

Combined Effect of Electromagnetic Field and Micro-pressure Technique on Abdominal Obesity in Post-Menopausal women: A randomized controlled clinical trial

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ABSTRACT

Background: One of the major problems affecting postmenopausal women is abdominal obesity. Increased body weight, mainly visceral fat weight, is a common occurrence during menopause and raises the risk of both cardiovascular illness and tumor growth.

Objective: To ascertain how the combined effect of electromagnetic field and micro-pressure technique affects abdominal obesity in post-menopausal women.

Subjects and Methods Forty volunteer postmenopausal women with abdominal obesity participated in this research; their ages were between 50 - 55 (5 years after last menstruation), their body mass index (BMI) varied from 30 to 40 kg/m², and their waist-hip ratio was > 0.88 cm. The women were distributed randomly into a study group (A) (n = 20) and a control group (B) (n = 20). The study group participants were treated with a combined electromagnetic field and micro-pressure (Redustim) for 45 minutes, twice a week for 12 sessions, plus a low-calorie diet regimen for 6 weeks. The control group (B) received only a low-calorie diet regimen for 6 weeks. All women were evaluated prior to and following the intervention by analyzing lipid profiles (total cholesterol (TC), high-density lipoprotein (HDL), low-density lipoprotein (LDL), and triglyceride (TG)), visceral fats, body composition analysis (Inbody), and anthropometric measures (body circumferences (waist and hip) and waist/hip ratio (WHR)).

Results: The results indicated that both groups' assessed variables had changed significantly before and after the intervention. When comparing the two groups, a significant difference favoring the study group (A) was also observed in the post-treatment values of all assessed variables.

Conclusion: The combined electromagnetic and micropressure, plus a low-calorie diet, were more beneficial to reduce weight, BMI, waist circumference (WC), WHR, visceral fat, and lipid profile than a low-calorie diet alone on abdominal visceral fats in postmenopausal women.

KEYWORDS: Electromagnetic field, micropressure, low-calorie diet, post menopause, abdominal obesity.

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INTRODUCTION

Postmenopausal women have a higher probability of being overweight and obese because of hormonal changes; they are among the almost 1.5 billion obese adults globally. Moreover, disorders linked to obesity threaten the lives of 2.8 million individuals annually throughout the world (Abd El-Kader and Al-Jiffri, 2019).

Postmenopausal women are more likely to develop metabolic syndrome (MetS), type 2 diabetes mellitus (T2DM), and cardiovascular disease (CVD), especially those who experience central obesity (Abd El-Kader and Al-Jiffri, 2019).

In general, aging and the decline in estradiol levels during the perimenopause and postmenopause are linked to changes in women's weight and fat distribution. Weight gain and body fat are also caused by changes in physical activity. Additionally, variations in triglyceride and cholesterol levels indicate elevated cardiovascular risks (Silva et al., 2021).

Obesity is becoming more commonplace globally. It is more prevalent in women, according to epidemiological data, and this trend appears to be growing. These disparate outcomes are linked to infertility and gestational pathology, as well as the increased risk of CVD, T2DM, disability, and cancer following menopause. Gaining fat and excessive lean mass is linked to premenopause and menopause. The woman's health is greatly impacted by this condition (Vazquez et al., 2021)

Lipid profile alters throughout menopause, with reduced HDL cholesterol levels and 10–15% increased LDL cholesterol and triglyceride (TG) levels (Choi et al., 2015).

Central obesity is a serious risk indicator for MetS. It is identified by increased WC and the buildup of visceral fat. It is associated with negative lipid profiles, raised diastolic blood pressure (BP), insulin resistance (IR), and generally diminished cardiovascular wellness (Ostman et al., 2017).

The weight loss of a macronutrient composition diet may have an impact on some intermediate outcomes, despite slight variations in cardiometabolic risk. Low-carb diets may be more efficient at lowering TG and raising levels of HDL-cholesterol, whereas low-fat diets often lower levels of LDL-cholesterol (Silva et al., 2021).

A reliable method that was initially created in the 1990s is BioStimology, a novel cell activation technology that uses alternating low-frequency electromagnetic fields (EMF) to promote the reduction of fat cells and enhance fertility. Similar to those brought on by prolonged physical activity, the EMFs cause undetectable muscle contractions at the abdominal level, which leads to the lipolysis of abdominal fat and regulated cutaneous pressure or micropressure secondary draining action to aid in the removal of toxins and the release of fatty acids in the systemic circulation (Beilin et al., 2018).

Transmission of a low-frequency intermittent magnetic field fluctuating between 0 and 2 Gauss is the usual technology, known as BioStimology. BioStimulation activates the sarcoplasmic reticulum's calcium ATPase (calcium pump) to target smooth and striated muscle cells (Blank et al., 2005).

To promote the destocking of fatty masses, one primary mechanism relies on the transmission of alternating low-frequency EMFs. These waves have unique characteristics that give them a particular function in a lipolytic strategy. At low frequencies of 40 to 60 Hz (50 Hz for the device), numerous studies indicated the activation of membrane ATPases that are closely related to calcium regulation, also known as calcium pumps, in the context of weak alternating magnetic fields, which enables the execution of the device without any hazards for body tissues or medical functional restrictions (less than 5 Gauss, which is comparable to those of the device) (Beilin et al., 2018).

Micropressure drainage is a secondary draining function of regulated micropressure that aids in the removal of toxins and the release of fatty acids in the body circulation (Beilin et al., 2018).

In individuals with abnormal BMI, lymphatic drainage may alleviate lymphatic system dysfunction. The mechanism of lymphatic drainage relies on stimulating the lymphatic system by improving fluid dynamics, accelerating the elimination of toxic compounds from bodily tissues, and increasing lymph circulation (Antoniak et al., 2021).

Need for the study

Ten to twenty-five percent of females in prosperous countries suffer from obesity and excessive weight, which are becoming serious public health issues. Additionally, the waistline can disclose the presence of visceral fat, which is important in diseases linked to cancer or CVD. It is among the main elements that contribute to the development of metabolic syndrome. Regular exercise, a healthy diet, consuming less salt and carbs, and having a smaller WC are the fundamentals of visceral fat reduction (Beilin et al., 2018).

The study aimed to provide novel knowledge and insights to the field of physical therapy. Therefore, elucidating the impact of electromagnetic fields and micropressure in combination on abdominal obesity in postmenopausal women will assist these women in managing their weight and reducing abdominal obesity to prevent metabolic and CVD, along with lowering the rate of disability and death.

METHODS

Study design

This prospective, single-blinded, randomized, controlled trial was conducted at Bloom Diet Expert Center in Zamalek, Egypt, with the practical aspect lasting for 1 year and 2 months, from September 2023 to November 2024. Before the first evaluation and inclusion in the trial, every patient received an overall clarification of the study protocol, and then they signed a consent form. Cairo University's Faculty of Physical Therapy's Ethics Committee approved the research protocol in January 2021 (P.T.REC/012/003100).

Study population

In this study, 40 postmenopausal women with abdominal obesity (central obesity) participated. Their ages were between 50 and 55 years (5 years after last menstruation), and their BMI varied from 30 to 40 kg/m². Their WHR was > 0.88 cm. Women who had diabetes mellitus, hypertension, CVD, lymphatic disease, or pacemakers, were not allowed to take part in the study.

Randomization and blinding:

The women were randomized using an online randomization program (<http://www.randomizer.org/>) to receive a combined electromagnetic field and micropressure plus a low-calorie diet regimen (Group A) (n = 20) or a low-calorie diet regimen alone (Group B) (n = 20). A researcher without any clinical involvement in the study generated systematically numbered index cards with random group allocations relying on the generated random numbers to confirm distribution concealment. The index cards were tied before being put in closed envelopes that were blind to all groups. The therapist delivered the procedures then opened every envelope and distributed the participants into groups according to the index card that was selected. The group allocation had been concealed by the participants. After randomization, there were no withdrawals of participants (Figure 1).

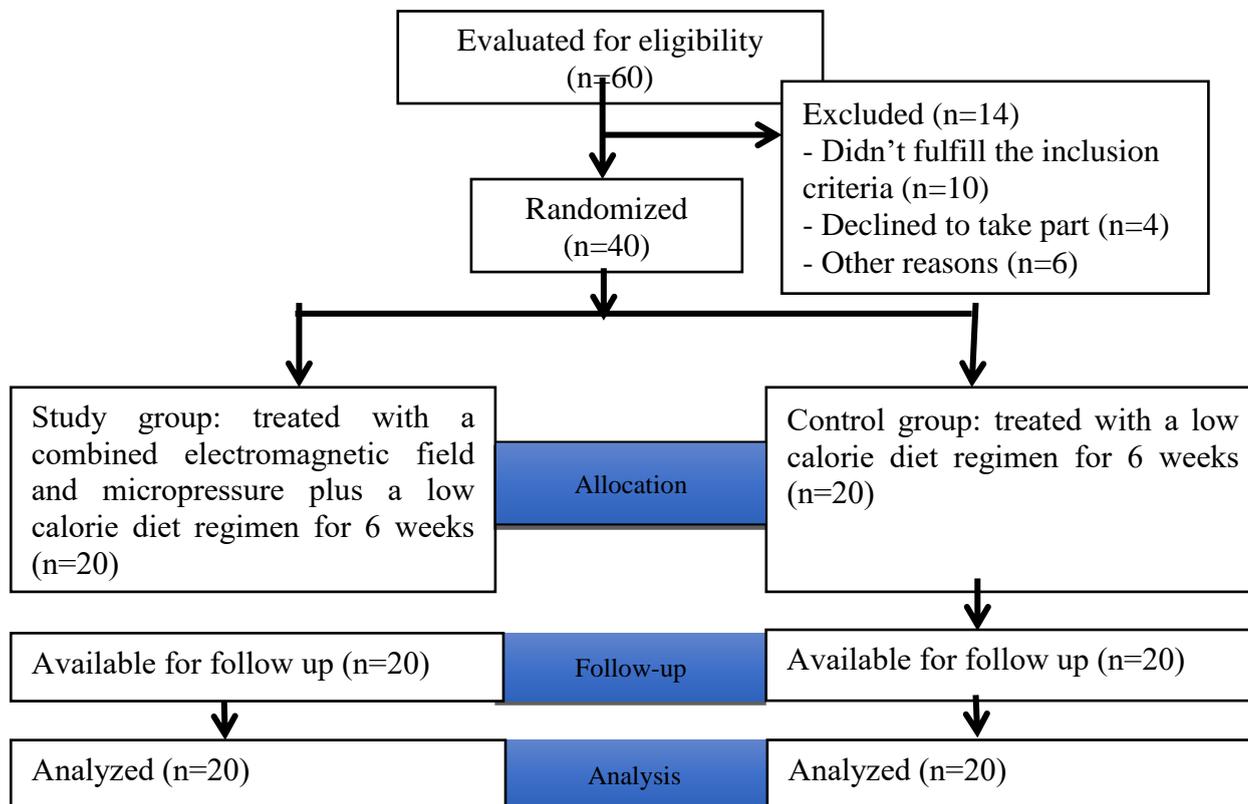


Fig. 1: Flow chart of the study.

Outcome measures:

Each woman in each group was evaluated before and following the treatment program through analyzing the lipid profile (TC, HDL, LDL, and TG), visceral fats, body composition analysis (InBody), and anthropometric measures (body circumferences (waist and hip) and waist/hip ratio).

The primary outcome measure:

1) Body mass index (BMI): It was computed by measuring the body weight and height of each patient as follows: (Nabil et al., 2017).

$$\text{Body mass index (BMI)} = \frac{\text{Weight (Kg)}}{\text{Height (m}^2\text{)}}$$

2) Waist-hip ratio (WHR): the waist and hip circumferences were measured from a standing position to determine WHR as a subjective method for all participating females in both groups (A&B) prior to and following 6 weeks of treatment according to this formula: (Nabil et al., 2017).

$$\frac{\text{Waist circumference in cm}}{\text{Hip circumference in cm}}$$

3) Body composition analysis (Inbody): To evaluate body composition outcomes, including body fat mass, skeletal muscle mass, (segmental) lean body mass, and body fat percent (visceral fats). (Kyle et al., 2004).

4) Lipid profile: Syringes have been used to draw a blood sample from every woman in both groups before and following the intervention to measure the lipid profile (TC, HDL, LDL, TG) by the Beckman Coulter DxC 700 AU Chemistry Analyzer.

Treatment interventions:

Low-calorie diet:

A low-caloric diet was followed by all patients in both groups. The diet plan was reviewed every 2 weeks for each woman.

Preparation for a low-calorie diet comprises the following stages:

The first step involves calculating a person's overall energy needs, also known as their total metabolic rate, or TMR, using nutritional criteria or their physical activity level (PAL). The PAL value of 1.4 or 1.6 indicates low levels of physical activity, 1.75 or 2.0 indicates moderate levels, and 2.2 or 2.4 indicates high levels (Harris-Benedict and Mifflin et al., 1990).

The body weight loss was calculated in units of time. The energy supply must be decreased by 500–1000 kcal per day to lower body weight by 0.5–1.0 kg in a week (Brończyk-Puzoń et al., 2015).

The final step involves assessing the level of a low-energy diet. An estimated daily energy deficit (kcal) should be subtracted from the TMR (Alfonzo-González et al 2004)

Estimating protein requirement (0.8–1 g/kg of adjusted ideal body weight [AIBW] or 20–25% of daily energy requirement), Estimating fat requirement (20–25% of daily energy requirement), Estimating carbohydrates requirement (supplementation of energy requirement about 45–50% of daily energy requirement), Determining food rations, Dividing daily rations into meals and Planning a menu (4–5 meals daily). Brończyk-Puzoń et al., 2015)

Combined electromagnetic field and micro-pressure (Redustim)

The combined electromagnetic field and micro-pressure (Redustim) were applied to all women in the study group for forty-five minutes, twice a week, for 12 sessions (Beilin et al., 2018). Every woman lay in a supine position inside the suit, while the therapist closed it using the strap and zipper to ensure a proper fit. The therapist switched on the touch screen and adjusted the percentage of micro-compression and the time of the session to 45 minutes, then started the session (Beilin et al., 2018).

Data analysis and statistical design:

Statistical analysis

The unpaired t-test was implemented to compare the participant characteristics across groups. To verify that the data was distributed normally, the Shapiro-Wilk test was utilized. The homogeneity of variances among groups was examined utilizing Levene's test. The effects of therapy on weight, BMI, WHR, visceral fat, and blood lipids were examined using mixed MANOVA. For the subsequent multiple comparison, post-hoc analyses were performed utilizing the Bonferroni correction. All statistical tests had a significant level of $p < 0.05$. The SPSS (IBM SPSS, Chicago, IL, USA) version 25 for Windows was employed for all statistical analyses.

RESULTS

- Subject characteristics:

Table (1) displays the participant characteristics of both groups. Age, height, weight, and BMI were not significantly different across groups ($p > 0.05$).

Table 1. Comparison of participant characteristics across both groups:

	Group A	Group B	MD	t- value	p-value
	Mean ±SD	Mean ±SD			
Age (years)	52.80 ± 1.64	52.70 ± 1.56	0.1	0.20	0.84
Weight (kg)	94.15 ± 16.60	93.80 ± 17.04	0.35	0.07	0.94
Height (cm)	159.35 ± 6.36	159.60 ± 6.06	-0.25	-0.13	0.89
BMI (kg/m ²)	36.86 ± 4.67	36.61 ± 4.95	0.25	0.18	0.86

SD, Standard deviation; MD, Mean difference, p value, Probability value

Impact of treatment on weight, BMI, WC, WHR, visceral fat and blood lipids:

A significant interaction effect between treatment and time was identified by mixed MANOVA ($F = 49.39$, $p = 0.001$). A significant main effect of time was observed ($F = 268.63$, $p < 0.001$). The intervention had a significant main effect ($F = 8.35$, $p = 0.001$).

Within-group comparison

A significant reduction was indicated in weight, BMI, WC, WHR, and visceral fat in both groups after intervention when compared with baseline values ($p > 0.001$). The percentages of changes in weight, BMI, WC, WHR, and visceral fat in group A were 10.57, 10.60, 10.05, 11.11, and 39.47%, respectively, and those in group B were 3.50, 3.51, 2.69, 6.93, and 14.32%, respectively. (Table 2).

A significant reduction was indicated in TG, LDL, and cholesterol, and a significant increase in HDL in both groups after treatment when compared with baseline values ($p > 0.001$). The percentage changes of TG, LDL, cholesterol, and HDL of group A were 26.27, 25.62, 21.71, and 37.75%, respectively, and those of group B were 9.54, 11.73, 12.56, and 24.84%, respectively. (Table 3).

Between-groups comparison

The groups weren't significantly different before treatment ($p > 0.05$). The weight, BMI, WC, WHR, and visceral fat of group A were significantly lower than those of group B after treatment ($p < 0.05$).

Group A's post-treatment TG, LDL, and cholesterol levels significantly decreased, while HDL significantly increased when compared with group B ($p < 0.05$). (Table 2-3).

Table 2. Mean weight, BMI, WC, WHR and visceral fat before and after treatment of both groups:

	Pre treatment	Post treatment	MD	% of change	p value
	Mean \pm SD	Mean \pm SD			
Weight (kg)					
Group A	88.90 \pm 7.90	79.50 \pm 7.60	9.40	10.57	0.001
Group B	88.50 \pm 10.00	85.40 \pm 9.60	3.10	3.50	0.001
MD	0.40	-5.90			
	<i>p = 0.90</i>	<i>p = 0.03</i>			
BMI (kg/m²)					
Group A	35.00 \pm 2.51	31.29 \pm 2.24	3.71	10.60	0.001
Group B	34.75 \pm 3.60	33.53 \pm 3.38	1.22	3.51	0.001
MD	0.25	-2.24			
	<i>p = 0.81</i>	<i>p = 0.01</i>			
WC (cm)					
Group A	102.15 \pm 10.58	91.88 \pm 8.49	10.27	10.05	0.001
Group B	100.55 \pm 9.24	97.85 \pm 8.98	2.70	2.69	0.001
MD	1.60	-5.97			
	<i>p = 0.61</i>	<i>p = 0.03</i>			
WHR					
Group A	0.99 \pm 0.06	0.88 \pm 0.07	0.11	11.11	0.001
Group B	1.01 \pm 0.05	0.94 \pm 0.04	0.07	6.93	0.001
MD	-0.02	-0.06			
	<i>p = 0.11</i>	<i>p = 0.001</i>			
Visceral fat (%)					
Group A	19.00 \pm 0.92	11.50 \pm 1.28	7.50	39.47	0.001
Group B	18.85 \pm 0.81	16.15 \pm 1.50	2.70	14.32	0.001
MD	0.15	-4.65			
	<i>p = 0.58</i>	<i>p = 0.001</i>			

SD, Standard deviation; MD, Mean difference; p value, Probability value

Table 3. Mean TG, LDL, Cholesterol and HDL before and after treatment of both groups:

	Pre treatment	Post treatment	MD	% of change	p value
	Mean \pm SD	Mean \pm SD			
TG (mg/dl)					
Group A	147.50 \pm 12.51	108.75 \pm 10.62	38.75	26.27	0.001
Group B	141.50 \pm 12.26	128.00 \pm 12.40	13.50	9.54	0.001
MD	6	-19.25			
	<i>p = 0.13</i>	<i>p = 0.001</i>			
LDL (mg/dl)					
Group A	150.25 \pm 6.78	111.75 \pm 17.42	38.50	25.62	0.001
Group B	153.50 \pm 8.13	135.50 \pm 14.32	18.00	11.73	0.001
MD	-3.25	-23.75			
	<i>p = 0.17</i>	<i>p = 0.001</i>			

Cholesterol (mg/dl)					
Group A	276.40 ± 35.69	216.40 ± 26.87	60.00	21.71	0.001
Group B	279.35 ± 32.88	244.25 ± 33.26	35.10	12.56	0.001
MD	-2.95	-27.85			
	<i>p = 0.78</i>	<i>p = 0.006</i>			
HDL (mg/dl)					
Group A	37.75 ± 4.72	52.00 ± 4.97	-14.25	37.75	0.001
Group B	38.65 ± 3.92	48.25 ± 5.91	-9.60	24.84	0.001
MD	-0.9	3.75			
	<i>p = 0.51</i>	<i>p = 0.03</i>			

SD, Standard deviation; MD, Mean difference; p value, Probability value

DISCUSSION

There is a link between accumulating fat and excessive lean mass both before and after menopause. This knowledge significantly impacts the woman's health. Various epidemiological studies have found that two-thirds of postmenopausal women have abdominal obesity. A sudden drop in estrogen secretion and an imbalance with androgens result in altered energy homeostasis, including decreased thermogenesis and increased appetite (Vazquez et al., 2021).

This research was done to explore the combined effectiveness of electromagnetic field and micro-pressure technique on abdominal obesity in postmenopausal women.

The study's results indicated that both groups' assessed variables had changed significantly before and after the intervention. When comparing the two groups, a significant difference favoring the study group (A) was also observed in the post-treatment values of all assessed variables.

The study's results are aligned with Beilin et al. (2018), who performed a scanning study to assess the potential of EMFs to reduce visceral and subcutaneous fat, corroborating the study's findings. Twenty participants were included in this study, and after 12 sessions, the results showed ($P < 0.01$): The biological evaluations conducted prior to and after the intervention revealed a highly significant decrease in the level of transaminases and the device effect on the activation of muscle contractions. There was also an average weight loss of 5.45 kg, a BMI decrease of 6%, and a waistline decrease of 7 cm.

According to Frydman et al. (2011), the average weight reduction at the beginning of the sixth session was 1.2 kg, and at the conclusion of all sessions, it was 1.6 kg. The results are consistent with their findings. Most of the weight changes occurred within the first three weeks. Similar patterns were observed in changes in the WC.

Additionally, the study supports the findings of David and Kinney (2021), who found that the abdominal VAT area consistently decreased by 14.3% and that the WC was decreased on average by 3.9 ± 3.1 cm after the treatment ended. Computed tomography (CT) scans of 22 individuals who received eight high-intensity focused electromagnetic (HIFEM) treatments demonstrated a reduction of 3.0 cm at S6 and 5.5 cm at S12, and the difference in weight over the course of six weeks was modest (-1.6 kg).

Comparing the before- and after-treatment results of lipid profiles indicated a significant difference that agrees with Ersek et al. (2017), who employed a mechanical lymph approach for noninvasive body contouring; a significant change was noted between the before- and after-treatment outcomes of the lipid profile (TC, LDL, HDL, and TG). Six out of 22 patients completed the 14 sessions of treatment, and they were advised to continue drinking water and eating a low-fat diet. They discovered that measurements of body circumference had decreased.

Furthermore, the results are corroborated with those of Bayrakci et al., (2010), who revealed that a mechanical massage approach enhanced the lipid-mobilizing properties of isoproterenol delivered in situ in the femoral adipose tissue of cellulite-affected women. Along with these outcomes, their treatment decreased skin-fold measurements and body circumferences. Furthermore, Lacomba et al. (2012) discovered that the lymphatic drainage technique is a unique way to enhance lymphatic circulation, particularly subcutaneous circulation, to stretch the lymph vessels and boost the initial lymphatics, which in turn improves the removal of interstitial fluid. Additionally, it enhances and promotes resorption without boosting filtration.

Moreover, earlier studies by Bordoni (2019) and Shander et al. (2012) indicated that lymphatic procedures had a beneficial effect on inflammatory cell migration. C-reactive protein levels decreased in the overweight patient following mechanical lymphatic drainage therapy. This could be one advantage of the lymphatic system's proper functioning being restored, and it could therefore cause a reduction in low-level chronic inflammation.

The present results also concur with those of Willemijn et al. (2019), who indicated that a 6–7% reduction in weight in postmenopausal women who were healthy and overweight to obese resulted in a reduction in both intra-abdominal and subcutaneous abdominal adipose tissue (SAAT). Weight reduction by exercise integrated with mild dietary restriction provides greater changes in SAAT but not intra-abdominal adiposity when compared to weight reduction from calorie restriction alone. The somewhat higher rate of weight reduction in the exercise and diet group may help explain its impact on subcutaneous fat.

Furthermore, Ibrahim (2014) reported that a low-calorie diet containing 1200 kcal, 60 g protein, 165 g carbohydrate, and 33 g fat for three months improved the body weight of 20 obese females and improved their anthropometric measures (weight, hips, WC, and BMI). Conversely, Suyardi et al. (2005) indicated that a 14-day balanced low-calorie diet decreased the weight, BMI, fat mass percent, WHR, and serum leptin of 39 obese women aged 19 to 55. Furthermore, these findings were corroborated by Fiastuti et al. (2018), who indicated that obese males and females aged 74 and older with a BMI between 25 and 35 kg/m² and a history of weight cycling had a decrease in WC following an eight-week low-calorie diet intervention. Weight loss occurs physiologically on low-calorie diets when fats are released from adipocytes into the bloodstream to provide the required energy (Porter et al., 2009).

Combined electromagnetic and micropressure operate through low-frequency electromagnetic pulses that activate mild, involuntary muscle contractions similar to light physical activity. This process enhances cellular metabolism and promotes the breakdown of fat deposits, particularly in the abdominal region, which is often resistant to fat loss (Beilin et al., 2018).

To promote the destocking of fatty masses, one primary mechanism relies on the transmission of alternating low-frequency EMFs. These waves have unique characteristics that give them a particular function in a lipolytic strategy. The stimulation of membrane ATPases, commonly referred to as calcium pumps, in the context of weak alternating magnetic fields, less than 5 Gauss, and at low frequencies of 40 to 60 Hz (50 Hz for the device) was, in fact, highlighted by various international studies (Beilin et al., 2018).

Ca²⁺ ATPases are membrane enzymes that make up 90% of the membrane proteins in muscle cells' sarcoplasmic reticulum membrane. The rapid movement of Ca²⁺ ions from the reticulum toward the sarcoplasm causes muscular contraction. The reticulum stores these ions (Beilin et al., 2018). Magnetic stimulation of Ca²⁺ ions boost ATPase activity, thereby activating lipolytic activity that targets muscle-stored fat cells. This process contributes to the energy expenditure cycle without muscular strain, mimicking the effects of physical activity without muscle extension. The body subsequently eliminates surplus ATP generated by this stimulation, similar to a sportsman's recovery after exertion (Beilin et al., 2018).

The intramuscular level hydrolysis of TG occurs as a consequence of the magnetic fields stimulating insensitive muscle contraction at the abdominal level. This enhances the production of lipase (HSL) (Beilin et al., 2018). The elimination of toxins and the diffusion of fatty acids into the bloodstream are facilitated by controlled cutaneous pressure, or micropressure (Beilin et al., 2018).

These results corroborate the findings of earlier research, which found that the medications help patients lose weight and reduce MetS (Beilin et al., 2012). However, take note that while this trial uses combined electromagnetic and micropressure alongside a low-calorie diet, some earlier studies utilized the REDUSTIM® device tailored with a micropressure system, while other studies used a different device version identified as "REDUSTIM® SPORT" that was not provided with micropressure. These current studies have shown further benefits of the technology: the reduction of visceral fat in postmenopausal women with abdominal obesity; improved lymphatic drainage and blood circulation that facilitate waste removal; deep tissue stimulation that doesn't impact internal organs; and the induction of lipolysis in adipose tissue without physical exertion, making it a safe fat loss technique with favorable device tolerance. Combining mechanical and electromagnetic stimulation may have contributed to the notable decrease in visceral fat. This improvement in the lipid profile, including lower levels of TG and TC, indicates a potential systemic metabolic benefit that may be mediated by increased lipolytic activity and hormonal regulation. The noticed weight loss confirms that the strategy was generally successful in controlling central obesity.

STRENGTHS AND LIMITATIONS:

Throughout the study period, no negative consequences were observed in the current patient series. The non-invasive combined electromagnetic and micropressure technique has a randomized design. In addition, the study assessed various outcomes, including WC, WHR, body composition analysis (InBody test), and lipid profile, to assess abdominal obesity. Further research is required to determine how the combined electromagnetic and micropressure technique will affect abdominal obesity, especially visceral fat in diabetic women and postpartum women, with a follow-up period. Further research is required to study the combined impact of electromagnetic and micropressure techniques in addition to cryolipolysis to decrease both visceral fat and subcutaneous fat.

CONCLUSION:

In postmenopausal women, the combination of electromagnetic therapy and micropressure, along with a low-calorie diet, was more beneficial in reducing weight, BMI, WC, WHR, and visceral fat and improving lipid profile than a low-calorie diet alone.

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AUTHOR CONTRIBUTIONS

RA-A, HM-H, ME-H, SH-S, and EJ-H carried out the concept, research design, data gathering, statistical analysis, and data interpretation. They cooperated to draft, edit, and accept the final manuscript before it was published.

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