

**The Effects of CSI Electrical Muscle
Stimulation of the Abdominal Muscles
and Walking On Body Image and
Abdominal Muscle Strength.**

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Research Team

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Abstract

A randomised, controlled, prospective study was undertaken to investigate the effects of CSI electrical stimulation of the abdominal muscles in conjunction with walking on body image, perceived abdominal shape and self esteem. Thirty-six women, aged between 18 and 50 years of steady weight and exercise patterns were recruited. The subjects were randomised into a treatment and control group. The groups were balanced by Body Mass Index and pre-existing exercise level. Informed consent was obtained. Those in the treatment group received 20 x 30 minute supervised sessions of electrical stimulation over a four week period while walking on a treadmill. Those in the control group completed 20 x 30 supervised walking sessions on a treadmill over four weeks. Psychometric measurements were taken pre and post test.

Results: Significant improvements in abdominal firmness, flatness and muscle tightness following use of Slendertone Flex Abdominal Training System while walking were reported ($p < 0.05$). Subjects in the treatment group reported that use of Flex while walking gave them a better workout than walking alone. Statistically significant improvements in physical self worth were also reported ($p < 0.02$). Self esteem remained stable across both groups. The findings suggest that use of Flex while walking results in significantly greater improvements in abdominal shape than walking on its own.

Introduction

Electrical muscle stimulation (EMS) is a well-accepted treatment modality in the fields of medicine and physiotherapy. Literature highlights include strength increases and the prevention of muscle wastage.¹⁻¹² A strong association between the use of electrical stimulation and changes in user shape and user well being has been previously identified.^{13,14} Research indicates that exercise programmes are associated with significant increases in self esteem and well being. The purpose of this study was to investigate the benefits seen from the use of an abdominal muscle stimulation device in conjunction with walking.

Study Objectives

- To investigate the body image effects of CSI Electrical Stimulation of the abdominal muscles in conjunction with walking.
- To investigate the self esteem effects of CSI Electrical Stimulation of the abdominal muscles in conjunction with walking.

- To investigate the perceived abdominal shape effects of CSI Electrical Stimulation of the abdominal muscles in conjunction with walking.

Research Design

A randomised, controlled, prospective study was undertaken. Female subjects of steady weight, and exercise patterns were recruited. The subjects were randomised into treatment and control groups. The groups were balanced according to body mass index and exercise levels. Informed consent was obtained.

Treatment group subjects received 20 x 30 minute supervised sessions of electrical stimulation over a four-week period while walking on a treadmill. Control group subjects completed 20 x 30 minute supervised walking sessions on a treadmill. Psychometric measurements were taken pre-test and post-test. An independent assessment of muscle strength using a standard timed sit up test was carried out pre and post test.

Subject Recruitment

Subjects were recruited from the membership database of a local gym and the Slendertone volunteer database.

Screening Criteria

Volunteers were screened based on the following screening criteria:

- Subjects must not have used an Electronic Muscle Stimulation device on the target muscles in the previous month.
- Subjects must not have engaged in abdominal exercises in the previous four weeks.
- Subjects must have maintained a stable exercise pattern for the previous four weeks. Subjects were asked to disclose their number of exercise sessions of at least twenty minutes in duration per week and the number of weeks that they had been exercising at this rate.
- Subjects must not have reported a gain or loss of more than seven pounds in weight over the previous four weeks.
- Subjects must not have had an intra-uterine device inserted in the previous four weeks.
- Subjects must not have given birth in the previous three months.
- Subjects must not have suffered from back problems or any medical condition contraindicated with use of the product.
- All pre-existing medical conditions were disclosed on the subject's case record form. A medical doctor assessed the significance of other medical conditions on an individual basis.
- Subjects must be aged between 18 and 50 years.
- Subjects must not have a Body Mass Index of less than 18.5 or more than 30.0 based on NIH guidelines.¹⁵
- Subjects must not disclose any of the conditions outlined in the Physical Activity Readiness Questionnaire. Subjects must have a menstrual cycle of 28 days +/- 3 days.

Volunteer Briefing

Volunteers were provided with information about the trial objectives, research design, subject responsibilities, age and medical requirements and reimbursement. Suitable subjects were notified of their allocation to the treatment or control group and invited to attend their first measurement and treatment appointment at the gym. Each subject was briefed on a one to one basis by a member of the research team prior to the start of the trial and provided with a detailed information pack which outlined a description of the measurement procedure and the commitments required of those taking part. The need for members of both the treatment and control groups to maintain their regular diet and exercise routines was emphasised. The list of contraindications for involvement was explained. In total thirty six subjects were recruited onto the study.

Subject Randomisation

A stratified randomised approach was taken. It was considered that body weight and pre-existing exercise levels were factors that could influence the outcome of the study. Subjects were ranked in ascending order of Body Mass Index. The sample was divided into three BMI categories: 18.5 – 22.33, 22.34 – 26.16 and 26.17 – 30.0. Within each category, attempts were made to balance the groups according to exercise level. Volunteers who disclosed more than three exercise sessions per week on average were classified as highly active, one to three exercise sessions per week as moderately active and no exercise sessions per week as sedentary. A tossed coin was used to determine whether the first subject was allocated to Group A or Group B and then every second subject was allocated to this group. A tossed coin was also used following the stratified randomisation procedure to select either Group A or Group B as the treatment group.

Informed Consent

In compliance with ICH E8 General Considerations for Clinical Trials¹⁶, each of the subjects was asked to sign an informed consent form prior to the start of the study. They were made aware that they were free to withdraw from the study at any time.

Elimination Criteria

The following elimination criteria applied to the subjects:

- The subject is unable to perform any aspect of the study.
- The subject is unwilling to fulfil their commitment to the study.

Sample Size

In total, thirty six subjects were recruited onto the trial. Five of the subjects dropped out prior to the first measurement. Three treatment group subjects dropped out for personal reasons after completing one, five and ten treatment sessions respectively and one control group subject dropped out for personal reasons after eighteen sessions. The findings are based on responses from thirteen treatment and fourteen control group subjects who completed the study.

Treatment Procedure

Members of both test groups attended the gym located at National University of Ireland, Galway, for a 30 minute supervised treatment, five days each week for four weeks. Prior to the first

session, they were given a demonstration of the unit and the stimulation electrode (pad) positions. During each session, the gym instructor supervised treatment. Subjects were asked to sign a treatment attendance sheet after each session.

Subjects in the treatment group used the Slendertone Flex Abdominal Training System to provide stimulation during the trial. This is a two channel commercially available electronic muscle stimulation garment.

The electrode positions consist of a central umbilical electrodes which acts a common between two lateral electrodes which are placed between the rib cage and the pelvis.

Subjects used the treadmill at a speed of between five and seven kilometres per hour for the duration of the study.

Measurement

Physical Measurement Abdominal Curl Conditioning Test

This is a test of abdominal muscle performance closely following the protocol of the National Coaching Foundation (U.K.).¹⁷ The test involves the continuous performance of abdominal curls in time with an audio signal, consisting of a bleep emitted from a tape recorder. There are two bleeps for each abdominal curl, one for the vertical position and one for the horizontal position. After each minute or “stage”, the time delay between the bleeps decreases so the frequency of the abdominal curls has to be increased to keep up with the required rate. Subjects are required to perform the abdominal curls in time with the bleeps for as long as possible. There are eight stages to the test making its maximum duration eight minutes. Research work carried out by the National Coaching Foundation shows that the test can effectively differentiate between individuals who have good or poor conditioning of their abdominal muscles. It is also sensitive to changes in the condition of the abdominal muscles after periods of training. A modification of the test was developed prior to the start of the study and it was intended for use to capture objective measurements in abdominal muscle strength. A Delta Abdo trainer was used in the study. This is a commercially available abdominal training device with an arm and neck support that is held by the user to bring him to a sit up position. The device was modified such that subjects did not use the arm of the device to move to a sit up position as this technique was considered to increase the risk of cervical spine injury. The device was attached to a wooden plinth and a contact sensor was placed on the plinth to coincide with a specified point on the subjects cervical spine. This point was decided by measuring the distance from the horizontal plane at the top of the subjects head to the horizontal plane at the lower part of the right scapula.

The sensor was attached to a Light Emitting Diode (LED) which lit up when pressure was applied to the sensor. When the subject lay on the sensor in the start position, the LED lit up and when the subject raised off the sensor to a sit up position the LED switched off. A valid sit up was counted when the LED switched off. A gym mat was placed on the plinth to provide a softer surface.

The test was explained to subjects and they engaged in a practice test which comprised of three sit ups. Subjects were instructed to tuck in their chin and cross their arms over their chest with their legs at 90 degrees. They then completed a fifteen minute rest period before the main test began.

A standard level of encouragement was maintained for all subjects. Subjects completed a half sit up in time with each beep. Subjects were required to continue with the test until they were unable to keep up with the beeps. The test ended when the subject missed two successive beeps or three beeps in total. The duration of the test was recorded for each subject. The investigator was instructed to eliminate subjects based on her personal assessment of effort and competency of the subject. Subjects were also eliminated if their reason for ceasing the test was due to neck discomfort rather than general fatigue.

Psychometric Measurement

A number of studies have investigated the relationship between exercise and the self concept. Changes in the lower level aspects of the self concept effect changes in global self worth.¹⁸ Positive changes in the self concept following exercise programmes have been reported.^{19,20}

For the purposes of this study, four measurement scales were administered to both treatment and control group subject to capture feelings about relevant aspects of body perceptions. In addition, treated subjects were required to complete a scale which investigated their perception of the effectiveness of the intervention relative to their previous exercise routine.

Slendertone Shape Evaluation Scale

The scale measures perceived abdominal shape using a set of ten dichotomous items taken to describe aspects of shape and appearance. The items are rated on a five point semantic differential scale.

Slendertone Body Satisfaction Scale

The scale consists of twelve items which measure feelings about body shape on a five point Likert scale ranging from "strongly agree" to "strongly disagree".

Both the Slendertone Shape Evaluation Scale and the Slendertone Body Satisfaction Scale were used in a previous Slendertone study on abdominal shape. Both scales were shown to have internal reliability (Cronbach's Alpha of 0.8). Test-retest reliability was shown to be high. (Pearson's Product Moment of 0.89). Both scales contain items that refer to body attractiveness, physical strength and physical condition therefore within a conceptual framework they may be seen as positioned on subdomain level of physical self worth.

Treatment Group Evaluation

Treated subjects were asked to evaluate the use of Flex while walking in comparison to their usual walking routine using a ten item Likert scale.

Physical Self Perception Profile

The scale focuses on measurement of aspects of physical self perception which contribute to the individuals overall self esteem structure. The scale provides a multidimensional analysis of the content of the physical domain of self esteem. This scale consists of five subscales which measure physical self worth, sports competence, physical condition, body attractiveness, and physical strength. Physical self worth is presented as the outcome of the

individuals perceptions in the other four sub domains. It is also seen as the mediator of the relationship between the sub domains and self esteem.

Self Esteem Scale

Rosenberg's Scale of Self Esteem²¹ consists of ten items on a four point Likert scale which refer to aspects of global self esteem including pride in self, general competence and equal worth to others.

Reporting of Adverse Events

None of the subjects developed medical conditions which resulted in their elimination from the study.

Questionnaire Administration

The questionnaire administrator explained the questionnaire format to each subject and observed completion. Items within the Slendertone scales were rotated and the semantic differential items were randomly reversed prior to the second and third measurements in order to minimise cognitive bias.

Statistical Analysis

The mean differences in pre and post-test measures were used to assess the outcome of the treatment. A two-tailed distribution was assumed. An independent, unpaired students t-test was used to assess the significance of the mean differences across both test groups and a paired students t-test was used to assess the significance of the mean differences in pre and post test scores within groups. A frequency distribution was used to quantify treated subjects post test evaluation of the intervention.

Group study success criteria were statistically significant differences in body image to the 0.05 level between treated subjects pre and post test scores and between treated and control subjects differences in scores pre and post test.

Results

Slendertone Shape Evaluation Scale

Table 1 presents the mean score and standard deviation by group for each item on the Slendertone Shape Evaluation Scale pre test and at week 4.

	Treatment Group					Control Group				
	Pre Test		Week 4		Significance	Pre Test		Week 4		Significance
	Mean	Std Dev	Mean	Std Dev		Mean	Std Dev	Mean	Std Dev	
Attractive	1.62	0.77	3.00	1.00	0.001	2.15	1.14	2.46	0.97	*
Clothes Fit Well	2.85	0.80	3.69	0.95	0.005	2.62	1.26	2.69	0.63	*
Firm	1.69	0.75	3.15	0.99	0.003	2.00	0.91	1.77	0.60	*
Flat	1.92	0.64	3.15	1.07	0.002	1.69	0.75	2.31	0.75	0.005
Good Shape	1.69	0.63	2.85	0.99	0.001	1.92	1.26	2.23	0.83	*
Hard	1.69	0.75	3.23	0.83	0.001	1.69	0.95	2.15	1.14	*
Size Reduction	2.58	1.00	3.08	1.08	*	0.92	0.91	2.46	0.66	*
Smooth	2.77	1.24	3.31	1.32	*	2.00	1.44	2.85	1.34	*
Strong	2.46	0.78	3.38	0.87	0.020	2.92	0.86	2.23	0.83	*
Thin	2.15	0.80	3.08	0.95	0.002	1.92	0.76	2.31	0.63	*
Total	21.23	4.59	31.69	7.52	0.001	20.85	7.50	23.46	5.08	*

Table 1: Slendertone Shape Evaluation Scale, Average Score by Item, Pre and Post Test.

As can be seen from the table, there was a marked improvement in the treatment group average scores after four weeks of treatment indicating that they had experienced an improvement in shape along the ten parameters. A paired ttest indicated that the changes in shape perceived by the treatment group are statistically significant while, with the exception of the flatness parameter, the changes reported by the control group were not statistically significant to the $p < 0.05$ level.

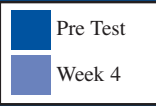
	Treatment Group		Control Group		Ttest
	Mean	Std Dev	Mean	Std Dev	
Attractive	1.38	1.04	0.31	0.85	0.01
Clothes Fit Well	0.85	0.90	0.08	1.04	0.05
Firm	1.46	1.39	-0.23	0.83	0.001
Flat	1.23	1.09	0.62	1.65	*
Good Shape	1.15	0.90	0.31	1.60	*
Hard	1.54	1.05	0.46	1.45	0.04
Size Reduction	0.50	0.90	0.46	0.88	*
Smooth	0.54	1.13	-0.08	0.64	*
Strong	0.92	1.26	0.31	0.75	*
Thin	0.92	0.86	0.38	0.65	*
Total	10.46	7.39	2.62	6.58	0.01

Table 2: Slendertone Shape Evaluation Scale, Average Change in Score by Item After Four Weeks

Table 2 presents the changes in the mean score on the Slendertone Shape Evaluation Scale at week four for the treatment and control groups respectively.

A positive change in the mean score indicates a move towards the positive adjective and a subsequent improvement in the perception of the group over the eight week period. The maximum average change possible per item is four and the maximum total change possible is forty.

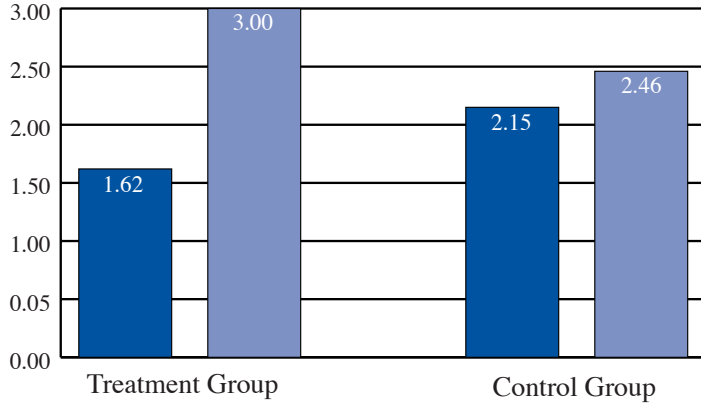
An intergroup analysis of the differences in pre and post test scores demonstrates that statistically significant improvements in appearance were recorded by the treatment group after four weeks on the aggregate of parameters on the scale. ($p < 0.01$) When analysed individually, statistically significant changes were seen across the attractiveness, clothes fit, firmness and hardness parameters. This suggests that use of Flex while walking results in greater perceived improvements in abdominal shape than just walking alone.



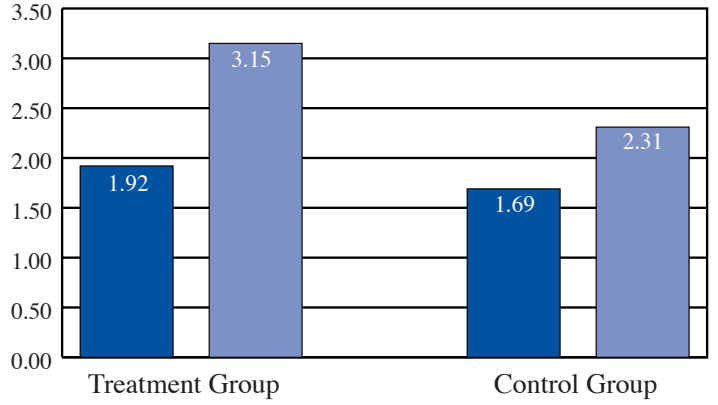
SLENDERTONE SHAPE EVALUATION SCALE

The following graphs illustrate the average scores displayed by both groups at the start of the study and at week four by item and in total on the Slendertone Shape Evaluation Scale.

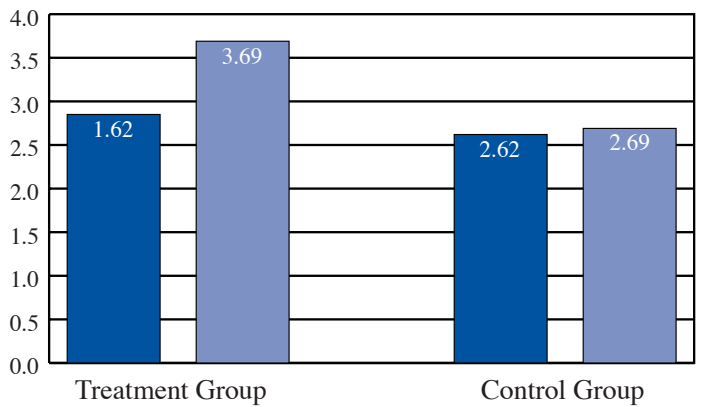
Graph 1: Attractive



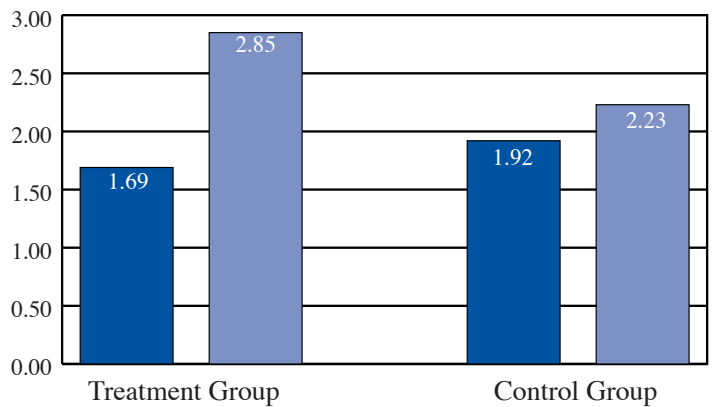
Graph 2: Flat



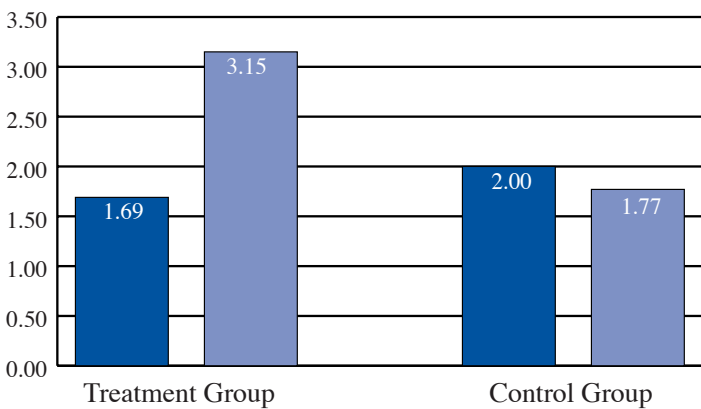
Graph 3: Clothes Fit Well



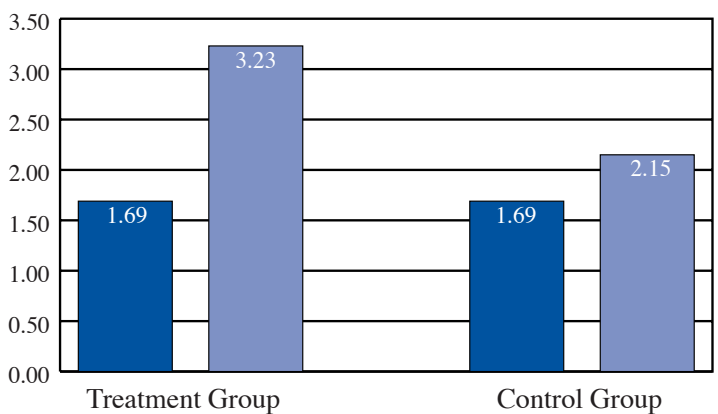
Graph 4: Good Shape

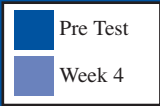


Graph 5: Firm



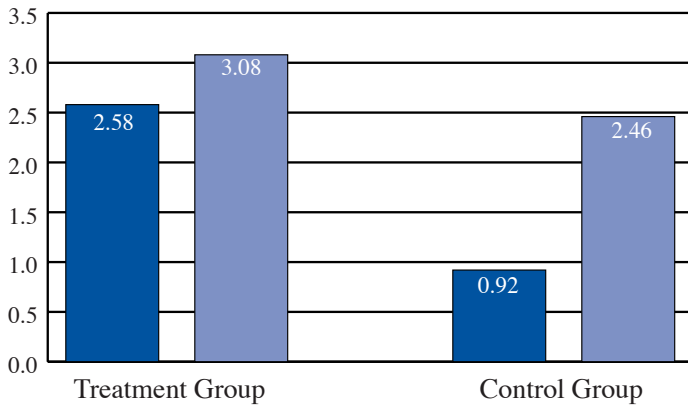
Graph 6: Hard



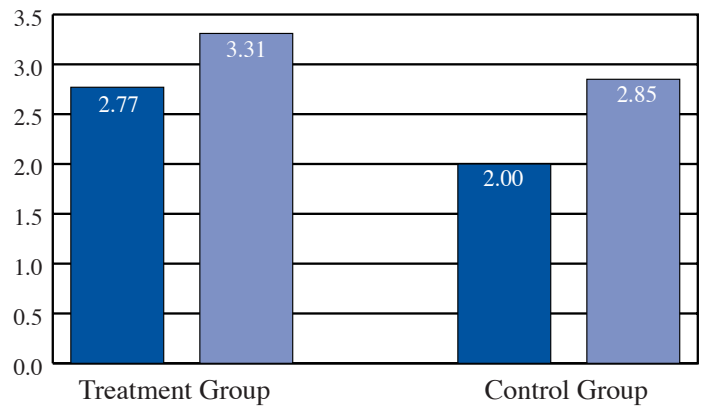


SLENDERTONE SHAPE EVALUATION SCALE

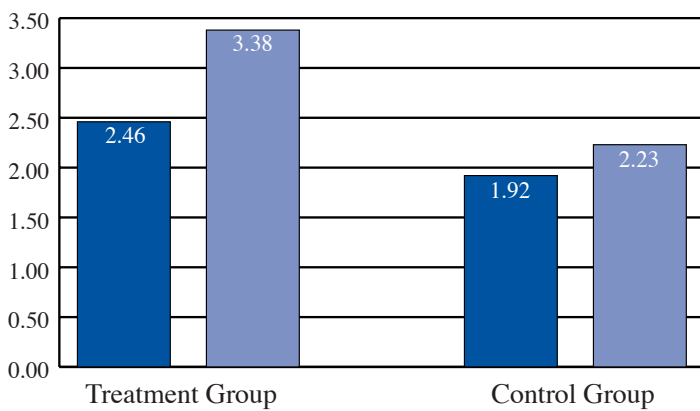
Graph 7: Size Reduction



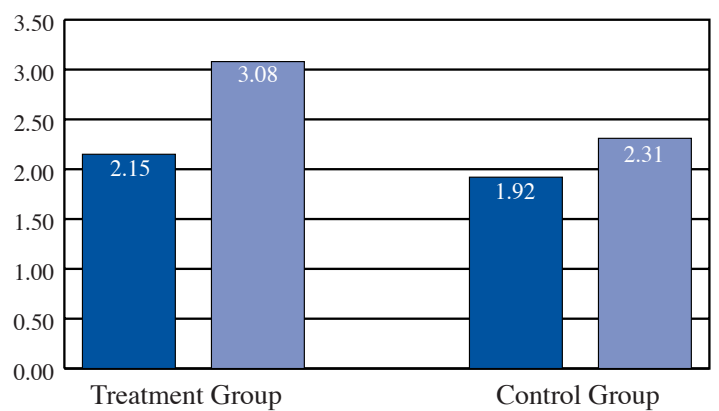
Graph 8: Smooth



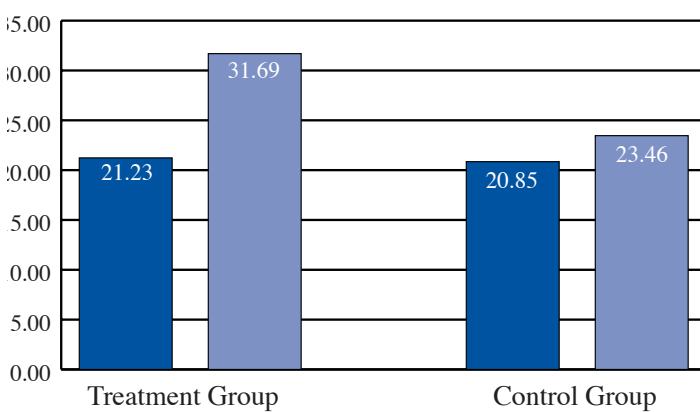
Graph 9: Strong



Graph 10: Thin



Graph 11: Total



Slendertone Body Satisfaction Scale

Subjects were asked to agree or disagree with a range of twelve statements relating to their feelings about body shape on a five point Likert Scale. The maximum score on the scale is five indicating strong agreement with the item. The one negatively posed item on the scale - "I regularly compare my shape unfavourably with the shape of other women" was reverse coded for analysis purposes, indicating that an increase in the score implied a reduction in the frequency of negative comparisons of shape with others.

Table 3 presents the mean score and standard deviation in aggregate and individually for each item at the start of the study and at week four. As can be seen from the table, the difference in the test and retest scores was statistically significant for ten of the twelve items for treatment group subjects and seven of the twelve items for control group subjects.

	Treatment Group					Control Group				
	Pre Test		Week 4		p<	Pre Test		Week 4		p<
	Mean	Std Dev	Mean	Std Dev		Mean	Std Dev	Mean	Std Dev	
My stomach feels flat	2.00	0.71	2.92	1.04	0.004	1.57	0.65	1.86	0.86	*
My stomach feels firm	2.00	0.41	3.23	0.93	0.002	1.57	0.65	1.86	0.77	0.040
My stomach muscles seems tight	2.08	0.28	3.54	0.88	0.000	1.57	0.76	2.07	0.83	0.047
My clothes seem to fit better than before	2.45	0.69	3.73	0.47	0.001	2.14	0.86	2.86	0.86	0.027
I have been feeling more positive about my shape recently	2.69	0.95	2.92	0.76	0.002	2.36	0.93	3.29	0.83	0.002
I have been feeling fitter than usual recently	2.54	0.78	3.92	0.64	0.001	2.64	1.01	3.93	0.73	0.001
I have been feeling more confident recently	3.00	0.82	3.85	0.69	0.005	2.57	0.94	3.36	0.74	0.028
Recently, I have noticed improvements in my shape	2.46	0.78	4.08	0.28	0.000	2.43	1.02	3.50	0.85	0.006
Recently, I have noticed improvements in my posture	2.46	0.52	3.62	0.96	0.003	2.36	0.93	3.00	1.04	*
Recently, I have become happier with my shape in comparison to others	2.15	0.75	3.62	0.77	0.001	2.43	1.02	2.86	0.86	*
I regularly compare my shape unfavourably with the shape of other woman	2.23	0.60	2.85	1.21	*	2.93	1.33	3.21	1.25	*
Recently, I have been feeling healthier than usual	2.69	0.95	3.54	0.88	*	2.79	1.19	3.57	0.85	*
Total	28.54	5.09	42.23	4.36	0.001	27.36	6.98	35.36	4.77	0.002

Table 3: Slendertone Shape Evaluation Scale, Average Score by Item, Pre and Post Test.

Table 4 presents the changes in the mean score by item after four weeks by the treatment and the control groups. The relative differences in scores by both groups indicates that changes in parameters referring specifically to abdominal shape were highly statistically significant. This suggests that use of Flex while walking results in significantly greater improvements in abdominal shape than just walking alone.

	Treatment Group		Control Group		p<
	Mean	Std Dev	Mean	Std Dev	
My stomach feels flat	0.92	0.95	0.29	0.61	0.05
My stomach feels firm	1.23	1.09	0.29	0.47	0.01
My stomach muscles seem tight	1.46	1.05	0.50	0.85	0.02
My clothes seem to fit better than before	1.27	0.90	0.71	1.07	*
I have been feeling more positive about my shape recently	1.23	1.09	0.93	0.92	*
I have been feeling fitter than usual recently	1.38	1.19	1.29	0.99	*
I have been feeling more confident recently	0.85	0.90	0.79	1.19	*
Recently, I have noticed improvements in my shape	1.62	0.87	1.07	1.21	*
Recently, I have noticed improvements in my posture	1.15	1.14	0.64	1.39	*
Recently, I have become happier with my shape in comparison to others	1.31	1.03	0.43	1.60	*
I regularly compare my shape unfavourably with the shape of other women	0.62	1.26	0.29	1.77	*
Recently, I have been feeling healthier than usual	0.85	1.46	0.79	1.37	*
Total	13.69	7.03	8.00	7.71	*

Table 4: Slendertone Body Satisfaction Scale, Average Score by Item, Pre and Post Test.

Slendertone Body Satisfaction Scale

The following tables present an analysis of the frequency of responses by each group at the start and at week 4 of the study.

Table 5a: My stomach feels flat

	TREATMENT GROUP		CONTROL GROUP	
	Pre Test	Week 4	Pre Test	Week 4
Strongly Disagree	15.38%	0.00%	50.00%	35.71%
Disagree	76.92%	53.85%	42.86%	50.00%
No Opinion	0.00%	0.00%	7.14%	7.14%
Agree	7.69%	46.15%	0.00%	7.14%
Strongly Agree	0.00%	0.00%	0.00%	0.00%

Table 5b: My stomach feels firm

	TREATMENT GROUP		CONTROL GROUP	
	Pre Test	Week 4	Pre Test	Week 4
Strongly Disagree	7.69%	0.00%	50.00%	35.71%
Disagree	84.62%	30.77%	42.86%	42.86%
No Opinion	7.69%	15.38%	7.14%	21.43%
Agree	0.00%	53.85%	0.00%	0.00%
Strongly Agree	0.00%	0.00%	0.00%	0.00%

Table 5c: My stomach muscles seem tight

	TREATMENT GROUP		CONTROL GROUP	
	Pre Test	Week 4	Pre Test	Week 4
Strongly Disagree	0.00%	0.00%	57.14%	21.43%
Disagree	92.31%	15.38%	28.57%	57.14%
No Opinion	7.69%	23.08%	14.29%	14.29%
Agree	0.00%	53.85%	0.00%	7.14%
Strongly Agree	0.00%	7.69%	0.00%	0.00%

Table 5d: My clothes seem to fit better than before

	TREATMENT GROUP		CONTROL GROUP	
	Pre Test	Week 4	Pre Test	Week 4
Strongly Disagree	0.00%	0.00%	21.43%	0.00%
Disagree	53.85%	0.00%	50.00%	42.86%
No Opinion	23.08%	23.08%	21.43%	28.57%
Agree	7.69%	61.54%	7.14%	28.57%
Strongly agree	0.00%	0.00%	0.00%	0.00%

Table 5e: I have been feeling more positive about my shape recently

	TREATMENT GROUP		CONTROL GROUP	
	Pre Test	Week 4	Pre Test	Week 4
Strongly Disagree	0.00%	0.00%	14.29%	0.00%
Disagree	61.54%	7.69%	50.00%	21.43%
No Opinion	7.69%	7.69%	21.43%	28.57%
Agree	30.77%	69.23%	14.29%	50.00%
Strongly Agree	0.00%	15.38%	0.00%	0.00%

Table 5f: I have been feeling fitter than usual recently

	TREATMENT GROUP		CONTROL GROUP	
	Pre Test	Week 4	Pre Test	Week 4
Strongly Disagree	0.00%	0.00%	7.14%	0.00%
Disagree	61.54%	0.00%	50.00%	7.14%
No Opinion	23.08%	23.08%	14.29%	7.14%
Agree	15.38%	61.54%	28.57%	71.43%
Strongly Agree	0.00%	15.38%	0.00%	14.29%

Table 5g: I have been feeling more confident recently

	TREATMENT GROUP		CONTROL GROUP	
	Pre Test	Week 4	Pre Test	Week 4
Strongly Disagree	0.00%	0.00%	14.29%	0.00%
Disagree	30.77%	7.69%	28.57%	14.29%
No Opinion	38.46%	7.69%	42.86%	35.71%
Agree	30.77%	76.92%	14.29%	50.00%
Strongly Agree	0.00%	7.69%	0.00%	0.00%

Table 5h: Recently, I have noticed improvements in my shape

	TREATMENT GROUP		CONTROL GROUP	
	Pre Test	Week 4	Pre Test	Week 4
Strongly Disagree	0.00%	0.00%	21.43%	0.00%
Disagree	69.23%	0.00%	28.57%	21.43%
No Opinion	15.38%	0.00%	35.71%	7.14%
Agree	15.38%	92.31%	14.29%	71.43%
Strongly Agree	0.00%	7.69%	0.00%	0.00%

Table 5i: Recently, I have noticed improvements in my posture

	TREATMENT GROUP		CONTROL GROUP	
	Pre Test	Week 4	Pre Test	Week 4
Strongly Disagree	0.00%	7.69%	21.43%	7.14%
Disagree	53.85%	0.00%	28.57%	28.57%
No Opinion	46.15%	23.08%	42.86%	21.43%
Agree	0.00%	61.54%	7.14%	42.86%
Strongly agree	0.00%	7.69%	0.00%	0.00%

Table 5j: Recently, I have become happier with my shape in comparison to others

	TREATMENT GROUP		CONTROL GROUP	
	Pre Test	Week 4	Pre Test	Week 4
Strongly Disagree	7.69%	0.00%	21.43%	0.00%
Disagree	61.54%	7.69%	28.57%	42.86%
No Opinion	23.08%	30.77%	35.71%	28.57%
Agree	7.69%	53.85%	14.29%	28.57%
Strongly Agree	0.00%	7.69%	0.00%	0.00%

Table 5k: I regularly compare my shape unfavourably with the shape of other women

	TREATMENT GROUP		CONTROL GROUP	
	Pre Test	Week 4	Pre Test	Week 4
Strongly Disagree	7.69%	15.38%	7.14%	7.14%
Disagree	61.54%	23.08%	50.00%	28.57%
No Opinion	30.77%	30.77%	0.00%	14.29%
Agree	0.00%	23.08%	28.57%	35.71%
Strongly Agree	0.00%	7.69%	14.29%	14.29%

Table 5m: How do you feel the appearance of your stomach

	TREATMENT GROUP		CONTROL GROUP	
	Pre Test	Week 4	Pre Test	Week 4
Strongly Disagree	23.08%	0.00%	28.57%	14.29%
Disagree	61.54%	0.00%	28.57%	21.43%
No Opinion	7.69%	53.85%	28.57%	50.00%
Agree	7.69%	38.46%	14.29%	7.14%
Strongly Agree	0.00%	7.69%	0.00%	7.14%

Table 5l: Recently, I have been feeling healthier than usual

	TREATMENT GROUP		CONTROL GROUP	
	Pre Test	Week 4	Pre Test	Week 4
Strongly Disagree	0.00%	7.69%	21.43%	0.00%
Disagree	61.54%	0.00%	14.29%	14.29%
No Opinion	7.69%	23.08%	28.57%	21.43%
Agree	30.77%	69.23%	35.71%	57.14%
Strongly Agree	0.00%	0.00%	0.00%	7.14%

Table 5n: How do you feel about body shape in general

	TREATMENT GROUP		CONTROL GROUP	
	Pre Test	Week 4	Pre Test	Week 4
Strongly Disagree	23.08%	0.00%	14.29%	7.14%
Disagree	46.15%	23.08%	35.71%	14.29%
No Opinion	15.38%	38.46%	35.71%	35.71%
Agree	15.38%	23.08%	14.29%	42.86%
Strongly Agree	0.00%	15.38%	0.00%	0.00%

A frequency distribution analysis of the Body Satisfaction Scale indicated that forty six percent of treated subjects agreed that their stomach felt flat and fifty four percent reported abdominal muscle firmness at the end of the study compared to seven percent and none of the control group subjects respectively. Sixty-two percent of treated subjects agreed that their clothes seemed to fit better compared to twenty nine percent of control group subjects. Eighty five percent of treated subjects felt more positive about their shape compared with fifty percent of the control group subjects. The findings indicate that general body satisfaction improvements are seen following a walking exercise programme and that these improvements are increased by using an abdominal training device simultaneously.

Treatment Group Evaluation

Table 6 presents the frequency distribution of responses of treatment group subjects to a range of statements which required them to compare the use of Slendertone Flex while walking to their previous exercise routine which consisted of just walking alone. As can be seen from the table ninety two percent of users reported that using Flex while walking improved the tone and shape of their stomach and gave them a better workout. Eighty five percent of users reported that using Flex while walking improved the flatness and firmness of their stomach and that they preferred using Flex while walking to just walking alone.

	Disagree/ Strongly Disagree	No Opinion	Agree	Strongly Agree
Using Flex while walking is convenient	0.00%	0.00%	30.77%	61.54%
Using Flex while walking adds value to my exercise routine	0.00%	0.00%	30.77%	61.54%
Using Flex while walking has improved the appearance of my stomach	0.00%	15.38%	38.46%	38.46%
Using Flex while walking gives me a better workout than just walking on its own	0.00%	0.00%	38.46%	53.85%
Using Flex while walking has improved the tone of my stomach more than just walking	0.00%	0.00%	53.85%	38.46%
Using Flex while walking has improved the firmness of my stomach more than just walking	0.00%	7.69%	46.15%	38.46%
Using Flex while walking has improved the shape of my stomach more than just walking	0.00%	0.00%	53.85%	38.46%
Using Flex while walking has improved the flatness of my stomach more than just walking	0.00%	7.69%	53.85%	30.77%
Overall my shape has improved since I started using Flex	0.00%	0.00%	61.54%	30.77%
I prefer using Flex while walking to just walking on its own	0.00%	7.69%	30.77%	53.85%

Table 6: Flex Walking Trial Treatment Group Subjects Attitude To Using Flex While Walking

Physical Self Perception Profile

Table 7 presents the mean group scores pre test and at week four of the study for each of the scales on the Physical Self Perception Profile.

As can be seen from the table statistically significant improvements were reported by both groups relative to their initial scores on the physical condition, body attractiveness and physical self worth subscales.

	Treatment Group					Control Group				
	Pre Test		Week 4		p<	Pre Test		Week 4		p<
	Mean	Std Dev	Mean	Std Dev		Mean	Std Dev	Mean	Std Dev	
Sports Competence	11.82	4.49	13.36	3.91	*	12.15	3.41	12.46	2.67	*
Physical Condition	10.82	2.56	14.64	3.32	0.001	12.92	3.95	14.92	2.99	0.022
Body Attractiveness	9.64	2.87	12.27	3.20	0.005	10.77	2.92	13.38	2.60	0.002
Physical Strength	13.00	3.03	14.91	3.05	*	13.54	3.36	14.08	3.25	*
Physical Self Worth	11.91	2.12	13.91	2.55	0.027	13.00	3.29	14.85	2.19	0.016

Table 7: Physical Self Perception Profile, Average Score by Item, Pre Test and Week 4.

	Treatment Group		Control Group		p<
	Mean	Std Dev	Mean	Std Dev	
Sports Competence	1.55	2.88	0.31	2.72	*
Physical Condition	3.82	2.86	2.00	2.74	*
Body Attractiveness	2.64	2.46	2.62	2.47	*
Physical Self Worth	2.00	2.57	1.85	2.38	*

Table 8: Physical Self Perception Profile Average Change in Score After 4 Weeks

Table 8 presents the average change in scores along each of the subscales of the Physical Self Perception Profile for treated and control group subjects. As can be seen from the table, the changes in scores recorded by both groups were not statistically significant, however in all cases the change reported by treated subjects was greater than that reported by control subjects, indicating that use of Slendertone Flex augmented the improvements in the physical self concept seen following a walking exercise programme.

Self Esteem Scale

Tables 9 and 10 present the average scores on the Self Esteem Scale for both treatment and control group subjects. Changes in self esteem scores were not statistically significant within each group pre and post test or when comparing the scores of both groups.

Treatment Group					Control Group				
Pre Test		Week 4			Pre Test		Week 4		
Mean	Std Dev	Mean	Std Dev	p<	Mean	Std Dev	Mean	Std Dev	p<
31.25	4.94	31.75	3.62	*	33.10	4.60	32.43	3.69	*

Table 9: Self Esteem Scale (Rosenberg, 1984) Average Score by Group, Pre Test and Week 4

Treatment Group		Control Group		p<
Mean	Std Dev	Mean	Std Dev	
0.5	3.68	-0.64	2.90	*

Table 10: Self Esteem Scale (Rosenberg, 1984) Average Change in Score After 4 Weeks

Abdominal Muscle Strength

Due to concerns over the validation of the abdominal curl sit up test, the findings of the test are considered void and will not be reported. It was discovered that the sit up test caused neck discomfort to one third of subjects during the first measurement and subsequently they were not re-measured.

Discussion of Results

The findings of the study indicate that subjects experienced improvements in abdominal firmness, flatness and muscle tightness following use of the Slendertone Flex Abdominal Training System while walking that were greater than the improvements seen by those following a walking exercise programme. The findings also indicate that subjects who followed an exercise programme using Flex while walking found it gave them a better workout than their previous walking exercise routine and resulted in improvements in abdominal shape.

As with all psychometric measurements, it may be suggested that subjects reported greater changes than they experienced, however there are a number of key aspects of the research design and results that counter this argument.

- There was internal consistency in the results between the scales.
- Subjects were not in any way exposed to marketing or promotional materials that may have biased their expectations or outlined the benefits of use of the product.
- Subjects did not have an incentive to record a positive result. They were aware that they received compensation for involvement regardless of the outcome and they were assured of confidentiality.
- Items within the Slendertone scales were rotated to minimise cognitive bias.

Sonstroem¹⁹ et al suggest that exercise can influence physical competence, physical acceptance and physical self efficacy and subsequently global self esteem. They suggest that specific elements are easier to change than general esteem elements therefore. The trial findings suggest that the lower level components of the self concept were effected by the intervention but global self esteem was not significantly affected. Self-esteem is generally a stable characteristic of adults, so it is not easily manipulated as an outcome in experimental designs²¹.

Sonstroem¹⁹ (1984) has suggested possible reasons why changes in self concept occur following participation in a fitness programme due to an increase in physical fitness, goal achievement, somatic well being, competence, adoption of health behaviours, social experiences, experimental attention and reinforcement of significant others. It is evident that the control group experienced improvements in the self concept due to involvement in an exercise programme and that subsequent increases in the self concept seen by the treatment group were due explicitly to use of the Slendertone Flex.

This suggests that changes reported by the treatment group after four weeks of use of the Slendertone Flex resulted in a more

positive evaluation of the appearance of the abdominal muscles relative to the evaluation reported by control group subjects.

Conclusion

It has been shown that a treatment regime of twenty x thirty minute sessions of Flex use while walking results in greater improvements in abdominal muscle shape compared to walking on its own. A subjective evaluation by treated subjects indicated that they found that using Flex while walking enhanced their exercise routine.

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