# Body Composition Changes after Weight-Loss Interventions among Obese Females: A Comparison of Three Protocols

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## Abstract

**AIM:** To evaluate body composition changes after use of three different types of obesity management protocols: dietary measures and physical activity; acupuncture or laser acupuncture with healthy diet; aiming at achieving stable weight loss among obese Egyptian females.

**METHODS:** A randomized longitudinal prospective study included 76 obese adult females; aged 26 up to 55 years. Anthropometric, body composition, ultrasonographic and biochemical assessments were done.

**RESULTS:** The three types of obesity management protocols showed significant improvement in body composition (decrease in fat% and increases in FFM and TBW) and visceral fat by US. However, nutritional intervention showed highly significant improvement in the skin fold thickness at triceps and biceps sites and peripheral adiposity index. Acupuncture intervention showed highly significant improvement in fasting blood glucose (decreased) and lipid profile (decreased triglycerides, total cholesterol and LDL, and increased HDL). Laser intervention showed highly significant improvement in all the skin fold thickness and some parameters of lipid profile (decreased total cholesterol and LDL).

**CONCLUSIONS:** The three obesity management protocols have significant effect on body composition, but acupuncture has the best effect in improving the lipid profile and fasting blood sugar. In addition, Laser intervention was recommended to improve skin fold thickness and subcutaneous fat.

## Introduction

Weight reduction is a global health priority because being overweight or obese is associated with multiple health problems, including the leading causes of preventable death such as cardiovascular disease and type-2 diabetes [1]. Body composition and fat distribution are important measures in determining potential health benefits of a weight loss program. Additionally, decreases of visceral adipose tissue, resulting from weight loss have been related to reductions in blood lipid levels. Such favorable changes may be explained by the effect of weight loss on cholesterol metabolism [2].

Several weight loss strategies have been developed and experimented over the past decades for treatment of obesity in order to improve health [3]. Common intervention methods for obesity include low-calorie diet, exercise. Also acupuncture has shown good therapeutic results in the treatment of obesity. A recent clinical observation showed that laser acupuncture could reduce body weight and body mass index in obese persons [4].

So, the aim of this research is focused on

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body composition changes as related to type of intervention, before and after intentional weight loss in overweight and obese females.

## Subjects and Methods

This was a randomized longitudinal prospective study carried out from October 2011 to December 2012. It included seventy- six obese adult females [their body mass index (BMI) greater than or equal to 30 kg/m$^2$]; aged from 26 up to 55 years with mean age 44.8 $\pm$ 8.8 years at the start of the study. They were recruited from the employers of the "National research Centre". Any female was excluded if they presented with a contra-indication to effort, a major orthopedic problem making gait on a treadmill impossible (such as invalidating knee osteoarthritis), severe psychiatric disorders, a personal history of heart disease and/or a recent myocardial infarction, subjects not consenting to the protocol and those who had not diligently followed twelve consecutive weeks of training. Participants were informed about the purpose of the study and their permission in the form of written consent was obtained. The protocol was approved by the "Ethical Committee" of the "National Research Centre". The agreement reference number is 10/119.

All the participant females underwent anthropometric, body composition, ultrasonographic and biochemical assessments.

Anthropometric evaluation was performed. The height, weight and skin fold thicknesses at 5 sites (triceps, biceps, subscapular, suprailiac and abdominal) were measured following the recommendations of the International Biological Program [5]. Three consecutive measurements were taken and the mean was recorded. The height was measured to the nearest 0.1 cm using a Holtain portable anthropometer and the weight was determined to the nearest 0.01 kg using a Seca Scale Balance, with the subject wearing minimal clothing and no shoes. Body mass index (BMI): as weight (in kilograms) divided by height (in meters squared) was calculated for the selection of the sample. The skin fold thicknesses were measured using Holtain skin fold caliper, and approximated to the nearest 0.1 mm. The peripheral adiposity; sum of triceps and biceps skin fold thicknesses; and central adiposity; sum of subscapular, suprailiac and abdominal skin fold thicknesses; were calculated.

### Body Composition

Each participant was also examined by the TANITA Body composition Analyzer. As specified by the manufacturer, the unit was calibrated before testing. The participant stood on the foot board of the device, while he was holding the 2 handles carefully; each by one hand at the same time. By using his sex, age, weight and height approximated to the nearest unit, the percentage body fat (Fat %: an estimate of the fraction of the total body mass that is adipose tissue), fat mass (FM: an estimate of the fraction of the total body weight that is adipose tissue) and fat free mass (FFM: an estimate of the fraction of the total body weight that is not adipose tissue), total body water (TBW) and basal metabolic rate (BMR) were derived.

Ultrasound (US) examination to each participant female was done to evaluate visceral and subcutaneous fat above the umbilicus in cm. Intra-abdominal fat thickness measurement was obtained using the "Medison Sonoace X8" Ultrasonographic equipment. For the visceral fat, a 3.5 MHz transducer was transversely positioned 1 cm above the umbilical scar on the abdominal midline, without exerting any pressure over the abdomen. The visceral fat thickness attempted corresponding to the measurement in centimeters between the internal surface of the abdominal rectus muscle and the anterior aortic wall, while the subcutaneous fat thickness attempted corresponding to the measurement in centimeters between the skin and the external surface of the abdominal rectus muscle, during expiration.

### Biochemical Assessment

Early morning forearm venous blood samples (10 ml) were obtained from each female; before breakfast; for biochemical screening tests of fasting blood glucose and lipid profile; after 12-hours overnight fasting. Professional staff performed venipuncture. The blood samples were left to clot; sera were separated by centrifugation for 10 minutes at 5000 rpm then stored at - 80ºC until assays. Fasting blood glucose level was measured using a quantitative enzymatic colorimetric commercial kit provided by STANBIO according to the glucose oxidase method. Serum concentrations of total cholesterol (TC), triglycerides (TG) and high-density lipoprotein cholesterol (HDL-C) were measured using commercially available kits provided by STANBIO Laboratory Inc. (1261 North 18 Res. J. Medicine and Med. Sci., 8(1): 16-22, 2013. Main Street Boerne Texas 78006 USA). LDL-C was calculated according to an equation developed by *Friedewald et al.* [6] as follows:

LDL-C= Total cholesterol –Triglycerides/5+ HDL-C.

In terms of the females who were evaluated at the start and at the end of the programme, they were classified into three groups as follow: 30 females who had received dietary modification plan and underwent an exercise programme; 21 females made acupuncture therapy in addition to the healthy diet;

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and 25 females who received laser acupuncture therapy in addition to healthy diet.

Dietary modification plan (30 females): It was done under the supervision of a dietary consultant, and was followed to assess the impact of a dietary behavior modification intervention to reach the ideal weight for age and sex. Nutritional education and behavior modification were performed first. Then, performing adequate exercise (in form of walking for at least 150 min/week; each not less than 30 min) and eating a healthy low caloric diet through participation evaluation, designing the program and patient education, specific programs for each age and sex group; and daily classes for health. 30 females only, who followed and completed the program, were included in the study.

### The Prescribed Low Calorie Diet

The interview-based food survey was performed for all subjects by dieticians to specify previous food habits and possible anomalies in dietary behavior. The prescribed low calorie diet was balanced, with 15% as protein, 30 to 35% as fat and 50 to 55% as carbohydrate, on average, in order to provide about 1000 calories daily for three months for whole participants in this study.

Three different low caloric diets were designed to be followed by the females; each was followed for about 3 weeks. The main daily food items that were prescribed were: boiled egg, low fat milk and dairy products, broad bean dip (Foul medams), steamed and fresh vegetables, fruits, whole grains product, low fat meat, chicken and fish which were either boiled or roasted. Green tea, coffee, cinnamon and natural fresh fruit were recommended as beverages. All sugar sweets and carbonate beverages were prohibited.

It was checked that food was eaten as three daily meals and emphasized the need to have a substantial breakfast. They underwent an identical dietary monitoring programme, with an initial consultation, a check-up in the middle of the programme and another during the final sessions by a dietician who was blinded to the type of the programme that the subject had been following.

### Exercise Programme

Adequate exercise (in form of walking for at least 150 min/week each not less than 30 min) with light aerobic exercises for 5-10 min daily was performed.

### Acupuncture

Twenty one female received 12 body and auricular acupuncture sessions (once/week) using filiform disposable acupuncture needles with electrical stimulation. The acupuncture points were selected according to the theory of traditional Chinese medicine and the guidelines of WHO [7]. The total number of the points selected for obesity was 27 points: 3 auricular and 24 body acupuncture points each session.

### Laser Acupuncture

Twenty five female received 12 laser sessions (once/week) using semiconductor diode laser (soft laser) wave length 808 nm , power output 99 mw ,and operation mode CW at the same points selected for group1. Laser apparatus used was SL-202 Gallium-Aluminium-Arsenide Laser (GaAlAs). Laser beam was directed to each acupuncture point for 30 seconds. Laser dose was calculated according to World Association of Laser Therapy (WALT) [8].

### Statistical Analysis

Data were analyzed using the SPSS computer program, version 16.0. Means and standard deviation (SD) of all studied parameters were calculated separately. Paired dependant t-tests were performed to compare between the anthropometric measurements, body composition and biochemical assessment before and after intervention. Multivariate ANOVA test was used to compare between the three types of intervention before and after their use. P value of 0.05 was considered significant.

## Results

The female group who undergo nutritional intervention showed significant improvement in the BMI, skin fold thickness at triceps and biceps sites; peripheral adiposity index, body composition (decrease in fat% and Fat mass and increases in FFM and TBW) and visceral fat by US. However, after nutritional intervention; there were insignificant differences in subcutaneous fat, central adiposity index, fasting blood glucose and all parameters of lipid profile (Table 1).

The female group who undergo acupuncture intervention showed highly significant improvement in body composition (decrease in fat% and increases in FFM, TBW and BMR), visceral fat by US (decreased), lipid profile (decreased triglycerides, total cholesterol and LDL, and increased HDL), and decreased fasting blood glucose. However, after acupuncture intervention; there were insignificant differences in the skin fold thickness except at biceps SF, peripheral and central adiposity indices and subcutaneous fat (Table 2).

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**Table 1: Comparison between the body composition before and after the nutritional diet intervention using paired t-test.**

| | Before N=30 | | After N=30 | | t | P |
|---|---|---|---|---|---|---|
| | Mean | ±SD | Mean | ±SD | | |
| Anthropometry: | | | | | | |
| BMI (Kg/m$^2$) | 34.44 | 6.37 | 32.54 | 6.79 | 4.70 | 0.000 |
| Skin fold (mm): | | | | | | |
| Triceps | 32.87 | 9.51 | 28.15 | 8.65 | 2.32 | 0.029 |
| Biceps | 27.57 | 8.78 | 22.92 | 10.48 | 2.69 | 0.013 |
| Subscapular | 32.97 | 6.25 | 33.02 | 8.86 | 0.81 | 0.425 |
| Suprailiac | 28.07 | 6.83 | 26.08 | 7.78 | 1.18 | 0.250 |
| Abdominal | 32.93 | 6.09 | 33.77 | 8.61 | -0.21 | 0.838 |
| Peripheral Adiposity | 60.43 | 16.67 | 51.08 | 18.82 | 2.65 | 0.014 |
| Central Adiposity | 95.32 | 14.55 | 92.86 | 23.88 | 0.62 | 0.540 |
| Body composition: | | | | | | |
| Fat % | 43.21 | 5.95 | 37.79 | 6.80 | 7.72 | 0.000 |
| Fat mass (Kg) | 37.97 | 10.56 | 31.43 | 11.3 | 7.42 | 0.000 |
| Fat Free mass (Kg) | 48.41 | 4.96 | 49.53 | 5.75 | -2.08 | 0.047 |
| TBW | 35.45 | 3.62 | 36.25 | 4.20 | -2.06 | 0.049 |
| BMR (Kcl) | 1508.87 | 162. | 1514.50 | 187.54 | 0.32 | 0.251 |
| US at umbilicus: | | | | | | |
| Subcutaneous fat (cm) | 1.99 | 0.70 | 2.24 | 0.88 | -1.64 | 0.114 |
| Visceral Fat (cm) | 5.52 | 1.44 | 4.82 | 2.03 | 2.24 | 0.033 |
| Laboratory investigations: | | | | | | |
| Fasting Blood glucose (mg/dl) | 100.93 | 27.51 | 96.47 | 30.93 | 0.50 | 0.625 |
| Total Cholesterol (mg/dl) | 209.00 | 50.41 | 228.60 | 29.00 | -1.82 | 0.079 |
| Triglycerides (mg/dl) | 130.87 | 46.34 | 151.13 | 63.55 | -1.45 | 0.157 |
| HDL (mg/dl) | 51.07 | 12.26 | 48.40 | 10.36 | 1.05 | 0.303 |
| LDL (mg/dl) | 132.20 | 46.00 | 150.07 | 35.98 | -1.05 | 0.111 |

**Table 3: Comparison between the body composition before and after the laser intervention using paired t-test.**

| | Before N=25 | | After N=25 | | t | P |
|---|---|---|---|---|---|---|
| | Mean | ±SD | Mean | ±SD | | |
| Anthropometry: | | | | | | |
| BMI (Kg/m$^2$) | 41.38 | 10.53 | 38.54 | 9.60 | 5.01 | 0.000 |
| Skin fold (mm): | | | | | | |
| Triceps | 41.20 | 3.50 | 32.60 | 10.95 | 3.45 | 0.002 |
| Biceps | 39.00 | 2.81 | 28.40 | 12.22 | 4.13 | 0.000 |
| Subscapular | 41.25 | 2.34 | 31.44 | 11.93 | 2.85 | 0.010 |
| Suprailiac | 33.20 | 5.72 | 28.60 | 12.26 | 3.39 | 0.002 |
| Abdominal | 31.98 | 14.72 | 24.64 | 14.86 | 3.99 | 0.001 |
| Peripheral Adiposity | 80.20 | 3.67 | 61.00 | 23.03 | 3.84 | 0.001 |
| Central Adiposity | 113.50 | 12.93 | 84.68 | 36.08 | 3.22 | 0.004 |
| Body composition: | | | | | | |
| Fat % | 43.90 | 8.46 | 40.96 | 12.48 | 3.26 | 0.003 |
| Fat mass (Kg) | 43.72 | 14.67 | 38.78 | 16.89 | 5.51 | 0.000 |
| Fat Free mass (Kg) | 50.58 | 2.26 | 52.46 | 4.25 | 52.46 | 0.004 |
| TBW | 37.02 | 1.66 | 38.38 | 3.11 | 38.38 | 0.004 |
| BMR(Kcl) | 1562.00 | 95.90 | 1632.40 | 154.78 | 1632.40 | 0.000 |
| US at umbilicus: | | | | | | |
| Subcutaneous fat (cm) | 3.71 | 2.90 | 2.49 | 0.69 | 2.16 | 0.041 |
| Visceral Fat (cm) | 8.67 | 1.97 | 6.41 | 2.37 | 5.42 | 0.000 |
| Laboratory investigations: | | | | | | |
| Fasting Blood glucose (mg/dl) | 113.80 | 35.77 | 109.20 | 16.14 | 0.76 | 0.456 |
| Total Cholesterol (mg/dl) | 238.80 | 32.17 | 206.00 | 24.49 | 2.99 | 0.006 |
| Triglycerides(mg/dl) | 173.00 | 77.41 | 146.60 | 47.49 | 1.58 | 0.127 |
| HDL(mg/dl) | 52.80 | 16.92 | 60.60 | 23.21 | -1.63 | 0.116 |
| LDL(mg/dl) | 151.40 | 34.26 | 115.00 | 18.53 | 5.07 | 0.000 |

The female group who undergo laser intervention showed highly significant improvement in all the skin fold thickness at triceps, biceps, subscapular, suprailiac and abdominal sites, peripheral and central adiposity), body composition (decrease in fat% and Fat mass and increase in Fat free mass, TBW and BMR), subcutaneous and visceral fat by US (decreased), and some parameters of lipid profile (decreased total cholesterol and LDL) (Table 3).

**Table 2: Comparison between the body composition before and after the acupuncture intervention using paired t-test.**

| | Before N=21 | | After N=21 | | t | P |
|---|---|---|---|---|---|---|
| | Mean | ±SD | Mean | ±SD | | |
| Anthropometry: | | | | | | |
| BMI (Kg/m$^2$) | 36.40 | 3.65 | 35.77 | 5.84 | 1.16 | 0.261 |
| Skin fold (mm): | | | | | | |
| Triceps | 32.50 | 14.24 | 34.00 | 11.3 | -0.58 | 0.566 |
| Biceps | 33.23 | 9.86 | 26.67 | 11.39 | 2.16 | 0.043 |
| Subscapular | 34.00 | 4.35 | 29.67 | 11.24 | 1.38 | 0.182 |
| Suprailiac | 31.67 | 6.81 | 27.33 | 6.28 | 1.82 | 0.084 |
| Abdominal | 35.33 | 8.95 | 30.33 | 8.46 | 1.74 | 0.097 |
| Peripheral Adiposity | 65.73 | 23.92 | 60.67 | 22.55 | 0.91 | 0.372 |
| Central Adiposity | 101.00 | 19.92 | 87.33 | 25.87 | 1.64 | 0.116 |
| Body composition: | | | | | | |
| Fat % | 46.67 | 2.43 | 42.50 | 5.95 | 4.48 | 0.000 |
| Fat mass (Kg) | 42.83 | 8.32 | 41.37 | 13.19 | 0.78 | 0.443 |
| Fat Free mass (Kg) | 48.33 | 4.69 | 53.33 | 6.49 | -6.09 | 0.000 |
| TBW | 35.37 | 3.43 | 39.03 | 4.75 | -6.10 | 0.000 |
| BMR(Kcl) | 1522.33 | 168.07 | 1652.67 | 233.21 | -4.35 | 0.000 |
| US at umbilicus: | | | | | | |
| Subcutaneous fat (cm) | 2.81 | 1.32 | 2.80 | 1.03 | 0.08 | 0.935 |
| Visceral Fat (cm) | 4.90 | 1.79 | 4.00 | 2.18 | 3.12 | 0.005 |
| Laboratory investigations: | | | | | | |
| Fasting Blood glucose (mg/dl) | 110.00 | 12.32 | 86.00 | 12.15 | 37.95 | 0.000 |
| Total Cholesterol (mg/dl) | 233.33 | 7.95 | 208.67 | 31.44 | 4.74 | 0.000 |
| Triglycerides (mg/dl) | 169.33 | 21.66 | 142.00 | 27.95 | 8.34 | 0.000 |
| HDL (mg/dl) | 43.67 | 4.76 | 58.00 | 2.90 | -13.40 | 0.000 |
| LDL (mg/dl) | 154.00 | 4.66 | 141.33 | 13.76 | 6.30 | 0.000 |

Before intervention, the females who were selected to laser intervention had highly significant highest values of skin fold thickness at triceps, biceps, subscapular and suprailiac sites, peripheral and central adiposity, body composition (FFM, TBW and BMR), subcutaneous and visceral fat by US and some parameters of lipid profile (triglycerides, total cholesterol and HDL) (Table 4). However, the picture changed after intervention. The females who undergo acupuncture intervention became having highly significant highest values of body composition (fat mass, FFM, TBW, and BMR (Table 5).These augment the effect of laser intervention on subcutaneous fat distribution and the effect of acupuncture intervention on lipid profile.

**Table 4: Comparison between body compositions among the 3 groups before intervention using ANOVA.**

| | Nutritional group (N=30) | | Acupuncture group (N=21) | | Laser group (N= 25) | | F | P |
|---|---|---|---|---|---|---|---|---|
| | Mean | +SD | Mean | +SD | Mean | +SD | | |
| Anthropometry: | | | | | | | | |
| BMI (Kg/m$^2$) | 34.44 | 6.37 | 36.40 | 3.65 | 41.38 | 10.53 | 6.03 | 0.004 |
| Skin fold (mm): | | | | | | | | |
| Triceps | 32.87 | 9.51 | 32.50 | 14.24 | 41.20 | 3.50 | 6.33 | 0.003 |
| Biceps | 27.57 | 8.78 | 33.23 | 9.86 | 39.00 | 2.81 | 14.93 | 0.000 |
| Subscapular | 32.97 | 6.25 | 34.00 | 4.35 | 41.25 | 2.34 | 18.96 | 0.000 |
| Suprailiac | 28.07 | 6.83 | 31.67 | 6.81 | 33.20 | 5.72 | 4.40 | 0.016 |
| Abdominal | 32.93 | 6.09 | 35.33 | 8.95 | 31.98 | 14.72 | 0.62 | 0.539 |
| Peripheral Adiposity | 60.43 | 16.67 | 65.73 | 23.92 | 80.20 | 3.67 | 10.19 | 0.000 |
| Central Adiposity | 95.32 | 14.55 | 101.00 | 19.92 | 113.50 | 12.93 | 7.66 | 0.001 |
| Body composition: | | | | | | | | |
| Fat % | 43.21 | 5.95 | 46.67 | 2.43 | 43.90 | 8.46 | 1.99 | 0.144 |
| Fat mass (Kg) | 37.97 | 10.56 | 42.83 | 8.32 | 43.72 | 14.67 | 1.97 | 0.147 |
| Fat Free mass (Kg) | 48.41 | 4.96 | 48.33 | 4.69 | 50.58 | 2.26 | 6.43 | 0.003 |
| TBW | 35.45 | 3.62 | 35.37 | 3.43 | 37.02 | 1.66 | 6.36 | 0.003 |
| BMR(Kcl) | 1508.87 | 162.0 | 1522.33 | 168.07 | 1562.00 | 95.90 | 4.52 | 0.014 |
| US at umbilicus: | | | | | | | | |
| Subcutaneous fat (cm) | 1.99 | 0.70 | 2.81 | 1.32 | 3.71 | 2.90 | 5.82 | 0.005 |
| Visceral Fat (cm) | 5.52 | 1.44 | 4.90 | 1.79 | 8.67 | 1.97 | 33.49 | 0.000 |
| Laboratory investigations: | | | | | | | | |
| Fasting Blood glucose (mg/dl) | 100.93 | 27.51 | 110.00 | 12.32 | 113.80 | 35.77 | 1.58 | 0.212 |
| Total Cholesterol (mg/dl) | 209.00 | 50.41 | 233.33 | 7.95 | 238.80 | 32.17 | 5.08 | 0.009 |
| Triglycerides (mg/dl) | 130.87 | 46.34 | 169.33 | 21.66 | 173.00 | 77.41 | 5.06 | 0.009 |
| HDL (mg/dl) | 51.07 | 12.26 | 43.67 | 4.76 | 52.80 | 16.92 | 3.31 | 0.042 |
| LDL (mg/dl) | 132.20 | 46.00 | 154.00 | 4.66 | 151.40 | 34.26 | 3.09 | 0.051 |

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## Discussion

Measurement of body composition and fat distribution is important in a variety of clinical situations, including weight management. The primary goal of weight-loss programs is to maximize the loss of fat mass (FM) while preserving fat-free mass (FFM) [9].

**Table 5: Comparison between body compositions among the 3 groups after intervention using ANOVA.**

| | Nutritional group (N=30) | | Acupuncture group (N=21) | | Laser group (N= 25) | | F | P |
|---|---|---|---|---|---|---|---|---|
| | Mean | +SD | Mean | +SD | Mean | +SD | | |
| Anthropometry: | | | | | | | | |
| BMI (Kg/m$^2$) | 32.54 | 6.79 | 35.77 | 5.84 | 38.54 | 9.60 | 4.10 | 0.021 |
| Skin fold (mm): | | | | | | | | |
| Triceps | 28.15 | 8.65 | 34.00 | 11.3 | 32.60 | 10.95 | 2.133 | 0.126 |
| Biceps | 22.92 | 10.48 | 26.67 | 11.39 | 28.40 | 12.22 | 1.542 | 0.221 |
| Subscapular | 33.02 | 8.86 | 29.67 | 11.24 | 31.44 | 11.93 | .569 | 0.569 |
| Suprailiac | 26.08 | 7.78 | 27.33 | 6.28 | 28.60 | 12.26 | .474 | 0.625 |
| Abdominal | 33.77 | 8.61 | 30.33 | 8.46 | 24.64 | 14.86 | 4.332 | 0.017 |
| Peripheral Adiposity | 51.08 | 18.82 | 60.67 | 22.55 | 61.00 | 23.03 | 1.724 | 0.186 |
| Central Adiposity | 92.86 | 23.88 | 87.33 | 25.87 | 84.68 | 36.08 | 0.520 | 0.597 |
| Body composition: | | | | | | | | |
| Fat % | 37.79 | 6.80 | 42.50 | 5.95 | 40.96 | 12.48 | 1.80 | 0.173 |
| Fat mass (Kg) | 31.43 | 11.3 | 41.37 | 13.19 | 38.78 | 16.89 | 3.49 | 0.036 |
| Fat Free mass (Kg) | 49.53 | 5.75 | 53.33 | 6.49 | 52.46 | 4.25 | 3.43 | 0.038 |
| TBW | 36.25 | 4.20 | 39.03 | 4.75 | 38.38 | 3.11 | 3.43 | 0.038 |
| BMR(Kcl) | 1514.50 | 187.54 | 1652.67 | 233.21 | 1632.40 | 154.78 | 3.64 | 0.031 |
| US at umbilicus: | | | | | | | | |
| Subcutaneous fat (cm) | 2.24 | 0.88 | 2.80 | 1.03 | 2.49 | 0.69 | 2.50 | 0.089 |
| Visceral Fat (cm) | 4.82 | 2.03 | 4.00 | 2.18 | 6.41 | 2.37 | 7.33 | 0.001 |
| Laboratory investigations: | | | | | | | | |
| Fasting Blood glucose (mg/dl) | 96.47 | 30.93 | 86.00 | 12.15 | 109.20 | 16.14 | 6.152 | 0.003 |
| Total Cholesterol (mg/dl) | 228.60 | 29.53 | 208.67 | 31.44 | 206.00 | 24.49 | 5.147 | 0.008 |
| Triglycerides (mg/dl) | 151.13 | 63.55 | 142.00 | 27.95 | 146.60 | 47.49 | .203 | 0.817 |
| HDL (mg/dl) | 48.40 | 10.36 | 58.00 | 2.90 | 60.60 | 23.21 | 5.134 | 0.008 |
| LDL (mg/dl) | 150.07 | 35.98 | 141.33 | 13.76 | 115.00 | 18.53 | 12.928 | 0.000 |

The current study indicated that dietary intervention program improve body composition with significant different decrease in fat mass and Fat %, visceral fat and increase in fat-free mass. The result of this study agreed with that of Balliett and Burke [10] who found improvement for body composition and lipid profile with significant difference when studied a pre-post diet intervention in 36 female and 13 males. However, current study found insignificant differences in lipid profile as they stated. Varady and Jones [11], gave an explanation for these findings as lipid alterations can be affected by a number of dietary approaches or specific dietary supplements.

The literature contains evidence that acupuncture treatment can produce body weight reductions in obese patients. However, it's physiologic and anorexigenic effects are not well understood [12]. Additionally, decreases of visceral fat, resulting from weight loss have been related to reductions in blood lipid levels [13]. In present study, it was indicated that acupuncture intervention program improved body composition with significant difference decrease in Fat %, visceral fat and increase in fat-free mass and excellent improvement lipid profiles with high significant difference decreases in fasting blood glucose, triglycerides, total cholesterol and LDL-C, as well as increases in HDL-C levels.

A similar pattern of changes have been proved in many other studies. Following acupuncture, changes in triglyceride, total-cholesterol, LDLC and HDL-C changed has been reported as indicated by Liu et al [14] in obese people from China and Wang et al. [15] in experimental study. Li and Wang [16], from China also have reported significant changes in total and LDL cholesterol during acupuncture therapy. In Iran, Abdi et al. [3], studied the weight loss of 196 subjects and stated that acupuncture intervention was associated with improvement in lipid profile with significant difference in TC, LDL-C, but not significant difference in fat %. However, some studies in agree with current lipid profile but with no changes for HDL-C as Cabioglu and Ergene [17] when studied obese women from Turkey and Sun and Xu [18] who studied obese patients from Chongqing in China, this may be explained by application of different acupoints. These changes in lipid metabolism have been suggested that may be caused by increase in the serum betaendorphin levels [17].

Few papers dealing with laser acupuncture referred to its application in the treatment of obesity [4]. Current results showed that weight loss by laser acupuncture reduces significantly peripheral and central adiposity, body composition, fat%, subcutaneous and visceral fat by US .The mechanism by which laser acupuncture reduced fat may include the systemic response and local response. Neira et al [19] reported that low-level laser therapy could release stored fat in adipocytes by the opening of cell membrane associated pores after a few minutes treatment. Caruso-Davis and his colleagues [20], confirmed the finding of Neira et al. [19], in the investigation of the efficacy of low-level laser therapy for spot fat reduction and at the same time found that low-level laser irradiation over the waist could significantly reduce waist girth in healthy adults, which is a typical phenomenon of indirect photobio-modulation. Liu et al.[4] suggested waist girth losses after laser acupuncture may partly result from the direct effect of low-level laser irradiation on fat tissue, when studied twenty-eight female from China and stated Laser acupuncture reduce body fat mass and lower body weight in manner in obese persons.

Laser intervention current results, also, showed improvements in lipid profile with significant difference in total cholesterol, and LDL- cholesterol. The study of Avci et al. [21], supported these results where they reported that laser has a potential to be used in fat and cellulite reduction as well as in improvement of blood lipid profile without any significant side effects.

In summary, the present study recommended that every obese female must do lipid profile and fasting blood glucose analysis before weight-loss intervention to take the decision of which method should be used. If there is normal lipid profile and fasting blood sugar, nutritional intervention is enough to reduce body composition. While, in cases of normal

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fasting blood glucose and impaired triglycerides and LDL-C, laser acupuncture is recommended. Finally, if there is impaired fasting blood glucose with impaired lipid profile, acupuncture is recommended.

The effect of nutritional intervention on body composition is augmented by use of laser acupuncture beside it. While using acupuncture beside healthy diet did not improve its effect on body composition. Nutritional intervention alone did not improve either the lipid profile or fasting sugar, while laser acupuncture significantly improve triglycerides and LDL-C and acupuncture significantly improve total lipid profile (TG,TC, HDL-C and LDL-C) and fasting blood sugar.

# Acknowledgments

# References

1. Tang J, Abraham C, Greaves C, Yates T. Self-directed interventions to promote weight loss: a systematic review of reviews. J Med Internet Res. 2014;16(2):e58.

2. Sénéchal M, Arguin H, Bouchard D, Carpentier A, Ardilouze J , Dionne I, Brochu M. Effects of rapid or slow weight loss on body composition and metabolic riskfactors in obese postmenopausal women. A pilot study. Appetite. 2012; 58:831–834.

3. Abdi H, Zhao B, Darbandi M, Ghayour-Mobarhan M, Tavallaie S, et al. The effects of body acupuncture on obesity: anthropometric parameters, lipid profile, and inflammatory and immunologic markers. ScientificWorldJournal. 2012: 603539.

4. Liu X, Zhang J, Lu J, and Yi Liu T. Laser Acupuncture Reduces Body Fat in Obese Female Undergraduate Students. International Journal of Photoenergy. 2012.

5. Hiernaux J, Tanner JM. Growth and physical studies. In: Human Biology: A guide to field methods. Weiner JS, Lourie SA, editors. Oxford. U.K: IBP. London: Blackwell Scientific Publications, 1969.

6. Friedewald WT, Levy RI, Fredrickson DS. Estimation of the concentration of low-density lipoprotein cholesterol in plasma, without use of the preparative ultracentrifuge. Clin Chem. 1972;18(6):499-502.

7. WHO 2008: WHO Standard Acupuncture Point Location in the Western Pacific Region, Jun 25, 2008:249.

8. FAD Laser Information 2009: Compliance Guide For Laser Products, US Department of Health and Human Services Public Health Service FAD Center for Devices and Radiological Health HHS publication FDA, 2009: 86-8260.

9. Johnstone A, Faber p, Gibney R, Lobley G, Stubbs R, Siervo. Measurement of body composition changes during weight loss in obese men using multifrequency bioelectrical impedance analysis and multi-compartment models. Obesity Research & Clinical Practice. 2014;8: e46—e54.

10. Balliett M, Burke JR. Changes in anthropometric measurements, body composition, blood pressure, lipid profile, and testosterone in patients participating in a low-energy dietary intervention J Chiropractic Med.2013;12:3-14.

11. Varady KA, Jones PJ. Combination diet and exercise interventions for the treatment of dyslipidemia: an effective preliminary strategy to lower cholesterol levels? J Nutr. 2005; 135:1829.

12. Shiraishi T, Onoe M, Kojima T, Kageyama T, Sawatsugawa Si, Sakurai Ki, Yoshimatsu H, Sakata T. Effects of bilateral auricular acupuncture stimulation on body weight in healthy volunteers and mildly obese patients. Exp Biol Med (Maywood). 2003; 228(10): 1201-7.

13. Leenen R, van der Kooy K, Droop A, Seidell JC, Deurenberg P, Weststrate JA et al. Visceral fat loss measured by magnetic resonance imaging in relation to changes in serum lipid levels of obese men and women. Arterioscler Thromb. 1993; 13: 487–494.

14. Liu Z, Sun F, Li J et al. Prophylactic and therapeutic effects of acupuncture on simple obesity complicated by cardiovascular diseases. Journal of Traditional Chinese Medicine. 1992;12(1):21–29.

15. Wang S, Xu H, Xiao H. Effect of high-frequency electroacupuncture on lipid metabolism in obesity rats. Zhen Ci Yan Jiu. 2008;33(3): 154–158.

16. Li L, Wang Z. Clinical therapeutic effects of body acupuncture and ear acupuncture on juvenile simple obesity and effects on metabolism of blood lipids. Zhongguo Zhen Jiu. 2006; 26: 173–176.

17. Cabioglu M, Ergene N. Electroacupuncture therapy for weight loss reduces serum total cholesterol, triglycerides,and ldl cholesterol levels in obese women. The American Journal of Chinese Medicine. 2005; 33(4): 525–533.

18. Sun Q, Xu Y. Simple obesity and obesity hyperlipemia treated with otoacupoint pellet pressure and body acupuncture. Journal of Traditional Chinese Medicine. 1993; 13(1):22–26.

19. Neira R, Arroyave J, Ramirez H et al. Fat liquefaction: effect of low-level laser energy on adipose tissue. Plastic and Reconstructive Surgery. 2002; 110(3):912–922.

20. Caruso-Davis M, Guillot T, Podichetty V et al. Efficacy of low-level laser therapy for body contouring andspot fat reduction. Obesity Surgery. 2011; 21(6):722–729.

21. Avci P, Nyame TT, Gupta GK, Sadasivam M, Hamblin MR. Low-level laser therapy for fat layer reduction: a comprehensive review. Lasers Surg Med. 2013;45(6):349-57.

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