Adding cognitive therapy to dietetic treatment is associated with less relapse in obesity.

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Journal of Psychosomatic Research 67 (2009) 315–324

Journal of Psychosomatic Research

Adding cognitive therapy to dietetic treatment is associated with less relapse in obesity☆

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Received 6 December 2007; received in revised form 22 December 2008; accepted 23 December 2008

Abstract

Objective: The treatment of obesity is universally disappointing; although usually some weight loss is reported directly after treatment, eventual relapse to, or even above, former body weight is common. In this study it is tested whether the addition of cognitive therapy to a standard dietetic treatment for obesity might prevent relapse. It is argued that the addition of cognitive therapy might not only be effective in reducing weight and related concerns, depressed mood, and low self-esteem, but also has an enduring effect that lasts beyond the end of treatment. **Methods:** Non-eating-disordered overweight and obese participants in a community health center (*N*=204) were randomly assigned to a group dietetic treatment+cognitive therapy or a group dietetic treatment+physical exercise. **Results:** Both treatments were quite successful and led to significant decreases in BMI, specific eating psychopathology (binge eating, weight-, shape-, and eating concerns) and general psychopathology (depression, low self-esteem). In the long run, however, the cognitive dietetic treatment was significantly better than the exercise dietetic treatment; participants in the cognitive dietetic treatment maintained all their weight loss, whereas participants in the physical exercise dietetic treatment regained part (25%) of their lost weight. **Conclusion:** Cognitive therapy had enduring effects that lasted beyond the end of treatment. This potential prophylactic effect of cognitive therapy is promising; it might be a new strategy to combat the global epidemic of obesity.

Keywords: Obesity; Cognitive therapy; Dietetic treatment

Obesity is a growing public health problem. In the USA, 66% of the adult population is currently overweight, of which 33% (about 70 million people) are obese, and trends predict that rates will continue to increase [1]. Rising prevalence rates led the World Health Organization recently to call obesity a 'global epidemic' [2,3]. Obesity is not only related to health problems—e.g., cardiovascular diseases, diabetes, and cancer—and huge economic costs, but it has also been associated with a variety of psychological problems such as intense concerns about the body, a depressed mood, and reduced self-esteem [4–11]. Weight loss programs typically focus on the reduction of energy intake and the stimulation of physical exercise. However, as many authors note [12–14], these interventions are rather ineffective in the long run. Follow-up studies have shown high relapse rates: most people soon regain their initially lost weight or even more. Attempts to lose the regained weight are by and large as unsuccessful as previous dieting attempts, thereby resulting in undesirable cycles of losing and gaining weight.

The discouraging long-run outcome of traditional obesity treatments led some experts to focus less on weight loss per se and more on positive psychological changes by using cognitive therapy [15–17]. It was argued that the use of cognitive therapy would reduce comorbid psychological

☆ This study was financed by The Netherlands Organization for Health Research and Development (ZonMw).

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doi:10.1016/j.jpsychores.2008.12.011

problems and, in the long run, facilitate weight loss. Such a treatment was found to be psychologically more beneficial than radical weight loss strategies [15,16], and to enable the maintenance of the weight lost [18,19].

An even more important reason to treat obesity with cognitive therapy is its well-known enduring effect or its ability to prevent relapse [20,21]. A most impressive finding of research into the cognitive treatment of a variety of disorders is that cognitive therapy has enduring effects that last beyond the end of treatment. Many treatments, including medication, are only effective as long as they are continued or maintained. The enduring effects of cognitive therapy, however, extend beyond treatment, meaning that cognitive therapy reduces the risk of relapse in chronic disorders [21]. This beneficial effect of cognitive therapy was found in several disorders and also eating disorders [22], but it has rarely been studied in the non-eating-disordered obese (i.e., the obese people who do not fulfill the criteria for an eating disorder).

We hypothesized that cognitive therapy would also be beneficial for non-eating-disordered obese people, especially in the long run. Although they have no eating disorder, the non-eating-disordered overweight and obese people are characterized by typical maladaptive schemas [23,24] and dysfunctional beliefs related to body image, depressed mood, unrealistic weight goals, a disproportionate role of their weight and shape in self-evaluation, and control over eating [6,25]. Challenging and changing these dysfunctional eating and body-related beliefs and schemas might enable the maintenance of a healthier eating pattern and thereby reduce relapse after successful weight loss.

In the Netherlands, many overweight and obese people who want to reduce weight consult with a dietician. The regular dietary treatment that is offered by dieticians usually is aimed at changing unhealthy dietary patterns into healthier ones. In the present study, cognitive therapy was added to a standard dietetic treatment for obesity, within the dieticians practice in a local health center. For the control group, physical education was added to the standard dietetic treatment. In both treatments, the dietetic intervention aimed at a weight loss of 5–10%, because of its realism and the significant health benefits that are reached with this modest weight loss [26,27]. Likewise, a weight loss of 5% or more has been defined as successful weight loss by the U.K. Royal College of Physicians [19]. It was hypothesized that adding cognitive therapy to the dietetic intervention would change the obese way of thinking (Hypothesis 1); would lead to larger short-term reductions in body- and eating concerns, to a better mood and to more self-esteem (Hypothesis 2); and would lead to increased eating restraint and decreased binge eating (Hypothesis 3), than adding physical exercise to the dietetic intervention. It was further hypothesized that the learning of cognitive tools would lead participants in the cognitive+dietetic treatment (CDT) to maintain their weight losses and psychological and behavioral gains better than participants in the exercise+dietetic treatment (EDT) (Hypothesis 4).

Method

Participants

Participants were recruited at the dietetics department of the local health center (Green Cross Care) in Maastricht and by advertisements in local newspapers focusing on this treatment opportunity in the said center. The Green Cross Care health center is well known for its dietary treatments for obesity. Applicants were screened and checked for inclusion and exclusion criteria in a telephone interview. Inclusion criteria were a body mass index (BMI) above 27 and age between 18 and 65 years. Exclusion criteria were participating in another treatment for weight loss, being treated by a mental health professional, not being able to exercise, and pregnancy. The local medical ethics committee approved the study, and all participants signed informed consent.

Participants were 204 overweight and obese men and women. Four people were excluded from the analyses because they had more than 10% missing values on pretreatment measures. The final study sample thus consisted of 200 overweight and obese people. Of the 200 participants, 81% were female. Mean age was 45 (S.D.=12) years, ranging from 19 to 65 years, and mean BMI was 33.4 (S.D.=4.6). BMI ranged from 27.0 to 52.3.

Procedure

Participants were randomly assigned to one of two treatment conditions: a cognitive dietetic group treatment (CDT; n=96) or a physical exercise dietetic group treatment (EDT; n=104). Ten days prior to the start of treatment participants received a file of questionnaires that they completed at home and handed in at the first treatment session. Four weeks after the last treatment session, the questionnaires were completed again, at home, and returned by mail. Weight and height were measured in each treatment session. Follow-up measurements took place at the university, 1 year after the end of treatment. A home visit was done if a participant was unable to attend the follow-up meeting. In case no follow-up appointment could be arranged, the questionnaires were sent by mail.

Treatments

Both treatments were given by protocol and consisted of 10 weekly sessions of 2 h each. Both were provided in groups with a maximum of 12 participants. Each treatment session was divided into two parts. The first part (the first hour) was always the dietetic intervention, carried out by dieticians. This dietetic treatment part was exactly the same for both treatment conditions. The main aims of the dietetic

intervention were to change unhealthy dietary patterns into more healthy ones and to improve self-control. To achieve this, nutritional education was provided, food diaries were kept, and cooking classes were given to learn healthy cooking. Dietary patterns were changed by a stepwise program, aimed at eating three meals a day, eating at a regular place, and mindful eating; slow, conscious, and without distraction. Participants were trained in changing bad eating habits into more healthy habits; they learned when to stop eating, how to refuse food, how to find social support, how to deal with parties and super market shopping, and so on. They further received guidelines for a healthy diet but this was not a prescribed diet.

Interventions in the second part (the second hour) differed between the experimental and the control treatment; in the experimental CDT condition cognitive therapy (CT) was added to the dietetic treatment, whereas in the control EDT condition physical exercise was added to the dietetic intervention. The cognitive therapy was performed by fully qualified cognitive behavior therapists and fully qualified physiotherapists led the physical exercise.

Cognitive therapy

Aims of the CT were to identify, challenge, and change dysfunctional cognitions concerning eating, control, weight, and shape, as well as related schemas (e.g., self-esteem schemas or interpersonal schemas). Automatic thoughts and beliefs were identified and challenged, and behavioral experiments were set up [28]. Participants were provided with workbooks entitled *Dik Tevreden* (Pleasantly Plump) containing background information about the cognitive intervention and homework assignments, including thought diaries. An example of a frequently reported dysfunctional thought related to control overeating was "whenever I start eating nuts [chocolates, candies, etc.], I *have to* finish the whole bowl". An example of a dysfunctional thought related to weight was "when I am this fat, I will *never* find nice clothes". The CBT therapists were intensely trained into the present CT protocol by the authors SM and HE who are fully qualified CBT therapists and experienced in the cognitive treatment of eating disorders and obesity. There were weekly supervision sessions. All CT sessions were audio taped and checked for compliance to the protocol (SM and HE).

Physical exercise

Participants in the control condition engaged in a 1-h low-intensity exercise program (gym) supervised by a qualified physiotherapist. The combination of dietetic treatment (1 h) and physical exercise (1 h) in groups is, in this Dutch field setting, the standard treatment for obesity.

Measures

Eating psychopathology

Specific eating psychopathology was measured with the Eating Disorder Examination–Questionnaire (EDE-Q [29]). The EDE-Q is a 36-item questionnaire that measures eating restraint, binge eating, compensatory behavior, and concerns about shape, weight, and eating. The subscale scores for shape-, weight-, and eating concerns as well as eating restraint range between 0 and 6, with higher scores indicating more concerns and increased eating restraint. The global score is an index of general eating psychopathology, ranging between 0 and 6, with higher scores referring to more severe eating psychopathology. Because the EDE-Q is not a reliable measure of binge eating [29–31], binge eating was measured by a self-composed questionnaire. In this questionnaire, overeating episodes were listed by the participant, together with a description of the context, emotions, and feelings that accompanied the overeating. The amount of food that was eaten was registered with great precision and the experienced sense of control was specified. An eating episode was defined as a binge by the researchers when (1) it was definitely larger than most people would eat during a similar period of time and under similar circumstances, and (2) a sense of lack of control over eating during the episode was experienced.

Depression

Depressive symptomatology was measured by the 21-item Beck Depression Inventory (BDI [32]). Items are scored on a four-point scale. The one item about weight loss was excluded from analyses and the sum of the remaining 20 items was calculated. A higher score indicates an increasingly depressed mood. Scores below 10 are normal, a score between 10 and 18 is indicative of mild to moderate depression, and higher scores indicate moderate to severe depression [33].

Self-esteem

Global self-esteem was measured by the Rosenberg Self-Esteem Scale (RSE [34]). The RSE is a 10-item questionnaire and the items are scored on a four-point scale. A higher score means a more positive self-esteem. Scores below 21 indicate low self-esteem [35].

Body mass index

Weight and length were measured in street clothes, without shoes, and the BMI (weight in kilograms/height in square meters) was calculated.

Belief in dysfunctional thoughts

The belief in dysfunctional thoughts that predict negative consequences (if–then) was measured. Eleven dysfunctional thoughts (e.g., "If I am fat I can never dress nicely" or "If I have a food craving, I can't resist the food"), derived from a list of obese cognitions reported in previous research from our lab [6,15], were scored on credibility (1=*very incredible* to 5=*very credible*). Reliability analyses showed that one item did not fit well into the scale. The remaining 10 items formed the Belief in Dysfunctional Thoughts Scale. This scale showed good reliability (α=.88). A higher score on the

Table 1
Means and statistics for the intention-to-treat sample (n=200) before and after treatment and at one year follow-up

	CDT (n=96)						EDT (n=104)			
	Pretreatment		Posttreatment		Follow-up		Pretreatment		Posttreatment	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
BMI	33.42	4.38	32.06	4.42	32.07	4.46	33.29	4.76	31.85	4.63
EDE-Q										
Restraint	1.46	1.07	2.06	1.08	2.00	1.03	1.27	0.97	1.97	1.04
Eating concerns	1.33	1.16	1.18	1.03	1.09	1.04	1.19	1.17	0.86	0.99
Weight concerns	3.09	1.15	2.46	1.24	2.41	1.33	2.65	1.19	1.97	1.23
Shape concerns	3.58	1.46	2.75	1.54	2.77	1.62	3.05	1.52	2.26	1.53
Global score	2.36	0.94	2.11	0.94	2.07	1.04	2.04	0.99	1.77	0.91
BDI	10.01	6.82	8.13	7.00	9.05	8.34	8.94	7.10	7.26	6.36
RSE	29.73	4.72	30.72	5.05	30.67	5.46	31.61	4.94	32.81	4.99
Dysfunctional thinking	3.07	0.81	2.74	0.80	2.69	0.83	2.72	0.83	2.48	0.92
Binges/28 days	2.10	7.33	0.56	1.85	0.55	1.95	1.63	5.07	0.77	3.15

Treatment effectiveness=pretreatment vs. posttreatment analyses; maintenance=posttreatment vs. follow-up analyses.
* P<.10.
** P<.05.
*** P<.01.

Belief in Dysfunctional Thoughts Scale reflects a stronger belief in dysfunctional thoughts.

Suitability of treatment

The suitability of both treatments was scored on a nine-point scale (1=*not at all* to 9=*extremely*), at Sessions 2 and 10. Questions were as follows: "How suitable do you think this treatment is for you?" "How much faith do you have in this treatment?" and "Would you recommend this treatment to an overweight friend?" The items showed good reliability (α=.83). A mean suitability score was calculated with a higher score reflecting a stronger belief in the suitability of the specific treatment.

Statistical analyses

A missing value analysis was performed to replace missing data. For each participant, the total number of missing values for the three questionnaires (EDE-Q, BDI, RSE) was calculated. A total of less than 10% missing values was accepted for the analyses. The mean score on the remaining items of the questionnaire replaced missing item scores.

Pretreatment differences between treatment conditions (CDT and EDT) on demographic variables (age, gender) and the main outcome measures were investigated by chi-square analyses (gender) and independent samples t tests (age and outcome measures). Differences between treatment dropouts and completers were also studied by independent samples t tests. To investigate whether demographic variables or outcome measures influenced treatment dropout, a logistic regression analysis with treatment dropout being the dependent variable was done.

Primary analyses were by intention to treat (n=200). In case of missing data the last available data were carried forward. To study the short-term effects of treatment, 2 (Treatment: CDT vs. EDT)×2 (Time: pretreatment vs. posttreatment) repeated measures ANOVAs were conducted. To study whether the effects of treatment were maintained, 2 (Treatment: CDT vs. EDT)×2 (Time: posttreatment vs. 1-year follow-up) repeated measures ANOVAs were done. Significant interactions were followed by paired samples t tests within each treatment. For the ANOVAs, partial eta squared is reported as a measure of effect size; for the paired samples t tests, Cohen's d is reported [36].

Secondary analyses were performed on complete cases (n=119). Complete cases were participants who completed treatment, as well as the posttreatment and follow-up measurements. Treatment completion was defined by attending at least six out of 10 treatment sessions. Following these criteria, there were 158 (79%) treatment completers. Of these completers, 119 (60%) filled in all questionnaires, n=59 in the EDT and n=60 in the CDT. Complete case analyses were similar to the intention-to-treat analyses.

Results

Data are given in Table 1.

Pretreatment characteristics and treatment suitability

In CDT, the mean age was 44 years (S.D.=11.9) and 84% of the participants were female. In EDT, the mean age was 45 years (S.D.=12.2) and 78% of the participants were female.

EDT (n=104)		Treatment effectiveness		Maintenance			
Follow-up		Time	Time×Treatment	Time	Time×Treatment	Within CDT	Within EDT
Mean	S.D.	F (1, 198) [η_p^2]	F (1, 198) [η_p^2]	F (1, 198) [η_p^2]	F (1, 198) [η_p^2]	t(95) [Cohen's d]	t(103) [Cohen's d]
32.21	4.72	320.2 *** [.62]	<1 [.00]	3.5 * [.02]	3.3 * [.02]	<1 [.00]	2.8 *** [.08]
1.69	1.11	63.4 *** [.24]	<1 [.00]	4.7 ** [.02]	1.8 [.01]		
0.95	1.03	15.5 *** [.07]	2.3 [.01]	<1 [.00]	4.9 ** [.02]	1.3 [.09]	1.9 * [.09]
2.12	1.26	89.5 *** [.31]	<1 [.00]	<1 [.00]	3.0 * [.02]	<1 [.04]	2.1 ** [.12]
2.39	1.56	99.6 *** [.34]	<1 [.00]	1.2 [.01]	<1 [.00]		
1.79	1.00	27.8 *** [.12]	<1 [.00]	<1 [.00]	<1 [.00]		
7.72	6.43	32.5 *** [.14]	<1 [.00]	4.7 ** [.02]	<1 [.00]		
32.24	4.48	25.4 *** [.11]	<1 [.00]	1.7 [.01]	1.1 [.01]		
		F (1, 194) [η_p^2]	F (1, 194) [η_p^2]	F (1, 194) [η_p^2]	F (1, 194) [η_p^2]		
2.51	0.87	52.3 *** [.21]	1.3 [.01]	<1 [.00]	1.4 [.01]		
		F (1, 190) [η_p^2]	F (1, 190) [η_p^2]	F (1, 190) [η_p^2]	F (1, 190) [η_p^2]		
1.00	3.63	8.3 *** [.04]	<1 [.00]	<1 [.00]	<1 [.00]		

There were no differences in gender and age between both conditions (all P>.19).

There were no pretreatment differences in BMI, restraint, eating concerns, binge eating, and depression between CDT and EDT (all P>.19). There were differences, however, for weight concerns [t(198)=2.69, P<.01], shape concerns [t(198)=2.51, P<.02], eating psychopathology [t(198)=2.38, P<.02], and self-esteem [t(198)=2.74, P<.01], with participants in the CDT scoring significantly higher on weight- and shape concerns and eating psychopathology, and lower on self-esteem, than participants in the EDT. For pretreatment means on the outcome measures, see Table 1.

Participants in the EDT rated treatment suitability significantly higher than participants in the CDT, both at Session 2 [t(185)=2.9, P<.01] and at Session 10 [t(161)=2.2, P<.03]. Inspection of the means reveals that both treatments were considered suitable [Session 2 (mean): CDT=6.8; EDT=7.4 on a nine-point scale; Session 10: CDT=6.6, EDT=7.3).

Dropout analysis

Participants who attended five sessions or less were considered treatment dropouts. Despite all effort that was made to encourage participants to attend all treatment sessions, 42 people (21%) dropped out of treatment. Treatment dropouts were characterized by higher pretreatment scores on weight concerns [t(198)=2.1, P<.04], shape concerns [t(198)=2.0, P<.05], eating psychopathology [t(198)=2.2, P<.03], and depression [t(198)=2.2, P<.03]. Moreover, there tended to be more treatment dropout in the EDT (26%) than in the CDT (16%) [χ^2(1)=3.2, P<.08]. A logistic regression analysis showed that dropout was predicted by (higher) pretreatment eating psychopathology (EDE-Q global scores) (b=0.52, P<.01) and by specific treatment (b=0.86, P<.03).

Hypothesis 1. Adding cognitive therapy to the dietetic intervention will change the obese way of thinking

The treatment effectiveness analyses showed significant main effects of time on dysfunctional thinking. The means in Table 1 show that beliefs in dysfunctional thoughts decreased during treatment. However, no significant Time× Treatment interactions emerged, showing that CDT and EDT did equally well, both in the short and in the long run. The complete case analyses did not change these findings. In

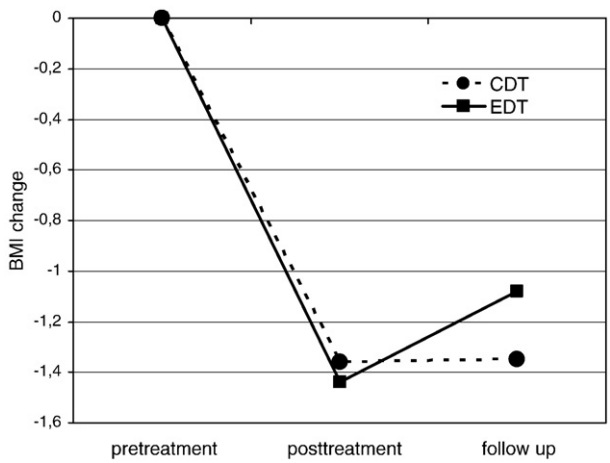

Fig. 1. BMI change from pretreatment to posttreatment to 1-year follow-up in the CDT and the EDT.

Table 2
Means and statistics for depressed participants (n=83) before and after treatment and at 1-year follow-up

	CDT (n=43)						EDT (n=40)			
	Pretreatment		Posttreatment		Follow-up		Pretreatment		Posttreatment	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
BMI	34.63	5.16	33.42	5.32	33.49	5.38	33.61	4.82	32.12	4.77
EDE-Q										
Restraint	1.57	1.11	2.03	1.05	2.15	0.95	1.44	0.97	2.10	0.91
Eating concerns	1.92	1.29	1.66	1.18	1.39	1.15	1.72	1.44	1.38	1.33
Weight concerns	3.67	1.00	2.83	1.31	2.81	1.38	3.49	0.93	2.76	1.27
Shape concerns	4.30	1.05	3.31	1.50	3.30	1.56	4.05	1.23	3.22	1.43
Global score	2.86	0.85	2.46	1.00	2.41	1.06	2.67	0.91	2.36	0.97
BDI	15.94	5.63	12.51	7.67	13.54	9.31	16.34	5.56	12.51	6.24
RSE	27.00	4.33	28.60	4.79	28.54	6.08	28.39	4.59	29.83	4.39
Dysfunctional thinking	3.49	0.71	3.06	0.77	2.97	0.76	3.26	0.70	3.08	0.86
Binges/28 days	4.29	10.53	1.03	2.41	0.93	2.54	3.04	7.12	1.65	4.93

Treatment effectiveness=pretreatment vs. posttreatment analyses; maintenance=posttreatment vs. follow-up analyses.
* P<.10.
** P<.05.
*** P<.01.

sum, both the CDT and the EDT interventions were quite successful in reducing the belief in dysfunctional thoughts.

Hypothesis 2. Adding cognitive therapy to a dietetic intervention (CDT) will lead to larger short-term reductions in body-related concerns, eating concerns, and eating psychopathology, and to a better mood and higher self-esteem than adding physical exercise to a dietetic intervention (EDT)

The treatment effectiveness analyses showed significant main effects of time: after treatment, eating-, weight-, and shape concerns, and eating psychopathology were decreased, whereas mood and self-esteem were increased. However, none of the short-term Time×Treatment interactions was significant, showing that CDT and EDT did equally well in the short run (see Table 1). The complete case analyses showed the same. In sum, both the CDT and the EDT interventions were quite successful in reducing shape-, weight- and eating concerns, and eating psychopathology, and in improving mood and self-esteem.

Hypothesis 3. Adding cognitive therapy to a dietetic intervention (CDT) will lead to larger short-term increases in eating restraint, and to larger reductions in binge eating, than adding physical exercise to a dietetic intervention (EDT)

The treatment effectiveness analyses showed significant main effects of time: after treatment, eating restraint was increased and binge eating was reduced. However, again none of the short-term Time×Treatment interactions was significant, showing that CDT and EDT did equally well in reducing binge eating and inducing more eating restraint (see Table 1). Again, the results of the complete case analyses were the same.

Hypothesis 4. the learning of cognitive tools in cognitive therapy will lead participants in the CDT to maintain their weight loss, behavioral gains, and psychological gains better than participants in the EDT

Weight loss

Of the intention-to-treat sample, the CDT group lost 1.36 BMI points (4.1%) in the short-term and 1.35 BMI points (4.0%) in the long-term. The EDT group lost 1.44 BMI points (4.3%) in the short-term and 1.08 BMI points (3.2%) in the long-term (see Fig. 1). The treatment effectiveness analyses showed a significant main effect of time (see Table 1), which demonstrates that the weight loss in both treatments was significant. No Treatment×Time interaction emerged, showing that there were no short-term differences between both treatments.

The maintenance 2 (Treatment: CDT vs. EDT)×2 (Time: posttreatment vs. follow-up) ANOVA showed a marginally significant main effect of time that was superseded by a marginally significant Treatment×Time interaction (see Table 1). Please note that a lack of significant differences between posttreatment and follow-up means that posttreatment results are maintained, whereas significant differences (with follow-up data being less positive) indicate (partial) relapse. Paired samples t tests within each treatment showed that the weight loss was maintained after CDT, but not after EDT. Being treated by EDT led participants to regain 25% of their initially lost weight within 1 year, whereas being treated by CDT predicted no weight regain at all (see also Fig. 1). Complete case analyses did not change these data. Thus, although both groups lost a significant amount of weight, this weight loss was close to, but somewhat less than, the predicted and desired 5%. However, participants who received cognitive therapy maintained their weight loss in

EDT (n=40)		Treatment effectiveness		Maintenance/relapse			
Follow-up		Time	Time×Treatment	Time	Time×Treatment	Within CDT	Within EDT
Mean	S.D.	F (1, 81) [η_p^2]	F (1, 81) [η_p^2]	F (1, 81) [η_p^2]	F (1, 81) [η_p^2]	t (42) [Cohen's d]	t (39) [Cohen's d]
32.68	4.84	130.1 *** [.62]	1.5 [.02]	5.3 ** [.06]	3.4 * [.04]	<1 [.01]	2.8 *** [.12]
1.81	1.20	19.3 *** [.19]	<1 [.01]	<1 [.01]	3.1 * [.04]	<1 [.12]	1.8 * [.28]
1.47	1.35	6.2 ** [.07]	<1 [.00]	1.4 [.02]	5.4 ** [.06]	2.4 ** [.24]	<1 [.07]
3.06	1.19	36.0 *** [.31]	<1 [.00]	2.2 [.03]	2.9 * [.04]	<1 [.02]	2.2 ** [.25]
3.60	1.43	36.1 *** [.31]	<1 [.00]	2.8 * [.03]	3.1 * [.04]	<1 [.01]	2.5 ** [.27]
2.48	1.07	15.7 *** [.16]	<1 [.00]	<1 [.00]	1.5 [.02]		
12.52	6.61	36.8 *** [.31]	<1 [.00]	<1 [.01]	<1 [.01]		
29.99	4.18	22.8 *** [.22]	<1 [.00]	<1 [.00]	<1 [.00]		
3.06	0.82	26.4 *** [.25]	4.4 ** [.05]	<1 [.01]	<1 [.01]		
		F (1, 77) [η_p^2]	F (1, 77) [η_p^2]	F (1, 77) [η_p^2]	F (1, 77) [η_p^2]		
2.19	5.54	5.9 ** [.07]	<1 [.01]	<1 [.01]	<1 [.01]		

the long-term, whereas the physically exercising participants partially relapsed, as the long-term significant weight increase after EDT demonstrates.

Behavioral gains

The maintenance analyses showed a significant main effect of time for restraint, and the means show that eating restraint was somewhat decreased at follow-up compared to posttreatment. No Time×Treatment interaction was found, indicating that this pattern of partial relapse in loss of restraint was similar for CDT and EDT. For binge eating, the maintenance ANOVA showed no significant main effect and no significant interaction effect, meaning that the binge reduction was maintained in the long run.

Psychological gains

No main effects of time were found for general eating psychopathology, shape concerns, and self-esteem in the maintenance analyses, meaning that the treatment-induced reduction in eating psychopathology and shape concerns as well as the increased self-esteem was maintained 1 year later. There were no significant Time×Treatment interactions either; thus neither treatment differed with respect to the long-term reduced eating psychopathology, shape concerns, and increased self-esteem.

There was, however, a significant time effect for depression. Depression was a bit, but significantly, increased at follow-up, compared to posttreatment. No Time×Treatment interaction was found, indicating that increased depression was similar for CDT and EDT.

Concerns about eating and weight showed significant Time×Treatment interactions in the maintenance 2 (Treatment: CDT vs. EDT)×2 (Time: posttreatment vs. follow-up) ANOVA. Unpacking these interactions by paired samples t tests showed that, between posttreatment and follow-up, neither eating concerns nor weight concerns changed in CDT, whereas eating concerns did marginally increase and weight concerns did significantly increase in EDT, meaning that EDT showed a partial relapse in eating and weight concerns, whereas CDT did not.

To sum up, the main difference in the long run between both treatments is that cognitive therapy prevented long-term weight relapse and led to long-term reduced eating and weight concerns, whereas the exercise therapy showed partial relapse in weight and in the concerns related to eating and weight.

Complete case analyses

The maintenance complete case analyses differed somewhat from the maintenance intention-to-treat analyses. Complete case maintenance analyses showed no main effect of time [F(1, 117)<1] and no Time×Treatment interaction [F (1, 117)=2.1, P=ns] for eating concerns, indicating no relapse in eating concerns in the completer EDT sample. For concerns about weight and shape, however, partial relapse was found; main effects of time were significant for shape concerns [F(1, 117)=5.2, P<.05] and marginally significant for weight concerns [F(1, 117)=3.6, P<.10]. Time×Treatment interactions were not significant (both F values <1), indicating that the relapse was similar for the CDT and EDT completers. The completer analyses thus showed no differences in long-term eating and weight concerns between both treatments, contrary to the intention-to-treat analyses.

A mildly depressed subgroup

Although our sample was not recruited in a mental health setting, it happened that 42% (n=83; CDT: n=43, EDT:

n=40) scored 10 or more on the BDI. Depression has been found to co-occur with a variety of disorders and generally aggravates symptoms [37]. More specifically, a depressed mood was earlier found in almost half (44%) of a community sample of overweight and obese participants who registered for dietary weight loss treatment [9] and in half of overweight and obese community sample that was not in treatment and participated in research [10]. Within this sample of overweight/obese participants, the depressed subgroups suffered more than their nondepressed counterparts from concerns about appearance and eating, and low self-esteem [9,10]. Moreover, a comorbid depression can affect treatment outcome in a negative way [38]. It will therefore additionally be investigated whether mildly to moderately depressed overweight and obese people also benefit from the cognitive treatment. To investigate the effectiveness of CDT and EDT for these mildly to moderately depressed participants, analyses were repeated for the subgroup with BDI scores above 10 (intention to treat). Data are presented in Table 2 and shortly summarized below.

For all variables, the 2 (Treatment: CDT vs. EDT)×2 (Time: pretreatment vs. posttreatment) repeated measures ANOVAs showed significant main effects for time, meaning that there was significant improvement in all variables. Most Time×Treatment interactions except for one were not significant, showing that both groups were equally successful. The only significant Time×Treatment interaction was found for the belief in dysfunctional thoughts, showing that dysfunctional beliefs decreased more after CDT than after EDT (see Table 2).

The maintenance 2 (Treatment: CDT vs. EDT)×2 (Time: posttreatment vs. follow-up) ANOVA showed no significant effects for eating psychopathology, binge eating, depression, self-esteem, and dysfunctional beliefs, meaning that there were no significant changes in these variables between the end of treatment and follow-up. In both treatments, the significant decreases in eating psychopathology, binge frequency, depression, dysfunctional beliefs, and the increase in self-esteem were maintained 1 year after treatment. The maintenance analyses showed, however, significant Time×Treatment interactions for eating concerns and marginally significant interactions for BMI, eating restraint, shape-, and weight concerns. Paired samples t tests between posttreatment and follow-up within each intervention showed that weight loss was maintained after CDT (t<1) and not after EDT (P<.01, see Table 2). Being treated by EDT led the depressed participants to regain 38% of their lost weight within 1 year, whereas being treated by CDT predicted a nonsignificant 6% weight regain at follow-up. The EDT participants also showed relapse in restraint (less restraint at follow-up) and in both the weight- and shape concerns (both concerns were increased at follow-up), whereas positive treatment effects were maintained in the long run after CDT. And whereas the EDT treatment showed no long-term change in eating concerns, CDT-treated participants even showed significantly decreased eating concerns at follow-up compared to posttreatment (see Table 2).

Discussion

In the present study, the long-term weight-reducing effect of cognitive therapy added to dietetic treatment in a field setting was compared to physical exercise added to dietetic treatment. Moreover, the psychological and behavioral benefits of both treatments were compared. It was expected that the cognitive dietetic treatment was more successful in reducing weight and psychopathology, both in the short- and long-term. In the short run, there were no substantial differences between both treatments. Both treatments were quite successful and led to significant decreases in BMI, specific eating psychopathology (binge eating, weight-, shape-, and eating concerns) and general psychopathology (depression, low self-esteem). In the long run, the cognitive dietetic treatment was superior to the exercise dietetic treatment; participants in the cognitive dietetic treatment maintained their weight loss, whereas participants in the physical exercise dietetic treatment regained part (25%) of their lost weight. Notably, the effects of cognitive therapy lasted beyond the end of treatment; the reductions in BMI, weight-, and eating concerns were maintained after the cognitive dietetic treatment, whereas the exercise participants showed partial relapse in BMI and in their weight- and eating-related concerns. Further analyses showed that the cognitive dietetic treatment was also highly beneficial for the mildly depressed subgroup.

The main finding of the present study is that adding cognitive therapy to a dietetic treatment for obesity is associated with long-term weight (loss) maintenance in this group. The pattern of findings clearly shows that the usual weight regain after behavior treatment [12–14] did occur in participants treated by the exercise dietetic treatment, but not in those who received the cognitive dietetic treatment. Although the absolute weight loss was not excessive (4.1% and 4.3%), this was almost in line with our goals (modest weight reduction of 5–10%). The particularly interesting thing is that the present sample was a non-eating-disordered sample that did not apply for psychotherapy at a mental health center. Participants were just overweight and obese people who applied for dietetic treatment at a community health center, to lose some weight. Cognitive therapy being beneficial for non-eating-disordered obese people, especially in the long run, is a novel finding that opens up new perspectives for the treatment of overweight and obesity that is not associated with eating disorders. The findings indicate that CT passes on cognitive strategies that are more beneficial in the long run than pure behavioral treatments. Adding cognitive therapy to the regular treatment of obesity by dieticians might thus be a valuable step in optimizing treatments.

Within the current state of evidence, it may be concluded that the effects of cognitive therapy can last beyond treatment termination; enduring effects were found in the treatment of depression, anxiety, eating disorders, and—as suggested by the present data—obesity [20–22,39,40]. The precise mechanisms through which cognitive therapy produces its effects, however, are still unknown [39,40]. In the present study, it was hypothesized that the cognitive treatment would change the obese way of thinking. While the data suggests that this is plausible, conclusive evidence was not established in our study. Interestingly, the belief in 10 dysfunctional thoughts—included as a measure of the obese way of thinking—decreased in both treatments. Cognitive therapy did not lead to a better reduction in dysfunctional beliefs than physical exercise. It might have been that the dietetic treatment and physical exercise also led to reduced beliefs in dysfunctional thoughts through exposure and experience, or just because of the weight loss that was reached. Apparently, however, the newly learned cognitive techniques in the cognitive dietetic treatment did last; participants in this group maintained weight loss as expected. It is likely to assume that, just in line with the aims of the cognitive treatment, participants in this group learned how to identify, challenge, and change their own specific dysfunctional beliefs concerning their body and eating control. Being able to keep using the cognitive techniques that they learned during CT enabled them to maintain a healthy eating pattern and to prevent relapse. Participants in the exercise group did not learn how to change their way of thinking. Possibly, our measure of dysfunctional beliefs was not specific enough to detect the differences in cognitive *processes* that occurred in both groups. A differential effect did occur in the depressed subsample: the belief in dysfunctional thoughts decreased more in the depressed participants who were treated with cognitive therapy than in the depressed participants who were treated with physical exercise. Note that the depressed subsample started with stronger beliefs in dysfunctional thoughts than the nondepressed participants, which might have enabled or facilitated reduction through cognitive therapy. Although our finding that the cognitive dietetic treatment was effective in producing weight (loss) maintenance is worthwhile and of clinical significance in itself, the present data do not provide an evidence-based explanation as to *how* or *why* CT is associated with less relapse. It would be highly interesting to study the mechanisms through which cognitive therapy operates and produces change in future research [39,40].

The finding that all participants increased their eating restraint during treatment fits well with the finding of decreased BMIs and decreased binge eating in both treatments. These data refute the restraint theory which claims that increased eating restraint leads to increased binge frequency, overeating, and weight increase [41], and is more in line with recent findings of decreased binge- and overeating after dieting [42,43].

Although the treatment suitability of the exercise dietetic treatment appeared to be significantly higher than the treatment suitability of the cognitive dietetic treatment, the dropout analysis revealed a selective dropout with increasing chances of dropping out of the exercise dietetic treatment. This might mean that before treatment the participants expected less of the cognitive intervention than of physical exercise, but during treatment, they were better able to carry on cognitive therapy than physical exercise. This is an extra argument to implement cognitive therapy into the regular dietary practices of obesity treatment. A relevant question in considering the implementation of cognitive therapy in community health centers that treat overweight and obesity is whether qualified cognitive therapists are available. There are lots of overweight and obese people worldwide, and professionally qualified cognitive therapists who are well trained in cognitive interventions are necessary but scarce [20,44]. Training programs are urgently needed to enable the dissemination of cognitive therapy in dietetic practices, and mental health centers specialized in cognitive therapy need to open their doors for the obese.

In sum, it was found that adding cognitive therapy to dietetic treatment was associated with less weight relapse in non-eating-disordered overweight and obese participants. This potential prophylactic effect of cognitive therapy is promising and might be a new strategy to combat the global epidemic. Of course, more research is needed, especially into the long-term effects of cognitive therapy, its mechanisms of change, and its possibilities of large-scale implementation.

Acknowledgments

The authors would like to thank the dieticians department of Groene Kruis Zorg (Green Cross Care) in Maastricht, The Netherlands, for enabling this field study. Furthermore, we thank the participants, the dieticians, CBT therapists, and physiotherapists involved in the study for their cooperation and involvement with the study, and Marcus Huibers and Anne Roefs for their useful comments on an earlier draft.

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