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ORIGINAL ARTICLE

Comparison of the Effect of Diet and Reality Therapy on Anthropometric, Biochemical and Psychological Variables in Overweight and Obese Population

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ABSTRACT

Background: Psychological conditions such as eating disorders, dissatisfaction with body image and dichotomous thinking can be associated with obesity. This study aimed to use a combination of diet and reality therapy interventions on the biochemical and anthropometrics variables in overweight and obese subjects.

Methods: Fifty eligible individuals aged between 18 and 65 years were recruited. The intervention group (IG, n=25) received dietary and reality therapy, while the control group (CG, n=25) only received dietary intervention for three months. Anthropometric, psychological, and biochemical variables were measured in the period of study before and after the intervention.

Results: There was a significant reduction in weight, body fat mass, body mass index (BMI), visceral fat area, fat mass index, circumferences of the abdomen and hip, dichotomous thinking, and body image (p<0.001) in IG group in comparison to the CG group before and after the intervention. Other variables such as total body water, extracellular water, soft lean mass, body fat percent, chest circumference, and energy intake showed a significant difference between the two groups (p<0.05). On the other hand, the biochemical variables such as complete blood count with differential (CBC-diff), liver enzymes, lipids profile, fasting blood glucose (FBG), and high sensitive C reactive protein (hsCRP) showed no significant difference between the two groups.

Conclusion: Combining reality therapy with dietary therapy could significantly affect anthropometric and psychological variables in overweight and obese individuals. However, there is a need to evaluate the long-term effects of this combination therapy in overweight and obese subjects.

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Introduction

Nowadays, obesity is one of the most complex public health issues. The global prevalence of obesity and overweight is increasing since 1980 and it is estimated that approximately a third of the world population are suffering from these conditions (1). Obesity is an independent risk factor for several chronic non-communicable diseases and has become a significant public health issue in developing countries (1-3). Overweight and obesity are also established risk factors for cardiovascular diseases (CVD), diabetes, and cancer (4). It was reported that psychological conditions, such as binge eating disorders (BEDs), dissatisfaction with body image, and dichotomous thinking, are associated with obesity (5-7). BEDs are important for their frequency in primary care and their relation to obesity and other medical or psychiatric comorbidities. It can also lead to a reduced quality of life and increased use of health service resources (5, 6).

A high prevalence of body image dissatisfaction in people with overweight has been shown in several countries (7-11). Several researchers examined the relationship between body image and body mass index (BMI) in adults (12-15). Body dissatisfaction is used to evaluate the benefit of weight loss during diets (16). Santos *et al.* evaluated the psychological and behavioral predictors of a 3-year weight loss and showed that developing a more body image and growing autonomous and fundamental motivation for exercise could significantly improve long-term weight loss maintenance. Also, individuals with a better understanding of body image were more likely to achieve at least 3-5% weight loss (17). Dichotomous thinking is a cognitive process in which individuals tend to think concerning binary opposition, like "black or white" and "good or bad" (18). Dichotomous thinking has been identified as a contributory factor for eating disorders and is highly prevalent among people with an eating disorder (18-20).

Thinking style and cognitive distortions also influence the attitude toward body image (21). Dichotomous thinking has been identified to provide the classification of bodies as either "thin" or "obese" with no middle option (22). Reality therapy is a therapeutic approach based on problem-solving, which helps subjects to make better choices to achieve specific goals. William Glasser's reality therapy theory was shown to cover five essential needs of survival, love, power, fun, and freedom (23). Each person attempts to be satisfied with these needs to reach a balance between a quality world image and the real world. If an individual does not reach a balance between them, they may become frustrated, agitated, or unhappy. These individuals may be locked into a negative image of their body or demonstrate dichotomous thinking, which means that perception cannot be updated even after a strict regime due to failure to lose the desired weight (23).

Even they are successful during diets, but they may not improve body dissatisfaction or dichotomous thinking. So they may either stop adhering to diet prescriptions or, at the opposite end, they may start more radical dieting attempts and ultimately lead to worse outcomes (i.e., binge eating) (23). This study aimed to use a combination of reality therapy and diet therapy for the first time in people who were overweight and obese. We hypothesized that this adjuvant approach would be more effective than diet therapy alone in improving some psychological, anthropometric, and biochemical variables and would result in better outcomes. In addition, combined therapy can help control adherence to a good diet.

Materials and Methods

This clinical trial that was approved by the Ethics Committee of Yazd University of Medical Sciences (code: IR.SSU.SPH.REC.1397.090) and the Iranian Registry of Clinical Trials (code: IRCT20190822044580N1) was conducted in Mashhad, Iran during three months in the last year. An informed consent was obtained from all individual participants included in the study before undergoing the procedures; while they received sufficient information about this research and the methods. A statistician determined the sample size by considering 80% statistical power and 5% probability of type one error (α) to enroll 50 eligible individuals aged between 18 and 65 years (Figure 1).

The subjects were divided into 25 individuals as intervention group (IG) and 25 as control group (CG) using a block randomization method. The intention-to-treat (ITT) method was employed to assess the study outcomes. All participants provided written informed consent before undergoing the procedures and received sufficient information about this research and the methods. Variables such as marital status, history of taking appetite stimulant drugs,

smoking history, eating out, interest in consuming a particular food, history of dietary supplementation, eating breakfast regularly, and fast food consumption were evaluated with yes or no answers. Questions about appetite and speed of eating had three options of low, medium, and high.

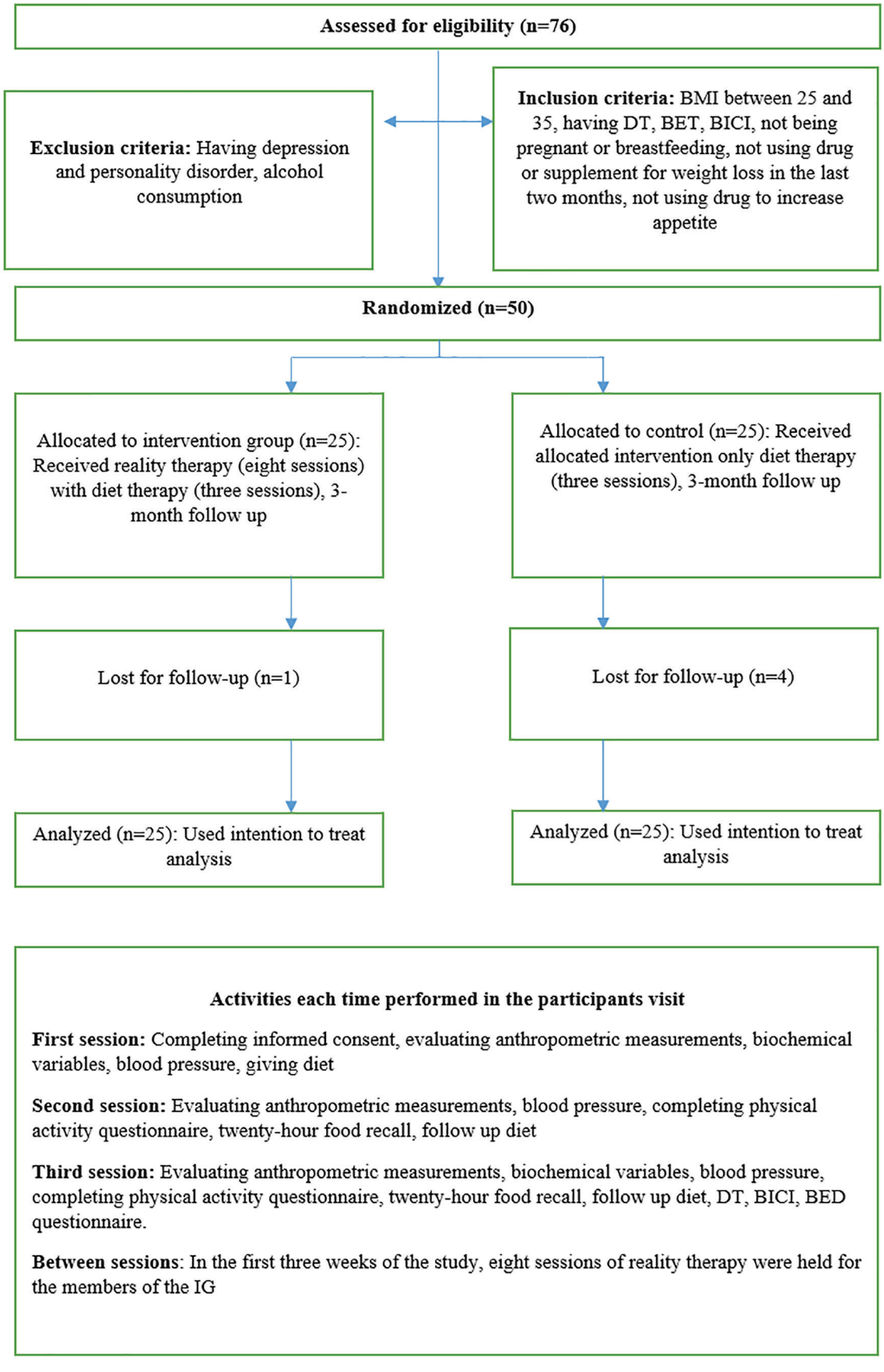

Figure 1: Details of the procedure. DT: Dichotomous thinking, BICI: Body image concern inventory, BED: Binge eating disorder

Regarding the number of meals and snacks, the least and the highest number of meals were three and six per day, respectively and the question was the intake of main meals and snacks. Four participants from the CG and one from the IG dropped out for many reasons. First, they were outside Mashhad city based on their employment status, and second, some of them still needed to complete the study flow chart (Figure 1). This study's intervention package included reality therapy with diet therapy for the IG and only diet therapy for the CG. The reality therapy was performed following the protocol previously described (Figure 1) (24) by a psychologist in the dietary clinic. The diet therapy focused on the goal of reducing 500 kcal per day. Also, the individual's energy level varied that was usually between 1200 and 1800 kcal. A diet therapist adjusted the dietary carbohydrates between 50 and 55 percent of total energy, and the protein in the diet also accounted for approximately 15 to 25 percent of total calories. Consumption of more fiber, such as fruits, vegetables, and whole-grain foods, and restricting foods with high sugar was also recommended. Also, a dietitian visited both the IG and the CG during three sessions at three-week intervals. Each individual in the IG participated in 8 sessions of reality therapy.

The dichotomous thinking scale comprised and assessed 11 questions on eating disorders using two subscales of the general aspect of dichotomous thinking and the specific aspect of eating in dichotomous thinking. The general subscale involved seven questions and evaluated general and non-specific dichotomous thinking. The specific subscale contained four questions and examined dichotomous thinking about eating, dieting, or weight. The reliability and validity of this questionnaire were 0.86 and 0.85, respectively (25). This questionnaire was consisted of 19 items that examined dissatisfaction and worry about appearance. The subject was asked to rate each substance on a scale from 1 to 5 in this instrument. Each of these items refleced emotions or behavior.

On this scale, a score of 1 means (I have never felt it or never did it) and a score of 5 means (I have always felt it or did it). The total score of the questionnaire ranged from 19 to 95, with higher scores indicating higher levels of dissatisfaction with the body image or appearance. The high reliability and validity of this instrument were shown by Littleton *et al.* (26). The validity of this questionnaire was assessed for internal consistency, and Cronbach's alpha coefficient was 0.93. A mean of 0.62 has been achieved for each subject's correlation coefficient with the total questionnaire score. The convergent validity of this tool was examined by calculating its correlation coefficient with Padua Obsessive Compulsive Inventory and Eating Disorders Questionnaire, and its correlation coefficients were obtained at 0.62 and 0.4, respectively ($p<0.01$) (26).

The eating disorders diagnostic scale was a 22-item questionnaire that measured anorexia nervosa, bulimia nervosa, and eating disorders based on the 1995 American Psychiatric Association criteria (27). The scale was consisted of a combination of Likert scores, two-part scores, frequency scores, and open-ended questions such as height and weight. The reliability and validity of this scale were calculated due to the lack of a previous questionnaire in Iran. The reliability and validity of this test were reported as 0.82 and 0.77, respectively. A higher Kaiser-Meyer-Olkin (KMO) value of 0.60 indicated the adequacy of the sample for the diagnostic scale of eating disorders (27).

The Beck Depression Inventory-2 was one of the most suitable tools for assessing depression states, with 21 items and four answers, each with a score of 0 to 3. This scale measured the different degrees of mild to severe depression and the physical signs and cognitive-behavioral of depression. Therefore, this questionnaire had good validity. In addition, the internal consistency of this instrument was reported to be from 0.73 to 0.92, with a mean of 0.86 and an alpha coefficient of 0.86 for the IG and 0.86 for the CG (28).

Each individual's diet during the study period was measured and evaluated twice by a 24-hour dietary recall. A 24-hour dietary recall can well estimate the amount of energy a person receives (29). The first phase of the 24-hour dietary recall report was taken at the end of the third week after the weight loss diet, and the second phase was completed at the end of the study. To evaluate the dietary recall more accurately, we set limits on the measurement. First, we used a dietitian to complete the questionnaire; second, the dietary recall was completed on both a holiday and a working day (30). Third, dietitian software IV was used to analyze the main meals and snacks in the questionnaire. In this statistical analysis, the amount of energy intake was calculated as the energy each person received in the last 24 hours.

The international physical activity questionnaire (IPAQ) has been validated to assess physical activity in 12 countries. The shortened form of IPAQ had seven questions. This questionnaire evaluated a person's physical activity over the past seven days. The reliability of this test was eligible and reported from 0.3 to 0.8 (31). Variables were measured using the InBody 170 body composition analyzer with an accuracy of 0.1 kg weight (InBody Co., Seoul, Korea). All participants were barefoot and wore

lightweight clothing during measurements. Height measurements were performed using the device Business Service Management 170. The formula for calculating the BMI was kg/m^2, where kg was a person's weight in kilograms, and m^2 was their height in meters square. A dietitian was also present to increase the accuracy of measuring.

Venous blood samples were collected after an overnight (twelve hours) fasting period at two points, namely on days 0 and 90. Almost the majority of individuals in the hospital were present for blood sampling. The remaining participants who could not obtain blood samples at the hospital were sampled in the workplace or at home. The blood samples were centrifuged at 3000 rpm for 10 minutes, and the sera were separated and stored at -80ºC until analysis. The cell counter (KX21-SYSMEX) and auto analyzerBT3000 (Biotechnics, Italy) were used for the complete blood count and the biochemical analysis, respectively.

The Statistical Package for the Social Sciences (SPSS, version 16 software; SPSS Inc., Chicago, IL, USA) was used for data analysis. Statistical significance was set at a $p<0.05$. Parametric and non-parametric data were expressed as mean±standard deviation and median and interquartile range (IQR), respectively. Data were analyzed using the ITT framework employing a model-based likelihood method. The Levin test was utilized to assess the default variance of the variables. The Kolmogorov-Smirnov test was applied to determine the data normality. Paired-sample t-tests or related-sample t-tests were used within each group. Independent-sample t- or Mann-Whitney tests were utilized to compare results between groups.

Results

Table 1 and 2 show the demographic data for both IG and CG. The two groups had no significant difference for demographic data. Twenty-one (84%) and 18 (72%) individuals were women in the IG and CG, respectively. Nineteen (76%) in the IG and 21 (84%) in the CG were married. Regarding the history of drug use, 13 (52%) in the IG and 11 persons (44%) in the CG used drugs such as omeprazole, pantoprazole, dimetikon, or antihypertensive. In the IG, 15 individuals had a moderate appetite, and others had a high appetite, while in the CG, 12 subjects were moderate, and 12 others had a high appetite. In both groups, 17 people (68 %) were interested in a particular food. In both groups, 20 participants (80 %) did not take a specific dietary supplement. Nineteen (76%) in the IG and 21 persons (84%) in the CG habitually and regularly ate breakfast. Regarding the family history of the disease, the highest prevalence (60%) was for diabetes mellitus, and the lowest (4%) was for cancer. Regarding personal disease history, the highest prevalence (14%) and the lowest (4%) were gastrointestinal disorders, and cancer, respectively.

Table 3 presents the results of the anthropometric variables. Variables such as weight, body fat mass, BMI, visceral fat area, fat mass index, and the circumference of the abdomen and hip showed a significant difference within the IG ($p<0.001$) and also in comparison to the CG ($p<0.001$), and the remaining variables such as total body water, extracellular water, soft lean mass, percent body fat, and chest circumference showed a significant difference ($p<0.05$) between the two groups.

Table 1: Results of demographic data in each group separately.

Type of variable	Intervention group (n=25)	Control group (n=25)	*P* value
Age (year, mean±SD)	38.16±11.16	40.12±9.86	0.07#
Gender (female): n (%)	21 (84)	18 (72)	0.31
Marital status (married): n (%)	19 (76)	21 (84)	0.48
Drug history (using): n (%)	13 (52)	11 (44)	0.26
Smoking history (No): n (%)	24 (96)	22 (88)	0.30
Appetite: n (%)			
Low	0 (0)	1 (4)	
Moderate	15 (60)	12 (48)	0.69
High	10 (40)	12 (48)	
Eating fast: n (%)			
Low	1 (4)	1 (4)	
Moderate	13 (52)	10 (40)	0.18
High	11 (44)	14 (56)	
Eating. Out (Yes): n (%)	17 (68)	19 (76)	0.21
Too much interest to a particular food (Yes): n (%)	17 (68)	17 (68)	0.54
Take special nutritional supplement (No): n (%)	20 (80)	20 (80)	0.53

Kolmogorov-Smirnov test was performed for normal and non-normal variables and independent-samples T-test or Mann-Whitney test for comparison between the two groups. *Fisher exact test was performed for categorical variables.

Table 2: Results of demographic data in each group separately.

Type of variable	Intervention group (n=25)	Control group (n=25)	*P* value
Number of meals (original and snacks) per day*: n (%)			
<3	5 (20)	6 (24)	0.73
4	5 (20)	4 (16)	
5	10 (40)	11 (44)	
6<	5 (20)	4 (16)	
The habit of eating breakfast (Yes)	19 (76)	21 (84)	0.48
Eating fast food (Yes)	14 (56)	15 (60)	0.39
Education*: n (%)			
Illiterate	1 (4)	--	0.72
Junior school	1 (4)	2 (8)	
Diploma	7 (28)	6 (24)	
Associate degree	4 (16)	5 (20)	
Bachelor	5 (20)	8 (32)	
Master's degree	6 (24)	2 (8)	
Doctor of philosophy or doctor	1 (4)	2 (8)	

*Fisher exact test was per-formed for categorical variables.

Table 3: Results of anthropometric data in each group separately.

Type of variable	Comparison within group						Comparison between group
	Intervention group (n=25)			Control group (n=25)			
	Before	After	*P* value	Before	After	*P* value	*P* value
Weight (kg)***	83.67±12.52	80.51±12.29	<0.001	83.44±12.37	83.41±12.17	0.95	<0.001
Total body water (kg)*	34.8±6.6	34.44±6.32	0.27	35.59±7.58	36.19±7.37	0.10	<0.05
Intracellular water (kg)	21.48±4.04	21.15±3.85	0.24	22.03±4.87	22.25±4.92	0.5	0.2
Extracellular water (kg)*	13.32±2.57	13.16±2.42	0.31	13.56±2.72	13.9±2.64	0.09	<0.05
Protein (kg)	9.3±1.74	9.17±1.67	0.22	9.52±2.10	9.63±2.06	0.19	0.07
Minerals (kg)	3.23±0.61	3.2±0.59	0.88	3.33±0.77	3.4±0.87	0.47	0.37
Body fat mass (kg)***	36.33±6.08	33.91±6.58	<0.001	34.99±6.67	34.66±6.23	0.21	<0.001
Soft lean mass (kg)*	44.67±8.43	43.93±8.17	0.25	45.69±9.82	46.78±9.57	0.08	<0.05
Fat free mass (kg)	47.33±8.93	48.95±8.00	0.28	48.45±10.45	49.11±10.22	0.14	0.1
Skeletal muscle mass (kg)	26.01±5.28	25.51±5.02	0.26	26.71±6.35	27.11±6.31	0.22	0.1
Body Mass Index (BMI, kg/m^2)***	32.42±3.74	31.30±3.76	<0.001	31.5±2.3	31.4±2.89	0.25	<0.001
Percent body fat (kg)*	43.57±4.68	42.09±5.17	<0.001	42.14±6.86	41.95±6.36	0.43	<0.05
Waist hip ratio	0.94±0.05	0.94±0.06	0.12	0.95±0.05	0.95±0.06	0.48	0.82
Visceral fat area (kg)***	177.8±27.34	166.06±31.83	<0.001	172.83±34.67	170.99±31.82	0.17	<0.001
Percent body fat (kg)	30.76±5.79	30.39±5.56	0.38	31.53±6.98	32.02±6.85	0.14	0.07
Arm circumference (cm)	35.95±2.67	35.10±2.89	<0.001	35.82±2.63	35.6±2.45	0.10	0.1
Arm muscle Circumference (cm)	29.02±2.09	28.62±2.18	<0.05	29.18±2.15	29.06±2	0.15	0.6
Bone mineral content (kg)	2.66±0.51	2.6±0.5	0.56	2.75±0.64	2.87±0.7	0.06	0.07
Total body water split up fat free mass	73.56±0.31	73.49±0.33	<0.05	73.49±0.29	73.45±0.31	0.34	0.54
Fat free mass index (%)	18.23±2.08	18.01±1.97	0.54	18.13±1.99	18.28±2.04	0.30	0.3
Fat mass index (%)***	14.18±2.7	13.21±2.83	<0.001	13.38±2.85	13.04±2.77	<0.05	<0.001
Measured circumference of neck (cm)	39.18±3	38.27±3.10	<0.001	39.09±2.58	39±2.06	0.38	0.31
Measured circumference of chest (cm)*	103.02±6.79	101.52±6.94	<0.001	102.84±6.25	102.87±5.88	0.72	<0.05
Measured circumference of abdomen (cm)***	102.28±9.19	99.29±9.62	<0.001	102.06±8.83	102.13±8.45	0.94	<0.001
Measured circumference of hip (cm)***	107.6±5.61	106.08±5.72	<0.001	106.63±5.39	106.85±5.36	0.86	<0.001

Values were expressed as mean±SD.*p<0.05; **p<0.01; ***p<0.001. Kolmogorov-Smirnov test were performed for normal and non-normal variables. Paired-samples T-test or Wilcoxon were performed for comparison within each group, and Independent-samples T-test or Mann-Whitney test for comparison between in two groups.

However, in the CG, just the fat mass index showed a significant reduction (p<0.05). Table 4 reveals the findings of the psychological test variables. The dichotomous thinking, body image, and eating disorder demonstrated a significant difference within the IG (p<0.001) and also in comparison to the CG (p<0.001, p<0.001, and p<0.05, respectively). However, there was no significant difference within the CG (p>0.05) before and after the intervention.

Table 4 illustrates the results of systolic and diastolic blood pressures. As indicated, blood pressure variables displayed no significant difference within and between groups. Table 4 presents the results of energy intake too. Again, there was a significant difference within the IG in the aspect of energy intake (p<0.01), which was not seen within the CG (p=0.1). However, it was significant between the two groups (p=0.19). Therefore, it was deduced that diet adherence was more in the IG than in the CG. Also, Table 4 show no significant difference in physical activity within the IG and CG (p=0 .85, p=0.91, respectively) and between the two groups (p=0.85). Table 5 presents the results of the biochemical variables such as CBC-diff, liver enzymes, lipids profiles, fast blood sugar, and high sensitive c reactive protein that in the study period between the two groups, no significant difference was visible.

Discussion

The important role of nutrients and diets in nutritional process has been emphasized before (32, 33); so this study assessed the two nutritional methods of diet therapy and reality therapy on several factors including weight, psychological, anthropometric, and biochemical variables before and after the intervention. We showed a significant difference in the parameters of weight, body fat mass, BMI, body fat percentage, visceral fat, fat mass index, and circumferences of chest, abdomen, and hip, in the IG when compared to the CG. There was a significant difference between the two groups regarding psychological variables such as dichotomous thinking, body image, and eating disorder. We showed that the combination therapy composed of reality therapy accompanied by diet therapy had a more effect on weight loss and aforementioned psychological variables in the IG.

Our results were consistent with several studies. In the study conducted by Manzoni *et al.* on 163 individuals with BMI>40 and aged between 18 and 55 years with no severe psychological problems such as anorexia, eating disorder, and medication use, the effect of standard behavioral inpatient program (the group undertook a low-calorie 1200 diet for six weeks with a well-established exercise program), the cognitive-behavioral therapy (CBT) and the virtual reality-enhanced cognitive behavioral therapy (ECT) were evaluated for one year. All three groups significantly differed in eating disorders and weight (34). Cesa *et al.* performed a study on 66 women divided into three groups with a mean BMI of 40.5 and ages between 18 and 50 years with no psychological problems such as depression, not using medication, and having an eating disorder. The effect of an inpatient multimodal treatment, CBT, and ECT were evaluated. It was shown that only ECT had a greater effect on weight after one year of follow-up. Although monthly CBT and ECT influenced the eating disorder variable, and this effect was not

Table 4: Results of psychological data, blood pressure and physical activity in each group separately.

Type of variable	Comparison within group						Comparison between group
	Intervention (n=25)			Control (n=25)			
	Before	After	*P* value	Before	After	*P* value	*P* value
Thinking dichotomous***	38.2±4.76	18.04±3.12	<0.001	38.2±4.8	35.17±5.72	0.051	<0.001
Body image***	70.04±5.36	35.76±10.11	<0.001	69.52±7.41	66.29±11.21	0.15	<0.001
Eating disorder*	29.44±7.61	16.32±4.49	<0.001	32.32±9.12	30.75±8.66	0.32	<0.05
Systolic blood pressure (mmHg)	126.63±17.36	124.93±11.71	0.3	126.98±11.89	122.52±13.12	0.08	0.42
Diastolic blood pressure (mmHg)	84.48±14.71	79.99±10.97	<0.05	84.01±10.5	81.78±11.62	0.18	0.22
Energy intake (kcal)	2010.2± 508.16	1656.79.11± 435.06	>0.01	1899.8± 292.08	1780.4± 377.82	0.10	0.19
Physical activity MET/ minutes/week	1407.72± 759.62	1379.82± 747.18	0.85	2225.95± 3398.06	2301.8± 2342.06	0.91	0.85

Values were expressed as mean±SD.*p<0.05; **p<0.01; ***p<0.001. Kolmogorov-Smirnov test were performed for normal and non-normal variables. Paired-samples T-test or Wilcoxon were performed for comparison within each group, and Independent-samples T-test or Mann-Whitney test for comparison between in two groups.

Table 5: Results of complete blood count data in each group separately.

Type of variable	Comparison within group						Comparison between groups
	Intervention group (n=25)			Control group (n=25)			
	Before	After	*P* value	Before	After	*P* value	*P* value
White blood cells (10^3/µL)	7.09±1.59	7.12±1.48	0.97	5.98±1.15	6.64±1.49	<0.001	0.13
Red blood cells (10^6/µL)	4.65±.36	4.81±.40	<0.001	4.6±.45	4.9±.51	<0.001	0.17
Hemoglobin (g/dL)	13.82±1.36	13.99±1.38	0.13	13.8±1.7	13.85±1.52	0.74	0.68
Hematocrit (%)	40.46±2.99	40.35±2.83	0.71	39.92±4.02	39.8±3.43	0.82	0.32
Mean corpuscular volume (fL)	87.18±5.06	83.66±5.14	<0.001	86.9±5.7	82.27±5.08	<0.001	0.06
Mean corpuscular hemoglobin (Pg)	29.78±2.54	29.1±2.68	<0.001	30.03±2.76	28.89±2.5	<0.001	0.09
Mean corpuscular hemoglobin concentration (g/dL)	34.11±1.33	34.66±1.58	<0.01	34.5±1.45	34.89±1.29	<0.05	0.78
Platelets (10^3/µL)	207.92±57.6	257.88±67.4	<0.001	188.36±48.9	233.54±44.1	<0.001	0.21
Lymphocytes (%)	33.74±7.09	35.69±5.75	0.33	35.67±8.2	35.83±6.11	0.78	0.61
Mix (%)	8.26±2.75	7.54±1.83	0.14	8.08±2.84	8.77±3.74	0.25	0.06
Neutrophils (%)	57.99±8.74	57.12±7.15	0.96	56.21±8.86	56.58±9.38	0.89	0.87
Red blood cell distribution width (%)	13.04±1.05	13.62±1.08	<0.001	13.21±1.04	13.73±.94	<0.001	0.71
Platelet distribution width (fL)	13.77±2.78	12.98±1.96	0.06	18.99±28.38	13.13±1.46	0.31	0.37
Mean platelet volume (fL)	10.4±.1.17	10.05±1.046	<0.05	15.28±24.12	10.37±.91	0.32	0.35
Platelet count blood test (%)	28.96±8.65	26.11±7.5	<0.05	31.11±14.7	28.13±5.67	0.3	0.96
Cholesterol (mg/dL)	204.72±40.52	201.3±40.55	0.95	200.56±41.22	188.35±37.36	0.12	0.20
Triglyceride (mg/dL)	169.12±90.71	141.5±85.85	0.054	145.48±78.4	147.65±73.94	0.83	0.09
High-density lipoprotein (mg/dL)	45.72±10.56	43.97±14.25	0.39	48.08±9.92	45.77±13.52	0.52	0.12
Low-density lipoprotein (mg/dL)	120.2±29.33	120.11±26.82	0.49	113.28±37.30	107.42±26.12	0.40	0.73
Aspartate aminotransferase (U/L)	21.8±9.26	22.03±12.01	0.86	23.64±7.58	23.63±12.51	0.99	0.9
Alanine aminotransferase (U/L)	16.28±11.9	26.18±22.26	<0.001	16.16±10.07	25.12±16.86	<0.001	0.81
Fasting blood glucose (mg/dL)	108.48±30.42	102.25±23.67	0.149	91.02±24.04	96.99±15.49	0.24	0.06
High sensitivity C-reactive protein (mg/dL)	4.41±4.31	2.70±3.22	0.053	2.92±2.68	3.44±3.09	0.96	0.10

Values were expressed as mean±SD.*p<0.05; **p<0.01; ***p<0.001. Kolmogorov-Smirnov test were performed for normal and non-normal variables. Paired-samples T-test or Wilcoxon were performed for comparison within each group, and Independent-samples T-test or Mann-Whitney test for comparison between in two groups.

observed in any group after a one-year follow-up (35).

In the study conducted by Annesi *et al.*, 107 obese individuals with a mean BMI of 35.4 and an age of 48 years were divided into two groups. The variables of body image dissatisfaction and anthropometrics were examined following psychotherapy intervention (experimental treatment) and learning programs in the areas of lifestyle, exercise, high level of motivation, communication, and nutrition for the comparison group. This intervention was performed for 20 weeks in 10 sessions, and the results were followed in 3, 6, and 24-month intervals. This study showed that the intervention to improve body image dissatisfaction could have a significant positive difference for psychological and anthropometric variables in obese individuals which confirms our results (36).

Other studies are different from these results. Since these studies did not measure diet adherence, and psychological treatment with diet therapy could not correctly indicate its effectiveness. Riva *et al.* conducted a study on 36 individuals with a

mean body mass index of 39.8 and had an eating disorder and body image dissatisfaction. They were divided into three groups of CBT, ECT, and diet therapy. Body image dissatisfaction was reduced significantly in the ECT group when compared to other groups. There was no significant difference between the three groups in relation to weight loss (37). Ramirez *et al.* studied 65 individuals that were divided into two groups of weight control and weight control with CBT of body image. The results did not show any significant difference between cognitive behavioral therapy and diet therapy. Although the efficacy of CBT for body image was not confirmed in this study (38).

In the present study, the CG did not show the expected weight loss due to the lack of a change in energy received during the study which was evaluated via a 24h food recall, so that the reality therapy might increase the compliance and diet adherence in the IG. Some studies suggested that psychotherapy combined with diet therapy can significantly improve eating disorders, body image dissatisfaction, or dichotomous thinking in people with an increased BMI (39, 40). Reality therapy is a new way to improve psychological variables such as dichotomous thinking, body image, and eating disorders in obese subjects. As mentioned earlier, the use of reality therapy in the present study increased the diet adherence in the IG when compared to the CG. Psychotherapy accompanied by diet therapy not only could be associated with a significant improvement in the psychological variables but also in the anthropometric variables. Achieving weight loss goals is accessible when factors such as physical activity, diet therapy, psychotherapy, and other environmental factors are considered. Several studies did not show a significant difference in using psychotherapy and diet therapy in controlling the psychological and anthropometric variables. These studies only showed this relationship in psychological variables (39, 40).

In our study, the combination therapy was effective on psychological and anthropometric variables. It might be due to the focus on the psychotherapy approach rather than just measuring adherence to the diet. Moreover, the mean BMI in those studies was included in grades 2 and 3 of obesity; while in our study, the participants had obesity of grade 1. Furthermore, the biochemical data did not show any significant differences between the two groups at the end of the study. It might be due to the short period of the study. We also suggest a study with a larger sample size to evaluate the long-term effects of this combination therapy on overweight and obese subjects.

Conclusion

Due to the importance of psychological variables in managing overweight and obesity, using these interventions accompanied by diet therapy can be more effective. Reality therapy combined with diet therapy was shown to be significantly more effective for weight loss and to improve the body image dissatisfaction, dichotomous thinking, and eating disorder.

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Authors' Contribution

Four authors were involved in interpreting the data and contributing to writing the manuscript. All authors read and approved the final manuscript.

Conflict of Interest

The authors declare that they have no conflicts of interest.

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