Physical Therapy and Rehabilitation
ISSN 2055-2386 | Volume 5 | Article 9

HOAJ
Herbert Open Access Journals

Original Research Open Access

Effect of electro acupuncture versus low level laser therapy on lipid profile in obesity

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Abstract

Background: Obesity is becoming increasingly common in the general population and is associated with several other conditions such as hypertension, diabetes, dyslipidemia, and cardiovascular disease. Abnormal blood lipids have been firmly established as a modifiable risk factor for the development of cardiovascular disease. However, medical practice in the area of lipid management is highly variable and has not been aggressively pursued for large number of patients that may be at risk.

Purpose: This study aimed to find out the effectiveness of electro acupuncture versus low level laser therapy on lipid profile in obesity.

Methods: Forty five patients including both male and female with mean age 39.93±3.47 and BMI 37.98±1.24 were enrolled in the study and divided randomly in to three groups. Group A had received LLLT (632.8nm-16J/cm^2) and aerobic exercises. Group B had received electro acupuncture andaerobic exercises. Group C had received aerobic exercises only. Blood samples were taken from each patient for analysis before initiation of the program and after completion of study.

Results: Study showed significant improvement in three groups after the treatment but in comparison electro acupuncture group showed significant results with respect to low level laser therapy group and control group.

Conclusion: Significant difference was found between electro acupuncture and low level laser therapy approaches in treating obesity. Findings of this study revealed the fact that treatment sessions of electro acupuncture were superior to low level laser therapy group in terms ofsignificant improvement in cholesterol, LDL, HDL and TG levels in patients with obesity.

Keywords: Electro Acupuncture, Low Level Laser Therapy, Lipid Profile, Obesity

Introduction

Obesity represents one of the most serious global health issues. The prevalence of obesity has increased at an alarming rate over the past 2 decades to the extent that it could be considered a pandemic. Over 3000 Million adults worldwide are obese [1]. Obesity is a determinant factor in the development of cardiovascular diseases (CV), and is associated to an increased incidence of hypertension, diabetes, metabolic syndrome and cardiac target organ damage [2].

Elevated triglyceride levels, small low density lipoproteins (LDL) particles, and diabetes in women and men were also strongly associated with higher BMI values in women and men. Also it was found that increased BMI is associated with an adverse effect on increasing risk of coronary heart diseases (CHD). These results emphasize the importance of excess body fat as a public health issue [3].

Abnormal blood lipids have been firmly established as a modifiable risk factor for the development of CV disease. However medical practice in the area of lipid management is highly variable and has not been aggressively pursued for large number of patients that may be at risk [4].

Lipid profile (Lipid test, cholesterol test, lipoprotein profile) is

 doi: 10.7243/2055-2386-5-9

used to diagnose a lipid disorder. It is a detailed blood test for cholesterol. The subject should to be fast for 9-12 hours prior to the test. Routinely performed on plasma include measurement of total cholesterol (TC), triglyceride (TG), high density lipoproteins (HDL), and LDL [**5**]. Due to the "hidden" nature of abnormal lipid profiles, hypercholesterolemia is referred to as the "silent killer" as individuals frequently overlook the need to have regular cholesterol tests [**6**].

There are several different modalities for treatment of obesity one of which is acupuncture. It would be desirable to control obesity by safe and effective treatment modalities, and among the different methods acupuncture is one of the most popular complementary treatments. Acupuncture is performed by stimulating particular points on the skin called acupoints. Among several methods used for acupoints stimulation [**7**], needling is one of the most common methods, and stimulation can either be manual or electrical (electro acupuncture). Acupuncture has been used in the treatment of several diseases including obesity [**8**,**9**] and also immune-related diseases, such as allergic disorders, autoimmune diseases, and immunodeficiency-syndromes [**10**,**11**].

Low-level laser therapy (LLLT) has evolved as an efficient tool to provide therapeutic outcomes for a variety of medical indications. Recent studies on LLLT indicate "liquefaction" or release of stored fat in adiposities by opening of the cell membrane after a short treatment. Fat cells that were not exposed to the laser treatment looked like round grapes. Eighty percent of the fat was released from the fat cells after 4 min of laser light exposure and 99% was released after 6 min of exposure. After exposure to the laser light, pores in fat cells were visible by scanning electron microscope. It was presumed, but not demonstrated, that the fat was released from these pores, taken up in the lymphatic and reesterified in other tissues or metabolized for energy [**12**]. Exercise is extremely important throughout a men's lifetime particularly as he gets older. Regular exercise benefits the heart and bones, regulate weight, contribute to sense of overall well-being and improves mood. If man is physically inactive, he is more subjected to CHD, obesity, high blood pressure, diabetes and osteoporosis [**13**].

There is little published research regarding which tools can be used with confidence. This research is designed to provide researchers and clinicians with a guide to the current and emerging management tools specifically associated with visceral obesity research and practice.

Therefore, the research questions for this study were:

Is there a significant effect of low level laser therapy (LLLT) on lipid profile in obesity? Is there a significant effect of Electro Acupuncture lipid profile in obesity? Is there a significant difference between effect of (LLLT) and Electro Acupuncture on lipid profile in obesity?

Materials and methods

Subjects

Forty five patients of both gender (34 females, 16 males) had high lipid profile value (LDL Low Density Lipoprotein from 130 to 160mg/dl -HDL High Density Lipoprotein from 30 to 40mg/dL-TG Triglycerides from 150 to 250 mg/dL -TC Total cholesterol from 200 to 300 mg/dL) participated in this study, their ages ranged from 35 to 45 years. All patients with moderate obesity mean (BMI ranged from 35 to 39.9 kg/m^2). They were recruited from new Qasr El Ainy teaching hospital outpatient clinics. All participants signed an informed consent prior to the study. Patients with a history of photosensitivity, Alcohol abuse and smokers, Hypothyroidism, lymphatic obstruction and Patient suffering from any uncontrolled conditions (sever hypertension, renal failure, unstable angina, diabetes mellitus, myocardial infarction, cardiovascular instability and severe autonomic neuropathy) which may affect treatment progressions were excluded from the study. Patients were randomly assigned into three groups with fifteen patients in each group, Group A, patients in this group received low level laser therapy (632.8nm-16J/cm^2), aerobic exercises (walking on treadmill for 30 min) twice weekly for 8 weeks. Group B, patients in this group received electro acupuncture, aerobic training (walking on treadmill for 30 min) twice weekly for 8 weeks. Group C, patients in this group received aerobic exercises only (walking on treadmill for 30 min) twice weekly for 8 weeks. The randomization was done by a colleague independent and blindedto the study who took a sealed opaque envelope from a box following a numerical sequence; within which the group description was randomly placed within them.

Instrumentation

A) Measurement instrumentation

1- Laboratory Investigation

1. Measurement of fasting serum lipid profile

Blood sample

A three milliliter-sample of venous blood had been drawn from the antecubital vein after 12-14 hours fast from all patients before the initiation of the program and after the completion of the study (i.e. at the end of the 8th week) to be assessed for measurement of fasting serum lipid profile (TC,TG,HDL,LDL) [**14**].

2- Standard Weight Scale (SWS)

Standard weight scale was used to measure the weight in kilogram and height in meter for all male patients before starting treatment. In the most widely used classification of body mass, body weight is expressed in terms of body mass index (BMI).

B) Treatment Instrumentation

1-Lapex 2000 BCS lipolaser

The Lapex 2000 BCS (LipoLaser) is a 100% Non-invasive, laser-based, spot fat reduction and body contouring system. Offering the relaxation of a 40-minute massage with the benefits of inch loss without a painful incision, the Lapex 2000 BCS (LipoLaser) uses laser energy to safely (and painlessly) pen-

doi: 10.7243/2055-2386-5-9

Figure 1. Standard weight scale.

Figure 2. Siemens dimension RXL.

Figure 3. The protective eye glasses.

etrate the skin and target specific adipose (or fat cells) [12].

2- Protective Eye Glasses

These protective eye glasses were worn during application of laser to avoid permanent eye damage resulting from direct exposure to the beam [15].

3- Electro Acupuncture

An electrical stimulator was used with an output of programmed pulse voltage, 30-40Hz, dense-disperse wave, 390 μS square pulse, and at a maximal tolerable intensity, 500Ω (12-23V) (a strong but not painful sensation to the patient). Each acupuncture treatment lasted for 20 minutes. All subjects were asked to receive two treatment sessions per week for a total of 8 weeks [16].

4-Treadmill

All patients in the study attended to the program of walking 30 minutes on treadmill 2 times per week for 8 weeks according to the following parameters;-

Warm up: 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.

Exercise: walking on treadmill 20 minutes at (60–75) % of the heart rate reserve (HRR). The treadmill speedand inclination were increased gradually, and adjusted for each subject according to her/his intensity based on the target heart rate. Karvonen equation: [(maximum heart rate-resting heartrate · % intensity) + resting heart rate]. A polar heart rate monitor was used to monitor the heartrate every 5 min during exercise. If the target heart rate exceeded the calculated one, the treadmill speed was slowed down until heart rate adjustment took place.

Cool down: 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 [17].

Treatment procedures

-Patient preparation for all groups

The purpose of the study was explained by researcher to each participant.

All patients were instructed not to eat before the test by 12 hours for lipid profile testing. Each participant would sign written approval Consent form. The patients were instructed not to eat heavy meal for two hours before training. The laboratory investigations were performed before the beginning of the program and after completion of the study (after the end of 8th week).

Procedures of electro acupuncture

Eight acupuncture points on the abdomen, including Tianshu (ST-25) both sides, Weidao (GB-28) both sides, Zhongwan (REN-12) Shuifen (REN-9) Guanyuan (REN-4) Sanyinjiao (SP-6), acupuncture needling with manipulation and use the normal

doi: 10.7243/2055-2386-5-9

electric lines of the electric acupuncture machine (Ying Lee, KWD 808) to 4 needles on the abdomen, two needles (ST-25) and (GB-28) on each side, was applied for 20 minutes. The needles were connected to an electrical stimulator. Electricity was generated as an output of programmed pulse voltage, 30-40Hz, dense-disperse wave, 390 μS square pulse, and at a maximal tolerable intensity, 500Ω (12-23V) (a strong but not painful sensation to the patient). Each acupuncture treatment lasted for 20 minutes. All subjects were asked to receive two treatment sessions per week for a total of 8weeks [16].

Procedures of Lapex 2000BCS laser application

Each patient was placed into a comfortable supine lying position. The therapist position strides standing beside patient for observation any problems. Both the patient and the therapist wore protective eye glasses. Two smaller probes lasers were placed over the appropriate lymphatic glands and hold in place. The Lapex BCS lipolaser was switched on for 10 minutes, then was re-located and was turned on for other 10 minutes; this was repeated until all the spot fatty areas were treated, usually in 40 minutes.

In order to increase the body's ability to remove the triglycerides (the broken down fat cells) it will be necessary to assist this natural process by increasing the metabolic rate. This can be achieved in a number of ways but they all involve some form of exercise. The use of a whole body vibration plate machine for about 10 minutes is effective right after the treatment. The treatment was applied twice per week for 2 months [12].

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. Threshold for statistical significance was set as p<=0.05. Kolmogorov-smirnov test was used, that reflect the data was normally distributed, so parametric statistical tests in the form of Multivariate Analysis of Variance (MANOVA) test was used to study significance difference between pre and post treatment results among three groups (A, B and C).

Results

General Characteristics of the Subjects

Total cholesterol

MANOVA test revealed that there were no statistical significant differences between the three groups for the pretreatment. While post treatment there were statistical significant differences between the three groups mean values as shown in **Tables 1** and **2**.

Low density lipoprotein

MANOVA test revealed that there were no statistical significant differences between the three groups for the pretreatment. While post treatment there were statistical significant differences between the three groups mean values as shown in **Table 3**.

High density lipoprotein

MANOVA test revealed that there were no statistical significant differences between the three groups for the pretreatment. While post treatment there were statistical significant differences between the three groups mean values as shown in **Table 4**.

Triglyceride

MANOVA test revealed that there were no statistical significant

Table 1. General characteristics of subjects in the study groups.

General characteristics	Group A	Group B	Group C	F-value	P-value
Age (yrs)	39.53± 2.82	39.93± 3.47	39.26± 2.96	0.176	0.839*
Weight (kg)	95.33± 4.98	94.2± 6.81	93.46± 6.57	0.288	0.571*
Height (cm)	168.66±2.79	167.93± 3.34	168.4± 2.87	2.879	0.067*
BMI (kg/m^2)	33.56±1.83	32.01±2.25	33.46±2.1	2.637	0.083*

P: probability, *Non-significant as P>0.05.

Table 2. Inter and intra group comparison among mean values of total cholesterol in the three groups measured pre- and post-treatment.

Total cholesterol	Group A	Group B	Group C	F- value	P-value
Pre-treatment	231.93± 26.88	227.2± 14.36	221.46± 13.6	2.348	0.108*
Post-treatment	188.33± 26.39	182± 11.5	213.06± 12.54	0.74	0.53*
% of improvement	18.8%	19.8%	3.79%		
t-value	19.39	16.92	3.84		
P-value	0.001**	0.002**	0.072*		

P: probability *Non-significant as P>0.05. ** Significant as p<0.05.

doi: 10.7243/2055-2386-5-9

differences between the three groups for the pretreatment. While post treatment there were statistical significant differences between the three groups mean values as shown in **Table 5**. Least significant difference (LSD) test between groups for lipid profile post-study **Table 6**.

Discussion

The current research revealed meaningful differences and improvements occurred for lipid profile. However, the present study revealed that electro acupuncture had the upper hand than LLLT as obesity management protocol. Those who received acupuncture and aerobic training (walking on treadmill for 30 min) twice weekly for 8 weeks (group B) had highly significant improvement in all the anthropometric measurements (total cholesterol, triglycerides, high density lipoproteins and low density lipoproteins) than those who received LLLT and aerobic training (walking on treadmill for 30 min) twice weekly for 8 weeks (group A) those who

Table 3. Inter and intra group comparison among mean values of LDL in the three groups measured pre- and post-treatment.

LDL	Group A	Group B	Group C	F- value	P-value
Pre-treatment	153.06± 17.27	146.2± 12.23	145.86± 13.04	2.956	0.087*
Post-treatment	125.2± 15.7	104.8± 12.65	129.53± 12.55	0.74	0.53*
% of improvement	18.2%	28.3%	11.19%		
t-value	5.65	34.66	9.26		
P-value	0.003**	0.001**	0.123*		

P: probability *Non-significant as P>0.05. ** Significant as p<0.05.

Table 4. Inter and intra group comparison among mean values of HDL in the three groups measured pre- and post-treatment.

HDL	Group A	Group B	Group C	F- value	P-value
Pre-treatment	37.53±4.18	37.26±3.08	38.86±2.8	1.086	0.347*
Post-treatment	49.33±3.28	53.26±3.43	40.25±2.7	78.39	0.001**
%of improvement	31.4%	42.9%	3.57%		
t-value	-13.85	-14.16	-7.35		
P-value	0.002**	0.001**	0.332*		

P: probability *Non-significant as P>0.05. ** Significant as p<0.05.

Table 5. Inter and intra group comparison among mean values of triglyceride in the three groups measured pre- and post-treatment.

Triglyceride	Group A	Group B	Group C	F- value	P-value
Pre-treatment	156.73± 4.94	157.26± 7.47	154±6.15	1.168	0.321*
Post-treatment	122.6±6.32	119.93±5.39	137.66±6.13	12.28	0.002**
%of improvement	21.77%	23.73%	3.57%		
t-value	15.45	11.26	-7.35		
P-value	0.001**	0.001**	0.332*		

P: probability *Non-significant as P>0.05. **Significant as p<0.0

Table 6. LSD test between groups for lipid profile post-study.

Variable	Cholesterol		LDL		HDL		Triglyceride	
	Mean difference	P-value	Mean difference	P-value	Mean difference	P-value	Mean difference	P-value
Group A vs. group B	6.33	0.044**	20.4	0.001**	-3.93	0.001	-17.33	0.001**
Group A vs. group C	-24.73	0.001**	-4.33	0.012**	9.06	0.002**	-25.06	0.001**
Group B vs. group C	-31.06	0.001**	-24.73	0.001**	13.01	0.001**	-17.73	0.002**

P: probability **Significant as p<0.05

doi: 10.7243/2055-2386-5-9

received aerobic training (walking on treadmill for 30 min) twice weekly for 8 weeks (group C).

The results of electro acupuncture group (B) were consistent with Lee et al. [18] who reported that electro acupuncture lead to normalization of blood serum lipids, reduction of body mass and decrease fatty tissues content. They attributed the effect of acupuncture to its beneficial effect on hypothalamus pituitary axis. Adipose tissue in liver produce cAMP by the membranous enzyme adenylatecyclase that acts on ATP producing cAMP and liberating pyrophosphate; cAMP is involved in the activation of phosphorylase helping glycogenolysis and on lipase enzyme helping lipolysis [19,20]. While Zhou-hong [21] stated that acupuncture can provide good therapeutic effects for simple obesity, as after twenty sessions, the body weight, the serum total cholesterol (TC), the fasting triglyceride (TG) and low-density lipoprotein (LDL) were significantly changed. On the other hand, Acupuncture also increases the metabolic rate of the body and aids in burning more calories. It stimulates the release of hormones called endorphins that help to reduce the body fat. Whereas, this effect was not seen by exercise and diet [22].

Also, the results were confirmed by Zhang et al. [23] was demonstrating that acupuncture therapy significantly reduces BMI and abdominal adipose tissue by reducing abdominal visceral fat content without significant changes in body weight, waist circumference, hip circumference, WHR, abdominal subcutaneous adipose tissue. Thus, the use of acupuncture therapy to selectively target a reduction in abdominal visceral fat content should become more important and more popular in the future.

In accordance with current results, Chu et al. [19], found that acupuncture reduces triglycerides and total cholesterol levels in overweight and obese subjects, as acupuncture has a good regulatory effect on lipid metabolism and plasma cycling adenosine monophosphate(cAMP); that is involved in the activation of phosphorylase helping glycogenolysis and on lipase enzyme helping lipolysis. They attributed the effect of acupuncture to its beneficial effect on hypothalamus-pituitary axis.

Furthermore, Cabioglu and Ergene [24] stated that a significant decrease of triglyceride, total cholesterol, LDL-C but no changes in HDL-C in acupuncture group when compared with controls. They suggested that these changes in lipid metabolism may be caused by increase in the serum beta endorphin levels. Moreover, Li and Wang [25] have reported significant changes in total cholesterol and LDL-c during acupuncture therapy when compared with control subjects.

The results of low LLLT agreed with Jackson and colleges which reported a significant decrease in the TC level after application of low-level laser therapy around abdomen for 20 min, 3 sessions/week for 2 weeks [26].

One explanation of this improvement is that laser stimulates the lipid peroxidation and increases the superoxide production. Increased production of the reactive oxygen species breaks down lipids found in the cell membrane. Lipids and fatty material pass through transitory pores formed in the cell membrane and enter the interstitial space where the lymphatic system removes the fatty debris [27].

Also, the results were confirmed by Pinar Avci [28], who reported that low level laser therapy started being investigated as an adjuvant to liposuction, for noninvasive body contouring, reduction of cellulite, and improvement of blood lipid profile. LLLT may also aid autologous fat transfer procedures by enhancing the viability of adipocytes. However, the underlying mechanism of actions for such effects still seems to be unclear. It is important, therefore to understand the potential efficacy and proposed mechanism of actions of this new procedure for fat reduction.

Regarding traditional treatment in group (C), the results revealed significant improvement in the current group but less than group (A) and group (B) with $P<0.05$.

In an attempt to explain the previous results Manson [13] reported that continuous physical activity from three to five sessions per week every session not less than 20 minutes helps to decrease lipid profile, blood pressure, osteoporosis and blood sugar level in both males and female's patients who had obesity associated high lipid profile. Physical activity has adverse proportional relationship with obesity and lipid profile.

Abnormal blood lipids have been firmly established as a modifiable risk factor for the development of CV disease. However medical practice in the area of lipid management is highly variable and has not been aggressively pursued for large number of patients that may be at risk.

Conclusion

There was a significant difference between electro acupuncture and low level laser therapy approaches in treating obesity. Findings of this study revealed the fact that treatment sessions of electro acupuncture were superior to low level laser therapy group in terms of significant improvement in cholesterol, LDL, HDL and TG levels in patients with obesity. So the best treatment intervention for obese patients with abnormal lipid profile can be obtained from electro acupuncture. This study was limited mainly to have long term follow up study. So, further research is needed, to include larger population, perform follow up study.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

Authors' contributions	RAM	AMY	HKA
Research concept and design	✓	✓	✓
Collection and/or assembly of data	✓	✓	✓
Data analysis and interpretation	✓	✓	✓
Writing the article	✓	✓	✓
Critical revision of the article	✓	✓	✓
Final approval of article	✓	✓	✓
Statistical analysis	--	--	--

doi: 10.7243/2055-2386-5-9

Acknowledgements
Many thanks, to all patients who participated in this study for their co-operation.

Publication history
Editor: Mohammad H. Hadadzadeh, Wheeling Jesuit University, USA.
Received: 21-Apr-2018 Final Revised: 20-Jun-2018
Accepted: 22-Jun-2018 Published: 04-Jul-2018

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Citation:
Mohamed RA, Yousef AM and Ata HK. **Effect of electro acupuncture versus low level laser therapy on lipid profile in obesity**. *Phys Ther Rehabil*. 2018; **5**:9. http://dx.doi.org/10.7243/2055-2386-5-9