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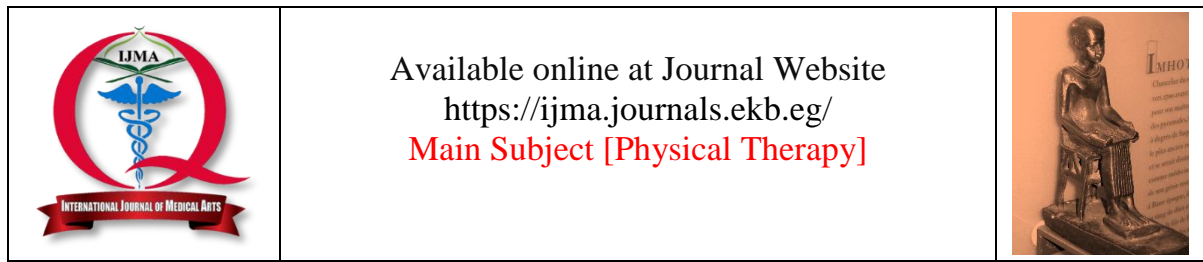


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## Original Article

### Effect of Electro-Acupuncture versus Ultrasound Cavitation on Leptin Hormone in Females with Insulin Resistance

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## ABSTRACT

### Article information

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**Background:** 42% of women in their conceptive age [*i.e.* the age that ranges from 30-45 years old] complain of a body mass index [BMI] > 25 Kg/m<sup>2</sup>. Also, besides highly reported BMI/weight, women's conceptive age is usually associated with the development of metabolic disorders including insulin resistance [IR], hyperleptinemia, diabetes mellitus [DM], and/or cardiovascular diseases [CVD]. Recently, weight loss interventions including ultrasound cavitation [UC] and electro-acupuncture [EA] have been very appreciated by obese women during their trials to lose general/local body fat.

**Aim of the work:** Comparing between IR-associated leptin hormone's response to EA versus UC was the objective of this in-women comparative study.

**Patients and Methods:** Fifty IR women whose age and BMI ranged from 30-45 years old and 30-45 Kg/m<sup>2</sup>, respectively were included in this study. Random/equal assignment into two weight loss groups [EA group A or 40-KHz UC group B]. In this comparative study, for 8 weeks, EA was applied two sessions per week while UC was applied one time only. A similar dietary restriction program was followed by both IR women groups. Besides the leptin hormone, measurements of anthropometry [weight, BMI, and waist circumference] were executed for both groups.

**Results:** After ending the weight loss program, the EA group's weight, BMI, waist circumference [WC], and leptin significantly improved with a percentage of 2.56%, 2.8%, 4.17%, and 24.5%, respectively. Also, the UC group's weight, BMI, WC, and leptin significantly improved with a percentage of 2.4%, 2.59%, 2.4%, and 14%. Leptin hormone showed a significantly improved difference [P=0.019] toward the EA group after the end-result post-treatment comparison between the EA group and UC group.

**Conclusion:** EA and UC are effective weight loss modalities but EA is more effective in controlling obesity-induced hyperleptinemia in IR women.

**Keywords:** Leptin; Insulin resistance; Electroacupuncture; Cavitation.



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## INTRODUCTION

Insulin is a type of hormone that is secreted/synthesized by pancreatic islet-of-Langerhans  $\beta$  cells. It regulates the body's blood glucose absorption into fatty tissues, skeletal muscle cells, and hepatic cells, which in turn affects the metabolic process of the body's lipids, carbohydrates, and proteins <sup>[1]</sup>. An impaired body's physiologic response to insulin stimulation of target tissues [hepatic, muscular, and adipose tissues] is known as insulin resistance [IR] <sup>[2]</sup>. IR describes the decrease in insulin signaling due to insensitivity and/or dysfunction of the body's insulin receptors <sup>[1]</sup>.

Because IR hinders the body's ability to process, metabolize, and utilize its glucose stores, IR causes a compensatory rise in pancreatic islet of Langerhans  $\beta$ -cells insulin synthesis, hence hyperinsulinemia develops <sup>[2]</sup>. IR may play a role in developing negative metabolic complications. Besides type 2 diabetes mellitus [T2DM], obesity is one of the main frequent negative IR-associated metabolic complications <sup>[1]</sup>.

Recently, in many nations, obesity/overweight has grown in importance as a global health concern/issue. Over 20% of adults suffer from obesity/overweight. Due to its association with a higher risk of acquiring several pathologies/complications, including peripheral arterial disease, cancer/malignancies, T2DM, and cardiovascular/neurodegenerative illnesses, studying the effect of obesity on the body's hormones [including leptin hormone] is the focus of researchers' attention <sup>[3]</sup>.

Through interactions with several hypothalamic receptors, including neuropeptide Y [a hunger promoter peptide], leptin hormone [produced with normal levels/concentration] is a vital hormone that reduces appetite and induces satiety <sup>[4]</sup>. It is documented that obesity-associated IR is associated with excessive production/synthesis of leptin hormone [hyperleptinemia]. Hyperleptinemia is associated with ineffective action of leptin in suppressing appetite, inhibited perception of satiety, increased fat accumulation, and excessive weight gain. Correction of IR and obesity-associated hyperleptinemia via weight loss is important for the hormone leptin to play its effective role in controlling the effects of IR-associated excessive appetite on increasing rates of insulin resistance and obesity <sup>[5]</sup>.

One of the popular weight loss interventions is the electro-acupuncture [EA] procedure. This procedure applies an electrical current to the ends of fine needles [acupuncture needles] inserted

into the body's specific acupoints to treat various disorders including obesity and IR <sup>[6]</sup>.

For losing weight, eliminating the local body's fat, and/or sculpting a specific portion of the body, ultrasound cavitation [UC, a non-invasive liposuction procedure that uses highly-focused ultrasound energy at the end of a probe/plate placed on the skin of fatty area] is another relatively new popular modality used by health professionals in their treatment programs designed for obese women/men <sup>[7]</sup>.

The mechanism of UC-induced lipolysis devices in eliminating unwanted excessive local body fat without negative effects on a patient's skin can be easily explained. These devices create waves and a large number of micron bubbles at fixed/stationary temperatures. These waves/bubbles produce repeated patterns of expansions/contractions within the fat cell. These patterns weaken fat cells' intracellular pressure and walls. This cellular wall weakness forces the fat cells to be ruptured and drained by the lymphatic system, hence local fat loss occurs <sup>[8]</sup>.

In Traditional Chinese Medicine [TCM], acupoint therapy, alone and/or combined with western medicine, is considered a main treatment for DM and/or its complications, with lower-reported rates of side effects than with the sole use of western medicine. Acupoint therapy is a treatment conducted through the meridians and acupoints utilizing one of the following: acupuncture, injection of acupoint, moxibustion, acupressure and external application <sup>[9]</sup>.

Welcomed by the public at large, one of the fastest burgeoning methods for weight loss is the use of medicinal plant extracts. Despite the long history of their traditional use for purposes of chronic disease prevention and cure, the effectiveness of these products, which consist of dietary phytochemical constituents, remains to be ascertained <sup>[10]</sup>.

Comparing obesity-and IR-associated leptin hormone's response to EA versus UC was the objective of this in-women comparative study.

## PATIENTS AND METHODS

**Design:** This weight loss study was a comparative trial.

**Ethics:** To conduct this weight-loss comparative trial in IR women, local ethical approval [P.T.REC/012/003653] from Cairo University. Participation and withdrawal rights/rules were explained to all IR women who signed the trial's consent form. The rules/criteria of the Declaration of

Helsinki were followed during IR women's enrollment, EA or UC applications, and outcomes evaluation.

**Settings:** Dekernes Central Hospital.

**Criteria of IR women:** Fifty IR women whose age and BMI ranged from 30-45 years old and 30-45 Kg/m<sup>2</sup>, respectively were enrolled from Dekernes Central Hospital from. This weight-loss comparative study was conducted from May to December 2023. Women reporting diagnosed renal/hepatic disorders, DM, lactation/pregnancy, neuro-degenerative/cardiovascular dysfunctions, cancer or malignant masses, immunological/allergic dysfunctions, diagnosed hypertension and coagulation disorders, and chest/kidney dysfunctions were excluded/discarded from enrollment.

**Sample size analysis:** The included 50 IR women were recruited according to G\*Power sample-size analysis. At a power of 95%, G\*Power analysis recommended the recruitment of 50 IR women.

**Randomization of IR women:** By a physio-therapist working in Dekernes Central Hospital and not involved in this weight loss study, the randomization was performed using the envelope technique. random/equal assignment of IR women into two weight loss groups [30-minute EA group or 30-minute 40-KHz UC group]. In this comparative study, for 8 successive weeks, EA was applied two sessions per week while UC was applied one time only]. A similar dietary restriction program [containing 1600-2000 kilocalories per day] was followed by both-IR women groups.

### Interventions

To be cleaned to start the EA session, the IR women's legs and abdomen were exposed. The IR women were instructed to lie in a comfortable supine position as the needles were put into the selected acupoints [CV12 and CV6, bilateral ST25, SP15, KID14, ST36, ST44, and ST22] after they have been sterilized using preparation pads containing 75% alcohol [11].

Regarding the UC sessions, the selected body part for the application of UC is the abdomen which was divided into right and left sides, each side received 15 minutes of UC. The used UC device in this trial was the Mabel6-DUO Ultra-Cavitation Technology/System manufactured by DAEYANG-MEDICAL CO., Korea.

**Evaluations:** Before the application of EA or UC interventions, both-group IR women's weight [assessed via weight scale, made in China], HOMA-IR, fasting insulin [measured by ELISA kit], BMI, waist circumference [WC] [WC was assessed at the end of expiratory phase of women's respiration at the midway between their lowest rib and their iliac crest], and fasting levels of leptin hormone [measured by ELISA kit] were assessed. After the 8-week application of EA or UC interventions, both IR groups' weight, leptin, BMI, and WC were only tracked.

**Blinding:** Before or after EA or UC interventions, all assessments performed on all IR women were done by assessors who were not informed of details/tips of EA or UC interventions.

**Statistical analysis:** A copy of the popular statistical software, SPSS version 22, was used for analytic procedures at a P-value significance < 0.05. Examining the IR women's demographic characteristics/criteria in the EA group and UC group, the popular Independent Sample T-test was chosen. Additionally, to pick up significant differences within EA and UC groups, pairwise comparisons were chosen. Also, to pick up significant differences among EA and UC groups, MANOVA was chosen.

## RESULTS

No significant differences in the pre-treatment IR women's age, IR women's weight, IR women's height, IR women's HOMA-IR, IR women's BMI [Table 1], IR women's WC [Table 2], and IR women's leptin [Table 3] were detected between EA and UC groups.

After ending the weight loss programs, the EA group's weight, BMI, waist circumference [WC] [Table 2], and leptin [Table 3] significantly improved with a percentage of 2.56%, 2.8%, 4.17%, and 24.5%, respectively. Also, the UC group's weight, BMI, WC [Table 2], and leptin [Table 3] significantly improved with a percentage of 2.4%, 2.59%, 2.4%, and 14%. Despite the percentage of improvements in variables of anthropometry [WC, BMI, and weight] being higher in the EA group than the UC group, the end-result post-treatment comparison between the EA group and the UC group did not show a significant difference. Only leptin hormone showed a significantly improved difference [P=0.019] toward the EA group after the end-result post-treatment comparison between the EA group and the UC group.

**Table [1]:** Comparison of IR women's characteristics between group

	Electro-acupuncture group	Ultrasound Cavitation Group	t-value	P-value
	$\bar{X} \pm SD$ [n=25]	$\bar{X} \pm SD$ [n=25]		
IR women's age [years]	37.7±5.6	35.2±4.8	1.669	0.102
IR women's HOMA-IR index	5.27±2.2	5.29±1.8	0.032	0.974
IR women's height [cm]	162.8±5.7	162.6±4.7	0.136	0.892
IR women's body mass/weight [kg]	103.1±12.8	102.5±11.6	0.160	0.874
IR women's BMI [Kg/m <sup>2</sup> ]	38.8±4.6	38.6±3.8	0.177	0.860

BMI: Women's body mass index;  $\bar{X}$ : Women's mean, Women's SD: Standard deviation; IR: Insulin resistance.

**Table [2]:** Weight, BMI, and WC comparison within and between groups

Variables		Electro-acupuncture Group $\bar{X} \pm SD$	Ultrasound Cavitation Group $\bar{X} \pm SD$	Comparison between Groups	
				F-value	P-value
IR women's Weight [kg]	Pre-Treatment	103.1±12.8	102.5±11.6	0.026	0.874
	Post-Treatment	100.4±12.2	100±10.8	0.015	0.904
	Change %	2.56%	2.4%		
	Comparison within Group	<b>P&lt;0.05*</b>	<b>P&lt;0.05*</b>		
Women's body mass index [kg/m <sup>2</sup> ]	Pre-Treatment	38.8±4.6	38.6±3.8	0.031	0.860
	Post-Treatment	37.7±4.2	37.6±3.5	0.002	0.965
	Change %	2.8%	2.59%		
	Comparison within Group	<b>P&lt;0.05*</b>	<b>P&lt;0.05*</b>		
IR women's WC [cm]	Pre-Treatment	117.4±9.6	114.9±10.8	0.750	0.391
	Post-Treatment	112.5±8.3	112.2±10.2	0.015	0.904
	Change %	4.17%	2.4%		
	Comparison within Group	<b>P&lt;0.05*</b>	<b>P&lt;0.05*</b>		

WC: Women's waist circumference: Mean, SD: Women's standard deviation, MD: Women's mean difference, p-value: Women's Probability value, \*: Significance, Change%: Women's percentage of change

**Table [3]:** IR women's leptin hormone level [ng/mL] comparison within and between groups

		Electro-acupuncture Group $\bar{X} \pm SD$	Ultrasound Group $\bar{X} \pm SD$	Comparison between Groups	
				F-value	P-value
Leptin level [ng/mL]	Pre-Treatment	41.4±7.8	41.9±7.5	0.032	0.859
	Post-Treatment	31.3±6.1	35.9±7.3	5.926	<b>0.019*</b>
	Change %	24.5%	14%		
	Comparison within Group	<b>P&lt;0.05*</b>	<b>P&lt;0.05*</b>		

$\bar{X}$ : Women's mean, SD: Women's standard deviation, MD: Women's mean difference, p-value: Women's Probability value, IR: Insulin resistance \*: significance, change%: Women's percentage of change

## DISCUSSION

Comparing IR-associated leptin hormone's response to EA versus UC in obese women with IR was the objective of this study. Besides their efficacy in reducing hyperleptinemia, this comparative trial revealed that both EA and UC are effective weight loss modalities/interventions. No significant differences between the two weight loss modalities in improving IR women's weight, BMI, and WC but EA is more effective in controlling obesity-induced hyperleptinemia in IR women.

The results of IR women's results agreed with **Arabpour-Dahoue et al.** [12] who found a significant decrease in obese patients' body weight/mass, WC, and leptin hormone after

applying an intervention constituted from EA and dietary restriction program. Also, the systematic review of **Lee et al.** [13] reported a significant role of EA in reducing WC and body mass/weight in patients with abdominal obesity. Also, **Notonegoro et al.** [14] demonstrated that the body weight/mass, WC, and BMI could be significantly improved after utilizing the therapeutic effects of EA in perimenopausal women with abdominal obesity. According to research by **Lima et al.** [15], EA helped normal-BMI women who had excess abdominal subcutaneous fat to reduce their WC, supra-iliac/abdominal skin folds, and percentage of body fats.

Regarding UC, **Naeimi et al.** [16] reported that overweight women who followed a dietary restriction

plan in addition to UC and radiofrequency therapies for five weeks reported a significant decrease in their leptin hormone levels. Also, **Abdel-Aal et al.** [17] reported that adding UC and radiofrequency to 3-month dietary restriction significantly decreased central obese women's BMI, body weight/mass, WC, and leptin hormone.

**Limitations:** Tracking IR women's results [leptin, WC, and BMI] was not executed in this comparative study, so future weight loss studies in IR women must investigate this issue.

**Conclusion:** Besides their efficacy in reducing hyperleptinemia, this comparative trial revealed that both EA and UC are effective weight loss modalities/interventions. No significant differences between the two weight loss modalities in improving IR women's weight, BMI, and WC but EA is more effective in controlling obesity-induced hyperleptinemia in IR women.

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**Conflict of interest:** Nil

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