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Original article

CHANGES IN THE BODY COMPOSITION OF PEOPLE PRACTICING EXERCISES ON PILATES APPARATUS

ISPAS Andrei-Marius[1], MACOVEI Sabina[1], ZAHIU Mihaela[1]

Abstract*

*Aims.*Through this study, we intended to track how a framework programme of exerciseson Pilates apparatus could influence body composition in adult women. The research started from the premise that Pilates would act on optimizing posture, toning muscles, improving balance and suppleness. We have also considered the benefits of using Pilates equipment, which allows any person to adaptthe exercises according to personal needs.

*Methods.*The research aimed to monitor changes in the body composition over a 4-month period, from October 2016 to January 2017, in 20 female subjects who attended a framework programme of exerciseson Pilates apparatus at the SHAPE ART PILATES Studio. Subject selection was based on the following criteria: gender, number of lessons attended and level of participation in lessons. To measure body composition, it was used the OMRON BF511 Body Composition Monitor. It provides data about weight, Body Mass Index (BMI), Body Fat Percentage (BFP), Skeletal Muscle Percentage (SMP) and Visceral Fat (VF). The framework programme consisted of 10 basic exercises with variations adapted to each subject, performed on the Allegro Reformer machine, which is the main pillar of Pilates equipment.

*Results.*The results have shown changes in all indicators measured with the help of OMRON BF511 Body Composition Monitor.

*Conclusions.*The performed measurements entitle us to state that Pilates exercises are beneficial to physical health and well-being by improving the indices of weight andbody fat percentage, in close relationship with the muscle tissue.

Keywords: body composition, Pilates apparatus, Reformer, OMRON.

Introduction

An active life thatcultivates movement ensures well-being and a healthy body. It also confers theindividualtraits related to optimism and self-confidence. And thisoccurs because,by knowinghis body, man identifies with his inner self (Epuran, 2011).

By practicing various physical exercises, the human bodyremains active andpreserves its integrity, in contrast with the alternative of an inactive body, whichresults from the influence ofthree factors that characterize modern society:sedentariness, overeating and overstress (Epuran, 2011).

One of the forms of exercise intended for adults to improvetheir physical fitness is Pilates. Practicing Pilates exercises has become anincreasingly common activityfor the population due to the characteristics of thismethod, which involvesthe control and awareness of body sensations. The performer becomes the master ofhis/her body and starts understanding the role of exercises and their effects on the body (Smith, Kelly, Monks, 2014).

The diversified offer of Pilates programmesallows performing free floor exercises using different accessories, objects orspecial equipment. Accessing Pilates programmes requires the practitioner to know about their benefits and the existence of material resources. One of the most importantaspects isindividual practice supported by theindividual-instructor relationship, which leads to better customization of programmes and the adjustment of exercises according to each one's needs (Ispas, Macovei, 2016).

By creating this method, Joseph Pilatesaimed to achieve theperfect coordinationof body, mind and spirit. Exercises based on well-established principlesdevelop the body restoring its vitality,suppleness, correct posture and influence the way of performing various motor skills(Pilates, Miller, 2010).Their addressability determines the body awareness, control andremodeling (Silver, 2011).

[1] National University of Physical Education and Sports, Bucharest, Romania,
E-mail address: andrei_23_rc@yahoo.com
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Pilates is thought to be one of the methods that stimulate weight loss andoptimally intervenesin the improvement of body composition. Muscle toning becomesobvious, but with no increase in mass,and the body transformsby remodeling its shapes.Some studiesstate that, after a Pilates session lasting 1 hour, beginner practitioners burn241 calories, intermediate practitioners burnaround 338 calories, and advanced practitioners burn 421 calories (http://www.sfatulmedicului.ro). An explanation for these differences lies, on the one hand, in the difficulty level of exercises, and on the other hand, in the improved control of movements.

In the practice of maintenance activities, adult people areinterested in evaluating their physical condition. This can be done by scaling some fitness components, and one of them is body composition (Bota, 2006).

Purpose and premises

Our research aimed to identify the impact of exercises withPilates equipment on the practitioners, through the investigation of their body composition.

We have started from the premise that the role of body composition is essential for physical health, and that Pilatesexercises shape andtone the body.

Evaluation of body composition provides dataformeasuring nutritional status, physiological andmetabolic variations. Comprising all components that make up the body,body composition is expressed asbody weight. The share of these different componentsisexpressed through absolute, relative and percentage values (Cordun, 2009).

Acrucial rolein the body composition is played by body mass. It has anatomical, biochemical andfunctional components thatcan be found in various measurement models and methods. They mainly aim toidentify the ratio between fat mass and fat-free mass (Cordun, 2009).

Body composition measurement and evaluation can be donethrough direct or indirect methods, especially by calculating Body Mass Index (BMI), which is considered a standard in assessing thelevel of normality or deviation from normality in adults (Cordun, 2011).

Hypothesis

The practice of exercise programmes on Pilates apparatus contributesto improving bodycomposition in adult people.

Method

The experimental-typeresearch was conducted at the SHAPE ART PILATESStudio in Bucharest, between October 2016 and January 2017.

The subjects are20 women whohave completed a framework programmeof exercises on Pilates apparatus, namely on the Allegro Reformer machine, at the aforementioned Studio.

Subject selection took into account the following criteria:

- gender,because the number of women practicing Pilates is much higher than that of men;
- number of lessons attended, reflecting the seriousness and continuity in preparation;
- acceptance and involvement in performing training.

Toassess body composition, it was used the OMRON BF511 Body Composition Monitormeasuringbody fat percentage by bioelectric impedance analysis.

Measurements were performed for the entire body to avoid fluctuations,by means of electrodes for hands and feet. The device sends an extremely weak electrical current of 50 kHz through the body, which is not felt by the subject. Personal data are entered into the device software: age, gender, height and, depending on the subject's weight, it generatesthe results of body composition related to: Body Mass Index (BMI), Body Fat Percentage(BFP), Skeletal Muscle Percentage(SMP)andVisceral Fat(VF) (Omron, 2015).

Reference values for each indicator are shown in table 1.

Table 1. Reference values to measure body composition

BODY MASS INDEX		UNDERWEIGHT	NORMAL	OVERWEIGHT	OBESE
		<18.5	18.5<25	25<30	30
BODY FAT PERCENTAGE RESULT					
GERDER	AGE	LOW	NORMAL	HIGH	VERY HIGH
	18-39	<21.0%	21-32.9%	33-38.9%	>39%
FEMALE	40-59	<23.0%	23-33.9%	34-39.9%	>40%
	60-80	<24.0%	24-35.9%	36-41.9%	>42%

	18-39	<8.0%	8-19.9%	20-24.9%	>25%
MALE	40-59	<11.0%	11-21.9%	22-27.9%	>28%
	60-80	<13.0%	13-24.9%	25-29.9%	>30%
SKELETAL MUSCLE PERCENTAGE RESULT					
GERDER	AGE	LOW	NORMAL	HIGH	VERY HIGH
	18-39	<24.3%	24.3-30.3%	30.4-35.3%	>35.4%
FEMALE	40-59	<24.1%	24.1-30.1%	30.2-35.1%	>35.2%
	60-80	<23.9%	23.9-29.9%	30.0-34.9%	>35.0%
	18-39	<33.3%	33.3-39.3%	39.4-44.0%	>44.1%
MALE	40-59	<33.1%	33.1-39.1%	39.2-43.8%	>43.9%
	60-80	<32.9%	32.9-38.9%	39.0-43.6%	>43.7%
VISCERAL FAT LEVEL					
Level	NORMAL	HIGH		VERY HIGH	
Visceral	1->9	10->14		15->30	

The tests were administered at the beginning and the end of the experiment.

The framework programme consisted of 10 basic exercises with variations adapted to each subject, performed on the Allegro Reformer machine, which is the main pillar of Pilates equipment. The framework programme is systematized in table 2.

Table 2. Theframework programme of exercises on the Allegro Reformer machine

General objectives	Improvement of body composition
Specific objectives	Muscle group toning
	Developing suppleness
	Developing thecontrol ofsegments
	Postural muscle toning
Types of muscleactivity	Alternations of concentric and eccentric contractions usingthe machine accessories
Number of exercises	10 basic exercises with 5 variants each
Dosage	10 repetitions for each variant
	Slow and controlled working tempo

Results

The test results were analyzed through the statistical method using the SPSS program, version 15. The calculated indicators were: arithmetic mean, median, standard deviation, coefficient of variation, minimum and maximum values,dependent t-test.

Table 3 shows data relating to the subjects' age and height, aspects required by the device softwareto calculate the indicators and which are stablefor both tests.

The 20 subjects included in the experiment group are aged between 21(one subject)and 53(one subject), with an average of 33-34 years old. Group homogeneity is average, in terms of age (coefficient of variation – 24%).

Table 3.Age – Descriptive data

	Age	Height
Number of cases	20	20
Arithmetic mean	**33.6**	**169.1**
Median	34.5	170.0
Standard deviation	8.2	7.1
Coefficient of variation	24%	4%
Minimum	21	154
Maximum	53	179

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As regards height, it falls between 154 and 179 cm, with an average of 169 cm,the group being highlyhomogeneous, as shown intable 3.

Results for weight testing indicate a decrease of 1.51 kg between the initialand final testing, from 62.85 kg to 61.34 kg (figure 1),a statistically significant aspect by applying the dependent t-testwiththe calculated value of 4.957, at a p-value lower than 0.05 (p=0.000), according to table 4. Group homogeneity is high in both tests(18% initial testing and 17% final testing).

Table 4.Weight– Descriptive data

	Initial (I)	Final (F)
Number of cases	20	20
Arithmetic mean	62.85	61.34
Dif. (I-F)	-1.51 (-2.4%)	
Median	60.95	59.10
Standard deviation	11.13	10.54
Coefficient of variation	18%	17%
Minimum	50.1	49.6
Maximum	99.2	95.9
Dependent t-test (I-F) ***Calculated t-value***	***4.957***	
p	***0.000***	

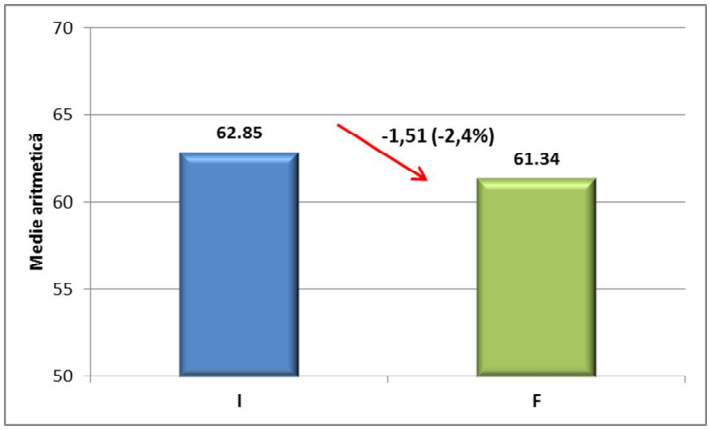

Figure 1:Weight – Initial testing vs. final testing

Results for Body Mass Index show a statistically significant decrease between the two tests (an average decrease of 0.50), from22.06 to 21.56 (according to figure 2). The significant decrease is given by the t-value (4.9625)calculated applying the dependent t-test, at a p-value lower than 0.05 (p=0.000), as shown in table 5.Group homogeneity is high in the initial and final testing, the coefficient of variation having the value 19% in both cases.

Table 5. Body Mass Index – Descriptive data

	Initial (I)	Final (F)
Number of cases	20	20
Arithmetic mean	22.06	21.56
Dif. (I-F)	-0.50 (-2.3%)	
Median	21.00	20.35
Standard deviation	4.21	4.05
Coefficient of variation	19%	19%
Minimum	17.3	17.4
Maximum	35.1	34.0
Dependent t- ***Calculated t-value***	***4.625***	

test (I-F)	***p***	***0.000***

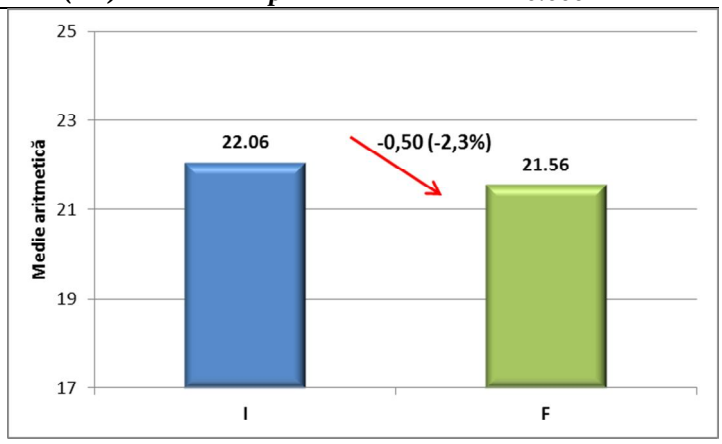

Figure 2: Body Mass Index – Initial testing vs. final testing

Reference values for assessing Body Mass Index indicate that most subjects have normal weight (80% in both the initial and final testing). In both tests, 10% of subjects are underweight, and 10% are obese. The group does not include overweight subjects.

Table6. Structureof the group of subjects vs.Body Mass Index

Body Mass Index – reference values		**Initial testing**		**Final testing**	
		Number of subjects	**%**	**Number of subjects**	**%**
UNDERWEIGHT	<18.5	2	10.0%	2	10.0%
NORMAL	18.5<25	16	80.0%	16	80.0%
OVERWEIGHT	25<30	0	0.0%	0	0.0%
OBESE	30	2	10.0%	2	10.0%
Total		**20**	**100%**	**20**	**100%**

Results for Body Fat Percentage show a statistically significant decrease between the two tests(from 31.28 to 30.08, according to figure 3). The significant decrease is given by the calculated t-value(3.959), at a p-value lower than 0.05 (p=0.001), according to table 7.

Group homogeneity is average in both tests, the coefficient of variation having the value 26% in the initial testing and 27% in the final testing.

Table 7. Body Fat Percentage – Descriptive data

	Initial (I)	**Final (F)**
Number of cases	20	20
Arithmetic mean	31.28	30.08
Dif. (I-F)	-1.21 (-3.9%)	
Median	29.10	27.75
Standard deviation	8.07	8.17
Coefficient of variation	26%	27%
Minimum	20.7	19.7
Maximum	52.8	51.7
Dependent t-test (I-F)	***Calculated t-value***	***3.959***
	P	***0.001***

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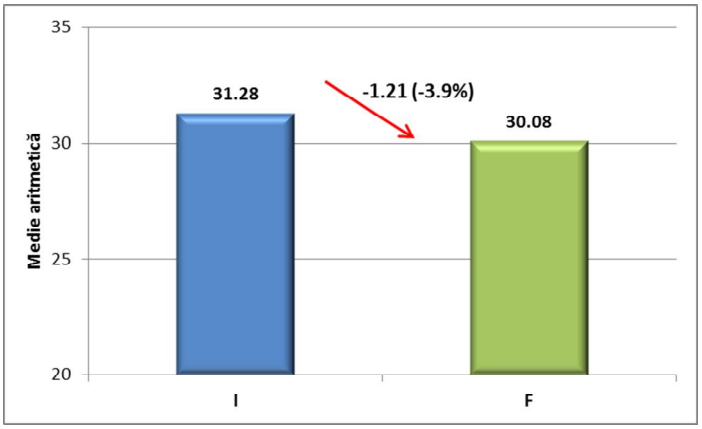

Figure 3: Body Fat Percentage – Initial testing vs. final testing

If compared to reference values, the group falls in the upper part of normal level.

For the Skeletal Muscle Percentage indicator, the obtained values show a statistically significantimprovement, from 28.14to 28.58 (as seen in figure 4). The significant increase is given by the calculatedt-value(-2.820),at a p-value lower than 0.05 (p=0.011), according to table8.

Group homogeneity is high in both the initial and final testing, the coefficient of variation having the value 12% in both cases.

Table 8. Skeletal Muscle Percentage – Descriptive data

	Initial (I)	Final (F)
Number of cases	20	20
Arithmetic mean	28.14	28.58
Dif. (I-F)	+0.44 (+1.6%)	
Median	28.65	29.25
Standard deviation	3.39	3.53
Coefficient of variation	12%	12%
Minimum	20.3	20.7
Maximum	33.9	34.4
Dependent t-test (I-F)	***Calculated t-value P***	***-2.820 0.011***

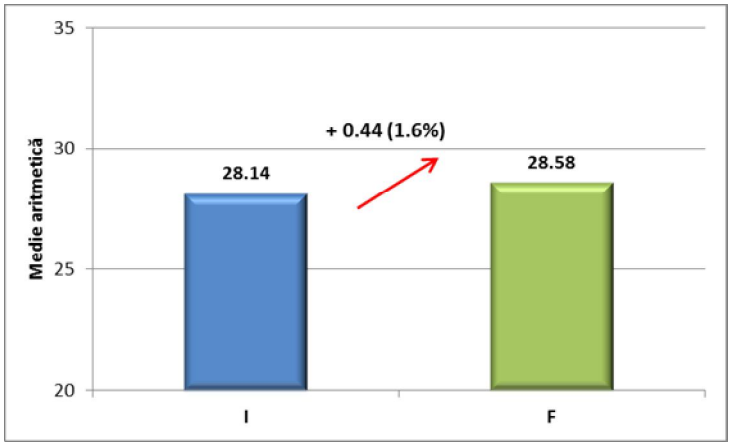

Figure 4: Skeletal Muscle Percentage – Initial testing vs. final testing

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Results for Visceral Fat indicator show significant improvements proven by the decreased index, from 4.20 to 3.95 (according to figure 5).If compared to reference values, 95% of subjects are normal in terms ofvisceral fat (values comprised between 1 and 9). The significant decrease is given by the t-value (2.517) calculated applying the dependent t-test, at a p-value lower than 0.05 (p=0.021), according to table 9.

Group homogeneity is lowin both tests, the coefficient of variation having the value 50% in the initial testing and 53% in the final testing.

Table 9. Visceral Fat – Descriptive data

	Initial (I)	Final (F)
Number of cases	20	20
Arithmetic mean	4.20	3.95
Dif. (I-F)	-0.25 (-6.0%)	
Median	4.00	3.00
Standard deviation	2.09	2.09
Coefficient of variation	50%	53%
Minimum	2.0	2.0
Maximum	10.0	10.0
Dependent t-test (I-F)	***Calculated t-value***	***2.517***
	p	***0.021***

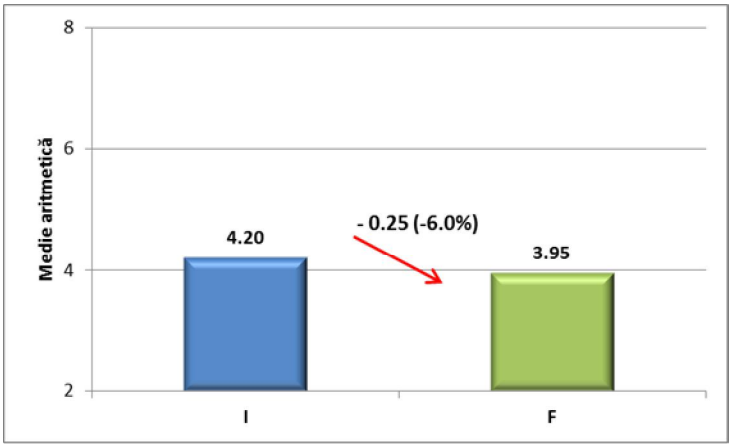

Figure 5: Visceral Fat – Initial testing vs. final testing

Discussion

The results of our experiment highlight that the group of subjects has a good body composition status. By relating them tothe reference values of all indicators measured (BMI, BFP, SMP,VF),it can be found that the results fall within the normal scale in both tests.

Regular attendance of the training programme ended with the improvement of individual values for all indicators, which proves the beneficial influence of exercises using Pilates equipment on the body of each participating subject.

Thus, the obtainedresults confirm the findings of literature, which describe Pilates as an activity that shapes the body, providing opportunities to improve its physical fitness and consequently the body composition (Traczinski, Polster, 2013;Tudor, 2012).

Due to the construction of Allegro Reformer, the practitioner manages to control and become aware of the performed movement, which makes the execution to be accurate and efficient, preparation reaching thus its purpose (Happy Cora Pilates, 2016). In this context, Pilates programmes become an effective and enjoyable form ofgymnastics, which creates the connection between body, mind and movement (Pilates, Miller, 2010, https://www.scribd.com/document/257662568/Pilates-Basic).

Conclusions

We think that the exercise programme on Pilates apparatus has reached its purpose, the obtained results highlighting changes in the body composition for all our subjects.

Given the obtained statistical significances, we can state that exercises using Pilates equipment contribute to improving body composition and, in this context, our hypothesis has been validated.

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