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Effect of ultrasound fat cavitation versus faradic stimulation on abdominal adiposity during postnatal period section

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Abstract---Background and Purpose: This study examines the effects of ultrasonic fat cavitation versus faradic stimulation on postnatal abdominal obesity. Subjects and Methods: It was a randomized controlled trial. Overall, 40 patients complaining of abdominal adiposity postnatal, aged 25-35 years, were randomized into two equal groups. The control group (A) received sessions of abdominal ultrasonic cavitation treatment three times per week with a frequency of 40 kHz, a power of 45 W, and a duration of 30 minutes, in addition to a balanced diet programme consisting of between 1000kcal and 1200kcal per day for six weeks. The study group (B) received faradic stimulation treatment sessions focusing on their abdomen area three times per week with a duration of 30 minutes, in addition to a healthy diet plan which ranged from 1000kcal to 1200kcal/day for six weeks. Tape measurement was used to assess waist circumference; a digital calliper was used to determine fat thickness, while body analysis was used to evaluate fat percentage in both groups before and after the treatment. Results: Statistical analysis showed that weight, body mass index (BMI), waist circumference, subcutaneous fat thickness and fat mass significantly decreased ($P>0.001$) in both groups (A &B) post-treatment with a greater percentage of improvement in favour of group A. Also, there was no significant difference between both groups

($p > 0.05$) in the pretreatment of both groups in all variables. Comparison between groups post-treatment showed a nonsignificant decrease in weight, BMI, waist circumference, subcutaneous fat thickness and fat mass between both groups post-treatment ($P > 0.001$). Conclusions: Ultrasound fat cavitation is more efficient than Faradic stimulation in lowering the waist-to-hip ratio and subcutaneous fat thickness in postpartum obese women.

Keywords---ultrasound fat cavitation, faradic stimulation, abdominal adiposity.

Introduction

Obesity or being overweight is a syndrome characterised by the unhealthy buildup of excessive fat in adipose tissue. In contrast, central obesity or abdominal adiposity refers to excessive fat accumulation in the centre of the body, particularly in the intra-abdominal region [1]. Excessive prenatal weight retention increases the risk of postpartum weight gain, where the active visceral fat is responsible. Increased cardiovascular disease, diabetes, and metabolic syndrome risks are associated with obesity [2]. An imbalance between a high-calorie intake and a lack of physical activity results in the accumulation of excess fat around the abdomen, the breasts, and the lower limbs, leading to dissatisfaction with one's body composition. In general, liposuction was the most popular technique for body contouring. Nonetheless, this rigorous treatment has been linked to several antagonistic occurrences and complications [3].

Faradic stimulation (FS) and ultrasound fat cavitation (USFC) are noninvasive fat mobilization technologies that are safe and effective. They have fewer problems than traditional liposuction techniques [4]. USFC is the method of handling obesity, especially in destroying fat and shaping a particular body part. USFC is preferred to decrease the risk of complications due to obesity as one of the nonsurgical correction methods [5]. FS has a lot of benefits and effects, such as breaking fat molecules, converting to the free fatty acid (FFA) and entering the Krebs cycle, returning the elasticity to skin and tone of muscle, increasing the power of atrophied muscle and stimulating the repelling of the liquids gathered in the organs [6]. According to the authors' knowledge, no prior research compares. The effect of USFC and FS on abdominal adiposity during the postnatal period. Consequently, the purpose of this study was to compare the impact of USFC to FS on weight, BMI, waist circumference, subcutaneous fat thickness and fat mass during the postnatal period. It was hypothesized that USFC and FS would have no significant effect on abdominal adiposity during the postnatal period.

Subjects and Methods

Design

This study is prospective, randomized, and controlled trial. Between June 2021 and January 2022, it was carried out. The study's protocol was explained in detail to each patient who signed informed consent at starting of this study.

Participants

A sample of 40 obese primipara women at six weeks postnatal was recruited from the obstetric outpatient Clinic, Zagazig University Hospital, El-Sharqia Governorate, Egypt. The inclusion criteria include sedentary and medically stable postnatal women. The age range of the participants was 25 to 35 years, and their BMI ranged from 30 to 35 kg/m². Pregnancy, heart disease, high cholesterol, liver and renal disorders, diabetes mellitus, hypertension, oral contraceptive use, and weight reduction medication use were exclusion criteria.

Randomization

Forty patients were randomly divided into two equal groups (control group and study group) using a sealed envelope procedure by an independent researcher; each sealed envelope contained a letter indicating whether the women would be assigned to the control or study group. Patients were not aware of which group they were assigned to.

Interventions

The control group (A): consisted of twenty patients who received ultrasound cavitation treatment sessions on their abdominal region three times per week for 30 minutes, in addition to a balanced diet programme ranging from 1000 to 1200 kcal/day, which was calculated on an individual basis for each woman based on her basal metabolic rate (BMR) for six weeks.

Ultrasound cavitation application

From a standing position, the abdominal region of each woman was divided vertically into two sections, right and left segments that extended bilaterally from the line extending from the mid axilla to the iliac crest and above from the centre of the diaphragm to the line extending between two iliac crests below. The skin of the abdominal area was cleaned with alcohol cotton then patients were placed into a comfortable, relaxed position to apply the conductive gel on the abdominal area while applying the cavitation head in a very slow and circular movement on each abdominal segment. Ultrasound cavitation was used on a cleaned skin of the abdominal area while patients were lying in a comfortable supine relaxed position. Cavitation frequency 40 kHz, Power: 45W, duration: 30 minutes/ session (15 minutes on each side of the abdomen). Treatment will be applied three times per week for 18 sessions [7].

The study group (B): Twenty patients underwent abdomen FS treatment sessions three times per week for 30 minutes in addition to the identical diet programme indicated for the group (A) for six weeks.

Faradic stimulation application:

The patients were positioned in a relaxed and comfortable supine position. Then the skin of the abdominal area was cleaned. The treatment session lasted 30 minutes (15 minutes on each side of the abdomen) three times per week for 18 sessions.

Outcome measures

- **Waist to hip ratio measurement (WHR)**

The waist circumference was determined at the apex of the right iliac crest. HC (Hip circumference) was measured at the level of the greatest circumference at the femoral trochanter. WHR was calculated by dividing WC (Waist circumference) by HC. Before and after the conclusion of the trial, all postpartum mothers in both groups (A & B) were given two separate estimates (6 weeks). All measures were obtained while the postpartum ladies were standing. The anterior abdominal wall's skin was cleaned, and the postpartum woman was instructed to wear light clothing occasionally. The measurements were done twice for more precision [8].

- **Subcutaneous abdominal fat thickness**

Stainless steel digital calliper was used to evaluate the thickness of subcutaneous abdominal fat. It is considered a simple, perfect, accurate and inexpensive technique for precise assessment of body composition, diameter, thickness, and depth and takes compound measurements. Still, it is influenced by the skin site or the obesity level.

- **Percentage of Fat**

In body analysis device was used to measure the percentage of fat. A new in-body analysis device has 3 Frequencies (5kHz, 50kHz, and 250kHz). 8-point Tactile Electrode Design allows for the whole rapid body and regional body composition evaluation. It can measure body Fat, height measurement, skeletal muscle, percentage of body fat, mineral salt, weight control, muscle control, BMI, goal weight, protein, obesity diagnosis, basic metabolism, Fat-free weight, nutritional assessment, and weight assessment. Input voltage (110V, 50/60 Hz) [9].

Statistical analysis

The statistical analysis was conducted using version 26 of SPSS for Windows (SPSS, Inc., Chicago, IL). The data were tested for normality assumption, homogeneity of variance, and extreme scores before the final analysis. This investigation was performed as a prerequisite for the difference analysis' parametric computations. The Shapiro-Wilk test indicated that the data for all measured variables were normally distributed ($p > 0.05$) based on a preliminary examination of the hypotheses. According to Levene's test of homogeneity of variances, variances and covariances were homogeneous ($p > 0.05$), and covariances were homogeneous ($p > 0.05$). Therefore, parametric statistics were employed. The independent sample t-test was used to determine whether the dependent variable differs between the two independent groups. While the paired sample t-test was employed to determine whether a difference exists within the same group. The unpaired t-test was performed to determine whether the demographic features of the two study groups differed before treatment. The Chi-square test was done to determine whether there is a difference in gender pretreatment. The amount of alpha was set at 0.05.

Results

- Demographic and clinical characteristics of participants:

After	31.34 ± 6.83	32.39 ± 9.01	0.67
% of change	↓ 13.23	↓ 8.14	
<i>P-Value</i>	0.0001*	0.0001*	

\bar{x} : Mean; SD: Standard deviation P-value: probability value; *Significant at $P < 0.05$

Discussion

The form of adipose tissue, the shape of the body, and the regional accumulation of body fat were significant contributors to metabolic problems. It was stated that the WHR was employed as a simple indicator of body fat distribution. Increased abdominal WC compared to HC was associated with an increased risk of coronary heart disease [10]. Subcutaneous adiposity demonstrated the same connections with metabolic problems as visceral obesity. Nonetheless, most research revealing such relationships did not account for concurrent variation in visceral adiposity. Even a basic measure like body weight has connections with metabolic abnormalities nearly as robust as visceral fat in a heterogeneous sample of patients that includes both lean and obese individuals [11]. This study showed that both groups receiving USFC and FS decreased WHR and subcutaneous fat thickness in managing abdominal obesity in postnatal women, with no significant difference.

Despite the increasing demand for noninvasive ultrasonic body contouring, there is a paucity of clinical evidence regarding its efficacy. Few trials have been conducted, to our knowledge, to examine the effectiveness of noninvasive ultrasonic lipolysis in reducing cellulite, and the cosmetics industry funds the majority of existing studies. This study demonstrates that external ultrasonic lipolysis can reduce cellulite accumulation in the abdomen. We find that an average circumference reduction of 1.8 cm might be anticipated during an ultrasonic lipolysis session. Surprisingly, increased lipolysis did not result in a greater circumference reduction. For instance, the second and seventh lipolysis sessions resulted in circumference reductions of 0.88 cm and 0.86 cm, respectively.

According to the findings of this investigation and a previous study, external ultrasonic lipolysis yielded an average circumference decrease of 2 cm per treatment [12]. In addition, Moreno-Morago et al. [13] demonstrated a consistent 1.8 cm circumference reduction per treatment session. Shek et al. found that after three sessions of ultrasonic lipolysis, the abdomen circumference of Asian participants increased by 2.03 cm. This disparity is thought to be attributable to differences in body size and measuring bias due to the flexibility of abdominal skin after lipolysis [14]. Moreover, these findings demonstrated the efficacy of targeted ultrasonic lipolysis in obese patients with a BMI greater than 30. [15].

Moreover, our results concur with Shek et al. [14]. They discovered a durable effect of ultrasonic lipolysis with the maintenance of a 7 cm mean circumference decrease, despite the development of a negligible degree of regression in 64% of patients. In addition, Moreno-Morago et al. [13] demonstrated the permanence of a cumulative circumference reduction of 3.95 cm. In the Shek et al. [14] trial, however, the average abdominal circumference at baseline and 3-month follow-up visits was 96.6 cm and 96.2 cm, respectively, resulting in poor overall results.

Additional experiments can assist assess the long-term effects of targeted ultrasonic lipolysis. In addition, the results were consistent with those of a previous study, which reported that in this open-label trial, we encountered some limitations, including the absence of a randomised control group, ultrasonographic subcutaneous fat calliper measurement, and hepatic evaluation of fat deposition in addition to serum lipid profile evaluation [16]. This work was corroborated by Razavi et al. 2012 [17], who demonstrated that FS therapy reduced the circumference of the thigh and abdomen.

Limitations

There are some limitations to the current study, despite revealing objective data with statistically significant differences. The primary one is the short time of the study. Therefore, long-term studies are required to assess the long-term effects of ultrasonic cavitation and FS on the WHR, subcutaneous fat thickness, and fat percentage. More research is necessary to discover both procedures' most appropriate and effective settings. Comparing faradic and other forms of electrical stimulation will require additional research. Also, further research is necessary to determine the efficacy of the multimodal strategy, which incorporates ultrasound cavitation, FS, and other physical therapy modalities for postnatal central obesity.

Conclusions

The current study showed that six consecutive weeks of USFC and FS is effective adjuvant therapy for treating abdominal obesity by reducing WC, weight, BMI, subcutaneous fat thickness, and fat mass.

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Disclosure statement

No author has any financial interest or received any financial benefit from this research.

Conflict of interest

The authors state no conflict of interest.

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Consent

The procedures of this study were explained to all participants, who signed a consent form before the beginning of the study.

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