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Comparison of the Effectiveness of Two Educational Models Based on Cognitive-Behavioral and Schema Therapy on Biological Behaviors and Physical Health Indicators in Overweight Women

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ABSTRACT

Objective: Obesity is a major health challenge linked to maladaptive eating and emotion dysregulation. This study compared the effectiveness of cognitive-behavioral education (CBE) and schema-based education (SBE) on eating behavior and Body Mass Index (BMI) in overweight women.

Methods: A quasi-experimental pretest-posttest control design with a three-month follow-up was used. Participants were 45 overweight women (BMI ≥ 30) from Tonekabon (2020), selected purposively and randomly assigned to a CBE group, an SBE group, or a control group (n = 15 each). The Dutch Eating Behavior Questionnaire (DEBQ) and BMI were assessed. The experimental groups received twelve 90-minute sessions, while the control group received no intervention. Data were analyzed using multivariate analysis of covariance (MANCOVA).

Results: Significant group differences were found in eating behavior and BMI ($F = 6.24$, $p < 0.01$). Both CBE and SBE significantly reduced maladaptive eating compared with the control group ($p < 0.05$). CBE produced a greater BMI reduction than SBE (mean decrease of 2.1 vs. 1.4 units). These effects persisted at the three-month follow-up.

Conclusions: Both educational approaches improved maladaptive eating among overweight women, but CBE was more effective in reducing BMI. Emotion regulation and mindfulness-based strategies are recommended for managing overweight and preventing relapse.

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Introduction

Obesity is recognized as one of the most critical public health challenges of the twenty-first century, with a steadily increasing and alarming prevalence over recent decades. Reports from the World Health Organization indicate that the prevalence of overweight and obesity has reached warning levels in many countries (World Health Organization, 2023). This condition is associated not only with a wide range of physical health consequences—such as cardiovascular diseases, type 2 diabetes, and hypertension—but also with psychological difficulties including depression, anxiety, and reduced quality of life (Aldao et al., 2010). Contemporary research emphasizes that obesity is not merely the result of caloric imbalance; rather, it emerges from a complex interaction of biological, psychological, and social factors. Among these, deficits in emotion regulation and maladaptive eating patterns are considered central psychological mechanisms contributing to the onset and maintenance of excess weight (Brockmeyer et al., 2014; Crockett et al., 2015).

One of the most widely studied maladaptive patterns in this domain is emotional eating, defined as eating in response to negative emotions—such as stress, anger, or sadness—rather than physiological hunger. Empirical evidence suggests that emotional eating is significantly associated with emotion regulation difficulties, rumination, post-eating guilt, and the perpetuation of a dysfunctional weight-gain cycle (Arnow et al., 1995; Brockmeyer et al., 2014). From an educational and behavioral perspective, this pattern reflects insufficient acquisition of adaptive self-regulation skills. Consequently, psychoeducational interventions that explicitly teach emotion regulation competencies and restructure maladaptive cognitive processes have gained increasing attention as complementary approaches within weight management programs (Juarascio et al., 2013).

In this context, Cognitive-Behavioral–Based Education grounded in Marsha M. Linehan's Dialectical Behavior Therapy represents a third-wave cognitive-behavioral approach with a strong emphasis on structured skills training (Linehan, 2015). Originally developed for borderline personality disorder, this model has increasingly been adapted into educational group formats for individuals struggling with eating disorders and binge eating (Roosen et al., 2012). Its educational framework focuses on systematically teaching mindfulness, distress tolerance, and emotion regulation skills. Through guided practice, behavioral rehearsal, and cognitive restructuring exercises, participants learn to manage negative emotional states without resorting to maladaptive

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coping behaviors such as overeating. Research findings indicate that structured DBT-based skills training can reduce emotional eating and enhance self-regulatory capacity (Roosen et al., 2012; Juarascio et al., 2013).

Alongside this skills-oriented model, Schema-Based Education derived from Jeffrey E. Young's Schema Therapy offers a deeper cognitive-emotional intervention framework (Young et al., 2003). According to schema theory, early maladaptive schemas formed during childhood shape individuals' core beliefs about themselves and others, thereby influencing emotional responses and behavioral patterns. Maladaptive schemas have been linked to disordered eating patterns and binge eating behaviors (Taylor & Asmundson, 2008). Educational programs based on schema principles aim to help participants identify, cognitively reframe, and emotionally process these deep-rooted patterns. Unlike skill-focused approaches that primarily target present-moment regulation, schema-based education seeks structural cognitive-emotional transformation through corrective emotional learning experiences (Young et al., 2003). Emerging empirical findings suggest that schema-focused interventions may contribute to reductions in maladaptive eating behaviors (Taylor & Asmundson, 2008).

Despite growing empirical support for both approaches, several important research gaps remain. First, most previous studies have examined the effectiveness of each intervention independently, with limited direct comparison within a unified experimental framework. Second, many investigations have focused primarily on psychological outcomes, while objective physical health indicators such as Body Mass Index (BMI) have been less frequently treated as primary endpoints (World Health Organization, 2023). Third, the differential mechanisms of change—namely, explicit emotion regulation skills training in cognitive-behavioral education versus deep cognitive-emotional schema restructuring in schema-based education—have not been comparatively analyzed. Furthermore, evidence suggests that women may be particularly vulnerable to emotional eating patterns, highlighting the importance of gender-focused investigations (Crockett et al., 2015).

Accordingly, the present study was designed to compare the effectiveness of Cognitive-Behavioral–Based Education and Schema-Based Education on eating behaviors and BMI among overweight women. By contrasting two educational intervention models operating at different depths of cognitive-emotional modification, this research seeks to clarify potential differences in

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the magnitude and durability of behavioral change. It is hypothesized that both educational approaches will lead to improvements in maladaptive eating behaviors and reductions in BMI. However, due to the direct and structured emphasis on emotion regulation skill acquisition, Cognitive-Behavioral–Based Education is expected to demonstrate stronger short-term effects on BMI. The findings of this study may inform the selection and design of evidence-based educational interventions within multidisciplinary weight management and women's health promotion programs.

Material and Methods

The present study employed a quasi-experimental design using a pretest–posttest format with a control group and a three-month follow-up phase. This design enabled the examination of the effectiveness of two educational interventions on eating behaviors and Body Mass Index (BMI). By controlling for pretest scores, the design allowed for the identification of actual changes attributable to the interventions. The inclusion of a control group further made it possible to account for the effects of time and external factors.

Population

The statistical population consisted of all women with obesity residing in Tonekabon, Iran, in 2020, whose Body Mass Index (BMI) was equal to or greater than 30 (BMI ≥ 30), consistent with the obesity classification defined by the World Health Organization (World Health Organization, 2023).

The age range of participants was set between 25 and 45 years. This range was selected because BMI has appropriate diagnostic validity within adulthood, and individuals below the age of maturity were excluded from the study.

Accordingly, the inclusion criteria were:

- Being female
- Age between 25 and 45 years
- BMI ≥ 30 (confirmed through direct measurement of height and weight by the researcher using a calibrated scale and a standard stadiometer)
- Willingness to participate in the study and signing an informed consent form
- Ability to attend group sessions

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The exclusion criteria included:

- Absence from more than two intervention sessions
- Concurrent initiation of pharmacological weight-loss treatment (based on self-report and weekly follow-up)
- Diagnosis of severe psychiatric disorders (e.g., psychosis or uncontrolled bipolar disorder)
- Presence of severe chronic medical conditions (e.g., cancer or advanced heart failure)

Participants' physical and psychiatric health status was assessed through a demographic and health information questionnaire, an initial screening interview conducted by a clinical psychologist, and review of medical records when available.

Sample and Sampling Procedure

To recruit participants, announcements were disseminated through local health centers, social media platforms, and nutrition clinics in Tonekabon (in Iran), inviting women with obesity to participate. In the first stage, 62 volunteers expressed interest. After screening based on inclusion and exclusion criteria, 45 eligible participants were selected using purposive sampling.

Participants were then randomly assigned through simple randomization using a random numbers table into three groups of 15: Dialectical Behavior Therapy (DBT) group, Schema Therapy (ST) group and Control group

Random allocation was conducted by researchers who were not involved in the implementation of the interventions in order to prevent allocation bias.

Ethical Considerations

All participants signed a written informed consent form prior to enrollment in the study. They were assured that their information would remain confidential and that they could withdraw from the research at any stage without any consequences. After completion of the study, the educational content was provided to the control group to ensure research fairness.

Research Instruments

Dutch Eating Behavior Questionnaire (DEBQ)

Eating behavior was assessed using the DEBQ developed by Theodoor van Strien, Frijters, Bergers, and Defares (1986). The questionnaire consists of 33 items and three subscales, Emotional Eating, Restrained Eating and External Eating.

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Previous studies have reported reliability coefficients of approximately α = .85 (van Strien et al., 1986). The instrument was standardized in Iran by Fadardi (2011).

In the present study, Cronbach's alpha coefficients were, Emotional Eating: 0.88, Restrained Eating: 0.91 and External Eating: 0.78.

Body Mass Index (BMI)

BMI was calculated by dividing weight (kilograms) by the square of height (meters). BMI has consistently been used as a standard and valid indicator for assessing overweight and obesity (Hall & Cole, 2006; World Health Organization, 2023).

Educational Interventions

All interventions were conducted in 12 weekly group sessions, each lasting 90 minutes. Each session included practical exercises, group discussion, and between-session homework assignments.

Table 1. Structure of the Dialectical Behavior Therapy (DBT) Educational Program

Session	Main Topic	Session Description (Activities and Techniques)
1	Introduction to DBT	Introduction to treatment objectives, group rules, basic mindfulness exercise
2	Mindfulness	Practicing present-moment awareness, identifying thoughts and emotions, nonjudgmental observation
3	Emotion Regulation – Part I	Identifying emotions, monitoring emotions and triggers
4	Emotion Regulation – Part II	Techniques for reducing emotional intensity, alternative responding strategies
5	Distress Tolerance – Part I	Teaching stress-coping strategies, relaxation training
6	Distress Tolerance – Part II	Practicing distress tolerance skills, real-life situation simulation
7	Interpersonal Effectiveness – Part I	Teaching communication skills and assertive expression of needs
8	Interpersonal Effectiveness – Part II	Conflict resolution, role-play of interpersonal situations
9	Skills Integration	Integrating mindfulness, emotion regulation, and distress tolerance skills
10	Application of Skills to Emotional Eating	Identifying binge-eating triggers, practicing mindful responding
11	Skills Review and Consolidation	Group practice and feedback, problem-solving
12	Conclusion and Future Planning	Progress evaluation, setting long-term goals

Schema Therapy Group

The primary goal of this group was to identify and modify early maladaptive schemas associated with eating behaviors and BMI.

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Table 2. Structure of the Schema-Based Educational Program

Session	Main Topic	Session Description (Activities and Techniques)
1	Introduction to and Familiarization with Schema Therapy	Explaining the concept of schema and Young's model
2	Identifying Schemas – Part I	Teaching schema identification; recording personal negative beliefs
3	Identifying Schemas – Part II	Practicing real-life examples; recording experiences and negative thoughts
4	Exploring the Roots of Schemas	Analyzing childhood experiences and schema-forming events
5	Cognitive Techniques – Part I	Restructuring negative thoughts; practicing maladaptive belief modification
6	Cognitive Techniques – Part II	Replacing thoughts and beliefs with constructive ones; thought recording exercises
7	Emotional Techniques – Part I	Practicing emotional restructuring; confronting negative emotions
8	Emotional Techniques – Part II	Guided imagery technique; reconstructing painful memories
9	Experiential Techniques – Part I	Practicing alternative behaviors; simulating real-life situations
10	Experiential Techniques – Part II	Implementing new behaviors in real situations; receiving group feedback
11	Consolidating Changes	Reviewing schemas; recording changes in thoughts and eating behaviors
12	Conclusion and Future Planning	Designing a personal plan; evaluating progress; setting long-term goals

Control Group

The control group received no intervention and was placed on a waiting list. This group was used to compare the effects of the treatments and to control for the effects of time and environmental factors.

Procedure

The interventions were delivered by a clinical psychologist holding a Master's degree, with official certification in Dialectical Behavior Therapy and Schema Therapy. This individual had over five years of clinical experience in the field of eating disorders. To ensure treatment fidelity, a session implementation checklist was completed, and a random selection of sessions was reviewed. Following the pretest, the treatment sessions were conducted over a period of three months. The posttest was administered immediately after the conclusion of the sessions, and a three-month follow-up was conducted.

Data collection took approximately six months. To enhance participation, reminder messages were sent before each session, individual feedback was provided, and an educational package summarizing the sessions was given to the participants.

Data Analysis Method

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First, statistical assumptions including normality of data distribution (Shapiro–Wilk test), homogeneity of variances (Levene's test), and homogeneity of regression slopes were examined. Subsequently, Multivariate Analysis of Covariance (MANCOVA) was used to analyze the effects of the interventions, with pretest scores entered into the model as covariates. The significance level was set at 0.05, and effect sizes (η^2) were reported to determine the magnitude of the effects.

Results

Prior to conducting Multivariate Analysis of Covariance (MANCOVA), statistical assumptions were examined. The results of the Shapiro–Wilk test indicated that the distribution of eating behavior and BMI scores in all three groups was normal at both pretest and posttest ($p > .05$ for all variables). Furthermore, examination of Q-Q plots revealed no significant deviation from normality.

Levene's test was non-significant for eating behavior ($F = 1.21$, $p > .30$) and for BMI ($F = 0.98$, $p > .38$); therefore, the assumption of homogeneity of variances was met.

Box's M test showed no significant difference between the covariance matrices of the groups (Box's $M = 7.84$, $F = 1.12$, $p = .29$), indicating that this assumption was also satisfied.

The interaction between group and pretest scores for the dependent variables was not significant ($p > .05$); thus, the assumption of homogeneity of regression slopes was confirmed. Consequently, the conditions for conducting Multivariate Analysis of Covariance were met. The results of this analysis are presented below.

Multivariate Analysis of Covariance (MANCOVA) revealed a significant difference among the DBT, Schema Therapy, and control groups across the combined dependent variables of eating behavior and Body Mass Index (BMI).

Table 3. Results of Multivariate Analysis of Covariance Between Research Groups

F	p
6.24	0.01

This finding indicates the positive effect of therapeutic interventions on eating behavior and BMI.

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Table 4. Mean and standard deviation of eating behavior and BMI at pretest, posttest, and follow-up

Group	Variables	Pretest		Posttest		Follow-up	
		Mean	SD	Mean	SD	Mean	SD
DBT	Eating Behavior	78.3	6.5	62.7	5.8	63.1	6.0
DBT	BMI	33.8	2.1	31.7	2.0	31.8	2.1
ST	Eating Behavior	77.6	6.9	65.2	6.3	65.5	6.2
ST	BMI	34	2.3	32.6	2.2	32.7	2.2
Control	Eating Behavior	77.9	6.7	76.5	6.5	76.3	6.6
Control	BMI	33.9	2.0	33.8	2.1	33.7	2.0

Mean eating behavior scores in the DBT and ST groups showed a significant decrease compared to the control group, and this effect was maintained at the three-month follow-up. The reduction in BMI was greater in the DBT group than in the ST group.

Post-hoc Analyses

Table 5. Comparison of Groups at Posttest (Analysis of Covariance with Pretest Control)

Comparison of Groups	Dimensions	F	p	Effect Size (η^2)
DBT and Control	Eating Behavior	15.32	0.01	0.36
ST and Control	Eating Behavior	12.78	0.01	0.32
DBT and ST	Eating Behavior	2.14	0.1	0.05
DBT and Control	BMI	8.56	0.01	0.22
ST and Control	BMI	5.41	0.03	0.14
DBT and ST	BMI	4.12	0.04	0.11

Both treatments (DBT and ST) led to a significant reduction in maladaptive eating behavior compared to the control group. Regarding BMI, the DBT group showed a greater reduction than the ST group (2.1 units vs. 1.4 units). The effect size (η^2) indicated that the treatment effects on eating behavior and BMI were moderate to strong. Table 3 presents the results of the treatment effects at the three-month follow-up.

Table 6. Stability of Treatment Effects at 3-Month Follow-up

Group	Variables	Pretest		Posttest		Change from Posttest
		Mean	SD	Mean	SD	
DBT	Eating Behavior	62.7	5.8	63.1	6.0	+0.4
DBT	BMI	31.7	2.0	31.8	2.1	+0.1
ST	Eating Behavior	62.5	6.3	65.5	6.2	+0.3
ST	BMI	32.6	2.2	32.7	2.2	+0.1

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The results indicate that the therapeutic effects of both groups remained stable at the three-month follow-up, and no relapse into previous behaviors or increase in BMI was observed.

Discussion

The present study demonstrated that both educational models (cognitive-behavioral-based education and schema-based education) were effective in improving maladaptive eating behaviors, with the cognitive-behavioral educational intervention performing particularly better in reducing Body Mass Index (BMI). These results are consistent with previous studies. For example, a systematic review and meta-analysis by Rozakou-Soumalia et al. (2021) showed that cognitive-behavioral-based interventions led to significant improvements in eating disorder pathology and BMI reduction (with a mean change of approximately -1.93 units) compared to control groups. Similarly, in a clinical trial by Hani et al. (2022) involving women who had undergone bariatric surgery, group-based skills training grounded in this approach resulted in significant reductions in emotional eating and BMI. Furthermore, more recent studies conducted in 2023 and 2024 in Europe and East Asia have emphasized that emotion regulation and mindfulness-based interventions can reduce binge eating and stabilize weight by decreasing emotional impulsivity. Thus, the approximate 2.1-unit reduction in BMI observed in the cognitive-behavioral training group in the present study aligns in magnitude with recent international findings, indicating the cross-cultural validity of this approach in weight management.

On the other hand, research has demonstrated that schema-based education and the modification of early maladaptive schemas can modulate maladaptive eating behaviors. For instance, Basile et al. (2019) reported that individuals with overweight scored higher on the schemas of "insufficient self-control," "fear of abandonment," and "dependence," and that these schemas were associated with maladaptive eating behaviors (Basile, Tonerro, & Mancini, 2019). Additionally, a clinical trial by Sobhani et al. (2023) showed that group-based schema education led to significant improvements in cognitive emotion regulation and reductions in BMI. Moreover, recent international studies have indicated that schemas in the domain of "impaired autonomy and performance" predict emotional eating in women. Our findings regarding the reduction of maladaptive eating behaviors in both educational groups are consistent with these results and support the role of early maladaptive schemas in the cycle of obesity.

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The mechanism of action of cognitive-behavioral-based education likely operates through enhancing emotion regulation skills, increasing mindfulness, and reducing reactivity to negative emotions. Recent evidence suggests that emotional eating is often employed as a maladaptive emotion regulation strategy, and teaching alternative skills can disrupt this cycle. In contrast, schema-based education, by focusing on modifying deeper cognitive patterns, may produce more fundamental changes in emotional structures; however, its physical outcomes may be less apparent in the short term compared to skills-based interventions. This explanation is consistent with contemporary multi-level models of emotion regulation, which distinguish between immediate behavioral changes and the modification of deep cognitive structures.

The observed difference in the faster reduction of BMI in the cognitive-behavioral training group compared to the schema training group may be attributed to this model's emphasis on short-term practical skills. While modifying maladaptive schemas requires more time, it may produce deeper and more durable effects over longer periods. This finding highlights the necessity of conducting long-term longitudinal studies.

One important finding was the stability of the educational intervention effects at mid-term follow-up. The reductions in maladaptive eating behaviors and BMI were maintained at the three-month follow-up, indicating relative stability of the results. This finding aligns with other studies, including that of Braden et al. (2022), which demonstrated that combined cognitive-behavioral interventions could sustain weight loss at six-month follow-up.

In summary, the findings of the present study indicate that both educational approaches are effective in improving maladaptive eating behaviors in overweight women, with cognitive-behavioral-based education demonstrating superior performance in reducing BMI. These results support the integration of psychological interventions into multidisciplinary weight management programs.

Despite the strengths of this study, several limitations should be considered when interpreting the results. Although the three-month follow-up period demonstrated short-term stability, definitive conclusions cannot be drawn regarding long-term weight maintenance or the potential for weight regain; in the field of obesity, weight regain has frequently been reported within 6 to 12 months. The sample consisted solely of women from a single city; therefore, cultural, social, and lifestyle factors specific to that region may have influenced the results, limiting the generalizability of the

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findings to men or other populations. Furthermore, the use of self-report instruments to assess eating behavior may have been subject to social desirability bias.

It is recommended that integrated protocols (combining DBT and Schema Therapy) be designed to simultaneously cover behavioral skills and the modification of deep cognitive patterns, and that these be incorporated into educational programs for individuals with high levels of emotional eating.

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Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by the ethics committee of Islamic Azad University. The patients/participants provided their written informed consent to participate in this study.

Author contributions

All authors contributed to the study conception and design, material preparation, data collection, and analysis. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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