



*Original article*

## The Effect of Low Frequency Electrotherapy on Anthropometry in Overweight Women of Child Bearing Age

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### ABSTRACT

**Purpose:** Health and wellness are the focus of not only health and medical research but also part of the growing market for training programmes and health and wellness clinics. The holistic approach to health and wellness requires an integrated and multidisciplinary approach. Individuals now seek assistance to improve their anthropometric parameters in an effort towards well-being and health. The purpose of the current study was to determine the effects of low frequency electrical stimulation in altering the anthropometric measurements in a selected cohort of overweight women. **Materials and Methods:** Fourteen women of child bearing age were randomly allocated to the control and experimental groups. The intervention consisted of a course of ten, 45 minute low frequency electrical treatments (LFET), three times a week over a period of four weeks. Height, weight, circumference of waist, hips, and thighs were measured. Body fat was measured using a Body Stat machine. Data was analyzed using paired and independent samples t test at  $p < 0.05$ . **Results:** Body fat decreased significantly from 33.79% to 32.26% in the experimental group. Weight and BMI decreased from 72.5 to 70.93 and 26.8 to 26.21 respectively in the experimental group. Decreases in circumferences of body parts were also significant in the intervention group compared to the control. **Conclusions:** LFET significantly decreased anthropometric parameters in the participants.

**KEYWORDS:** Anthropometry, complementary alternative medicine (CAM), Low frequency electrical stimulation

### INTRODUCTION

Health and wellness exemplified by acceptable Body Mass Index (BMI) and a shapely body has been the focus of attention not only in the health care field but also in the wellness and beauty industry. Anecdotally, it is clear that more people are seeking assistance from spas and alternative health care practitioners for a range of "look and feel good" options. An individual's weight status provides a dynamic physical marker which that person may use to form and develop self-appraisals over time [1,2]. Dissatisfaction with body image results in finding alternative means towards correction.

Hawket al. [3] reported that substantial proportions of respondents in a United States survey reported using complementary and alternative medicines for wellness and disease prevention. Bodeker et al. [4] confirmed this based on their study in the United Kingdom, that traditional, complementary, and alternative medicine constitutes a major source of health care in developing countries and is also widely utilized, typically by around 50% of the population, in industrialized countries.

Allopathic medicine links wellness to BMI which when greater than  $25 \text{ kg/m}^2$  is a risk factor for a range of chronic diseases and mortality [5]. The quest to achieve acceptable BMI and body contours is supported by the proliferation of devices and diet plans, many of which are not evidence based, but attractive to the obese individual [6]. Obese persons who fail on fad diets or programs [7,8] turn to cosmetic surgery, bariatric surgery or liposuction [9,10], which are expensive and may result in medical complications [11].

The simple need to look and feel good diverts attention to interventions that are deemed effective, efficient and affordable. Anthropometric reductions, commonly referred to as body contouring through the reduction of body fat and cellulite attracts significant numbers of individuals who have developed issues related to self-image [1,2]. The suggested regimen include an exercise and diet plan supplemented by other modalities commonly used in the aesthetic or plastic surgery specialties of allopathic medicine or somatology. The techniques and modalities used by somatologists have

not been tested empirically but are used widely by the public.

The lack of evidence for the effectiveness of alternate interventions results in these modalities being considered as the “quack” armamentaria. However, complementary and alternative therapies are receiving more attention by the public and the research community. The basis for this is that CAM therapies have the ability to flush toxins from the body [12], resulting in a normalization of the body’s physiology reducing obesity or the possibility of becoming obese. Passive exercise rendered through low frequency electrical stimulation [13] has been found to achieve effects similar to those obtained through active exercise, diet and medication [7].

Alternative therapies offer a bio psychosocial alternative to allopathic interventions in improving health and wellness through normalizing anthropometric measures [14]. Cosmetic electrotherapy uses low frequency electrotherapy to tone muscles through the recruitment of most of the motor units creating a readiness for active exercise [15], (LFET) is used traditionally to rehabilitate muscles following injury [1]. Van Gaalen [16] states that LFET or spot reduction techniques do not alter weight or body contour despite anecdotal evidence for this. Pocari et al [17] reported a 58% increase in abdominal muscle strength, a 3.5cm decrease in waist circumference and improved self-perceived abdominal firmness and tone through the use of neuromuscular electrical stimulation using a Slendertone FLEXTM belt, for 8 weeks.

Given the associations between low body satisfaction and attempts to regulate one’s body size [1,2] it seems plausible that body dissatisfaction may serve as a protective factor against overweight and obesity [2]. Although slimming electrical stimulation is sought after for body contouring, it should be used as adjuvants to more conventional therapies of calorie restriction and exercise [18,19]. This does not obviate the need to provide evidence for the effects of slimming electrotherapy. This study seeks to provide evidence for the effects of slimming LFET on anthropometry in a selected cohort of overweight women of child bearing age.

## MATERIALS AND METHODS

The study was approved by the Health Sciences Ethics Committee which subscribes to the Declaration of Helsinki. The population consisted of endomorphic females of child bearing age with a regular menstrual cycle to eliminate factors that could influence the rate of weight gain such as menopause. Candidates were excluded if they suffered from any disorders of the circulatory, nervous, muscular and skeletal system or any other contra indications to electrical stimulation. Only women with a BMI between 18.5 and 30 kg/m<sup>2</sup> were considered for participation.

The 14 women who met the eligibility criteria were randomly allocated into the control and experimental groups by using the fishbowl technique. All participants were instructed to continue to eat normally and not participate in weight loss diets or exercise regimes during the course of the trial. Each participant in the experimental group received a course of ten, 45 minute low frequency electrical

treatments (LFET), three times a week over a period of four weeks.

At each visit the, height, weight, body fat and selected circumferential measurements were taken. Circumferences of the waist, hip and right and left thigh were taken using a non-elastic tape measure. Abdominal and hips/buttocks circumference was measured at the levels of the umbilicus and above the gluteal fold respectively with the subject in relaxed standing. The circumference of each thigh was taken at its maximal circumference below the gluteal fold, with the subject standing with the legs slightly apart. Body weight was measured twice, using a digital scale placed on a flat surface, after emptying the bladder. Height was measured using a tape measure fixed to a wall. Participants were measured standing erect against the wall, barefoot.

A low frequency electrical stimulator “24-Pro/Combo Professional Series” from Health Technology [19] was used to deliver the LFET through 12 pairs of silicone electrodes placed as shown in Rosser[20]. Electrodes were placed parallel to each other for the Rectus Femoris and Sartorius, Adductor Longus and Gracilis, Tensor Fasciae Latae and Gluteus Medius. For the Gluteus Maximus, External Oblique and Rectus Abdominis, electrodes were placed longitudinally. A rectangular biphasic wave form was used to produce strong and consistent muscle contractions under each electrode [20]. Pulses frequency was set at 65 to 135 Hz per second and the pulse width between 200 and 300 micro amps (μs) to optimize the contraction effect [21]. Pulse interval varied from 0.5 – 2.5 seconds to allow a rest period between contractions [22]. The device was set to the automatic mode to ensure consistency of application of the electrical stimulation.

The body composition (% fat) was determined using a bio impedance analyzer, the Bodystat® 1500 Sports and Fitness as per the instruction manual [22]. The impedance was measured at a fixed frequency of 50 kHz.

The data was normalized to reduce variability and analyzed using paired t-tests at  $p < 0.05$  for the paired data and independent samples t tests for comparison of the control and experimental group mean for each variable. To normalize, each subject’s pre-test readings served as a standard and the post-test values were worked as a percentage of the standard. Normalized data was pooled to obtain means for statistical comparison. Probability was set at  $p \leq 0.05$ .

## RESULTS

The participation rate was 100% with seven females each in the control and experimental groups. All participants were endomorphs of child bearing age with regular menstrual cycles. The mean age of the participants in the placebo group was 35 years and that of the experimental group was 37 years. As shown in Table 1, height was not significantly different between the groups as was pre-test weight and BMI. Marginal significant differences between pre and post control group means as opposed to experimental group means were noted for body weight and BMI. Normalized means for weight and BMI were significantly different between the groups.

**Table: 1 Comparison of weight and BMI values in control and experimental groups.**

	Weight (kg)		Body Mass index(kg/cm <sup>2</sup> )	
	Pre test	Post test	pretest	Post test
<b>Control group (n=7)</b>				
Range	60-83	60-82	24.6-30.1	23.4-29.7
Mean ± SD	74.57 ±6.18	74.07 ±5.97	27.5 ±2.2	27.33 ±2.1
p values: Pre-test Vs post-test	0.04		0.05	
<b>Experimental group (n=7)</b>				
Range	58.5-83	56.5-80	24.5-28.3	24.5-28
Mean ± SD	72.5 ±7.96	70.93±7.83	26.8 ±1.12	26.21 ±1.2
p values: Pre-test Vs post-test	0.01		0.01	
p values: control Vs experimental	0.03		0.04	

P value <0.05 is considered significant

**Table :2 Waist and hip circumference in control and experimental groups**

	Circumference (cm)			
	Waist		Hips	
<b>Control group</b>	Pre-test	Post-test	Pre-test	Post-test
Range	80-96	80-96	104-120	104-119
Mean ± SD	90.21 ±4.66	90.36 ±4.69	111 ±5.07	111.14 ±4.99
p values: Pre-test Vs post-test	0.36		0.6	
<b>Experimental group</b>				
Range	75.5-104	73-101	101.5-116.5	98-115
Mean ±SD	91.14 ±7.68	88.57±7.59	109.64±4.33	107.71±5.38
p values: Pre-test Vs post-test	<0.001		0.019	
p values: Control Vs. experimental	<0,001		<0.001	

p value <0.05 is considered significant

No significant differences in waist, hip and thigh circumference were noted between pre and post- test in the control group but differences in the experimental group were significant for all variables. Normalized means for these variables in the experimental group were significantly different from those of the control group for all variables as shown in Tables 2 and 3.

Table 4 shows no significant difference between the pre-test and post-test body fat % means for the control group. Significant differences were noted for pre and post-test body fat means for the experimental group and between control and experimental group body fat means.

**Table :3 Right and left thigh circumference in control and experimental groups**

	Circumference (cm)			
	Right Thigh		Left thigh	
	Pre-test	Post-test	Pre-test	Post-test
<b>Control group</b>				
Range	63-73	63-73.5	61-73	61-73
Mean ± SD	67.93 ±3.47	67.93 ±3.62	67.36 ±3.83	67.57 ±3.92
p values: Pre-test Vs post-test	1.0		0.2	
<b>Experimental group</b>				
Range	62.5-71.5	61-71.5	62.5-72	61.5-71
Mean ±SD	66.64 ±2.58	65.36 ±3.06	66.21±2.97	65.29 ±2.87
p values: Pre-test Vs post-test	0.001		0.05	
p values: Control Vs experimental	0.01		0.02	

**Table : 4 Comparison of body fat measurements in control and experimental groups**

	Body fat %			
	Control group (n=7)		Experimental group (n=7)	
	Pre-test	Post-test	Pre-test	Post-test
Range	30.20-39.30	30.10-39.1	23.5-40.50	21-39.10
Mean	35.23	35.11	33.79	32.26
SD	2.76	2.69	5.1	5.69
p values: Pre-test Vs post-test	0.14		0.009	
p value: control Vs experimental	0.01			

p value <0.05 is considered significant

## DISCUSSION

This study showed that LFES significantly altered anthropometric parameters in the tested sample. These were reflected as significant reductions in weight, BMI, circumference of selected body parts and body fat. Electrical stimulations are a passive form of exercise and as such are not expected to produce changes in body contours. They are traditionally used to reduce pain, improve circulation, reduce swelling, retain the physiological properties of muscles in paralyzed individuals or strengthen weak muscles. Pocari et al. [23] following a commissioned study reported that electrical stimulations were not effective in reducing any of the parameters measured in this study.

The electrical stimulation used in this study has been specifically designed to tone muscles and the application of stimulation is different from that used in physiotherapy. Despite the findings in this study and the anecdotal evidence for the popular use of this modality for body contouring, it must be noted that to produce sustainable health benefits, electrical stimulation should be used as an adjuvants to more

conventional therapies of calorie restriction and exercise[19]. Despite the small sample size, a structured programme of electrical stimulations resulted in significant reductions in body fat, body part circumference, BMI and body weight. These findings cannot be compared to other studies except the one published by Pocari et al. [17] who reported that LFET improved muscle strength by 58%, a 3.5% decrease in waist circumference and perceived improvement in body contour.

Kawaguchi [24], found that a hybrid training of voluntary contractions and electrical stimulation of the quadriceps and hamstring muscles reduced insulin resistance and increased hepatic steatosis in these individuals. Insulin resistance has been associated with overweight and obesity. Therefore any reductions in insulin resistance are likely to impact on anthropometric measurements. Linet al. [25] reported that modulated middle frequency currents can improve body composition in post-menopausal obese women.

Our study shows a similar result on overweight women of child bearing age. The findings of this study have implications not only for the wellness and beauty industry but also the health sector. It also speaks to a multidisciplinary approach to health care rather than independent parallel processes by allopathic and complimentary therapies, towards ensuring the best care for patients.

## CONCLUSION

Baseline measurements in BMI and circumference of the thigh, waist and hips were not significantly different between the control and experimental groups. Although post-test measures of BMI and circumference of measured body parts in the control group was reduced, this was not significant. Significant decreases in BMI, body fat measurements and circumference for waist, hips and thighs between control and experimental groups were noted post-test. Slimming LFET decreased anthropometry in the study population.

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