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Efficacy of Topical Chamomile and Dill Oil on Abdominal Obesity in Women Ages 25-55 Years: A Randomized Clinical Trial

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Abstract

Background: In Persian Medicine topical use of chamomile and dill oils were used for obesity treatments. The aim of this study was to investigate the effect of topical use of chamomile and dill oils on abdominal obesity.

Methods: This randomized double-blind clinical trial was achieved in 60 women with abdominal obesity at the Behesht Persian Traditional Medicine Healthcare Center in Tehran, Iran, between May 2022 and December 2022. The subjects were divided into the intervention and control groups. They received chamomile oil and dill oil once a day on the entire abdominal area in the intervention group (n = 30) and topical of sesame oil on the entire abdominal area in the control group (n = 30) for 6 weeks. Abdominal circumference (AC) size was measured by tape measure. Abdominal subcutaneous fat thickness in three areas were measured with skinfold caliper at baseline, week 3, and week 6. (Including: the thickness of the skin fold above and below the navel and the left supra iliac skin fold above the iliac crest) Repeated-measures analysis of variance (ANOVA) was utilized to examine changes in abdominal size over time

Results: Abdominal circumference reduction was more significant in the intervention group ($P = 0.027$). In addition, the thickness of the skin fold above and below the navel and the left supra iliac skin fold above the iliac crest at each visit were also more significant in the intervention group (respectively $P = 0.005$, $P < 0.001$ and $P < 0.001$).

Conclusion: Topical chamomile and dill oil can reduce the abdominal fat thickness at above and below the navel and the left supra iliac skin fold above the iliac crest, as well as the waist circumference.

Keywords: Abdominal Obesity, Central Obesity, Chamomile, Dill, Persian Medicine

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Introduction

Obesity is characterized by the excessive or abnormal accumulation of fat or fat tissue in the body, resulting from an imbalance between daily energy intake and energy consumption. This imbalance leads to excessive weight gain, which is associated with an increased risk of diabetes mellitus and heart diseases. Hypertension and elevated blood fat levels can also negatively impact health (1). Abdominal obesity (AO) is linked to inflammation, endothelial dysfunction, diabetes mellitus, insulin resistance, metabolic syndrome, hypercholesterolemia, and cancer (2). A waist circumference of ≥ 80 cm in female and ≥ 94 cm in male is considered indicative of AO (3). Current treatments for obesity include dietary modifications, behavioral interventions, pharmaceutical treatments, and surgical interventions

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↑What is "already known" in this topic:
In Persian Medicine topical use of chamomile and dill oils were used for obesity treatments. Oxidative stress can cause obesity by stimulating white adipose tissue. Chamomile and dill reduces oxidative stress.

→What this article adds:
This study is the first clinical trial to evaluate the effects of topical chamomile and dill oil on abdominal obesity. Results reveal topical chamomile and dill oil can reduce the abdominal fat thickness at above and below the navel and the left supra iliac skin fold above the iliac crest, as well as the waist circumference.

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if necessary (4). Chemical drugs such as Orlistat, Lorcaserin, Phentermine/Topiramate, and Naltrexone/Bupropion are commonly used in obesity treatment (5). However, these drugs may have side effects such as headache, nausea, heart attack, anxiety, and depression. Additionally, they often provide short-term therapeutic effects with weight regain shortly after discontinuation (6). Various interventions are available to reduce local fat mass, including methods that involve the destruction of fat tissue such as cryolipolysis, high-intensity focused ultrasound, laser therapy, and the use of fat breakdown-stimulating drugs. Surgical procedures for fat tissue removal, such as liposuction, have been widely used and are considered effective in fat reduction (7, 8). Other methods for reducing local fat tissue include shockwave therapy and the application of local creams (9). Persian traditional medicine, with its extensive and effective history, can serve as a valuable guide in treating abdominal obesity. Persian Medicine has long emphasized the importance of addressing obesity, identifying its causes, and enumerating the associated health risks. Weight loss methods in Persian Medicine focus on food management, lifestyle corrections, and the use of orally or topically administered herbs and medicinal plants, such as chamomile oil and dill oil (10, 11). Recent studies have also confirmed the anti-obesity effects of chamomile and dill (12, 13). A large amount of various natural chemical compounds, including monoterpenes, flavonoids, coumarins, sesquiterpenes, and phenolic acids, have been identified in chamomile flowers (14). Chamomile has antioxidant properties due to its phenolic compounds and essential oils, and as a result, it has the ability to protect against oxidative stress associated with obesity and can improve inflammation caused by obesity (12). Dill, with the scientific name Anethum graveolens, also contains active ingredients such as flavonoids, terpenoids, alkaloids, tannins, and polyphenols that combat inflammation and oxidative stress (15). Oxidative stress and inflammation play a significant role in causing obesity, so using chamomile and dill can reduce obesity and abdominal fat by improving oxidative stress (16). The anti-inflammatory effects of topical application of chamomile and dill oil have also been confirmed (17-20). The aim of this study was to investigate the effect of topical use of chamomile and dill oils on abdominal obesity in women.

Methods

Participants and study setting

This randomized clinical trial was conducted at the Behesht Persian Traditional Medicine Healthcare Center in Tehran, Iran, between May 2022 and December 2022. The inclusion criteria consisted of women (25 to 55 years old) who were suffering from abdominal obesity, willing to cooperate in taking medicine, and had a waist circumference greater than 80 cm. Exclusion criteria included pregnancy during the study, unwillingness to continue the trial, allergic reactions to oils, patient dissatisfaction, hypothyroidism, uncontrolled diabetes mellitus, a history of using steroid drugs in the last three months, consumption of other drugs during the study, and changes in medications for any reason.

Herbal drug preparation

To prepare chamomile oil: chamomile 1 unit, sesame oil 6 units. Chamomile is soaked overnight in water (5 times the weight of the plant) and then boiled until a quarter of the water remains. Then, it is filtered and placed in a bain-marie with sesame oil and boiled until the water evaporates and the oil remains. Then, it is poured into the percolator with a paper filter and after the water settles, the oil is separated.

To prepare dill oil: 1 unit of fresh dill leaves, 1 unit of half-pounded dill seeds; Sesame oil 10 units. Washed leaves and eggs are added to sesame oil and placed in a bain-marie and boiled until the leaf dries and the color of the egg changes. Then, the oil is filtered.

Sesame oil was prepared by cold compress method.

Randomization, blinding

A block randomization method and a random number table were used to randomize participants. The subjects were divided into two groups: the intervention group, which received a can of chamomile and dill oil, and the control group, which received a can of sesame oilThe packaging of both the chamomile+dill and sesame oils was identical, with dark-colored cans used for both. To further mask the contents, the lid of the sesame oil can was coated with chamomile+dill essential oil. Both the researcher and participants were blinded to the contents of the boxes.

Sample size

The sample size was determined using a superiority analysis, assuming normally distributed data, with an alpha error of 0.05, a power of 80%, and an effect size of 0.7 for the primary outcome, based on previous literature in similar clinical contexts (21). Based on these assumptions, a sample size of 60 subjects, which was calculated by considering 15% drop-out rate, the sample size was considered 35 patients in each study group was deemed sufficient.

Intervention

All participants provided informed consent prior to participating in the study. Initially, the researcher completed a basic information registration and history form for each participant. Based on the inclusion criteria, women with a waist circumference greater than 80 cm were screened for abdominal obesity. Abdominal circumference, weight, body mass index, and abdominal subcutaneous fat thickness were determined for each patient by the investigator.

The intervention group received a daily dose of 2 cc per square meter of a combination of chamomile oil and dill oil, applied evenly to the entire abdominal area, excluding a 2-centimeter radius around the navel (approximately 10 square centimeters), to create a thin layer. No massaging was performed. The treatment was administered for a period of 6 weeks.

Following application of the oil, a plastic layer was placed over the treated area, and participants performed aerobic activity for 30 minutes. The plastic cover was then removed after the aerobic activity. The control group followed the same protocol, using sesame oil instead of the intervention oil. Study subjects were not allowed to receive

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other methods of obesity control and were asked to maintain their usual diet and eating habits throughout the study (a 24-hour food recall was used at baseline and at the end of the study to assess the individual's adherence to usual dietary habits (validity and reliability have been evaluated) (22). And do not participate in any other exercise program except the one mentioned. Exercise control was controlled by giving a daily medication usage record and 30 minutes of aerobic exercise after taking the medication made by the researcher and asking the patients.

Measurements

Abdominal and waist circumference were measured using a tape measure with an accuracy of 0.1 centimeters. Abdominal subcutaneous fat thickness was measured using a skinfold caliper in three areas: the thickness of the horizontal skin fold at 3 cm from the navel, 1 cm below it on the right side; the thickness of the skin fold above the navel at the midpoint of the line between the breast and navel junction; and the thickness of the left supra iliac skin fold above the iliac crest in the left mid-axillary line (primary outcomes). weight, and BMI (secondary outcomes) were examined by the researcher at the first visit, as well as after 3rd and 6th weeks. The researcher also administered a questionnaire to assess side effects of medication. Finally, data from patients who completed the study were analyzed using a per-protocol analysis.

Data analysis

Data analysis was performed using SPSS 26 software. Descriptive statistics, including means and standard deviations, were used to summarize quantitative variables, while frequency and ratio expressions were used to describe qualitative variables. To compare the intervention and control groups for nominal and ordinal qualitative variables, chi-square tests and Fisher's exact tests were employed. For quantitative variables with normal distributions, Student's t-tests were used to compare the two groups, whereas for non-normal distributions, Mann-Whitney U tests were used. Repeated-measures analysis of variance (ANOVA) was utilized to examine changes in abdominal size over time. A significance level of less than 5% was considered for all analyses.

Results

Participants' characteristics

A total of 80 patients with abdominal obesity were recruited for the study, but 10 patients were excluded due to one or more exclusion criteria, resulting in a final sample of 70 patients who were randomly assigned to two groups. During the 6-week study period, 10 patients (5 from each group) withdrew from the study, leaving a total of 60 patients who completed the study and were included in the analysis (30 patients in the intervention group and 30 patients in the control group). Figure 1 illustrates the patient flow through the study. Baseline variables were compared between the two groups and did not show any significant differences ($P > 0.05$), as presented in Table 1.

Effects of intervention on clinical treatment response

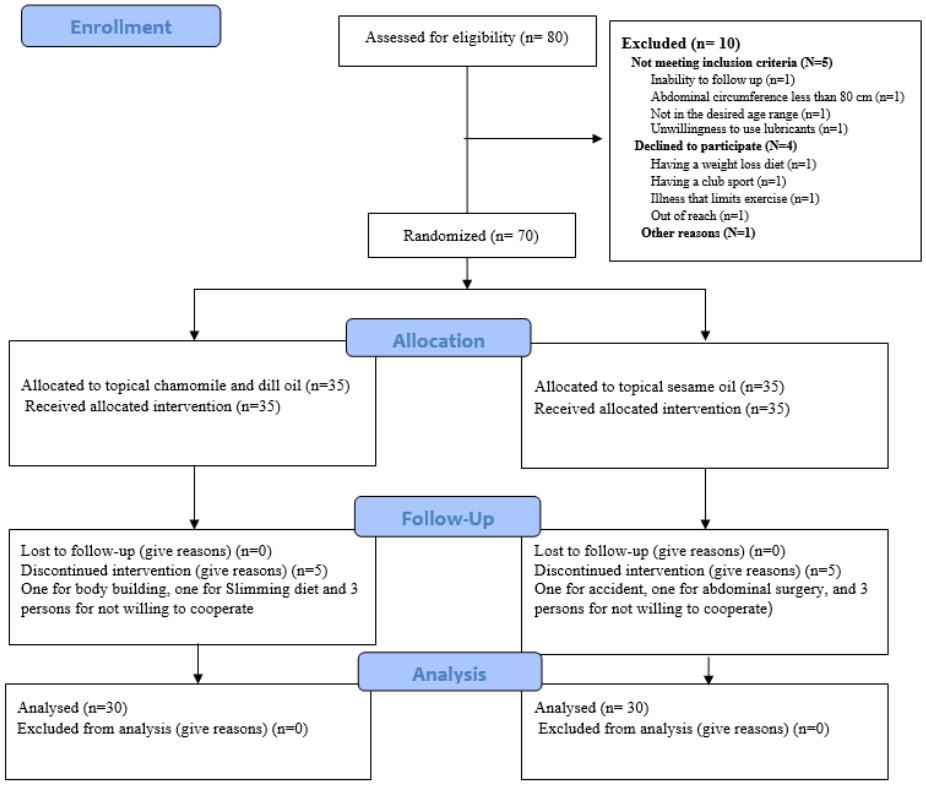

Figure 1. Consort diagram

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Table 1. Baseline data of the participants

Variable		Intervention (topical chamomile and dill oil) (N=30)	Control (topical sesame oil) (N=30)	*P*-value
[a] Age (years)		40.40 ± (7.88)	38.90 ± (9.12)	0.498
[b] Marital status	Single	8 (26.7%)	10 (33.3%)	
	Married	22 (73.3%)	20 (66.7%)	0.573
[b] Education	<High school	4 (13.3%)	7 (23.3%)	
	high school diploma	11 (36.7%)	14 (46.7%)	0.251
	Academic	15 (50%)	9 (30%)	
	Housewife	19 (63.3%)	20 (66.7%)	
[b] Occupation	Student	2 (6.7%)	3 (10%)	0.707
	Government jobs	5 (16.6%)	2 (6.7%)	
	freelance job	4 (13.4%)	5 (16.6%)	
	Height (cm)	160.23 ± (5.85)	162.56 ± (6.18)	0.139
[a] Anthropometric indices	Weight (kg)	80.20 ± (9.90)	82.00 ± (13.33)	0.555
	Body mass index (BMI)	31.30 ± (4.10)	31.02 ± (4.92)	0.811

[a]: Data are expressed as mean ± standard deviation.
[b]: Data are expressed as a percentage of patients
Statistical significant difference ($P < 0.05$).

Table 2. Comparison of main variables in 3th and 6th week after intervention between two groups

Variable		Intervention (topical chamomile and dill oil) (N=30)	Control (topical sesame oil) (N=30)	*P*-value
weight (kg)	baseline	80.20 ± (9.90)	82.00 ± (13.33)	0.555
	3rd week	78.65 ± (9.99)	81.10 ± (13.23)	0.422
	6th week	77.23 ± (10.21)	79.97 ± (13.42)	0.379
	baseline	31.30 ± (4.10)	31.02 ± (4.92)	0.811
	3rd week	30.70 ± (4.04)	30.68 ± (4.88)	0.994
Body mass index (BMI)	6th week	30.13 ± (4.10)	30.25 ± (4.93)	0.921
	baseline	108.37± (9.38)	112.23 ± (13.04)	0.351
Waist circumference (cm)	3rd week	104.33 ± (9.04)	109 ± (12.77)	0.248
	6th week	101.07 ± (9.17)	106.47 ± (13.21)	0.185
lateral skin fold (mm)	baseline	58.00 ± (12.51)	60.00 ± (8.66)	0.812
	3rd week	48.60 ± (11.13)	54.73 ± (8.78)	0.020*
	6th week	42.67 ± (9.91)	51.00 ± (9.65)	0.006*
	baseline	54.87 ± (12.26)	59.73 ± (7.96)	0.135
above the navel (mm)	3rd week	46.00 ± (9.81)	54.07 ± (8.76)	0.002*
	6th week	40.70 ± (9.41)	49.67 ± (9.71)	0.002*
below the navel (mm)	baseline	54.10 ± (7.61)	57.40 ± (7.61)	0.424
	3rd week	45.47 ± (8.85)	53.07 ± (8.46)	0.002*
	6th week	41.00 ± (7.10)	49.13 ± (9.03)	0.001*

Data are expressed as mean ± standard deviation.
* Statistical significant difference $P < 0.05$).

Clinical treatment response was found to be better and statistically significant in the intervention group compared to the control group, as measured by the thickness of skin folds on the sides above and below the navel at weeks 3 and 6. In contrast, there were no significant differences between the two groups in terms of abdominal circumference at weeks 3 and 6 (Table 2). A repeated-measures analysis of variance revealed a significant effect of the intervention on abdominal circumference ($P = 0.027$).

Furthermore, analysis of repeated measures revealed that the average abdominal size decreased more significantly in the intervention group (Figure 2). Additionally, skin fold thickness above (Figure 3), below (Figure 4), and left suprailiac (Figure 5) at each visit were all more significant in the intervention group (respectively $P = 0.005$, $P < 0.001$, and $P < 0.001$).

Effects on secondary outcome

There were no significant differences between the two groups in terms of weight, body mass index at weeks 3 and 6 (Table 2).

Side effects

In the intervention group, 4 patients (13.3%) experienced adverse effects, including itching, hives, and rashes. In contrast, no complications were reported in the control group. Notably, The frequency of side effects in the two groups did not show a statistically significant difference.

Discussion

The aim of this study was to investigate the efficacy of chamomile oil and dill oil on abdominal obesity in women. Our study showed that the thickness of the skin fold in all three areas (side, above the navel, below the navel) in both intervention and control groups decreased significantly during six weeks. However, this reduction in the intervention group that used chamomile and dill oil was significantly higher than the control group. A similar clinical study on 60 women with abdominal obesity compared the local effect of Arnebia euchroma ointment with a placebo (eucerin) over a 6-week period. At the end of the study, it was found that abdominal circumference (AC) decreased more significantly in the Arnebia euchroma group (13.9 vs. 6.5 cm, $P = 0.004$). Additionally, abdominal fat thickness

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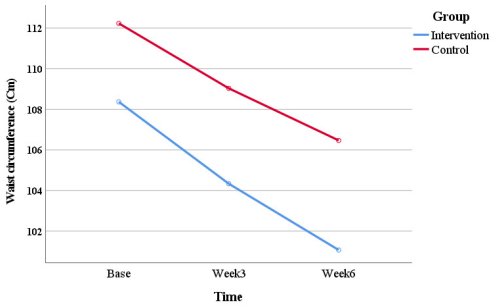

Figure 2. Comparison waist circumference between the two groups in the 6th week's intervention

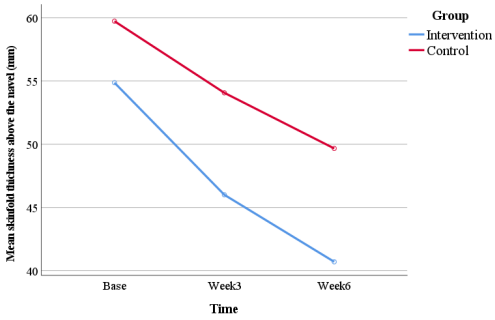

Figure 3. Comparison the thickness of the skin fold above the navel between the two groups in the 6th week's intervention

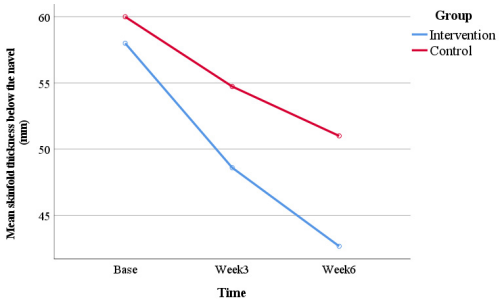

Figure 4. Comparison the thickness of the skin fold above the navel between the two groups in the 6th week's intervention

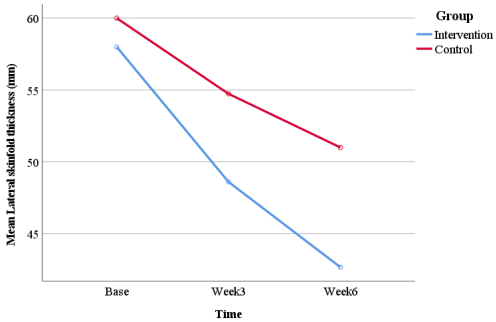

Figure 5. Comparison the thickness of the left supra iliac skin fold above the iliac crest in the left mid axillary line between the two groups in the 6th week's intervention

(AF) reduced significantly in patients (2.3 ± 1.1 cm, $P < 0.001$). Although changes in AF were not significantly different between the two groups (2.53 vs. 2.04 cm, $P = 0.139$), this study demonstrated the potential efficacy of topical Arnebia euchroma in reducing AC and AF. Notably, there were no severe drug reactions or complications reported from using Arnebia ointment (21). The number of participants in this study was similar to our study. The duration of the study was also similar to our study (6 weeks). The results of this study also showed that the local use of lipolytic drugs reduces fat in the abdominal area. Another clinical study investigated the local effect of Lipoxyderm (containing aminophylline, gotu kola (Centella asiatica), yohimbe, L-carnitine, and caffeine) on thigh fat mass, circumference, and skinfold thickness in 10 female volunteers. In this study, Lipoxiderm was applied twice daily for 28 days to one thigh of each subject and a placebo was applied to the other thigh. A total of seven subjects completed the study. The results showed significant differences between Lipoxyderm and placebo for thigh circumference ($P = 0.005$), thigh skinfold ($P = 0.009$), and thigh fat mass ($P = 0.001$) (23). The number of participants in this study was almost one tenth of the present study. The duration of the study was 4 weeks and 2 weeks was shorter than our study. The results of this study, like our study, showed the local effect of lipolytic drugs on body fat. In other clinical study, the topical effect of cream containing glycerinic acid (the major active ingredient of licorice) on fat thickness on the thigh surface evaluated on eighteen healthy, non -obese female (20-32 years) The circumference of both thighs was assessed at the base and in the middle of the thigh by ultrasound for superficial and deep fat layers. Subjects were randomly divided into two groups: 9 people were treated with cream containing 2.5% glycyrrhetinic acid on their dominant thigh, and 9 people in the placebo group received cream containing placebo on their dominant thigh. Their results showed a significant reduction in the superficial fat layer thickness in the glycyrrhetinic acid cream-treated thigh, both in relation to the contralateral untreated leg and to the placebo-treated ones ($p < 0.005$). The average amount of fat reduction in the superficial layer after one month of treatment was about 2.1 mm (24). The anti-inflammatory effect of topical use of chamomile has been investigated and confirmed in several clinical studies (17, 19, 25). According to studies, chamomile can be absorbed locally from the skin of the abdomen and the flavonoids and volatile oils of chamomile can penetrate into the deeper layers of the skin (26). Mitochondria in fat cells play a key role in breaking down fats and producing energy. Antioxidant compounds can improve the function of mitochondria and beta oxidation of fatty acids. By improving the function of mitochondria, fatty acid breakdown and ATP production increase. Also, in the process of producing ATP, there is an increase in heat and the production of H2O (27). oxidative stress and inflammation play an important role in the cause of obesity (16), Oxidative stress can cause obesity by stimulating white adipose tissue (WAT) deposition and changes in food intake. Based on studies, oxidative stress can increase pre adipocyte proliferation, fat cell differentiation, and mature fat cell size (28). Chamomile and dill reduces oxidative stress (29, 30). The chemical compounds in chamomile oil include camazolin, alpha-bisabolone oxide A, (Z)-β-farensene, α-bisabolol oxide A and apigenin.

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Apigenin is a remarkable bioactive ingredient that increases skin permeability (31). Flavonoid components of chamomile can bind directly to PPARγ and thereby activate this protein promoting its anti-inflammatory effects Phenolic compounds and chamomile essential oils have antioxidant properties. Therefore, they show the ability to protect against obesity-related oxidative stress. The anti-inflammatory activity of chamomile compounds (dependent and independent of antioxidant properties) can improve inflammation caused by obesity. Another protective mechanism that reduces lipotoxicity and improves insulin resistance in obesity appears to be direct modulation of PPARγ activity (12). Chamomile can also lead to the activation of stress-responsive transcription factor regulators Nrf2 and FOXO1(12) In general, chamomile can combat obesity through direct antioxidant action of phenolic constituents and essential oils and improve mitochondrial function, anti-inflammatory action ،modulation of PPARγ activity, activation of Nrf2 and FOXO stress regulators mechanisms (12). Dill seed extract activated peroxisome proliferator-activated receptor- (PPAR-) (32). Dill contains flavonoids, terpenoids, alkaloids, tannins, and polyphenols that combat inflammation and oxidative stress caused by obesity (15). In addition, with its antioxidant properties, can improve mitochondrial function (33).

On the other hand flavonoids dilate blood vessels and improve blood circulation and improve fat burning (34). Flavonoids, quercetin and apigenin, have potential in complementary therapy against obesity (35). According to studies, sesame oil orally also causes weight loss (36, 37).

According to studies, consuming sesame seeds significantly reduces body fat percentage. Although consuming sesame seeds and their products does not affect body weight, BMI, or waist circumference (38). However, the effects of topical use of this oil on abdominal obesity have not been investigated. But topical consumption of sesame oil has anti-inflammatory (39) and by adjusting the concentration of superoxide dismutase, glutathione, glutathione peroxidase, and catalase, it reduces oxidative stress. (40). Our study showed that sesame oil reduces abdominal fat in the control group, and the combination of chamomile and dill in the sesame base creates a synergistic effect in this reduction. Because of their anti-inflammatory and antioxidant properties, chamomile and dill show promise as effective agents in the treatment of obesity. The strengths of our study include several notable features. This clinical study is the first to investigate the topical effects of chamomile and dill oil on abdominal obesity in women, offering a novel approach to this issue. Additionally, these oils are readily available and affordable, and their consumption did not result in any significant adverse effects for the subjects. However, one of the limitations of our study is the lack of follow-up data after treatment discontinuation.

Conclusion

This study demonstrates that topical application of chamomile and dill oil can significantly decrease the thickness of skin folds on the abdomen, above and below the navel. Moreover, our findings indicate that topical chamomile and dill oil had no severe adverse effects on the skin, suggesting a high level of safety for this treatment approach.

Authors' Contributions

M.B. conceived the study, data collection, and led the manuscript drafting. F.E. contributed to the study design, B.S.Y. contributed to data analysis and statistical consultation and assisted with data interpretation. M.I. participated in the literature review and manuscript formatting S.M. contributed to the study design and manuscript revision. All authors reviewed and approved the final version of the manuscript.

Ethical Considerations

This study was approved by Ethics Committee of Iran University of Medical Sciences (approval code: IR.IUMS.REC.1401.133), and registered at the Iranian Registry of Clinical Trials; https://irct.ir under the code number of IRCT20230902059321N1.

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Conflict of Interests

The authors declare that they have no competing interests.

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