The Efficacy of Electrolipolysis on Visceral Adiposity in Perimenpausal Women

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ABSTRACT

Background: *The evidence of the adverse effects of obesity on women's health is overwhelming and indisputable. Obesity has been linked to development of diabetes mellitus, cardiovascular diseases, dementia, and cancers. Specifically, in the accumulation of abdominal visceral adipose tissue were related to difference in the metabolic profile and indicator of cardiovascular disease (CVD) risk in postmenopausal women. The purpose of this study was to determine the efficiency of electrolipolysis in reducing visceral adiposity of perimenopausal obese women.* ***Methods:*** *Thirty perimenopausal obese women , their age ranged between 37 and 49 years, their BMI between 31.5 and 40.04Kg/ m2 , WHR between 0.9 and .95% and waist circumference between 89 and 108 cm, were selected from the out patient clinic of gynecological department faculty of medicine, Cairo University. They were assigned into two equal groups A and B. Each of them consisted of 15 participants. Group (A) received electrolipolysis on the abdomen region and follow a low-calorie diet. While, group (B) followed a low-calorie diet alone. The study lasted for three consecutive months. Evaluation was done for both groups before and after treatment, to evaluate the body weight, waist circumference, waist hip ratio, total body composition and plasma liopoprotein profile.* ***Results:*** *No significant differences were observed when comparing the pre treatment results of both groups. However significant improvement was noticed in all measuring variables for both groups, when comparing their pre and post treatment mean values. After treatment, significant differences were observed when the results of both groups were compared in favor of group (A).* ***Conclusions:*** *The results of this study testified that the combination of electrolipolysisis and low-calorie diet characterized by a higher efficiency than a low-calorie diet alone in lowering anthropometric, total body composition and plasma liopoprotein variables. Also, electrolipolysisis is an additional useful physical therapy method in reducing of visceral adiposity in perimenopausal obese women.*

Keywords: *obesity, electrolipolysis, low-calorie diet, perimenopause, visceral adiposity, total body composition.*

INTRODUCTION

Literally, the term perimenopause means "around the menopause"[9]. Generally, however, clinicians use the term to refer to the several years or more that precede the final cessation of menstruation. The North American Menopause Society defines the perimenopause as the entire menopausal transition plus 1 year after the final menstrual period[22]. The perimenopause, a woman begins to experience the changes associated with impending menopause. Although each woman is different, the perimenopause typically begins in the mid- to late40s and menopause occurs at an average age of 51[25].

Obesity is common complaint among perimenopausal women, with aging women metabolisms slow so that, reducing in her caloric requirements and if her eating and

exercises habits do not change a women may gain weight Moreover, weight gain during this period is associated with fat deposition in the abdomen[15] . Abdominal adiposity is an excess body fat distributed around the waist more than 35 inches which increases the likelihood of developing insulin resistance and subsequent diabetes and heart diseases[19]. Numerous factors underline the weight gain that may occur during this period, including genetic factors neuropeptides, adrenergic nerves system activity and hormones[29]. Cardiovascular disease, the leading cause of death in women also it is an important health concern for the perimenopausal women[30].

Estrogen has a number of cardioprotective benefits including favorable effects on blood lipids levels[29]. Estrogen deficiency adversely affect circulating lipid levels, leading to increase in low-density lipoprotein cholesterol, total serum cholesterol and triglyceride levels and a decline in high density lipoprotein cholesterol[20]. As women grow older, their rates of myocardial infraction and stroke approach exceed those of men[21].

A healthful diet, low in fat and high in grains, fruits and vegetables can benefit perimenopausal women by reducing their risk of atherosclerotic disease, hypertension, osteoporosis, diabetes mellitus, cancer and obesity[13]. Regular exercise, along with moderate caloric control, will help women maintain a healthy weight and avoid the weight gain often associated with the perimenopause[20].

Ryan et al. (2000)[27] suggested that changes in energy expenditure and dietary intake patterns may play a role in weight gain during menopause. In a longitudinal study of perimenopausal women, they reported that women who experienced menopause had greater decreases in resting metabolic rate and leisure-time physical activity than did women of the same age who remained premenopausal. Both groups of women slightly increased their energy intake; thus, the women who experienced menopause had a significantly greater positive energy balance than did the premenopausal women.

Electrical muscle stimulation is a well-accepted treatment modality in the fields of medicine and physiotherapy. Literature highlights their effect on strength increase and the prevention of muscle wastage[1,6].

A strong association between the use of electrical stimulation and changes in the body shape[17]. As well as, it was found that transcutaneous electrical abdominal muscle stimulation for two months can significantly reduced body weight and visceral obesity in women[3].

Electrolipolysis uses a weak electrical current to effectively correct unaesthetic features related to localized or diffuse adiposity as well as lipodystrophy[5]. The low voltage current, low intensity impulses through electrodes implanted directly in adipose tissue is used as a signal to stimulate the sleeping adipocytes to eliminate their contents through three mechanisms firstly. The effect of electroliopolysis was mentioned by Kantor et al. (1994)[17] who reported that electrical stimulation stimulates the adrenergic interstitial nerve endings that liberates more catecholamine hormone which enhance the adenilate cyclase to convert adenosine triphosphate to cyclic adenosine monophosphate thus activated lipases.

Secondary electrolysis when a low frequency electrical current passing through the electrode creates magnetic field in the area which cause the sodium, chlorine and potassium ions to be moved through the cell membrane, the variations in the concentration of ions make it possible for the cells to break

down and eliminate the metabolites and excess fluid through the normal excretion channels[2].

Finally the electrical current gently stimulation the muscular fibrils and the collagen fiber which constitutes the walls of the small blood vessels and stimulates the adrenergic interstitial nerve ending which will cause vasodilatation and activation of lipases by boosting the cholaminergic effect[18].

Porcari et al. (1997)[23] reported that when a muscle contract as a result of electrical stimulation, the chemical changes taking place within the muscle are similar to those associated with voluntary contractions in normal exercising. The chemical reactions which results form muscle contractions utilities glycogen fat and other nutrients stored around the muscles.

MATERIALS AND METHODS

Subjects

Thirty perimenopausal abdominally obese women the mean age was (44.14 ± 5.14 years), Height (166.54 ± 5.95 Centimeters), Weight (98.29 ± 9.16 Kilograms), Body mars index (36.67 ± 3.03 Kilograms/meter), Waist circumference (96.91 ± 4.95 centimeters) and waist hip ratio (0.93 ± 0.010 percentage) abdominally adiposity defined by waist / hip ratio more than 0.80 %, were selected from the out patient clinic of gynecological department faculty of medicine, Cairo University. All women signed informed consent after reading it and hearing verbal explanations of the relevant doubts.

All women free from any medical disorders as diabetes mellitus, thyroid dysfunction or concomitant cardiovascular respiratory, renal and liver dysfunctions or on medication known to effect carbohydrate or lipid metabolism were excluded from the present study. Perimenopausal status was as certain by self report on the basis of regularity of the menstrual cycle at physical examination.

All women were randomly divided into two groups equal in numbers. Group (A) received electrolipolysis on the abdomen region and low calorie diet and Group (B) received low calorie diet alone.

Materials

Assessment tools:

1- Weight height scale for measuring the weight and height.
2- A one centimeter wide measuring tape to measure waist and hip circumference.
3- Bio Dynamics (model 310) whole body bio-impedance analyzer to measure percentage body fat, lean weight, fat weight and basal metabolic rate.

Treatment tools:

Body program slimy (model numberer IGC 601-1) with four channels used for the application of electrolipolis in group (A).

Methods

a- Evaluative procedures:

- Initially a careful history was taken from each perimenopausal women then the following evaluation and recording of the parameter for each participant of the two studying groups were made at the beginning and at the end of study period (three months).
- Diet therapy protocol: The diet principle in both groups assured that energy intake was 500K calorie below daily requirements on average three meals at the same time of the day. The composition of the dietary regimen was: carbohydrates (55%), Proteins (30%), Fat (15%), Fiber 20g, Sodium 1.1g, Potassium 3g and 2 Litters of fluids were included daily. Each woman's basal metabolic rate (BMR) was measured to determine her energy requirement during

the study period by the bio-impedance analyzer. This regimen was very similar to the Mediterranean style step (I) diet, which is under active evaluation by the American Heart Association as possible tool to lower cardiovascular risks[26]. All women were encouraged to have physical activity at least one hour walk three times a week.

- Anthropometric measurement: Height and body weight were measured with women wearing light clothes and bare feet also , body mass index in which the weight in kilograms divided by the square of the height in meters and waist to hip circumference they were evaluated over single layer of clothing with women standing in an a erect position with feet together waist circumference it was obtained at level of umbilicus with normal respiratory pattern while, Hip circumference it was obtained at the level of greater than the waist to hip ratio was calculated.
- Bioelectrical impedance measurements: The measurements were made about two hours after eating and with the thirty minutes after voiding. Each woman wore clothes but no shoes or socks and lied on supine lying position. After cleaning all skin contact area with alcohol aluminum foil spot electrodes were placed on the dorsal surfaces of the hands and feet at the distal metacarpals and metatarsals respectively and also between the distal prominences of the radius and ulna and between the medial and lateral malleoli at the ankle and clips attached these spot electrodes to the analyzer, the height, weight, age and sex were feed into then analyzer. After calibrators of the machine a painless localized electric signal was started to ran through the body tissue and impedance to current flow was determined the impedance to current flow was converted to represent the percent of body fat, fat weight, lean weight and basal metabolic rate.
- Plasma lipoprotein- lipids profile: A venous blood samples were collected from each woman after twelfth hours over night fast for the measurement of plasma lipid and lipoprotein level. The samples were collected in plain tubes and were transported to the laboratory. Serum was removed and stored at 50ºC for measurement of triglyceride, total cholesterol low density lipoprotein and high density lipoprotein.

b- Treatment procedures:

- Electrolipolysis treatment: only in group (A) before starting treatment sessions each woman was asked to evacuate her bladder to make sure that she was comfortable and relaxed. Then the women lied in the supine lying positions. Electrical stimulation was delivered via eight surface electrodes (Unipatch Encore Plus silver, 7.5 cm in diameter, Wabasha, MN). Two pairs of electrodes were placed on the lower abdomen, near the midline and just above iliac crest on the right and left side. Two other pairs of electrodes were placed on the upper abdomen near midline just below the ribs; acing between the electrodes edges was approximately 3 cm on the right and left side. The treatment started with contraction time for four seconds followed by another four seconds of relation time, the machine adjusted at 20 pulses/minutes was set manually by the investigator based visual inspection of the contraction obtained (Up to maximum approximately 400mA) the machine was automatically switched off when the session time ended (60 minutes).

Statistical analysis

Changes in the measured variables (anthropometric, bio-impedance, plasma lipids and lipoprotein measurements) were collected and statistically analyzed by using mean standard deviation and paired t-test to compare between before and after three months of treatment in the first intervention (electrolipolysis and low caloric diet) and their corresponding measurements in the second intervention (low caloric diet) at a confidence of 95% (α-level of 0.05).

RESULTS

The results of the present study showed that:

- The anthropometric measurements results post treatment revealed a statistically highly significant (P<0.01) decrease in weight and waist circumference However, there was statistically significant (P<0.05) decrease in waist hip ratio and Body mass index for each group. While, comparing the results of both groups post treatment showed that group (A) was statistically significant (P<0.05) decrease in weight, waist circumference, wait hip ratio than group (B) expect for the Body mass index which was statistically non significant (P>0.05) (Table 1).

Table (1): shows the mean values and standards deviations of anthropometrics measurements in both groups.

			Mean	SD	x -diff	% improve	t-test	P value	
Weight (Kg)	Group (A)	pre ttt	95.80	8.69	12.53	-13.08	17.34	Hs	0.00
		post ttt	83.27	6.09					
	Group (B)	pre ttt	100.77	9.63	11.57	-11.48	13.44	Hs	0.00
		post ttt	89.20	6.52					
waist circumference (cm)	Group (A)	pre ttt	96.47	4.81	10.27	-11.64	6.98	Hs	0.00
		post ttt	86.20	3.59					
	Group (B)	pre ttt	97.33	5.09	11.00	-10.30	9.36	Hs	0.00
		post ttt	86.33	5.79					
Waist hip ratio (%)	Group (A)	pre ttt	0.92	0.01	0.13	-13.74	46.88	s	0.02
		post ttt	0.80	0.01					
	Group (B)	pre ttt	0.93	0.01	0.06	-6.84	28.77	s	0.03
		post ttt	0.87	0.01					
BMI (Kg/m2)	Group (A)	pre ttt	37.10	3.57	4.83	-0.13	18.72	S	0.01
		post ttt	32.27	2.82					
	Group (B)	pre ttt	36.24	2.49	4.12	-0.11	16.01	S	0.01
		post ttt	32.11	1.91					

x –diff: mean difference S: significant SD: standard deviation Ns: non-significant
Hs: high significant P value: Level of Significant

- The Plasma lipoprotein- lipids profile post treatment results in group (A) showed a statistically, significant (P<0.05) decrease in Triglyceride and total cholesterol and low density lipoprotein while it was statistically significant (P<0.05) increase in High density lipoprotein. The same results were shown after treatment in group (B).

Comparing post treatment results in both groups (A and B) showed that group (A) was statistically significant (P<0.05) decrease in triglyceride, total cholesterol and low density lioprotien than group (B). The difference between the two groups were not statistically significant (P>0.05) in high density lipoprotein [table (2) figure (1)].

Table (2): shows the mean values and standards deviations of Plasma lipoprotein- lipids profile before and after treatment in both groups.

			Mean	SD	x -diff	% improve	t-test	P value	
Triglyceride (mg/dl)	Group (A)	Pre ttt	166.20	4.20	28.47	-17.13	31.12	Hs	0.00
		post ttt	137.73	2.69					
	Group (B)	Pre ttt	165.80	2.81	24.20	-14.60	55.17	Hs	0.00
		post ttt	141.60	2.47					
Total cholesterol (mg/dl)	Group (A)	Pre ttt	212.87	7.82	38.60	-18.13	19.49	Hs	0.00
		post ttt	174.27	2.96					
	Group (B)	Pre ttt	216.07	7.14	23.73	-10.98	8.96	Hs	0.00
		post ttt	192.33	6.23					
Low density lipoprotein (mg/dl)	Group (A)	Pre ttt	145.33	4.37	26.40	-0.18	11.51	S	0.01
		post ttt	118.93	8.51					
	Group (B)	Pre ttt	145.73	4.04	18.00	-0.12	9.29	S	0.02
		post ttt	127.73	6.83					
High density lipoprotein (mg/dl)	Group (A)	Pre ttt	46.80	2.83	-4.73	0.10	-10.72	S	0.02
		post ttt	51.53	2.13					
	Group (B)	Pre ttt	46.47	2.36	-4.20	0.09	-8.57	S	0.03
		post ttt	50.67	2.19					

x –diff: mean difference
SD: standard deviation
Hs: high significant
S: significant
P value: Level of Significant
mg/dl: milligrams/ deciliter

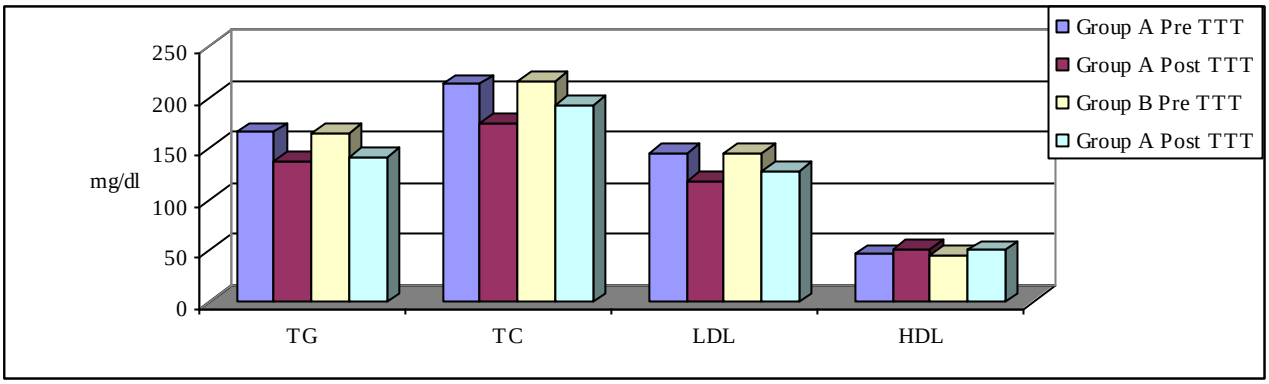

Fig. (1): shows the difference in Plasma lipoprotein- lipids profile (TG: Triglyceride, TC: Total cholesterol, LDL: Low density lipoprotein & HDL: High density lipoprotein) before and after treatment in both groups.

The bioelectrical impedance post treatment results in group (A) showed a statistically highly significant (P<0.01) decrease in the percent of body fat and fat weight and statistically significant (P<0.05) increase in lean weight and basal metabolic rate the same results were obtained in groups (B). Comparing post treatment results in both groups (A and B) showed a statistically non significant (P>0.05) in all parameters. [Table (3)]

Table (3): shows the mean values and standards deviations of bio-electrical impedance measurements pre and post treatment in both groups.

			Mean	SD	x -diff	% improve	t-test	P value	
Percent of body fat (%)	Group (A)	pre ttt	41.09	4.08	10.56	-25.70	13.95	Hs	0.00
		post ttt	30.53	4.96					
	Group (B)	pre ttt	42.47	5.26	10.67	-25.13	20.13	Hs	0.00
		post ttt	31.79	4.74					
Fat weight (Kg)	Group (A)	pre ttt	40.77	8.92	15.13	-37.10	11.61	Hs	0.00
		post ttt	25.65	5.47					
	Group (B)	pre ttt	42.56	8.07	13.92	-32.71	14.35	Hs	0.00
		post ttt	28.64	5.26					
Lean weight (Kg)	Group (A)	pre ttt	54.82	5.69	-3.42	6.24	-2.09	S	0.01
		post ttt	58.24	2.87					
	Group (B)	pre ttt	57.15	5.00	-3.41	5.96	-4.58	S	0.01
		post ttt	60.56	5.30					
BMR (calorie)	Group (A)	pre ttt	1710.87	90.38	-89.80	3.50	-2.14	S	0.01
		post ttt	1800.67	84.33					
	Group (B)	pre ttt	1739.40	152.39	-93.60	5.96	-4.59	S	0.01
		post ttt	1833.00	161.06					

x –diff: mean difference S: significant
SD: standard deviation P value: Level of Significant
Hs: high significant

DISCUSSION

Obese women with a high accumulation of visceral adipose tissue tend to have hyper triglyceridaemia and low concentration of high density lioprotien cholesterol[7] furthermore; the reduction in plasma concentration of high density lioprotien cholesterol in these viscerally obese women is a major factor responsible for the increase in their ratio of cholesterol[11].

Obesity, particularly with central fat distribution being a powerful predictor of risk of coronary heart disease and mortality are directly related in middle-aged women. Many studies have shown that women in their midlife tend to gain weight, with a shift to visceral fat distribution[19].

This study was designed to determine the effectiveness of electrolipolysis and low caloric diet in reducing the body weight and visceral adiposity among perimenopausal obese women.

Tochikubo et al. (1994)[29] who used transpercutaneous electric abdominal muscle stimulation (3000 muscle contractions /day) for four weeks to treat obese subjects, those subjects showed significant reduction in body

weight and intra abdominal visceral fat. Also, Alon et al. (1987)[3] reported that when a muscle contracts as a result of electrical stimulation, the chemical changes taking place /within the muscles are similar to those associated with voluntary contractions in normal exercising. These chemical reactions which results from muscle contractions utilize glycogen fat and other nutrients stored in the muscles. Also, it enhances energy consumption, carbohydrate oxidation and whole body glucose uptake.

Other explanation about the effect of electrolipolysis was mentioned by Kantor et al. (1994)[17] who reported that electrical stimulation stimulates the adrenergic interstitial nerve endings that liberates more catecholamine hormone which enhance the adenilate cyclase to convert adenosine triphosphate to cyclic adenosine monophosphate thus activating lipasis.

Regarding the results of anthropometric variables. The weight loss decrease in BMI in this study after low caloric diet may attributed to several mechanisms including, the diuriesis and depletion in stored glycogen and reduction in fat mass the depletion of fat depot caused by hydrolysis and clearance of triglyceride stored in adipose tissue into glycerol and free fatty acid (FFA) by the action of lipoprotein lipase (LPL) Després et al. (2001)[13]. Results of previous studies showed that more than a 10% reduction in body weight in a three months period of diet regimen Ellen et al, (2000)[14]. Other studies have reported similar weight losses in the range of 10 to 13 kg in obese women undergoing 16 weeks diet programs Berman et al. (2004)[8] and it was also reported that significant body weight losses, 14.5% compared to baseline over 16 week diet regimen Martin et al. (2001)[19].

Also the decrement in Waist circumference and waist hip ratio may be explained by decrement in body fat mass in the abdominal region. It may also be related to regional change in LPL activity in the abdominal fat area. This lead to mobilization of FFA from centrally distributed adipose tissue[11]. This is in agreement with Astrup and Rossner, (2002)[4] showed that post menopausal women appear to lose more fat from abdominal region during diet regimen. In contrast Clifton et al. (2002)[10] found that in obese post menopausal women, weight loss does not affect the regulation of regional fat metabolism and a greater tonic inhibition of basal lipolysis by endogenous adenosine that may increase the activity of adipose tissue LPL after weight loss and predispose older women to develop abdominal obesity. In addition, the results of this study showed a reduction of body fat mass in group A and B.

The change in fat mass may be due to several possible mechanisms including, shifting in substrate utilization, decrease in proteolytic counter regulatory hormones and increase in lipo-protein lipase activity which could explain the change in fat mass[4].

In this study perimenopausal women showed high levels of plasma lipoproteins-lipids profiles before the study and their metabolism were significantly influenced by treatment programs. The noticed lowering in plasma lipids may be related to the postulated decreased synthesis of VLDL, which in turn lowers the formation of LDL in the plasma compartment or increase hepatic B/E receptor[30].

The increase in HDL is related to the strong negative association exists between plasma TG-rich lipoprotein and HDL cholesterol, manipulations that modify plasma TG will also affect HDL cholesterol concentration[19].

The results of the current study are also supported by Pricharha et al. (2003)[24] who postulated that weight loss over 3 months

period lowered plasma concentration of LDL, TG, TC and raised plasma HDL. On the other hand, the results of this study contradict other studies reporting a negative correlation between BML WHR and blood lipids or between BMI and total cholesterol[12].

In conclusion, from the obtained results and discussion, it may be concluded that the electrolipolysis and low calorie diet enhance the visceral adiposity in obese perimenopausal women.

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الملخص العربي

كفاءة التحليل الكهربائي للدهون المتراكمة بالبطن لدى السيدات البدينات قبل انقطاع الطمث

إنّ دليل التأثيرات الضارّة للسمنة على صحة المرأة ساحقة وغير قابلة للجدال . يوجد حاليا اهتمام خاص بالسمنة الموضعية وخصوصا سمنة البطن وذلك لأنها لها كثير من المضاعفات على عدة أجهزه وخصوصا الجهاز الدوري وذلك بما لها من تأثير على نسبة الدهون في الدم . وكذلك على مرضى السكر لأنها تؤثر على حساسية المريض للأنسولين الذي يفرزه الجسم . هذا النوع من السمنة يظهر في السيدات قبل انقطاع الطمث . هدف الدراسة : هو بحث ومقارنة تأثير التحليل الكهربائي للدهون وبرنامج نقص الغذاء المتوازن معا وبرنامج نقص الغذاء المتوازن فقط على القياسات الإكلينيكية (الوزن- مؤشر كتلة الجسم - دوران الوسط - الدهون في الجسم) والقياسات المعملية (الدهون في الدم) لدى السيدات البدينات قبل انقطاع الطمث . اشترك في الدراسة30 سيدة بدينه فى مرحلة ما قبل انقطاع الطمث تعانى من سمنة موضعية بالبطن وتراوحت أعمارهم بين 37 و 49 عاما وقد تم تقسيم السيدات المشاركات إلى مجموعتين متشابهتين . كلتا المجموعتين تكونت من 15 مريضة تم تقسيمهن عشوائيا . القياسات : تم قياس الوزن والطول ودوران الوسط وكمية الدهون . إلى جانب كمية الدهون في الدم في بداية ونهاية 3 شهور هي مدة الدراسة . المجموعة الأولى : وتلقت برنامج من العلاج التحليل الكهربائي للدهون إلى جانب برنامج نقص الغذاء المتوازن وتلقت برنامج العلاج بمعدل ثلاث جلسات أسبوعيا لمدة ثلاثة شهو ر . المجموعة الثانية : تلقت برنامج نقص الغذاء المتوازن فقط خلال فترة الدراسة . النتائج : بعد إجراء التحليل الإحصائي لم توجد فرواق ذات دلالة إحصائية بين نتائج المجموعتين فبل العلاج ، بينما اثبت النتائج وجود فروق ذات دلالة إحصائية واضحة بمقارنة نتائج ما قبل وبعد الدراسة للمجموعتين . وكذلك أوضحت النتائج وجود فروق ذات دلالة إحصائية عالية لمجموعه (ا) عند مقارنة نتائج ما بعد العلاج للمجموعتين في نهاية البرنامج العلاجي .

الخلاصة : من هذه النتائج يتضح أن استخدام التحليل الكهربائي للدهون مع برنامج نقص الغذاء المتوازن له تأثير أفضل عن استخدام برنامج نقص الغذاء المتوازن فقط في علاج سمنة البطن .

الكلمات الدالة : السمنة - التحليل الكهربائي للدهون - برنامج نقص الغذاء المتوازن- ما قبل انقطاع الطمث- سمنة البطن .