Effect of Electrical Muscle Stimulation on Reducing Fat from the Body

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Abstract

The study was conducted on 120 healthy female volunteer subjects. The volunteers were taken from Patran city of Punjab and the various departments of Punjabi University, Patiala, Punjab. All volunteers were adults within the age range of 20 to 40 years who have Body Mass Index (BMI) >27. All the anthropometric measurements like Weight, height, thickness of skinfold from biceps, triceps, subscapular, suprailiac and abdominal sites were measured on the subjects belonging to four groups, following standard techniques given by *Weiner & Lourie (1969)* before the start of the program, after two weeks and at the end of the four weeks. To the first group of females that was used as the control of the study, no intervention was given to these subjects. To the second group of females was given Interferential Therapy (IFT) only, while the third group of females was given both hot water application and (IFT). Fourth group of females was administered supervised aerobic exercise programme on treadmill / brisk walking in the laboratory. Interferential therapy (Intensity-as tolerated by the subject, Frequency- 4000 Hz ; Beat Frequency –swing mode, time of swing-12 secs, Pattern of swing; method 4Pole vector; Total treatment time-20-30 min) was given to the second and third groups. It was concluded that Fat deposition and Skinfold thickness was reported minimum in Group-IV followed by Group -III and Group-II and maximum in Group - I After given treatment body fat was decreased in Group-II, Group-III, and Group- IV. Maximum fat reduction was seen by IFT machine and IFT + hot water application. The results have shown significant differences among four groups. It has been concluded that % body fat was found less after the treatment.

Key words: Body Mass Index, Skinfold Thickness, Interferential Therapy, Hot Water Application, Aerobic Exercise Program

Introduction:

Obesity is defined as a condition in which excess body fat is accumulated. The practical and clinical definition of obesity is based on the Body Mass Index (BMI expressed as weight (in kg)/height (in m^2). It is generally agreed that a BMI of greater than 30 is indicative of obesity, while a BMI of 25.0-29.9 is suggestive of overweight in an individual. BMI ranging from 18.5 to 24.99 is considered normal. Obesity is increasing at an alarming rate throughout the world and has become a global problem.

In the public health arena, obesity constitutes one of the important medical and public health problems *(Berke and Morden, 2000).* Modernisation has led to over abundance of foods rich in fats along with decrease in physical activity of people leading to conditions that favour obesity. By definition, obesity refers to a condition of building up of body fat beyond that deemed normal for the age, sex, body type of a given individual. Obesity is not only related with a number of health problems but with psychological problems also *(Wadden and Foster, 1992; NIH, 1992; Bray et al, 1996; Food and Drug Administration, 1996; Centers for Disease Control and Prevention, 1997; Connolly et al, 1997).*

Obese people suffer from guilt, depression, anxiety and low self-esteem. In addition to this there is increased

incidence of high blood pressure, increased level of cholesterol and other lipids in the blood, increased diabetes and colon cancer, liver ailments, mechanical difficulties particularly back and foot problems in obese and overweight subjects *(Lew and Garfinkel, 1979; Larsson et al, 1981; Hubert et al, 1983; Dyer and Elliott, 1989; Chute et al, 1991; Stampfer et al, 1992).*

Various electrotherapy modalities e.g. ultrasound, short wave diathermy and interferential therapy are also used by the health and obesity clinics world over to counter obesity *(Anderson & Wadden 1999; Klein 2000; Jakicic et.al, 2001).* These clinics are commercially exploiting the people by assuring them fast fat reductions. It is claimed by these professionals that Electrical Muscle Stimulation (EMS) leads to faster and greater weight loss form the fat compartments of the body. The scientific validity of such claims direly needs to be ascertained. Electrical stimulation is effectively used in physiotherapy clinics to provide a situation whereby there is an electrical generation of action potentials; giving rise to therapeutically significant physiological responses e.g. increased muscle strength, stimulated lymph and blood flow, analgesia, kinesthetic awareness and autonomic nervous system responses. It is believed by these clinics that EMS initially breaks the fatty capsule that covers the muscle, improves blood supply to the muscles, and then helps it to gain the lost tone to return to its original size. This return to size and tone gives the abdominal muscles the strength to crumble the fatty capsule from the inside, through their contractions *(Bailey, 1976).* There are four different types of electrical muscle stimulations. These are regular EMS, transdermal electrical neural stimulation (TENS), interferential (IFT) and Russian muscle stimulation. Out of these, IFT has the ability to stimulate (a) large number of muscle fibers for greater muscular work (b) parasympathetic nerve fibers for causing increased blood flow in the region and (c) deeper tissues at the stimulated sites. According to *Gersh (1992)* and *Hayes (2000)* neuromuscular electrical stimulation increases metabolic demand through activating the muscle pump around the circulation network. They recommend that a low frequency of 20-30 pps with 10- 30% of maximal effort up to 10- 30 minutes duration is most effective.

It is thus pertinent to explore the EMS through interferential currents to counter the problem of overweight as well as disturbed fat profiles in the people. In this context the present study has been undertaken on females ranging in age 20–40 years to explore the impact of EMS-Interferential program on weight loss as well as the shedding of fat from the abdominal region, so as to reduce the health risks.

Material & Methods

The study was conducted on 120 obese females possessing BMI greater than 27. The subjects were selected in the age range of 20 to 40 years and divided into four equal groups. The subjects were divided into four different groups. The subjects were taken from the Patiala district. Anthropometric measurements were taken before starting the treatment, after two weeks and then after four weeks from the treatment.

Group I - Control (N=30)

Group II - IFT (N=30)

Group III - IFT+Hot application (N=30)

Group IV - Aerobic Exercises (N=30)

To the first group no intervention was given, it acted as a control group of the study. To the second group was given Interferential Therapy (IFT) only, while the third group of females was given both hot water application and (IFT). Fourth group of females were administered supervised aerobic exercise programme on treadmill/brisk walking in the laboratory 4 days/week. Interferential therapy (Intensity-as tolerated by the subject to produce observable contractions; Frequency- 4000 Hz ; Beat Frequency – swing mode, time of swing-12 secs, Pattern of swing; method 4 Pole vector; Total treatment time-20-30 min.) was given to the second and third groups for 3 days/week. The aerobic group of females was administered 30 minutes of aerobic exercise on treadmill at 50-70% of the individual's maximum heart rate as per Karvonen's procedure described by *Verma & Mokha (1993).*

At a time, only 12 subjects were selected and longitudinally followed for four weeks time. Weight, height, thickness of skinfold from biceps, triceps, subscapular, suprailiac and abdominal sites were measured on the subjects following standard techniques given by *Weiner & Lourie (1969)* before the start of the program, after two weeks and at the end of the four weeks. Of the 12 subjects, three were given only interferential therapy at abdominal region for 20 minutes, and another three subjects were first given 10 minutes of hot water bottle application in the abdominal region at 40 degree C followed by 20 minutes of IFT in the same area. The IFT treatment was administered to the subjects three times a week. Yet, another three subjects were given aerobic exercise programme three times a week for four weeks duration. Rest of the three subjects acted as control for study. The statistical test viz., mean, standard deviation, standard error of mean were applied on the data, Anova was applied on the data, Post hoc test for significant mean differences and Paired 't' test have also been applied.

Results & Discussion

Table 1 shows the Mean, SD and SEM of % body fat before starting the programme, after two weeks and after four weeks from the programme which was given to the subjects for fat reduction. Before starting the programme maximum mean value of % body fat was found in (IFT i.e. Group-II) (41.07%) followed by (Control Group i.e. Group – I) and (IFT + Hot water group i.e. Group-III) and minimum in (Aerobic group i.e. Group-IV) (37.71). After two weeks from the programme maximum mean value was found in Group-I (41.12%) and lower mean values of % body fat were observed in all the experimental groups but in case of the control group the mean value was found to increase. After four weeks mean value of % body fat was observed to decrease nearly 2 to 3% in Group - II (39.34), Group III. (38.04) and Group IV (36.48). The mean changes in % body fat after the programme were found to be significant in the Interferential therapy group and support the finding of *Bailey, (1976)* and similarly the effect of IFT+ hot application and Aerobic Exercises on percent body fat has also been found to be statistically significant.

It is evident from the results enlisted in tables 1 & 2, that four weeks of intervention may it be aerobic; IFT or IFT+ hot application was able to reduce % body fat. However IFT+ hot

application intervention was successful in reducing fat % to a relatively greater degree than the other interventions namely the aerobic or the IFT. The study necessitates future explorations on individuals possessing varying amounts of body fat.

Table-1: Comparison of % body fat among four different females group before staring the programme, after two weeks and after four weeks

	Group	N	Mean	SD	SEM
% body fat before starting programme	Control	30	40.61	1.43	0.26
	IFT	30	41.07	1.61	0.29
	IFT+ hot water application	30	39.24	1.67	0.31
	Aerobic exercises	30	37.71	1.46	0.27
	Total	120	39.66	2.02	0.18
% body fat After two weeks	Control	30	41.12	1.35	0.25
	IFT	30	40.57	1.56	0.28
	IFT+ hot water application	30	38.51	1.75	0.32
	Aerobic exercises	30	37.07	1.56	0.28
	Total	120	39.32	2.24	0.20
% body fat after four weeks	Control	30	40.96	1.41	0.26
	IFT	30	39.34	2.34	0.43
	IFT+ hot water application	30	38.04	1.85	0.34
	Aerobic exercises	30	36.48	1.56	0.29
	Total	120	38.70	2.45	0.22

Table-2: Paired' test results for the different groups

GROUP	Before V/S After Two Weeks			Before V/S After Four Weeks			After Two Weeks V/S After Four Weeks		
	Mean Diff	SD	't'	Mean Diff	SD	't'	Mean Diff	SD	't'
Control	0.51	0.98	2.84	0.35	1.24	1.53	0.16	0.82	1.06
IFT	0.50	0.57	4.83*	0.50	1.50	6.33*	1.23	1.45	4.65*
IFT + hot water application	0.73	0.39	10.23*	1.20	0.56	11.72*	0.47	0.28	9.18*
Group Aerobic	0.64	0.37	9.47*	1.23	0.32	20.91*	0.60	0.36	9.16*

*significant at 0.05 % level

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