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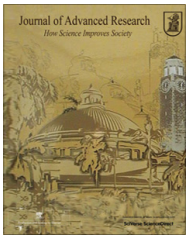

SHORT COMMUNICATION

Effect of laser acupuncture combined with a diet-exercise intervention on metabolic syndrome in post-menopausal women

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ABSTRACT

This study aimed to evaluate the effect of laser acupuncture combined with a diet-exercise intervention on features of the metabolic syndrome (MetS). Twenty-eight obese post-menopausal women were randomly distributed to the control and laser acupuncture group. The control group received the diet-exercise intervention and the study group received the same intervention and sessions of laser acupuncture, 3 times/week for 12 weeks. Anthropometric measurement, fasting blood glucose and insulin levels, homeostatic model assessment-insulin resistance (HOMA-IR), and lipid profile were assessed before and after the treatment course. Both groups showed a significant decrease in the anthropometric and metabolic parameters. However, laser acupuncture group showed a greater decrease in the waist ($P = 0.001$) and hip ($P = 0.001$) circumferences, cholesterol ($P = 0.04$), and insulin levels ($P = 0.043$) than the control group. These results suggest that laser acupuncture is a valuable approach that could be added to the diet-exercise intervention to correct features of the MetS.

Introduction

Metabolic syndrome (MetS) is a group of metabolic abnormalities including insulin resistance, increased body weight, high abdominal fat mass, mild dyslipidemia and hypertension. MetS is now increasing worldwide, and considered an important health problem that boosts the risk of developing cardiovascular disease (CVD) and type 2 diabetes [1].

Post-menopausal women develop the MetS three times more than the pre-menopausal women [2]; this syndrome affects 32.6% to 41.5% of the post-menopausal women [3]. Estrogen loss, which leads to metabolic changes and increased abdominal obesity, is one of the hypotheses that explain the increased incidence of the MetS after menopause [4].

Previous studies have proved the association between the visceral obesity and the MetS. Abdominal obesity leads to a cluster of atherogenic and diabetogenic complications. There are an elevation in plasma triglyceride (TG) concentration, a marked decline in plasma high-density lipoprotein cholesterol (HDL-C) level, and an increased proportion of small, low

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dense lipoprotein (LDL) particles. Also, there is an insulin resistant state that results in a severe disturbance of plasma glucose-insulin homeostasis [5].

Lifestyle change through the diet and moderate-intensity exercise is an essential strategy for improving all features of the MetS. However, further research evaluating lifestyle change versus combined therapies is needed to find out which treatment is best to resolve the MetS [6]. Previous literature has described the use of laser acupuncture in obesity as reducing the body weight (BW) and body mass index (BMI) with [7] or without a low-calorie diet in obese post-menopausal women [8].

Acupuncture therapy significantly reduces BMI and abdominal fat by reducing the abdominal visceral adipose tissue content [9], which lead to decrease several atherogenic and metabolic complications. Currently, the effect of laser acupuncture on lipid metabolism and glucose-insulin homeostasis is still unclear. Therefore, this study aimed to examine the effect of combined laser acupuncture and a diet-exercise intervention on the anthropometric measurements, fasting blood glucose and insulin levels, homeostatic model assessment-insulin resistance (HOMA-IR), and lipid profile in obese post-menopausal women. It was hypothesized that adding laser acupuncture to a diet-exercise intervention had more effect on features of the MetS than a diet-exercise intervention did alone.

Subjects and methods

Subjects

Twenty-eight post-menopausal women diagnosed with the MetS had been referred by a doctor. Diagnosis of the MetS was performed using the National Cholesterol Education Program Adult Treatment Panel III (NCEP-ATP III). The post-menopausal women possessed three or more of the following criteria: increased fasting blood glucose ($\geqslant$110 mg/dl or $\geqslant$6.1 mmol/L), high TG ($\geqslant$150 mg/dl or $\geqslant$1.65 mmol/L), low HDL-C ($<$50 mg/dl or $<$1.30 mmol/L), and waist circumference of $\geqslant$88 cm. All post-menopausal women were obese (BMI $>$ 30 kg/m^2). The exclusion criteria included women diagnosed with hypothyroidism, ischemic heart disease (IHD) or diabetes, as well as those who received hormone replacement therapy (HRT) or anti-diabetic medications.

The post-menopausal women were randomly distributed into two groups using computer generated random numbers. Allocation was concealed in sequentially numbered opaque envelopes. The control group followed an energy-restricted diet, and engaged in a supervised treadmill-training program 3 times/week for 12 weeks; while the study group (laser acupuncture) received the same diet-exercise intervention and sessions of laser acupuncture 3 times/week for 12 weeks. The sample size was calculated based on a previous study according to the change in the weight post-treatment [10].

A sample of 14 women per group was recruited to detect an effect size of 0.727 at a power of 0.80 and alpha level of 0.05. The sample size was calculated using GPower 3.1. *The Ethical Committee of the Faculty of Physical Therapy, Cairo University approved this study. The study protocol was explained to all women, who had signed an informed consent form.*

Methods

Anthropometric measurements

Weight and height were measured for each post-menopausal woman wearing light clothes and without shoes. Then, BMI was calculated by dividing weight (kg) by height squared (m^2). The same therapist blinded to the group assignment measured the waist and hip circumferences. The therapist measured the waist circumference from the narrowest point between the lower border of the rib cage and the iliac crest at the end of normal expiration; she measured the hip circumference at the widest part of the hip. Then, waist-hip ratio was calculated by dividing waist circumference by hip circumference.

Biochemical analysis

Blood samples were drawn from all post-menopausal women on the morning after fasting for 6 h in clean tubes containing a few mg of K2EDTA. Blood samples were centrifuged, and plasma separated and stored frozen at-20° until analysis. Fasting blood glucose, serum insulin, total cholesterol (TC), HDL-C, LDL-C and TG levels were estimated according to the methods used by Kesim et al. [11]. HOMA-IR was computed with US formula: fasting plasma glucose (mg/dl) multiplied by fasting serum insulin (mU/l) and divided by 405 [12].

Interventions

Diet regime

All post-menopausal women followed an energy-restricted diet for 12 weeks. First, the recommended daily kilocalorie intake was computed by multiplying the Harris-Benedict equation by 1.55. Then, daily energy intake was restricted by 1000 kcal/day (daily kilocalorie requirement-1000 kcal). The diet caloric proportion of the protein, fat and carbohydrate was set at 15%, 30% and 55% respectively.

Each post-menopausal woman was given a booklet including a database of foods, and their energy and macronutrient values. The therapist asked each woman to select her foods freely, and give instructions about planning her meals to help adhere to the prescribed kilocalories and the assigned macronutrient. All women were advised to keep 3-day dietary records and interviewed by the therapist weekly. The therapist checked these records to ensure the total kilocalories per day did not exceed the previous calculated one, and give any advice about the meal plans when they did not meet the assigned macronutrient. All post-menopausal women had closely adhered to the assigned energy intake.

Treadmill training protocol

The treadmill-training program was performed 3 times/week for 12 weeks. Each exercise session consisted of warm up, active and cool down phases. The warm up phase started with walking on a treadmill at a speed of 4–5 km/h with 0% grade elevation for 5 min. The active period lasted for 30 min at (60–75)% of the heart rate reserve (HRR). The treadmill speed and inclination were increased gradually, and adjusted for each subject according to her prescribed intensity based on the target heart rate. The target heart rate was calculated from