized by a vulnerability to anxiety and depression (high HA), a high appetitive drive for new situations and stimuli (high NS), and immature character traits (low SD and low C), exactly as found in the study by Grucza et al. [30]. Nevertheless, the main differences that emerged in our study between the two clusters, a higher HA and a lower SD in cluster 1, are not those hypothesized by these authors. They proposed a subtype of BED characterized by an impulsive NS behavior, and a second subtype with an underlying mood dysregulation (i.e., 'comfort eating') correlated with HA. Instead, in our sample, high NS is a trait common to all patients, and is the mood dysregulation and the character fragility to distinguish the two subtypes.

Moreover, it seems quite interesting that even though BED patients have higher HA and lower SD and C than s-BED patients, the categorization in clusters 1 and 2 does not appear to strictly overlap with the distinction between BED and s-BED. This fact could suggest that there are personality differences among binge eaters which have an impact on eating behaviors and psychopathology. Future studies should test the prognostic significance of this subcategorization, as already done for previously proposed conceptual models [7,8,10,11].

Regarding clinical and demographic characteristic of the two clusters, cluster 1 patients showed the worst condition. They showed higher depression, higher eating impulsivity, greater problems with their body image and poorer quality of life, but these differences were not explained by a major incidence of BED (rather than s-BED) or higher BMI. These differences could probably be associated with the extent of the

expression of the personality trait (HA and SD) among the subjects. From a clinical point of view, patients identified by cluster 1 could deserve a different and more intensive treatment, probably representing a more pathological variant of BED.

This study has some limitations. We examine a sample of people seeking treatment and consequently our results should not be generalized to the whole population of obese binge eaters. The sample we studied was composed only of subjects who choose to refer to an eating disorder center to receive treatment, and these patients could have personality traits that differ from subjects searching for a dietician or a surgeon. Finally the study's assessment of psychopathology was limited to measures regarding eating behaviors and depressive symptomatology.

Nevertheless our results seem to confirm the heterogeneity of the binge eater population, and suggest the importance of HA and SD to subtype these subjects. This study could be considered as a contribution to generate an exploratory hypothesis regarding clinical differences and personality profile among BED and s-BED patients and can stimulate further studies to develop more targeted treatments [45,46]. Future research should also test our model in general population samples and verify the overlap between the clusters found in our study and the conceptual models proposed by Stice et al. [7,8] and by Grilo et al. [10,11].

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