

# CAVITATION RADIO FREQUENCY VERSUS MESOTHERAPY ON ABDOMINAL ADIPOSITY

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## Abstract

The purpose of the study is compare between cavitation radiofrequency and mesotherapy on abdominal adiposity. 45 obese subjects of both sexes ranged in age from twenty five to forty five years participated in this study were selected from specialized center for obesity and categorized randomly into 3 groups of equal number (each group 15 subjects). Group A received (cavitation radiofrequency and diet), Group B received (mesotherapy and diet), Group C received (diet only) all groups were observed for 6 weeks. Body weight, height, waist hip ratio and skin fold were measured before and after intervention.

Results: There was significant improvement in the three groups in waist circumference, waist hip ratio, and suprailiac skin fold in favor of cavitation radiofrequency group, with no significant difference in body weight and BMI in the three groups after intervention.

Conclusions: Cavitation radiofrequency is more effective than mesotherapy in reduction of abdominal obesity.

**KEYWORDS: Abdominal adiposity. Cavitation radiofrequency. Mesotherapy.**

## 1. INTRODUCTION

Abdominal obesity, also known as beer belly, beer gut, pot belly or clinically as central obesity, is when excessive abdominal fat around the stomach and abdomen has built up to the extent that it is likely to have a negative impact on health. There is a strong correlation between central obesity and cardiovascular disease.(1) Abdominal obesity is not confined only to the elderly and obese subjects.(2) Abdominal obesity has been linked to Alzheimer's Disease as well as other metabolic and vascular diseases.(3)

While central obesity can be obvious just by looking at the naked body, the severity of central obesity is determined by taking waist and hip measurements. The absolute waist circumference (>102 centimetres (40 in) in men and >88 centimetres (35 in) in women) and the waist-hip ratio (>0.9 for men and >0.85 for women) are both used as measures of central obesity.(1)

High-intensity-focused ultrasound cavitation (HIFU) is a promising clinically relevant, thermal ablation technique that allows minimally invasive treatments while not necessitating the insertion of a probe into the target tissue, the hallmark of a true noninvasive procedure. Instead the source device in HIFU is placed on the surface of the body. The high-powered beam of ultrasound generated does not harm the tissues it traverses, but focuses at a predetermined focal point to enable selective destruction of targeted subcutaneous adipose tissue leaving surrounding tissues intact. This ensures trackless ablation of target tissues without the insertion of an applicator into the target area thus allowing for increased patient comfort and acceptability compared to traditional liposuction procedures. This noninvasive ablation procedure offers several advantages in that it allows the movement of the source device to target different tissue, while procedures that require probes to be inserted are only able to target tissues in its immediate vicinity. Furthermore, the wound healing response attracts fibroblasts into the area, which together with heat denaturation of collagen that has occurred during the HIFU procedure, induces the formation of new collagen and tightening of septal fibers potentially resulting in a skin tightening effect.(4)

Once adipocytes have been ablated with HIFU, macrophages are attracted to the area to engulf and transport the lipids and cellular debris. This removal results in an overall reduction in local adipose tissue volume. The HIFU is an attractive alternative to more invasive procedures for body contouring that may appeal to patients resistant to surgical options. It does not require general anesthesia and can be performed as an outpatient procedure thus substantially cutting treatment cost, recovery time, and decreasing the risk of side effects, complications, and patient discomfort.(5)

Radiofrequency (RF) technologies, which use electrical current, have been introduced as a new approach for the purpose of body contouring although for local fat disruption. Radiofrequency treatments are procedures involving the use of a radiofrequency energy device to heat up and tighten tissue to boost blood flow and break down cellulite and fat. The radiofrequency energy heats the skin without damaging it, in order to break down fatty cells and stimulate collagen production, which improves skin tone and elasticity. Radiofrequency treatments can be used to treat excess pockets of fat on the abdomen, hips and thighs, reduce cellulite and tighten saggy skin caused by weight loss or pregnancy. The treatment is very safe and has minimal downtime.(6)

Mesotherapy treatment is a non-surgical cosmetic solution aimed at diminishing problem areas in the body such as cellulite, excess weight, body contouring, and face/neck rejuvenation. It is administered via numerous injections containing various types of FDA

approved medicines, vitamins, and minerals. It is introduced into the mesoderm, the layer of fat and tissue underneath the skin. The content mixture of the injection varies in accordance with each unique case and specific area to be treated.(7)

Up to our best knowledge there is a wide gap in literature regarding the comparison between cavitation radiofrequency and mesotherapy on subjects with localized abdominal adiposity. The importance of the study to both the overweight subjects and clinicians; it will help the overweight subjects to knowing the best and the safer way that effect on their abdominal obesity. On the other hand, clinicians will be able to find out the most effective way that effect on the abdominal obese subjects.

## 2. MATERIAL AND METHODS

This study was conducted in specialized center for obesity, to investigate the effect of cavitation radiofrequency versus mesotherapy on abdominal obese subjects. The design of the study was pre-test post-test design. 45 subjects of both sexes (16M-29F) were assigned randomly into three groups of equal number (each group 15 subjects). They randomly selected from population according to the following criteria: Their ages was ranged from 25 to 45 years. They had no current or previous neurological or musculoskeletal Disorders, non-pregnant females and with normal liver functions. Their body mass index (BMI) of less than 30 and an abdominal fat thickness of at least 2.5 cm prior to treatment as measured by commercial pinch caliper. They can understand and follow verbal commands and instructions included in the test. Subjects randomly assigned into 3 groups. Group (A) consisted of 15 subjects (6 male and 9 female) abdominal obese were received cavitation radiofrequency and diet. Group (B) consisted of 15 subjects (5male and 10 female) abdominal obese were received mesotherapy and diet. Group (C) consisted of 15 subjects (5male and 10 female) abdominal obese were received diet only.

### INSTRUMENTATION:

**1- Weight and height scale:** Hanson professional scale was used to measure weight and height in order to calculate the body weight.(8)

**2- Tape measurement:** To measure the waist and the hip circumference.

**3- Skin fold calipers:** To measure the Skin fold at the waist (Suprailiac) level.

#### Procedure:

**a) Initial preparation:** All subjects agreed to participate in the study by completing an informed consent form.

#### b) Assessment procedures:

**I- weight assessment:** - All groups were their weight measured by the Hanson professional scale.

**II- Waist-to-hip ratio measurement:-** Each subject assessed by the tape measurement and tacked the waist and the hip circumference then Divide the waist measurement by the hip measurement. Abdominal obesity is typically measured by waist circumference; a measurement of 40 inches or more in men and 35 inches or more in women indicates abdominal obesity.(9)

**III- Body mass index (BMI) :-** weight (in kilograms)/ [height of power 2 (in meters)].(8)

**VI-skin fold calipers:-**subject assessed by the calipers and tacked the waist (Suprailiac) region fat. This is located just above the iliac crest, the protrusion of the hip bone, a little towards the front from the side of the waist. The fold is taken approximately horizontally

#### c) Treatment procedures:

**I- group A** was received cavitation radiofrequency sessions and diet ( one session every week for 6weeks 60 minute ).Cavitation conditions .Pressure - 0.6 kPa .Vibration frequency - from 39-41 kHz (thus achieving a more profound impact - 8-10 cm) for 40 minutes using (UltraShape Syneron System . device)(10).

Bipolar RF treatment was applied for 20 minutes immediately after the focused ultrasound treatment in all subjects. The RF frequency mode used was 0.8 MHZ which is suitable for deep layer (15-18mm) treatments. Using (Velashape III , Syneron Medical Ltd, device)(11).Both cavitation and radiofrequency done from supine lying position and subject was completely relaxed.

**II-group B** was received mesotherapy injection composed of (phosphatidylcholine (PC) and deoxycholate (DC),lidocaine, aminophylline, conjugated linolenic acid, L-carnitine,isoproterenol, yohimbine, pentoxiphylline, and collagenase) and diet ( 1 session per week for 6 weeks ). Subjects was injected by will trained physician have an experience more than 10 years in mesotherapy with one-half-inch needles with the injections placed one-half inch apart using multi injector over the abdominal area.(12,13,14)

**III- group C** was received diet only for 6 weeks. The diet prescribed for the 3 groups was a balanced hypocaloric diet that provided 1500 to 1800 kcal daily according to the requirement of each subjects. The menu varied according to the subject age and eating habits. It was low in fat (20% to 25%), high in complex carbohydrate (50% to 60%), and sufficient in protein (25% to 30%). No vitamins or other nutritional supplements were prescribed. (15)

#### Statistical analysis:

A statistical power analysis suggested that sample sizes of 15 subjects per group were required to achieve more than 80% power. Data were first analyzed using the Kolmogorov-Smirnov test to recognize a normal distribution. The differences between the beginning and post treatment measurements were analyzed using the paired Student t test. The differences between the three groups were analyzed using one-way analysis of variance (ANOVA) followed by least square difference (LSD) post hoc test. Level of significance for all tests was set at (0.05). Statistical tests were performed using SPSS version 17.

### 3. RESULTS

There was no significant difference between participants in the three groups in their Physical characteristics at the beginning of the study as shown in table (1).

**Table 1. Physical characteristics of the subjects at the beginning of the study.**

Characteristics	Group (A)	Group (B)	Group (C)	Significant (P-value)
Age(year)	34.26±4.52	34.13±5.89	35.33±4.7	0.77
Weight(kg)	79.66±2.76	79.73±3.69	79.2±4.07	0.9
Height (Cm)	167.06±3.21	167.26±5.92	167.8±4.9	0.91
BMI(kg/m <sup>2</sup> )	28.54± 0.57	28.51±0.94	28.12±0.62	0.22

Data presented as mean± standard deviation; p >0.05 (No significant).

#### Effect of U.S cavitation radiofrequency and diet (Group A):

The Body weight significantly decrease post U.S cavitation, radiofrequency and diet with a percentage of 7.36% (Pre: 79.66±2.76; post: 73.8±3.0; p < 0.0001). BMI showed also significant reduction with a percentage of 7.35% (Pre: 28.54±0.57; post: 26.44±0.81; p < 0.0001). In addition, there was a significant reduction of waist circumference with a percentage of 8.6 % (Pre: 92.93±3.55; post: 84.93±3.67; p < 0.0001). While there was no significant reduction of hip circumference with a percentage 0.12% (Pre: 106.66±3.24; post: 106.53±3.22; p >0.05). Furthermore, there was a significant reduction of waist hip ratio with a percentage of 8.04% (Pre: 0.87±0.01; post: 0.79±0.02; p < 0.0001) Finally, there was a significant reduction of Suprailiac skin folds with a percentage of 20.31% (Pre: 25.74±0.98; post : 20.51±1.39; p < 0.0001) as shown in table (2) fig (1,2,3,4).

#### Effect of mesotherapy and diet (Group B):

There was significant decrease in Body weight post mesotherapy and diet with a percentage of 6.52% (Pre: 79.73±3.69; post 74.53±3.31; p < 0.0001). Also, BMI showed significant decrease with a percentage of 6.48% (Pre: 28.51±0.94; post: 26.66±0.92; p < 0.0001). Furthermore, waist circumference showed significant reduction with a percentage of 6.41% (Pre: 93.53±3.2; post: 87.53±2.72; p < 0.0001). While there was no significant reduction of hip circumference with a percentage 0.06% (Pre: 107.93±2.89; post: 107.86±2.85; p >0.05). In addition, there was a significant reduction of waist hip ratio with a percentage of 6.39% (Pre: 0.86±0.01; post: 0.81±0.01; p < 0.0001). Finally, Suprailiac skin folds significantly reduced with a percentage of 12.38% (Pre: 25.96±1.02; post 22.63±1.43; p < 0.0001) as shown in table (2) fig (1, 2, 3, 4).

#### Effect of diet (Group C):

The Body weight significantly decrease post diet with a percentage of 4.12% (Pre: 79.2±4.07; post: 75.93±3.71; p < 0.0001). BMI showed significant reduction with a percentage of 4.08% (Pre: 28.12±0.62; post: 26.96±0.63; p < 0.0001). In addition, waist circumference reduced significant with a percentage of 2.93% (Pre: 93.06±2.6; post: 90.33±2.66; p < 0.0001). While there was no significant reduction of hip circumference with a percentage 0.06% (Pre: 107.26±2.21; post: 107.2±2.14; p >0.05). Furthermore, there was a significant reduction of waist hip ratio with a percentage of 2.79% (Pre: 0.86±0.01; post: 0.84±0.01; p < 0.0001). Finally, there was a significant reduction of Suprailiac skin folds with a percentage of 6.6% (Pre: 26.2±1.2; post: 24.46±1.42; p < 0.0001) as shown in table (2) fig (1, 2, 3, 4).

**Table 2.** Body weight, BMI, Waist circumference, hip circumference, Waist hip ratio, Suprailiac skin folds pre and post treatment in each group

Variables		Group (A) (mean±SD)	Significant (P-value)	Group (B) (mean±SD)	Significant (P-value)	Group (C) (mean±SD)	Significant (P-value)
Body Weight	Pre	79.66±2.76	0.0001*	79.73±3.69	0.0001*	79.2±4.07	0.0001*
	Post	73.8±3.0		74.53±3.31		75.93±3.71	
BMI	Pre	28.54±0.57	0.0001*	28.51±0.94	0.0001*	28.12±0.62	0.0001*
	Post	26.44±0.81		26.66±0.92		26.96±0.63	
Waist circumference	Pre	92.93±3.55	0.0001*	93.53±3.2	0.0001*	93.06±2.6	0.0001*
	Post	84.93±3.67		87.53±2.72		90.33±2.66	
HIP circumference	Pre	106.66±3.24	0.16	107.93±2.89	0.33	107.26±2.21	0.33
	Post	106.53±3.22		107.86±2.85		107.2±2.14	
Waist hip ratio	Pre	0.87±0.01	0.0001*	0.86±0.01	0.0001*	0.86±0.01	0.0001*
	Post	0.79±0.02		0.81±0.01		0.84±0.01	
Suprailiac Skin folds	Pre	25.74±0.98	0.0001*	25.96±1.02	0.0001*	26.2±1.2	0.0001*
	Post	20.51±1.39		22.63±1.43		24.46±1.42	

Data presented as mean± standard deviation; \*p <0.05(significant).

**Comparison among the three groups pretreatment:** At baseline (pretreatment), all parameters were not different among the participants in the examined groups as revealed by ANOVA test table (3)

**Table 3.** comparison between the three groups in body weight, BMI, Waist circumference, Hip circumference, Waist Hip Ratio, Suprailiac Skin folds pretreatment.

Variables	Group (A)	Group (B)	Group (C)	P-value
Body Weight	79.66±2.76	79.73±3.69	79.2±4.07	0.9
BMI	28.54±0.57	28.51±0.94	28.12±0.62	0.22
Waist circumference	92.93±3.55	93.53±3.2	93.06±2.6	0.86
Hip circumference	106.66±3.24	107.93±2.89	107.26±2.21	0.47
Waist Hip Ratio	0.87±0.01	0.86±0.01	0.86±0.01	0.61
Suprailiac Skin folds	25.74±0.98	25.96±1.02	26.2±1.2	0.52

Data presented as mean± standard deviation; p >0.05 (No significant).

**Comparison among the three groups post treatment:**

Post treatment, there were no significant difference among the three groups in body weight (P=0.22), BMI (P=0.2), and waist circumference (P=0.42). While there were significant difference among the three groups in waist circumference (P=0.0001), waist hip ratio (P=0.0001), and Suprailiac Skin folds (P=0.0001) as revealed by ANOVA test. For waist circumference, group (A) showed better reduction than group (B) and group (C) as (P=0.02) and (P=0.0001) respectively as revealed by post hoc test. While group (B) showed better reduction in waist circumference than group (C) (P=0.01). Also, for waist hip ratio group (A) showed better reduction than group (B) and group (C) as (P=0.03) and (P=0.0001) respectively. While group (B) showed better reduction in waist hip ratio than group (C) (P=0.0001).

Concerning Suprailiac Skin folds group (A) showed better reduction than group (B) and group (C) as (P=0.0001) and (P=0.0001) respectively. While group (B) showed better reduction in waist hip ratio than group (C) (P=0.001).

**Table 4.** comparison between the three groups in body weight, BMI, Waist circumference, Hip circumference, Waist Hip Ratio, Suprailiac Skin folds post treatment.

Variables	Group (A)	Group (B)	Group (C)	P-value
Body Weight	73.8±3.0	74.53±3.31	75.93±3.71	0.22
BMI	26.44±0.81	26.66±0.92	26.96±0.63	0.2
Waist circumference	84.93±3.67	87.53±2.72	90.33±2.66	0.0001*
Hip circumference	106.53±3.22	107.86±2.85	107.2±2.14	0.42
Waist Hip Ratio	0.79±0.02	0.81±0.01	0.84±0.01	0.0001*
Suprailiac Skin folds	20.51±1.39	22.63±1.43	24.46±1.42	0.0001*

Data presented as mean± standard deviation; \*p <0.05(significant).

#### 4. DISCUSSION

Our findings demonstrate that there were no significant difference among the three groups in body weight, BMI, and hip circumference post treatment. While for waist circumference, waist hip ratio, and Skin folds at umbilical level U.S cavitation radiofrequency and mesotherapy groups showed better improvement than control (diet) group at the end of study. Furthermore the participants in U.S cavitation radiofrequency group showed better reduction in waist circumference, waist hip ratio, and Skin folds at suprailiac level at the end of treatment than mesotherapy group.

Regarding the results of ultrasound cavitation radiofrequency group our findings had an agreement with Coleman et al. Who reported a favorable effect of Cavitation in reduction of localized fat Moreover, these results persist because the accumulation of fat in the treated field is terminated. Cavitation is not only used for reduction of localized fat, but also to effectively fight cellulite: fibrous tissue (orange peel) is destroyed, and not just "squeezed out" as in other procedures. (16)

In addition, Moreno-Moraga et al. investigated the effect of U.S cavitation on 30 healthy patients who underwent three treatments, at 1-month intervals by U.S cavitation, and were followed for 1 month after the last treatment. All patients showed significant reduction in subcutaneous fat thickness within the treated area. The mean reduction in fat thickness after three treatments was 2.28±/0.80 cm. Circumference was reduced by a mean of 3.95±/1.99 cm. (17)

Also it come in agreement with Nazanin S. et al. Who reported that High intensity focused ultrasound is a new promising method for fat reduction. HIFU works by ablating subcutaneous adipose tissue and causing molecular vibrations that increase the temperature of local tissue and induce rapid cell necrosis. Several studies reveal the safety and efficacy of HIFU for fat reduction in the abdomen and the flanks. These studies indicate consistent reduction in abdominal circumference >2 cm after a single treatment. The adverse events are limited to transient tenderness, bruising, and edema. As a result, the likelihood of using HIFU for fat reduction will increase over time.(10)

In the present study our choice to use Ultrashpe cavitation device based on its mechanical acoustic effects of UltraShape because selective fat cell disruption without injury to skin, vessels, nerves, or connective tissue. After disruption of the fat cells, the contents, primarily triglycerides, are dispersed into interstitial space and then transported through the vascular lymphatic system to the liver.



These triglycerides are theoretically absorbed slowly and then metabolized by endogenous lipases to glycerol and free fatty acids. The fatty acids are transported to the liver where they are processed like any other fatty acids. UN metabolized triglycerides are bound to carrier proteins, or lipoprotein complexes, to become part of the total lipoprotein pool. To date, there have been no abnormal changes in serum lipids detected in clinical studies of Ultrashape (6,17)

The present study come in agreement with Brightman L et al. Who reported that the combination of infrared light (IR), bipolar radiofrequency (RF), vacuum and mechanical massage has demonstrated efficacy in improving arm circumference, at the 5th treatment it was statistically significant with a mean loss of 0.625 cm. At 1- and 3-month follow-ups, mean loss was 0.71 and 0.597 cm respectively. Reduction of abdominal circumference at 3rd treatment was statistically significant with a 1.25 cm mean loss. At 1- and 3-month follow-ups, average loss was 1.43 and 1.82 cm respectively. They concluded that sustainable reduction in circumference and improvement in appearance of arms and abdomen following treatment.(18)

In the present study selection of Radiofrequency (RF) came in agreement with Romero et al who stated that using combines of bipolar radio frequency (RF) and intense infrared light (IR) together with mechanical massage and suction has recently been reported as being efficient for reduction of adipose tissue Ten patients were enrolled for 12 sessions of 30 minutes each performed over one buttock, the other buttock serving as an untreated control. Sessions were conducted twice a week for a period of 12 weeks. Clinical photography and profilometry were carried out to assess textural changes before (baseline) and 2 months after the final treatment. Histopathology was performed at baseline, 2 hours after the first session, and just before the 12th session and 2 months thereafter. All patients noted improvement in the treated buttock before the final session, which was maintained at the 2-month assessment. Improved skin appearance and reduction of adipose tissue was noticed after the first session and was maintained throughout the study. All patients were satisfied with the results and requested further treatment in order to balance the results in both buttocks. They concluded that treatment sessions with the combined RF, IR light and mechanical massage and suction system were complication free, produced improvements in the treated area appearance and skin condition. (19)

Furthermore Maurice A et al. stated that the combination of bipolar RF, IR light, and mechanical tissue manipulation with pulsed vacuum and massage rollers appears to be a safe and effective therapeutic modality for the reduction of adipose tissue volume and skin tightening. It is suggested that using higher bipolar RF energy may also result in a more intense heating of the targeted tissues, resulting in both faster treatment times as well as improved clinical outcomes.(20)

In the present study applying the bipolar RF energy to the hypodermis increases fat cells' metabolism and accelerated triglyceride egress from the cell. Increased tissue temperature increases vascular perfusion, which further enhances lipid turnover owing to increased oxygen content. Increased lipid turnover results in fat cell shrinkage and reduced fat tissue volume, a circumferential reduction, and an esthetic reduction in the convex distension.(21)

Concerning the results of mesotherapy group the results of our study come in agreement with Rotunda et al. Who stated that Fat Reduction/Weight Loss with mesotherapy usually need from 2 to 4 treatments (injections) required at intervals of 2 to 4 weeks. Depending on the problem area, the number of procedures could increase. Because mesotherapy treatments for weight loss do not produce drastic changes, it is generally recommended for patients who require a little fat reduction in specific areas, as with body contouring.(13)

Injection of Phosphatidylcholine and Deoxycholate did not produce anticipated aesthetic results. This narrative does not imply that under different circumstances, PC-DC will not work. In fact, Kythera Biopharmaceuticals, Inc (Calabasas, California) has produced a first-in-class injectable drug that has undergone 4 successful clinical studies: 2 randomized, double-blind, placebo-controlled, Phase 2 studies using the injectable drug in the reduction of submental fat and 2 Phase 1 pharmacokinetic and histology studies.(22) The company reports that the injectable is safe and shows efficacy in reducing localized fat deposits.(23)

The present study selecting Phosphatidylcholine and Deoxycholate (PC-DC) Mesotherapy injections effectively reduce abdominal fat volume and thickness by inducing adipocyte necrosis. These treatments do not appear to increase circulating markers of inflammation or affect glucose and lipid metabolism. The ideal candidate for injection lipolysis desires treatment of small areas of excess fat or localized deposits, such as the correction of postlipoplasty contour irregularities or asymmetry. Injection lipolysis is a tool for those patients who wish to have less invasive procedures and/or are afraid of anesthesia. However, patients need to be aware that achieving desired results may take several months. (24)

## 5. CONCLUSION

From the obtained results it may be concluded that U.S cavitation with radiofrequency has a favorable effect than mesotherapy in reduction of waist circumference, waist hip ratio, and Skin folds at Suprailiac level.

### Competing interests:

We did not received any financial support from any institution or company it is our project and we insured all expenses. No competing interests

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### Author contribution:

We are three authors for this work and we did all requirement to accomplish this work, there is no other researchers participate in this work.

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## 7. APPENDAGES

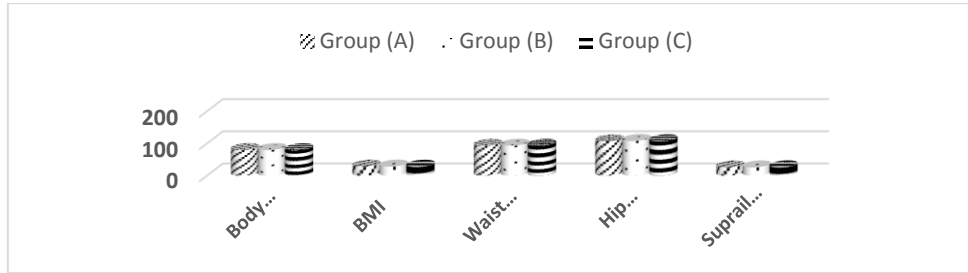


Fig (1): body weight, BMI, Waist circumference, Hip circumference, Suprailiac Skin folds pretreatment.

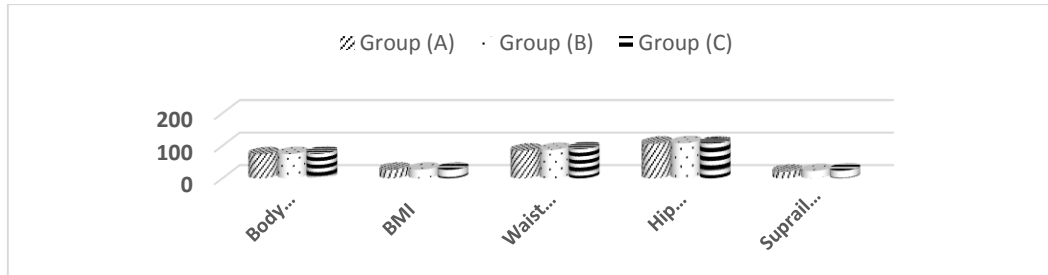


Fig (2): body weight, BMI, Waist circumference, Hip circumference, Suprailiac Skin folds post treatment.

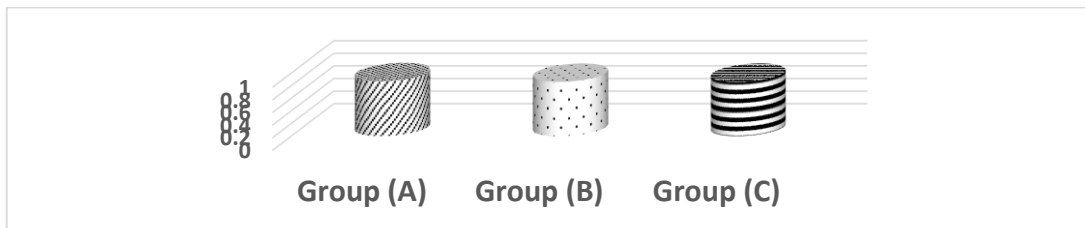


Fig (3): Waist hip ratio pre treatment for the three groups.

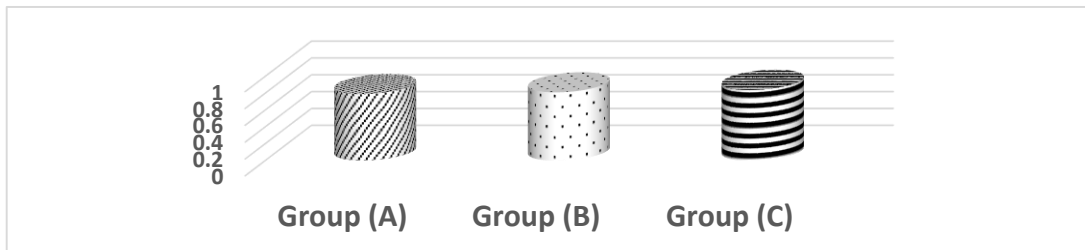


Fig (4): Waist hip ratio post treatment for the three groups.

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