

## Comparative effectiveness of weight loss programs to Reduce Body Fat in Women aged 25-50 in Greece

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### Introduction

Obesity has been recognized as one of the leading health risk factors worldwide. It concerns children, women and men, of all ages. It is associated with many other risk factors and health problems. Obesity is considered to be a psychological and a physical problem, as well.

When overweight or obese people lose weight, health risks may be induced, mobility may be increased, and the onset of metabolic problems might be delayed. Weight loss occurs, when the body has more energy expenditure at work, compared to energy consumption through nutrition. It then uses stored fat or muscle tissue stores and will gradually lead to weight loss. Psychological issues are expressed both before and during a multidisciplinary approach in the treatment of obesity.

The reduction in fat and body weight, as a whole, occupies the female population, mostly in developed societies. Often women visit gyms and beauty salons to achieve the desired outcome, under the guidance of experts. Nutrition, physical activity, behavior, hereditary characteristics, physiological, clinical consequences of everyday life and working life are combined with psychological and socioeconomic factors and they might shape the existing

### Abstract

There is a variety of weight loss programs to reduce Body Fat. In Greece, there is reported a 38% prevalence of obesity among the women, mainly in urban areas. This is a survey to compare the effectiveness of 3 weight loss programs among Caucasian women, aged 25-50 from Thessaloniki. Sixty obese women with a floating Body Mass Index (BMI)  $\geq 25$  kg/m<sup>2</sup> were recruited for this trial and were randomly divided into 4 groups (3 Experimental and 1 Control). Their daily intake of energy was at least 1.200 kcal. The three different protocols were: Massage, Treadmill and Treadmill with Vacuum. They were applied for 12 weeks. Using the triangulation method, the processing of the data, which were collected from quantitative and qualitative research tools, showed, that the women, who followed the Treadmill with Vacuum protocol, showed the largest reductions in body fat, which were significant overall weight loss difference determined between the four groups. The factors (personal behavior, psychological, socioeconomic), that may have had affected, are presented and discussed. Accounting for the economic strategy (time and money) in those protocols, Treadmill with Vacuum alone may present a reasonable and effective option in the treatment of overweight and obesity in adults.

Key words: body fat reduction, massage, treadmill, treadmill with Vacuum

somatotype of people. The results of exercise programs designed to reduce body fat are disappointing. However, reporting weight loss as an average, overlaps those people, who lose significant amounts of fat.

The reason, why some participants produce significant fat loss due to exercise, while others lose little or increase fat stores, is likely to be the result of a series of behavioural, environmental, socioeconomic and psychological effects. The following review explores and highlights the potential factors associated with weight loss, and examines, how individual differences can determine the extent of weight loss after an intervention exercise. Individual weight loss response standards and key mechanisms are important to understand, why some people can and others cannot lose weight through exercise interventions.

Urbanization in Greece is intense and the daily life of people of all ages, especially of women, in cities has been diversified. The obesity now appears to be disturbing.

The main purpose of this research was to determine the most effective method for reducing body fat and, consequently, reducing body weight. The investigator decided to investigate 3 different methods of reducing fatty tissue levels. One of these methods was massage, which is one of the methods of classical beautician treatments. The next, method, to be evaluated, was aerobic exercise on a treadmill, which is a method of active exercise. Finally, the effectiveness of aerobic exercise in sub pressure (negative pressure) was evaluated.

## **Materials and Methods**

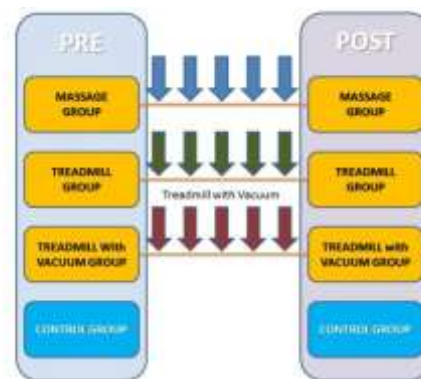
This study recruited 60 Caucasian women. It was much easier to identify obese women, who would like to get rid of their unnecessary weight by systematically conducting sessions with such a goal. Nowadays, in developed societies, there is a tendency for attending gyms and beauty salons among women, who focus on improving their outward appearance (Leontari, 2011). They were aged 25-50 years old, and lived in the wider area of Thessaloniki in Macedonia, North Greece. Exclusion criteria for all participants included diabetes, pregnancy, hypertension, treatment with antidepressants, and use of weight loss drugs. All women were told to maintain their usual diet for the total duration of the study. None were engaged in physical training programs or calorie restriction protocols and all participants gave written informed consent. For the research needs, further determinant criteria for the selection of the subjects of the original sample, were important, such as: their

body weight, the intention to reduce it, their average daily routine, lifestyle, physical activity, the available free time and how to use it.

The design of the research is described in the following two diagrams (Figure 1 and Figure 2). They show, how research questions and research methodology (qualitative, quantitative and triangular), research tools for data collection, team design (Experimental and Control) and effects on experimental groups, for investigation of research cases were formulated. The research project was guided by the concept of "suitability for the purpose". The tools were semi-structured interviews, questionnaires and measurement and observation protocols. This survey was carried out from 01/03/2010 until 28/04/2014.



**Figure 1.** The Research Process



**Figure 2.** Post- and Pre-Repeated Design

The research included the following phases: the preliminary, the PRE-phase, the application of the methods (12 weeks' duration) in the 3 experimental groups (Massage Group, Treadmill Group and Treadmill with Vacuum Group) with differentiated sessions, measurements of body fat, body weight and skinfolds (abdomen, suprailium, thigh, triceps), and the comparison of the PRE-and POST results in terms of weight loss (by the method of repeated measurements). The triangulation method was used to analyse the data. Triangulation is defined as the use of two or more methods of data collection in the study of some dimensions of human behavior (Cohen et al, 2008). All group were equivalent, homogenous and with similar characteristics. The daily intake of energy was at least 1.200 kcal. The recurring factor was the "time of measurement" within 5 steps (1 before the initiation of the treatment protocol, 3 interstitials, and 1 after the completion of the program). All tools and methodology (quantitative and qualitative) were tested for reliability and validity. Four key features were created: (1) sample size  $n = 71$ , (2) sample sampling, (3)

face-, construct- and content validity, and (4) reliability, in order to form a powerful and effective tool (quantitative research). Great reliability, that is acceptable, is satisfactory and can be considered good to excellent reliability (Cronbach's Alpha = 0.838, 0.807 and 0.778). Ensuring the quality and validity of a qualitative research is achieved through the satisfaction of specific research consistency criteria, and the detailed description of the research process for its readers, so that readers can make a judicious assessment of the validity and credibility of this due to research. The criteria (credibility, validity, verifiability, confidentiality, transferability and universality of research) set in this case were "legitimacy" (Denzin et al, 2000) or "standards" (Eisenhart et al., 1992) or even "philosophical variability of validity and reliability" (Varieties), as suggested by Guba and Lincoln (Guba et al, 2001).

SPSS ver 13, Atlas.ti ver 6 and a WordCloud were used for increasing confidence in research data (SPSS, 2015; Howitt et al, 2010). It is possible to create innovative ways of understanding, under investigation, each phenomenon. At the same time, unique findings are revealed, which recommend or incorporate theories, contributing to a clearer understanding of the problem (Thurmond, 2001). These advantages are mainly due to the variety and amount of data, which can be used for investigation and analysis (Crucial benefits of triangulation).

Regular distribution (Apostolakis et al, 2003; Plichta et al, 2005), the differences and homogenous group characteristics (One-way ANOVA) were checked. For the independent variables, one-way ANOVA was performed. Multivalent variance analysis (MANOVA) was performed for the dependent variables, with repeated measurements.

The entire work on the texts of the transcripts of the interviews had to be done on three levels. The primary and basic level was that of codification. First came the "textual level", which includes basic functions, such as the fragmentation of data files, encoded texts, and the recording and transcription of observations and notes by the researcher. Second came the "conceptual level", which includes sophisticated functions such as building the model and linking the codes to the networks. The third level was necessary for "management and exchange of data" (Kern et al, 2004; Muhr et al, 2004).

## Results and Discussion

Methodological triangulation (Denzin, 1970) involves the use of different methods in the same research object, so the collected data has also been extensively studied. The results of qualitative research will be quoted and the quantitative ones will follow, in order to distinguish and embroider the personal, psychological and socioeconomic factors that influenced the observed changes from the application of the three protocols.

A) The qualitative research has confirmed, that the following factors are important for the research results:

- Women's perceptions of the results of their body fat reduction efforts.
- Women's perceptions of their self-confidence and self-esteem.
- Factors, that are thought to influence positively the body weight loss.
- Factors, that have been thought to have had a negative impact on the body weight loss.
- Demand for continuation and re-participation in a similar program for further weight reduction.

B) The quantitative research has confirmed, that the research results are related with:

- A decrease in the thickness of the abdominal skinfold.
- Decrease of the body fat percentage: It is observed, that the lower body fat percentage values, at the end of the measurements, occur in women in the Treadmill with Vacuum Group, and seem to be influenced by factors, such as the age, and the research program. This is observed after the 3d measurement (Table 1).

**Table 1.** Estimated marginal means of the body fat percentage for each group, during each measurement

	N	1 <sup>st</sup> body fat measurement		2 <sup>nd</sup> body fat measurement		3 <sup>d</sup> body fat measurement		4 <sup>th</sup> body fat measurement		5 <sup>th</sup> body fat measurement	
		M	Std. D	M	Std. D	M	Std. D	M	Std. D	M	Std. D
<b>Group</b>											
<b>Massage</b>	15	36,629	3,264	35,725	3,296	34,874	3,453	34,092	3,441	33,221	3,744
<b>Treadmill</b>	15	38,556	3,540	37,726	3,308	36,777	3,161	35,851	2,998	34,723	2,783
<b>Treadmill with Vacuum</b>	15	38,185	3,989	36,626	3,671	34,077	4,061	32,982	3,214	31,029	2,943
<b>Control</b>	15	36,248	4,044	36,040	3,988	35,725	4,023	35,479	4,139	35,202	3,956
<b>Total</b>	60	37,404	3,761	36,529	3,569	35,363	34,601	3,738	3,576	33,544	3,690

Note. N= Number, M = Mean, Std. D = Standard Deviation

- The change in BMI. It is obvious, that the greatest reduction in the body fat percentage is recorded by the people in the Treadmill with Vacuum Group. In addition, these women exhibit the lower end values in BMI (Table 2).

**Table 2.** Comparison of the (PRE) BMI with the POST BMI of each Group separately, after the applications.

BMI Classification		PRE	POST	CHANGE OF CLASS
<b>NORMAL RANGE</b>	<b>GROUP</b>	<b>N</b>	<b>N</b>	
	Massage	2	7	5
	Treadmill	1	5	4
	Treadmill with Vacuum	1	9	8
<b>OVERWEIGHT</b>	Control	5	7	2
	Massage	13	8	-5
	Treadmill	14	10	-4
	Treadmill with Vacuum	13	5	-8
<b>OBESE CLASS I</b>	Control	10	8	-2
	Treadmill with vacuum		1	1
<b>OBESE CLASS II</b>	Treadmill with Vacuum	1		-1

It is observed, that the lower BMI values at the final measurement occur in women, who follow the Treadmill with Vacuum Group. This is observed after the second measurement (Table 3).

**Table 3:** Estimated marginal means of measure (means) and standard Deviation (Std D) of BMI, in 5 repeated measures, by group.

	N	1 <sup>st</sup> BMI		2 <sup>nd</sup> BMI		3 <sup>rd</sup> BMI		4 <sup>th</sup> BMI		5 <sup>th</sup> BMI	
		MEAN	STD. D	MEAN	STD. D	MEAN	STD. D	MEAN	STD. D	MEAN	STD. D
<b>GROUP</b>											
<b>Massage</b>	15	26,733	1,835	26,626	1,674	26,097	1,736	25,668	1,797	25,180	1,768
<b>Treadmill</b>	15	27,440	1,463	26,918	1,509	26,323	1,578	25,753	1,569	25,208	1,587
<b>Treadmill with Vacuum</b>	15	27,748	2,861	26,506	1,487	25,883	1,569	25,288	1,463	24,644	1,355
<b>Control</b>	15	25,946	1,665	25,798	1,664	25,595	1,610	25,415	1,633	25,297	1,509
<b>Total</b>	60	26,967	1,956	26,462	1,584	25,975	1,623	25,531	1,615	25,082	1,555

Note. N= Number, M = Mean, Std. D = Standard Deviation

- The alcohol consumption.
- The physical activity at work.
- The presence or absence of a similar effort in the past.
- The presence of systematic physical exercise in the last 10 years.

- Overeating episodes due to anxiety.
- The number of cigarettes smoked per day.
- The water consumption.
- The concomitant, external use of medcosmetics, as ancillary products, throughout the research program.
- The improvement in the clinical picture of cellulite.
- The somatotype.

It is noted, that only 3 types of Sheldon intradermal somatotype appear in the sample: *rectangular* 30%, *round apple* 35% and *pear* 35%. They appear overall, at similar frequencies (Patel et al, 2013).

This study has confirmed that the pear somatotype shows the biggest decreases in Massage and Treadmill Groups. The round apple somatotype scores the biggest decreases in the Treadmill with Vacuum Group, and the rectangular somatotype shows the biggest decrease in the Control Group.

Investigating the change in abdominal skinfold reveals, that in the Treadmill Group, women with a pear somatotype have a statistically significantly greater reduction in the abdominal skinfold, compared to the round apple somatotype (Table 4).

**Table 4:** Comparison between the abdominal skinfold thickness of women in the Treadmill Group, after the 5<sup>th</sup> measurement, according to their somatotype, with a Post-hoc test (according to Scheffe criterion).

<b>Treadmill Group</b>				
<b>Somatotype</b>		<b>N</b>	<b>Subset for alpha = .05</b>	
			1	2
<b>Scheffe</b>	<b>round apple</b>	5	<b>3,000</b>	
	<b>rectangular</b>	4	3,875	3,875
	<b>pear</b>	6		<b>4,500</b>
		<b>Sig.</b>	0,272	0,497

Investigating the change of the abdominal skinfold, it is noted, that in the Treadmill with Vacuum Group, pear-shaped women have a statistically significantly greater reduction in the abdominal skinfold, compared to women with a rectangular somatotype (Table 5).

**Table 5:** Comparison between the abdominal skinfold thickness of women in the Treadmill with Vacuum Group, after the 5<sup>th</sup> measurement, according to their somatotype, with a Post-hoc test (according to Scheffe criterion).

<b>Treadmill with Vacuum Group</b>				
	Somatotype	N	Subset for alpha = .05	
			1	2
<b>Scheffe</b>	rectangular	3	<b>3,833</b>	
	pear	7	6,857	6,857
	round apple	5		<b>11,000</b>
	<b>Sig.</b>		0,455	0,246

By studying the comparisons between mean body weight reduction values (POST- PRE), women with round apple- or pear somatotype are the most overweight in all groups. In the Massage Group, women with rectangular somatotype show significant body weight reductions (Table 6).

**Table 6:** Comparison between the estimated marginal means of measure of women's body weight reduction values (POST- PRE), in case of their somatotype, with a Post-hoc test (according to Scheffe criterion).

<b>WEIGHT REDUCTION DIFERRENCIATIONS (POST- PRE)</b>								
Somatotype	Message Group		Treadmill Group		Treadmill with Vacuum Group		Control Group	
	N Subset for alpha = .05		N Subset for alpha = .05		N Subset for alpha = .05		N Subset for alpha = .05	
rectangular	7	<b>-5,600</b>	4	-5,725	3	-6,200	4	-1,975
round apple	5	<b>-5,540</b>	5	<b>-6,620</b>	5	<b>-6,940</b>	6	<b>-1,983</b>
pear	3	-4,533	6	-6,050	7	-6,929	5	-1,340
<b>Sig.</b>		0,235		0,429		0,798		0,568

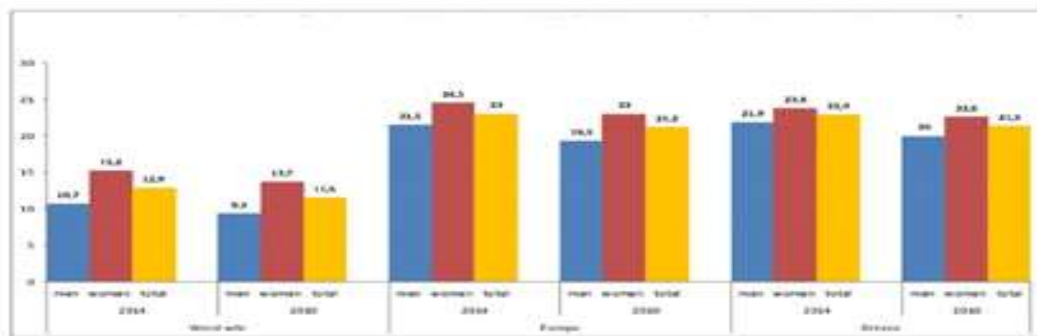
## Conclusions

A marked trend towards increasing levels of adult overweight and obesity can be found throughout Europe, although there are variations in prevalence. Obesity rates range from 10% to 27% in men and up to 38% in women. In the United States of America, obesity stands at 28% of men and 34% of women, including a very significant component of morbid obesity. In parts of Europe the combination of reported overweight and obesity in men exceeds even the 67% prevalence found in the USA's most recent measured survey. Finland, Germany, Greece, Cyprus, the Czech Republic, Slovakia and Malta all have overweight rates, which surpass that of the USA. However, when judged on obesity alone, at least nine



European countries have male obesity rates above 20% including Greece and Cyprus reaching 27% (Lobstein et al, 2005). For women obesity levels vary from 10% to 26% in the Czech Republic with a significant study in Greece reporting a 38% prevalence of obesity among the women surveyed. In at least seven countries one in five women is obese. With regard to obesity, over the five-year period 2010-2014, the proportion of obese adults in Greece increased slightly from 21.3% in 2010 to 22.9% in 2014. Obesity rates for Greeks over the past five years are similar with the corresponding European and much higher (almost double) than the international (Figure 3) (Kapantais et al, 2004; WHO, 2015; WHO 2015; WHO European Childhood Obesity Surveillance Initiative (COSI), 2015; WHO, 2015).

**Figure 3.** Diastolic changes in the percentage of obese adults at global, European and Greek level, for the whole and by sex, for the five-year period 2010- 2014.



Women, who participated in Treadmill with Vacuum Group, experienced the largest reduction in fat levels, compared to those in the other Experimental Groups and the Control Group. The reduction of skinfolds was statistically significant. This suggests that women of the Treadmill with Vacuum Group, experienced a decrease in their body weight and fat, and, at the same time, a significant reduction of their skinfolds. The continuous downward trend in women’s fatty tissue levels and the support of the researcher has increased their will and self-confidence, and enthusiasm, for the course of their development. Familiarizing them with all of the training programs of the Treadmill with Vacuum has been a surprising, pleasant experience for women and an incentive for them, to make their best possible effort. The results for those women were very satisfactory.

It is noted, that women with the 5 best performances in the Treadmill with Vacuum Group, belonged mostly to the Sheldon's intraformal somatotype with a larger deposition of unnecessary body fat at the bottom of the trunk and in the lower limbs (pear). Only one of them belonged to the Sheldon's intraformal somatotype, with a larger deposition of unnecessary body fat in the upper body (round apple).

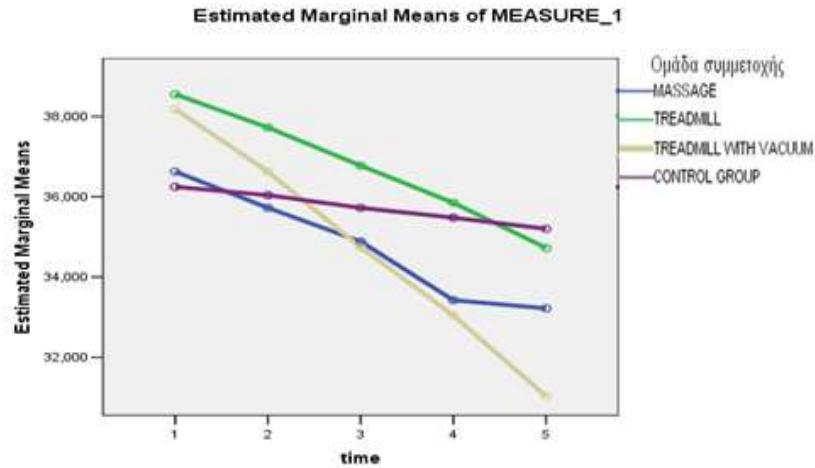
Women, who followed the Treadmill with Vacuum protocol, showed a very high body fat reduction, compared to all women in other groups. The decrease began to appear after the 6th week and was statistically significant at the end of all the 12 weeks. They also showed the biggest differences compared to the Control Group women. Women's body fat values in the Treadmill with Vacuum Group are reported to show a statistically significant downward trend after the 3rd week of the sessions, which is consistent with similar international literature (LaSala, 2015; Evans et al, 2011). This assumption demonstrates the effect of the number of sessions of each protocol on reducing body fat levels. The effect of the number of sessions is deduced in the total of Experimental Groups, when compared to the Control Group. Women, aged between 41 and 45, show the highest rate of reduction in their body fat levels, which is not evidenced by a relevant, already existing bibliographic reference.

In addition, women younger than 40 years old in the Treadmill with Vacuum Group reported a statistically significant reduction in their fatty tissue levels, compared to the rest of women. The already existing international and Greek bibliography on the aerobic exercise Treadmill with Vacuum Group is limited. There is no published bibliography indicating this conclusion

After 12 weeks of Massage, Treadmill Group and Treadmill with Vacuum protocols, body fat skinfold measurements, performed every 3 weeks, showed that the abdominal skinfold was reduced. Therefore, it can be concluded, that a medium-term aerobic exercise or Massage program (2.5 months) causes a statistically significant reduction in the abdominal skinfold, which is observed gradually in the next 4 measurements. It can be seen, that even in Control Group women, who only follow a nutrition protocol, there is a gradual statistically significant reduction in the abdominal skinfold. However, it is noted, that this is the smallest decrease observed. The largest decrease in the abdominal skinfold is seen in women, who follow the Treadmill with Vacuum protocol.

The reduction in body fat percentage is statistically significant, especially in those women, who followed the Treadmill with Vacuum protocol. Observing the reduction rates, there is

a difference between Experimental Groups and the Control Group. The smallest decrease was observed in Control Group women, who only followed the proposed diet program (Graph 4).



**Graph 4.** Graph of the estimated marginal means body fat percentage reduction of women, after the 5<sup>th</sup> measurement.

After 12 weeks of Massage, Treadmill Group and Treadmill with Vacuum protocols, and a 3-week measurement, a statistically significant reduction in body fat has been observed. Consequently, it can be concluded, that a medium-term aerobic exercise or Massage causes a statistically significant reduction in body fat, which is gradually being observed in the 4 subsequent measurements. It is clear, that even in Control Group women, who follow only a diet protocol, having adopted the nutritional advice given by the researcher, there is a gradual statistically significant reduction in body fat. However, it is noted, that the lowest relative decrease has been observed in the Control Group. The largest reduction in body fat is seen in women, following the Treadmill with Vacuum protocol (Table 7).

**Table 7:** Comparison between the Means, the Standard Deviation, the smallest- and the biggest body fat percentage, the BMI classification, the rate of the body fat percentage reduction, the reduction of the sum of the skinfolds, and the reduction of the Suprailiac skinfold, after the 5<sup>th</sup> measurement.

		N	Mean	Std. Deviation	Minimum	Maximum
<b>5<sup>th</sup> measurement of body fat percentage</b>	Massage	15	33,22	3,744	24,936	38,358
	Treadmill	15	34,72	2,783	29,835	38,912
	<b>Treadmill with Vacuum</b>	15	<b>31,03</b>	<b>2,943</b>	<b>24,924</b>	<b>35,576</b>
	Control	15	35,20	3,956	29,614	41,930
	Total	60	33,54	3,690	24,924	41,930
<b>5<sup>th</sup> measurement (BMI classification)</b>	Massage	15	2,53	0,516	2	3
	Treadmill	15	2,67	0,488	2	3
	<b>Treadmill with Vacuum</b>	15	<b>2,47</b>	<b>0,640</b>	2	<b>4</b> *
	Control	15	2,53	0,516	2	3
	Total	60	2,55	0,534	2	4
<b>Reduction of body fat percentage in the meantime, between the POST- and the PRE-measurement</b>	Massage	15	3,41	1,796	1,089	7,341
	Treadmill	15	3,83	0,880	2,190	4,831
	<b>Treadmill with Vacuum</b>	15	<b>7,16</b>	<b>1,786</b>	<b>5,081</b>	<b>10,502</b>
	Control	15	1,05	0,555	-0,253	1,818
	Total	60	3,86	2,570	-0,253	10,502
<b>5<sup>th</sup> measurement (calculation of BMI)</b>	Massage	15	25,18	1,768	21,242	28,086
	Treadmill	15	25,21	1,587	<b>20,900</b>	27,574
	<b>Treadmill with Vacuum</b>	15	<b>24,64</b>	<b>1,355</b>	22,395	<b>26,983</b> *
	Control	15	25,30	1,509	23,065	27,855
	Total	60	25,08	1,544	20,900	28,086
<b>Reduction of the sum of the skinfolds (POST- PRE)</b>	Massage	15	33,22	3,744	24,936	38,358
	Treadmill	15	34,72	2,783	29,835	38,912
	<b>Treadmill with Vacuum</b>	15	<b>31,03</b>	<b>2,943</b>	<b>24,924</b>	<b>35,576</b>
	Control	15	35,20	3,956	29,614	41,930
	Total	60	33,54	3,690	24,924	41,930
<b>Reduction of the of the suprailiac skinfold (POST- PRE)</b>	Massage	15	3,20	2,226	0,500	7,000
	Treadmill	15	3,90	1,417	1,500	6,000
	<b>Treadmill with Vacuum</b>	15	<b>6,30</b>	<b>4,225</b>	<b>-4,500</b>	<b>13,000</b> *
	Control	15	1,10	1,105	-0,500	4,000
	Total	60	3,63	3,112	-4,500	13,000

## Acknowledgments

The authors would like to thank all the women, who were part of the research sample.

## Disclosure statement

The authors declare that they have no conflicts of interest and no financial interests, related to the material of this manuscript.

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