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EFFECT OF ELECTROACUPUNCTURE ON CENTRAL OBESITY AND FATTY LIVER IN POSTMENOPAUSAL WOMEN

By

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Chapter I
Introduction

Menopause is defined as a permanent interruption of menstruation, because of limited endometrial stimulation by estrogens and the end of the ovarian follicles. The estrogen reduction happened especially during the first year of amenorrhea **(Rannevik et al., 2004)**. Estradiol levels being reduced to near 75% in postmenopausal period than menstrual women **(Barret and Stuenkel., 2009).**

Obesity is a chronic condition that can cause multiple metabolic diseases, obesity problems will cause both economic and medical burdens in the long run. Obesity can be categorized into generalized and abdominal obesity (also known as central obesity). Central obesity is defined as the accumulation of excessive fat in the abdomen compared with the lower extremities and hips **(Adiels et al., 2010).**

Fatty liver disease encompasses a spectrum of liver conditions, ranging from simple fatty liver to steatohepatitis. It is associated with visceral adiposity and metabolic syndrome, and its prevalence is as high as that of type 2 diabetes **(Diehl and Day, 2017).**

The pathogenesis of fatty liver disease is primarily attributed to the accumulation of fat in the liver, which is typically associated with various metabolic abnormalities. Insulin resistance (IR), a critical factor in the pathogenesis of fatty liver disease, leads to an increase in de novo lipid

synthesis, promotes the transport of fatty acids to the liver, inhibits the β-oxidation of free fatty acids (FFA), thereby further contributing to the accumulation of hepatic lipids. So, central obesity and fatty liver increases body mass index (BMI), Waist circumference, Waist-hip ratio, Cholesterol, Triglyceride, low-density lipoproteins (LDL) and high-density lipoproteins (HDL) (**Li and Xu, 1999**).

In China in the 1960‟s, electro-acupuncture (EA) was introduced into clinical practice, especially for the treatment of chronic pain and neurological diseases **(Stux and Pomeranz, 1998).**

Acupuncture is a treatment method used in Traditional Chinese Medicine (TCM). Acupuncture has been used for the treatment of neurological and musculoskeletal diseases such as intervertebral disk disease and spinal cord (**Stener-Victorin et al., 2013**).

According to traditional Chinese medicine there are more than 2,000 acupuncture points on the human body, and these connect with the twelve main and two of eight extra pathways called meridians (channels). In practice, however, a typical acupuncturist may only use 150 points. Traditionally each acupuncture point has defined healing (therapeutic) actions. Western acupuncture uses the same needling technique but is based on affecting nerve impulses and the central nervous system **(Ahsin et al., 2009).**

Statement of the problem:

Does electroacupuncture has an effect on central obesity and fatty liver in postmenopausal women?

Purpose of the study:

The aim of this study is to determine the effect of electroacupuncture on central obesity and fatty liver in postmenopausal women.

Significance of the study:

Post menopause is the time after you've been without a menstrual period for 12 months. It lasts for the rest of your life. During this stage, menopausal symptoms, such as hot flashes, get milder or go away **(Chang and Lewis, 2023).**

Electro-acupuncture has a major advantage that it's the margin of error in needle placement for electro-acupuncture is greater than for manual therapy and therefore a less accurate placement is required, as the current spreads and may reach a nerve several millimeters away **(Stux and Pomranz, 1998)**.

In electro-acupuncture, the therapist inserts the acupuncture needles in acupuncture points and electric current is connected to the body through the acupuncture needles **(Ahsin et al., 2009)**.

Electro-acupuncture treatment helps in decreasing blood lipids in patients with fatty liver disease and plays a significant role in improving the immunity system in patients with hepatitis in addition to improving their clinical symptoms. Previous clinical studies in China indicated that electro-acupuncture able to decrease total cholesterol (TC), triglycerides (TG), LDL, and elevate HDL in patients suffering from dyslipidemia **(Steven and William, 2007).**

Delimitations:

This present study will be delimited by the following aspects:

1- Subjects:

Sixty obese postmenopausal women will be recruited from the outpatient clinic of gynecology department in Kasre El Ainy University Hospital in Cairo, Egypt.

2- Instruments:

A- Standard weight height scale.

B- Tape measurement.

C- Red kites blood.

D- Brahminy kites blood.

E- Electro acupuncture.

3- Outcome measures:

A- Measurement of weight, height and BMI.

B- Measurement of waist circumferences, hip circumferences and waist/hip ratio.

C- Assessment of liver function test serum glutamic oxaloacetic transaminase (SGOT) and serum glutamic pyruvic transaminase (SGPT).

D- Assessment of lipid profile (TC, TG, LDL, and HDL).

4- **Interventions:**

Group A (Control group) will be treated by medical treatment in addition to hypocaloric diet (1200 kcal/day) for 12 weeks.

Group B (Intervention group) will receive the same medical treatment and hypocaloric diet (1200 kcal/day) as Group A, in addition to electroacupuncture sessions administered three times per week for 12 weeks.

Limitations:

This study will be limited to the following criteria:

1- Psychological status.
2- Cooperation of the patients may affect the result of the study.
3- Environmental factors that may have affected the patient's response.
4- The daily effort may affect the result of the study.

Basic assumptions:

It will be assumed that:

1- All potential participants will show adequate cooperation with study procedure.
2- All patients will follow the instructions that will be given to them.
3- The results obtained from this study would be of value in physical therapy.

Null Hypothesis:

There will be no effect of electroacupuncture on central obesity and fatty liver in postmenopausal women.

Chapter II

Literature review

Post menopause is defined retrospectively after 12 consecutive months of amenorrhea. It represents the end of the reproductive period and ovarian failure. A decrease in estrogen leads to several changes in the short and long term. Among the early changes, vasomotor symptoms (hot flashes) are particularly common, occurring in about 70% of women **(Helena et al., 2023).**

Menopause is a cycle that happens spontaneously or is medically induced in women to mark the end of their ability to reproduce **(Nikpour and Haghani, 2014).**

In comparison to medically induced menopause, natural menopause is a progressive cycle with permanent cessation of menstruation which is determined 12 months after the last menstrual period, which occurs in most women between 47 and 55 years of age **(Lee et al., 2011).**

Symptoms and causes:

Many people in post menopause feel lingering symptoms from menopause, although the symptoms are usually less intense. Lingering symptoms occur due to low levels of reproductive hormones. Some people have no symptoms in post menopause **(Chang et al., 2023).**

Common postmenopausal symptoms include:

- Hot flashes and night sweats.
- Vaginal dryness and pain during sex.
- Depression.
- Changes in sex drive (low libido).
- Insomnia.
- Dry skin.
- Weight changes.
- Hair loss.
- Urinary incontinence **(Koothirezhi and Ranganathan, 2023).**

The risks of excess body weight and related comorbidities are influenced by diet, physical inactivity, perceptions of health, and cultural beliefs. The World Health Organization15 claims that lack of physical activity, for example, has been recognized as the fourth major cause of global death, accounting for 27% of diabetes cases, and about 30% of ischemic heart disease cases **(Li et al., 2023).**

Menopause is associated with increased cardiovascular disease and once women develop acute coronary symptoms, they have worse short- and long-term outcomes than men **(Ng, 2007).**

Many different factors contribute, including marked hormonal changes changes in metabolic profile associated with increased risk of the metabolic syndrome and relative increase in intra-abdominal fat with age **(Pasquali et al., 1997).**

Accumulation of intra-abdominal fat is associated with increased waist circumference and liver fat overproduction of very low-density lipoprotein (VLDL), and decreased catabolism of apolipoprotein (apo)B-containing particles in men **(Pou et al., 2009).**

Although abdominal obesity tends to be associated with obesity in men, data from the United States have been used to estimate that 40% of women have an abdominal fat distribution pattern as defined by waist:hip ratio **(Chan et al., 2002).**

Hypertriglyceridemia is associated with atherogenic dyslipidemia including the production of small dense LDL, lower HDL cholesterol, and accumulation of postprandial TG-rich lipoproteins. In men with type 2 diabetes, the secretion of $VLDL_1$ is associated with liver fat, hypertriglyceridemia, and increased atherogenic risk **(Meigs et al., 2003).**

Obesity in postmenopausal women:

Women have an increased tendency to gain weight after menopause. The increase of body fat and central obesity may be due to hormonal changes occurring during or after the menopausal transition. The decline of endogenous estrogen and decreased physical activity are the major causes of these phenomena. The insufficiency of estrogen? leads to decreased basal metabolic rate and energy expenditure **(Nieves et al., 2003).**

Postmenopausal overweight and obesity increases the risk of hypertension, coronary artery disease, diabetes, and mortality.The incidence of excess body weight among women is increasing worldwide to epidemic proportions **(Abate and Garg, 2005).**

The arrival of the menopause in middle age is associated with a tendency to gain weight. It is estimated that the prevalence of obesity among women aged 40–59 years in the United States is approximately 38.2%, while the prevalence of overweight and obesity is 66.3% **(Lakka et al., 2002)**.

Obesity is the most prevalent nutrition-related disorder in Western countries, and the prevalence of overweight and obesity is increasing worldwide at an alarming rate affecting both developed and developing countries **(Hall, 2004).**

Although increasing BMI is a powerful predictor of metabolic disease risk, individuals with the same BMI may have greatly different amounts of visceral (central or abdominal) fat, the adipose tissue depot known to be associated with the greatest metabolic risk **(Abate and Garg, 2005).**

Abdominal obesity, when accompanied by metabolic derangements, including insulin resistance, low HDL, elevated TG, and raised blood pressure, significantly increases the predicted cardiovascular disease risk and constitutes the well-known metabolic syndrome. Insulin resistance and inflammation are the two more common abnormalities that link obesity with adverse metabolic changes **(Festa et al., 2000).**

The rapid increases in overweight and obesity are multifactorial and only partly attributable to changes in lifestyle practices. The prevalence of obesity is typically higher in females than males globally. Moreover, weight gain, with an increase in body fat percentage and a concomitant redistribution of fat accumulation from peripheral locations toward increased intra-abdominal depots, is common after the menopause. This timing suggests that the female sex steroid pattern is important in adipose tissue metabolism and highlights the role of sex hormones on fat distribution, a fact that has been extensively reported **(McKinlay et al., 2002)**.

Causes obesity with postmenopausal women:

Postmenopausal women have an increased tendencyfor gaining weight. It is as yet unclear whether themenopausal transition itself leads to weight gain, but is known that the physiological withdrawal of estrogen bringsabout changes in fat distribution, together with physical inactivity, are probably the major causes of this phenomenon. Other contributing factors include ethnicity, reduced lean mass, resting metabolic rate and treatment with certain drugs, e.g. steroids, insulin, glitazones **(Hodson et al., 2014).**

Moreover, estrogen withdrawal during menopause has a detrimental effect on metabolism and bring changes in body fat distribution from a gynoid to an android pattern, reduced glucose tolerance, abnormal plasma lipids, increased blood pressure, increased sympathetic tone, endothelial dysfunction and vascular inflammation **(Berry et al., 2003).**

As a result postmenopausal obesity compounds the situation leading to increased rates of hypertension, diabetes mellitus, coronary artery disease and mortality. Additional consequences of obesity may include hormone-dependent cancer, gallstones, nephrolithiasis, and osteoarthritis withincreased mortality **(Basurto et al., 2003).**

Lipid profile of postmenopausal women with central obesity:

Following menopause, adverse changes in lipid profile occur and the levels of several coagulation factors increase. The lipid profile is a group of tests that are often done together to determine risk of CHD. It includes TC, HDL cholesterol, LDL- cholesterol and triacylglycerol (TAG). It is used to guide health care providers in decision making as to how a person at risk should be treated. The scenario of the lipid profile is considered along with other known risk factors of CHD to develop a plan of treatment and follow-up **(Ruppelli, 2002).**

Obesity is a term commonly used to describe individual with increased body fat. It is associated with an increased risk of atherosclerosis, diabetes mellitus and gall bladder disease. Normal fat content of body is considered to be 12-18% of body weight in men and 18–25% of body weight in women **(Loverove et al, 2002).**

Abdominal obesity has been linked to signi-ficant metabolic abnormalities including insulin resistance, hyperinsulinaemia, and elevated TAG levels as well as increased incidence of hypertension, glucose intole-rance and diabetes mellitus. Abdominal adiposity as measured by waist-hip ratio (WHR), is an independent risk factor for CHD in men and perhaps also in women **(Rexrode et al., 2008).**

Waist circumference and WHR are important indicators of cardiovascular risk even after adjustment for BMI. The increased visceral fat mass associated with increased waist circumference is largely the result of overall obesity, whereas in case of an increased WHR, the increase in visceral fat is due to other factors as well. The prevalence of obesity is increasing worldwide. Cardiovascular disease (CVD) remains the major cause of death in postmenopausal women. Before menopause, women are relatively protected from ischaemic heart disease and thromboembolism by their circulating oestrogen, but this protection is lost after menopause**(Chang et al., 2000).**

Therefore it is important to study lipid profile in postmenopausal women with central (abdominal) obesity. So this study was designed to observe the pattern of lipid profile parameters in the postmenopausal central obese wome **(Loverove et al., 2002).**

Fattyliver in postmenopausal women:

Nonalcoholic fatty liver disease (NAFLD) is a chronic disease that develops as a result of excessive accumulation of triglycerides in the liver. Nonalcoholic fatty liver disease is also a common disease, affecting ~24% of the global population **(Younossi et al., 2018).**

Development and progression of NAFLD:

Nonalcoholic fatty liver disease is defined by the presence of hepatic steatosis in the absence of excessive alcohol consumption, certain hereditary disorders, and use of medications that may contribute to secondary hepatic fat accumulation **(Ipsen et al., 2018).**

Hepatic steatosis arises from an imbalance of fat accumulation and disposal, which result from increased *de novo* lipogenesis and/or hepatic fatty acid uptake, and decreased lipid disposal, respectively. Hepatic steatosis is defined as liver fat fraction exceeding 5% to 10% by weight and is also estimated as the percentage of hepatocytes containing visible triglycerides **(Kleiner et al., 2005).**

Estrogen deficiency Levels of 17β estradiol (E2), an endocrine hormone produced by the ovaries and circulated in plasma, decline significantly following menopause. The impact of estrogen deficiency on liver lipid metabolism has been investigated extensively in animal models. Aromatase-deficient (ArKO) mice, which lack endogenous estrogen production, accumulated abdominal fat and developed abundant fat droplets in liver cells of the centrilobular and intermediate zones, indicative of hepatic steatosis **(Zhong and Tang, 2024).**

Management of obesity in patients with NAFLD:

Medical treatment:

Anti-obesity medications:

Anti-obesity medications (AOMs) approved by the Food and Drug Administration (FDA) for weight loss might be considered as the next line of treatment for obesity or obesity-related liver diseases. The FDA adopts a figure of at least 5% difference in mean weight loss of medication, compared with placebo, to be approved for the long-term use in patients with a body mass index (BMI) > 30 kg/m ^{2} , or those with a BMI > 27 kg/m ^{2} and have one or more obesity-related comorbidities such as T2DM, hypertension, and dyslipidemia **(Daneschvar et al., 2016).**

The current AOMs approved for long-term use include phentermine/ topiramate, orlistat, liraglutide and bupropion/naltrexone reviewed in detail elsewhere **(Acosta et al., 2017)**.

These medications achieved 6 to 11% TBWL over 12 months in conjunction with lifestyle modifications **(Daneschvar et al., 2016)**.

GLP-1 is an endogenously produced, gut-derived incretin hormone. It augments insulin secretion by β-cells and reduces glucagon release. It also reduces gastric emptying and food intake. GLP-1 analogs demonstrated potency in enhancing insulin sensitivity and reducing body weight; thus, improving the overall outcome in patients with NAFLD and NASH **(Sunyer et al., 2015).**

Physical treatment for central obesity and fatty liver:

1- Lifestyle modifications through:

A-Diet:

The cornerstone of NAFLD management is weight loss. This requires adopting an energy restrictive lifestyle that includes a decrease in oral caloric intake and an increase in the body's energy expenditure. According to multiple randomized-controlled trials (RCTs), weight loss

in NAFLD patients led to an improvement in hepatic triglyceride contents (determined using an MR) and in NAS (determined by liver biopsy) with an accompanied reduction in cardiovascular risk factors such as insulin resistance and the level of serum lipid **(George et al., 2009).**

B-Exercises:

Along with the prescription for a reduced-calorie diet, a comprehensive lifestyle intervention program should advocate increasing aerobic physical activity for ≥ 150 min per week (such as brisk walking for ≥ 30 min/d most days of the week), and a goal of > 10,000 steps per day. Higher levels of physical activity, approximately 200 to 300 minutes per week, are recommended to maintain weight loss or minimize weight regain for long term (> 1 year) **(Hannah and Harrison, 2016).**

2- Electroacupuncture:

Acupuncture has been the subject of active scientific research since the late 20th century, but it remains controversial among medical researchers and clinicians **(Ernst et al., 2007).**

Point selection, location and application:

There are tender areas at certain points of the body surface with all diseases, regardless of whether they are physical or mental, which disappear when the illness is cured. There are acupuncture points. **Jayasuria (1993)** stated that the use of acupuncture points to treat diseases of local and adjacent areas is one of the key principles in the practice of acupuncture therapy. It is the first consideration that should govern the selection of the acupuncture points for any regional disease. The local points are the most effective points in treating a majority of

disorders. Every acupuncture point has a local effect on the surrounding tissues **(Stux and Pomeranz, 1998).**

Location methods for body acupuncture :

There are various methods for locating acupuncture points :

Anatomical approach: many acupuncture points are situated at clearly defined anatomical locations, for example in depressions, at muscle and tendon insertions, in grooves, at joint clefts, at bony prominences, etc.

Proportional measurements: when trying to locate points not situated at any prominent structures, Chinese medicine applies the proportional cun measurement.

Electric tools: these measure the electric resistance of the skin in order to find the correct location of the points. Generally, electric resistance is lower in the immediate area around the point **(Steven and William, 2007).**

Chapter III

Subjects, Materials and Methods

Design of the study:

The study is designed as a prospective, randomized, pre-post test, controlled trial.

I- Subjects:

Sixty obese postmenopausal women will participate in this study to determine the effect of electroacupuncture on central obesity and fatty liver. They will be selected randomly from the Outpatient Clinic of gynecology department of Kasre El Ainy University Hospital, in Cairo, Egypt on the following criteria:

Inclusion criteria:

1- Their ages will be ranged between 50 and 60 years old.
2- Their body mass index will be ranged from 30-40 kg/m^2.
3- SGOT more 40 U/L.
4- SGPT more 40 U/L.
5- Waist/Hip Ratio more 1 cm.
6- Triglyceride more 150 **mg/dl.**
7- Cholesterol more 200 **mg/dl.**
8- LDL more 100 **mg/dl.**
9- HDL less 40 **mg/dl.**

Exclusion criteria:

Women will be excluded if they have one of the following criteria:

1- Cancer.
2- Concomitant cardiovascular disorders.
3- Respiratory, renal and liver dysfunction.

They will be randomly distributed into two equal groups:

Group (A) (Control group):

It will be consisted of thirty obese postmenopausal women. They will be treated by medical treatment in addition to hypocaloric diet (1200 kcal/day) for 12 weeks.

Group (B) (Study group):

It will be consisted of thirty obese postmenopausal women who will receive the same medical treatment and hypocaloric diet (1200 kcal/day) as Group A, in addition to electroacupuncture sessions administered three times per week for 12 weeks.

II- Instrumentations:

A- Evaluation instrumentations:

1- Informed consent form: **(Appendix I).**

2- Recording data sheet:

It will be used to record all data of each woman before starting this study **(Appendix II).**

3- Standard weight height scale:

It will be used to measure weight and height to calculate the body mass index (BMI) for each woman in both groups (A&B) before and after treatment through this equation:

BMI= body weight (Kg) / square of body height (m^2) = Kg/m^2.

4- Tape measurement:

It will be used to measure waist and hip circumferences to calculate the waist/hip ratio for each patient in both groups (A&B) before and after treatment, **Fig (1).**

Fig. (1): Tape measurement.

5- Red kites blood:

It will be used to assess the level of liver function test (SGOT and SGPT) for each woman in both groups (A&B) before and after treatment.

6- Brahminy kites blood:

It will be used to assess the level of lipid profile (TC, TG, LDL, and HDL) for each woman in both groups (A&B) before and after treatment.

B- Treatment instrumentation:

1- Electro acupuncture (SDZ- Chinese):

Electro acupuncture device (No 18 Huatuo Rd., Suzhou New District, china) power supply: 6 * 1.5 V (AA UM3) battery or (AC Adaptor (output DC9V, 200Ma), input power: 10.0 VA, output power: 0.3 VA, output frequency: 1- 100HZ. It will be used for treatment of all women in study group B, 3 sessions/week for 12 weeks, **Fig. (2).**

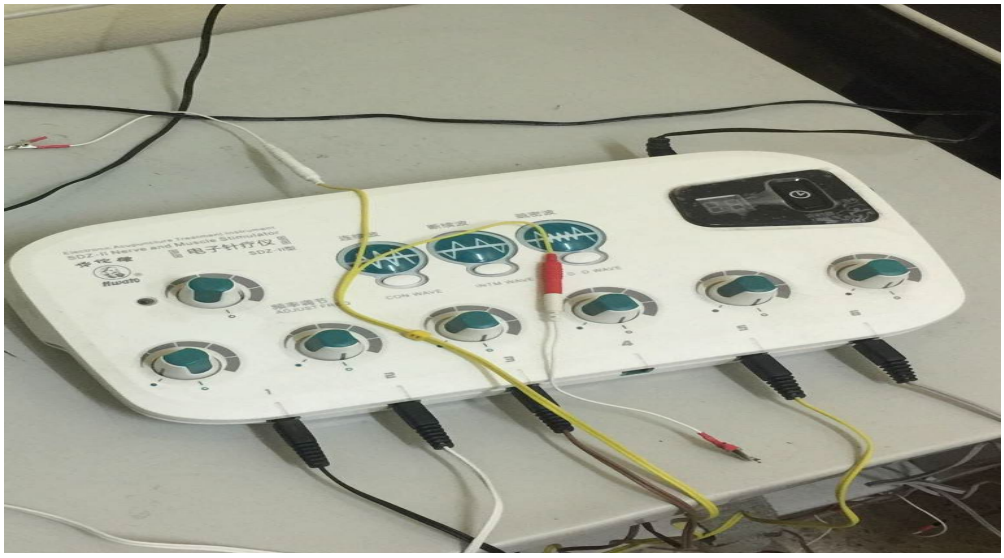

Fig. (2): Electro acupuncture.

III- Procedures:

All women will be given a full explanation of the protocol of the study and consent form will be signed for each woman before participating in the study, the purpose and nature of the study will be explained to all women.

A-Evaluation procedures:

1. **BMI:**

Weight and height measurements will be measured while the patient is wearing a thin layer of clothes to calculate the BMI according to the following equation before and after treatment for both groups:

BMI = weight/height^2 (kg/m^2) **(Hamilton et al., 2015).**

2. **Waist/Hip Ratio:**

Waist circumference will be measured at the narrowest point between xipho-sternum and the iliac crest at the end of a gentle expiration; hip circumference will be measured at the maximum circumference at the level of the femoral trochanter. Then, the waist /hip ratio will be calculated by dividing waist circumference by hip circumference **(Ross et**

al., 2008). This will be taken for all patients in both groups (A&B), while she is in the standing position, before and after treatment (12 weeks).

3. Blood analysis:

Blood samples will be collected from the antecubital vein of each woman both before and after the treatment period. Samples will be centrifuged within 8 hours of collection. The obtained serum will be stored at −20°C and later analyzed for liver function tests (SGOT and SGPT) as well as lipid profile parameters **(Tilburt and Kaptchuk, 2008).**

B- Treatment procedures:

1- Medical treatment:

It will be given for all women in both groups in the form of orlistat (120 mg capsule, 3 times before the meal and phentermine (15 mg capsule, one time before the meal). **(Guerciolini, 1997 and Greydanus et al., 2011).**

2- Hypocaloric diet:

All women in both groups (A and B) will be instructed to follow the same hypocaloric diet, as prescribed by a certified nutrition specialist, with a daily caloric intake of 1,200 kcal for a duration of 12 weeks **(Evert et al., 2014) (Appendix III).**

- Carbohydrates: Approximately 55% of total caloric intake will be derived from complex carbohydrates rich in dietary fiber and low in glycemic index. Each participant will consume 170–240 grams of carbohydrates per day, emphasizing whole grains, legumes, and vegetables.
- Fats: Fat will comprise 15% of the total caloric intake, and each patient will be advised to consume between 60 and 100 grams of fat per day.

- Proteins: Approximately 30% of the total caloric intake will come from protein. Each patient will be instructed to consume between 30 grams of protein per day, sourced from low-fat meat, fish, or other high-protein foods.
- Fiber: Each patient will be advised to consume about 20 to 35 grams of fiber per day.
- Dietary restrictions: Patients will be advised to avoid increased amounts of salt (to prevent effects on blood pressure), as well as tea and caffeine.

3- Electroacupuncture:

All women in group B will be treated by electroacupuncture, 3 times per week for a total duration of 12 weeks. Each session will begin with the woman lying in a supine position on the treatment bed, with the abdomen and lower limbs exposed for proper skin disinfection. Sterile verum acupuncture needles (asia-med Special No. 16, 0.30×0.30 mm) will be inserted into a total of eight standardized acupoints, selected for their efficacy in central obesity and weight management. The insertion depth at each point will range between 10–25 mm, depending on anatomical location.

Following needle insertion, electrical stimulation will be applied using a low-frequency current (2 Hz) with a pulse width of 0.5 ms, targeting the abdominal area for 30 minutes per session.

The selected acupoints will include:

- **Central obesity-related points**: Daheng (SP-15), Daimai (GB-26)
- **Body weight regulation points**: Zusanli (ST-36), Sanyinjiao (SP-6), Tianshu (ST-25), Fenlong (ST-40), Zhongwan (CV-12), Qihai (CV-6)

Table (1): The acupuncture points and its locations:

Acupuncture points	Locations
Tianshu (ST-25)	2-in. lateral to the AML level with the umbilicus (CV 8)
Daheng (SP-15)	4-in. lateral to the center of the umbilicus (CV 8) lateral to rectus abdominus
Daimai (GB-26)	Directly below LV 13 at the crossing point of a vertical line through the free end of the 11th rib and a horizontal line through the umbilicus (level with CV 8)
Qihai (CV-6)	Midway between CV 5 and CV 7, 1.5-in. below CV 8 (umbilicus)
Zhongwan (CV-12)	Midway between CV 8 and CV 16, 4 -in. above CV 8 (umbilicus)
Zusanli (ST-36)	3-in. below ST 35, one finger width lateral from the anterior border of the tibia
Fenlong (ST-40)	8-in. below ST 35, one finger width lateral to ST 38, two finger widths lateral to the anterior border of the tibia
Sanyinjiao (SP-6)	3-in. directly above the tip of the medial malleoulus on the posterior border of the tibia

Statistical analysis:

- The data will be collected and statistically analyzed by using the following:
- Descriptive statistics and unpaired t-test will be conducted for comparison of the demographic data between both groups.
- Unpaired t-test will be conducted for comparison of mean values of pre and post-treatment between groups.
- Paired t-test will be conducted for comparison between pre and post-treatment mean values in each group.
- The level of significance for all statistical tests will be set at $p < 0.05$.

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Appendix I

Informed consent form

I am Misses / freely and voluntarily consent to participate in research study under the direction of the researcher /Mohamed Abdel Hamid Elgaedy. A thorough description of the procedures has been explained and I understand that I may withdraw my consent and discontinue participation in this research at any time without prejudice to me.

Participant: **Date:**

……. ……..

اقـــــــرار

أقر انا السيدة/ ..... الموقعة أدناه بإرادتي بأنني موافقه بحرية وتطوع علي المشاركة في البرنامج البحثي تحت إشراف وتوجيه من الباحث/ محمد عبد الحميد الجعيدي وذلك من خلال وصف وشرح الاختبارات ومعرفتي بأنني يمكن أن أنسحب من المشاركة في أي وقت بدون أي ضرر لي.

التوقيـــــع **التـــــاريخ**

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Appendix II

Recording data sheet

Number:

Name:

Group:

Age:

Address:

Occupation:

	Group	
	Control treatment	Intervention treatment
Weight		

Height		
BMI		
TC		
TG		
LDL		
HDL		
SGOT		
SGPT		

Appendix III

Hypocaloric Diet (Evert et al., 2014)

Breakfast	Energy (Kcal)	Fat (GM)	%Fat	Exchange for:
Whole-wheat bread, 1 med. slice	70	1.2	15	(1 Bread/Starch)
Jelly, regular, 2 tsp	30	0	0	(½ Fruit)
Cereal, shredded wheat, ½ C	104	1	4	(1 Bread/Starch)
Milk, 1%, 1 C	102	3	23	(1 Milk)
Orange juice, ¾ C	78	0	0	(1½ Fruit)
Coffee, regular, 1 C	5	0	0	(Free)
Breakfast Total	**389**	**5.2**	**10**	

Lunch	Energy (Kcal)	Fat (GM)	%Fat	Exchange for:
Roast beef sandwich				
Whole-wheat bread, 2 med. slices	139	2.4	15	(2 Bread/Starch)
Lean roast beef, unseasoned, 2oz	60	1.5	23	(2 Lean Protein)
Lettuce, 1 leaf	1	0	0	
Tomato, 3 med. slices	10	0	0	(1 Vegetable)
Mayonnaise, low-calorie, 1 tsp	15	1.7	96	(1/3 Fat)
Apple, 1 med.	80	0	0	(1 Fruit)
Water, 1 C	0	0	0	(Free)
Lunch Total	**305**	**5.6**	**16**	

Dinner	Energy (Kcal)	Fat (GM)	%Fat	Exchange for:
Salmon, 2 oz edible	103	5	40	(2 Lean Protein)
Vegetable oil, 1½ tsp	60	7	100	(1½ Fat)
Baked potato, ¾ med.	100	0	0	(1 Bread/Starch)
Margarine, 1 tsp	34	4	100	(1 Fat)
Green beans, seasoned with margarine, ½ C	52	2	4	(1 Vegetable) (½ Fat)
Carrots, seasoned	35	2	0	(1 Vegetable)
White dinner roll, 1 small	70	2	26	(1 Bread/Starch)
Iced tea, unsweetened, 1 C	0	0	0	(Free)
Water, 2 C	0	0	0	(Free)
Dinner Total	**454**	**20**	**39**	

Calories:1200 **Total fat:** 15%

Total Carb: 55% **Protein:** 30%

Avoid salt, tea, caffeine **Fibers:20-25gm/day**