

# Effect of Structured Cognitive-Behavioral Group Therapy on Body Weight, Mental Status and the Quality of Life in Obese and Overweight Individuals: A 16-Week Follow Up Study



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## SUMMARY

**Objective:** It was aimed in this study to investigate the effects of group cognitive and behavioral therapy (CBT) on the body weight, depression, anxiety, quality of life, self-esteem, dietary cognitive distortions and eating behavior of obese and overweight people.

**Method:** The study was carried out at the Department of Psychiatry, Gazi University Faculty of Medicine, between 01.07.2017 and 31.12.2017. The participants attended group CBT sessions once weekly for eight weeks. Reinforcement sessions took place at the 12th and 16th weeks. At the first, 8th, 12th and the 16th weeks, body weights were measured and the participants were asked to complete the Beck Depression Inventory (BDI), Beck Anxiety Inventory (BAI), the Obese Individuals Specific Quality of Life Scale (OISQLS), the Dutch Eating Behavior Questionnaire (DEBQ), the Rosenberg Self-Esteem Scale (RSES) and the Diet Related Dysfunctional Attitudes Scale (DRDAS).

**Results:** The group mean age was 41.71±4.46 years, 32 (91.4%) being female. Significant improvements were found in body weight and the scores on the BDI, BAI, DEBQ, OISQLS, DRDAS, and the RSES ( $p<0.001$  for each). The average percent weight loss was 10.2%. The BDI score was the best predictor of the change in body mass index (BMI).

**Conclusion:** CBT-based group treatments for obese and overweight people are effective in losing weight. Therapy participants with less depression symptoms benefit more from treatment and lose more weight. These results should be re-evaluated in randomized controlled trials.

**Keywords:** Obesity, cognitive behavioral therapy, body weight, depression, anxiety, quality of life

## INTRODUCTION

Obesity, defined by the World Health Organization (WHO) as the abnormal or excessive accumulation of fat with adverse health effects, is diagnosed with a body mass index (BMI) greater than 30 kg/m<sup>2</sup> (WHO 2017). Obesity represents a major risk factor for non-infectious diseases and, depending on variable factors, reduces life expectancy by 5 to 20 years. Non-infectious diseases such as cardiovascular disorders, cancer, type 2 diabetes account for nearly 70% of all deaths globally (WHO 2017). Obesity has become a global epidemic in the recent years. According to the last data of the WHO, there are approximately 650 million obese individuals worldwide and 1.9 billion individuals are overweight with BMI

>25 kg/m<sup>2</sup> (WHO 2020). During the period between 1975 and 2016, the prevalence of obesity has tripled throughout the world (NCD-RisC 2017). Turkey ranks as the country with the highest prevalence of obesity in Europe, with age adjusted prevalences of overweight (BMI>25 kg/m<sup>2</sup>) and obesity (BMI>30 kg/m<sup>2</sup>) being 66.8% and 32.2%, respectively. (WHO 2016) indicating obesity as a significant public health problem in the country.

Preventive measures are the most cost-effective approaches for the developing countries that are not equipped to meet the economical and social costs of obesity (Yüksel 2019). The two fundamental objectives of obesity prevention include reduced caloric intake through diet and increased energy

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expenditure. A wide spectrum of treatment methods are available, ranging from the basic dietary changes implemented by the individual to interventional procedures such as bariatric surgery (Oğuz et al. 2016, Galindo Munoz et al. 2019). Prevention of weight regain in the long term is as critical as weight loss in obesity treatment. The absence of long term follow up controls in the treatment process has resulted in gaining, within one year, nearly one third of the weight lost (Wadden et al. 2007), and returning to baseline weight within 2-5 years (Wadden et al. 1989, Berk et al. 2018). It was reported by a 4-year prospective study that 5% reduction in the bodyweight of 46% of the patients after lifestyle changes was a successful outcome (Wadden et al. 2011). In treatment programs based on lifestyle changes, prolonged intervals in follow up were associated with increased weight regain (Kramer et al. 1989). Pharmacological treatment of obesity is based on several basic mechanisms. Drugs generally aim to suppress appetite, reduce fat absorption or increase energy expenditure (Yetkin and Çimen 2011). A comparative study on the effects of pharmacological agents used for the treatment of obesity, reporting the additional percent weight losses versus placebo as 2.6%, 3 to 3.6%, 6.6%, 3.2 to 5.2%, and 4 to 6% for orlistat, lorcaserin, topiramate, bupropion/naltrexone, and liraglutide, respectively, emphasized the necessity of research for new treatment approaches given the serious doubts on the long term use of these agents (Jones and Bloom 2015).

Bariatric surgery has been reported to result in higher weight loss as compared to pharmacotherapy (Güngör 2019). Also, in the long term, bariatric surgery provides improvements in many parametric health indices and particularly those associated with the cardiovascular system (Sjöström et al. 2012). However, being an interventional method involving surgery related complications and, although rare, the risk of perioperative mortality are serious factors of concern. Cognitive Behavioral Therapy (CBT) is another method for treating obesity (BulutÇakmak and Dönmez 2014) by using both behavioral techniques and aiming to increase awareness of the individual on the unrealistic and dysfunctional cognitive processes Cognitive-behavioral group therapy for obesity treatment includes therapeutic steps of self-monitoring, control of stimuli, control of eating behavior, reinforcement and augmentation, cognitive re-structuring, training for proper nutrition, increased physical activity and maintenance of the ideal weight once it has been reached (Oğuz et al. 2016, Gilbert et al. 2019). Treatment duration varies between guidelines but generally lasts between 7 and 20 weeks (BulutÇakmak and Dönmez 2014, Oğuz et al. 2016). Group CBT for obesity is reported not only to contribute to weight reduction, but also to alleviation of anxiety, depression, anger, and impulsiveness, resulting in increased quality of life and self-respect (Galindo Muñoz et al. 2019, Gilbert et al. 2019). Sertöz and Mete

(2005) reported reduced weight and BMI, lowered severity of the symptoms assessed on the sub domains of Symptom Checklist-90 (SCL-90) and increased quality of life after group CBT and recommended further investigations with larger patient groups in our country.

Depression, eating behaviour disorder, which is psychiatrically closely related to obesity (Pereira-Miranda et al. 2017), and cognitive distortions impede the efforts to lose weight (Paul et al. 2017). A current meta-analysis reported the lifetime prevalence of depression to be 7% and 32% higher in overweight and obese individuals, respectively, as compared to individuals with normal body weight (Pereira-Miranda et al. 2017). Investigation of obesity and comorbid psychiatric disorders in the general population demonstrated 1.46 fold higher incidence of anxiety disorders in cases of obesity (Scott et al. 2008). A relationship was reported between increased weight and anxiety in obesity (Guedes et al. 2013). The prevalence of anxiety among obese Turkish females was reported to be 14.5% as compared to 5.5% in the controls (Özdel et al. 2011). The cited reports indicate higher incidences of depression and anxiety in obese individuals. Psychiatric disorders in general, and depression and anxiety in particular, are associated with bad cognitive functionality, lowered quality of life and self-respect (Millan et al. 2012, Sagayadevan et al. 2018). Insulin resistance, hypertension, hypercortisolemia, and leptin resistance seen in obesity give rise to cognitive dysfunction (Waldstein and Katzel 2006, Smith et al. 2011) caused by reduced synaptic plasticity, alterations in neurotransmitter levels and receptor numbers, alterations of blood flow, demyelination, micro-infarcts of the white matter and vascular injury (Wang et al. 2001, Fatani et al. 2007, Raschpichler et al. 2013). The observed cognitive impairments range from simple forgetfulness that can be tolerated in daily life to executive dysfunction, depending on the part of the brain involved and the severity of the change (Macit and GezmenKaradağ 2014). One of the important consequences of cognitive dysfunction in obesity is the difficulty in losing or controlling weight (Spitznagel et al. 2013, Spitznagel et al. 2014), due to failure in complying with appointments, following the instructions issued for physical activity, and failing to comprehend the need for dietary restrictions or behavioral changes (Bond et al. 2009, Macit and GezmenKaradağ 2014). Other problematic areas among obese individuals include poor quality of life and low self-esteem (Koloktin and Andersen 2017, Emre and Öner 2018).

This is a 16-week observational study aiming to assess the effects of group CBT on body weight, depression, anxiety, the quality of life, self esteem, cognitive distortions related to dieting and eating behaviour in obese and overweight individuals.

## METHOD

### Study Design and the Participants

The study was carried out at the Department of Psychiatry, Gazi University Medical Faculty between 01 July 2017 and 31 December 2017, with the individuals consulting the psychiatry and endocrinology outpatient clinics for weight loss. The size of the participant group was estimated using the G\*Power software pack (Faul et al. 2009). At least 22 participants were required in each therapy group to attain the minimum statistical power of 80% with alpha-error rate of 0.05 and an intermediate Cohen effect size of 0.5 with measurements involving four repetitions. Considering a 25% drop-out incidence, 28 participants were targeted for in order to make up 4 treatment groups with 8-10 participants in each session.

The inclusion criteria of the study were being overweight ( $25 < \text{BMI} < 30 \text{ kg/m}^2$ ) or obese ( $\text{BMI} > 30 \text{ kg/m}^2$ ). The exclusion criteria were having severe mental disorders such as mental retardation, psychotic disorder, major depression or systemic illnesses such as cancer, Parkinsonism, chronic obstructive pulmonary disorder, unstable hormonal disorders such as hypothyroidism, hyperthyroidism, Cushing's disease, pheochromocytoma, pregnancy and lactation; use of or inability to discontinue agents for weight loss or which may affect weight change such as corticosteroids, antipsychotics, antiepileptics among others.

The approval for study protocol, dated and numbered 19.06.2017- 340, was given by The Ethics Committee for Clinical Research, Gazi University.

Group therapy sessions were initiated when 40 participants meeting the inclusion and exclusion criteria were enrolled. The objective of the group therapy and scientific use of the resultant information was explained to each participant and all participants provided written informed consent before the study.

Measures were taken to eliminate the effects of seasonal changes and alterations in the therapists. Hence, all sessions were conducted simultaneously; and each therapy session was conducted by the same team of therapists, trained and experienced in the subject, including a professor of psychiatry, a psychiatrist and a psychiatry nurse. A total of eight weekly sessions were performed, each lasting approximately 50 to 60 minutes. At the 12th and 16th weeks, reinforcement and augmentation sessions were undertaken.

Body weight and height measurements were made on the day of the first therapy session, and only weights were measured at the 8th, 12th, and the 16th weeks. A digital scale was utilized for weight measurements after a minimum four-hour fasting and intestinal evacuation, use of similar clothing were ensured before the measurements. Psychometric tests were carried out at the first, 8th, 12th, and the 16th weeks. The study flowchart is shown in Figure 1.

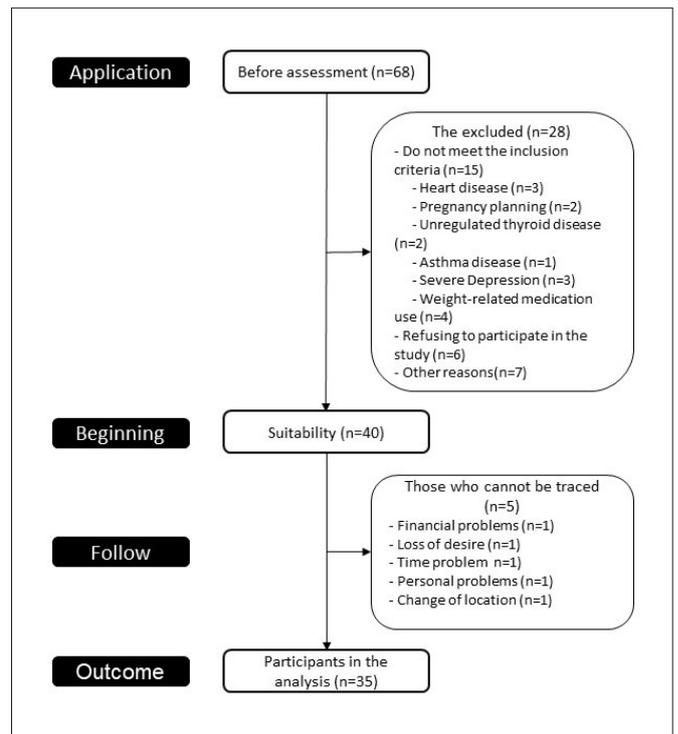


Figure 1. Study Flowchart

### The Content of Group CBT Sessions

Group therapy sessions were carried out in accordance with the CBT session structure. The first 15 minutes were allocated to mood control, follow up on homework and conversations on the session agenda, and the planned therapeutic programs were undertaken during the following 30 to 40 minutes. The sessions were closed by 5-10 minutes of going over the session content and planning the new homeworks. The contents of successive session are summarized below:

**1<sup>st</sup> session:** Getting the group members acquainted with each other, explaining the group therapy rules and the CBT program to be delivered and establishing the basis of collaboration between the participants and with the therapy team.

**2<sup>nd</sup> session:** Explanation of the rationale for behavioral change, determination of the diet list and planned meals

**3<sup>rd</sup> session:** Organising the environment, awareness during eating, appointing a diet coach

**4<sup>th</sup> session:** Continuation of behavioral therapy, exercise planning, discussing different types of hunger

**5<sup>th</sup> session:** Discussing emotional eating

**6<sup>th</sup> session:** Description of automated thinking, discussing cognitive distortions

**7<sup>th</sup> session:** Continuation of cognitive intervention, formation of alternative thoughts

**8<sup>th</sup> session:** General assessment, discussion of the methods to prevent recurrence

**12<sup>th</sup> and 16<sup>th</sup> sessions:** General assessment, determining and discussing the problem areas

### Data Acquisition Tools

**The Sociodemographic Questionnaire:** This 26-item form was prepared by the researchers to acquire data on the socio-demographic features, dietary characteristics and information and medical conditions of the participants.

#### **The Beck Depression Inventory (BDI):**

The BDI, developed by Beck et al. (1961), is a 21-item, 4-point Likert-type scale used to assess the severity and the risks of depression. Increases in the scores indicate increased depression severity. The validity and reliability of the Turkish language version were reported by Hisli (1988).

**The Beck Anxiety Inventory (BAI):** The BAI was developed by Beck et al. (1988) and the validity and reliability of the Turkish language version were reported by Ulusoy et al. (1998). It is a 21-item 4-point Likert type self-report assessment tool to evaluate the severity of the anxiety symptoms experienced by the individual. High scores indicate increased severity of anxiety.

**The Dutch Eating Behavior Questionnaire (DEBQ):** Developed by Van Strien et al. (1986), the DEBQ is a 33-item 5-point Likert type scale with three subdomains on emotional eating, external eating, and restrained eating. There is not a total score for the tool, but higher scores in emotional eating and external eating subdomains indicate negative eating attitudes, while higher scores obtained in the restrained eating subdomain show a reduced frequency of uncontrolled eating. Bozan et al. (2011) carried out the validity and reliability study on the Turkish language version. The Cronbach's alpha coefficient is 0.97, explaining 36% of the variance. The low correlation coefficient ( $r=0.30$ ) for test-retest reliability needs to be addressed in scientific research. The structural factor and reliability analyses performed on the DEBQ indicated that the emotional eating subdomain could explain 31% to 35% of the variance with a reliability coefficient of 0.96 to 0.97. Considering these results, it has been concluded that the data obtained through the emotional eating subdomain is of adequate quality for analysis.

**The Obesity Quality of Life Scale (OQOLS):** The OQOLS, developed by Patrick et al. (2004) is a six-point Likert type psychometric tool with 17 items forming a single factor. High total score indicates poor quality of life. The validity and reliability of the Turkish language version were demonstrated by ÇırayGündüzoğlu et al (2014).

**The Diet Related Dysfunctional Attitudes Scale (DRDAS):** The DRDAS was developed by Okumuşoğlu (2015), using the cognitive impairment described in the book "Beck Diet Solution" (Beck 2010) as well the published data on dysfunctional attitudes. It is an 18-item, seven-point Likert type scale with a single domain that measures the dysfunctional attitudes toward diet. The total score ranges between 18 and 126, indicating the number of dysfunctional attitudes.

**The Rosenberg Self-Esteem Scale (RSES):** Developed by Rosenberg (1965), the first ten items of the RSES measures self-esteem. It is a four-point Likert type scale with the total score ranging between 0 and 6, and high scores indicate high self esteem. The validity and reliability of the Turkish language version were proven by Çuhadaroğlu (1986).

**The International Physical Activity Questionnaire (IPAQ):** This questionnaire was developed by Craig et al. (2003) to determine physical activity levels. The short self-report form of the IPAQ was used in our study to provide information on time spent on activities such as sitting, walking, moderate exercise and intense activity. Scoring, based on the requirement of a minimum duration of 10 minutes spent for each activity type, is expressed as "MET (metabolic equivalent task, amount of oxygen consumption at rest) - minutes/week" and estimated by multiplying the MET with minutes and days. For example, the calculation of walking score (MET-minutes/week) is  $=3.3 \times \text{walking duration} \times \text{walking day}$ . The MET coefficients for moderate and intense activity are, respectively 4 and 8. The total physical activity score is the sum of the subscores for walking, moderate exercise, and low activity. High scores indicate more physical activity. The validity and reliability of the Turkish language version were shown by Öztürk (2005).

### Statistical Analysis

Data were analysed on the SPSS (Statistical Package for Social Sciences) 23.0 software pack. Descriptive statistics were expressed by number and percentage distributions. and continuous variables were expressed by the arithmetic mean and standard deviation. Qualitative data were compared by using the chi-square test, and, when required, by the Fisher's exact test. Normality of data distribution was tested using the Kolmogorov-Smirnov test. The independent sample t-test was used for intergroup comparison of BMI values, which showed normal distribution. Data recorded at different measurement time-points were evaluated by Variance Analysis for Repeated Measurements.

Changes in BMI, and the scores on the BDI, QOOLS, DRDAS and the DEBQ-emotional eating subdomain were analysed by multiple linear regression analysis; and the change was estimated by subtracting the values recorded at the

16<sup>th</sup> week from those recorded at the first week. All calculated changes had a positive value. A stepwise approach was adopted in the multiple linear regression analysis in order to avoid the multi-collinearity problem due to the small size of the participant group. When assessing the BMI change by multiple linear regression analysis, the first week 'baseline' data on the BDI, BAI, DEBQ, OQOLS, DRDAS, RSES, and the IPAQ were taken as independent variables. When analysing the change in the BDI score, the 'baseline' measurements on all tests other than the BDI were included in the analysis as independent variables. The same approach was adopted for assessing the change in the OQOLS, DRDAS and the DEBQ- emotional eating subdomain. A *p*-value of < 0.05 was considered to indicate statistical significance.

## RESULTS

### Demographic and Dietary Characteristics

Table 1 shows the demographic and the dietary characteristics of the participants. The mean age was 41.71±4.46 years (min:31, max:48 y) for the total group consisting of 32(91.4%) females, 19 (54.3%) married individuals and 27(77.1%) university graduates, 2(5.7%) alcohol consumers and 8(22.8%) cigarette smokers. Chronic diseases were present in 13(37.1%) including hypothyroidism in 4(11.4%), hypertension alone in 3(8.5%), type 2 diabetes alone in 3(8.5%) and hypertension with type 2 diabetes in 2(5.7%). All of these conditions were under control. Skipped meals were reported by 15(42.9%) which included breakfast in (n=2; 5.7%), lunch (n=9; 25.7%) and dinner in (n=4; 11.4%). Previously, four or more dietary interventions were attempted in 17(48.6%) participants, and 10 (28.6%) reported having been overweight/obese for more than 20 years. The excessive weight was ascribed to *nutritional habits* by 27(77.1%), *familial tendency* by 14(40%), *work conditions* by 15(42.9%), *psychological reasons* by 8(22.9%), *stress* by 11(31.4%) and *inactivity* by 14 (40%).

### Measurement Data and Changes in Body Mass Index (BMI)

Table 2 shows the time dependent changes in the psychometric scores and in the BMI. Significant improvements were observed in BMI, body weight and also the scores on the BDI, BAI, OQOLS, DRDAS, IPAQ, RSES and all subdomains of the DEBQ (*p*<0.001, for all) from the first week 'baseline' to the 8<sup>th</sup>, 12<sup>th</sup>, and the 16<sup>th</sup> weeks (Table 2). Figures 2 and 3 show the changes in body weight and the measurements made in the study. The percent weight loss was <5% by 3(8.6%), 5% -10% by 16(45.7%), 10%-15% by 12(34.2%), and 15%- 20% by 4(11.4%), with the mean percent body weight loss being 10.2%.

**Table 1.** Sociodemographic and Dietary Characteristics of the Participants

Variable	Sample (n=35)		
	n	%	
Gender	Female	32	91.4
	Male	3	8.6
Marital status	Married	19	54.3
	Single	16	45.7
Occupation	Civil Servant	25	71.4
	Worker	4	11.4
	Housewife	1	2.9
	Other	5	14.3
Education	Primary	2	5.7
	High School	6	17.1
	University	27	77.1
Siblings	Absent	13	37.1
	Present	22	62.9
Smoking	Absent	27	77.1
	Present	8	22.9
Alcohol consumption	Absent	33	94.3
	Present	2	5.7
Chronic disease	Absent	22	62.9
	Present	13	37.1
No. of meals	2	3	8.6
	3	17	48.6
	4	11	31.4
	5	4	11.4
Skipping meals	Absent	20	57.1
	Present	15	42.9
Snacking	Absent	3	8.6
	Present	32	91.4
Previous dieting history	Absent	5	14.3
	Present	30	85.7
No. of diets	0	5	14.3
	1	4	11.4
	2	2	5.7
	3	7	20.0
	≥ 4	17	48.6
Duration of time spent with excessive weight*	≤ 5 years	2	5.7
	6-10 years	10	28.6
	11-20 years	13	37.1
	≥ 20 years	10	28.6

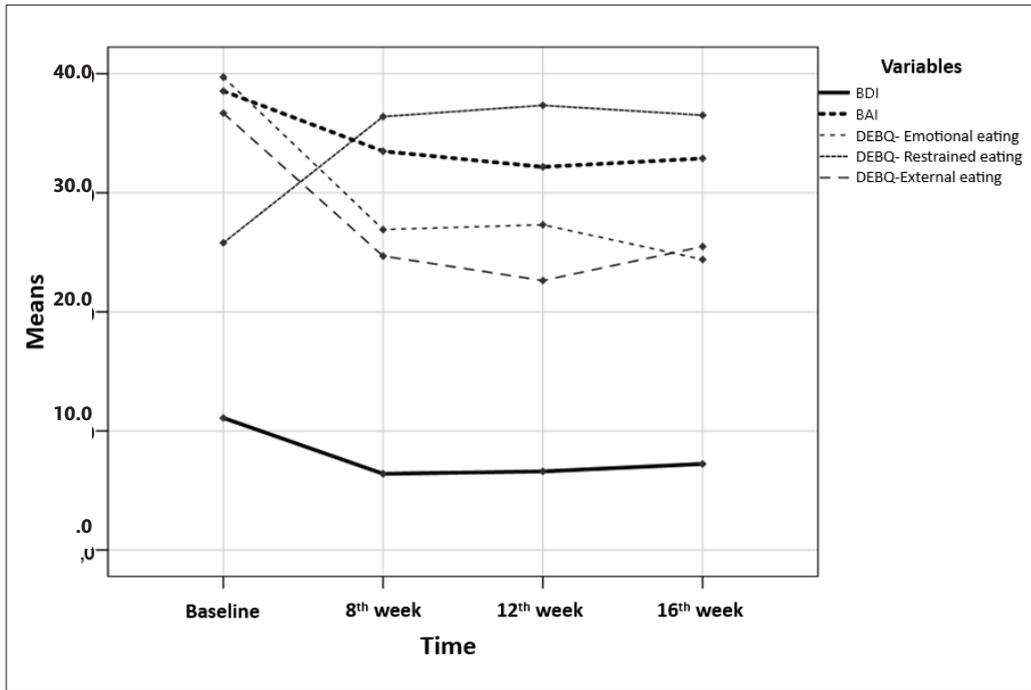
\*BMI>25

**Table 2.** Changes in the Measurements Made Over Time

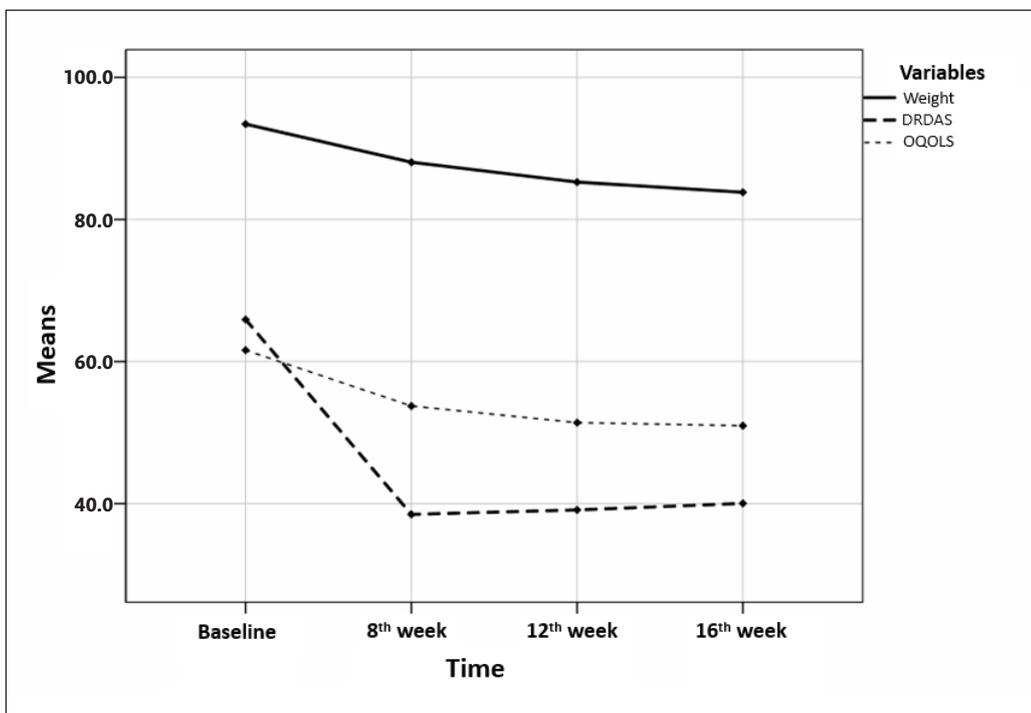
Variables	Baseline (1)	Week 8 (2)	Week 12 (3)	Week 16 (4)	F	p	Partial Eta <sup>2</sup>	Secondary analyses	
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD				Pairs	p*
Weight (kg)	93.42±13.08	88.05±12.59	85.25±12.47	83.82±11.78	122.851	<0.001	0.783	1-2	<0.001
								1-3	<0.001
								1-4	<0.001
								2-3	<0.001
BMI	35.73±5.37	33.69±5.25	32.61±5.15	32.09±5.05				2-4	<0.001
								3-4	0.003
BDS	11.08±6.87	6.40±9.11	6.60±7.23	7.22±6.17	17.272	<0.001	0.337	1-2	<0.001
								1-3	<0.001
								1-4	<0.001
BAS	38.54±11.23	33.48±9.81	32.17±10.53	32.88±7.98	17.976	<0.001	0.346	1-2	0.001
								1-3	<0.001
								1-4	0.001
DEBQ- Emotional eating	39.71±15.02	26.91±12.35	27.31±10.08	24.40±8.11	22.4421	<0.001	0.397	1-2	0.002
								1-3	<0.001
								1-4	<0.001
								3-4	0.006
DEBQ- Restrained eating	25.80±6.28	36.40±6.46	37.34±6.95	36.51±5.72	86.003	<0.001	0.717	1-2	<0.001
								1-3	<0.001
								1-4	<0.001
DEBQ-External eating	36.68±7.93	24.68±7.69	22.62±5.84	25.48±7.26	55.180	<0.001	0.619	1-2	<0.001
								1-3	<0.001
								1-4	<0.001
								2-3	0.007
OQOLS	61.60±22.84	53.74±20.42	51.40±18.54	50.97±18.43	15.334	<0.001	0.311	3-4	<0.001
								1-2	0.026
								1-3	0.001
DRDAS	65.91±23.12	38.48±13.86	39.11±13.17	40.02±13.89	53.979	<0.001	0.614	1-4	<0.001
								1-2	<0.001
								1-3	<0.001
IPAQ (MET)	827.6±755.5	1002.4±682.3	1154.6±658.7	1095.5±697.0	9.902	<0.001	0.226	1-2	0.003
								1-3	<0.001
								1-4	0.008
RSES	1.30±0.83	0.81±0.43	0.81±0.29	0.79±0.30	14.588	<0.001	0.300	1-2	<0.001
								1-3	0.004
								1-4	0.001

\*Bonferroni correction was made for multiple comparisons.

BMI: Body Mass Index, BDI: Beck Depression Scale, BAI: Beck Anxiety Scale, DEBQ: Dutch Eating Behaviors Questionnaire, OQOLS: Obesity Quality of Life Scale, DRDAS: Diet Related Dysfunctional Attitudes Scale, IPAQ: International Physical Activity Questionnaire, MET: Metabolic Equivalent, RSES: Rosenberg Self-Esteem Scale, SD: standard deviation



**Figure 2.** Changes in the BDI, BAI, and the DEBQ subdomain scores over time. BDI: Beck Depression Inventory, BAI: Beck Anxiety Inventory; DEBQ: Dutch Eating Behaviors Questionnaire



**Figure 3.** Changes in Bodyweight, the DRDAS Score and the OQOLS Score over time. OQOLS: Obesity Quality of Life Scale, DRDAS: Diet Related Dysfunctional Attitudes Scale

### Regression Analysis for the Change in BMI and the Scores on Psychometry

Table 3 shows the results of the multiple linear regression analysis for the predictors of change in BMI, the BDI, OQOLS, DRDAS and the DEBQ emotional eating subdomain. Accordingly, the ‘baseline’ scores on the BDI ( $\beta = -0.473$ ;  $p = 0.003$ ) and the DEBQ restrained eating subdomain ( $\beta = -0.365$ ;  $p = 0.020$ ) were the two strongest predictors of the change in BMI. Hence, those participants with less severe

depressive symptoms and less restrained eating behaviour were likely to lose more weight. The only variable that significantly predicted the change in the BDI score was the ‘baseline’ DRDAS score ( $\beta = -0.375$ ;  $p = 0.026$ ). Also, the ‘baseline’ BDI and DEBQ-external eating subdomain scores were predictive for the change in the DEBQ-emotional eating subdomain score ( $p = 0.001$  and  $p = 0.006$ , respectively). The ‘baseline’ scores on the DEBQ- external eating subdomain and the BAI predicted the change in the DRDAS score ( $p < 0.001$ , for both).

**Table 3.** Multiple Linear Regression Analysis for the Predictors of the Change Over Time in BMI and the Scores on the BDI, DEBQ-Emotional Eating, OQOLS and the DRDAS Change Over Time

Dependent variable	Independent variables	$\beta$ (Beta)	T	p	Results of Model Analysis			
					F	p	R <sup>2</sup>	CI
Change in BMI	Constant	-	6.519	<0.001	7.146	0.003	0.30	10.614
	BDI	-0.473	-3.189	0.003				
	DEBQ-Restrained eating	-0.365	-2.458	0.020				
Change in BDI	Constant	-	3.878	<0.001	5.407	0.026	0.14	5.952
	DRDAS	-0.375	-2.325	0.026				
Change in DATDS	Constant	-	2.054	0.048	53.227	<0.001	0.76	12.200
	DEBQ-External eating	0.811	-9.502	<0.001				
	BAI	-0.419	4.906	<0.001				
Change in DEBQ-Emotional Eating	Constant	-	2.260	0.031	14.569	<0.001	0.47	11.343
	BDI	0.477	-3.592	0.001				
	DEBQ-External eating	0.387	-2.918	0.006				

BMI: Body Mass Index, BDI: Beck Depression Inventory, BAI: Beck Anxiety Inventory, DEBQ: Dutch Eating Behaviors Questionnaire, OQOLS: Obesity Quality of Life Scale, DRDAS: Diet Related Dysfunctional Attitudes Scale, CI: Condition Index

## DISCUSSION

This study was undertaken to investigate the efficacy of group CBT on weight reduction as well as the variables that affected weight loss during the therapy. Following the 16-week group therapy program, decreases were recorded in body weight, depression, anxiety, dysfunctional dietary attitudes, and problematic eating behaviors such as emotional eating, restrained eating, and external eating, were observed, and improvements in the quality of life, self-esteem and physical activity level (Figure 2 and Table 2). The participants with less depression and less restrained eating behaviour lost more weight, and these variables had a significant predictive value for weight reduction (Table 3).

A steep increase is noted globally in the incidences of overweight and obesity. Obesity has become a major public health problem and it will be more so in the future given the projection that worldwide 57.8% of adults will be overweight or obese by 2030 (Kelly et al. 2008). Therefore, effective treatment strategies are required for conditions of overweight and obesity. One current and effective approach is using the CBT for treating obesity (Oğuz et al. 2016). In a meta-analysis investigating the effect of psychological interventions in obese individuals, CBT was found to be highly effective (Palavras et al. 2017) which was confirmed by others (Sertöz and Mete 2005, Paul et al. 2017, Gulley et al. 2019). Similarly, in our study, group CBT was effective in reducing body weight (Figure 2) and also in improving the symptoms of anxiety, depression or self-esteem (Table 2). Furthermore, reductions in problematic eating behaviour and dysfunctional attitudes toward diet were observed together with an increase in physical activity level and the quality of life (Table 2). Pharmacotherapy for obesity provides only 2.6% to 6.6% additional weight loss as compared to placebo. Bariatric surgery

which, only, enables further weight loss involves risks of serious perioperative complications. Hence, group CBT can be considered relatively safe and effective for weight reduction. Participants of an 8-week group CBT with a 2-year follow up are reported to have lost 8.7% of their body weight during the therapy program (Berk et al. 2018). while the weight loss was 9.4% over a 3-month period in another program using cognitive based therapy (Galindo Munoz et al. 2019). The participants of our study lost 5% and 10.2% of their body weight after 8 and 16 weeks, respectively, indicating the agreement of our results with the literature. Despite the significant initial weight loss during the therapy, subsequent regain of weight has been reported. The 8.7% weight loss reported during 8 weeks of group CBT was found to decrease to 4.9% at the end of the 2-year follow up (Berk et al.2018)

Group CBT programs also provide benefits in psychosocial functionality. One year after a 10-week CBT-based intervention, significant improvements in depression, anxiety, self-esteem, physical activity, and life quality were observed by Lores et al. (2020) which is similar to our observations. The psychiatric disorder of depression, characterized by symptoms including psychomotor retardation, lack of energy and appetite changes, lack of motivation, forgetfulness, inability to focus, memory problems, drug non-compliance, and alterations in sleep and appetite, is comorbid with obesity and makes weight loss a significant challenge for the patients. (Dixon et al. 2003, American Psychiatric Association –APA-2013, Pereira-Miranda et al. 2017,). Consistent with these reports, our results showed depression symptoms to be one of the two critical predictors of change in weight loss, the other being restrained eating behaviour which refers to restricted eating, both in terms of timing and frequency, for the purpose of weight control (Burton et al. 2007). In our study, individuals with less restrained eating behaviour achieved more weight

loss (Table 3). Behavioral advice and correction of cognitive distortions lead to more prudent eating habits among our participants, suggesting that participants with lower severity of depressive symptoms and less restrained eating behaviour are more likely to benefit from this therapeutic approach. Abnormal patterns of restrained eating, such as the total absence of or the excessiveness of restrained eating behaviour, may lead to weight gain (Greeno et al. 2000, Larsen et al. 2007). Over restraining of eating leads to an increased desire for food with subsequent binge eating and weight gain. just as with the total absence of restrained eating. In our study, the severity of depressive symptoms at the outset of the group CBT program was the most significant predictor of weight loss, while the DRDAS score was the most significant predictor of improved depressive symptoms (Table 3). More marked improvements in depression were observed in individuals with the least dysfunctional eating attitudes. In other words, the participants with better cognitive attitudes toward diet were found to have more pronounced weight loss. Previous studies suggested a reciprocity of positive correlations between weight loss and cognitive functions (Barton et al. 2004, Okumuşoğlu 2017, Veronese et al. 2017). In a recent meta-analysis involving 13 prospective and seven randomized controlled studies, weight reduction was found to improve attention, memory, cognitive functions, language, and executive functions (Veronese et al. 2017). Good cognitive functioning and appropriate cognitive attitudes toward diet were associated with even better outcomes in body weight reduction (Barton et al. 2004, Okumuşoğlu 2017).

Cognitive distortions shaping the emotions and behaviours that underlie psychiatric disorders such as depression and panic disorder and cause disease progress and reduced quality of life, are also associated with physical conditions such as obesity (Arkar 1992, Hofmann et al. 2014). Increased anxiety is a major impediment to the alleviation of cognitive distortions (Hofmann et al. 2014). In our study, the level of anxiety was one of the two predictors of a change in functional attitudes toward diet (Table 3). Accordingly, participants with low level of anxiety had more reduction in cognitive distortions.

Another predictor of the change in functional attitudes toward diet was external eating behaviour (Table 3), which is described as increased eating behaviour in response to external stimuli such as the smell, appearance, or taste of food. The tendency to consume food for satisfaction in the absence of hunger is not only an eating disorder (Burton et al. 2007) but also a cognitive problem. Our results suggest that participants with external eating behaviour already have an attitude disorder regarding the diet. Participants experiencing the most marked improvement in dysfunctional attitudes toward diet were those with lower anxiety levels and problems with eating, mainly the external eating behaviour. These results imply that group CBT served its purpose. It was suggested

that a significant association exists between successful weight loss and dysfunctional attitudes and beliefs (Beck 2010). Despite the presence of several effective treatment methods such as dieting, exercise, drug treatment or bariatric surgery for weight loss, persistence of dysfunctional attitudes and beliefs that jeopardize the ability to adhere to treatment and diet is associated with weight regain and recurrence (Franz et al. 2007, Beck 2010, Okumuşoğlu 2017). (Franz et al. 2007). The results of this study indicate the presence of an intricate relationship between weight loss and the variables tested, such that weight change is associated with depression at the outset of the group CBT, the change in depression is linked with the dysfunctional attitudes, which are associated with anxiety and eating disorders, which in turn, are associated with depression, thus completing a vicious cycle. An intervention directed at one of the cycle steps is likely to activate a cascade of improvements. Group CBT for obesity has a positive effect on each of these steps such as depression, anxiety, dysfunctional attitudes to diet, external eating and emotional eating, which results in improved quality of life.

We would like to draw attention to the potential limitations of our study when interpreting the results. Firstly, the majority of our participants were female, and therefore, the results are less representative of the male members of the population. Secondly, the psychometric assessment method was based on 'self-report' by the participants, which is associated with bias. Thirdly, our participants had been actively searching for treatment before this study, which probably introduces a factor associated with higher than normal level of motivation for successful results. Therefore, randomized studies with larger numbers of participants in group CBT and a control group consisting of individuals on the waiting lists or undergoing dietary intervention alone would have been more appropriate for the study design. On the other hand, assessment of multiple obesity related factors including anxiety, depression, dietary habits, dysfunctional dietary attitudes, physical activity, self-esteem and the quality of life constitutes the strength of this study.

## CONCLUSION

Group CBT for overweight or obese individuals was effective in reducing weight ( $p < 0.001$ ), depression ( $p < 0.001$ ) and anxiety ( $p < 0.001$ ) and in improving dysfunctional dietary attitudes ( $p < 0.001$ ), problematic eating behaviour ( $p < 0.001$ ), physical activity ( $p < 0.001$ ), self-esteem ( $p < 0.001$ ) and the quality of life ( $p < 0.001$ ). Although these effects were more pronounced during the initial intensive stages of the program, they persisted at similar levels 8 weeks after the completion of the program. However, further randomized controlled studies with longer follow up will shed more light on the question of whether such positive effects will be maintained in the longer term. The presence of depression is a significant impediment

to weight loss ( $p=0.003$ ). Future research should focus on the type of depression and both the symptoms and the age at disease onset for better understanding this relationship. Particularly the participants with high levels of dysfunctional dietary attitudes and low anxiety benefited more from group CBT ( $p<0.001$ , for each). Also, the participants with lower anxiety levels experienced more pronounced reduction in cognitive distortions ( $p<0.001$ ). Treatment efficacy may be improved if such factors are considered when management strategies for obese and overweight individuals are planned.

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