

# Effects of inpatient treatment on compulsive exercise in adults with longstanding eating disorders: Secondary analysis from a randomized controlled trial with 12-month follow-up

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## Abstract

**Purpose:** This study aimed to examine changes in compulsive exercise among adults with eating disorders (ED) admitted for inpatient treatment in a randomized controlled trial comparing cognitive behavioral therapy (CBT) and compassion-focused therapy (CFT) and whether such changes were influenced by treatment condition, childhood trauma, or level of compulsive exercise.

**Method:** A total of 130 adults admitted to inpatient treatment for EDs mean (SD) age 30.9 (9.7) years, mean illness duration 14.2 (8.9) years, were randomized to receive CBT or CFT and analyzed using multilevel modeling. Assessments included Eating Disorders Examination – Interview, Compulsive Exercise Test and Childhood Trauma Questionnaire.

**Results:** Mean total CET score at baseline was 14.7 (4.0) with no difference between the treatment groups. A total of 63 (48.5%) had CET score  $\geq 15$ , indicating clinical levels. There was an overall time effect on reduction in CET total and all CET subscale scores except *Lack of enjoyment*, and CFT provided greater reduction compared to CBT on the CET subscale *Mood improvements*. Patients with clinical CET score levels showed greater reduction on CET total and the subscales *Avoidance*, *Weight*, and *Rigidity* across time compared to persons with non-clinical CET score. Childhood trauma did not predict changes in CET total or subscale scores.

**Discussion:** Both CBT and CFT improve overall compulsive exercise. The greater effect of CFT than CBT on exercise as a maladaptive mood regulator calls for further research on how affective oriented psychotherapies can not only reduce compulsive exercise but also promote functional exercise among persons with EDs.

**Public Significance Statement:** Understanding and addressing compulsive exercise in adults with eating disorders is crucial. This study comparing cognitive-behavioral therapy and compassion-focused therapy shows both improve compulsive exercise. Importantly, compassion-focused therapy has a greater impact as an emotion-focused regulator. This emphasizes the need for further exploration into how

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emotion-focused therapies can reduce compulsive exercise and promote healthier, functional physical activity for individuals with eating disorders.

**KEYWORDS**

cognitive behavioral therapy, compassion-focused therapy, eating disorders, outcome, randomized controlled trial

## 1 | INTRODUCTION

Compulsive exercise has been identified as one of the most common symptoms in youth with eating disorders (ED), and it is suggested as a gateway to other pathogenic behaviors such as purging and use of diuretics and laxatives (Davis et al., 1994, 2016; Stiles-Shields et al., 2012). Although compulsive exercise has been shown to be most frequent in the acute phases of the ED (Mond et al., 2006; Shroff et al., 2006), it has also been reported as a persistent behavior associated with more severe psychopathology, poorer treatment outcome, higher risk of relapse, and suicidality in persons with ED (Smith et al., 2013). The existing knowledge, as demonstrated by Gorrell et al. (2021), emphasizes a dynamic interplay between dietary restraint and compulsive exercise, and personality factors such as perfectionism and obsessive-compulsiveness are maintenance factors for compulsive exercise (Meyer et al., 2011). The current understanding of compulsive exercise in ED acknowledges its dual function in affective regulation. Exercise holds greater significance as a downregulator of distress and anxiety in individuals with ED, as opposed to its role in healthy populations, where exercise is often utilized to upregulate enjoyment, pleasure, and happiness (Bratland-Sanda et al., 2010; Lichtenstein et al., 2017; Meyer et al., 2011; Monell et al., 2018; Weinstein et al., 2015).

The same affect behavior link that is present with compulsive exercise is also strongly associated with childhood traumatic experiences among persons with EDs (e.g., Fallon & Wonderlich, 1997; Root & Fallon, 1989), yet the relationship between compulsive exercise, trauma, and ED is understudied. The scholarly discourse surrounding ED has underscored the connections between trauma and impulsive behaviors, notably encompassing actions like binge eating, purging, and self-harm. This emphasis on impulsive behaviors prevails in contrast to a comparable emphasis on compulsive behaviors (Fairburn et al., 2003; Lavender et al., 2015; Meule et al., 2021; Meyer et al., 1998). This contrasts with the evidence that obsessive-compulsive disorder and other compulsive behaviors have broad links to trauma (e.g., de Silva & Marks, 1999; Lochner et al., 2002; Ross-Gower et al., 1998).

Although a recent systematic review reported benefits of psychoeducation and adapted and supervised exercise in reducing compulsive exercise in treatment of ED, effects of various therapeutic approaches are less known (Hallward et al., 2021; Martenstyn et al., 2022). Dreier et al. (2021) used hierarchical-dimensional modeling and found compulsive exercise to be associated with various psychological traits, and thus suggested a need for more tailored treatment of compulsive exercise. A German study found a combination of cognitive behavioral therapy (CBT) and physical exercise as

supplement to regular treatment was more effective in reducing compulsive exercise in atypical anorexia nervosa compared to regular treatment alone (Dittmer et al., 2020). Although most existing studies have examined compulsive exercise in anorexia nervosa, a clinical trial on community-dwelling females with bulimia nervosa or binge eating disorder reported similar effects of CBT and supervised physical exercise and dietary therapy to reduce compulsive exercise (Mathisen et al., 2018). In the aforementioned study, the utilization of Fairburn's cognitive treatment model for ED was implemented (Fairburn, 2008), emphasizing modifying maladaptive thought patterns related to food, body image, and self-worth in order to achieve effective therapeutic outcome. None of the existing studies have reported strong effects of the various approaches on reducing compulsive exercise, and this might have to do with the need for addressing compulsive exercise as an affect regulator. The relatively newly developed treatment approach compassion-focused therapy (CFT) offers a treatment perspective that is more oriented toward affect and mood in contrast to other approaches such as CBT. Through increasing self-compassion, CFT is specially developed to cope with specific symptoms of EDs and childhood trauma (Goss & Allan, 2009, 2014; Kelly et al., 2013; Kopland et al., 2023). Controlling food and weight as a coping mechanism for, e.g., shame and self-criticism can be viewed as a loop that maintains the ED, and self-criticism is also suggested as a maintenance factor for compulsive exercise as a symptom of EDs (Meyer et al., 2011). Increasing self-compassion can be an antidote against high levels of shame and self-criticism for individuals with ED, and especially for patients with ED and a history of trauma (Lee & James, 2012) and might be a possible mechanism of change (Kopland et al., 2023). Self-compassion can be defined in multiple ways, such as sensitivity to suffering accompanied by a commitment to alleviate and prevent it (Gilbert, 2010) or relating to one's suffering with a loving, kind, and nonjudgmental attitude (Neff, 2003). Hence, there is an inherent interest in investigating whether therapeutic strategies that emphasize affect and understanding emotional processes such as CFT could provide a more precise approach to addressing the underlying causes of compulsive exercise. This interest arises in comparison to CBT which typically places a relatively greater emphasis on cognitive aspects, including thoughts and beliefs.

The overall aim of the study was twofold. First, we aimed to examine the outcome of CET total and subscale scores following inpatient treatment for longstanding EDs. The second aim was to explore whether the change in CET total and subscale scores were influenced by childhood trauma history, treatment condition (CFT or CBT) or exercise group (noncompulsive exercise group or compulsive exercise group).

## 2 | METHOD

### 2.1 | Ethical clearance and preregistration

The study was approved by the Norwegian Regional Ethical Committee (REC:2014/836) and the data protection officer at Modum Bad Psychiatric Centre. Patients gave informed consent to take part in the study. It was preregistered at [ClinicalTrials.gov](https://clinicaltrials.gov) (NCT02649114). The data presented in this study are analyses on secondary outcomes of this large clinical trial.

### 2.2 | Design

The study used a randomized controlled design, where a transdiagnostic group of patients with or without a childhood trauma history were randomly allocated to either CBT or CFT, and outcomes were measured at the start and end of treatment and at follow-up. The data collection for took part for patients admitted to treatment between the spring of 2015 to the autumn of 2018. Detailed information about the design, setting, and sample size calculation, is available from Vrabel et al. (2019).

### 2.3 | Participants

To be eligible for participation in the study, patients had to meet criteria for a DSM-IV or DSM-5 ED. The Eating Disorder Examination interview (version 12 and 17) (Fairburn & Cooper, 1993) and The Mini-International Neuropsychiatric Interview (MINI; Sheehan et al., 1998) were used to establish diagnosis. Inclusion criteria also included that the patient had to: have failed to benefit from at least one structured ED psychological outpatient or inpatient treatment; be 18 years or older and be able to provide informed consent. Patients were excluded if they had: a current DSM-IV diagnoses of organic mental disorders; clear and current suicidal risk; or evidence of current substance abuse.

Participants who were included in the trial ( $N = 137$ ) were randomized to treatment stratified on trauma. After diagnostic screening, seven patients had a loss of eligibility (five in CBT and two in CFT). The remaining 130 participants who started treatment ( $n = 65$  CBT,  $n = 65$  CFT) were included in the final analysis. Thus, the number of patients who started met the criteria for sample size ( $N = 130$ ).

Of the patients starting treatment, 17 did not complete the treatment program. Thus, 113 completed treatments ( $n = 58$  in CBT,  $n = 55$  in CFT), though all starting patients were included in the intention-to-treat (ITT) analysis. At baseline, no statistically significant differences were observed between patients who successfully completed the treatment program and those who did not in relation to various measured parameters, including EDE ( $t = .06$ , ns), CET total ( $t = .20$ , ns), Avoidance ( $t = .20$ , ns), Mood ( $t = 1.69$ , ns), Weight ( $t = 1.89$ , ns), Enjoyment ( $t = .36$ , ns), or Rigidity ( $t = .78$ , ns). A total of 126 (97%) were women, and four (3%) were men. The mean age was 30.9 years ( $SD = 9.7$ ), and the mean duration of illness was 14.2 years ( $SD = 8.9$ ). There were 33 (25%) patients who met the criteria for anorexia nervosa, 51 (39%) met the criteria for bulimia nervosa, and

46 (35%) patients had symptoms in line with atypical variants (other specified feeding and eating disorders). A total of 87 participants (67%) were either disabled, unemployed, or on sick leave when entering treatment (see Kopland et al., 2023 for more information). The fact that only a few participants were working regularly, in combination with long duration of the ED, confirm the severity and the patients' reduced functional capacity, encompassing aspects like work and education. The sample characteristics are outlined in Table 1, and Figure 1 shows the CONSORT diagram of all patients from recruitment onwards.

### 2.4 | Treatments

The treatment in both conditions was a multicomponent inpatient program, including a combination of small groups, individual, and milieu therapy lasting for 13 consecutive weeks. The treatment was closed, such that each group of eight patients started and ended treatment at the same time and the groups were not open to new patients if one or more discharged prematurely from treatment. Each patient had six sessions of 90-min group therapy per week and three sessions of 55-min individual therapy per week – two with the individual therapist and one with the milieu therapist. The group and individual sessions were based on CBT or CFT, according to condition. The therapy manuals are available upon request from the first author. In addition to the model-specific therapy, each patient participated in two 45-min supervised group physical activity sessions led by a qualified exercise professional per week. Moreover, they attended at least one 45-min individual exercise counseling session with the same professional and participated in a 60-min community group meeting weekly.

#### 2.4.1 | Common content of the two therapies

Both conditions had a focus on the working alliance, in which the therapist and the patient co-operated to overcome the ED. Underweight patients were encouraged to regain and maintain weight. Both therapeutic approaches targeted the replacement of dysfunctional eating patterns with normal eating habits and the development of strategies for resisting bingeing and purging. Patients in both groups were required to consume sufficient food to meet the body's demands for energy. Ongoing self-monitoring and the accomplishment of planned homework assignments at the hospital were stressed in order to achieve and maintain the change. Notably, patients demonstrating excessive or compulsive exercise behaviors received personalized treatment interventions, in collaboration with the treatment unit's clinical exercise physiologist. In both therapeutic conditions, compulsive exercise was viewed as a compensatory strategy, akin to behaviors such as vomiting.

#### 2.4.2 | Cognitive behavioral therapy

The version of CBT used was an adaptation of outpatient CBT for EDs, developed by Waller et al. (2007). This version used the same

TABLE 1 Sample and group characteristics at pre-treatment.

Characteristics	Total (N = 130)	CFT (n = 65)	CBT (n = 65)	Statistics	Cet cutoff <15 (n = 61) <sup>a</sup>	Cet cutoff ≥15 (n = 63) <sup>b</sup>	Statistics
Age, years (M ± SD)	30.94 (9.71)	32.62 (10.91)	29.01 (7.64)	2.01 <sup>c</sup>	32.26 (9.41)	32.83 (10.91)	.31 <sup>c</sup>
Duration of illness, years (M ± SD)	14.22 (8.91)	15.63 (9.60)	12.95 (8.12)	1.52 <sup>c</sup>			
Duration of treatment, years (M ± SD)	5.62 (5.10)	7.26 (6.02)	4.52 (3.86)	2.94 <sup>**c</sup>	4.45 (2.90)	7.16 (5.54)	1.83 <sup>c</sup>
Previous inpatient treatment n (%)	76 (58.46)	33 (50.77)	43 (66.15)	3.11 <sup>d</sup>	34 (55.73)	38 (60.32)	.20 <sup>d</sup>
Bulimia nervosa n (%)	51 (39.23)	21 (32.30)	30 (46.15)	2.61 <sup>d</sup>	22 (36.07)	25 (39.68)	.42 <sup>d</sup>
Anorexia nervosa n (%)	33 (25.38)	18 (27.69)	15 (23.08)	.36 <sup>d</sup>	15 (24.59)	17 (26.98)	.31 <sup>d</sup>
Other specified eating disorder n (%)	46 (35.38)	26 (40.00)	20 (30.76)	1.21 <sup>d</sup>	24 (39.34)	21 (33.33)	.52 <sup>d</sup>
BMI (M ± SD)	21.52 (5.25)	20.95 (5.37)	22.18 (5.67)	1.23 <sup>c</sup>	21.60 (5.69)	21.11 (5.10)	.48 <sup>c</sup>
EDE (M ± SD)	4.61 (1.19)	4.35 (1.30)	4.36 (1.10)	.11 <sup>c</sup>	4.22 (1.3)	4.45 (1.26)	1.06 <sup>c</sup>
Binging n (%)	70 (54.85)	32 (49.23)	38 (58.46)	1.13 <sup>d</sup>	36 (59.01)	32 (50.79)	.14 <sup>d</sup>
Vomiting n (%)	78 (60.00)	35 (53.85)	43 (66.15)	2.42 <sup>d</sup>	32 (52.46)	43 (68.25)	.90 <sup>d</sup>
CTQ							
Sexual abuse, mean (SD)	7.53 (5.86)	8.53 (7.18)	6.55 (4.01)	1.79 <sup>c</sup>	7.27 (6.13)	7.71 (5.67)	.42 <sup>c</sup>
Emotional abuse, mean (SD)	10.02 (5.55)	11.09 (5.57)	8.98 (5.37)	2.02 <sup>*c</sup>	9.69 (5.41)	10.50 (5.77)	.72 <sup>c</sup>
Emotional neglect, mean (SD)	18.33 (5.76)	17.39 (5.41)	19.23 (5.99)	-1.69 <sup>c</sup>	18.44 (5.96)	18.08 (5.74)	.32 <sup>c</sup>
Physical abuse, mean (SD)	6.35 (3.11)	6.59 (2.88)	6.11 (3.31)	.81 <sup>c</sup>	6.13 (2.32)	6.52 (3.68)	.62 <sup>c</sup>
Physical neglect, mean (SD)	12.27 (1.97)	12.44 (2.27)	12.11 (1.63)	.89 <sup>c</sup>	12.62 (2.13)	11.96 (1.81)	1.72 <sup>c</sup>
CET							
Total	14.69 (4.02)	14.67 (3.77)	14.71 (4.29)	-.05 <sup>c</sup>	11.41 (2.73)	17.77 (2.02)	14.61 <sup>***c</sup>
Avoidance	2.84 (1.43)	2.89 (1.40)	2.80 (1.48)	.34 <sup>c</sup>	1.78 (1.07)	3.83 (.90)	11.41 <sup>***c</sup>
Weight	3.33 (1.20)	3.35 (1.17)	3.32 (1.23)	.10 <sup>c</sup>	2.62 (1.16)	4.03 (.73)	8.01 <sup>***c</sup>
Enjoyment	1.86 (1.18)	1.67 (1.09)	2.03 (1.23)	-1.74 <sup>c</sup>	1.71 (.99)	1.98 (1.26)	1.36 <sup>c</sup>
Mood	3.77 (1.02)	3.96 (.84)	3.60 (1.14)	1.95 <sup>c</sup>	3.34 (1.10)	4.18 (.74)	4.96 <sup>***c</sup>
Rigidity	2.94 (1.35)	2.94 (1.41)	2.94 (1.30)	-.00 <sup>c</sup>	2.07 (1.16)	3.75 (.88)	8.98 <sup>***c</sup>
Number of diagnosis	2.13 (1.65)	2.10 (1.56)	2.14 (1.67)	.00 <sup>c</sup>	2.00 (1.31)	1.90 (1.39)	.10 <sup>c</sup>
PTSD, n (%)	36 (28.13)	22 (34.38)	14 (21.88)	2.47 <sup>d</sup>	16 (26.23)	18 (29.51)	.31 <sup>d</sup>
Panic disorder, n (%)	29 (22.66)	14 (21.88)	15 (23.44)	.05 <sup>d</sup>	15 (24.59)	10 (16.45)	.49 <sup>d</sup>
Agoraphobia, n (%)	23 (17.69)	9 (14.06)	14 (21.88)	1.33 <sup>d</sup>	9 (14.74)	12 (19.71)	.81 <sup>d</sup>
Social phobia, n (%)	34 (26.15)	15 (23.44)	19 (29.69)	.64 <sup>d</sup>	17 (27.87)	17 (27.42)	.00 <sup>d</sup>
Affective disorder, n (%)	90 (70.31)	44 (68.75)	46 (71.88)	.15 <sup>d</sup>	42 (68.85)	44 (70.97)	.07 <sup>d</sup>
Obsessive compulsive disorder, n (%)	20 (15.38)	10 (15.63)	10 (15.63)	.00 <sup>d</sup>	8 (13.11)	10 (16.46)	.50 <sup>d</sup>
Substance abuse disorder, n (%)	14 (10.77)	5 (7.94)	9 (14.06)	1.22 <sup>d</sup>	11 (18.33)	1 (1.61)	9.61 <sup>***d</sup>

Abbreviations: CBT, cognitive behavioral therapy; CET, compulsive exercise test; CFT, compassion focused therapy; CTQ, childhood traumatic questionnaire; M, mean; PTSD, post traumatic stress disorder; SD, standard deviation.

<sup>a</sup>Missing data on four patients.

<sup>b</sup>Missing data on two patients.

<sup>c</sup>t-Test.

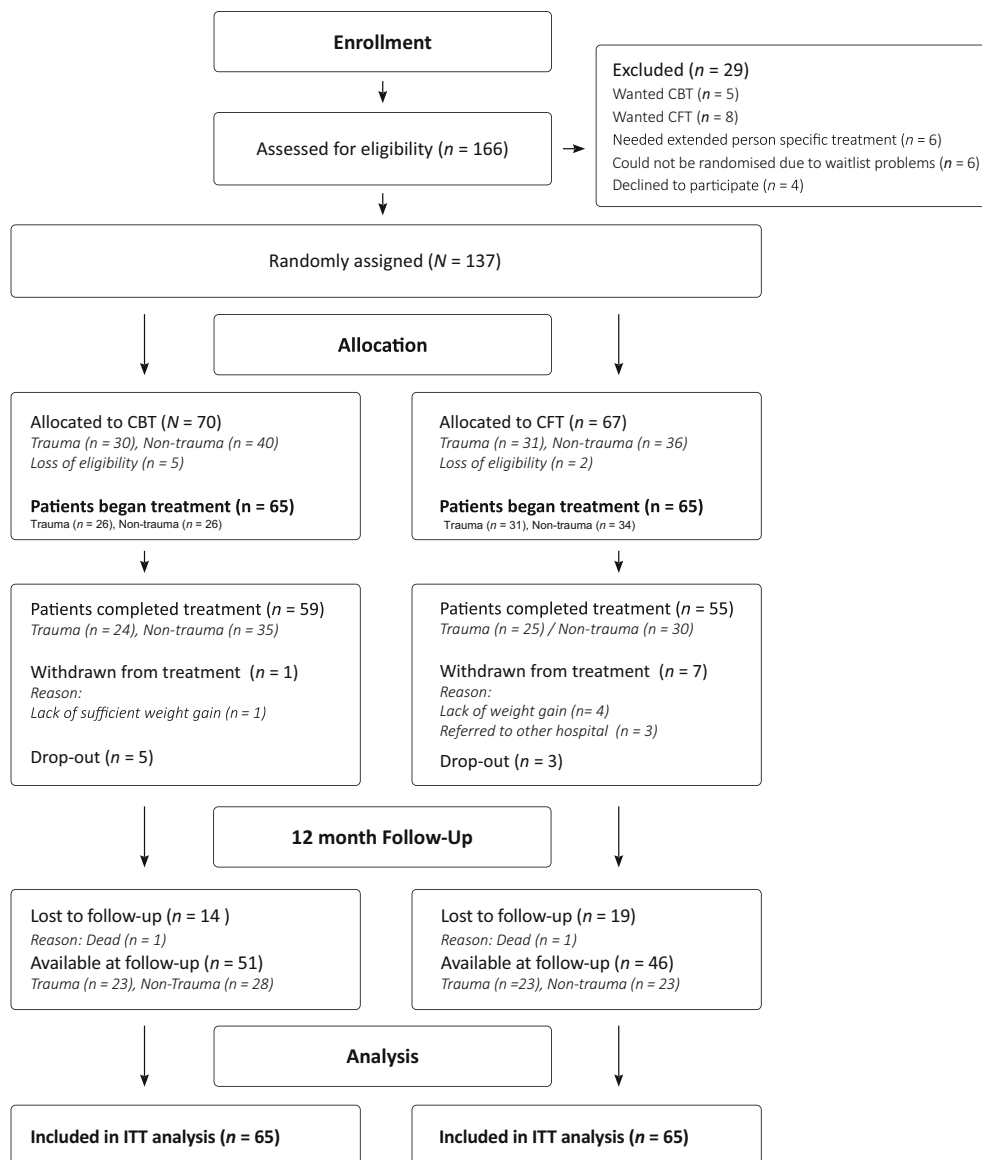
<sup>d</sup>Chi-square.

\* $p < .05$ ; \*\* $p < .001$ ; \*\*\* $p < .0001$ .

procedures and strategies but was delivered more intensively in group and individual formats (see above). It was primarily concerned with the processes that maintain the patients' ED psychopathology, using cognitive, behavioral, and psychoeducational strategies. The specific ED diagnosis was not of relevance to the treatment. Rather, the content was dictated by the individual's problems and the processes that

appeared to be maintaining them, as defined by the case formulation. This case was built with patients in the beginning of the treatment but revised during the treatment if necessary. If the patients had trauma symptoms that maintained their ED, imaginal exposure and/or imagery rescripting were used. The treatment was designed to reduce ED symptoms and enhance control over life.

**FIGURE 1** Consort diagram of participant flow. CBT, Cognitive Behavioral Therapy; CFT, Compassion Focused Therapy.



### 2.4.3 | Compassion-focused therapy

The CFT used in this trial was an adaptation of outpatient CFT for EDs, developed by Gale et al. (2014) and Goss and Allan (2014). The implemented procedures and strategies mirror those of the outpatient version, albeit characterized by a heightened level of intensity. CFT involves a structured approach to help patients gain control of their chaotic eating patterns, trauma symptoms (if any), and the processes that underlie them. It develops a compassionate approach in the patient, helping them to manage the physical and emotional demands of following a structured eating program and helping to reduce shame, particularly body shame.

Compassionate mind training was a central part of the program and had two main aims. The first was to help patients develop their soothing system and use this to regulate other motivational systems and affective states (e.g., fear, anger, or disgust). The second was to

help patients develop a compassionate motivational system and develop their capacities of giving compassion to others, receiving compassion from others, and self-compassion. It was especially focused on helping the patients imagine a future in which they can be motivated by compassion and no longer need their ED. It also helped to identify and work with blocks to feeling safe and experiencing compassion from others and compassion for the self. Within the CFT treatment program, there was a specific target of managing ED symptoms, the issues that trigger them, and the functions they serve (e.g., exploring questions such as “How would a compassionate person help you to eat?” or “What compassionate things could you do or say to help you eat breakfast?”). The aims were to develop coping thoughts and responses that were “felt” to be helpful, to enable patients to let go of ED behavior that had come to feel like a “safe” way of managing difficult emotions or experiences, and to develop more “self-caring” behavior in everyday life.

## 2.4.4 | Therapists and supervision

A total of nine clinical psychologists and one psychiatrist served as CBT therapists, and six clinical psychologist and three psychiatrists served as CFT therapists. Each therapist treated 9.3 patients on average ( $SD = 4.1$ , Range = 3–16). The CBT and CFT therapists have similar levels of clinical experience (CBT mean = 8.7 years,  $SD = 3.7$ ; CFT mean = 9.2 years,  $SD = 5.6$ ). Training workshops in CFT and CBT were run for the team by an expert in CBT (Glen Waller) and an expert in CFT-E (Ken Goss). Throughout the study period, all of the individual sessions were videotaped, and the supervisors provided 90-min supervision sessions biweekly to both the milieu staff and individual therapists to ensure the therapists' fidelity.

## 2.5 | Measures

The following measures were used.

### 2.5.1 | MINI international neuropsychiatric interview (MINI)

The MINI is a short structured diagnostic interview, compatible with international diagnostic criteria, including the International Classification of Diseases (ICD-10) and the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV; Sheehan et al., 1998). The MINI was used to assess present psychosis, depression, suicidal risk and abuse of alcohol, medicine, and/or narcotics.

### 2.5.2 | Eating disorder examination – Interview (EDE)

The EDE was used both to obtain ED diagnoses for inclusion and as a treatment outcome measure at discharge and 12-month follow-up (Fairburn & Cooper, 1993). We use the authorized Norwegian version. Both version 12 and 17 were used, since a validated Norwegian version of the EDE-I was launched during the project period (2016). The interviews were performed by four trained interviewers. The Cronbach's  $\alpha$  coefficients for EDE for this study at start of treatment, end of treatment, and one-year follow-up were .85, .92, and .87, respectively.

### 2.5.3 | Childhood trauma questionnaire (CTQ)

The CTQ was used to assess childhood trauma (Bernstein et al., 2003). This questionnaire measures childhood maltreatment in five areas. After reverse coding of some items, items can be summed to obtain a total CTQ score. To identify possible cases of trauma and differentiate between no-trauma/trauma, we also used this instrument as a categorical measure with the recommended scoring options (Walker et al., 1999). The Cronbach's  $\alpha$  coefficient for CTQ for this study at start of treatment was .61.

## 2.5.4 | The compulsive exercise test (CET)

The CET is a self-reported questionnaire designed to explore the emotional, cognitive, and behavioral characteristics of compulsive exercise (Taranis et al., 2011). It comprises 24 items answered on a six-point Likert scale, from 0 (never true) to 5 (always true). CET consists of five subscales: "avoidance and rule-driven behaviour" (*Avoidance*); "weight control exercise" (*Weight*), "mood improvement" (*Mood*), "lack of exercise enjoyment" (*Enjoyment*), and "exercise rigidity" (*Rigidity*). Mean scores of each subscale are summarized to obtain a CET total score. The Cronbach's  $\alpha$  coefficient for CET for this study ranged from .68 to .96. One study found that a cutoff score of 15 on the CET resulted in acceptable values of both sensitivity and specificity to distinguish between clinical cases with and without compulsive exercise (Meyer et al., 2016). A rationale for including both low and high compulsive exercise groups is to examine potential differential intervention effects based on initial compulsive exercise severity based on the clinical cutoff levels recommended by Meyer et al. (2016). This approach offers insights into treatment effectiveness across varying baseline severities and allows a comprehensive exploration of the full spectrum of compulsive exercise behaviors, aiding tailored interventions.

## 2.6 | Data analysis

The data from all patients who started treatment were analyzed according to the ITT approach. Treatment differences were analyzed using Hierarchical Linear Modeling (HLM; Raudenbush & Bryk, 2002). In HLM, all available data are used. Thus, a research participant with only baseline data can be included in an analysis and contribute to the estimation of model parameters (Kwok et al., 2008). The models were built by starting with a model with only fixed intercept and no random effects. Random intercepts and random slope were then added if they significantly increased model fit. The data were modeled for heteroscedastic residual variance over time. A Toeplitz covariance structure of the residuals gave the best model fit for CET total and all the subscales. Maximum likelihood (ML) was used as the estimation method (Fitzmaurice et al., 2012). All models were tested for model fit using log likelihood tests, and the most parsimonious model was selected. The MCAR (Missing Completely at Random) test (Little, 1988) was not significant on CET ( $\chi^2 = 240.43$ ,  $p = .720$ ), indicating that the data could be considered to be missing at random. Interpretations on the effect size description were based on the classifications of Cohen (1988). SPSS version 25.0 was used.

## 3 | RESULTS

### 3.1 | Patient characteristics

Table 1 gives an overview of the characteristics of the patients at pre-treatment. The sample analyzed included 130 patients, of whom 127 were Norwegians (Caucasian), one was African, and two were

Latino-Americans. Their mean age was 30.9 years ( $SD = 9.7$ ), mean duration of illness was 14.2 years ( $SD = 8.9$ ), 127 (98%) were females, and 65 (50%) lived alone. As shown in Table 1, the patients had a mean 2.1 axis one diagnosis, and the highest mean of childhood trauma was emotional neglect in their childhood ( $M = 18.3$ ,  $SD = 5.8$ ). A total of 97 (75%) patients had previous experience with ED treatment. The patients in the CFT and CBT groups did not differ on key variables at pretreatment, except for duration of previous treatment, where patients in the CFT group had received more extensive treatment ( $t = 2.9$ ,  $p = .03$ ). Further, no significant pretreatment differences between conditions emerged on the outcome variables ( $p > .05$ ). The patients categorized within the predefined compulsive exercise group (i.e., scoring at or above a mean total CET score of 15) exhibited higher scores across all these scales: CET total ( $t = 14.6$ ,  $p < .001$ ), *Avoidance* ( $t = 11.4$ ,  $p < .001$ ), *Weight* ( $t = 8.0$ ,  $p < .001$ ), *Mood* ( $t = 5.0$ ,  $p < .001$ ), *Rigidity* ( $t = 9.0$ ,  $p < .001$ ), and substance abuse disorder ( $t = 3.0$ ,  $p = .03$ ). Refer to the Appendix for details on the calculations of EDE and BMI, which are based on CET cutoff values below 15 for pre-, post-, and follow-up assessments.

### 3.2 | Preliminary analysis

The descriptive statistics for CET total and its subscales, encompassing means, standard deviations, and effect sizes, have been presented in Table 2. These initial examinations revealed that the most substantial reductions in CET total and all the subscales were observed post-treatment, accompanied by small to medium effect size.

### 3.3 | Aim 1: Outcome of CET total and subscale scores throughout the course of the study through to follow-up

HLM was used to test for main effect of time (pretreatment, post-treatment, and 1-year follow-up) in CET total and all the subscales. Table 3 shows that there was a significant decrease in CET total ( $B = -.86$ ,  $SE = .25$ ,  $t(129.93) = -3.41$ ,  $p < .001$ ), *Avoidance* ( $B = -.25$ ,  $SE = .07$ ,  $t(131.26) = -3.61$ ,  $p < .001$ ), *Mood* ( $B = -.16$ ,  $SE = .06$ ,  $t(130.21) = -2.50$ ,  $p < .014$ ), *Weight* ( $B = -.19$ ,  $SE = .06$ ,  $t(106.85) =$

**TABLE 2** Mean, standard deviation and effect sizes from pre- to post-treatment and 1-year follow-up (1YFW) on CET total and all the subscales.

Group	Pre M (SD)	Post M (SD)	1YFW M (SD)	t-Value pre-post	d pre-post <sup>a</sup>	t-Value post-1YFU	d Post-1YFU <sup>a</sup>	t-Value pre-1YFU	d Pre-1YFU <sup>a</sup>
<i>CET total</i>									
Total sample	14.67 (4.02)	13.42 (3.69)	13.79 (3.94)	5.03***	-.47	.33	.04	2.97**	-.34
CBT	14.71 (4.29)	12.89 (3.61)	14.09 (3.68)	4.66***	-.61	1.13	.13	1.90*	-.31
CFT	14.67 (3.78)	13.94 (3.73)	13.51 (4.20)	2.36*	-.31	1.04	-.10	2.27*	-.36
<i>Avoidance and rule-driven behavior</i>									
Total sample	2.84 (1.43)	2.42 (1.36)	2.60 (1.35)	5.11***	-.48	.26	.03	2.90**	-.33
CBT	2.80 (1.48)	2.17 (1.41)	2.51 (1.32)	5.12***	-.68	.55	.09	2.51**	-.41
CFT	2.89 (1.40)	2.67 (1.28)	2.68 (1.40)	1.99*	-.27	.80	.13	1.61	-.26
<i>Mood improvement</i>									
Total sample	3.77 (1.02)	3.60 (.98)	3.48 (1.11)	2.07*	-.19	1.12	-.13	2.75**	-.31
CBT	3.60 (1.15)	3.65 (1.01)	3.54 (1.17)	.34	.05	1.05	-.18	1.14	-.14
CFT	3.96 (.84)	3.56 (.96)	3.42 (1.06)	3.70***	-.49	.61	-.10	2.68**	-.43
<i>Weight control exercise</i>									
Total sample	3.34 (1.20)	2.98 (1.21)	3.16 (1.05)	4.89***	-.46	.29	.03	2.72**	-.31
CBT	3.33 (1.23)	2.81 (1.20)	3.13 (.96)	4.63***	-.61	1.00	.17	1.73*	-.28
CFT	3.35 (1.17)	3.14 (1.22)	3.18 (1.15)	2.20*	-.29	.48	.08	2.08*	-.33
<i>Lack of exercise enjoyment</i>									
Total sample	1.86 (1.18)	1.62 (1.11)	1.94 (1.12)	2.91**	-.27	2.80**	.32	.41	.05
CBT	2.03 (1.23)	1.51 (1.12)	1.98 (1.19)	3.86***	-.51	3.50**	.60	.00	.00
CFT	1.67 (1.09)	1.72 (1.10)	1.90 (1.07)	.17	.02	1.05	.16	.52	.08
<i>Exercise rigidity</i>									
Total sample	2.94 (1.34)	2.80 (1.13)	2.76 (1.30)	1.40	-.13	1.83	-.21	1.51	-.17
CBT	2.94 (1.30)	2.75 (1.07)	2.62 (1.36)	1.20	-.16	.67	-.11	.47	-.08
CFT	2.94 (1.41)	2.85 (1.18)	2.91 (1.24)	.72	-.10	1.85	.29	1.68*	-.27

Abbreviations: CBT, Cognitive Behavioral Therapy; CFT, Compassion Focused Therapy; CET, compulsive exercise test; 1YFU, one-year follow-up.

<sup>a</sup>Cohen's  $d = M1 - M2/SD$  pooled.

\* $p < .05$ ; \*\* $p < .001$ ; \*\*\* $p < .0001$ .

**TABLE 3** Fixed effects estimates (top) and variance (bottom) for models by main effect of time on CET total and all the subscales.

Parameter	CET total	Avoidance	Mood	Weight	Enjoyment	Rigidity
Fixed parameters						
Intercept	15.29 (.44)***	3.07 (.17)***	3.93 (.12)***	3.50 (.15)***	1.80 (.13)	3.09 (.16)***
Slope <sup>a</sup>	-.86 (.25)**	-.25 (.07)***	-.16 (.05)**	-.19 (.06)**	.00 (.05)	-.15 (.07)**
Random parameters						
Intercept	8.59 (1.43)***	.78 (120.99)***	.44 (.08)***	.60 (39.86)***	.47 (.19)***	1.16 (.44)**
	2.58 (1.42)	.34 (102.03)**	.34 (.07)***	.28 (48.30)	.58 (.12)***	.52 (.18)**
	7.64 (3.24)*	-.19 (184.84)**	.59 (.12)***	-.24 (82.34)	.48 (.12)***	
	2.08 (.42)***	1.20 (120.99)**	.62 (.10)***	.81 (39.86)	.81 (.13)***	.44 (.43)
AIC	1682.98	515.07	835.18	884.14	895.12	948.91

Abbreviations: AIC = Aikake criteria; CET = compulsive exercise test.

<sup>a</sup>Slope = pre-treatment, post-treatment and 1-year follow-up.

\* $p < .05$ ; \*\* $p < .001$ ; \*\*\* $p < .0001$ .

**TABLE 4** Fixed effects estimates (top) and variance (bottom) for models by group (treatment condition, CBT vs. CFT) on CET total and all the subscales.

Parameter	CET	Avoidance	Mood	Weight	Enjoyment	Rigidity
Fixed parameters						
Intercept	15.57 (1.54)***	2.96 (.54)***	4.71 (.38)***	3.42 (.47)***	1.31 (.40)***	3.22 (.50)***
Slope <sup>a</sup>	-.45 (.62)	-.00 (.22)	-.51 (.16)**	-.04 (.20)	.20 (.15)	-.23 (.21)
Group	-.17 (.97)	.07 (.34)	-.52 (.24)*	.05 (.29)	.31 (.25)	-.09 (.31)
Group × Slope <sup>a</sup>	-.28 (.40)	-.16 (.14)	.24 (.10)*	-.09 (1.12)	-.13 (.10)	.06 (.13)
Random parameters						
Intercept	6.45 (1.14)***	.77 (117.35)	.41 (.08)***	.59 (167.76)	.59 (262.52)	1.16 (.45)**
	1.99 (.81)*	.34 (99.69)	.34 (.08)***	.27 (202.93)	.05 (422.08)	.52 (.19)**
	9.06 (1.78)***	-.18 (179.74)	.61 (.12)***	-.25 (348.82)	.33 (298.00)	
Intercept	10.86 (1.66)***	1.20 (117.36)	.62 (.10)***	.81 (167.76)	.73 (262.52)	.44 (.43)
AIC	1641.65	971.16	834.26	894.98	886.47	952.31

Note: Coding of groups: CFT = 1, CBT = 2.

Abbreviations: AIC, Aikake criteria; CET, compulsive exercise test.

<sup>a</sup>Slope = pre-treatment, post-treatment and 1-year follow-up.

\* $p < .05$ ; \*\* $p < .001$ ; \*\*\* $p < .0001$ .

-3.06,  $p < .003$ ), and *Rigidity* ( $B = -.15$ ,  $SE = .07$ ,  $t(134.60) = -2.20$ ,  $p < .030$ ) over time. *Enjoyment* was nonsignificant ( $B = .00$ ,  $SE = .05$ ,  $t(82.25) = .17$ , ns) (Table 3).

### 3.4 | Aim 2: Explore whether change in CET total and subscale scores were influenced by childhood trauma history, treatment condition or compulsive exercise

To test whether changes in CET total and subscale scores were influenced by childhood trauma history, treatment condition or compulsive exercise, we conducted two-way interactions (Tables 4–6). As evident in Table 4, there was a significant two-way interaction between treatment condition and time on *Mood* ( $B = .24$ ,  $SE = .10$ ,  $t(132.42) = 2.26$ ,  $p = .025$ ), indicating greater

reduction of *Mood* for patients in CFT. Compulsive exercise predicted CET total ( $B = -1.89$ ,  $SE = .34$ ,  $t(162.14) = -5.63$ ,  $p < .001$ ), *Avoidance* ( $B = -.53$ ,  $SE = .13$ ,  $t(136.54) = -4.06$ ,  $p < .001$ ), *Weight* ( $B = -.37$ ,  $SE = .12$ ,  $t(113.47) = -3.09$ ,  $p < .003$ ), and *Rigidity* ( $B = -.58$ ,  $SE = .12$ ,  $t(126.12) = -4.75$ ,  $p < .001$ ) (Table 5). This indicates that patients with clinical levels of compulsive exercise show greater reduction on CET total and all subscales across time. Trauma was not a significant predictor of CET total and all the subscales (Table 6).

## 4 | DISCUSSION

This present study investigated outcome of CET total and subscale scores following inpatient treatment for longstanding EDs and whether change in CET total and subscale scores were influenced by



**TABLE 5** Fixed effects estimates (top) and variance (bottom) for models by CET cutoff on CET total and all the subscales.

Parameter	CET total	Avoidance	Mood	Weight	Enjoyment	Rigidity
Fixed parameters						
Intercept	11.31 (.46)***	1.73 (.21)***	3.49 (.17)***	2.58 (.19)***	1.53 (.18)***	1.98 (.20)***
Slope	.11 (.25)	.03 (.09)	-.09 (.08)	.01 (.09)	.07 (.07)	.15 (.09)
CET cutoff	8.31 (.64)***	2.63 (.29)***	.91 (.23)***	1.82 (.27)***	.48 (.25)	2.22 (.28)***
CET cutoff × Slope <sup>a</sup>	-1.89 (.34)***	-.52 (.13)***	-.15 (.10)	-.37 (.12)**	-.14 (.09)	-.58 (.12)***
Random parameters						
Intercept	2.37 (.59)***	.59 (161.78)	.38 (.08)***	.52 (463.26)	.56 (439.32)***	.81 (.23)***
	4.71 (.86)***	.20 (218.15)	.36 (.08)***	.19 (728.52)	.08 (724.19)	.38 (.18)*
	9.73 (1.84)***	-.35 (367.97)	.61 (.12)***	-.35 (1214.31)	.32 (536.81)	
	3.70 (.69)***	.63 (161.78)	.52 (.09)***	.55 (463.26)	.73 (439.33)	.40 (.23)
AIC	1506.73	876.15	809.10	836.16	870.13	881.18

Note: Coding of CET cutoff: <15 = 0, ≥15 = 1.

Abbreviations: AIC, Aikake criteria; CET, compulsive exercise test.

<sup>a</sup>Slope = pre-treatment, post-treatment and 1-year follow-up.

\* $p < .05$ ; \*\* $p < .001$ ; \*\*\* $p < .0001$ .

**TABLE 6** Fixed effects estimates (top) and variance (bottom) for models by trauma on CET total and all the subscales.

Parameter	CET total	Avoidance	Mood	Weight	Enjoyment	Rigidity
Fixed parameters						
Intercept	15.45 (.64)***	3.17 (.22)***	4.02 (.16)***	3.50 (.19)***	1.66 (.16)***	3.25 (.21)***
Slope <sup>a</sup>	-1.03 (.26)***	-.31 (.09)**	-.23 (.07)**	-.21 (.08)*	.05 (.06)	-.25 (.09)**
Trauma	-.35 (.97)	-.22 (.34)	-.24 (.24)	.01 (.29)	.26 (.25)	-.38 (.31)
Trauma × Slope <sup>a</sup>	.41 (.40)	.15 (.14)	-.17 (.11)	.04 (.13)	-.09 (.09)	.24 (.13)
Random parameters						
Intercept	6.42 (1.12)***	.77 (307.69)	.43 (.08)***	.60 (107.77)	.59 (197.38)	1.20 (.48)**
	2.13 (.82)	.34 (259.26)	.33 (.07)***	.27 (130.51)	.05 (317.28)	.54 (.19)**
	8.80 (1.71)	-.19 (473.07)	.59 (.12)***	-.25 (223.63)	.37 (210.87)	
	10.79 (1.66)	1.20 (307.69)	.62 (.10)***	.81 (107.77)	.73 (197.38)	.40 (.47)
AIC	1649.70	972.21	836.75	895.59	895.19	949.10

Abbreviations: AIC, Aikake criteria; CET, compulsive exercise test.

<sup>a</sup>Slope = pre-treatment, post-treatment and 1-year follow-up.

\* $p < .05$ ; \*\* $p < .001$ ; \*\*\* $p < .0001$ .

childhood trauma history, treatment condition, or compulsive exercise.

The mean total CET scores in the sample correspond to the clinical samples in Meyer et al. (2016) and Mathisen et al. (2018). The overall effect of time on CET total and all but one subscale scores are in accordance with findings from the systematic review by Hallward et al. (2021). All participants in our study received the same treatment components except for the randomization into either CBT or CFT. In accordance with components emphasized as important in Hallward et al. (2021), the treatment components for our participants also included weekly group exercise sessions and psychoeducation about exercise led by experienced and highly competent exercise professionals. The significant contribution of each treatment component is thus difficult to examine; however, these results support in our

opinion the importance of a multicomponent treatment for patient admitted to an inpatient treatment.

The score for CET subscale *Lack of enjoyment* remained unchanged over time. Previous studies have also failed to show improvements in this subscale (Mathisen et al., 2018), and we speculate that this is due to the duality of exercise as both a maladaptive and an adaptive affect regulator. The changes in CET subscale *Mood improvement* are in contrast to, e.g., Meyer et al. (2016) can potentially be explained by the large effect seen in the CFT group, in addition to the integration of twice weekly adaptive, functional, and healthy exercise sessions led by exercise professionals as part of the treatment program for both CFT and CBT groups. Numerous studies have consistently demonstrated that individuals with EDs attribute a greater significance to exercise as a mechanism for downregulating stress and

anxiety, rather than elevating feelings of enjoyment (Bratland-Sanda et al., 2010; Meyer et al., 2011; Monell et al., 2018). The lower prevalence of substance use disorder in individuals with CET total scores above than below clinical levels is interesting in the view of how both exercise and use of various substances might serve as affect regulators (Cook et al., 2014). However, the mechanisms and factors behind abuse of substances such as alcohol are multifactorial and debated, therefore this finding must be interpreted with great caution. Nevertheless, this study underscores the pivotal role of compulsive exercise in serving as a primary modulator of adverse affects. We therefore contend that identifying a reduction in the reliance on exercise as a regulator of negative emotions holds paramount importance and warrants heightened emphasis within the context of ED treatment.

We believe it is important to acknowledge that our study is among the first to undertake a comparison of the effects on compulsive exercise stemming from two distinct treatment conditions, as well as integrating CFT into this research. The observed similarities in effects on the total CET scale between CBT and CFT warrant consideration. Notably, patients receiving CFT exhibited more pronounced reductions in Mood scores. It is worth noting that, while theoretical underpinnings suggest that CFT's emphasis on affective components might offer advantages in addressing exercise as an emotional regulator (Gilbert, 2010, 2015), definitive conclusions are cautious due to the comprehensive nature of the multi-component therapeutic program. The proposed mechanisms, including emotion regulation enhancement, interpersonal dynamics, and compassion cultivation, hold potential as mediators for long-term therapeutic outcomes, though their comprehensive effects require further exploration (Treasure et al., 2010). The attenuation of shame and self-criticism, which may contribute to enhanced emotion regulation (Goss & Allan, 2009; Turk & Waller, 2020), deserves particular attention for its role within this context. History of childhood trauma was not found as a predictor of change in neither of the CET scores. This suggests the necessity to investigate alternative variables or factors, such as perfectionism, that may play a pivotal role in understanding the maintenance of compulsive exercise behaviors, in line with the comprehensive framework proposed by Meyer et al. (2011). It is, however, important to acknowledge that the mean scores on CTQ subscales were quite high in the total sample, regardless of CET score and the sample consisted adults with long duration of EDs. There might be other patterns in the links between childhood trauma and compulsive exercise in younger samples, samples with shorter durations of the ED, and in populations from high performance cultures with known violent or non-violent abusive behavior such as elite sports and dancing (Mountjoy et al., 2016; Sølvsberg et al., 2022). This should be further explored in future studies.

#### 4.1 | Strength and limitations

This study has several strengths, including its thorough testing of CFT delivered in the context of a multidisciplinary program, its naturalistic setting, its adequate sample size, and its focus on patients who had

relatively high levels of eating pathology and comorbidity. However, the limitations of the study also need to be addressed in future work. First, there was no no-treatment control group, which prevents examination of whether the two treatments were superior to no treatment. However, the level of spontaneous recovery in such patients is low (Wonderlich et al., 2012), and both therapies are well established, making the use of a non-intervention condition hard to justify ethically (Deville & McFarlane, 2009). Second, the study was carried out at one clinic and needs to be replicated across settings, including outpatient settings. The single clinic setting means that there could have been contamination of the therapies due to patients sharing experiences during the treatment phase. However, maintaining treatment-specific teams of therapists and patient groups is likely to have minimized that effect. Another potential limitation arises from the introduction of exercise related counseling and supervised physical activity sessions, which could potentially confound the results. These supplementary interventions have the potential to impact observed outcomes, creating difficulties in disentangling the distinct effects of the exercise components within the treatment. The sample was ED transdiagnostic and based on work with adults. It is not known whether these effects would be found among younger cases, or whether they would apply equally to all diagnoses, particularly given the lower levels of recovery among anorexia nervosa patients (N. G. A. (UK), 2017). The sample mainly included adult, White women, with a severe and enduring ED, likely to restrict the generalizability of the findings as culture, ethnicity and gender might impact both the vulnerability for ED and for trauma exposure of different kinds. Other forms of childhood maltreatment, such as bullying and witnessing domestic violence are not included in the CTQ. Future diagnosis-specific trials of the same therapies would allow for meaningful comparison of such effects for specific diagnoses, including changes at the behavioral level (e.g., frequency of binge-eating and purging) and in terms of body mass index. Finally, the lower Cronbach's alpha value (.61) observed in the childhood traumatic questionnaire test underscores the need for circumspection in interpreting findings pertaining to childhood trauma. Previous investigations of the factor structure in CTQ have raised concern regarding the differentiation of this scale (Grassi-Oliveira et al., 2014) and considering this limitation, it is imperative to explore avenues for addressing the issue of lower internal consistency in future research endeavors.

The results suggest the necessity for future prospective studies to validate the influence of affective-oriented therapies compared to behavioral-oriented therapies in addressing unfavorable exercise behaviors and promoting positive exercise patterns in individuals receiving ED treatment. Subsequent research should aim to expand and confirm the observed effects, offering a more thorough comprehension of the effectiveness of these therapeutic approaches and the potential mechanisms governing exercise regulation in this context. Further, future research should broaden the population to also include outpatient settings and populations that are younger and with more recent onset of the ED. The findings have clinical implications, providing support for considering CFT as a viable treatment approach for individuals with enduring and severe ED.

## AUTHOR CONTRIBUTIONS

**KariAnne R. Vrabel:** Conceptualization; data curation; formal analysis; investigation; methodology; project administration; resources; software; supervision; validation; writing – original draft. **Solfrid Bratland-Sanda:** Conceptualization; formal analysis; investigation; methodology; writing – review and editing.

## CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest to declare. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

## DATA AVAILABILITY STATEMENT

The ethical approval granted by the Regional Committees for Medical and Health Research Ethics in Norway (REK and NSD) and in accordance with the information given to the patients in the informed consent form regarding the use of data, does not allow the authors to submit the data to a public repository. In line with the ethics approval, the data are to be kept at a secure server only accessible by the authors of this study. Data will be stored at least 5 years in accordance to the ethical approval granted by the Regional Committees for Medical and Health Research Ethics in Norway. Access to the data can be granted following ethical approval of suggested project plan for the use of data from NSD and REK. The data will then be anonymized and further stored at the secure data storage system at Modum Bad. Such requests are to be sent to Associate Professor, KariAnne R. Vrabel, Institute of Psychology, University of Oslo, email: [karianne.vrabel@modum-bad.no](mailto:karianne.vrabel@modum-bad.no). Although the authors cannot make their study's data publicly available at the time of publication, both authors commit to make the data underlying the findings described in this study fully available without restriction to those who request the data. For data sets involving personally identifiable information or other sensitive data, data sharing is contingent on the data being handled appropriately by the data requester and in accordance with all applicable local requirements.

The content of this manuscript is original work that have not been previously copyrighted or published elsewhere. This manuscript is not under consideration for publication elsewhere, and further, has not been posted to the Internet for public access. This manuscript will not be submitted for publication elsewhere before a decision is made by Your Editorial Board. The trial protocol—a description of the study—has been published in *Frontiers of Psychology* (Vrabel et al., 2019) and a process-outcome paper focusing on data collected throughout the admission period has been published in the *Psychotherapy Research* (Kopland et al., 2023). A main outcome paper “Cognitive behavioral therapy versus compassion focused therapy for adult patients with eating disorder with and without childhood trauma: A randomized controlled trial in an intensive treatment setting” is currently under review in *Behavior Research and Therapy*.

## ETHICS STATEMENT

This study was approved by the Regional Committee for Medical and Health Research Ethics in Southern Norway approval no. 2014/836 and it was pre-registered at [ClinicalTrials.gov](https://clinicaltrials.gov) (NCT02649114).

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#### APPENDIX: CALCULATIONS FOR PRE-, POST-, AND FOLLOW-UP ASSESSMENT ON EDE AND BMI, DIVIDED BY CET CUTOFF BELOW AND ABOVE 15.

Characteristics	Pre CET cutoff <15	Pre CET cutoff ≥15	Post CET cutoff <15	Post CET cutoff ≥15	1YFU CET cutoff <15	1YFU CET cutoff ≥15
BMI (M ± SD)	21.60 (5.69)	21.11 (5.10)	23.93 (6.05)	20.73 (2.29)	22.52 (5.62)	21.78 (5.98)
EDE (M ± SD)	5.84 (4.23)	4.45 (1.25)	2.90 (1.59)	2.90 (1.45)	2.96 (1.65)	3.32 (1.65)

Abbreviations: 1YFU, 1-year follow-up; BMI, Body Mass Index; CET, Compulsive Exercise Test; EDE, Eating Disorder Examination.