ISSN : 2350-0743

www.ijramr.com

*International Journal of Recent Advances in Multidisciplinary Research*

*Vol. 10, Issue 06, pp. 8534-8537, June, 2023*

## RESEARCH ARTICLE

# EFFECT OF ULTRACAVITATION ON ABDOMINAL ADIPOSITY IN WOMEN AGED 30 TO 40 YEARS ULTRACAVITATION ON ABDOMINAL ADIPOSITY

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**ARTICLE INFO**

***Article History:***
Received 20th March, 2023
Received in revised form
23rd April, 2023
Accepted 06th May, 2023
Published online 20th June, 2023

***Key words:***

Abdominal adiposity, ultracavitation, abdominal perimetry, body fat, pliometry.

**ABSTRACT**

***Introduction:*** The increase in abdominal fat is associated with cardiovascular, metabolic and neoplastic diseases and has an aesthetic interest especially in young women. Ultracavitation, which is a physical agent that applies the mechanical effects of ultrasound on adipocytes, is an option for its approach. ***Objective:*** To determine the effect of ultracavitation in the reduction abdominal adiposity in women aged 30 to 40 years. ***Methodology:*** Preexperimental study in healthy woman or with overweight or obese, aged 30 to 40 years who received 15 ultracavitation sessions of 15 minutes per flank with multifunctional equipment at 40 kHertz, 40 W / cm2 and 100% of work cycle, 10 cm2 on each flank. Measurements of weight, height, BMI, percentage of fat mass, waist circumference and pliometry were made. Analysis with descriptive statistics, chi-square and Student's t for repeated measurements. ***Results:*** We included 24 women aged 34.4 ± 3.7 years. The weight was 81.4 ± 26.7 kg at baseline and 80.2 ± 25.5 kg at the end (p=0.01), basal body fat percentage of 39.7 ± 6.3 and 37.0 ± 6.8 final (p = 0.001), abdominal circumference 96.7 ± 14.9 cm and 92.5 ± 15.6 initial and final respectively (p < 0.001) and abdominal pliometry 38.5 ± 9.5 mm at baseline and 34.6 ± 10.6 final (p < 0.001). ***Conclusions:*** The approach to abdominal adiposity with 15 sessions of ultracavitation significantly reduces weight, body fat percentage, abdominal circumference and abdominal skin fold.

# INTRODUCTION

Abdominal adiposity refers to the increase in fat mass located in the cavity of the abdomen that is directly related to located obesity in this body region. Abdominal obesity can be defined operationally as the measurement of abdominal circumference ≥ to 90 centimeters (cm) in men and ≥ to 80 cm in women and is not always related to body mass index (BMI) (Dhawan, 2020 and Kim, 2019). Body fat is deposited as triglycerides in the adipocytes that constitute the adipose tissue, it has two types, the white adipose tissue that constitutes an energy reservoir to be used when the body requires it, and the accumulation of lipids in brown adipose tissue that allows body temperature to be maintained (Dhawan, 2020 and Sánchez, 2016). The assessment of the nutritional status of the individual contemplates the determination of different clinical parameters. It is necessary the basic measurement of weight and height with which the BMI can be obtained that allows to classify it as: normal, overweight and obese. A complete assessment of nutritional status that includes the measurement of abdominal circumference and the percentage of general or localized fat mass also makes it possible to determine the type of obesity. The percentage of fat mass measures the proportion of this tissue according to body segments or in a general way for which the methods of electrical bioimpedance and plethysmography by air displacement among others can be used. Abdominal obesity is a risk factor for numerous noncommunicable diseases (World Health Organization, 2020 and Powell-Wiley, 2021). It is strongly associated with phenotypic conditions of hypertension and metabolic syndrome, but also with hypertriglyceridemia and moderate and high cardiovascular risk. In general, abdominal obesity is associated with increased cardiovascular risk but also with fasting glucose intolerance, alterations in serum lipids, metabolic syndrome and diabetes (Parlá-Sardiñas, 2020 and Sigit, 2020). There is sufficient evidence that abdominal obesity also increases the risk of colorectal, pancreatic and gastroesophageal cancers among others (Silveira, 2021). Due to its important relationships with cardiometabolic and neoplastic disease, the reduction of abdominal obesity is a recommended health goal in all population groups and may also have aesthetic function. Increased physical activity, exercise programs and dietary strategies have been useful for this purpose in some groups of patients, however, adherence to an effective program of both strategies can be variable and sometimes insufficient (Gamarra-Camacho, 2021; Molina, 2016 and Almudena-Tárraga, 2021). Beyond the benefits and health conditions, the management of abdominal obesity often pursues aesthetic reasons with non-invasive procedures that can be useful due to their focused application in the segment of the abdomen and that require less application time and, therefore, greater adherence. For this purpose, focused ultrasound has been applied with ultracavitation technique

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that through thermal and mechanical effects subjects the subcutaneous tissue to micromassages that provide rhythmic and alternative rarefaction and compression movements that cause the lysis of the fat cell which is achieved with equipment that provides mechanical energy with a frequency of 37-45 kHz, power greater than 17 W/cm$^2$ and 100% duty cycles (Mancinelli-Fonseca, 2018 and Trelles, 2020). The purpose of our study is to determine the efficacy of abdominal ultracavitation in reducing localized adiposity in healthy, overweight and obese women aged 30 to 40 years attending a physiotherapy clinic.

# MATERIALS AND METHODS

A preexperimental pretest-retest study was conducted in women aged 30 to 40 years with localized adiposity in the abdomen which was defined by pliometry as a fat fold greater than 20 mm. Patients with a history of treatment for abdominal adiposity in the two months prior to the start of the study, who were taking special dietary management, physical activity to reduce body weight or with comorbidities such as diabetes mellitus and hypertension were excluded. The patients were selected by non-probability sampling from those who attended consecutively for their attention to the private clinic "Dr. Cadena" in the city of Cosoleacaque, Ver., in the period from October to December 2022. The study was authorized by the research and bioethics committees of the university educational institution and all participants received a complete explanation about the characteristics, objectives, risks and benefits of the research and were asked for their consent to participate by signing the informed consent letter. Prior to the experimental intervention, sociodemographic, anthropometric and clinical data were collected from the participants. Age, comorbidities were questioned and weight, height, body mass index (BMI), abdominal circumference, abdominal skinfold measurement, percentage of fat mass were obtained. Body weight measurement was performed on a digital scale with the patient wearing light clothing and no shoes; height was obtained by manual statimeter and with both measurements BMI was calculated by applying the formula BMI = weight / height$^2$. Patients were classified according to this body mass index as normal (BMI < 24.9), overweight (BMI 25 to 29.9) and obese (BMI > 30).

The measurement of abdominal circumference expressed in centimeters (cm) was performed with a tape measure at waist height passing through the umbilical scar and was classified as normal or low risk (< 82 cm), high risk (83 to 87 cm) and very high (88 cm or more). As for, the abdominal skinfold was obtained by pliometry applied to 5 cm to the right of the umbilical scar and was expressed in millimeters (mm). All procedures were performed by one of the investigators who was previously trained. The percentage of body fat was measured by electrical bioimpedance in *In body Dial* brand device and *OKOK International* digital application; Prior to its application, the areas of contact with the electrodes were cleaned with alcohol and the participants were asked not to have performed physical exercise prior to the exam and fasting for at least 4 hours. According to this measurement, patients were classified as healthy (percentage from 23 to 35), overweight (percentage 35.1 to 40) and obese (percentage ≥ 40). After the initial measurement of weight, abdominal circumference, pliometry and percentage of fat mass, 15 ultracavitation sessions were applied to the participants, distributed in 3 times a week for 5 weeks. The ultracavitation was performed with a *Siluet perfect* multifunctional equipment with 110/220 volts, power of 40 W / cm$^2$ and frequency of 40 KHz, each session was constituted by 15 minutes in areas of 10 cm$^2$ per flank, 30 minutes in total, with a work cycle of 100%. At the end of the 15 ultracavitation sessions, weight, abdominal circumference, abdominal skinfold and percentage of fat mass were measured again under the same conditions as at the beginning. Data were analyzed by calculating absolute and relative frequencies, estimating means and standard deviation, an inferential analysis was performed using the Chi square and Student's t tests for repeated measurements after determining criteria for the use of parametric tests with a significance level of 0.05 for acceptance and rejection of the null hypothesis. Statistical procedures were performed in Excel spreadsheets and SPSS 28 version software.

# RESULTS

24 female participants were incluted with an age (mean and standard deviation) of 34.4 ± 3.7 years, residents of the city of Minatitlán Veracruz, Mexico. The participants' weight at baseline was 81.4 ± 26.7 kg, height 1.60 ± 0.06 m and BMI of 31.7 ± 10.2 and their nutritional status was classified as normal at 6 (25.0%), overweight 6 (25.0%) and obese 12 (50.0%).

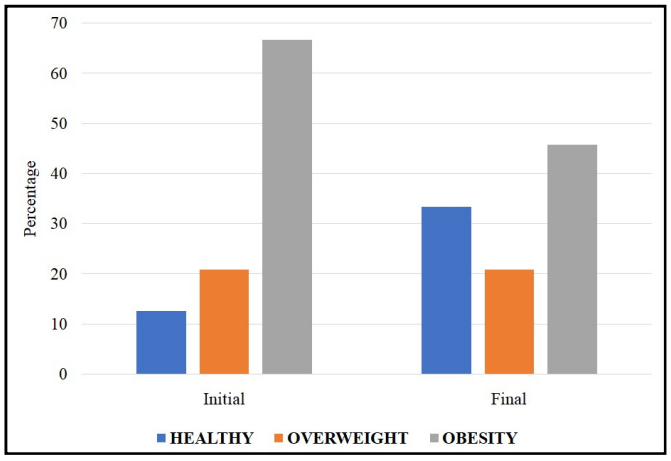


**Fig. 1. Distribution of body fat percentage categories at the beginning and end of ultracavitation treatment**

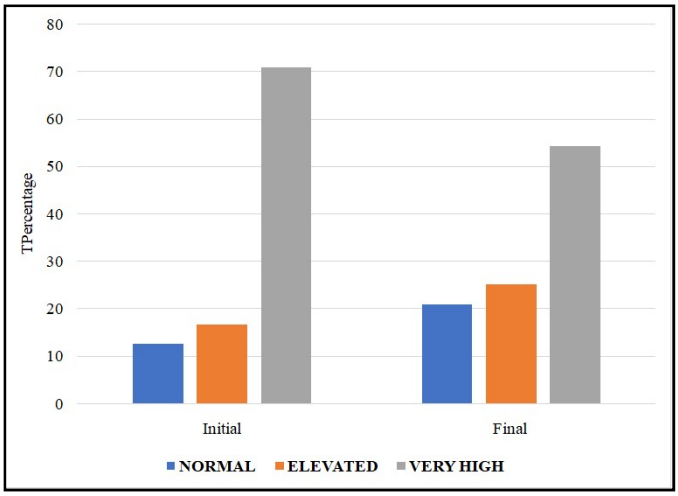


**Fig. 2. Distribution of abdominal circumference categories at the beginning and end of ultracavitation treatment**

**Table 1. Comparison of indicators of abdominal adiposity in women before and after ultracavitation N=24**

| | Initial measurement | Initial measurement | P Value |
|---|---|---|---|
| Body weight (Kg) | 81.4 ± 26.7 | 80.2 ± 25.5 | 0.01 |
| % Body fat | 39.7 ± 6.3 | 37.0 ± 6.8 | 0.001 |
| Abdominal circumference (cm) | 96.7 ± 14.9 | 92.5 ± 15.6 | < 0.001 |
| Abdominal pliometry (mm) | 38.5 ± 9.5 | 34.6 ± 10.6 | < 0.001 |

P values obtained with paired Student's T-test

With the application of ultracavitation in the abdominal area, the percentage of body fat went from a measurement of 39.7 ± 6.3 at the beginning to 37.0 ± 6.8 at the end of the intervention (p = 0.001). The clinical classification before the experimental intervention was 3 (12.5%) participants in the category of healthy, 5 (20.8%) overweight

and 16 (66.7%) obese while at the end 8 (33.3%) healthy, 5 (20.8%) overweight and 11 (45.8%) obese (p = 0.202). (Table 1, fig. 1) The abdominal circumference before the intervention was 96.7 ± 14.9 cm and 92.5 ± 15.6 cm at the end (p < 0.001); 3 (12.5%) of the participants were in normal category, 4 (16.7%) elevated and 17 (70.8%) very high at baseline while 5 (20.8%) normal, 6 (25.0%) elevated and 13 (54.2%) very high after the application of ultracavitation in the abdominal area (p = 0.488). (Table 1, Fig. 2) Abdominal pliometry was 38.5 ± 9.5 mm before experimental application and 34.6 ± 10.6 mm after ultracavitation (p < 0.001). Likewise, with the intervention, a reduction in body weight of 1,200 kg was observed and patients obtained 80.2 ± 25.5 kg after the procedure (p = 0.01). (Table 1, Fig. 3)

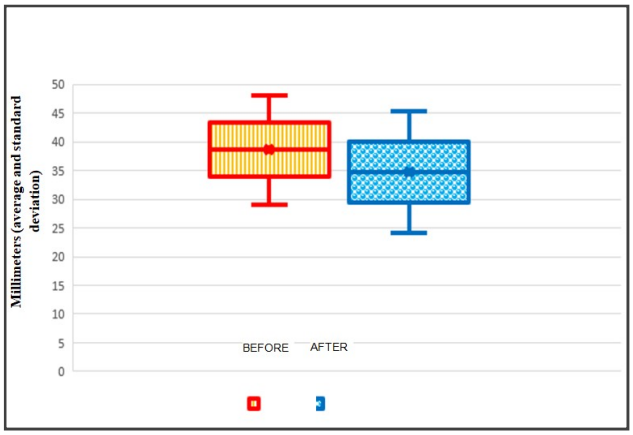


**Fig. 3. Measurement of abdominal pliometry before and after ultracavitation in the abdominal area in women from Minatitlán, Ver**

# DISCUSSION

Ultracavitation was effective in reducing abdominal adiposity in the sample of women aged 30 to 40 years who received the intervention. We observed statistically significant decreases in participants' weight, abdominal circumference, percentage of body fat mass and pliometry, with greater emphasis on these last two indicators. Likewise, in the assessment of clinical significance, our group of patients showed a reduction in the proportion of women categorized with obesity according to the percentage of fat mass and the percentage at a high and very high level of the abdominal circumference. Our research has the strength of having applied a design where a group of mostly overweight and obese women were prospectively observed in which ultracavitation was applied in the abdominal area. However, it has the limitation of lacking a control group and at the same time the small number of patients operated on did not allow corroborating the clinical significance of the differences obtained in each of the indicators A study conducted in 2017 by Petraglia L *et al*. (x1) obtained a significant reduction in abdominal circumference in 30 women aged 30 to 45 years. Patients reduced on average 27.2 cm with ultracavitation alone or including aerobic exercise. Similar to our study, the difference between the initial and final measurement was statistically significant, but differs from our results in the magnitude of the reduction in abdominal circumference that is not explained by having added physical exercise but instead, ethnic factors, food and to a lesser extent the greater frequency of the device could explain Castillo C, *et al* (x2) in a study with test-retest design published in 2022 found statistically significant reduction of 5.13 cm in abdominal perimetry and 4.59 mm in pliometry that were slightly higher than those obtained in our work; In contrast, unlike our results, they did not obtain statistically significant modifications in fat and body weight. The differences with our study could be due to the different composition of the sample, since in the study of Castillo C and collaborators individuals of both sexes were included and their body weight was lower than that of our patients at the beginning of the intervention.

Valentim da Silva RM *et al*.,(x3) in 2022 through a randomized clinical trial in 45 female patients found statistically significant reduction in abdominal pliometry and perimetry at 30 days of intervention with ultracavitation and ultracavitation plus radiofrequency, but not 15 days after starting the experimental maneuver. Likewise, by ultrasonography they identified reduction of abdominal fat with both procedures. These results coincide with those obtained in our research except that no significant reduction in body weight was identified, which was possibly explained by the lower weight at the beginning of the study. The discoveries of our study are relevant given the high prevalence of overweight and obesity in the population studied and in Mexico, as well as in many other countries of the world where changes in eating habits have led to increases in body weight that are associated with poor nutritional status. In particular, abdominal obesity is a major indicator of risk of cardiovascular disease, diabetes and decreased life expectancy. Demonstrating the efficacy of ultracavitation as part of dermatofunctional therapy to reduce abdominal circumference, skin folds and body fat percentage will allow health professionals to have an additional tool that alone and especially combined with other lifestyle modification measures contributes to reducing risks and improving individual health. We conclude that 15 sessions of ultracavitation allow to reduce in a statistically significant way abdominal perimeter, percentage of body fat and skin folds of the abdominal area in women aged 30 to 40 years mainly overweight and obese, there is also a trend to clinically improve indicators of nutritional status that need to be confirmed through studies with larger sample sizes.

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