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Binge or control? : assessment of the validity, treatment and underlying mechanisms of Binge Eating Disorder

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Chapter 5

Predictors and mediators of treatment outcome in patients with Binge Eating Disorder

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Predictors and mediators of treatment

Summary

A randomized controlled trial (N=52) was conducted comparing cognitive behavioural therapy with a waiting list control group to identify mediators and predictors of treatment outcome. Reduction of weight concerns mediated abstinence of binge eating at post-treatment. Abstinence was marginally mediated by changes in eating and shape concerns, depressive symptoms and global severity of general psychopathology. Neither treatment outcome nor status at 1-year follow-up could be predicted by severity of eating disorder, comorbid psychopathology or maladaptive core beliefs at baseline or at post-treatment. The only predictor for abstinence at both post-treatment and 1-year follow-up was the coping style palliative reacting: Higher scores predicted less favourable outcomes. Lower expression of emotions at post-treatment predicted more reduction of eating disorder psychopathology at follow-up. No other patient characteristics allowing treatment-patient matching could be identified.

Introduction

Several controlled clinical trials indicate that psychological treatment leads to a significant reduction in binge eating in patients with Binge Eating Disorder (BED) compared to a waiting list control group. Reductions in the number of binge episodes after treatment reported in these studies ranged from 68 to 90% and rates of abstinence post treatment range from 40 to 87%. Reductions in the number of binge episodes in a waiting list control group reported in the studies above ranged from 8 to 22% and abstinence rates range from 0% to 19% (Dingemans et al., 2002).

In all of these controlled clinical trials, the frequency of binge eating and/or abstinence of binge eating were the primary outcome measures, though most studies also assessed comorbid symptoms or disorders such as depressive symptoms or depressive disorder by means of self-report questionnaires or structured interviews as well. However, the previously mentioned controlled clinical trials primarily looked at differences in pre- and post-treatment scores on the primary and secondary outcome measures and barely addressed these variables as possible predictors or mediators of outcome. Treatment predictors specify for whom the treatment works. Mediators on the other hand define how or why effects occur (Baron & Kenny, 1986). They identify possible mechanisms by which a treatment might achieve its effect. These mechanisms are causal links between treatment and outcome (Kraemer, Agras, Wilson, & Fairburn, 2002).

To our knowledge, only two studies have investigated possible treatment predictors in patients with BED. Wilfley et al. (2000a) examined the association of baseline comorbid axis I and II disorders with eating disorder severity at baseline, at the end of treatment, and at 1-year follow-up. Axis I psychopathology was not associated with binge eating or global eating disorder severity, whether at baseline, post treatment or 1-year follow-up. Contrary to their expectations, comorbid axis I disorders did not predict treatment outcome. However, axis II psychopathology was associated with higher levels of binge eating and overall eating pathology at baseline. The presence of cluster B personality disorders predicted significantly higher levels of binge eating at 1-year follow-up. Safer et al. (2002) found that predictors for relapse were early age of binge eating onset and greater overall dietary restraint at post treatment. To our knowledge, mediators of change in the treatment for BED have never been studied.

The aims of the present randomized controlled trial were to explore the effectiveness and to identify possible predictors and mediators of CBT for patients with BED. First, we attempted to replicate findings in previous randomized controlled trials and investigated the effectiveness of CBT versus a waiting list control group (WLC) in patients with BED. We were not only interested in the effects of treatment on reducing the frequency of binge eating but also in treatment influence on other eating disorder psychopathology, as well as comorbid psychopathology (such as general psychopathology and depressive symptoms), maladaptive core beliefs (as a measure for personality psychopathology), ineffective coping styles and body weight loss. We expected that CBT results would be superior to the WLC.

Our second aim was to investigate whether changes in coping styles, general eating disorder psychopathology, comorbid psychopathology and body weight during treatment mediate treatment outcome. During CBT patients learn to identify and correct dysfunctional cognitions (with respect to eating, weight and shape) and to avoid behaviours associated with binge eating and to replace these behaviours with healthier coping styles. Since negative affect and binge eating seem to be related (Grilo et al., 1994) we were also interested whether changes in negative affect mediate treatment outcome.

Our third aim was to investigate whether comorbid psychopathology, maladaptive core beliefs, body weight and coping styles at baseline predict treatment outcome and whether these variables predict maintenance of treatment outcome during the 1-year follow-up period. We expected that patients with more severe eating and more general psychopathology, more severe maladaptive core beliefs and more ineffective coping styles would benefit less from treatment and would be less able to maintain their treatment gains during the follow-up period.

Methods

Participants and recruitment

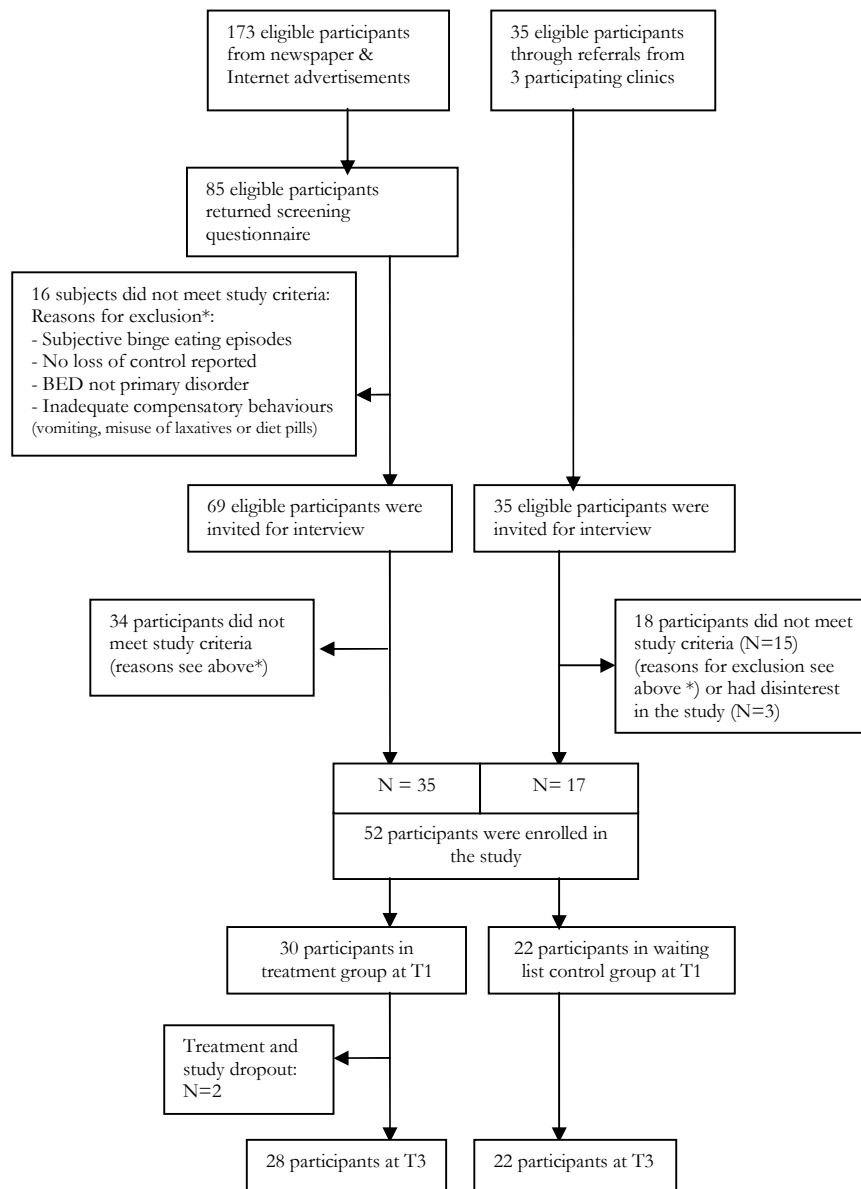
The patients included in the study had a primary diagnosis of binge eating disorder (BED) according to the DSM-IV (American Psychiatric Association, 1994). Comorbid psychiatric disorders were accepted. Patients were not admitted to the study if one of the following exclusion criteria was met: a) a current history of self-induced vomiting, misuse of laxatives, diuretics, enemas, diet pills or other weight controlling medications, fasting, or excessive exercise within the last 24 weeks, b) concurrent psychological or weight loss treatment, c) a comorbid diagnosis of psychotic disorder, self-damaging behaviours or mental deficiency, or d) pregnancy. We did not restrict our sample to those of any particular body weight.

Participants were recruited from three eating disorder centers, by advertisements in a local newspaper and via four Internet websites (see Figure 1). In total, 52 individuals (49 women and 3 men) appeared suitable and were enrolled in the study. The Medical Ethics Committee for Mental Health Institutions approved the study.

Design and procedure

The study was designed as a randomized controlled treatment trial with four assessments (baseline (T1), after ten weeks (mid-point, T2) by mail only, the end of treatment (T3) and 1 year after the end of treatment (T4)). The assessors had no therapeutic relationship with any of the participants. The assessors were blind to the group assignment.

Figure 1: Flow chart of patients in the study



Participants were recruited in four equal phases. A neutral person performed random allocation to the CBT or WLC GROUP blindly after the first assessment. After the third assessment (T3), participants in the waiting list control condition were all offered CBT.

Measures

The study used a number of assessment instruments to measure the primary and secondary outcome variables.

Eating psychopathology

The Dutch Eating Disorder Examination (Jansen, 2000) is an investigator-based, semi-structured interview format for the assessment of eating disorder specific psychopathologies. It provides a comprehensive profile of individual psychopathology based on scores from four subscales: restraint, eating concern, shape concern and weight concern. A global scale of eating pathology (mean of the four subscales) was also computed to assess overall eating psychopathology. Items are rated on 7-point forced-choice scales (0-6), with higher scores reflecting greater severity or frequency. Additionally, the EDE assesses frequency of overeating and use of extreme methods of weight control. The EDE provides frequency ratings for their occurrence in the past 28 days. The Eating Disorder Examination Questionnaire (EDE-Q) is a self-report version of the EDE interview and generates the same data and subscales (Fairburn et al., 1993a).

General Psychopathology

The Structured Clinical Interview for DSM IV axis I disorders (SCID-I) (First, Spitzer, Gibbon, & Williams, 1997; van Groenestijn, Akkerhuis, Kupka, Schneider, & Nolen, 1999) is a semi-structured interview for diagnosing the major DSM-IV axis I disorders (American Psychiatric Association, 1994). It is divided into six relatively self-contained modules: Mood episodes, psychotic symptoms, psychotic disorders, mood disorders, substance use disorders, anxiety and other disorders.

The Dutch Symptom Checklist-90 (SCL-90)(Arrindell & Ettema, 1986) presents respondents with a series of 90 physical and psychological complaints and asks them to rate each for the degree of distress associated with these complaints on a 5-point scale ranging from 0 (not at all) to 4 (extremely). The standard time frame that respondents use to rate the symptoms is the preceding 7 days. The Global Severity Index (GSI) is the average rating on all 90 items.

Depression

The Dutch version of the Beck Depression Inventory-II (BDI-II-NL) (Van der Does, 2002) contains 21 items, each with four self-evaluative statements rated on severity. The BDI-

II-NL measures severity of depressive symptomatology. The score is a simple sum of values from 0 to 3 responses. The range of possible scores is 0 to 63.

Coping

The Utrecht Coping List (UCL) (Schreurs, van de Willige, Tellegen, & Brosschot, 1993) is a Dutch questionnaire that measures coping behaviour when confronted with problems. The UCL consists of 47 items and of 7 subscales: active tackling; palliative reacting; avoiding, waiting; seeking social support; passive reacting; expression of emotions; reassuring thoughts. Participants are asked to rate their usual reaction to a range of problems or unpleasant incidents on a 4-point scale ranging from 1 (not at all) to 4 (extremely).

Maladaptive core beliefs

The Young Schema Questionnaire (YSQ) is a 205-item self-report questionnaire developed to measure 16 maladaptive core beliefs. Young (1999) hypothesized that maladaptive core beliefs are at the core of personality disorders. These core beliefs are thought to underlie all personality pathology. The items are answered on a 6-point Likert scale ranging from 1 ("totally inapplicable to me") to 6 ("describes me perfectly"). The core beliefs are grouped into four domains, according to Lee et al. (1999a). Item mean scores are calculated for each domain. A higher score indicates a more dysfunctional level of that core belief domain.

- 1) Disconnection (the sense of being unlikable or unlovable).
- 2) Impaired autonomy (expectations about oneself and the environment that interfere with one's perceived ability to separate, survive, function independently or perform successfully).
- 3) Impaired limits (deficiency in internal limits, responsibility to others or long-term goal orientation which lead to difficulty in respecting the rights of others, cooperating with others, making commitments or setting and meeting realistic personal goals).
- 4) Over-control (an emphasis on over-controlling one's feelings and choices, an emphasis on performance, duty, perfectionism and following rules).

Body mass index (BMI)

Body weight and length were measured in clothes without shoes. Body Mass Index (BMI) was calculated (body weight (kg) / height (m)²).

Suitability of and confidence in cognitive behavioural therapy (CBT)

Suitability of and confidence in cognitive behavioural therapy was measured on a 100 mm Visual Analogue Scale (VAS). A higher score indicates reflects more suitability and more confidence.

Treatment

The cognitive-behavioural therapy (CBT) was conducted on an outpatient basis. It consisted of 15 group sessions conducted over a 20-week period. The first 10 sessions were weekly and the last five sessions were biweekly. Each session lasted two hours. Two therapists trained in cognitive-behaviour therapy and with ample experience in treating eating disorders conducted all the 15 sessions. A treatment manual from the Neuropsychiatric Institute Fargo, USA was used.

CBT is semi-structured, problem-oriented, and mainly concerned with the patients' present and future rather than their past. The group CBT for BED consisted of three phases. In the first phase (sessions 1 to 7), the main goal was to develop a regular eating pattern and to resist the urge to binge eat. Patients learned to identify and correct dysfunctional cognitions and avoidance behaviours related to eating. Another goal was to replace these behaviours with healthier, self-enhancing responses. In the second phase (sessions 8 to 13) underlying problems such as body image, self-esteem, stress management, problem solving, assertiveness and weight loss issues were addressed. The third and last phase of the treatment (sessions 14 and 15) was concerned with relapse prevention after the end of treatment. Homework assignments were part of all sessions. Feedback was given on the food diaries and homework assignments. The elements, which were included in this treatment, were also present in the treatment given to participants in the study by Wilfley et al. (2002).

Statistical analysis

Differences in pre-treatment demographics and clinical variables between the two conditions (CBT and WLC) were analyzed by means of independent sample t-test or chi-square tests if appropriate

The analyses were performed on the following outcome measures: abstinence of binge eating, global eating disorder psychopathology (EDE), four subscales of the EDE, depressive symptoms (BDI), general psychopathology (SCL-90), four domains of core beliefs (YSQ), seven coping styles (UCL) and BMI.

Multilevel analysis (MLA) was used to analyze the development of each outcome measure over time. MLA is especially suitable to analyze repeated measure data because it takes into account the dependencies among observations nested within individuals. Another advantage to the methodology is its ability to handle missing data. Random coefficient models were fitted for all outcome measures, allowing for individual variation of intercepts and regression slopes. Fixed effects of Time and the interaction between Time and Condition were tested using two-tailed z-tests. We corrected for outcome variable at baseline in each analysis (Busing, Meijer, & Van der Leeden, 2005)

For the mediation analyses, the three-step process as described by Baron and Kenny was used (1986). All analyses were performed with linear or logistic regression. In the first step the criterion (outcome as measured by abstinence and global eating disorder psychopathology)

is regressed on the predictor (treatment). In the second step, the mediator (changes in coping styles, depressive symptoms, eating disorder psychopathology and general psychopathology) is regressed on the predictor (treatment). In the third and last step, the criterion (outcome) is regressed on both the predictor (treatment) and the mediator.

For the prediction analysis, all treated groups, including the participants from the former waiting list control group, were combined ($n=50$). We used regression analyses to calculate residualized change scores by statistically correcting post treatment scores (T3) for any between-participants differences on the dependent variable at baseline (T1). The same was done for the follow-up period (T3-T4). Subsequently, to determine whether there is an association between potential predictors and outcome (the residualized change scores) Pearson r correlations or t-tests were performed, when appropriate.

We corrected for multiple comparisons by using an alpha < 0.01 in all analyses.

Results

Participants: randomization and dropouts

The participants in the two conditions (CBT and WLC) did not differ in demographical or clinical variables or in any of the dependent measures at baseline except on current Axis I anxiety disorder (see Tables 1 and 2). Participants who attended ten sessions or less (i.e. less than 67% of the sessions) were considered treatment dropouts ($N=2$).

Table 1: Demographical variables at baseline

	CBT ($N=30$)	WLC ($N=22$)	Test statistics and significance
Age (years), mean \pm S.D.	38.8 \pm 10.4	36.4 \pm 11.3	$t(50) = 0.79, p = 0.43, ns$
Axis I disorders (SCID)			
Any axis I disorder, current	7 (23%)	9 (40%)	$\chi^2(1) = 1.84, p = 0.18, ns$
Any axis I disorder, lifetime	21 (70%)	16 (72%)	$\chi^2(1) = 0.05, p = 0.83, ns$
Mood disorders, current	5 (17%)	3 (14%)	$\chi^2(1) = 0.09, p = 0.54, ns$
Anxiety disorders, current	2 (7%)	7 (32%)	$\chi^2(1) = 5.6, p = 0.027$
Some previous treatment eating disorders (Including psycho-education, dietician, self-help groups)	11 (37%)	7 (32%)	$\chi^2(1) = 0.13, p = 0.78, ns$
Marital status			
Never married	8	9	$\chi^2(3) = 3.14, p = 0.37, ns$
Married/living together	16	12	
Divorced	5	1	
Widow	1	0	
Socio-economic status			
Fulltime job/education	13		$\chi^2(3) = 1.73, p = 0.63, ns$
Part-time job	7	9	
Unemployed/homemaker	2	5	
Sick leave/disabled	6	5	
Education			
High	9	11	$\chi^2(2) = 1.58, p = 0.45, ns$
Intermediate	9	4	
Low	12	8	

Table 2: MLA Effects for Time and Time X Conditions for differences on outcome measures between CBT and WLC Group (* $p < 0.01$ ** $p < 0.001$)

	Pre-treatment (T1)		Mid-treatment (T2)				Post-treatment (T3)				Test statistics and significance			
	CBT		WLC		CBT		WLC		CBT		WLC		Time	Time x Condition
	mean	S.D.	mean	S.D.	mean	S.D.	mean	S.D.	mean	S.D.	mean	S.D.	B (SE)	B (SE)
Subjective binge episodes/28 days	7.0	16.7	8.8	11.6	2.3	3.7	3.9	8.0	2.3	5.4	7.9	13.3	3.07 (1.50)	-2.40 (1.18)
Objective overeating/ 28 days	6.6	9.9	9.6	12.4	1.3	3.5	1.2	3.4	2.1	5.5	4.6	6.0	2.57 (0.93)*	-0.88 (0.71)
EDE Global	2.4	0.9	2.3	0.8	2.3	1.2	3.1	1.1	1.3	1.0	2.3	0.9	-0.58 (0.16)**	-0.60 (0.12)**
EDE Restraint	1.7	1.1	1.7	1.2	1.5	1.3	2.1	1.5	0.9	1.0	1.9	1.3	-0.21 (0.21)	-0.52 (0.17)*
EDE Eating conc.	2.0	1.2	1.8	1.2	1.6	1.1	2.6	1.5	0.9	1.1	1.6	1.1	-0.52 (0.23)	-0.56 (0.17)**
EDE Weight conc.	3.4	1.4	3.1	1.3	2.9	1.6	3.8	1.1	1.9	1.4	3.2	1.2	-0.47 (0.24)	-0.79 (0.17)**
EDE Shape conc.	2.5	1.0	2.8	1.0	3.0	1.6	3.8	1.3	1.6	1.0	2.6	1.2	-1.17 (0.23)**	-0.47 (0.15)*
Global Severity Score (SCL90)	169.3	48.0	167.2	45.6	152.1	39.7	166.8	52.0	143.6	49.0	170.0	57.7	5.08 (5.56)	-16.09 (4.85)**
Depression (BDI)	20.7	13.1	17.7	9.8	14.6	10.4	18.2	11.9	12.9	13.2	17.4	10.5	0.78 (1.41)	-3.72 (1.32)*
Coping styles (UCL)														
- Active tackling	17.5	3.5	16.5	3.5	18.1	4.4	16.8	2.9	17.7	3.9	16.3	3.3	-0.63 (0.51)	0.32 (0.41)
- Palliative reacting	19.0	2.9	19.3	3.0	18.4	3.0	19.6	3.0	18.8	3.3	18.6	2.7	-0.10 (0.53)	-0.08 (0.38)
- Avoiding, waiting	17.5	3.8	17.2	3.5	16.2	3.2	17.5	3.6	16.4	3.4	17.1	3.2	0.32 (0.46)	-0.74 (0.34)
- Seeking social support	12.1	4.3	12.6	3.3	13.1	4.1	13.5	3.9	13.7	4.4	12.7	3.6	-0.37 (0.53)	0.68 (0.43)
- Passive reacting	14.0	3.5	13.5	2.7	13.4	3.2	13.9	3.8	12.0	3.6	13.6	3.4	-0.35 (0.50)	-1.06 (0.44)*
- Expression of emotions	6.4	1.5	6.6	1.7	6.4	1.5	6.2	1.4	6.4	1.5	5.6	2.9	-0.49 (0.28)	0.43 (0.26)
- Reassuring thoughts	15.5	2.6	14.3	3.2	15.2	3.0	14.8	3.8	15.1	2.7	14.1	2.5	-0.35 (0.44)	0.03 (0.29)

Effectiveness of treatment

The mean scores on the clinical outcome measures at pre-treatment, halfway and post-treatment in both conditions and the results of the statistical tests can be found in Table 2¹. As expected, in all cases results for the CBT group were superior to the WLC group. In the CBT group, 63% ($n=19$) of the participants were abstinent for objective binge eating episodes at the end of treatment, compared to 18% ($n=4$) in the WLC group ($\chi^2 (1, N=52)=10.5$, $p < 0.001$). The frequency of objective binge eating episodes dropped by 86% in the CBT group and by 11% in the WLC group at the end of treatment compared to pre-treatment. In the CBT group the frequency of objective binge eating in the last 28 days dropped from 14.8 (± 7.8) (T1), to 3.5 (± 5.8) at mid-treatment (T2), to 2.0 (± 5.5) at the end of treatment (T3) (Wilcoxon, $z = -4.36$, $p < 0.001$). The number of objective binge eating episodes in the WLC

¹ All analyses were corrected for baseline differences between the treatment conditions

group at the three assessments was 14.7 (T1), 10.3 (T2) and 13.1 (T3) (Wilcoxon, $\chi=0.74$, $p=0.46$, ns).

Mediation analyses

As described by Baron and Kenny (1986), mediation would be suggested if 1) outcome is significantly related to treatment, 2) treatment is significantly related to changes in mediating variables, and 3) the relationship between treatment and outcome decreases (or goes to zero) when change in mediating variables is entered into the equation. As indicated above, primary outcome (abstinence) was significantly related to treatment (step 1; see table 2)) and treatment resulted in significant changes with respect to possible mediating variables such as global eating disorder psychopathology, the BDI, the Global Severity Index of the SCL-90 and the UCL subscale passive reacting. In order to execute step 3, first residualized change scores (baseline to post treatment) were calculated for the global and four subscales of the EDE, BDI, GSI-index of the SCL-90 and the UCL subscale for passive reacting. In the subsequent third step, it was investigated whether these potential mediating variables were still a significant predictor of abstinence and change scores for global eating disorder psychopathology, whereas the association between treatment and abstinence or change scores for global eating disorder psychopathology decreases (to zero) when both mediator and treatment are included in the regression equation. These analyses (see table 3) revealed only one instance of full mediation. Change in global EDE-scores during treatment was a mediator for abstinence of binge eating at the end of treatment. There was no longer a significant main effect for treatment (OR=0.43, 95% CI=0.085 – 2.18, $p=0.31$), which indicates that abstinence at the end of treatment, was totally mediated by change in eating disorder psychopathology (global EDE scale, OR=0.21, 95% CI=0.08 – 0.58, $p=0.003$). Further analysis of the four EDE subscales restraint, concerns about eating, weight and shape indicated that abstinence at post treatment was totally mediated by change in concerns about weight. Restraint did not, and concerns about eating and shape did only marginally mediate abstinence. Also, change scores on the BDI and SCL-90 only marginally mediated the effect of treatment. The UCL subscale for passive reacting did not prove to be a significant independent predictor of abstinence over and above the effect of treatment.

The same analyses were repeated with respect to the EDE conceptualized as an outcome measure: No mediators were identified.

Prediction analyses

For these analyses, the CBT group and the treated (former) WLC group were combined ($n=50$)(see Table 4). As expected, during treatment participants improved on most treatment outcome variables. At the end of treatment 70% ($n=35$) was abstinent for objective binge eating and at 1-year follow-up, 80% ($n=40$). The frequency of objective binge eating episodes dropped 90% (T1: $M=14.3$, S.D.= 10.4 and T3: $M=1.5$, S.D.= 6.5). These results are

Predictors and mediators of treatment

Table 3: Mediation analyses: Logistic regression with abstinence at post-treatment as dependent variable, and condition and changes in global scale and the four subscales of the EDE (restraint, concerns, about eating, weight and shape), BDI and SCL-90 as independent variables

		B	S.E.	Wald	df	p	OR	CI 95%
Step 1	condition	-2.051	.670	9.363	1	.002	.129	.035 – .478
Step 2	condition	-.843	0.827	1.037	1	.309	0.431	.085 – 2.180
	residual changes scores							
	EDE global	-1.565	0.524	8.912	1	.003	0.209	.075 – .584
Step 2	condition	-1.854	.718	6.671	1	.010	.157	.038 – .639
	residual changes scores							
	EDE Restraint T1-T3	-.252	.362	.485	1	.486	.777	.382 – 1.580
Step 2	condition	-1.555	.740	4.416	1	.036	.211	.05 – .901
	residual changes scores							
	EDE concerns about eating T1-T3	-1.256	.496	6.428	1	.011	.285	.108 – .752
Step 2	condition	-.842	.829	1.030	1	.310	.431	.085 – 2.189
	residual changes scores							
	EDE concerns about weight T1-T3	-1.915	.610	9.862	1	.002	.147	.045 – .487
Step 2	condition	-1.518	.788	3.714	1	.054	.219	.047 – 1.026
	residual changes scores							
	EDE concerns about shape T1-T3	-1.597	.530	9.091	1	.003	.203	.072 – .572
Step 2	condition	-1.683	.708	5.654	1	.017	.186	.046 – .744
	residual changes scores							
	BDI T1-T3	-.814	.386	4.444	1	.035	.443	.208 – .944
Step 2	condition	-1.523	.723	4.437	1	.035	.218	.053 – .900
	residual changes scores							
	SCL-90 T1-T3	-.882	.448	3.874	1	.049	.414	.172 – .996

comparable to those of the treated CBT-group in the previous analyses (CBT versus WLC) (see Table 2). Treatment success was maintained during the 1-year follow-up. Post hoc tests found no significant changes in any outcome variables during follow-up (see Table 4). Only the UCL subscale palliative reacting predicted improvement in eating disorder psychopathology during treatment. More palliative reacting (seeking distraction and trying to feel more comfortable by smoking, drinking or by trying to relax) at baseline predicted a less favourable treatment outcome at the end of treatment for eating disorder psychopathology (Pearson $r=0.36$, $p=0.01$). No other significant predictors were found. Moreover, no predictors were found for abstinence of binge eating at the end of treatment.

During the 1-year follow-up period, participants with high scores on expression of emotions (UCL) at the end of treatment (T3) improved less on eating disorder

psychopathology than participants with lower scores on this subscale (Pearson $r=0.50$, $p<0.001$). Logistic regression analyses revealed one significant predictor for abstinence for binge eating at one-year follow-up. Patients who still binged at 1-year follow-up had higher scores on the subscale UCL palliative reacting at post treatment (T3) (OR= 1.35, 95% CI= 1.06 – 1.72, $p=0.01$).

Body weight loss

During treatment no significant changes were found in BMI ($F(1,49)=2.83$, $p=0.1$). However, from baseline to one-year follow-up the total group did have a significant drop in mean BMI from 38.9 (S.D.=7.9) to 37.7 (S.D.=8.0) ($F(2,50)= 4.4$, $p=0.02$). Binge eating abstinence was significantly related to percentage body weight loss ($F(1,49)=5.7$, $p=0.02$). However, abstinence did not mediate body weight loss or vice versa. Thirty –eight percent ($n=19$) lost more than 5% of their initial body weight.

Table 4: MLA effects for Time on outcome measures for all CBT-treated participants (** $p< 0.001$ * $p<0.01$)

	Baseline		Halfway		Post-treatment		One-year follow-up		Tests and significance
	T1	T2	T2	T3	T3	T4	T4		
	M	S.D.	M	S.D.	M	S.D.	M	S.D.	Time effects, β (SE)
Objective binge eating episodes /28 days	14.3	10.4	4.1	6.5	1.5	4.4	2.6	7.1	0.008 (0.001)**
Subjective binge eating episodes/28 days	7.6	15.5	2.8	4.6	3.3	8.9	3.4	6.8	0.005 (0.001)**
Objective overeating/ 28 days	5.7	8.7	0.9	3.2	2.2	5.7	2.0	4.9	0.007 (0.001)**
Eating Disorder Psychopathology- EDE									
Global	2.4	0.8	2.2	1.1	1.3	0.9	1.3	1.0	0.007 (0.003)*
Restraint	1.8	1.1	1.6	1.3	0.9	0.9	1.0	1.1	-0.01 (0.007) ns
Eating Concerns	1.9	1.1	1.4	1.1	0.8	1.1	0.7	1.0	0.02 (0.006)**
Weight Concerns	3.3	1.3	2.8	1.5	1.8	1.3	2.0	1.5	0.02 (0.007) ns
Shape Concerns	2.6	1.1	2.9	1.4	1.6	1.0	1.6	1.2	-0.03 (0.007)**
General psychopathology									
Global Severity Score- SCL90	171	51.8	150	42.0	138	43.1	141	54.0	0.02 (0.006) **
Depression- BDI	19.6	12.2	13.3	9.6	10.3	11.5	10.8	12.7	0.005 (0.001)**
Coping styles- UCL									
Active tackling	16.8	3.4	17.6	4.2	17.1	3.6	17.6	4.1	-0.0006 (0.003) ns
Palliative reacting	18.9	2.8	18.4	3.1	18.2	3.0	17.4	3.0	0.002 (0.005) ns
Avoiding, waiting	17.4	3.6	15.9	3.1	15.9	3.3	16.0	3.8	0.10 (0.02)**
Seeking social support	12.4	4.0	13.4	3.9	14.4	5.7	13.8	3.4	-0.023 (0.02) ns
Passive reacting	14.0	3.4	13.2	3.2	11.9	3.2	12.1	3.4	0.020 (0.016) ns
Expression of emotions	6.4	1.3	6.3	1.5	6.2	1.4	6.3	1.7	0.006 (0.01) ns
Reassuring thoughts	14.9	2.6	15.2	2.9	14.7	3.0	14.9	2.6	0.03 (0.009)**

Discussion

In the present randomized controlled trial, the effectiveness and possible mediators and predictors of cognitive-behaviour therapy (CBT) in patients with Binge Eating Disorders (BED) were examined. As expected, objective binge eating frequency, eating disordered psychopathology and comorbid psychopathology decreased significantly in the CBT group whereas no reduction was found in the control (WLC) group. Mediator analyses indicated that abstinence of binge eating at post treatment was totally mediated by changes in weight concerns and marginally by changes in concerns about shape and eating, depressive symptoms and more general psychopathological symptoms. However, a note of caution is needed. Overall a rapid response to treatment can be seen, as evidenced by the substantial reduction in frequency of objective binge eating episodes during the first half of treatment. This rapid treatment response precludes the use of the approach of Kraemer et al. (2002) to study mediation of outcome in our study, because this approach requires that changes in putative mediators temporarily precede substantial changes on the outcome measures used. By using the approach of Baron and Kenny (1986) we were only able to identify correlates of outcome. Consequently, our data do not allow causal interpretations of the associations between clinical improvement and changes on putative mediators as observed in our study.

Two other studies, both using the Eating Disorder Examination Questionnaire (EDE-Q), also found evidence that concerns about weight might be a maintaining factor in BED and lead to binge eating (Cachelin et al., 1999; Pratt, Telch, Labouvie, Wilson, & Agras, 2001). Weight concerns, as well as the other marginal mediators for abstinence of binge eating are in some way related to negative affect and negative self-evaluation (Pratt et al., 2001). Binging may be a way to escape from this negative affect or negative self-evaluation (Heatherton et al., 1991). Experimental studies confirm the link between negative affect and binge eating (Agras et al., 1998; Chua et al., 2004). In treatment, patients have to learn to break the vicious spiral of dysfunctional thoughts and concerns to subsequently abstain from binge eating.

Contrary to our expectations, patient with BED benefited equally from treatment independent of the severity of their comorbid symptoms. Thus CBT might be an effective treatment for the majority of patients. However, we did find that participants with higher levels of the coping style palliative reacting (trying to feel better by eating, smoking, or drinking) at baseline and end of treatment benefited less from treatment than participants with less palliative reacting. Similar indications were found by Bloks et al. (2001) in patients with bulimia nervosa, who are similar, in many aspects, to patients with BED (Dingemans et al., 2002). High levels of expression of anger and annoyance at end of treatment were associated with less improvement than would be expected during the 1-year follow-up. As observed in previous studies patients who reacted less angry and annoyed in their emotions were better capable of maintaining treatment success (Penas-Lledo, Fernandez, & Waller, 2004; Fassino, Leombruni,

Piero, Abbate-Daga, & Rovera, 2003). Therapists should be aware of these emotions because it might be an indication for relapse.

Another notable finding is that changes in restraint did not mediate abstinence of binge eating. This result is consistent with the growing body of evidence that the association between dieting/restraint and binge eating as a factor maintaining BED does not apply to a substantial number of individuals with BED (de Zwaan, 2005b). Not restraint but negative emotional disturbances and coping deficits seem to increase the likelihood of binge eating (Grilo et al., 1994). In an experimental study Agras and Telch (1998) found that negative mood, and not caloric deprivation, significantly increased loss of control over eating, perhaps explaining the mechanism underlying the triggering of binge eating by a negative mood. During the 1-year follow-up period, the BMI of the participants decreased significantly. Our results, and those of other studies (Wilfley et al., 2002a; Agras et al., 1997a) suggest that participants who are able to stop binge eating tend to lose body weight. At follow-up, almost 40% of the participants lost 5% or more of their initial body weight, which has been associated with significant health benefits (The National Heart, 1998).

The results of the study should be considered in conjunction with a few limitations. First, the number of participants is relatively small. As a result, potential mediators or predictors could have been missed. Second, we did not take session-by-session measures of the possible mediators and outcome measures. More frequent assessments would have allowed us to perform a mediation analysis along the lines of Kraemer et al. (2002). Third, we did not assess axis II personality disorders. However, the Young Schema Questionnaire gives some indication of personality pathology. Finally, although we attempted to keep assessors blind to group assignment, this was not possible in all cases.

One of strength of this study is that we used very few exclusion criteria. Our conclusions are based on a representative sample of patients with BED. Furthermore, this is the first study, which investigated possible mediators of changes of CBT for patients with BED. Also, this is one of the few studies, which investigated possible predictors of treatment outcome in BED.

Future research on BED should focus on identifying mechanisms of treatment action and the order in which changes occur. Session-by-session assessment of behavioural and cognitive measures might shed light on maintaining factors of binge eating. This may help both to focus the substance and to improve the (cost) effectiveness of treatment.