

Effects of Cognitive Behavioral Therapy on Body Mass Index, Emotional Eating and Mindful Eating of Post-Bariatric Surgery Patients: A Randomized Controlled Trial

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Abstract

Bariatric surgery is one of the most effective treatments of obesity, but some patients regain weight post-operatively. Continuum of disordered eating behaviors and emotional eating are among the main predictors of weight regain. The purpose of this study was to investigate the effects of cognitive behavioral therapy on the body mass index, emotional eating and mindful eating of post-bariatric surgery patients. The study was designed as a randomized control trial. A total of 60 post-bariatric surgery patients were randomized into two groups: 1) 30 patients received only nutritional education; 2) 30 patients received cognitive behavioral therapy and nutritional education. Acute treatment phase consisted of 5 one in two-week sessions, maintenance phase consisted of 3 monthly sessions, and a follow-up session was made at the end of 1 year. All patients were evaluated for body mass index and emotional eating scale and mindful eating questionnaire were applied at baseline (1st session), after the acute phase (5th session), at last session of maintenance phase (8th session), and at 1-year follow-up. Body mass index of both groups decreased significantly at the end of acute and maintenance phase, but mean body mass index of only nutritional education group increased at the end of 1st year follow up while CBT group preserved the weight loss. Cognitive behavioral therapy is effective for continuum of weight loss, decrease of emotional eating and increase of mindful eating of post-bariatric patients, and these beneficial effects of cognitive behavioral therapy are preserved at the end of 1 year.

Keywords: cognitive behavioral therapy, bariatric surgery, emotional eating, mindful eating

Öz

Bariatrik Cerrahi Ameliyatı Sonrası Hastalarda Bilişsel Davranışçı Terapinin Beden Kitle Endeksi, Duygusal Yeme ve Bilinçli Yeme Üzerine Etkisi: Randomize Kontrollü Çalışma

Bariatrik cerrahi, obezitenin en etkili tedavilerinden biridir ancak bazı hastalar ameliyattan sonra tekrar kilo almaktadır. Düzensiz yeme davranışlarının sürekliliği ve duygusal yeme davranışı kilo alımının ana belirleyicileri arasındadır. Bu çalışmanın amacı, post-bariatrik cerrahi hastalarında Bilişsel Davranışçı Terapi'nin; beden kitle endeksi, duygusal yeme ve bilinçli yeme üzerindeki etkilerini araştırmaktır. Çalışma, randomize kontrol denemesi olarak tasarlanmıştır. Toplam 60 post bariatrik cerrahi hastası iki gruba randomize edilmiştir: 1) 30 hasta sadece beslenme eğitimi almıştır; 2) 30 hastaya Bilişsel Davranışçı Terapi ve beslenme eğitimi verilmiştir. Akut tedavi fazı iki haftada bir beş seanstan, idame fazı üç aylık seanslardan oluşmuştur ve bir yılın sonunda takip seansı yapılmıştır. Başlangıçta (1. seans), akut faz sonrasında (5. seans), idame fazının son seansında (8. seans) ve 1. yılda; hastaların beden kitle endeksine bakılmıştır. Ayrıca başlangıçta (1. seans), akut faz sonrasında (5. seans), idame fazının son seansında (8. seans) ve 1. yılda; hastalardan duygusal yeme ölçeğini ve bilinçli yeme ölçeğini doldurmaları istenmiştir. Akut dönem ve idame dönemi sonunda her iki grubun vücut kitle endeksi anlamlı olarak azalmıştır. Sadece beslenme eğitimi alan grubunun ortalama vücut kitle endeksi 1. yıl izlemi sonunda artarken, BDT grubunda kilo kaybı korunmuştur. Bilişsel davranışçı terapi, post bariatrik hastalarda; kilo kaybının devam etmesi, duygusal yemenin azalması ve bilinçli yemenin artmasında etkilidir. Bilişsel Davranışçı Terapinin bu yararlı etkileri bir yıl sonunda da korunduğu yapılan çalışmada açıkça gösterilmiştir.

Anahtar Kelimeler: bariatrik cerrahi, bilinçli yeme, bilişsel davranışçı terapi, duygusal açlık

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INTRODUCTION

Obesity, defined as a body mass index of ≥ 30 kg/m², is a growing public health problem worldwide because of its high mortality and morbidity rates. It has even been argued to be considered as an epidemic (globesity) (Castelnuovo et al., 2015; WHO Obesity and overweight, 2017). According to the most recent estimations from the World Health Organization, more than 1.9 billion adults are overweight (body mass index of ≥ 25 kg/m²) worldwide (including 650 million who are obese). This prevalence increased three-fold from 1975 to 2016 (WHO Obesity: preventing and managing the global epidemic, 2000). For this reason, many efforts have been carried out to find solutions to treat it. Since it is a complex disease with multifactorial etiology (including a genetic component, individual, familial, behavioral, cultural, and environmental factors) (Marcus & Wildes, 2009; Swencionis & Rendell, 2012), there is consensus that its treatment should be multi-disciplinary. A biopsychosocial approach including dietetic, nutritional, physical, behavioral, psychological, and if necessary pharmacological and surgical treatment methods are recommended.

Psychological problems can increase the development of obesity and vice versa is also true. Stressful life events, mood problems, anxiety, low self-esteem, affect regulation problems, some personality traits, and Eat Disord have been found to be closely related with obesity (Davin & Taylor, 2009; Hudson, Hiripi, Pope & Kessler, 2007; Manzoni, Cribbie, Villa, Arpin-Cribbie, Gondoni, & Castelnuovo, 2010; Petry, Barry, Pietrzak, & Wagner, 2008; Pickering, Grant, Chou, & Campton, 2007; Scott et al., 2008). Psychotherapies for obesity typically address these issues, and among them, Cognitive Behavioral Therapy (CBT) has been found to be the most effective one (Abiles et al., 2013; Gade, Hjelmesaeth, Rosenvinge, & Friberg, 2014; Grilo, Masheb, Wilson, Gueorguieva, & White, 2011; Munsch, Meyer, & Biedert, 2012; Tsiros et al., 2008; Vanderlinden, Adriaensen, Vancompfort, Pieters, Probst, & Vansteelandt, 2012). Cognitive behavioral therapy typically helps patients develop a stable “weight-control mind-set” by teaching them techniques to reduce dysfunctional behaviors (such as low level of activity, disordered eating patterns such as emotional eating ect.) and focuses on dysfunctional cognitive processes (such as sabotaging thoughts which increase calorie intake). Cognitive behavioral therapy also modifies unrealistic weight goals and negative perceptions of body image, and improves psychological skills for effective weight loss (such as the

client’s ability to self-monitor, stimulus control, behavioral modification strategies such as chewing slowly, taking time to enjoy food, and increasing awareness of the pleasure associated with taste and food (Castelnuovo et al., 2015; Foster, Makris, & Bailer, 2005; Grave, Sartinana & Calugi, 2020; Swencionis & Rendell, 2012).

Among the other treatments for obesity, bariatric surgery is one of the most effective ones, resulting in substantial long-term weight loss up to 20 to 35% of initial body weight and decreased morbidity and mortality rates (Adams et al., 2017; Chang, Stoll, Song, Varela, Eagon, & Colditz, 2014; Heymsfield & Wadden, 2017; Jakobsen et al., 2018). However, research has shown that 20% of patients experience only minor weight loss 1 year after surgery (Courcoulas et al., 2013; Lutfi, Torquati, Sekhar, & Richards, 2006) and 33% of patients experience minor weight loss 10 years after surgery (Higa, Ho, Tercero, Yunus & Boone, 2011). Additionally, 30–50% of patients experience weight regain within 2 years after surgery (Karmali, Brar, Shi, Sharma, Gara, & de Birch, 2013; Magro, Geloneze, Delfini, Pareja, Callejas, & Pareja, 2008; Nicoletti et al., 2015). Studies have been carried out to find significant predictors for less post-operative weight loss and/or weight regain. Post-operative dysfunctional eating behaviors (such as; binge-eating, loss of control over eating, emotional eating etc.) (Chesler, 2012; Colles, Dixon, & O’Brien, 2008; King, Belle, Hinerman, Mitchell, Steffen, & Courcoulas, 2019; Marino et al., 2012; Meany, Conceição, & Mitchell, 2014; Mitchell et al., 2016; Nicolau et al., 2017; Sarwer, Wadden, & Fabricatore, 2005; Sheets et al., 2015; White, Kalarchian, Masheb, Marcus, & Grilo, 2010; de Zwaan et al., 2010), as well as psychological problems (such as; depression and anxiety) (Edwards-Hampton, Madan, Wedin, Borckardt, Crowley, Byrne, 2014; Jakobsen et al., 2018; Karlsson, Taft, Ryden, Sjöström, & Sullivan, 2007; Kontinen, Peltonen, Sjöström, Carlsson, & Karlsson, 2015; Sarwer et al., 2005; Sheets et al., 2015; de Zwaan et al., 2011) have been found to be mostly related to unsuccessful surgical outcomes. Among the psychiatric disorders and psychological problems, binge-eating disorder is one of the leading ones to cause obesity.

Previous studies have reported the beneficial effects of adding CBT during pre and post-operative periods to bariatric surgery (Cheroutre, Guerrien, & Rousseau, 2020; Gade, Friberg, Rosenvinge, Smastuen, & Hjelmesaeth, 2015; Paul, van der Heiden, & Hoek, 2017; Rudolph &

Hilbert, 2020). In a single centered parallel group randomized controlled trial from Norway (Gade et al., 2015), the effects of 10 weeks of CBT treatment prior to bariatric surgery were compared to the effects of nutritional support and education in 80 patients. Both groups were assessed at baseline, post CBT intervention preoperatively, and 1 year postoperatively. Although the CBT group showed an earlier onset of improvements in all eating behaviors and affective symptoms than the control group, the decline in body weight was comparable between two groups after 1 year postoperatively (30.2% in CBT group, 31.2% in control group). In an uncontrolled pilot study from Germany (Rudolph & Hilbert, 2020), 7 patients who had gastric bypass surgery at least 6 months ago received 15 CBT sessions. The patients showed a significant reduction of body weight, improvement of eating disorder symptoms, depressive symptoms, and self-esteem at post-treatment assessment. Most of these favorable changes remained stable during the 3-month follow-up. A recent review of 11 cross-sectional and longitudinal studies concerning bariatric surgery patients who participated in CBT programs reported that therapeutic efficacy of CBT was demonstrated in ten out of eleven studies (Cheroutre et al., 2020).

According to us, the major limitations of these previously conducted studies about CBT for bariatric surgery patients is that they do not answer an important question: what is the best time for adding CBT to surgical treatment? Post-bariatric surgery patients usually do not return to their disordered eating behaviors at the early postoperative period because of the decreased gastric volume. Thus, one may assume that adding CBT at preoperative period and early postoperative period may not be necessary. But finding the most beneficial timeline for adding CBT postoperatively is important for reducing the relapse rates. In addition to this, the effect of adding CBT on mindful eating and emotional eating, has not been well studied. Emotional eating has been described as “the tendency to eat in response to emotional distress and during stressful life situations” (Canetti, Berry & Elizur; 2009) and has been associated with a variety of problematic eating behaviors, including binge-eating, grazing, uncontrolled eating and snack eating in both pre and post-operative bariatric surgery patients (Chesler, 2012; Fischer et al., 2007). Mindful eating movement emphasizes being aware of the present moment when one is eating, paying attention to the effect that food has on the senses and taking into account the physical and emotional sensations in response to eating process (Hendrickson & Rasmussen,

2013; Kristeller & Wolever, 2011). In this study, we aimed to find answers to these important issues. Our purpose was to evaluate the effect of adding CBT on weight loss, emotional eating, and mindful eating patterns of post bariatric surgery patients during different timelines postoperatively. We had two hypotheses: 1) The time of CBT application to bariatric surgery patients would have different effects on weight loss and disordered eating patterns; 2) CBT would cause significant weight loss, decrease in emotional eating, and increase mindful eating for these patients.

METHOD and MATERIALS

Trial Design

This study was designed as a parallel group randomized control trial.

Settings and Participants

This study was conducted at Diet and Nutrition Outpatient Clinic of Yeditepe University Hospital during September 2017- April 2019. Post bariatric surgery patients who had their surgery at least 6 months before the study, and who gave consent to participate to the study were included. During the initial interview, the purpose and the design of the study was told to participants, and a written and oral consent were taken from them. For this research, “Ethics Committee Approval” dated 25/12/2017 from B.08.6. YÖK.2.ÜS.0.05.0.06/2017/316 from Üsküdar University Non-invasive Research Ethics Committee has been obtained. Additionally, the necessary permissions were obtained for the study to be conducted at Yeditepe University Hospital.

Procedure

The flow chart of recruitment of the participants and overall procedure of the study is presented in the Figure 1.

Interventions

A total of face-to-face individual 9 sessions were conducted for each group. The first 5 sessions were referred as Acute Treatment Phase, and these sessions were conducted once in two weeks. The next 3 sessions are referred as Maintenance Phase, and these sessions were conducted once a month. The last session is referred as follow-up, and it was conducted at 1 year after the first session of the Acute Treatment Phase. The duration of the sessions was

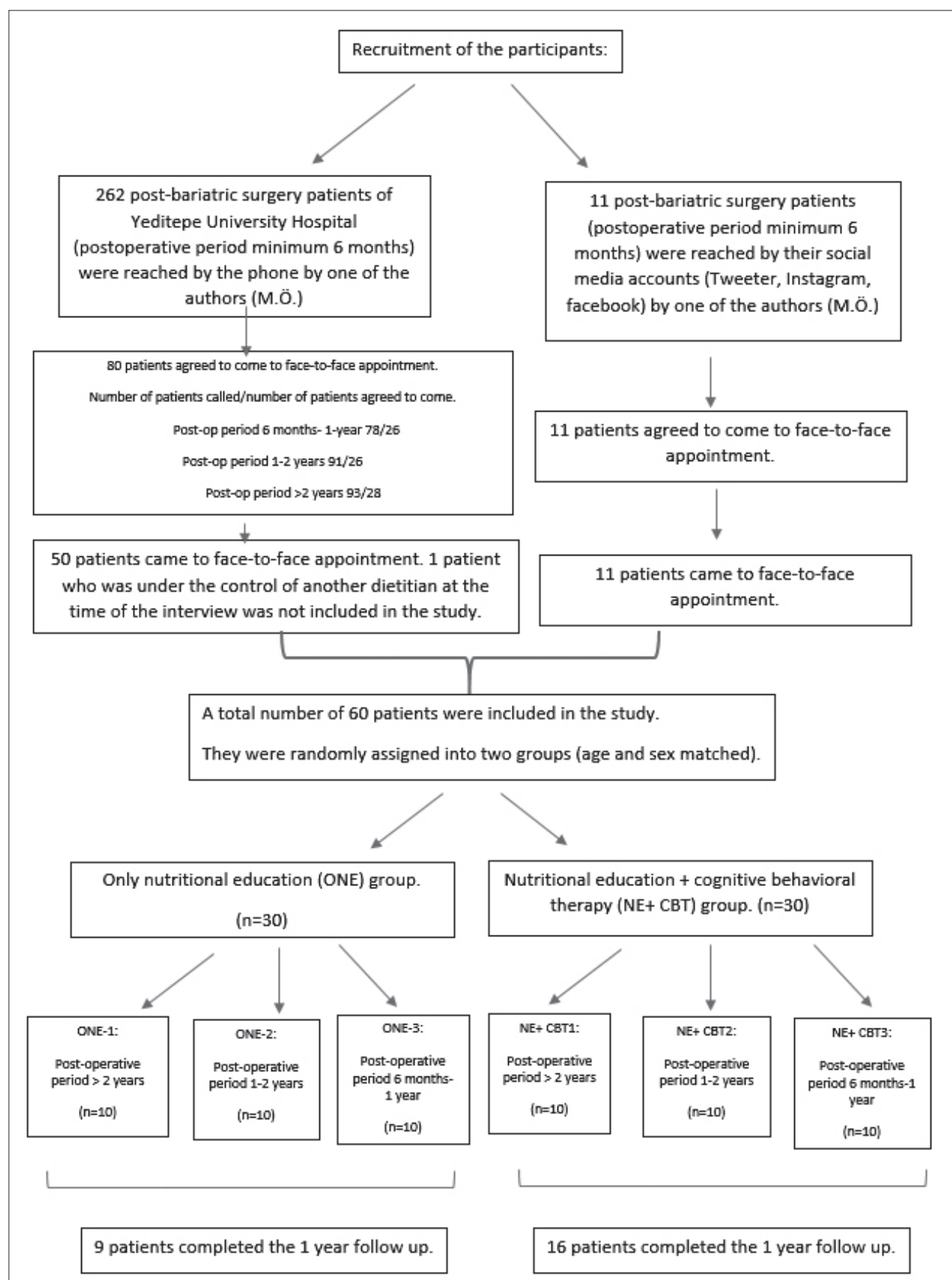


Figure 1. Flow chart of the procedure.

half an hour each for Group-ONE, and 1 hour each for Group NE + CBT. Summary of contents of each session is presented in Table 1. As CBT protocol, an adaptation of Judith Beck's "Beck's Diet Solution" (Beck, 2007) was used. Both CBT and NE were applied by the first author (M. Ö.), who has a master's degree on both clinical psychology and nutrition and dietetics.

Measurement and Scales

At the beginning of each session, participants were weighed with Inbody 770 which is professional body analyzer. Height was evaluated only at the first session (in order to calculate BMI for each participant) with Seca which is adult scale with a height meter. The Emotional Eating Scale (EES) and the Mindful Eating Questionnaire (MEQ) were applied to the participants in the 1 st, 5th and 8th sessions and at the end of the 1st year (9th session).

Emotional Eating Scale: It is a self-report scale developed by Bilgen and consists of 27 Likert-type questions. It evaluates the occurrence of eating behavior when faced with stressful situations, in order to cope with negative feelings, as well as the ability to self-control when faced with a food clue or trigger.

The scale was developed in three stages. In the factor analysis at the end of the first stage, four sub-factors were determined for the scale. In the second stage, Emotional Appetite Questionnaire, Three-Factor Nutrition Questionnaire and Emotional Eating Scales, which were validated and reliable in Turkish, were applied in order to examine the validity of the scale. The Turkish Emotional Eating Scale was reapplied one month later in order to determine the reliability of the scale. Its Cronbach alpha value was reported as 0.959 for Turkish population (Bilgen, 2018).

Mindful Eating Questionnaire: This is a self-report questionnaire and consists of 28 Likert-type questions (Framson, Kristal, Schenk, Littman, Zeliadt, & Benitez, 2009). It is developed in order to evaluate the mindful eating patterns of individuals; such as having knowledge about healthy diet, focusing on what you are eating, intuitive eating ect. It has 7 sub-scales titled Eating without Thinking, Emotional Eating, Control of Eating, Eating Discipline, Mindfulness, Interference (influence from external factors), and Conscious Nutrition. Its Cronbach alpha value was reported as 0.733 for Turkish population (Köse, Tayfur, Birinci, & Dönmez, 2016).

Statistical Analysis

The data were analyzed using IBM Statistical Package for Social Sciences (SPSS) program version 25.0. The suitability of the data to normal distribution was evaluated with the Kolmogorov-Smirnov test. Explanatory statistics are shown as mean \pm standard deviation for continuous variables, as frequency and percentage for categorical variables. Two independent samples t test were used to compare data of two independent groups that shows normal distribution. Mann-Whitney U test was used to compare the data that did not conform to the normal distribution. For the analysis of the difference between categorical variables, chi-square test and Fisher's exact probability test were performed according. Kruskal-Wallis test was used to compare variables that did not fit the normal distribution of more than two groups, and Mann-Whitney U test was performed for binary comparisons (post-hoc). The results were interpreted by making Bonferroni correction. A p value less than 0.05 was considered as significant. In comparison of categorical variables between groups, Chi-square test or Fisher exact probability test were used. Friedman test was performed to evaluate whether there is a difference in the changes of the groups over time. Binary comparisons of the measurements with significant difference were made by Wilcoxon test and p values were interpreted by Bonferroni correction.

RESULTS

There was no statistically significant difference between the mean age (37.5 ± 9.98 for ONE, $36.9 \pm 6.08 \pm 8.10$ for NE + CBT, $p=0.799$), and mean BMI at baseline (46.08 ± 7.78 for ONE, 46.20 ± 5.93 for NE + CBT, $p=0.945$) between two groups. For both groups, half were males and the other half were females. Comparison of mean scores of both groups and all sub-groups with regard to BMI, EES and MEQ at the 1 st, 5 th, 8th sessions and at 1 year follow up is shown in Table 2. Statistical analysis for the change of BMI, EES and MEQ at the 1 st, 5 th, 8th sessions and 1 year follow up can be seen in Table 2.

With regard to BMI, for ONE group there is no statistically significant difference between sub-groups at baseline. For NE + CBT group the mean BMI for NE+CBT1 is significantly higher than NE+CBT2 and NE+CBT3 (34.29 , 29.13 , and 29.43 , respectively, $p=0.005$). This statistically significance continues until the 1-year follow-up within the sub-groups of NE + CBT group. Decrease in

Table 1: Sample grouping, study design, and contents of each session

<i>Acute treatment phase (sessions once in 2 weeks)</i>	<i>Content of the session (each session lasts for half an hour)</i>	<i>Content of the session (each session lasts an hour)</i>
Session 1	Measurement for weight and height Fill up the scales (EES, MEQ) History about weight was taken Target setting Teaching self-monitoring for eating	In addition to the contents Group ONE's first session: Psychoeducation about how CBT works Formulation about yo-yo dieting Homework: List of reasons to lose weight, planned eating
Session 2	Measurement for weight Education about the importance for a healthy and regular weight loss program (rather than strict diets) Preparing a personalized eating program Importance of increasing the daily step count	In addition to the contents of Group ONE's second session: Choosing key-words among the reasons to lose weight Finding the triggers for over-eating Sharing the importance of physical activity and preparing an exercise plan Sharing the importance of positive feedback
Session 3	Measurement for weight Checking for daily step counts Education about food groups Education about preparing a healthy plate Fine-tuning the personalized eating program	In addition to the contents of Group ONE's third session: Techniques for mindful eating Techniques to stop emotional eating
Session 4	Measurement for weight Checking for preparing a healthy plate Education about how to solve constipation Education about what to do if meals are skipped Fine-tuning the personalized eating program	In addition to the contents of Group ONE's fourth session: Finding the self-sabotaging thoughts that cause weight gain Techniques for cognitive-restructuring (list of cognitive distortions, finding the alternative thought ect.)
Session 5	Measurement for weight Fill up the scales (EES, MEQ) Sharing the importance of label reading habit Fine-tuning the personalized eating program Review for reaching targets Risk assessment before the next session and planning the possible solutions	In addition to the contents of Group ONE's fifth session: Preparing the self-instructions or the coping cards
Maintenance phase (sessions once a month)	Content of the session (each session lasts for half an hour)	Content of the session (each session lasts an hour)
Session 6	Measurement for weight Review of the previous months Fine-tuning the personalized eating program Adding different recipes Risk assessment before the next session and planning the possible solutions	Measurement for weight Review of the previous months Fine-tuning the personalized eating program Adding different recipes Risk assessment before the next session and planning the possible solutions
Session 7	Measurement for weight Review of the previous months Fine-tuning the personalized eating program Adding different recipes Risk assessment before the next session and planning the possible solutions	Measurement for weight Review of the previous months Fine-tuning the personalized eating program Adding different recipes Risk assessment before the next session and planning the possible solutions
Session 8	Measure for weight Fill up scales (EES, MEQ) Review of the changes since the first session Encouragement for maintenance of weight loss	Measure for weight Fill up scales (EES, MEQ) Review of the changes since the first session Encouragement for maintenance of weight loss
Follow-up (1 year after first session)	Content of the session (session lasts for half an hour)	Content of the session (session lasts an hour)
Session 9	Measure for weight Fill up scales (EES, MEQ) Review of the changes since the first session Encouragement for maintenance of weight loss	Measure for weight Fill up scales (EES, MEQ) Review of the changes since the first session Encouragement for maintenance of weight loss

ONE: Only nutritional education; **NE + CBT:** Nutritional education plus cognitive behavioral therapy; **BMI:** Body Mass Index; **EES:** The Emotional Eating Scale; **MEQ:** Mindful Eating Questionnaire

Table 2: Comparison of mean scores of BMI, EES, and MEQ within sub-groups and between groups at 1st, 5th, 8th sessions and 1 year follow up

	ONE group (n=30)					NE + CBT group (n=30)					
	ONE-1	ONE-2	ONE-3	ONE Total	P value ^a	NE+CBT-1	NE+CBT-2	NE+CBT-3	NE+CBT TOTAL	P value ^a	P value ^b
BMI											
1 st session	31.32	29.16	30.16	30.19	0.679	34.29	29.13	29.43	30.95	0.005**	0.589
5 th session	30.66	25.56	26.25	27.65	0.182	33.37	29.74	27.18	30.50	0.007**	0.011*
8 th session	26.26	24.38	28.90	25.52	0.395	31.33	29.72	26.36	29.44	0.037*	0.025*
1-year follow-up	27.83	26.18	28.90	27.03	0.566	31.71	30.63	26.04	29.73	0.049*	0.074
EES											
1 st session	57.80	84.70	72.70	71.73	0.144	77.10	62.4	86.8	75.43	0.128	0.631
5 th session	60.33	80.33	48.25	64.81	0.072	62	66.71	76.71	67.67	0.71	0.557
8 th session	42.33	80.40	60	65.44	0.185	50.11	60.86	76	60.56	0.161	0.835
1-year follow-up	43	78.8	45	63.11	0.219	46	55	62	52.68	0.196	0.559
MEQ											
1 st session	100.1	88.1	97.5	95.23	0.442	93.30	103.9	86	94.4	0.071	0.86
5 th session	102.5	90.33	121.25	102.63	0.022*	107.1	98.43	97.14	101.67	0.715	0.84
8 th session	113.67	94.4	109	102.44	0.049*	111.67	102	109.5	108.6	0.602	0.23
1-year follow-up	115.66	96.8	108	104.33	0.17	118.62	114.33	104.8	113.5	0.383	0.065

^a: P value within sub-groups, ^b: P value between two groups

*: Statistically significant for $p < 0.05$, **: Statistically significant for $p < 0.01$

BMI of both groups is statistically significant during the acute phase of treatment: for ONE group the mean for BMI drops from 26.60 to 25.51 during the acute phase ($p=0.016$), while for NE + CBT group the mean of BMI drops from 31.15 to 19.63 during the acute phase and the ($p=0.000$). The mean BMI is of ONE group is significantly lower at the end of 5th ($p=0.025$) and 8th session ($p=0.01$) than NE + CBT group. The mean BMI of ONE group increases when baseline mean BMI and mean BMI at 1-year follow-up is compared (26.60 and 27.03, respectively, $p=0.016$), while for NE + CBT group the mean BMI at the baseline is significantly higher than at the 1 year follow-up session (31.15 and 29.73 respectively, $p=0.037$) (Figure 2).

With regard to EES scores; there is no statistically significant differences between two groups and within sub-groups according to mean scores at baseline. For ONE group; mean EES scores begins to decrease as early as the 5th session but this decrease becomes significant at the eighth session ($p=0.37$). Yet, this significant decrease in EES scores is preserved at the 1-year follow-up for ONE-2 (80.4 to 78.8) and ONE-3 (60 to 45) subgroups, while the mean EES scores ONE-1 subgroup slightly increases (42.33 to 43) at

1-year follow-up. For NE + CBT group; for all sub-groups mean EES scores begins to decrease during the acute phase treatment ($p=0.001$), and all sub-groups preserve this decrease at 1-year follow-up ($p=0.000$). There is no statistically significant difference between mean EES scores of ONE group and NE + CBT group during both acute and maintenance phase (Figure 3).

With regard to MEQ scores; there is no statistically significant difference between two groups and within sub-groups according to mean scores at baseline. For ONE group, there is an increase in MEQ scores (increase in MEQ score favors an improvement of mindful eating) and this increase begins as early as 5th session, especially for ONE-3 sub-group (mean scores of MEQ increase from 97.5 to 121.25, $p=0.022$), but this increase is not statistically significant for ONE group at the 8th session and 1 year follow-up ($p=0.072$). For NE + CBT group, the increase in MEQ scores begins as early as at the 5th session for NE + CBT-1 (mean scores of MEQ increase from 93.3 to 107.1) and NE + CBT-3 (mean scores of MEQ increase from 86 to 97.14), and remains statistically significant even at 1-year follow-up ($p=0.000$) (Figure 4).

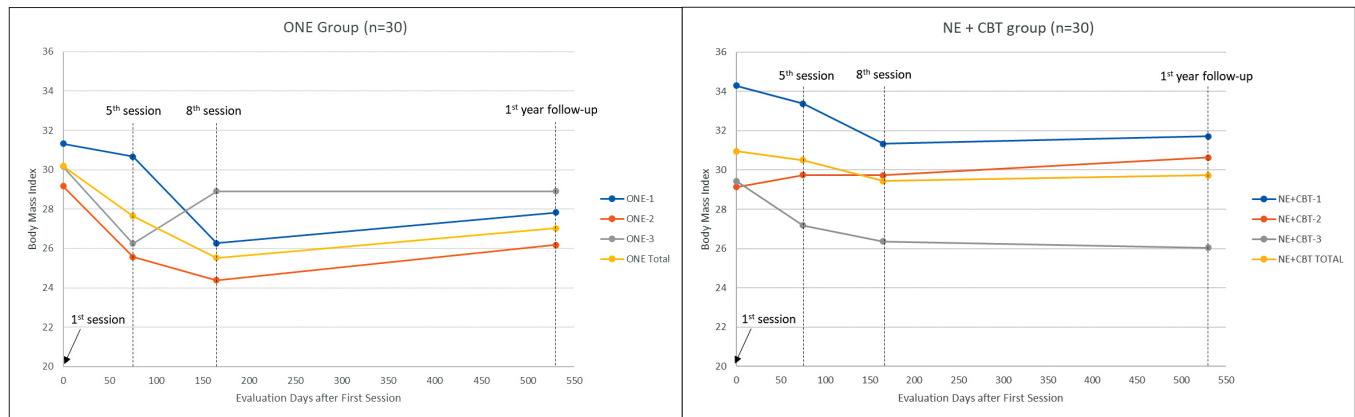


Figure 2. Comparison of mean scores of Body Mass Index (BMI) between groups at 1st, 5th, 8th sessions and 1 year follow up

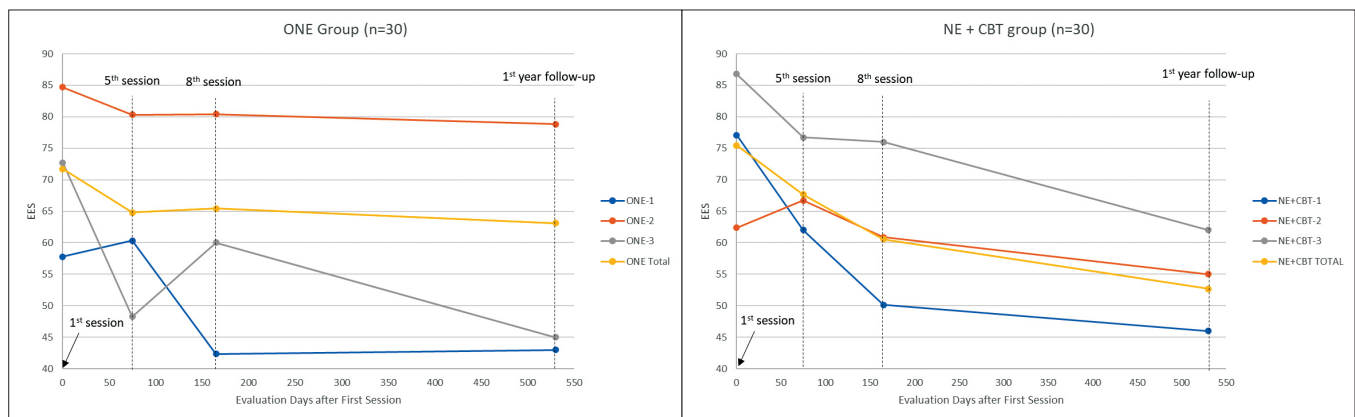


Figure 3. Comparison of mean scores of Emotional Eating Scale (EES) between groups at 1st, 5th, 8th sessions and 1 year follow up

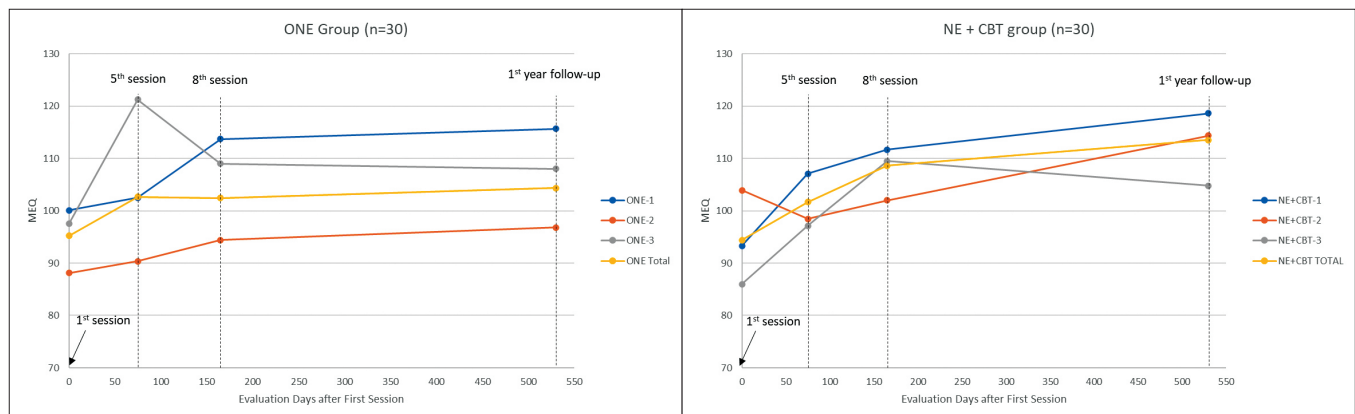


Figure 4: Comparison of mean scores of Mindful Eating Questionnaire (MEQ) between groups at 1st, 5th, 8th sessions and 1 year follow up

DISCUSSION

The aim of this study was to evaluate the effect of adding CBT on weight loss, emotional eating, and mindful eating patterns of post bariatric surgery patients during different timelines postoperatively. We had hypothesized that the time of CBT application to bariatric surgery patients would have different effects on weight loss and disordered

eating patterns. This hypothesis was not confirmed by the results of this study, since the mean scores from emotional eating and mindful eating scales did not significantly differ between sub-groups of NE + CBT group. Yet our results confirm the effectiveness of adding CBT to general nutritional education for postoperative bariatric surgery patients regardless of the application time. Emotional eating

decreases and mindful eating increases for all sub-groups of CBT, and these beneficial results are preserved at 1-year follow-up. Only the mean BMI differs significantly between subgroups of NE + CBT group: The baseline BMI of the first subgroup (NE + CBT-1; the patients who had surgery at least 2 years before the study) is higher than the other two sub-groups. Interestingly, at the end of 1st year, the first and third sub-groups preserve the beneficial effect of CBT with regard to weight loss, while the second subgroup gained some weight. These results may show that time of application of CBT does not cause a significant difference with regard to beneficial effects on BMI. This was actually a bit surprise for the authors, since the author who contacted the patients (M. Ö.) by telephone had a personal observation. The patients who had the surgery 6th month-1 year before was not generally eager to participate in the study (They would generally say “Why should I participate in the study? I am losing enough weight anyway”). The patients who had the surgery 1 st-2nd year before would generally say “Okay, that can be a good idea”. But the patients who had surgery at more than 2 years prior the study were generally more eager to participate in the study; they would generally say “Please help me, I am regaining the weight”. Because of this personal observation, we expected that the first sub-group would benefit more from CBT since they were more motivated for the therapy, but our expectation was not met.

To our knowledge, this is the first study to investigate the best time for application of CBT after the bariatric surgery. There are some studies conducted with bariatric surgery candidates, and they report that CBT significantly reduces dysfunctional eating behaviors, affective symptoms, and body weight before surgery (Ashton, Drerup, Windover & Heinberg, 2009; Cassin, Sockalingam, Du, Wnuk, Hawa, & Parikh, 2016; Gade et al., 2014; Gade et al., 2015). But one study shows that presurgical CBT was not associated with better long-term outcomes, with regard to breaking of the interrelationship between eating behaviors, negative mood, and dysfunctional cognitions (Hjelmessaeth, Rosenvinge, Gade, & Friberg, 2019). Another study compared the effect of applying CBT and nutritional support prior to bariatric surgery and both groups had comparable outcomes with regard to BMI, depression and anxiety levels, and disordered eating behaviors even at 1st year follow up, but the beneficial effects of CBT began earlier (Gade et al., 2015). In a preoperative pilot RCT, a 6-week telephone-based CBT intervention was compared with standard preoperative care (routine clinic visits and information meetings), and CBT group experienced statistically

significant improvements with large effect sizes in eating behaviors and psychological well-being (Cassin et al., 2016). Effects of applying CBT post-operatively have also been studied. In a pilot study with 17 patients, post-operative application of 8-week CBT significantly improved well-being and decreased psychological symptoms and distress, but unfortunately the time of application is stated as only at least 3 months after surgery (Beaulac & Sandre, 2015). In another postoperative study, 28 post bariatric surgery patient who had regained weight (the time of application is only stated as “mean time since surgery was 4 years”) received 6-week group behavioral intervention utilizing techniques of CBT and dialectical behavioral therapy, and this intervention resulted with loss of weight, improvement of depressive symptoms, decrease in grazing patterns and subjective binge eating episodes (Himes, Grothe, Clark, Swain, Collazo-Clavell, & Sarr, 2015). The fact that these studies were conducted with samples from different ethnic backgrounds, as well as the difference between the scales used to measure the eating behavior problems and psychopathology may be cause different results between studies. Comparison the effects of applying CBT pre and post operatively on weight loss, mood symptoms, and disordered eating behavior would be an interesting area to study.

Our second hypothesis was confirmed by our results. We had hypothesized that CBT would cause significant weight loss, decrease in emotional eating, and increase of mindful eating. Our control group was the patients who received only nutritional education. A comparison of the results of CBT and control group can be seen in Table 3. With regard to decrease in BMI; the control group has significantly better results than CBT group at the end of acute treatment phase and maintenance phase. But at the 1st year follow up, the control group has regained weight, while CBT group preserves the weight. This result shows that for these groups of patients, CBT had longer beneficial effects with regard to BMI than only nutritional education. A recent meta-analysis has summarized the results of 12 RCT (a total of 6805 obese or over-weight patients) in order to investigate the effects of CBT on weight loss. The control groups consisted of behavioral interventions, stimulus control, self-monitor, increase of physical activity, nutritional education and waiting list. Cognitive behavioral therapy had significant better effects with regard to weight loss and emotional eating, but interestingly, there were no statistically significant difference between CBT and control groups with regard to decrease in depressive symptoms (Jacob et al., 2018).

Table 3: A statistical analysis for the change of BMI, EES and MEQ at the 1st, 5th, 8th sessions and 1-year follow-up of both groups.

	ONE (n=9)						NE + CBT (n= 16)					
	Mean	Friedman test P value	Wilcoxon test P value				Mean	Friedman test P value	Wilcoxon test P value			
			1S-5S	1S-8S	1S-1Y	8S-1Y			1S-5S	1S-8S	1S-1Y	8S-1Y
BMI		0.002**	1	0.016*	1	0.016*		0.000**	1	0.000**	0.037*	1
1st session (1S)	26.60						31.15					
5th session (5S)	26.27						30.52					
8th session (8S)	25.51						29.63					
1-year follow-up (1Y)	27.03						29.73					
EES		0.012*	1	0.037*	0.028*	1		0.000**	0.068	0.001**	0.000**	1
1st session (1S)	80.44						75.5					
5th session (5S)	71						62					
8th session (8S)	65.44						55.20					
1-year follow-up (1Y)	63.11						52.68					
MEQ		0.072	NA	NA	NA	NA		0.000**	0.045*	0.000**	0.000**	1
1st session (1S)	92.22						93.06					
5th session (5S)	95.44						105.88					
8th session (8S)	102.44						111.06					
1-year follow-up (1Y)	104.33						113.5					

*, Statistically significant for $p < 0.05$, **, Statistically significant for $p < 0.01$

With regard to emotional eating; the results are similar between control group and CBT groups. The emotional eating in both groups began to decrease as soon as the acute treatment phase started and the effect was preserved until the end of first year. Emotional eating has been regarded as one of the main reasons for weight regain after bariatric surgery (Chesler, 2012; Colles et al., 2008; King et al., 2019; Marino et al., 2012; Meany et al., 2014; Mitchell et al., 2016; Nicolau et al., 2017; Sarwer et al., 2005; Sheets et al., 2015; White et al., 2010; de Zwaan et al., 2010), thus every treatment should focus on decreasing the emotional eating after bariatric surgery. For both our groups included of patients in our study, both CBT and nutritional education seems to decrease emotional eating.

With regard to mindful eating; there is no statistically significant change in control group, while CBT increases mindful eating significantly. This beneficial effect of CBT on mindful eating begins as early as during the acute phase and lasts even at one-year follow-up. Mindful eating techniques include promoting the conscious choice of food, developing awareness of the differences between physical hunger and psychological hunger, noticing the satiety signs and eating healthily as response to all these signals. Mindful eating has been shown to reduce binge-episodes

(Kristeller & Hallett, 1999; Mason et al., 2016), decrease emotional eating (Mason et al., 2016), increased food-related self-efficacy and cognitive control with respect to eating behavior (Miller, Kristeller, Headings, Nagaraja & Miser, 2012; Miller, Kristeller, Headings & Nagaraja, 2014), and caused significant weight and glycemic control in patients with diabetes (Medina et al., 2017). These results may show that mindful eating helps to develop a healthier relationship with food, so it is important to address mindful eating in every weight loss program. In fact, our results show that CBT has a significant effect on increasing mindful eating.

Despite these important results, our study has some major limitations. The first one is that; our study sample was small and comes mainly from one center. The second limitation is that; the acute treatment phase lasted for only five sessions, and we only had one follow-up sessions. A recently developed personalized cognitive behavioral therapy for obesity (CBT-OB) protocol includes a Phase 1 - acute treatment phase with 16 sessions which lasts about 24 weeks, and a Phase 2 - maintenance phase with 12 sessions which lasts 48 weeks (Grave et al., 2020). Third limitation is that; we did not evaluate the effects of CBT on general eating disorder symptomatology (especially binge

eating) and depression. Yet the results of this study support the addition of CBT to nutritional education for postoperative bariatric surgery patients, especially because of its significant effects on decreasing emotional eating, increasing mindful eating, and preservation of weight loss. Future studies comparing the effect of adding CBT to pre and post-surgical patients would be an interesting area to study.

Ethics Committee Approval: The study was approved by Üsküdar University Non-invasive Research Ethics Committee: 25/12/2017 / B.08.6.YÖK.2 ÜS.0.05.0.06/2017/316).

Informed Consent: Informed consent was obtained from all individual participants included in the study.

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