Objective. The aim of this study is to analyse associations between eating behaviour and psychological dysfunctions in treatment-seeking obese patients and identify parameters for the development of diagnostic tools with regard to eating and psychological disorders. Design and Methods. Cross-sectional data were analysed from 138 obese women. Bulimic Investigatory Test of Edinburgh and Eating Disorder Inventory-2 assessed eating behaviours. Beck Depression Inventory II, Spielberger State-Trait Anxiety Inventory, form Y, Rathus Assertiveness Schedule, and Marks and Mathews Fear Questionnaire assessed psychological profile. Results. 61% of patients showed moderate or major depressive symptoms and 77% showed symptoms of anxiety. Half of the participants presented with a low degree of assertiveness. No correlation was found between psychological profile and age or anthropometric measurements. The prevalence and severity of depression, anxiety, and assertiveness increased with the degree of eating disorders. The feeling of ineffectiveness explained a large degree of score variance. It explained 30 to 50% of the variability of assertiveness, phobias, anxiety, and depression. Conclusion. Psychological dysfunctions had a high prevalence and their severity is correlated with degree of eating disorders. The feeling of ineffectiveness constitutes the major predictor of the psychological profile and could open new ways to develop screening tools.
treatments including psychological support are essential in those patients to improve long term results and to escape from weight cycling [19–22]. Interestingly, most patients with BED start binge eating prior to the onset of dieting. The eating disorder therefore seems to be the *primum movens* leading to weight gain [23, 24]. Other psychological dysfunctions such as depression are also frequent among obese subjects [25]. Moreover, obese patients with BED present a higher prevalence and/or severity of most psychological dysfunctions than obese patients without BED [26–32]. The detection of psychological dysfunctions in obese patients is essential as these are associated with lower weight self-efficacy and limited weight loss [20, 33]. This evidence suggests that the identification of potential psychological dysfunctions is a very important step in the assessment of an obese patient, as are the detecting potential cardiovascular and metabolic comorbidities. Unfortunately, the implementation of psychological assessment is complex and time consuming and requires the use of specific questionnaires by psychologists.

Despite the fact that a number of studies already showed that binge eating in obese women is a marker for greater psychiatric morbidity, no data is available concerning potential predictive factors for the identification of psychological distress in patients who suffer from eating disorders.

Thus, the aim of this study was to analyse the associations between eating behaviour and psychological dysfunctions in obese patients searching weight loss and to identify possible predictive parameters for future development of diagnostic tools in the field of eating and psychological disorders.

2. Materials and Methods

2.1. Patient's Sampling. This work was approved by the Ethical Committee of Lausanne University Medicine School and was conducted at the Outpatient Obesity Clinic of the University Hospital of Lausanne, Switzerland. Inclusion criteria were female gender, willingness to lose weight, and agreeing to participate; as men represent less than 5% of our Obesity Clinic, it was decided to exclude them as it would be very difficult to obtain an adequate sample size. The current use of psychotropic medication was an exclusion criterion. Overall, one hundred and fifty women trying to lose weight and to control food compulsion accepted to participate.

2.2. Anthropometric Measurements and Weight History. Body weight was measured in kg with a Detecto scale with a precision of 0.2 kg; height was measured in cm with a stadiometer with a precision of 0.5 cm. For the weight the clothes and shoes were left off and for the height the shoes and socks were left off. For each parameter only one measurement was taken. BMI was calculated as weight/height squared (kg/m²). Waist circumference was taken at the smallest standing horizontal circumference between the ribs and the iliac crest using a TEC anthropometric tape (Rollfix, Hoechst Mass, Germany). Three measurements were taken with the criterion that difference between the measurements had to be less than 2 cm apart and an average of these three values was calculated. Additional measurements were taken when needed until this criterion was fulfilled.

2.3. Eating Behaviours and Eating Disorders. The eating behaviours over the last six months before evaluation were assessed by the use of a clinical specific interview and two specific questionnaires: the Bulimic Investigatory Test of Edinburgh (BITE) [36] and the Eating Disorder Inventory-2 (EDI-2) [37, 38].

Regarding the BITE scales the score used was proposed previously by Henderson and Freeman [36]: symptom score was divided in three groups: high (≥20, indicating presence of binge eating), medium (10–19, suggesting unusual eating pattern), and low (<10, being within normal limits) score; for severity scale, a score ≥5 was considered as clinically significant. For the ineffectiveness item of the EDI-2, since the absence of standardized scores, three groups were arbitrarily established for statistical analysis: low (0–5), medium (6–10), and high (≥11) score.

2.4. Psychological Profile. All patients were evaluated by the same trained psychologist with a large experience of years of practice and a specific formation in eating disorders, through three one-hour semistructured interviews. During these interviews, depression, anxiety, phobias, and assertiveness were assessed by the following questionnaires: the Beck Depression Inventory II (BDI-II) [39]; the Spielberger State-Trait Anxiety Inventory (STAI) [40], form Y (French-Canadian adaptation IASTA-Y) [41]; the Rathus Assertiveness Schedule (RAS) [42], and the Marks and Mathews Fear Questionnaire (Fear M and M) [43]. These questionnaires were used to assess characteristic attitudes and symptoms of depression, anxiety, phobia, and assertiveness and not to perform a clinical diagnosis.

The following cutoff values were used for grouping total BDI-II scores: 0–9 not depressed; 10–15 mildly depressed; 16–24 moderately depressed; ≥25 severely depressed [44]. For the STAI-Y, considering the sex and the mean age of our cohort, a value ≥40 was applied to define clinically significant symptoms of transient and enduring levels of anxiety [45–47]. For the RAS, a score ≥105 was considered representative of a low degree of assertiveness, as proposed by Bouvard and Cottraux in the French version of the questionnaire [48]. The Fear M and M questionnaire has no formal cutoff point, so the following cutoff values were defined according to Cottraux [43] in the validated French version of the questionnaire: agoraphobia ≥27 and for social phobia ≥23.

2.5. Statistical Analysis. All analysis was performed using JMP 8 statistical package (SAS Institute, Cary, NC, USA).
Results were expressed as number of patients and percentages or as mean ± standard deviation (SD). Between-group comparisons were performed using Chi-square for qualitative variables and Student's t-test or analysis of variance (ANOVA) for quantitative variables. The associations between anthropometric measurements, eating behaviours, and psychological profile were evaluated by univariate non-parametric Spearman's correlation. The associations between eating behaviours and psychological profile were further refined by Cochran-Armitage trend test and by multivariate forward stepwise regression (P value for entry is 0.05) using the scores of the psychological questionnaires (BDI-II, STAI-Y, and RAS), as dependent variables, and age, BMI, BITE score, and items score of EDI-2 as independent variables. The $R^2$ values for each final (i.e. including all significant variables) model were computed. Statistical significance was considered for $P < 0.05$.

3. Results

3.1. Patients' Characteristics. Of the 150 women, 12 (8%) were excluded from the analysis because of missing data for height ($n = 3$), waist circumference ($n = 12$), and/or STAI-Y ($n = 9$). The remaining 138 women had a mean age (±SD) of 41.4 ± 11.6 years, a mean BMI of 39.3 ± 6.4 kg/m², and a mean waist circumference of 108.6 ± 14.3 cm.

One hundred and ten (80%) of all patients had made >5 intentional weight loss attempts and 109 (79%) presented with WCS. The BMI of patient with WCS was significantly higher than in patients without WCS: 40.3 ± 7 versus 35.8 ± 4 ($P < 0.01$).

3.2. Eating Profile. The mean BITE symptom and severity scores were 18.3 ± 6.4 and 4.0 ± 3.3, respectively. Almost half of the patients (48.6%) had a high (>20) BITE symptom score, and 41% of them had a clinically significant BITE severity score. No correlations were found between the questionnaire scores and age or BMI or waist circumference of the patients. The mean scores of EDI-2's items were drive for thinness 8.9 ± 5.3; bulimia 5.2 ± 4.3; body dissatisfaction 20.8 ± 6.6; ineffectiveness 8.1 ± 6.9; perfectionism 5.7 ± 4.3; interpersonal distrust 4.0 ± 3.8; interpersonal awareness 7.6 ± 5.8; maturity fears 3.8 ± 4.1; asceticism 5.9 ± 3.2; impulse regulation 4.0 ± 4.4; social insecurity 5.6 ± 4.4.

3.3. Psychological Profile. The psychological profile of the patients is summarized in Table 1. Over half of the patients showed moderate (26%) or major (35%) depressive symptoms. Clinically significant signs of enduring levels of anxiety were found in 77% of patients, and a low degree of assertiveness was found in approximately half of the patients. Agoraphobia was identified in about 4% of patients and social phobia was identified in 20%. Conversely, no differences in BMI and waist circumference were found within all subclasses of the different psychological groups evaluated by the four questionnaires.

3.4. Association between Eating Behaviours and Psychological Profile. No correlations were found between psychological markers and age or BMI, while strong positive correlations were found between psychological markers and BITE components. Similarly, strong correlations were found between psychological markers and most EDI-2 components, namely, ineffectiveness, social insecurity, interpersonal regulation, and impulse regulation (Table 2).

The results of the stepwise regression analyses using psychological (BDI-II, STAI-Y State-Trait, and RAS) scores as dependent variables and the scores of BITE and EDI-2 items and age as independent variables are summarized in Table 3. Overall, depression and anxiety were associated with BITE symptom score and EDI-2 ineffectiveness score, while anxiety was associated with BITE severity score and EDI-2 ineffectiveness score. In all models, EDI-2 ineffectiveness score was the variable most related with psychological scores, and in all models the percentage of variance explained was over 30%, with a value >50% for the Beck Depression score (Table 3).

The results of the different psychological questionnaires (BDI-II, STAI-Y State-Trait, RAS, and Fear M and M anxiety-depression and social phobia items) according to the BITE symptoms categories and EDI-2 ineffectiveness groups are summarized in Figures 1 and 2. Depression scores as well as the number of patients presenting with major depressive symptoms increased with high severity at BITE symptoms; similarly, STAI-Y Trait score and prevalence of patients presenting clinically significant symptoms of anxiety also increased with high severity of assertiveness. Finally, RAS scores increased with high severity of BITE symptoms while a borderline significant ($P$ value <8%) trend was found for the prevalence of a high degree of the assertiveness (Figures 1 and 2).

4. Discussion

This study confirms that obese women with an obesity level 2 and seeking weight loss present high prevalence of typical psychological characteristics especially depressive and anxious symptoms and a low degree of assertiveness. These results are compatible with those shown in the literature [25, 49–56].

The prevalence and the severity of eating disorders and of psychological dysfunctions were not correlated with the degree and type of obesity. In a previous study, Onyike et al. [57] reported a positive correlation between major depression and obesity. However, they analyzed data from the Third National Health and Nutrition Examination Survey, which included underweight and obese subjects. Ahlberg et al. [58] also documented a significant correlation between depressive and anxious symptoms and abdominal distribution of body fat, but not with degree of obesity, and Hill and Williams [59] showed that a higher severity of the obesity was not bound with a higher frequency of psychological disorders.

On the other hand the prevalence and severity of depression, anxiety, and assertiveness increased according to the degree of eating disorders. Several studies showed that obese patients with BED presented with a higher prevalence and/or severity of most of psychological dysfunctions in comparison to obese patients without BED [26–32]. Didie and Fitzgibbon...
Table 1: Distribution and characteristics of patients according to psychological profile.

<table>
<thead>
<tr>
<th>Score</th>
<th>N* patients (%)</th>
<th>Age (years)</th>
<th>BMI (kg/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–9</td>
<td>37 (26.8)</td>
<td>40.9 ± 11.4</td>
<td>39.5 ± 6.7</td>
</tr>
<tr>
<td>10–15</td>
<td>17 (12.3)</td>
<td>45.2 ± 11.6</td>
<td>39.0 ± 8.6</td>
</tr>
<tr>
<td>16–24</td>
<td>36 (26.1)</td>
<td>40.7 ± 10.2</td>
<td>39.8 ± 6.5</td>
</tr>
<tr>
<td>≥25</td>
<td>48 (34.8)</td>
<td>40.9 ± 12.7</td>
<td>38.9 ± 5.3</td>
</tr>
</tbody>
</table>

Test (P value)

- BDI-II ≤39: 0.98 (0.40)
- BDI-II ≥40: 0.10 (0.96)
- STAI-Y State ≤39: 0.19 (0.67)
- STAI-Y State ≥40: 0.01 (0.91)
- STAI-Y Trait ≤39: 0.12 (0.73)
- STAI-Y Trait ≥40: 0.01 (0.96)
- RAS <105: 0.31 (0.76)
- RAS ≥105: 1.49 (0.14)
- Fear M and M Agoraphobia ≤26: 0.82 (0.37)
- Fear M and M Agoraphobia ≥27: 0.13 (0.71)
- Social phobia ≤22: 4.93 (0.03)
- Social phobia ≥23: 0.79 (0.38)

Results are expressed as number of subjects and percentages or as mean ± standard deviation. BMI: body mass index; BDI-II: Beck Depression Inventory II; STAI-Y: Spielberger State-Trait Anxiety Inventory, form Y; RAS: Rathus Assertiveness Schedule; Fear M and M: Marks and Mathews Fear Questionnaire.

Table 2: Spearman’s correlations between anthropometric parameters, eating behaviour, and psychological profile.

<table>
<thead>
<tr>
<th></th>
<th>BDI-II</th>
<th>STAI-Y State</th>
<th>STAI-Y Trait</th>
<th>RAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>−0.102NS</td>
<td>−0.084NS</td>
<td>−0.150NS</td>
<td>0.026NS</td>
</tr>
<tr>
<td>BMI</td>
<td>−0.003NS</td>
<td>0.041NS</td>
<td>−0.005NS</td>
<td>−0.104NS</td>
</tr>
<tr>
<td>Waist circumference</td>
<td>0.027NS</td>
<td>−0.166NS</td>
<td>−0.008NS</td>
<td>0.006NS</td>
</tr>
<tr>
<td>BITE Symptom</td>
<td>0.374***</td>
<td>0.398***</td>
<td>0.338***</td>
<td>0.275***</td>
</tr>
<tr>
<td>BITE Severity</td>
<td>0.261**</td>
<td>0.314***</td>
<td>0.283***</td>
<td>0.184*</td>
</tr>
<tr>
<td>EDI-2 Ineffectiveness</td>
<td>0.677***</td>
<td>0.616***</td>
<td>0.709***</td>
<td>0.548***</td>
</tr>
<tr>
<td>Interpersonal distrust</td>
<td>0.221*</td>
<td>0.088 NS</td>
<td>0.333***</td>
<td>0.234**</td>
</tr>
<tr>
<td>Desire for thinness</td>
<td>0.291***</td>
<td>0.375***</td>
<td>0.294***</td>
<td>0.133 NS</td>
</tr>
<tr>
<td>Bulimia</td>
<td>0.335***</td>
<td>0.292***</td>
<td>0.285***</td>
<td>0.322***</td>
</tr>
<tr>
<td>Body dissatisfaction</td>
<td>0.105 NS</td>
<td>0.250**</td>
<td>0.251**</td>
<td>0.200*</td>
</tr>
<tr>
<td>Perfectionism</td>
<td>0.190*</td>
<td>0.218*</td>
<td>0.162 NS</td>
<td>0.082 NS</td>
</tr>
<tr>
<td>Interoceptive awareness</td>
<td>0.564***</td>
<td>0.486***</td>
<td>0.488***</td>
<td>0.438***</td>
</tr>
<tr>
<td>Maturity fears</td>
<td>0.304***</td>
<td>0.265**</td>
<td>0.360***</td>
<td>0.115 NS</td>
</tr>
<tr>
<td>Asceticism</td>
<td>0.260**</td>
<td>0.366***</td>
<td>0.262**</td>
<td>0.232**</td>
</tr>
<tr>
<td>Impulse regulation</td>
<td>0.461***</td>
<td>0.387***</td>
<td>0.472***</td>
<td>0.315***</td>
</tr>
<tr>
<td>Social insecurity</td>
<td>0.576***</td>
<td>0.462***</td>
<td>0.565***</td>
<td>0.437***</td>
</tr>
</tbody>
</table>

BMI: body mass index; BITE: Bulimic Investigatory Test of Edinburgh; EDI-2: Eating Disorder Inventory-2; BDI-II: Beck Depression Inventory II; STAI-Y: Spielberger State-Trait Anxiety Inventory, form Y; RAS: Rathus Assertiveness Schedule. Statistical analysis by Spearman’s rank correlations: NS not significant; *P < 0.05; **P < 0.01; ***P < 0.001.
showed that eating disorders account for psychological dysfunction independently of weight status and Fassino et al. [27, 28] showed that obese patients with eating disorders were at higher risk of being diagnosed with personality disorders and concluded that the presence of binge eating in obese women is a marker for greater medical and psychiatric morbidity. Particularly Behar et al. [61] showed that a lack of assertiveness was a significant trait in patients with eating disorders and may be considered as a predictive factor in the development of an eating disorder and Elfhag [62] showed that a lack of assertiveness characterized obese patients with more problematic eating behaviours and that a greater self-assertiveness was found in patients with a relatively more efficient eating strategy.

Furthermore Iliceto et al. [63] showed that overweight or obese women have higher scores on the EDI-2 subscales and Villarejo et al. [64] showed that obese women with BED had still higher scores on some EDI-2 subscales compare with obese women without BED or control group with normal weight. In another study Barry et al. [65] found also that
patients with BED differ also in subscale of EDI-2. This variation was bound to the presence of BED but not with the obesity.

Stepwise regression analyses of eating status and psychological profile identified the ineffectiveness score of the EDI-2 as the major determinant of each of the questionnaires used (BDI-II, STAI-Y, and RAS). This is the most relevant and new finding of this work. In fact, for the first time, a potential predictive parameter for the identification of psychological distress has been recognized.

This finding has clinical implications in the health care of obese patients. Indeed, in order to recognize patients at risk of psychological dysfunctions, the first step in patient’s evaluation should include a specific interview focusing on emotional behavioral aspects, such as body dissatisfaction, ineffectiveness, or perfectionism, for example. The development of such a questionnaire based on these emotional behavioral aspects could complement the interview and generate a promising data basis to conduct longitudinal cohort studies comparing results of long-term weight loss depending on different screening methods.

From a psychopathological point of view, these results (high ineffectiveness score, low interoceptive awareness, and impulsivity among obese) are in line with Hilde Bruch
Table 3: Multivariate analysis of the associations between eating behaviours and psychological profile.

<table>
<thead>
<tr>
<th></th>
<th>BDI-II</th>
<th>STAI-Y State</th>
<th>STAI-Y Trait</th>
<th>RAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td>0.150</td>
</tr>
<tr>
<td>BITE</td>
<td></td>
<td></td>
<td></td>
<td>0.222</td>
</tr>
<tr>
<td>Symptom</td>
<td>0.222</td>
<td></td>
<td></td>
<td>0.190</td>
</tr>
<tr>
<td>Severity</td>
<td></td>
<td>0.188</td>
<td>0.199</td>
<td></td>
</tr>
<tr>
<td>EDI-2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ineffectiveness</td>
<td>0.653</td>
<td>0.636</td>
<td>0.651</td>
<td>0.495</td>
</tr>
<tr>
<td>Interpersonal distrust</td>
<td>-0.149</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R² of model</td>
<td>0.546</td>
<td>0.400</td>
<td>0.478</td>
<td>0.323</td>
</tr>
</tbody>
</table>

Statistical analysis by forward stepwise linear regression. BITE: Bulimic Investigatory Test of Edinburgh; EDI-2: Eating Disorder Inventory-2; BDI-II: Beck Depression Inventory II; STAI-Y: Spielberger State-Trait Anxiety Inventory, form Y; RAS: Rathus Assertiveness Schedule. Results are expressed as standardized slope. —: not retained. The other items of the EDI-2 (desire for thinness, bulimia, body dissatisfaction; perfectionism, interoceptive awareness, maturity fears, asceticism, impulse regulation, and social insecurity) were not retained.

5. Conclusions

In conclusion this study confirms the high prevalence of psychological dysfunction such as depression, anxiety, self-affirmation, and phobia in obese women trying to lose weight and that their severity is correlated to the degree of eating disorders. In addition, the fact that the feeling of ineffectiveness constitutes the major determinant of these patients’ psychological profiles was demonstrated. This evidence opens new ways for the development of screening tools for outcome prediction in the field of eating and psychological disorders and for early and targeted intervention for patients at risk for unfavorable developments after bariatric surgery. For example, the future development of easy questionnaires based on these parameters done by patients alone at home will be a great development and a great benefit in time and in money for a better care of these patients.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

References


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