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Research Article

Effectiveness of Cognitive Therapy Focusing on Dietary Traps on Weight and BMI in Obese Women with Hypothyroidism

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Abstract

Objective: This study aimed to investigate the effectiveness of cognitive therapy, focusing on dietary traps, in reducing weight and BMI, including thyroid hormones (T3, T4, TSH), weight, and Body Mass Index (BMI), among individuals with obesity and hypothyroidism. The thyroid gland controls the body's metabolism through hormone production. Thyroid dysfunction can alter the metabolic rate, impacting weight. Research consistently indicates that increased BMI is often associated with higher TSH levels and an increased likelihood of hypothyroidism. However, the overall findings from studies in this area are not yet entirely consistent. Although individuals with obesity due to conditions like hypothyroidism initially find weight loss straightforward, maintaining this reduced weight becomes challenging over time due to psychological traps such as stress, family issues, and social situations. While cognitive therapy primarily focuses on improving an individual's cognitions and thought patterns, it may not directly influence hormonal physiological processes.

Method: This research utilized a quasi-experimental design involving an experimental group and a control group, with pre-test, post-test, and follow-up stages. Participants were selected using convenience sampling and then randomly assigned to groups. The study included 30 women from Tehran diagnosed with hypothyroidism and obesity. These participants were divided into two groups: an experimental group (15 individuals) and a control group (15 individuals). The experimental group received 10 weeks of cognitive therapy sessions, concentrating on dietary traps, while the control group received no intervention. Participants signed the consent form before attending the study. Data were collected using standardized questionnaires, blood tests, and BMI measurements. Statistical analysis involved MANOVA, performed using SPSS 26 software.

Results: Cognitive therapy with an emphasis on dietary traps significantly reduced weight and BMI ($P < 0.001$), and significant differences were observed between the experimental and control groups at post-test and follow-up stages ($P < 0.001$). Cognitive therapy focused on dietary traps did not have a significant effect on T3, T4, and TSH hormones. The group × time interaction effect for these variables was not significant ($p = 0.358$), but the main effect of time was fully confirmed.

Conclusion: The results of this study indicate that cognitive therapy with an emphasis on dietary traps effectively reduces weight and BMI in individuals with hypothyroidism and obesity. The experimental group showed greater improvements compared to the control group, and these effects remained stable during the follow-up period. However, the therapy did not have a significant effect on improving thyroid hormone levels.

Keywords: Cognitive Therapy, Dietary Traps, Hypothyroidism, Body Mass Index, Health.

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Extended Abstract

Background and Objectives

Hypothyroidism is one of the most prevalent endocrine disorders worldwide, affecting 3 to 15 percent of adults and up to 20 percent of women over 60 years of age. The thyroid gland produces triiodothyronine (T3) and thyroxine (T4), which regulate metabolism and the body's response to stress. Reduced T3 and T4 levels lead to decreased basal metabolic rate, weight gain, and increased Body Mass Index (BMI). Epidemiological evidence consistently demonstrates a positive correlation between elevated BMI and increased Thyroid-Stimulating Hormone (TSH) levels. In Iran, the prevalence of hypothyroidism is notably higher than the global average, underscoring the need for effective interventions.

Despite pharmacological treatments such as levothyroxine replacement therapy, many patients with hypothyroidism struggle with weight management. While initial weight loss may appear achievable, long-term maintenance remains challenging due to psychological factors such as stress, family conflicts, social pressures, and unrealistic expectations about rapid weight loss. These cognitive distortions often lead to a cycle of failed diets, self-blame, emotional eating, and eventual weight regain.

Cognitive therapy, particularly approaches targeting maladaptive thought patterns and behavioral habits, has emerged as a promising adjunctive intervention for individuals struggling with obesity and chronic conditions. By addressing dysfunctional beliefs about food, weight, and self-worth, cognitive therapy aims to foster sustainable behavioral change, enhance self-regulation, and improve emotional well-being. However, the extent to which such psychological interventions can influence physiological parameters, including thyroid hormone levels, remains an area of ongoing investigation. Furthermore, the specific effectiveness of cognitive therapy targeting dietary traps—rather than general cognitive-behavioral approaches—has not been previously investigated in obese hypothyroid populations, particularly in Iran.

The primary objective of this study was to evaluate the effectiveness of cognitive therapy focusing on dietary traps on weight, BMI, and thyroid hormones (T3, T4, and TSH) in obese women with hypothyroidism. The study further aimed to determine whether the therapeutic effects would be sustained over a follow-up period.

Materials and Methods

This study employed a quasi-experimental design with a pretest-posttest-follow-up framework, including an experimental group and a control group. The research was conducted at a specialized clinic in Tehran, Iran. The study protocol was approved by the Research Ethics Committee of Payame Noor University under the ethics code IR.PNU.REC.1403.652. All participants provided written informed consent prior to their involvement.

The target population consisted of women aged 30 to 50 years with a confirmed diagnosis of primary clinical hypothyroidism by an endocrinologist, based on elevated TSH (>4.0 mIU/L) and low free T4 levels (<0.8 ng/dL). Participants had a BMI of 30 kg/m² or higher, classified as obese. A total of 30 eligible participants were selected through convenience sampling and subsequently randomly assigned to either the experimental group (n = 15) or the control group (n = 15) using a simple randomization method based on a computer-generated random number sequence (Random Allocation Software, version 1.0).

Inclusion criteria included: being female, having at least a high school diploma, age between 30 and 50 years, confirmed hypothyroidism, willingness to participate in therapy sessions, absence of acute psychosis, and provision of informed consent. Exclusion criteria included unwillingness to complete the study, presence of debilitating physical illness, inability to cooperate or comprehend study materials, refusal to continue participation, presence of another debilitating

psychiatric disorder, and use of medications known to affect weight or thyroid function.

The experimental group received 12 weekly sessions of cognitive therapy focusing on dietary traps, based on the cognitive-behavioral protocol developed by Judith S. Beck and colleagues. Each session lasted 90 minutes. The control group received no intervention. All sessions were conducted by a licensed clinical psychologist with a PhD in Health Psychology and over five years of experience in CBT.

Data were collected at three time points: pre-test, post-test (immediately after the intervention), and a follow-up assessment conducted six weeks after the post-test. Thyroid function tests, including TSH, Free T4, and Free T3, were measured using standard chemiluminescence immunoassay (CLIA) and electrochemiluminescence immunoassay (ECLIA) methods. Weight was measured using a calibrated clinical digital scale accurate to 0.1 kg, and height was measured using a standard wall-mounted stadiometer. BMI was calculated by dividing weight in kilograms by height in meters squared.

Data analysis was performed using SPSS-26 software. Descriptive statistics were calculated for all variables. The Kolmogorov-Smirnov test was used to assess normality, and Levene's test was employed to evaluate homogeneity of variances. Multivariate Analysis of Variance (MANOVA) with repeated measures was conducted to examine the main effects of time, group, and the group × time interaction effects on the dependent variables. A significance level of $\alpha = 0.05$ was adopted for all statistical tests.

Results

A total of 30 participants completed the study. No participants were lost to follow-up. The experimental group demonstrated a significant reduction in weight compared to the control group at both post-test and follow-up assessments ($P < 0.001$). The effect size was large (partial $\eta^2 = 0.715$). Similarly, Body Mass Index (BMI) decreased significantly in the experimental group relative to the control group ($P < 0.001$), with a large effect size (partial $\eta^2 = 0.736$). These improvements were sustained over the six-week follow-up period, indicating the durability of the intervention effects.

In contrast, no significant changes were observed in thyroid hormone levels, including T3, T4, and TSH. The group × time interaction effect for these variables was not statistically significant ($P = 0.358$), with a small effect size (partial $\eta^2 = 0.036$). Although the main effect of time was significant ($P < 0.001$), suggesting a general improvement across both groups, the cognitive therapy intervention did not produce a differential effect on thyroid hormones compared to the control group.

Pairwise comparisons using the Bonferroni correction showed that the mean differences in weight and BMI were significant between pre-test and post-test for the experimental group ($P < 0.001$), and between pre-test and follow-up for the experimental group ($P < 0.001$). The differences between post-test and follow-up were not significant for either group ($P = 1.00$), indicating that the intervention effects were sustained over time.

Discussion

The findings of this study provide compelling evidence for the effectiveness of cognitive therapy focusing on dietary traps in reducing weight and BMI in obese women with hypothyroidism. The substantial and sustained reductions observed in the experimental group underscore the critical role of addressing maladaptive cognitive patterns in facilitating behavioral change and promoting weight management, even in individuals with chronic endocrine conditions.

Several mechanisms may explain these observed effects. Cognitive therapy specifically targets dysfunctional beliefs related to dieting, such as unrealistic expectations, perfectionistic thinking, catastrophic predictions about weight gain, and negative self-evaluations following dietary lapses. By challenging these cognitive distortions and fostering more realistic and compassionate self-perceptions, participants are better equipped to adhere to dietary recommendations, regulate emotional eating, and maintain motivation in the face of setbacks.

Despite the significant improvements in weight and BMI, the intervention did not produce a significant differential effect on thyroid hormones. This finding aligns with previous research suggesting that psychological interventions primarily influence behavioral and emotional parameters rather than directly altering endocrine function. The hypothalamic-pituitary-thyroid (HPT) axis is relatively resistant to short-term psychological manipulation. Hormonal changes are more likely to occur gradually, following sustained metabolic improvements and long-term weight stabilization. The six-week follow-up period may have been insufficient to capture such delayed hormonal responses.

The findings are consistent with some previous research that reported limited effects of psychological interventions on thyroid hormones, but differ from studies suggesting cognitive therapy may indirectly influence hormonal regulation through stress reduction. This discrepancy may be due to differences in sample characteristics, intervention duration, or outcome measures.

Several limitations should be acknowledged. The sample size was small (30 participants), which may have limited statistical power. The follow-up period was short (six weeks). The use of convenience sampling and recruitment from a single clinic in Tehran limits generalizability. Furthermore, the absence of a validated instrument to assess dietary traps prevents confirmation of the mediating role of cognitive change. These factors should be considered when interpreting the findings.

Conclusion

In conclusion, cognitive therapy focusing on dietary traps is a highly effective intervention for reducing weight and BMI in obese women with hypothyroidism, with effects that persist beyond the active treatment phase. However, the therapy did not result in significant differential improvements in thyroid hormone levels. These findings highlight the complementary role of cognitive therapy in optimizing weight management and behavioral outcomes for patients with chronic endocrine conditions, while acknowledging that physiological parameters such as thyroid function may require more extended or multimodal interventions to achieve measurable changes.

Future research should employ larger samples, extended follow-up periods, and validated instruments to assess dietary traps and confirm the mediating role of cognitive change. Given the clinical significance of these findings, it is recommended that cognitive therapy be integrated as a standard adjunctive component in multidisciplinary treatment protocols for hypothyroidism and obesity.

Introduction

Hypothyroidism is one of the most common endocrine disorders worldwide. It affects 3 to 15 percent of adults and up to 20 percent of women over 60 years of age (Maqsudi et al., 2022). The thyroid gland produces triiodothyronine (T3) and thyroxine (T4). These hormones regulate metabolism and the body's response to stress. Low levels of T3 and T4 reduce basal metabolic rate. This leads to weight gain and increased Body Mass Index (BMI) (Muller & Seitz, 2003). Research shows a positive link between higher BMI and higher Thyroid-Stimulating Hormone (TSH) levels. This highlights the relationship between thyroid dysfunction and obesity (An et al., 2018). In Iran, hypothyroidism is more common than the global average. This shows the need for effective interventions (Maqsudi et al., 2022).

Women with hypothyroidism are more likely to be obese (Baharloo et al., 2014). Initial weight loss may seem achievable. However, long-term maintenance is challenging. Psychological factors like stress, family conflicts, and social pressures make it harder. Cognitive traps also play a role. These include unrealistic expectations,

disappointment with diet failure, and self-blame. They often lead to repeated diet failure and weight regain (Mehran et al., 2021). These patterns are strengthened by situations like travel and celebrations. Such events disrupt dietary adherence (Beck, 2015).

Cognitive therapy is a promising intervention for obesity and chronic conditions. Beck's program focuses on maladaptive thoughts and behaviors. It teaches psychological skills for lifelong behavioral change (Beck, 2008; Saravanapala et al., 2022). Patients learn to identify and challenge negative thoughts about food and weight. They adopt healthier coping strategies. These include realistic goals and sustainable lifestyle changes. Some evidence suggests cognitive therapy may indirectly affect hormonal balance. It may do this by reducing psychological stress. However, findings remain inconclusive (Yang et al., 2024; Krause et al., 2022).

Despite growing evidence, several research gaps remain. First, most studies focus on psychological outcomes like quality of life and anxiety. Few have examined physiological parameters, especially thyroid hormones. Second, the specific effect of cognitive therapy on dietary traps has not been studied in obese hypothyroid populations. Third, most research comes from Western countries. Evidence from Iranian populations is limited. Some studies show that cognitive therapy improves quality of life and reduces anxiety in hypothyroid patients (Rezaei et al., 2020; Parsapour et al., 2025). However, its direct effects on thyroid hormones are still unclear.

Research Hypotheses

Based on the theoretical framework and empirical evidence, the following hypotheses were formulated:

1. Cognitive therapy focusing on dietary traps significantly reduces weight in obese women with hypothyroidism.
2. Cognitive therapy focusing on dietary traps significantly reduces Body Mass Index (BMI) in obese women with hypothyroidism.
3. Cognitive therapy focusing on dietary traps significantly improves thyroid hormone levels (T3, T4, TSH) in obese women with hypothyroidism.

Therefore, this study aimed to address these gaps. It evaluated the effectiveness of cognitive therapy focusing on dietary traps on weight, BMI, and thyroid hormones in obese women with hypothyroidism in Tehran, Iran.

Method

This study used a quasi-experimental design with a pretest-posttest-follow-up framework. It included an experimental group and a control group. The research was conducted at a specialized clinic in Tehran, Iran.

The target population included women aged 30 to 50 years. All had a confirmed diagnosis of primary clinical hypothyroidism by an endocrinologist. Diagnosis was based on elevated TSH (>4.0 mIU/L) and low free T4 levels (<0.8 ng/dL). Participants had a BMI of 30 kg/m² or higher. This classified them as obese.

A total of 30 eligible participants were selected through convenience sampling. They were then randomly assigned to either the experimental group (n = 15) or the control group (n = 15). Randomization was performed using a simple method based on a computer-generated random number sequence. The software used was Random Allocation Software, version 1.0.

Inclusion criteria were: being female, having at least a high school diploma, age between 30 and 50 years, confirmed hypothyroidism, willingness to attend therapy sessions, absence of acute psychosis, and provision of informed consent.

Exclusion criteria included: unwillingness to complete the study, presence of debilitating physical illness, inability to cooperate or understand the materials, refusal to continue participation, presence of another

psychiatric disorder confirmed by a psychiatrist, and use of medications affecting weight or thyroid function. These medications included corticosteroids, antipsychotics, or weight-loss drugs.

Due to the nature of the psychological intervention, blinding of participants and therapists was not possible. However, the researcher who collected and analyzed the data was blinded to group assignment. This minimized potential bias.

The sample size was determined using G*Power software (version 3.1) based on an a priori power analysis. Considering a moderate effect size (f = 0.25), an alpha level of 0.05, and a statistical power of 0.80, the required sample size was calculated to be 30 participants (15 per group).

All participants were on a stable dose of levothyroxine. This had been maintained for at least three months prior to the study. They continued their regular medication throughout the intervention period. The dosage ranged from 50 to 150 µg/day. The mean dose was 89.5 µg/day.

Participants using medications affecting weight or thyroid function were excluded. These included corticosteroids, antipsychotics, or weight-loss drugs.

No additional booster sessions were provided. No concurrent psychological interventions were offered during the study. Participants were asked to maintain their usual dietary habits and physical activity levels. No specific dietary intervention or standardized meal plan was provided. The study focused on cognitive restructuring, not dietary modification.

No participants were lost to follow-up. All 30 participants (15 in each group) completed the intervention. They also participated in all three assessment stages: pre-test, post-test, and follow-up. Thus, the final sample .matched the initial sample, and no attrition occurred

Ethical statements

This study followed the ethical principles of the Declaration of Helsinki. The research protocol was approved by the Research Ethics Committee of Payame Noor University (PNU). The ethics code is IR.PNU.REC.1403.652. Before participation, all participants received comprehensive information about the study. This included its objectives, procedures, potential risks and benefits, and their rights. Written informed consent was obtained from all individuals prior to enrollment.

Participants were assured of confidentiality. Their personal information was kept private. Data were used solely for research purposes. They were also told that they could withdraw at any stage without negative consequences. The study respected participants' autonomy, privacy, and dignity.

Intervention

The experimental group received 10 weekly sessions of cognitive therapy focusing on dietary traps, based on the cognitive-behavioral protocol developed by Judith S. Beck and colleagues. Each session lasted 90 minutes. The control group did not receive any intervention during the study period. The content of the sessions was as follows:

The first session was dedicated to orientation. It introduced the foundations and benefits of cognitive therapy and set expectations for the program. The second session focused on identifying destructive emotions and teaching strategies for coping with them. In the third session, the ABC model of cognitive therapy was introduced. This helped participants understand the relationship between activating events, beliefs, and consequences. The fourth session involved goal setting and identifying healthy eating habits. In the fifth session, participants

learned to identify dysfunctional thoughts related to dieting and were taught strategies to challenge them. The sixth session addressed responses to dysfunctional thoughts and explored alternative, rational responses. The seventh session focused on developing and implementing new coping skills for managing high-risk situations such as stress, fatigue, and social pressure. The eighth session taught strategies for maintaining weight loss and preventing relapse. The ninth session evaluated progress and results, reinforcing self-efficacy and commitment. Finally, the tenth session summarized the therapy process, consolidated learning, and helped participants plan for long-term weight management.

Measures

Data collection employed multiple instruments to ensure comprehensive assessment through two main methods: library research and field study. A demographic questionnaire captured personal information, including age, gender, marital status, educational level, and duration of illness. The content validity of this instrument was reviewed and confirmed by three experts in health psychology. Thyroid function tests, conducted through blood samples, measured thyroid-stimulating hormone (TSH) and thyroxine (T4) levels, with elevated TSH and reduced T4 levels indicating hypothyroidism. Normal values of thyroid hormones in blood tests may vary slightly depending on the laboratory and the measurement method used. The serum levels of thyroid hormones, including TSH, Free T4, and Free T3, were measured using Chemiluminescence Immunoassay (CLIA) and Electrochemiluminescence Immunoassay (ECLIA) methods. These techniques are considered standard in clinical laboratories due to their high sensitivity and specificity. The commonly accepted reference ranges in adults are 0.4 to 4.0 mIU/L for TSH, 0.8 to 1.8 ng/dL for FreeT4, and 2.3 to 4.2 pg/mL for Free T3 (Garber et al., 2012; Kricka, 1999).

Additionally, Body Mass Index (BMI) was calculated by dividing weight in kilograms by height squared in meters to determine participants' weight status, such as underweight, normal, or obese. To track changes throughout the study, we recorded participants' weight and height at their first and last sessions. We used a calibrated clinical digital scale for weight, which was accurate to 0.1 kg, and a standard wall-mounted stadiometer for height, providing millimeter precision.

Data Analysis

Data analysis was performed using SPSS-26 software. Descriptive statistics, including means and standard deviations, were calculated for all variables.

Prior to the main analysis, the assumptions of normality, homogeneity of variances, and homogeneity of covariance matrices were tested. The Shapiro-Wilk test indicated a normal distribution for all dependent variables ($p > 0.05$). Levene's test confirmed homogeneity of variances across groups ($p > 0.05$ for all variables). Box's M test showed that the assumption of homogeneity of covariance matrices was met (Box's $M = 15.41$, $F = 1.21$, $p = 0.098$).

Given the study design with three measurement stages (pre-test, post-test, and follow-up) and two groups (experimental and control), a Repeated Measures Multivariate Analysis of Variance (MANOVA) was conducted. This analysis was chosen for the following reasons: (1) it allows simultaneous examination of multiple dependent variables (weight, BMI, T3, T4, and TSH), (2) it accounts for the correlation among these variables, (3) it tests the main effects of time (within-subjects), group (between-subjects), and the group × time interaction, and (4) it is appropriate for repeated measures designs with multiple dependent variables. Alternative methods such as ANCOVA were not suitable because they do not handle multiple dependent

variables simultaneously, and the assumption of sphericity was tested using Mauchly's test. For variables where sphericity was violated ($p < 0.05$), the Greenhouse-Geisser correction was applied to adjust the degrees of freedom. Mixed Models were not employed because the design was balanced with no missing data, and MANOVA assumptions were met.

The Bonferroni correction was applied for post-hoc pairwise comparisons to control for Type I error. A significance level of $\alpha = 0.05$ was adopted for all statistical tests. Effect sizes were reported using partial eta squared (η^2).

Results

To assess baseline comparability, independent samples t-tests were conducted for continuous variables (age, BMI, weight, and thyroid hormone levels). No significant differences were found between the experimental and control groups at baseline ($p > 0.05$ for all variables). Chi-square tests were used for categorical variables (education level and family history of hypothyroidism), and no significant differences were observed ($p > 0.05$). These results indicate that the two groups were comparable at the outset of the study.

A total of 30 participants completed the study. The experimental group demonstrated a significant weight reduction compared to the control group at both post-test and follow-up assessments ($P < 0.001$). The effect size was large (partial $\eta^2 = 0.715$, 95% CI [0.58, 0.82]). Similarly, Body Mass Index (BMI) decreased significantly in the experimental group relative to the control group ($P < 0.001$), with a large effect size (partial $\eta^2 = 0.736$, 95% CI [0.60, 0.84]). These improvements were sustained over the six-week follow-up period, indicating the durability of the intervention effects.

In contrast, no significant changes were observed in thyroid hormone levels, including T3, T4, and TSH. The group × time interaction effect for these variables was not statistically significant ($P = 0.358$), with a moderate-to-large effect size (partial $\eta^2 = 0.310$). However, given the non-significant p-value, this effect should be interpreted with caution and does not indicate a meaningful differential impact of the intervention on thyroid hormones. Although the main effect of time was significant ($P < 0.001$), suggesting a general improvement across both groups, the cognitive therapy intervention did not produce a differential effect on thyroid hormones compared to the control group.

Pairwise comparisons using the Bonferroni correction showed that the mean differences in weight and BMI were significant between pre-test and post-test for the experimental group ($P < 0.001$), and between pre-test and follow-up for the experimental group ($P < 0.001$). The differences between post-test and follow-up were not significant for either group ($P = 1.00$), indicating that the intervention effects were sustained over time.

Overall, the findings indicate that cognitive therapy focusing on dietary traps was effective in reducing weight and BMI, but did not significantly influence thyroid hormone levels.

Table 1. Demographic Characteristics of Participants by Group

Variable	Group	Mean	SD
Age (years)	Experimental	45.66	8.45
	Control	46.46	10.10
	Total	46.06	9.19

Variable	Group	Mean	SD
Age at Onset of Hypothyroidism (years)	Experimental	26.73	7.67
	Control	28.73	8.53
	Total	27.73	8.03
Family History of Hypothyroidism	Experimental	Positive: 10	66.7%
		Negative: 5	33.3%
	Control	Positive: 5	33.3%
		Negative: 10	66.7%
	Total	Positive: 15	50%
		Negative: 15	50%

Table1, presents that the study included 30 participants with hypothyroidism, equally divided between an experimental group (n = 15) and a control group (n = 15). The results indicate a mean age of 45.66 years for the experimental group and 46.46 years for the control group, with an overall mean of 46.06 years. The results further reveal that the mean age at onset of hypothyroidism was 26.73 years in the experimental group and 28.73 years in the control group, averaging 27.73 years across the sample. The results demonstrate that 66.7% of the experimental group (10 participants) and 33.3% of the control group (5 participants) reported a positive family history of hypothyroidism, while 33.3% (5 participants) and 66.7% (10 participants), respectively, reported a negative history. Overall, the results indicate an even split, with 50% (15 participants) reporting a positive family history and 50% a negative history.

Table 2. Descriptive Statistics for Biological Indicators

Variable	Group	Pre-Test Mean	Pre-Test SD	Post-Test Mean	Post-Test SD	Follow-Up Mean	Follow-Up SD
T3	Experimental	0.79	0.52	1.21	0.68	1.28	0.39
	Control	0.93	0.44	1.17	0.63	1.14	0.49
	Total	0.86	0.48	1.19	0.64	1.21	0.44
T4	Experimental	3.67	4.23	3.81	2.67	5.82	3.46
	Control	3.82	3.29	4.06	1.99	5.93	2.98
	Total	3.75	3.73	3.94	3.32	5.87	3.18
TSH	Experimental	9.87	4.67	6.31	2.39	4.88	2.19
	Control	10.90	5.35	9.28	3.81	6.66	2.90

Variable	Group	Pre-Test Mean	Pre-Test SD	Post-Test Mean	Post-Test SD	Follow-Up Mean	Follow-Up SD
	Total	10.30	4.97	7.08	3.47	5.77	2.68

Based on the results presented in Table 2, the mean scores for biological indicators such as T3, T4, and TSH are provided. As observed, the variables T3 and T4 showed an increase in both the experimental and control groups at the post-test and follow-up stages compared to the pre-test stage. Conversely, the variable TSH demonstrated a decrease in both groups at the post-test and follow-up stages relative to the pre-test. The standard deviations indicate the dispersion of data at different stages. To confirm the statistical significance of these changes, statistical tests such as ANOVA and post-hoc analyses are required. The findings of this research suggest that the cognitive therapy intervention with an emphasis on dietary traps did not have a statistically significant effect on improving the levels of T3, T4, and TSH hormones in obese individuals with hypothyroidism. This section will elaborate on these findings and explore potential reasons for the lack of intervention effectiveness.

Table 3. Descriptive Statistics for Weight and Body Mass Index (BMI)

Variable	Group	Pre-Test Mean	Pre-Test SD	Post-Test Mean	Post-Test SD	Follow-Up Mean	Follow-Up SD
Weight (kg)	Experimental	88.40	11.53	80.13	11.35	79.60	10.80
	Control	87.46	11.78	86.20	11.54	86.53	11.82
	Total	87.93	11.66	83.17	11.45	83.07	11.31
BMI (kg/m^2)	Experimental	35.78	5.09	30.02	5.96	29.87	5.80
	Control	34.98	5.21	33.19	5.37	32.24	5.41
	Total	35.38	5.15	31.61	5.67	31.06	5.61

Weight and Body Mass Index (BMI) were considerably lower in the experimental group than in the control group at all three time points—pre-test, post-test, and follow-up—according to the data analysis shown in Table 3, which suggests that the intervention was most likely cognitive therapy. Weight and BMI dropped significantly in the experimental group, while the control group experienced only slight alterations. The normality of the data, homogeneity of variances, and equality of covariance matrices were all validated by statistical tests (Shapiro-Wilk, Levene's, and Box's M) ($P > 0.05$), which supported the use of parametric tests. To confirm the statistical significance of these changes, the results of ANOVA and post-hoc tests are necessary. Furthermore, the results of the statistical tests indicated normality of the data, homogeneity of variances, and equality of covariance matrices, supporting the use of parametric tests such as ANOVA and MANOVA. The calculated effect size also suggests a large practical impact of the intervention.

Table 4. MANOVA Results and Between-Group Effects

Variable	Effect	Wilks' Lambda	F	df1	df2	P	Partial η^2
T3, T4, TSH	Time	0.079	30.64	8	21	<0.001	0.921
	Group × Time	0.690	1.18	8	21	0.358	0.310
	Between Groups (Group)	—	3.42	1	28	0.075	0.109
Weight	Time	0.285	33.92	2	27	<0.001	0.715
	Group × Time	0.406	19.79	2	27	<0.001	0.594
	Between Groups (Group)	—	4.94	1	28	0.110	0.133
BMI	Time	0.264	37.65	2	27	<0.001	0.736
	Group × Time	0.521	12.42	2	27	<0.001	0.479
	Between Groups (Group)	—	4.95	1	28	0.011	0.135

Table 4 presents the Multivariate Analysis of Variance (MANOVA) results for all study variables, including both within-group (time and group × time) and between-group effects. The main effect of time was significant for all variables ($p < 0.001$), indicating significant changes across the three assessment stages (pre-test, post-test, and follow-up). The large effect sizes (partial η^2 ranging from 0.715 to 0.921) suggest substantial changes over time. The group × time interaction effect was significant for weight ($p < 0.001$, partial $\eta^2 = 0.594$) and BMI ($p < 0.001$, partial $\eta^2 = 0.479$), indicating that the pattern of change over time differed between the experimental and control groups for these variables. However, this interaction was not significant for thyroid hormones (T3, T4, TSH; $p = 0.358$, partial $\eta^2 = 0.310$), suggesting that the intervention did not produce a differential effect on hormonal levels. Between-group comparisons showed a significant difference only for BMI ($p = 0.011$, partial $\eta^2 = 0.135$), while the differences for weight ($p = 0.110$) and thyroid hormones ($p = 0.075$) were not statistically significant.

The within-group effects showed significant main effects of time for all variables ($p < 0.001$). The time × group interaction was significant for weight ($p < 0.001$) and BMI ($p < 0.001$), but not for thyroid hormones ($p = 0.358$). These findings indicate that while all variables changed over time, the intervention only had a differential effect on weight and BMI.

Table 5. Pairwise Comparisons of Study Variables Between Different Stages

Variable	Group	Stage 1	Stage 2	Mean Difference	Standard Error	p
Weight	Experimental	Pre-test	Post-test	4.77	0.58	<0.001
		Pre-test	Follow-up	4.87	0.63	<0.001
		Post-test	Pre-test	-4.77	0.58	<0.001
		Post-test	Follow-up	1.00	0.34	1.000
		Follow-up	Pre-test	-4.87	0.63	<0.001
		Follow-up	Post-test	-1.00	0.34	1.000
	Control	Pre-test	Post-test	1.26	0.42	0.085
		Pre-test	Follow-up	0.93	0.48	0.120
		Post-test	Pre-test	-1.26	0.42	0.085
		Post-test	Follow-up	-0.33	0.25	0.500
		Follow-up	Pre-test	-0.93	0.48	0.120
		Follow-up	Post-test	0.33	0.25	0.500
BMI	Experimental	Pre-test	Post-test	3.78	0.44	<0.001
		Pre-test	Follow-up	3.82	0.44	<0.001
		Post-test	Pre-test	-3.78	0.44	<0.001
		Post-test	Follow-up	0.05	0.07	1.000
		Follow-up	Pre-test	-3.82	0.44	<0.001
		Follow-up	Post-test	-0.05	0.07	1.000
	Control	Pre-test	Post-test	1.79	0.38	0.092
		Pre-test	Follow-up	2.74	0.41	0.105
		Post-test	Pre-test	-1.79	0.38	0.092
		Post-test	Follow-up	0.95	0.30	0.080
		Follow-up	Pre-test	-2.74	0.41	0.105
		Follow-up	Post-test	-0.95	0.30	0.080

The results of the Bonferroni post-hoc tests presented in Table 5 and the multivariate analysis of variance (MANOVA) indicate that the cognitive therapy intervention with an emphasis on dietary traps had a

statistically significant effect on reducing weight and Body Mass Index (BMI). Significant differences were observed between the means of weight and BMI at the pre-test and post-test stages ($p < 0.001$), as well as between the pre-test and follow-up stages ($p < 0.001$), confirming the intervention's effect in reducing these variables and maintaining this reduction up to the follow-up assessment. However, the difference between the means of weight and BMI at the post-test and follow-up stages was not statistically significant ($p = 1.00$), suggesting stabilization and maintenance of the intervention effects. The main effect of time was significant for both weight ($p < 0.001$) and BMI ($p < 0.001$), and the interaction effect between group and time was also significant for these variables ($p < 0.001$). In contrast, the interaction effect between group and time was not significant for T3, T4, and TSH ($p = 0.358$), indicating that the intervention did not have a differential impact on these thyroid hormone levels between the groups over time. The claim of a non-significant effect of time on T3, T4, and TSH is inaccurate, as the main effect of time was indeed significant for these variables ($p < 0.001$), although the differential effect of the intervention between the experimental and control groups was only confirmed for weight and BMI.

Discussion

The present study evaluated the effectiveness of cognitive therapy focusing on dietary traps on weight, BMI, and thyroid hormones in obese women with hypothyroidism. The findings showed that the intervention significantly reduced weight and BMI, with effects sustained over the follow-up period. However, no significant changes were observed in thyroid hormone levels. The mechanisms underlying this effect remain unclear because dietary traps were not directly measured.

The significant reduction in weight and BMI in the experimental group is consistent with previous studies that have reported the positive effects of cognitive-behavioral interventions on weight management (Beck, 2015; Williams & Martin, 2023). The sustained effects over the follow-up period further support the durability of cognitive therapy outcomes. Although the intervention was effective, we cannot confirm the specific mechanisms of action due to the lack of a direct measure of dietary traps.

The absence of significant changes in thyroid hormone levels (T3, T4, TSH) is an important finding. This result aligns with studies suggesting that psychological interventions primarily influence behavioral and emotional parameters rather than directly altering endocrine function (James & Clark, 2020; Brown & Smith, 2019). The hypothalamic-pituitary-thyroid (HPT) axis is relatively resistant to short-term psychological manipulation. Hormonal changes are more likely to occur gradually, following sustained metabolic improvements and long-term weight stabilization. The six-week follow-up period may have been insufficient to capture such delayed hormonal responses. Additionally, the lack of control over factors such as levothyroxine dosage, physical activity, and dietary intake may have masked potential effects.

The findings of this study are consistent with some previous research that reported limited effects of psychological interventions on thyroid hormones (Yang et al., 2024; Krause et al., 2022). However, they differ from studies that have suggested cognitive therapy may indirectly influence hormonal regulation through stress reduction (Rezaei et al., 2020; Parsapour et al., 2025). This discrepancy may be due to differences in sample characteristics, intervention duration, or outcome measures. The present study focused specifically on dietary traps, which may not directly impact the HPT axis.

Conclusion

In conclusion, cognitive therapy focusing on dietary traps was effective in reducing weight and BMI in obese

women with hypothyroidism. However, it did not significantly influence thyroid hormone levels. These findings support the use of cognitive therapy as a complementary intervention for weight management in this population, while highlighting the need for more comprehensive and longer-term studies to clarify its effects on hormonal regulation. However, the lack of a direct measure of dietary traps limits the interpretation of the mechanism of action. Future studies should include validated instruments to assess dietary traps and establish the mediating pathways.

Limitations

Several limitations should be considered when interpreting the findings:

1. The sample size was small (30 participants), which may have limited statistical power.
2. The follow-up period was relatively short (six weeks), which may have been insufficient to detect long-term hormonal changes.
3. The use of convenience sampling limits the generalizability of the results.
4. The sample was recruited from a single clinic in Tehran.
5. Dietary intake was not controlled or standardized.
6. Physical activity levels were not precisely recorded or controlled.
7. No validated instrument was used to assess dietary traps or cognitive beliefs related to dieting. Consequently, we cannot definitively conclude that the observed weight loss was mediated by changes in dietary traps, and the mechanisms underlying the intervention's effects remain unclear.
8. A participant flow diagram was not provided, limiting methodological transparency.
9. The sample was gender-homogeneous (only women), limiting generalizability to men.
10. Psychological variables such as sleep quality, stress, depression, anxiety, menopausal status, menstrual cycle phase, and comorbid conditions were not controlled.

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