Predictors of outcome among young adult patients with anorexia nervosa in a randomised controlled trial

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Abstract
Objective: The prognosis in cases of anorexia nervosa (AN) is unsatisfactory, and it is therefore important to examine pretreatment predictors of outcome.

Methods: Female AN patients (N = 74) included in a randomised controlled trial receiving individual cognitive behavioural therapy (CBT) or family-based treatment (FBT) were included. Predictors of the outcome were explored using pretreatment eating disorder psychopathology.

Results: In the CBT group, lower levels of emotional dysregulation and greater deficits in identifying and coping with inner states were predictors of weight increase, explaining 37.7% of the variance. In the FBT group, lower interoceptive deficits predicted an increase in weight (explaining 17.7% of the variance), whereas bulimic behaviour (32.4%) and problems with emotional regulation (23.3%) were predictors of increased diagnostic symptoms.

Conclusions: Bulimic symptoms and the ability to identify and cope with emotional states appear to be important aspects that should be addressed in the treatment of young adult patients with AN.

Keywords
anorexia nervosa, BMI, outcome, prediction, young adults

1 | INTRODUCTION

Unsatisfactory recovery rates, high risk of relapse, and consequences of physiological, psychological, and social dysfunction characterise the disorder of anorexia nervosa (AN; Carter, Blackmore, Sutandar-Pinnock, & Woodside, 2004; Keel & Brown, 2010; Treasure, Claudino, & Zucker, 2010). There is no consensus regarding the definitions of recovery and remission in eating disorders (EDs), and it is difficult to draw firm conclusions about the outcome results, but the most consistent predictors associated with a better outcome are higher baseline body mass index (BMI), lower age at entry, and shorter duration of illness (Vall & Wade, 2015). However, prediction research based on randomised controlled trials (RCTs) in an AN outpa
tient setting is scarce; therefore, examining predictors of a young AN population could aid knowledge regarding treatment of different approaches.

Patients with AN can exhibit either a restrictive subtype or a combination of binging and purging. The binge/purge subtype appears to have a worse outcome, both at the end of treatment and at follow-up (Vall & Wade, 2015; Woodside, Carter, & Blackmore, 2004). The findings of a recent RCT on adults with AN support the consistent predictors (i.e., higher BMI at baseline and duration of illness). Depression was also related to BMI and recovery at end of treatment (Wild et al., 2016). Levels of ED symptoms at baseline, patient distress, and...
confidence in their ability to change predicted ED symptoms at discharge (Goddard et al., 2013). Self-image has also been found to be a predictor of outcome, especially the aspects of self-control (Birgegard, Bjorck, Norring, Sohlberg, & Clinton, 2009) and self-love, which had almost the same impact as baseline ED psychopathology at a 12-month follow-up (Forsén Mantilla, Norring, & Birgegård, in press).

Improved knowledge concerning the outcome of specific clinical characteristics could help clinicians to tailor treatment to the individual. The Eating Disorder Inventory-3 (EDI-3) is widely used for self-rating of ED psychopathology and psychological factors usually present in ED patients (Garner, 2004). The previous version, EDI-2 (Garner, 1991), has been used in a handful of studies where the subscales of the inventory served as possible outcome predictors in patients with AN. The predictive power was examined in a follow-up study of severely ill AN patients. When the subscales were analysed with respect to outcome, ineffectiveness, perfectionism, interpersonal distrust, interoceptive awareness, and drive for thinness were found to be significantly associated with a poorer prognosis 5–10 years after treatment (Bizeul, Sadowsky, & Rigaud, 2001). Levels of the EDI-2 subscales body dissatisfaction, impulse regulation, and social insecurity were found to be negatively related to outcome in adult AN patients (Schlegl, Quadflieg, Lowe, Cuntz, & Voderholzer, 2014). However, contradictory findings have also been presented, indicating that there is no association between outcome and the severity of ED symptoms or weight at admission for AN patients (Abd Elbaky et al., 2014; McIntosh et al., 2005). Psychological characteristics measured in terms of the total EDI score have also been found/reported not to predict BMI at follow-up (Wild et al., 2016). Increased ED symptoms and general psychopathology have also been shown to predict dropout from treatment (Wallier et al., 2009), as have lower restraint, high worry about weight, and increased maturity fears (Woodside et al., 2004).

The findings regarding the outcome of treatment for AN in adults are thus inconclusive. This could be explained by differences in the definition of outcome used in the various studies (Vall & Wade, 2015; Watson & Bulik, 2013). However, weight gain is the primary outcome variable in most treatment efficacy studies (Bulik, Berkman, Brownley, Sedway, & Lohr, 2007), and weight restoration is an important factor in recovery, because maintaining an abnormally low weight requires restrictive eating, which affects social interactions, as well as physical and psychological factors (Fairburn & Harrison, 2003). Weight is an objective measure and can be compared across studies. Weight restoration and reduction of ED psychopathology are important aspects of remission (American Psychiatric Association [APA], 2013).

If we can better understand the predictors of treatment response, guided decisions on the choice of treatment and personalised approaches could be used to target specific factors and reduce the risk of protracted illness. The main purpose of this study was, therefore, to explore predictors of change in BMI and improved ED psychopathology in young adult women with AN. First, we wanted to explore the importance of possible clinical ED-specific characteristics measured with a self-reporting questionnaire capturing several of the predictors previously found to affect outcome, that is, concerns regarding body shape and weight, low self-esteem, interpersonal problems, and bingeing/purging behaviour. Second, we wanted to ascertain whether specific symptoms were related to outcome when using two different treatment approaches: cognitive behavioural therapy (CBT) and family-based treatment (FBT).

2 | METHODS

2.1 | Subjects and procedures

The participants included in this study were female patients with AN who were taking part in an RCT conducted in Gothenburg, Sweden The Gothenburg Anorexia nervosa Study. This study was a single-centre study evaluating the efficacy of CBT and FBT in an outpatient setting for young adult women with AN (Nyman-Carlsson et al., 2016). The participants and their parents were consecutively recruited during the period 2006–2011 when seeking treatment at the Anorexia and Bulimia Unit of the Sahlgrenska University Hospital. Informed consent was obtained from all participants, and written consent was required from the patients themselves or their parents/guardians in the case of minors. Further inclusion criteria were age between 17 and 24 years with an AN diagnosis according to the Diagnostic and Statistical Manual of Mental Disorders, fourth edition (DSM-IV; APA, 2000), except for criterion D (amenorrhoea) following the fifth edition of the DSM (APA, 2013). Patients with ongoing psychotherapeutic and/or psychotropic treatments were included but only if the psychopharmacological treatment was discontinued, because the study aim was to evaluate the effect of the specific psychotherapy and to reduce the risk of weight gain as a side effect of medication. Patients could receive psychopharmacological treatment during treatment, and this is reported as adverse events and reported in Section 3. Patients were excluded if they were in critical medical status in need of acute care, had current suicidal thoughts/behaviour, or were currently abusing alcohol/substance. If participants who are 18 years or older did
not accept their parents' participation, or if parents themselves chose not to take part, the patient/family was not included in the study.

As the general aim of the study was to examine a study population in a naturalistic context, we used generous inclusion criteria that match the true population. Therefore, measures of co-morbidity were not included. It can be difficult, especially in underweight patients, to determine whether another psychiatric illness is present or if the symptoms are secondary to the eating problem and the starvation per se. We wanted to avoid measuring conditions secondary to the ED such as depression, anxiety, compulsion, and personality traits. These symptoms may resemble autism spectrum disorders and disappear to a large extent during treatment/weight gain.

A total of 78 patients were assessed in the present study and randomised, using closed envelopes, to one of two kinds of treatment, but four patients withdrew and were considered external dropouts. The remaining 74 patients were equally distributed between the CBT group (n = 37) and the FBT group (n = 37). The age range for inclusion was 17–25 years, and the mean age of the participants in GANS was 18.91 (1.95) years. The participants had a mean BMI pretreatment of 16.44 (0.88) units. The Ethics Committee of Gothenburg approved the study (Reg. No. 123-05), and the trial is registered at http://www.isrctn.com (ISRCTN25181390).

Research staffs were responsible for recruitment and provided the patients and parents with information concerning the study and the assessment procedure. The participants were assessed pretreatment, and postassessment was performed after 18 months. All patients completed the postassessment. No significant differences were found between the two groups in age, duration of illness (months), previous psychotherapy, civil or marital status, or family situation (Table 1).

CBT was based on the transdiagnostic therapy for EDs: CBT-E (Fairburn, 2008). When the study was initiated, no manual for CBT-E had been published, and a specific manual was drawn up on the basis of available information. The treatment includes a maximum of 60 1-hr sessions divided into four phases over 18 months. In Phase 1, the therapist focuses on alliance, motivation, and treatment formulation. Phase 2 is a short transition phase for evaluation and planning, and Phase 3 is the main working phase. The sessions are held weekly, targeting the psychopathology of the ED in order to modify the patient’s dysfunctional thoughts and behavior related to eating, body image, and weight. The final phase, Phase 4, is concerned with preparing the patient for life without treatment and maintaining the changes achieved. The CBT used in this trial differs from the original treatment manual of CBT-E (Fairburn, 2008) regarding number of sessions. For underweight patients, the

<table>
<thead>
<tr>
<th>Variable</th>
<th>CBT (n = 37)</th>
<th>FBT (n = 37)</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td>19.10 (1.91)</td>
<td>18.70 (1.98)</td>
<td>0.895</td>
<td>0.374</td>
</tr>
<tr>
<td>BMI units</td>
<td>16.52 (0.82)</td>
<td>16.59 (1.0)</td>
<td>-0.337</td>
<td>0.737</td>
</tr>
<tr>
<td>Duration of the eating disorder (months)</td>
<td>34.05 (29.63)</td>
<td>28.86 (28.66)</td>
<td>0.766</td>
<td>0.446</td>
</tr>
<tr>
<td>Number of previous treatments (N)</td>
<td>1.37 (1.58)</td>
<td>1.18 (1.04)</td>
<td>0.605</td>
<td>0.547</td>
</tr>
<tr>
<td></td>
<td>N (%)</td>
<td>N (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psychopharmacological treatment</td>
<td>6 (16.2%)</td>
<td>2 (5.4%)</td>
<td></td>
<td>0.261</td>
</tr>
<tr>
<td>Civic status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>27 (73%)</td>
<td>26 (70%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Housing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Living with parents</td>
<td>28 (73.7%)</td>
<td>31 (77.5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Living alone</td>
<td>2 (5.2%)</td>
<td>4 (1%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cohabiting</td>
<td>7 (18.4%)</td>
<td>4 (1%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>1 (2.6%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parents divorced</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>27 (71.1%)</td>
<td>22 (55%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>11 (28.9%)</td>
<td>18 (45%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. BMI: body mass index; CBT: cognitive behavioural therapy; FBT: family-based treatment.

*Fisher’s exact test.
CBT-E recommends up to 40 sessions, and we used 60 sessions as a maximum. This could have an impact on comparing outcome because patients receive more treatment over a longer time period than the CBT-E as it is formulated today.

The FBT manual was based on the Maudsley model that has support of being effective for young patients (Lock, 2001). The treatment consists of a maximum of forty 90-min sessions also divided into four phases over a maximum of 18 months. During the first 10 weeks (Phase 1), the therapist focuses on the parents, and ways in which they can help their daughter to eat, regardless of whether they live together or not. During the second phase, achievements are summarised, and further treatment is planned during two sessions. The aim of Phase 3 is to give the patient more responsibility for her own weight restoration and development, whereas the final phase focuses on relationships and establishing functional family relations. More detailed information on the GANS recruitment, randomisation procedure, and treatment manuals can be found elsewhere (Nyman-Carlsson et al., 2016).

2.2 Measures

EDI-3 was used to measure ED symptoms and the psychological traits commonly associated with an ED. It is a widely used self-reporting measure consisting of 91 items divided into 12 primary subscales, three ED risk subscales that measure ED symptoms (i.e., drive for thinness, bulimia, and body dissatisfaction) and nine that measure general psychological symptoms (i.e., low self-esteem, personal alienation, interpersonal insecurity, interpersonal alienation, interoceptive deficits, emotional dysregulation, perfectionism, asceticism, and maturity fears). These 12 subscales can be merged into six composite scales consisting of combinations of two or more of the separate subscales, where the three eating-related subscales constitute the ED risk composite and the nine nonpsychological scales constitute the general psychological maladjustment composite. The EDI-3 has recently been validated for Danish and Swedish use with satisfactory factor structure and reliability and was found to discriminate well between ED patients and normal controls (Claussen, Rosenvinge, Friborg, & Rokkedal, 2011; Nyman-Carlsson, Engstrom, Norring, & Nevonen, 2015).

The Rating of Anorexia and Bulimia Interview—revised version (RAB-R) is a Swedish semistructured interview used for clinical and research purposes for a wide range of ED symptoms and related psychopathology. RAB-R can generate operational DSM-IV diagnoses. The majority of items are scale rated and formulated as questions. The assessor answer each item on the basis of

the information from the interview with the patient. It has been shown to have good psychometric properties (internal consistency, interrater and test–retest reliability, criterion and convergent validity; Nevonen, Broberg, Clinton, & Norring, 2003).

The relative change in BMI from pretreatment to posttreatment was corrected for individual differences using standardised residuals (Steketee & Chambless, 1992). One participant in the CBT group was excluded as her postassessment BMI was missing. High values of BMI change indicate a positive outcome.

Research has suggested that improved eating habits and body image are related to a good outcome (Carter et al., 2004; Karlsson, Clinton, & Nevonen, 2013). Combining three questions from the RAB-R follow-up interview formed a diagnostic index associated with weight phobia, body image, and eating habits. The aim of this index was to measure key characteristics and behaviour associated with AN. High values of the diagnostic index indicate more eating-related symptoms. Each question was z-transformed to take into account the different response scales of each item. Cronbach’s $\alpha$ for the diagnostic index was 0.67, which was deemed to be satisfactory for the current purpose (Bland & Altman, 1997). The index has not previously been used, and the borderline level alpha indicates that one must interpret the result cautiously.

2.3 Data analysis

To reveal possible differences in sociodemographic and clinical characteristics between the CBT and FBT groups, $t$ tests and Fischer’s exact test were used. Multiple stepwise regression was used for the main analysis, where the predictive variables were the scores on the 12 EDI-3 subscales at pretreatment and the dependent variables were the change in BMI and a postassessment on the diagnostic index, described below. Multiple regression analysis was then performed in several steps to find predictors of treatment outcome postassessment, measured as the change in BMI and the diagnostic index. In an initial exploratory analysis, stepwise regression was used to examine the ED risk subscales as possible predictors of outcome in the whole group. A separate regression analysis was then carried out for the CBT and FBT groups to determine whether there were different predictors in each group. The same procedure was adopted for the psychological problem subscales.

Bivariate outliers were identified using jack-knife residuals: studentized deleted residuals distributed as $t$ with $df = n - k - 2$, where $k$ is the number of predictors, thus controlling for the number of predictors. Values greater than the critical value of $t$ for $p < 0.05$ in each
regression for each group were excluded (Kleinbaum, Kupper, & Muller, 1988). The explained variance, expressed as percent, is presented as $r^2$. Analyses were performed using SPSS Statistics 21.0.

A variable that is significant in a stepwise regression model may be nearly significant in another. This increases the risk of overinterpreting differences between groups. We therefore investigated direct contrasts between groups regarding regression slopes of the predictors that were significant in the stepwise regression models (i.e., whether predictor slopes were significantly different in the respective treatments). We used postestimation contrasts of average marginal effects (the “margins” command in Stata 14.2 for Mac) with the significant predictors in the stepwise models prior to testing interactions (i.e., for BMI change, both interoceptive deficits and emotion dysregulation were included when testing each respective slope difference using margins syntax). As age and duration of disease have been established as consistent predictors of outcome, and as they correlate highly in this sample, we adjusted for duration because it had the highest zero-order correlation with outcome.

3 | RESULTS

No significant differences were found in pretreatment clinical characteristics or measures upon comparing the EDI-3 scores between participants in the CBT and FBT groups (Table 2).

<table>
<thead>
<tr>
<th>Variable</th>
<th>CBT (n = 37)</th>
<th>FBT (n = 37)</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDI-3 eating disorder risk subscales</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drive for thinness</td>
<td>17.43 (8.33)</td>
<td>16.19 (7.55)</td>
<td>0.672</td>
<td>0.504</td>
</tr>
<tr>
<td>Bulimia</td>
<td>5.24 (6.62)</td>
<td>3.89 (6.33)</td>
<td>0.897</td>
<td>0.373</td>
</tr>
<tr>
<td>Body dissatisfaction</td>
<td>22.97 (11.61)</td>
<td>22.46 (8.88)</td>
<td>0.214</td>
<td>0.831</td>
</tr>
<tr>
<td>Psychological subscales</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low self-esteem</td>
<td>11.73 (6.96)</td>
<td>11.73 (5.25)</td>
<td>0.000</td>
<td>1.0</td>
</tr>
<tr>
<td>Personal alienation</td>
<td>11.95 (5.98)</td>
<td>10.24 (5.21)</td>
<td>1.305</td>
<td>0.196</td>
</tr>
<tr>
<td>Interpersonal insecurity</td>
<td>10.49 (6.06)</td>
<td>10.24 (5.24)</td>
<td>0.185</td>
<td>0.854</td>
</tr>
<tr>
<td>Interpersonal alienation</td>
<td>9.16 (4.96)</td>
<td>8.19 (4.17)</td>
<td>0.913</td>
<td>0.364</td>
</tr>
<tr>
<td>Interoceptive deficits</td>
<td>18.19 (7.57)</td>
<td>15.38 (6.09)</td>
<td>1.759</td>
<td>0.083</td>
</tr>
<tr>
<td>Emotional dysregulation</td>
<td>8.32 (5.89)</td>
<td>6.76 (4.18)</td>
<td>1.319</td>
<td>0.191</td>
</tr>
<tr>
<td>Perfectionism</td>
<td>10.16 (4.75)</td>
<td>10.35 (4.69)</td>
<td>−0.172</td>
<td>0.864</td>
</tr>
<tr>
<td>Asceticism</td>
<td>10.65 (6.64)</td>
<td>8.16 (4.45)</td>
<td>1.892</td>
<td>0.063</td>
</tr>
<tr>
<td>Maturity fears</td>
<td>12.59 (6.43)</td>
<td>13.41 (6.41)</td>
<td>−0.543</td>
<td>0.589</td>
</tr>
</tbody>
</table>

Note. CBT: cognitive behavioural therapy; EDI-3: Eating Disorder Inventory-3; FBT: family-based treatment.

After the exclusion of outliers ($n = 12$), as seen in Table 2, stepwise regression was carried out for the whole group using the three ED risk subscales and the nine psychological subscales. No variables were related to either measure of outcome. A higher degree of bulimia was related to poorer outcome on the diagnostic index in the FBT group, explaining 32.4% of the variance, when examining the groups separately. In the CBT group, none of the eating-related subscales were related to outcome in terms of the diagnostic index or change in BMI.

Two of the psychological subscales were related to change in BMI in the CBT group: lower emotional dysregulation and higher interoceptive deficits being related to a better outcome. No predictors were related to the diagnostic index in the CBT group. In the FBT group, interoceptive deficits predicted outcome in terms of the change in BMI, but in the opposite direction, with lower scores being related to a better outcome. Higher bulimia and emotional dysregulation scores were related to poorer outcome in terms of the diagnostic index for the FBT group (Table 3).

3.1 | Interaction analyses

Age and duration were highly correlated ($r = 0.367$, $p = 0.01$), and we therefore chose to adjust for the variable with the highest zero-order correlation with each outcome variable. We adjusted for duration for both outcomes (BMI change; $r = −0.48$, diagnostic index; $r = 0.136$).
The interaction analyses show two significant effects for the BMI change outcome variable. In the analysis when emotional dysregulation was included as a predictor, where we also accounted for interoceptive deficits, we found a significant contrast between the regression lines ($t = 2.42$, $p = 0.0184$). We also found a contrast between the groups’ regression lines when we examined interoceptive deficits as predictor for BMI change and also adjusted for emotional regulation ($t = 3.46$ and $p = 0.0010$). Interaction analyses only considering one of the predictors did not yield significant results.

Comparisons between groups with change index as outcome (where bulimia and emotional dysregulation were significant predictors in the regression models) showed no significant slope difference ($t = 0.35$, $p = 0.728$ and $t = 1.21$, $p = 0.231$, respectively).

### 3.2 | Treatment process

Adverse events included receiving intermittent inpatient/day treatment and/or psychopharmacological treatment. Nine cases (24%) in the CBT group (mean duration = 18.00 weeks, $SD = 13.8$) and eight cases (22%) in the FBT group (mean duration = 14.37 weeks, $SD = 6.50$) received intermittent inpatient/day treatment. No significant difference was found posttreatment ($p = 0.39$, $d = 0.2$) or at Follow-up ($p = 0.31$, $d = 0.33$) in BMI between groups. Eight CBT and nine FBT patients received psychopharmacological treatment during the trial, and Fisher’s exact test did not show any significant difference between patients who received psychopharmacological treatment during the trial ($p = 1.0$). Thirty-one patients had a completion rate of attending at least 75% of the total number of treatment sessions, 32% in the CBT group ($M = 31.1$, $SD = 19.2$) and 51% in the FBT group ($M = 41.2$, $SD = 17.0$) with no significant difference of received treatment hours ($p = 0.49$, $d = 0.25$).

### 4 | DISCUSSION

The present study was carried out to identify possible predictors of outcome in young adults with AN receiving individual CBT or FBT, using a self-reporting questionnaire including eating-related and psychological subscales. The outcome measures studied were change in BMI between pretreatment and postassessment and a diagnostic index postassessment. When examining predictors for the whole group, no subscales of the EDI-3 entered the equation. A separate analysis of the groups undergoing the two different forms of treatment with stepwise regression revealed different prediction models. In the CBT group, a combination of less emotional dysregulation and more interoceptive deficits predicted a positive change in BMI. Interoceptive deficits also predicted a positive change in BMI in the FBT group, but in the opposite direction, that is, an increase in BMI when patients exhibited less problems on this subscale. Symptoms of a bulimic character as well as emotional dysregulation predicted higher levels on the diagnostic index postassessment in the FBT group. Bulimic symptoms and the ability to identify and cope with inner states and emotions emerged as important aspects of treatment of young adult patients with AN in this study.

Problems associated with emotional dysregulation have been suggested to be a key component in the psychopathology of AN. Restrictive eating is a way of regulating emotions in the absence of functional regulating strategies and serves to maintain the ED (Haynos & Fruzzetti, 2011). Emotional dysregulation was found as a predictor of weight increase in the CBT group, where lower levels of pretreatment were related to a better outcome. This has been suggested in a previous study, where low levels of impulse regulation were associated with a clinically significant change in the total EDI score (Schlegl et al., 2014). The impulse regulation scale from the EDI-2 has been converted and renamed into the emotional dysregulation scale in EDI-3, which consists of

### TABLE 3 | Separate stepwise regression with predictive variables for the CBT and FBT groups

<table>
<thead>
<tr>
<th>Outcome variable</th>
<th>Group</th>
<th>EDI-3 subscale</th>
<th>$\beta$</th>
<th>$t$</th>
<th>$p$</th>
<th>$R^2$ (adjusted $R^2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI change</td>
<td>CBT</td>
<td>Emotion dysregulation$^a$</td>
<td>−0.802</td>
<td>−4.187</td>
<td>&lt;0.001</td>
<td>0.377 (0.334)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Interoceptive deficits$^b$</td>
<td>0.509</td>
<td>2.656</td>
<td>0.001</td>
<td>0.421 (0.307)</td>
</tr>
<tr>
<td></td>
<td>FBT</td>
<td>Interoceptive deficits$^c$</td>
<td>−0.421</td>
<td>−2.668</td>
<td>0.012</td>
<td>0.177 (0.152)</td>
</tr>
<tr>
<td>Diagnostic index</td>
<td>CBT</td>
<td>No predictors</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>FBT</td>
<td>Bulimia$^b$</td>
<td>0.569</td>
<td>3.856</td>
<td>0.001</td>
<td>0.324 (0.302)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Emotion dysregulation$^a$</td>
<td>0.473</td>
<td>2.986</td>
<td>0.005</td>
<td>0.233 (0.198)</td>
</tr>
</tbody>
</table>

Note. BMI: body mass index; CBT: cognitive behavioural therapy; EDI-3: Eating Disorder Inventory-3; FBT: family-based treatment.

$^a$Three outliers excluded.

$^b$Two outliers excluded.

$^c$One outlier excluded.
eight of 12 items from the impulse regulation scale (Garner, 2004). In the present study, emotional dysregulation was also found to be a predictor of outcome in the FBT group in terms of the diagnostic index. Greater difficulty in regulating emotions was linked to higher levels of ED symptoms postassessment. This subscale is intended to measure a tendency towards mood instability, impulsivity, recklessness, anger, and self-destructiveness, which are connected to impulse regulation (Garner, 2004). Associations between AN and impulse regulation have been found previously (Racine & Wildes, 2013; Svaldi, Griepenstroh, Tuschen-Caffier, & Ehring, 2012), which suggests that these patients have difficulties in regulating their emotions and exhibit a poor impulse control. Fassino, Piero, Tomba, and Abbate-Daga (2009) reported that it is important to address impulsivity because it increases the risk of dropout. Furthermore, the present study suggests that impulsivity is negatively related to outcome. However, other studies have found that a higher degree of impulsivity is a positive predictor, increasing the likelihood of recovery, although the likelihood decreased as the duration of the illness increased (Zerwas et al., 2013). It has been suggested that interventions that address deficits in emotion regulation are important in the treatment of patients with AN, as developing coping skills, such as problem solving, has a positive effect on ED psychopathology (Rowssell, MacDonald, & Carter, 2016).

Another dimension of emotional deficits is the inability to describe, respond to, or be aware of emotional inner states (i.e., alexithymia), which has been identified in patients with AN (Gilboa-Schechtman, Avnon, Zubery, & Jeczmi, 2006). The interoceptive deficit subscale measures deficits in the patient’s ability to understand, acknowledge, and respond to emotions and was found to be a predictor of outcome in both treatment groups, but in opposite directions. A greater change in BMI was predicted by a higher degree of interoceptive deficits in the CBT group and less interoceptive deficits in the FBT group. A possible explanation of this could stem from the specific treatment procedures used in CBT, in which the individual’s responses to emotional states and challenging events are particularly addressed, as are problem-solving strategies (Fairburn, 2008), which have been shown to improve outcome and weight restoration (Rowssell et al., 2016). Emotional regulation may be identified as a problem early in the treatment, and considerable effort is therefore devoted to this specific area. Level of interoceptive deficit emerges as a predictor in the same model as emotional dysregulation in the CBT group, as discussed above. Improving the patient’s ability to regulate emotions and addressing a deficit in acknowledging and responding to inner states might be helpful in the treatment. These predictors were related to a decrease in diagnostic symptoms postassessment measured with the diagnostic index. Individuals with this combination of problems might struggle through the unpleasant feelings and anxiety of fatness and weight gain by suppressing and avoiding their feelings, but when they do experience high levels of distress or anxiety, they have adequate tools to deal with them instead of trying to counteract weight gain. It might be more difficult to explore one’s own feelings and emotions in FBT, where the focus is on the functioning of the family and relationships within the family, and therefore, less deficits with emotional awareness are beneficial when receiving FBT.

Regression analysis revealed bulimia as a predictor of outcome in the FBT group, where higher scores were related to poorer outcome in terms of the postassessment diagnostic index. However, no significant interaction effect was detected between groups. No relationship was found with BMI change in the treatment groups. Previous studies on the binge/purging subtype of AN patients have shown that these patients are less likely to respond well to treatment than do restrictive patients (Vall & Wade, 2015). Zerwas et al. (2013) also reported that self-induced vomiting was a negative prognostic factor for AN patients, and reduced the likelihood of recovery, which was confirmed in the present study among patients receiving FBT. It has also been found that AN patients with bulimic behaviour have a higher probability of ending treatment prematurely (Fassino et al., 2009; Wallier et al., 2009). However, previous findings regarding underweight patients receiving CBT-E showed that dropout rates and outcome did not differ significantly between underweight AN patients exhibiting subjective/objective bulimic episodes and patients who do not engage in this kind of behaviour (Dalle Grave, Calugi, & Marchesini, 2012). The present study included patients in a treatment programme derived from CBT-E (Fairburn, 2008), which is in turn based on the evidence-based CBT for bulimia nervosa (BN; National Institute for Health and Care Excellence, 2017). CBT-BN is specifically designed to target the core psychopathology of BN. This includes developing coping skills to overcome bingeing, purging, and mood intolerance, and coping with changes in emotional states or other external circumstances without engaging in disturbed eating behaviour. The findings of Dalle Grave et al. (2012) could be an effect of treating underweight patients with the same procedures and addressing the same psychopathology irrespective of diagnosis. This is also the case in the present study regarding the CBT group but where higher scores on the bulimia subscale emerged as a predictor for worse outcome in terms of the diagnostic index in the FBT group, but not in the CBT group, and was not related to the change in
BMI in either group. This is in line with the findings of studies on baseline binge eating and purging as a negatively related predictor for weight gain when treating underweight patients with CBT-E (Calugi, Dalle Grave, Sartirana, & Fairburn, 2015; Dalle Grave et al., 2012). As the clinical characteristics before treatment were similar in both groups in the present study, it is worth considering this matter, especially because AN patients with binge/purging behaviour are more likely to suffer relapse (Carter et al., 2012).

The between-group comparisons of regression slopes for significant predictors showed that both interoceptive deficits and emotional dysregulation were significantly differently predictive of outcome in CBT and FBT when the other variable was taken into account.

When using this analysis, we can add several predictors simultaneously yet get tests of a significantly different slope in one of the regression lines resulting from the multiple regression. A potential problem is that emotional dysregulation is taken into account in the underlying regression, the regression line changed very little in the FBT group (data not shown).

It seems important to further investigate the relationship between the ability to interpret internal states and regulate emotions. Speculatively, better emotion regulation in combination with interoceptive deficits may enable increased self-regulation, that is, control of behaviour in accordance with treatment requirements, relatively “undisturbed” by inner sensations. When such sensations are, however, clearer and emotion regulation skills are less developed, interoceptive awareness may increase anxiety that interferes with weight gain, especially in CBT where patients need to take more individual responsibility for food intake.

### 4.1 | Strengths and limitations

A strength of this study is that two different kinds of treatment were included. The naturalistic setting also strengthens the translation into routine clinical settings. The data set is essentially complete with only one missing BMI postassessment, which is unusual in such a patient population. However, statistical power is still relatively low, which may have affected slope contrasts for the diagnostic index outcome variable where no significant differences were found. Possible confounding factors that might moderate predictor impact, such as treatment duration (i.e., the number of sessions), or motivation to change, were not taken into account in this study.

### 4.2 | Conclusions and clinical implications

The main aim of this study was to examine the possibility of identifying predictors of the outcome in an RCT involving young adult AN patients using a self-reported questionnaire measuring both eating-related and psychopathologic problems common in EDs. Two groups of patients, one undergoing CBT-E and the other FBT, were studied. No attempt was made to determine which kind of treatment was best suited for a specific patient or to identify the factors that could influence the process of recovery. Important findings of this study worth highlighting are that bulimic behaviour and emotional dysregulation of patients appear to be important. Poor impulse control is a typical characteristic of bulimic psychopathology, and both these difficulties were related to the outcome in patients receiving FBT. From a clinical point of view, the results indicate that FBT should focus specifically on potential bulimic symptoms, as they may have a negative effect on outcome. For patients offered CBT, it is important to pay attention to their covariation of interpretation of inner emotional states and the ability to regulate emotions. Overall, our results point to the importance of addressing the ability of young patients with AN to regulate, interpret, and express their emotions.

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