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Comparative study of eating behavior between patients with mental illness and healthy controls using the Japanese version of the Dutch Eating Behavior Questionnaire

doi: 10.6133/apjcn.202403/PP.0005

Published online: March 2024

Running title: Comparison of eating behavior using Japanese DEBQ

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ABSTRACT

Background and Objectives: To examine the reliability and validity of the Japanese version of the Dutch Eating Behavior Questionnaire (DEBQ-J) for patients with mental illness, and to determine the characteristics of eating behavior among these patients when compared with healthy controls. **Methods and Study Design:** In May 2018, 120 outpatients with mental illness and 132 healthy controls were surveyed. First, exploratory factor analysis was conducted on the DEBQ-J statement responses for both patients and healthy controls. Next, reliability coefficients were calculated for the eating behavior scale scores (emotional, restrained, and external eating) extracted from the factor analysis. The association between BMI and eating behavior was examined using Student's t-test and Pearson's correlation coefficient. **Results:** The DEBQ-J had a similar factor structure to that of the original DEBQ for healthy controls, with a cumulative contribution of 52.4% for the three factors, and alpha coefficients ranging from 0.87 to 0.91. For patients, factor analysis showed that four statements classified as emotional eating items in the original DEBQ were recategorized as external eating items, and the percentage of patients with obesity (BMI \geq 25) was 57.5%, compared with only 25.4% among the healthy controls. The patients with obesity tended to score higher on the external eating scale than did those with BMI $<$ 25. **Conclusions:** Patients tended to blur the distinction between emotional feelings of mental irritability or anxiety and feelings in response to external stimuli. Monitoring of the DEBQ-J external eating score and appropriate intervention among patients living with mental illness may help to prevent obesity.

Key Words: DEBQ, eating behavior, obesity, mental illness, nutrition education

INTRODUCTION

In 2013, in response to the increasing number of people experiencing mental illness in Japan, the Ministry of Health, Labour and Welfare classified mental illness as the fifth major disease requiring urgent national attention, in addition to cancer, heart disease, cerebrovascular disease, and diabetes.¹ Japan's "Vision for Reform of Mental Health and Medical Welfare" states that strengthening the transition from inpatient to outpatient care can help patients with mental illness to lead independent lives in the community.² For patients with mental health conditions, not only can the effects of psychiatric drugs contribute to obesity, but also those receiving treatment as outpatients are free to make their own food choices, which can lead to extreme picky eating and a loss of control over the amount of food eaten, when compared

with patients undergoing inpatient treatment.³ Japan has a long history of keeping patients with psychiatric disorders in hospitals separated from the community. As a result, the reintegration of these patients into society lags behind that of other OECD member countries.⁴ One of the causes is discrimination and prejudice against people with psychiatric disorders, which has been attributed to ignorance of mental illness contributing to stigmatization.^{5,6} A study in Japan reported that mental health-related stigma was reduced through biomedical messages and psychosocial content in education to improve practical understanding of mental illness.⁷ Fostering a better understanding of eating tendencies among patients with mental illness may reduce mental health-related stigma among healthcare professionals, leading to better nutritional guidance for patients.

The Dutch Eating Behavior Questionnaire (DEBQ), developed by Van Strien et al.,⁸ is used to assess eating behavior with respect to three factors: external eating, emotional eating, and restrained eating. It has been translated and used as an evaluation method for eating behavior in many countries.^{9,10} In Japan, the Japanese version of the DEBQ adapted by Imada is widely used.^{11,12} The original target population was primarily Japanese university students,^{13,14} but this was later expanded to include adult workers.¹¹

Scales such as the DEBQ are often used to understand patient eating behavior characteristics. In a study of nutritional guidance outcomes for patients with mental illnesses such as schizophrenia and mood disorders, the DEBQ scores for the external eating scale (i.e., the desire to eat due to external stimuli) tended to be higher among patients who had made poor progress after nutritional guidance.¹⁵ A previous study outside Japan reported a higher DEBQ score for the external eating scale,¹⁶ and another international study reported a higher disinhibition score in the Three-Factor Eating Questionnaire among patients taking medications for mental illness.³ Similar to the DEBQ, the Three-Factor Eating Questionnaire is often applied in eating behavior-related research, but it contains 51 items and measures three dimensions of human eating behaviors: cognitive restraint of eating, disinhibition, and hunger.

In this study, for reasons of practicality, we chose to use the DEBQ, which is widely used in Japan and has 18 fewer questions than the Three-Factor Eating Questionnaire. It has been reported that levels of health literacy (the skills to obtain and use health information) among patients with mental illness are typically lower than among patients with other diseases such as diabetes.¹⁷ Better nutritional guidance could be provided to patients with mental illness if a suitable scale were available to detect the eating tendencies that contribute to obesity among individuals in this group. Although the original version of the DEBQ has been used overseas

for patients with mental illness, the reliability and validity of the DEBQ for patients with mental illness in Japan has not been investigated. The purpose of this study was therefore to examine the reliability and validity of the scale among Japanese patients with mental illness and to further clarify the characteristics of their eating behaviors by comparing them with those of people without mental health conditions. By exploring whether there are common eating tendencies that contribute to obesity among patients with mental illness living in the community, regardless of their primary disease diagnosis, we hope to contribute to the reduction of mental health-related stigmatization and the improvement of general dietary guidance methods based on eating behaviors.

MATERIALS AND METHODS

Survey subjects

This was a cross-sectional study using a self-administered questionnaire. The study subjects were 123 outpatients with mental illness (hereafter referred to as patients) attending a single clinic in City A, Fukushima Prefecture, and 147 people without mental health conditions (hereafter referred to as healthy controls) living in the same City A.

Patients were surveyed on May 15, 17, and 19, 2018. Although patients were not asked the name of their mental illness or disorder as part of this survey, the breakdown of disorders based on the records of outpatients attending the clinic on the survey days was as follows: neurodevelopmental disorder, 24%; schizophrenia spectrum, 24%; stressor-related disorder, 14%; bipolar affective disorder, 16%; depressive disorder, 7%; epilepsy, 4%; anxiety, 4%; and other, 7%. The DSM-5, a manual for the classification of mental illness that was developed by the American Psychiatric Association, was used to classify the disorders. No patient was classified as having an eating disorder.

The participation criteria required patients to be able to complete the questionnaire in their own handwriting. The patient survey procedure was as follows: a verbal and written request for the survey was made to a representative of the clinic and permission was obtained. The survey was conducted using a self-administered questionnaire, and at the beginning of the survey form, patients were given an overview of the survey and told that personal information would be protected. Patients were informed that they could withdraw from the process if they did not wish to respond, and that they would be under no disadvantage for choosing not to respond.

The survey distribution dates for the healthy controls were May 23, 28, and 30, 2018. Questionnaires in sealed envelopes were distributed among parents and siblings of university

students in the same City A, and the questionnaires were collected two weeks later. In a similar manner to the patient survey, the questionnaire began with an outline of the survey and included a statement that personal information would be protected and that there would be no disadvantages to not participating. This study was conducted after obtaining approval from the Koriyama Women's University Ethics Committee (Approval No. 2016-4).

Survey items

The survey for this study consisted of questions on sex, age, height, and weight, followed by a modified version of the Japanese DEBQ,^{13,14} hereafter referred to as the DEBQ-J. The DEBQ-J includes modifications to some statements that have low factor loadings in the original Japanese translated version. Respondents were asked to score each of the 33 statements in the DEBQ-J from “never” (1 point) to “always” (5 points). Each statement corresponds to one of the three eating behavior scales (external eating, emotional eating, and restrained eating), which allows an overall score to be determined for each scale, with higher scale scores indicating a stronger tendency towards that behavior. The external eating scale includes questions (statements) such as “If you see or smell something delicious, do you have a desire to eat it?”; emotional eating includes statements such as “Do you get the desire to eat when you are anxious, worried or tense?”; and restrained eating includes statements such as “Do you deliberately eat less in order not to become heavier?”

The BMI classification used in this study is based on the WHO Asian-BMI classification,¹⁸ which classifies BMI among Asian populations as follows: underweight, $BMI < 18.5 \text{ kg/m}^2$ (hereafter units omitted); normal range, $BMI 18.5\text{--}22.9$; overweight, $BMI 23.0\text{--}24.9$; obese I, $BMI 25.0\text{--}29.9$; and obese II, $BMI \geq 30.0$. In Japan, an increased risk of CVD has been reported for $BMI \geq 25$ (i.e., obese I classification and above),¹⁹ and the Japan Society for the Study of Obesity defines obesity among Japanese individuals as $BMI \geq 25.20$. For the purposes of this study, we therefore also define obesity as $BMI \geq 25$.

Statistical analysis

First, descriptive statistics were calculated for both male and female respondents, and t-tests were conducted with the aim of clarifying demographic characteristics stratified by sex. Comparisons of means were tested for equal variances, and either Student's or Welch's t-test was performed. Second, exploratory factor analysis was performed for the two subject groups (patients and healthy controls) with the aim of confirming the factorial validity of the DEBQ-J. Third, reliability coefficients (Cronbach's alpha coefficients) were calculated to confirm the

reliability of the subscales extracted from the factor analysis. Student's t-test and Pearson's product-rate correlation coefficient were also calculated.

Statistical analysis was performed using IBM SPSS Statistics version 26.0 (IBM Japan, Tokyo, Japan) and STATA version 14.2 (LightStone, Tokyo, Japan). There were a few cases of missing data among the healthy controls, as follows. There were two cases of missing responses to DEBQ-J statements, which were excluded from the factor analysis for the relevant eating behavior. There were three cases of missing responses for sex, one case of missing age, and eight cases of missing responses for height and weight. These missing data were excluded from the analytical calculations and are not reflected in the tables.

RESULTS

Differences in obesity between patients and healthy controls

Of the 123 patients asked to participate in the study, 121 responded (98.4%) and 2 declined. One patient who gave the same answers to all questions was excluded from the analysis, resulting in a total of 120 valid responses (97.6%) among the patient group (54 men and 66 women). Of the 147 healthy controls invited to participate in the study, 132 responded (89.8%) and 15 declined. All 132 received responses among the healthy group were valid (47 men, 82 women, and 3 individuals who did not state their sex), albeit with some cases of missing data as previously described. The basic attributes (height, weight, BMI, and age classification) of the surveyed patients and healthy controls are shown in Table 1.

Sixty-nine (57.5%) of the 120 respondents in the patient group had BMI ≥ 25 , which is defined as obese in this study. This included 17 men and 12 women with BMI ≥ 30 . Among the 124 healthy controls for whom BMI could be calculated (i.e., excluding the 8 individuals who did not provide their height and weight), 32 (25.8%) had BMI ≥ 25 , and 4 men and 1 woman had BMI ≥ 30 . A comparison of the mean values of height, weight, and BMI between the patient group and the healthy controls by sex showed that the patient group had significantly higher values for weight and BMI than the healthy controls, among both men and women ($p < 0.01$; Table 1).

DEBQ-J scores for patients and healthy controls

Based on the DEBQ-J responses of the patients and healthy controls, exploratory factor analysis was performed to confirm the scree plot of the three eating behaviors. This demonstrated that the three-factor structure was similar to that of the original DEBQ (Table 2). The mean and standard deviation (SD) for each statement item are presented in Table 2,

and no items showed floor or ceiling effects. For the healthy controls group, the overall reliability coefficient scale scores determined for each behavior indicated that emotional eating was the first factor, restrained eating was the second factor, and external eating was the third factor. Two items relating to emotional eating in the original DEBQ (No. 27, “Do you have a desire to eat when you have nothing to do?”; and No. 11, “Do you have the desire to eat when you are irritated?”) were classified in our analysis as external eating items, but all other items retained the same classification as the original DEBQ. The cumulative contribution of the three factors was 52.44%, with alpha coefficients ranging from 0.87 to 0.91.

For the patient group, the factor array showed external eating as the first factor, emotional eating as the second factor, and restrained eating as the third factor, with a cumulative contribution of 52.48% for the three factors and alpha coefficients ranging from 0.87 to 0.92. Four statement items originally classed as emotional eating (No. 11, “Do you have the desire to eat when you are irritated?”; No. 8, “Do you have a desire to eat when you are disappointed?”; No. 14, “Do you have a desire to eat when you are cross?”; and No. 4, “Do you get the desire to eat when you are anxious, worried or tense?”) were reclassified as external eating in the DEBQ-J. Furthermore, two of the external eating items (No. 24, “If you walk past a snack bar or a cafe, do you have the desire to buy something delicious?” ; and No. 32, “ Can you resist eating delicious foods?”) showed low factor loadings of ≤ 0.22 . In a comparison of DEBQ-J scores between patients and healthy controls, patients had significantly higher mean emotional eating scale scores than healthy controls ($p=0.009$), and healthy controls had significantly higher mean external eating scale scores than patients ($p=0.033$).

Relationship between obesity and DEBQ-J scores for patients and healthy controls

Patients and healthy controls were subdivided into two groups, $BMI \geq 25$ (i.e., obese) and $BMI < 25$ (i.e., not obese), and Student's t-test was performed to examine whether there were differences between the mean values of the three original DEBQ-J eating behavior scale scores for these BMI subgroups (Table 3). There was no significant difference in the mean scale scores between the two BMI subgroups for healthy controls, regardless of eating behavior scale. However, for the patient group, the mean external eating scale score among those with $BMI \geq 25$ was 3.1 (SD 0.9), which was higher than the mean scale score of 2.8 (SD 0.7) among those with $BMI < 25$ ($p=0.050$).

Correlations between BMI and DEBQ-J scores for patients and healthy controls

Correlation coefficients between BMI and original DEBQ-J scale scores for patients and healthy controls were calculated (Table 4). The normality of each data set was confirmed, and Pearson's product-rate correlation coefficient was used. For patients, BMI showed significant correlation with emotional eating ($r=0.220$, $p<0.05$) and external eating ($r=0.289$, $p<0.01$). Emotional and external eating also showed a strong positive correlation with each other ($r=0.644$, $p<0.01$). For healthy controls, a significant correlation was found between BMI and external eating ($r=0.203$, $p<0.05$), but not for emotional eating. Emotional eating and external eating were positively correlated ($r=0.510$, $p<0.01$).

DISCUSSION

In this study, the results of the DEBQ-J showed a mixture of external and emotional eating among patients with mental illness, and there was a higher incidence of obesity among patients with mental illness than among healthy controls. The data also show that obesity among patients is associated with external eating, which means that managing external eating behaviors is important for obesity prevention in this group.

The scale structure of the DEBQ-J is comprised of the same three behavioral factors as the original DEBQ developed by Van Strien et al.,⁸ namely emotional eating, restrained eating, and external eating. The alpha coefficient was broadly consistent across the three scales for both patients and healthy controls, and internal consistency was judged to be high (Table 2). For healthy controls, two of the 33 statement items comprising the DEBQ-J (No. 11, "Do you have the desire to eat when you are irritated?"; and No. 27, "Do you have a desire to eat when you have nothing to do?") were shown to be classified as external eating, based on factor loadings, which differed from the original classification by Van Strien et al. as emotional eating. However, the factor loadings for items 11 and 27 were moderate, at 0.42 and 0.50, respectively, which is almost the same as those loadings found in previous studies of healthy subjects,^{10,12} confirming the reliability and factorial validity of the present study.

Regarding the eating behavior factor classification of DEBQ-J statement items for patients with mental illness, four items (No. 8, 4, 14, and 11) that are typically categorized by DEBQ-J as emotional eating were reclassified as external eating among the patients in our study, based on factor loadings. One of these items (No. 11) also loaded on the external eating scale among healthy controls. In addition, we observed smaller differences between the mean scores for external and emotional eating among patients than among healthy controls (Table 2). This may be a result of these four items being more likely to be associated with external factors

that drive eating than with emotional factors that drive eating. One possible explanation for this is that patients may have a tendency to externalize and attribute negative mood states (such as irritability, feeling “cross,” and disappointment) to external events. The correlation coefficients between BMI and DEBQ-J scale scores for patients and healthy controls (Table 4) showed relatively strong positive correlations between emotional and external eating, indicating that these behaviors influence each other. Because an interrelationship between these two eating behaviors was observed for both patients and healthy controls, we cannot conclude that the strength of this relationship is specific to patients. From neuropsychological and cognitive neuroscience perspectives, however, Takano et al. analyzed mood disorders in patients with mental illness and reported that, while the results of neuropsychological tests varied somewhat depending on the type of psychiatric disorder, executive dysfunction was evident and the integrated function of the frontal lobe, which controls complex cognitive and behavioral functions, was reduced compared with healthy subjects.²¹ The cognitive and behavioral decline described by Takano et al. may have affected the cognitive function to distinguish between emotional and external eating among patients, making the distinction between the two less clear than among healthy controls.

The results of this study showed that the mean BMI in the patient group was >25 for both men and women, corresponding to obesity level I (obese I) in the WHO Asian-BMI classification and the Obesity Guidelines 2016 of the Japan Society for the Study of Obesity.^{18,20} There were 40 patients in the obese I category (BMI 25.0–29.9), 22 patients in the obese II category (BMI 30.0–34.9), and 7 patients in the obese III category (BMI 35.0–39.9). The numbers of healthy controls in these same obesity categories were substantially lower (25, 4, and 1, respectively). These results are consistent with previous studies that found higher rates of obesity among patients with mental illness than among healthy controls.^{22–24} When considering the tendency toward obesity in patients with mental illness, it is necessary to consider the influence of medications (treatment) as well as eating. In particular, while atypical antipsychotics have a high therapeutic effect, they are problematic because they affect glucose metabolism and contribute to lifestyle-related diseases.²⁵ A nationwide survey conducted in Japan in 2004 by the National Council of Psychiatric Nutritionists on 7,094 outpatients attending psychiatric hospitals in various prefectures reported that 44.6% had BMI ≥ 25 .²⁴ In the current survey, 69 of 120 patients (57.5%) had BMI ≥ 25 , which is approximately 13 points higher than the national rate. According to the results of the 2010 National Health and Nutritional Survey,²⁶ Fukushima Prefecture, where the patients in this study reside, ranks third in Japan for the percentage of men with BMI ≥ 25 , at 40%. Therefore,

the influence of a lifestyle environment that predisposes people to obesity must also be considered.

Comparing DEBQ-J scale scores between subjects with BMI<25 and BMI \geq 25 showed a trend toward higher external eating scale scores in both the patient group and healthy controls group, although it did not reach significance (patients: $p=0.05$; healthy controls: $p=0.07$; Table 3). In a study investigating the relationship between medications and DEBQ in patients with schizophrenia,³ patients treated with atypical antipsychotics tended to have significantly higher external eating behavioral tendencies than those treated with multiple tranquilizers, which may make them more responsive to external eating cues and contribute to weight gain. In addition, in psychiatric outpatient nutritional guidance, patients with schizophrenia, mood (affective) disorders, and other disorders that did not continue and worsened with the results of the guidance tended to have significantly higher external eating scale scores.¹⁵ Control of external eating behavior is important in preventing the onset of type 2 diabetes and other lifestyle diseases, such as obesity, which stem from patients' eating behavior.

In other countries, researchers used the DEBQ along with other tools to explore the complex relationship between various eating behaviors and psychological conditions, such as anorexia, in university students.²⁷ The scale was also used alongside other mental health scales to assess eating tendencies in patients with various diseases receiving cognitive therapy at psychiatric wards.²⁸ The DEBQ thus served as a tool for multidimensional evaluation of health behaviors and health states among people with mental health disorders when used in conjunction with other scales. The present study is novel in that it tested the use and reliability of the DEBQ among Japanese patients with various mental health disorders. Further examination of the DEBQ-J is warranted before it can be used as a basis for dietary instructions to patients with mental illness in Japan.

The main limitations of this study are the following three points. First, outpatients were not asked the name of their primary illness, which is considered highly sensitive in Japan and thus might have decreased the participation rate in the study. Our survey was independent of the medical consultation or treatment, and patients' medical records were not checked to confirm their individual mental health conditions; therefore, the only available data relating to the mental illnesses of the patients in this study were an overall breakdown of disorders based on the records of all outpatients attending the clinic on the survey days. Patients with different mental illnesses may exhibit different eating behaviors, and detailed analysis by specific disease is an area for future research, including consideration of DEBQ factor items for patients with mental illness. Second, because the healthy controls were not screened for any

mental health-related medical history as part of the survey, there exists the possibility that some individuals in this group may have had previous or current psychiatric diagnoses, such as an eating disorder, which would affect their suitability for comparison with the patient group. Third, this analysis was based solely on questionnaire responses from patients who chose to cooperate with the survey of their own free will, whose condition and eating behaviors may not be representative of or generalizable to all patients with mental illness living in the community. There are therefore limitations in applying the results of this survey directly to all patients with mental health conditions.

Conclusions

In the DEBQ-J, the eating behavior factor structure was shown to be almost identical to the original DEBQ for healthy controls, but our analysis suggested that some questionnaire items for patients fell into different eating behavior categories. There was a tendency among patients to blur the distinction between emotional feelings, such as mental irritability and anxiety, and feelings in response to external stimuli, such as the desire to eat when there is something tasty available. The percentage of patients classed as obese (i.e., $BMI \geq 25$) was 57.5%, compared with only 25.4% classed as obese among the healthy controls. Patients with obesity tended to score higher on the external eating scale than did those with $BMI < 25$. This suggests that monitoring scores on the DEBQ-J external eating scale among patients with mental illness, and responding appropriately in cases where these scores are elevated, such as through appropriate nutritional guidance methods and collaboration across multiple health professions, may help prevent the development of obesity. The results of this study showed that two items on the external eating scale (specifically, No. 24, “If you walk past a snack bar or a cafe, do you have the desire to buy something delicious?”; and No. 32, “Can you resist eating delicious foods?”) had lower factor loadings in the patient group than in the healthy controls group. Although we left both items in the analysis for the sake of comparability with the results of the healthy controls, we believe that the factor loadings for these two items require careful consideration when using the DEBQ-J for patients, and that further research on this aspect of the DEBQ-J is warranted.

ACKNOWLEDGEMENTS

We are very grateful to Miho Suzuki, Shoichi Suzuki, Saki Marumori, Hideyuki Oshima, Miki Okuyama, and Noriko Namba for their cooperation in this study. We would like to

express our sincere gratitude to all those who took the time to answer the questionnaire. We thank Oliver Stanyon for editing this manuscript.

CONFLICT OF INTEREST AND FUNDING DISCLOSURE

There are no conflicts of interest related to this study.

This study was supported by JSPS Grant-in-Aid for Scientific Research 19K10934.

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Table 1. Basic attributes of patients and healthy controls, by sex

| Attribute | Men | | <i>p</i> | Women | | <i>p</i> |
|-----------------------------------|--------------------|----------------------------|--------------------|--------------------|----------------------------|----------|
| | Patients (n=54) | Healthy controls (n=47) | | Patients (n=66) | Healthy controls (n=74) | |
| Height (cm, mean±SD) | 171.0± 7.2 | 170.7 ±5.2 | 0.800 [†] | 156.1±8.4 | 158.8 ±5.6 | 0.025 |
| Body weight (kg, mean±SD) | 79.4±14.8 | 70.1± 10.9 | 0.001 [†] | 62.8±14.1 | 56.5±8.9 | 0.003 |
| BMI (kg/m ² , mean±SD) | 27.2±4.9 | 24.0±3.4 | 0.001 [†] | 25.7 ±5.1 | 21.8± 4.8 | <0.001 |
| BMI distribution (n, %) | | | | | | |
| <25.0 | 20 (37.0) | 31 (66.0) | 0.004 | 31 (47.0) | 60 (81.9) | <0.001 |
| 25.0–29.9 | 17 (31.5) | 12 (25.5) | | 23 (34.8) | 13 (17.6) | |
| 30.0–34.9 | 14 (25.9) | 4±8.5 | | 8 (12.1) | 0 (0.0) | |
| >35.0 | 3 (5.6) | 0 (0.0) | | 4 (6.1) | 1 (1.4) | |
| Age classification (n, %) | | | | | | |
| 10s | 2 (3.7) | 4 (8.5) | 0.015 | 2 (3.1) | 2 (2.5) | 0.011 |
| 20s | 17 (31.5) | 7 (14.9) | | 10 (15.4) | 8 (9.9) | |
| 30s | 7 (13.0) | 0 (0.0) | | 14 (21.5) | 4 (4.9) | |
| 40s | 13 (24.1) | 14 (29.8) | | 15 (23.1) | 27 (33.3) | |
| 50s | 12 (22.2) | 19 (40.4) | | 18 (27.7) | 36 (44.4) | |
| 60s and over | 3±5.6 | 3 (6.4) | | 6 (9.2) | 4 (4.9) | |

[†]p-value determined by Welch's t-test (otherwise Student's t-test).

Fisher's exact probability test used for BMI distribution and age classification

Table 2. DEBQ-J factor loadings for patients and healthy controls

| Scale name (No.) | Item | Patients | | | Healthy Controls | | | Mean and Standard Deviation (SD) | | | |
|------------------|---|--------------|-------------|-------------|------------------|-------------|-------------|----------------------------------|-----|------------------|-----|
| | | First Factor | Second | Third | First Factor | Second | Third | Patients | | Healthy controls | |
| | | External | Emotional | Restrained | Emotional | Restrained | External | Mean | SD | Mean | SD |
| E | | | | | | | | | | | |
| 15 | Do you have a desire to eat when somebody lets you down? | 0.36 | 0.48 | -0.06 | 0.82 | 0.03 | -0.08 | 2.0 | 1.2 | 1.7 | 0.8 |
| 21 | Do you have a desire to eat when you are feeling lonely? | -0.32 | 1.18 | 0.03 | 0.81 | -0.02 | -0.13 | 2.1 | 1.2 | 1.8 | 0.8 |
| 28 | Do you have a desire to eat when you are approaching something unpleasant to happen? | 0.25 | 0.57 | 0.05 | 0.80 | -0.05 | 0.03 | 2.2 | 1.2 | 1.9 | 0.8 |
| 16 | Do you have a desire to eat when you are frightened? | 0.02 | 0.64 | 0.09 | 0.78 | -0.04 | -0.16 | 1.7 | 1.1 | 1.5 | 0.6 |
| 20 | Do you have a desire to eat when things are going against you or when things have gone wrong? | 0.05 | 0.75 | -0.06 | 0.78 | 0.01 | -0.01 | 2.3 | 1.3 | 1.8 | 0.8 |
| 30 | Do you have a desire to eat when you are depressed or discouraged? | 0.18 | 0.60 | 0.05 | 0.78 | 0.03 | -0.04 | 2.2 | 1.3 | 1.8 | 0.8 |
| 22 | Do you have a desire to eat when you are emotionally upset? | -0.05 | 0.76 | -0.01 | 0.72 | -0.03 | -0.17 | 1.9 | 1.1 | 1.6 | 0.7 |
| 8 | Do you have a desire to eat when you are disappointed? | 0.60 | 0.20 | -0.19 | 0.70 | -0.02 | 0.15 | 2.3 | 1.3 | 2.0 | 1.0 |
| 27 | Do you have a desire to eat when you have nothing to do? | 0.20 | 0.56 | -0.01 | 0.33 | 0.01 | 0.50 | 2.8 | 1.3 | 2.5 | 1.1 |
| 26 | Do you have a desire to eat when you are bored or restless? | 0.33 | 0.42 | 0.10 | 0.60 | -0.07 | 0.16 | 2.7 | 1.4 | 2.4 | 1.1 |
| 4 | Do you get the desire to eat when you are anxious, worried or tense? | 0.46 | 0.29 | -0.03 | 0.51 | 0.00 | 0.21 | 2.5 | 1.4 | 2.1 | 1.0 |
| 14 | Do you have a desire to eat when you are cross? | 0.51 | 0.39 | -0.05 | 0.47 | 0.14 | 0.37 | 2.4 | 1.3 | 2.3 | 1.1 |
| 11 | Do you have the desire to eat when you are irritated? | 0.68 | 0.05 | -0.03 | 0.39 | 0.10 | 0.42 | 2.8 | 1.5 | 2.6 | 1.2 |
| R | | | | | | | | | | | |
| 17 | Do you deliberately eat less in order not to become heavier? | -0.01 | 0.06 | 0.89 | -0.13 | 0.83 | 0.06 | 3.0 | 1.3 | 3.1 | 1.1 |
| 29 | Do you deliberately eat foods that are slimming? | -0.17 | 0.13 | 0.72 | 0.06 | 0.83 | 0.00 | 2.6 | 1.3 | 3.0 | 1.2 |
| 33 | If you have put on weight, do you eat less than you usually do? | 0.10 | -0.07 | 0.82 | -0.19 | 0.79 | 0.27 | 3.2 | 1.3 | 3.1 | 1.1 |
| 23 | Do you take into account your weight with what you eat? | 0.26 | 0.00 | 0.79 | 0.01 | 0.76 | 0.01 | 3.2 | 1.4 | 2.8 | 1.2 |
| 5 | How often do you try not to eat between meals because you are watching your weight? | -0.05 | 0.04 | 0.53 | 0.03 | 0.76 | -0.20 | 2.8 | 1.2 | 2.8 | 1.1 |

E: Emotional Eating; R: Restrained Eating; Ext: External Eating.
Statement numbers (No.) shown are the order from the original DEBQ.
Factor loadings calculated by least squares method, promax rotation.
 p -values determined by Student's t -test.

[†]For this item scoring has to be reversed.

[‡]Items not equally distributed by Levene's test.

Table 2. DEBQ-J factor loadings for patients and healthy controls (cont.)

| Scale name (No.) | Item | Patients | | | Healthy Controls | | | Mean and Standard Deviation (SD) | | | |
|------------------------------|--|-----------------|-------------|-------------|------------------|-------------|-------------|-------------------------------------|-----|---------------------|-----|
| | | First Factor | Second | Third | First Factor | Second | Third | Patients | | Healthy controls | |
| | | External | Emotional | Restrained | Emotional | Restrained | External | Mean | SD | Mean | SD |
| 13 | When you have eaten too much, do you eat less than usual the following days? | -0.06 | 0.06 | 0.51 | 0.11 | 0.69 | -0.04 | 2.5 | 1.3 | 2.6 | 1.1 |
| 25 | How often in the evening do you try not to eat because you are watching your weight? | -0.14 | -0.01 | 0.61 | 0.02 | 0.66 | -0.07 | 3.4 | 1.4 | 3.4 | 1.3 |
| 3 | Do you watch exactly what you eat? | -0.03 | -0.09 | 0.63 | -0.15 | 0.61 | -0.01 | 3.0 | 1.2 | 3.3 | 1.1 |
| 1 | How often do you refuse food or drink offered because you are concerned about your weight? | 0.39 | -0.20 | 0.46 | 0.09 | 0.58 | -0.04 | 2.2 | 1.2 | 2.2 | 0.9 |
| 19 | Do you try to eat less at mealtimes than you would like to eat? | -0.13 | 0.10 | 0.58 | 0.12 | 0.57 | -0.18 | 2.9 | 1.3 | 2.8 | 1.0 |
| Ext | | | | | | | | | | | |
| 9 | If you see others eating, do you also have the desire to eat? | 0.73 | 0.05 | 0.05 | -0.13 | 0.06 | 0.89 | 2.8 | 1.2 | 3.0 | 1.0 |
| 10 | If you see or smell something delicious, do you have a desire to eat it? | 0.77 | -0.12 | 0.00 | -0.17 | -0.09 | 0.87 | 3.2 | 1.1 | 3.5 | 0.9 |
| 12 | If food tastes good to you, do you eat more than usual? | 0.78 | -0.09 | -0.09 | -0.08 | 0.00 | 0.75 | 3.3 | 1.3 | 3.5 | 0.9 |
| 6 | When preparing a meal are you inclined to eat something? | 0.43 | 0.07 | -0.06 | -0.03 | -0.09 | 0.60 | 2.5 | 1.4 | 2.9 | 1.2 |
| 7 | If food smells and looks good, do you eat more than usual? | 0.66 | 0.02 | 0.01 | 0.08 | 0.06 | 0.58 | 3.0 | 1.3 | 3.2 | 1.0 |
| 24 | If you walk past a snack bar or a cafe, do you have the desire to buy something delicious? | 0.22 | 0.22 | -0.07 | 0.00 | -0.14 | 0.55 | 2.8 | 1.3 | 3.1 | 1.1 |
| 18 | Do you eat more than usual, when you see others eating? | 0.57 | 0.17 | -0.02 | 0.25 | -0.01 | 0.55 | 2.3 | 1.2 | 2.5 | 1.0 |
| 31 | If you walk past the baker do you have the desire to buy something delicious? | 0.43 | 0.13 | 0.17 | 0.10 | 0.04 | 0.51 | 2.8 | 1.2 | 2.9 | 1.2 |
| 2 | If you have something delicious to eat, do you eat it straight away? | 0.69 | -0.08 | 0.10 | 0.04 | 0.00 | 0.46 | 3.4 | 1.2 | 3.6 | 1.0 |
| 32 [†] | Can you resist eating delicious foods? | 0.13 | 0.10 | -0.23 | -0.04 | -0.23 | 0.38 | 3.1 | 1.3 | 3.1 | 1.1 |
| Cronbach's alpha coefficient | | 0.90 | 0.92 | 0.87 | 0.91 | 0.90 | 0.87 | | | | |
| | | n | Mean | SD | n | Mean | SD | <i>p</i> | | | |
| | Restrained Eating | 120 | 2.9 | 0.9 | 132 | 2.9 | 0.8 | 0.73 | | | |
| | Emotional Eating | 120 | 2.3 | 1 | 132 | 2 | 0.6 | 0.01 [‡] | | | |
| | External Eating | 120 | 2.9 | 0.8 | 132 | 3.1 | 0.7 | 0.03 [‡] | | | |

E: Emotional Eating; R: Restrained Eating; Ext: External Eating
Statement numbers (No.) shown are the order from the original DEBQ.
Factor loadings calculated by least squares method, promax rotation
p-values determined by Student's *t*-test

[†]For this item scoring has to be reversed; [‡]Items not equally distributed by Levene's test

Table 3. DEBQ-J scores for patients and healthy controls, by BMI

| Group; Scale Name | BMI \geq 25 | | | BMI $<$ 25 | | | <i>p</i> |
|-------------------|---------------|------|-----|------------|------|-----|----------|
| | n | Mean | SD | n | Mean | SD | |
| Patients | | | | | | | |
| Restrained Eating | 69 | 2.9 | 0.9 | 51 | 2.8 | 0.9 | 0.581 |
| Emotional Eating | 69 | 2.4 | 1.0 | 51 | 2.1 | 0.9 | 0.076 |
| External Eating | 69 | 3.1 | 0.9 | 51 | 2.8 | 0.7 | 0.050 |
| Healthy controls | | | | | | | |
| Restrained Eating | 32 | 2.9 | 0.9 | 94 | 2.9 | 0.8 | 0.960 |
| Emotional Eating | 32 | 2.1 | 0.7 | 94 | 2.0 | 0.6 | 0.371 |
| External Eating | 32 | 3.3 | 0.6 | 94 | 3.1 | 0.7 | 0.073 |

Table 4. Correlation coefficients between BMI and DEBQ-J scores for patients and healthy controls

| | Restrained | Emotional | External | BMI |
|--------------------------|------------|-----------|----------|---------|
| Patients (N=120) | | | | |
| Restrained Eating | — | -0.142 | -0.128 | 0.065 |
| Emotional Eating | | — | 0.644** | 0.220* |
| External Eating | | | — | 0.289** |
| BMI | | | | — |
| Healthy Controls (N=132) | | | | |
| Restrained Eating | — | 0.057 | -0.123 | -0.007 |
| Emotional Eating | | — | 0.510** | 0.175 |
| External Eating | | | — | 0.203* |
| BMI | | | | — |

Pearson's product-rate correlation coefficient used.

* $p < 0.05$, ** $p < 0.01$