Sportif Bakış: Spor ve Eğitim Bilimleri Dergisi, 11(SI1): 1-13, 2024 Research Article
www.sportifbakis.com
E-ISSN: 2148-905X
doi: 10.33468/sbsebd.396

Investigation of the Effect of Mini-trampoline Exercises on Body Composition and Balance

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Abstract

This study aims to investigate the impact of twelve weeks of mini trampoline exercises on body composition and balance in women aged 18 and older. The study included 15 female athletes in the experimental group and 16 female athletes in the control group, aged 18-24, who regularly engaged in mini trampoline exercise. Height, weight, general body mass index (BMI), fat mass, fat-free mass (FFM), and body fat distribution in the torso, right arm, left arm, right leg, and left leg were measured using a Tanita device before exercise (pre-test) and 12 weeks after exercise (post-test). Measurements of mass (fat), fat-free mass (FFM), and Y balance test values for the right and left legs were also recorded. The exercise program was conducted three times weekly for twelve weeks, with each session lasting sixty minutes, inclusive of a warm-up and cool-down phase. In the data analyzes Paired samples t-test was utilized for intra-group (pre-test-post-test) comparisons, while an independent samples t-test was employed for inter-group (experiment-control) comparisons. All analyses in the study were performed using the SPSS 25.0 software, and the variables were assessed at a 95% confidence level. The analyzed results indicate that the post-test averages of the control group were statistically significantly greater than those of the experimental group ($p<.05$). The post-test and balance results averages in all measurements for both groups were statistically significantly greater than the pre-test averages ($p < .05$). The study concluded that mini trampoline exercise significantly improved body mass index values and balance in women over 18 years of age. This aerobic exercise enhances body composition and balance; therefore, it is advisable for individuals to perform it under the supervision of a sports trainer.

Key Words: Mini trampoline, exercise, body mass index

1. INTRODUCTION

Mini trampoline rebound exercise (MRE) is a long-known and very popular fitness exercise. As cited in Cugusi et al. (2017), the first research in this field was conducted by Carter (1979) and White (1980). First, the authors tried to outline the characteristics of rebound when describing the effects on the human body. Later, other studies conducted by Bhattacharya et al. (1980) confirmed the beneficial effects of this exercise. Special training on the human body, especially in humans, has been subjected to the absence of gravity (cited in Cugusi et al., 2017).

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Minitramboline exercises are defined as exercises that are considered as jumping or rebounding from the ground. This exercise uses activities involving choreographic arrangements of locomotor movements to a rhythm supported by music on a flexible jumping surface (Ambruster ve Yoke, 2014; Heyward ve Gibson, 2014; Hertling ve Kessler, 2006). The presence of music, the trainer's aerobic exercise expertise play a very important role in ensuring that the exercise creates the necessary workload and realises the expected gain from the exercise. Mini trampoline exercises are evaluated as a study showing that the development of many different biomotor and physiological characteristics is supported and that the activities have positive responses in many physiological systems, especially postural responses are emphasised in terms of the difference of the moving environment in the dynamic approach of the skill (Acton, 2013; Fee, 2011; Calbom 2014; Triveri, 2021; Fetzner, 2020). It is also seen that exercise is recommended in nutrition and health applications, taking into account the competence of the exercise and the characteristics within its sphere of influence, as well as the environment variability in the realisation of the skill (Belen, 2005; Calbom, 2018; LaGreca, 2021).

Trampoline is an entertainment and sports equipment that has the ability to bounce thanks to the connection of springs within a frame. Recreational use of trampolines is becoming increasingly widespread around the world, and research on their effects is increasing (Esposito and Esposito, 2009). Mini-trampoline II, patented by George Nissan in 1936. During World War II, it was used to improve pilots' spatial orientation and balance, and after the war it was used effectively in schools and competitive sports (Walker, 2000). The Chartered Physiotherapy Society (Physios) in the UK has stated that mini trampolines are a great way to exercise as long as they are used safely and can be used as an effective tool to improve balance and coordination as well as boost self-confidence and also provide a sense of achievement. The first study on mini-trampoline exercise was commissioned by NASA in 1978. An attempt was made to find the best exercise to prevent shortness of breath while astronauts were in space, and eight young male astronauts participated in this study. Heart rates (HR) and oxygen consumption (VO_2) were analyzed while the subjects were running and bouncing on the mini-trampoline, and as a result, mini-trampoline training was found to be a greater biomechanical stimulus than running on the treadmill (Bhattacharya et al., 1980). Mini trampoline exercises consist of a multicomponent approach that is likely to affect many other physical factors other than strength, such as body stability, muscle coordinative responses, joint movement amplitudes and spatial integration. Unusual new exercises are initially associated with some inefficient accompanying movements. These effects are suppressed by facilitation and movement patterns become more efficient through neural adaptation expressed by improvement in intra- and inter-muscular coordination. Trampoline interventions have been shown to improve muscular strength, balance, motor skills, and physical functioning in adults and children, and compared to typical movement environments in disabled children, a mini trampoline provides an elastic surface with reduced stiffness for jumping.

Trampoline exercises are useful in teaching diving movements such as somersaults, some athletics and ski movements; On the other hand, trampoline exercises are used as effective tools in improving coordination, space-time perception and reaction time (Sovelius et al., 2006; Schevchenko et al., 2008). Repeated jumps on the trampoline can reduce the risk of injury and landing trauma, it is also known that plyometric exercises can be quite stressful for joints and muscles and can cause injuries (Hill et al., 2011; Meylan and Malatesta, 2009). While many coaches state that trampoline exercise is essentially an aerobic exercise that can improve aerobic capacity, there are no studies that can confirm the effects of trampoline exercise on strength, aerobic capacity and other parameters. Moreover, the common opinion of gymnastics coaches is that trampoline exercise has negative effects on strength and power.

The mini trampoline has been promoted as a useful piece of equipment for exercising all different parts of the body. A trampoline allows a person to bounce on one or both legs with a variety of upper and

www.sportifbakis.com
E-ISSN: 2148-905X
doi: 10.33468/sbsebd.396

lower extremity movements. There have been recent studies proving the benefits of mini-trampoline exercise, which is considered a fitness enhancer. In mini-trampoline exercise, the cardio-respiratory system works harder as it causes an increase in both heart and respiratory rate against the increasing effect of gravity as well as the demand on the muscles to support the body (Smith and Cook, 2007). Increased heart and respiratory rate causes venous return and increased lymphatic drainage (Tortora and Grabowski, 2003). The use of an unstable surface increases sensory stimulation between the skin and joints and stimulates balance reactions through stimulation of postural mechanisms. Using a trampoline in this way can help improve balance and develop protective and saving reactions (Carr and Shepherd, 1998). It has also been reported that this exercise can increase the explosive power of children's lower extremities (Atikovic et al., 2018).

Although trampoline training is not a new method, the use of equipment has increased recently. Currently, the most popular method involves jumping activities on a flexible surface such as a mini trampoline (Lemos et al., 2007), Kidgell et al., 2007; Jensen et al., 2013). The flexible surface of the equipment is very integrative and challenging on the neuromuscular system. The increase in oxygen capacity and jumping distance, as well as the decrease in body weight and body fat percentage, are important for both general fitness and athletic performance. It is known that aerobic activities such as jogging, long-distance running, walking and dancing are effective in increasing oxygen capacity and reducing body weight (Reeves et al., 1991; Talanian et al., 2007; Edvardsen et al., 2011). Previous studies have been conducted showing that mini-trampoline exercise reduces the body fat percentages of healthy and unhealthy individuals. In this study, unlike the previous ones, we tried to examine whether mini trampoline exercise affects body composition and balance, as well as whether the exercise affects the body more at the beginning or after the last measurements by taking measurements after 12 weeks.

2. METHOD

This section encompasses details regarding the research's objective, the primary issue, subsidiary issues, research framework, research population, sample, research participants, data collection instruments, data acquisition, and statistical analysis of the gathered data. This study aims to investigate the impact of twelve weeks of mini trampoline exercises on body composition and balance in women aged 18 and older.

Research Model

The present study, grounded in the quantitative research paradigm, employs a quasi-experimental design with a pretest-posttest control group to compare data from the control and experimental groups before and after a 12-week mini trampoline exercise intervention.

Study Group

The study comprised 15 female athletes in the experimental group and 16 female athletes in the control group, aged 18-24, who consistently participated in mini trampoline exercises for a duration of 12 weeks.

The mean age of the participants was 20.47 years (minimum 19, maximum 24), and the average height was 163.33 cm (minimum 154 cm, maximum 174 cm). The ages of 16 female athletes in the control group ranged from a minimum of 19 to a maximum of 23, with an average age of 20.81. The height ranged from a minimum of 157 to a maximum of 174, with an average of 165.38.

Data Collection Tools/Techniques

To collect the research data, the form created by the researcher was evaluated on the Tanita MC 780 ST model (BMI) Body composition values and Y Balance Test Kit (Alpmed) brand model equipment.

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E-ISSN: 2148-905X
doi: 10.33468/sbsebd.396

Figure 1. Tanita

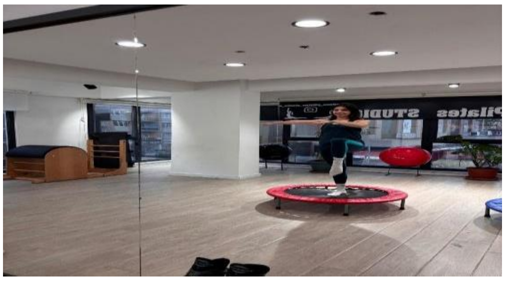

Figure 2. Mini trampoline

Figure 3. Y balance test

Data Analysis

Initially, an analysis for extreme values and outliers was conducted on the data, revealing no extreme or outlier values. Subsequently, descriptive analyses were performed to ascertain the minimum, maximum, and arithmetic means of the demographic characteristics of the research groups. Subsequently, to evaluate the appropriateness and assumptions of parametric tests, the Kolmogorov-Smirnov and Shapiro-Wilk statistics for all applications and measurements of the experimental and control groups were analyzed, confirming the suitability of parametric tests ($p > .05$). Consequently, a paired samples t-test was utilized for intra-group (pre-test-post-test) comparisons, while an independent samples t-test was employed for inter-group (experiment-control) comparisons. All analyses in the study were performed using the SPSS 25.0 software, and the variables were assessed at a 95% confidence level.

3. RESULTS

Table 1. Within-group comparison of pre- and post-test measurements of general skills in experimental and control groups

	Variable	Measurement	$\underline{X}$	SS	t	p
Experimental n=15	Body Weight	Pre-Test	55.16	5.999	1.279	.222
		Post-Test	54.86	6.086		
	BMI	Pre-Test	20.70	2.159	1.090	.294
		Post-Test	20.60	2.328		
Control n=16	Body Weight	Pre-Test	60.14	10.136	-1.469	.162
		Post-Test	60.59	10.195		
	BMI	Pre-Test	21.94	3.312	-1.225	.239
		Post-Test	22.08	3.359		

A dependent groups t-test was performed to compare the pre-test and post-test general skills within the experimental and control groups. The analysis revealed no statistically significant difference in body weight and BMI values between the pre-test and post-test of the two groups ($p>.05$).

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Table 2. Intergroup comparison of pre- and post-tests of general skills of experimental and control groups

	Variable	Group	X	SS	t	p
Pre Test	**Body Weight**	**Experimental**	55.16	5.999	-1.652	.109
		Control	60.14	10.136		
	BMI	**Experimental**	20.70	2.159	-1.223	.231
		Control	21.94	3.312		
Post Test	**Body Weight**	**Experimental**	54.86	6.086	-1.884	.070
		Control	60.59	10.195		
	BMI	**Experimental**	20.60	2.328	-1.425	.165
		Control	22.08	3.359		

An independent groups t-test was performed to compare the general skills of the experimental and control groups. No statistically significant difference was found in body weight and BMI comparisons between the groups in both the pre-test and post-test (p > .05).

Table 3. Within-Group comparison of pre- and post-test measurements of general body characteristics of experimental and control groups

	Variable (n=15)	Measurement	X	SS	t	p
Experimental n=15	Fat Free Mass Kg	Pre-Test	43.83	3.571	-1.595	.133
		Post Test	44.23	3.329		
	Muscle -Kg	Pre-Test	41.42	3.433	***-3.743***	***.002****
		Post Test	42.13	3.127		
	Fat-Kg	Pre-Test	11.44	4.095	***4.282***	***.001****
		Post Test	10.55	4.087		
Control n=16	Fat Free Mass Kg	Pre-Test	44.61	4.528	-2.012	.063
		Post Test	45.01	4.590		
	Fat-Kg	Pre-Test	41.75	4.251	.041	.968
		Post Test	41.74	4.560		
	Fat-Kg	Pre-Test	16.17	6.322	.424	.678
		Post Test	16.06	6.093		

**p<.05*

Upon examination of the table, it is evident that the experimental group's post-test average muscle mass (X: 42.13 kg) is statistically significantly greater than the pre-test average (X: 41.42 kg), while the pre-test average fat mass (X: 11.44 kg) is statistically significantly higher than the post-test average (X: 10.55 kg). p < 0.05 No significant difference was observed in fat-free mass between pre-test and post-test values (p>). The analysis determined that there was no statistically significant difference in lean mass, muscle kg, and fat kg values between the pre-test and post-test in the control group (p>.05).

Table 4. Intergroup comparison of pre- and post-test measurements of general body characteristics of experimental and control groups

	Variable	Measurement	X	SS	t	p
PreTest	Fat Free Mass Kg	Experimental	43.83	3.571	-.531	.600
		Control	44.61	4.528		
	Muscle-Kg	Experimental	41.42	3.433	-.242	.811
		Control	41.75	4.251		
	Fat-Kg	Experimental	11.44	4.095	**-2.450**	**.021***
		Control	16.17	6.322		
Post Test	Fat Free Mass Kg	Experimental	44.23	3.329	.538	.595
		Control	45.01	4.590		
	Muscle-Kg	Experimental	42.13	3.127	.270	.789

E-ISSN: 2148-905X
doi: 10.33468/sbsebd.396

		Control	41.74	4.560		
	Fat-Kg	Experimental	10.55	4.087	**.2.934**	**.006***
		Control	16.06	6.093		

**p<.05*

The independent groups t-test revealed that the mean fat mass in kilograms for the control group (X: 16.17) was statistically greater than that of the experimental group (X: 11.44) in the pre-test (t = -2.450, p < .05). In the post-test averages, the fat kg control group (X:16.06) was statistically higher to the experimental group (X:10.55) (t=-2.934, p<.05). No significant difference was found in the average lean mass (kg) and muscle mass (kg) between the groups in the pre-tests and post-tests.

Table 5. Within-Group comparison of pre- and post-test measurements of experimental group Tanita characteristics

	Variable (n=15)	Measurement	$\underline{X}$	SS	t	p
Tanita TRUNK	Muscle Kg	Pre-Test	24.43	2.195	***-2.442***	***.029****
		Post Test	24.87	2.018		
	Fat Kg	Pre-Test	5.20	1.944	***2.237***	***.042****
		Post Test	4.73	2.082		
	Fat Free Kg	Pre-Test	25.73	2.311	***-2.548***	***.023****
		Post Test	26.23	2.126		
Tanita Right Arm	Muscle Kg	Pre-Test	1.98	.223	***-2.125***	***.052****
		Post Test	2.04	.237		
	Fat Kg	Pre-Test	.54	.276	***2.148***	***.050****
		Post Test	.49	.272		
	Fat Free Kg	Pre-Test	2.10	.223	-1.080	.298
		Post Test	2.12	.231		
Tanita Right Leg	Muscle Kg	Pre-Test	6.57	.385	***-2.255***	***.041****
		Post Test	6.69	.445		
	Fat Kg	Pre-Test	3.01	.670	.117	.909
		Post Test	3.00	.729		
	Fat Free Kg	Pre-Test	7.04	.471	.671	.513
		Post Test	6.99	.412		
Tanita left Arm	Muscle Kg	Pre-Test	1.92	.247	-1.625	.126
		Post Test	1.97	.223		
	Fat Kg	Pre-Test	.57	.279	1.680	.115
		Post Test	.51	.306		
	Fat Free Kg	Pre-Test	2.04	.248	-.881	.393
		Post Test	2.06	.249		
Tanita Left Leg	Muscle Kg	Pre-Test	6.46	.396	***-3.045***	***.009****
		Post Test	6.60	.465		
	Fat Kg	Pre-Test	2.91	.627	.268	.792
		Post Test	2.90	.661		
	Fat Free Kg	Pre-Test	6.91	.486	1.016	.327
		Post Test	6.84	.422		

**p<.05*

A dependent groups t-test was utilized to compare the intra-group pre-test and post-test TANITA measurements of the experimental group. The analysis revealed that the post-test averages for trunk muscle kg and fat-free kg were statistically significantly elevated compared to the pre-test averages, while the pre-test average for fat kg was statistically significantly greater than the post-test average (p < .05). The post-test average muscle mass in the right arm was statistically significantly greater than the pre-test average, while the pre-test average fat mass was statistically significantly higher than the post-test average (p < .05). The post-test mean muscle mass in the left leg was significantly greater than the

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E-ISSN: 2148-905X
doi: 10.33468/sbsebd.396

pre-test mean (p<.05). No statistically significant difference was found between the pre-test and post-test of other regions and values (p > .05).

Table 6. Within-Group comparison of pre- and post-test measurements of control group Tanita characteristics

	Variable (n=16)	Measurement	X	SS	t	p
Tanita TRUNK	Muscle Kg	Pre-Test	24.58	2.789	***3.913***	***.001****
		Post Test	24.10	2.471		
	Fat Kg	Pre-Test	6.72	2.916	-1.911	.075
		Post Test	7.01	3.089		
	Fat Free Kg	Pre-Test	25.74	2.879	-1.123	.279
		Post Test	25.95	2.852		
Tanita Right Arm	Muscle Kg	Pre-Test	1.99	.248	-.785	.444
		Post Test	2.00	.248		
	Fat Kg	Pre-Test	.80	.418	-.400	.695
		Post Test	.81	.416		
	Fat Free Kg	Pre-Test	2.09	.262	-.795	.439
		Post Test	2.11	.284		
Tanita Right Leg	Muscle Kg	Pre-Test	6.72	.519	-.815	.428
		Post Test	6.74	.591		
	Fat Kg	Pre-Test	3.66	1.155	-1.355	.195
		Post Test	3.74	1.112		
	Fat Free Kg	Pre-Test	7.08	.547	-1.730	.104
		Post Test	7.17	.703		
Tanita left Arm	Muscle Kg	Pre-Test	1.99	.312	***-2.282***	***.037****
		Post Test	2.04	.329		
	Fat Kg	Pre-Test	.84	.391	.716	.485
		Post Test	.82	.404		
	Fat Free Kg	Pre-Test	2.10	.329	***-2.643***	***.018****
		Post Test	2.15	.332		
Tanita Left Leg	Muscle Kg	Pre-Test	6.60	.552	-.221	.828
		Post Test	6.61	.567		
	Fat Kg	Pre-Test	3.57	1.044	-1.187	.254
		Post Test	3.66	1.069		
	Fat Free Kg	Pre-Test	6.96	.582	-1.951	.070
		Post Test	7.00	.619		

**p<.05*

The dependent groups t-test was utilized to compare the pre-test and post-test TANİTA measurements within the control group. The analysis revealed that the pre-test average for the Tanita trunk (X: 24.58) exceeded the post-test average (X: 24.10) (t=3.913, p<.05). Conversely, the post-test average for the Tanita left arm muscle (X: 2.04) surpassed the pre-test average (X: 1.99) (t=-2.282, p>.05), and the post-test average for Tanita left arm lean mass (X: 2.15) was significantly greater than the pre-test average (X: 2.10) (t=-2.643, p<.05). It was determined to be markedly elevated. No statistically significant difference was observed between the pre-test and post-test results of other regions and values (p > .05).

Table 7. Intergroup comparison of pre-test measurements of Tanita characteristics of experimental and control groups

	Variable (n=15)	Group	X	SS	t	p
Tanita TRUNK	Muscle Kg	Experimental	24.43	2.195	-.167	.869
		Control	24.58	2.789		

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E-ISSN: 2148-905X
doi: 10.33468/sbsebd.396

	Fat Kg	Experimental	5.20	1.944	-1.701	.100
		Control	6.72	2.916		
	Fat Free Kg	Experimental	25.73	2.311	-.006	.995
		Control	25.74	2.879		
Tanita Right Arm	Muscle Kg	Experimental	1.98	.223	-.047	.963
		Control	1.99	.248		
	Fat Kg	Experimental	.54	.276	***-2.016***	***.053****
		Control	.80	.418		
	Fat Free Kg	Experimental	2.10	.223	.028	.977
		Control	2.09	.262		
Tanita Right Leg	Muscle Kg	Experimental	6.57	.385	-.900	.376
		Control	6.72	.519		
	Fat Kg	Experimental	3.01	.670	-1.918	.065
		Control	3.66	1.155		
	Fat Free Kg	Experimental	7.04	.471	-.234	.817
		Control	7.08	.547		
Tanita left Arm	Muscle Kg	Experimental	1.92	.247	-.690	.496
		Control	1.99	.312		
	Fat Kg	Experimental	.57	.279	***-2.200***	***.036****
		Control	.84	.391		
	Fat Free Kg	Experimental	2.04	.248	-.611	.546
		Control	2.10	.329		
Tanita Left Leg	Muscle Kg	Experimental	6.46	.396	-.848	.403
		Control	6.60	.552		
	Fat Kg	Experimental	2.91	.627	***-2.118***	***.043****
		Control	3.57	1.044		
	Fat Free Kg	Experimental	6.91	.486	-.268	.791
		Control	6.96	.582		

**p<.05*

When the table was examined, it was determined that the pre-test averages of the control group in tanita right arm fat kg, tanita left arm fat kg and tanita left leg fat kg were statistically significantly higher than the pre-test averages of the experimental group (p <.05).

Table 8. Intergroup comparison of post-test measurements of Tanita characteristics of experimental and control groups

	Variable (n=15)	Group	$\underline{X}$	SS	t	p
Tanita TRUNK	Muscle Kg	Experimental	24.87	2.018	.937	.356
		Control	24.10	2.471		
	Fat Kg	Experimental	4.73	2.082	***-2.396***	***.023****
		Control	7.01	3.089		
	Fat Free Kg	Experimental	26.23	2.126	.318	.752
		Control	25.95	2.852		
Tanita Right Arm	Muscle Kg	Experimental	2.04	.237	.408	.686
		Control	2.00	.248		
	Fat Kg	Experimental	.49	.272	***-2.515***	***.018****
		Control	.81	.416		
	Fat Free Kg	Experimental	2.12	.231	.159	.874
		Control	2.11	.284		
Tanita Right Leg	Muscle Kg	Experimental	6.69	.445	-.262	.795
		Control	6.74	.591		
	Fat Kg	Experimental	3.00	.729	***-2.162***	***.039****
		Control	3.74	1.112		

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www.sportifbakis.com
E-ISSN: 2148-905X
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	Fat Free Kg	Experimental	6.99	.412	-.862	.396
		Control	7.17	.703		
Tanita left Arm	Muscle Kg	Experimental	1.97	.223	-.761	.453
		Control	2.04	.329		
	Fat Kg	Experimental	.51	.306	***-2.404***	***.023****
		Control	.82	.404		
	Fat Free Kg	Experimental	2.06	.249	-.810	.425
		Control	2.15	.332		
Tanita Left Leg	Muscle Kg	Experimental	6.60	.465	-.079	.938
		Control	6.61	.567		
	Fat Kg	Experimental	2.90	.661	***-2.355***	***.026****
		Control	3.66	1.069		
	Fat Free Kg	Experimental	6.84	.422	-.839	.408
		Control	7.00	.619		

**p<.05*

An independent groups t test was conducted to compare the posttests of the tanita measurements of the experimental and control groups. As a result of the test, İt was found that the post-test averages of the control group were statistically significantly higher than the post-test averages of the experimental group (p<.05).

Table 9. Within-Group comparison of pre- and post-test measurements of y-balance characteristics of experimental and control groups

		Variable (n=15)	Measurement	$\bar{X}$	SS	t	p
Experimental (n=15)	Right Foot Stationary	Left Foot Anterior	Pre-Test	60.27	4.773	*-8.301*	*.000**
			Post Test	65.47	5.842		
		Left Foot Posterolateral	Pre-Test	88.60	7.199	*-7.917*	*.000**
			Post Test	95.87	7.463		
		Left Foot Posteromedial	Pre-Test	84.07	9.161	*-8.312*	*.000**
			Post Test	90.60	8.542		
	LeftFoot Stationary	Right Foot Anterior	Pre-Test	60.67	5.094	*-5.698*	*.000**
			Post Test	64.13	4.340		
		Right Foot Posterolateral	Pre-Test	86.53	8.634	*-13.284*	*.000**
			Post Test	94.33	7.335		
		Right Foot Posteromedial	Pre-Test	85.60	8.749	*-6.549*	*.000**
			Post Test	91.33	8.474		
Control (n=16)	Right Foot Stationary	Left Foot Anterior	Pre-Test	63.25	5.092	*-5.344*	*.000**
			Post Test	65.69	5.862		
		Left Foot Posterolateral	Pre-Test	89.25	7.996	*-9.733*	*.000**
			Post Test	92.69	7.761		
		Left Foot Posteromedial	Pre-Test	85.31	10.442	*-3.471*	*.000**
			Post Test	88.81	9.425		
	Left Foot Stationary	Right Foot Anterior	Pre-Test	62.69	6.019	*-5.192*	*.000**
			Post Test	65.50	5.598		
		Right Foot Posterolateral	Pre-Test	87.63	6.571	*-7.093*	*.000**
			Post Test	92.06	7.280		
		Right Foot Posteromedial	Pre-Test	85.75	6.758	*-6.573*	*.000**
			Post Test	88.94	6.351		

**p<.05*

E-ISSN: 2148-905X
doi: 10.33468/sbsebd.396

Dependent groups t test was applied to compare the y balance test results of the experimental and control groups with the pre-test and post-test within the group. As a result of the analysis, it was concluded that the post-test averages in all measurements in both groups were statistically significantly higher than the pre-test averages (p <.05).

Table 10. Intergroup comparison of y balance pre- and post-test measurements of experimental and control groups

		Variable (n=15)	Measurement	$\bar{X}$	SS	t	p
Pre test	Right Foot Stationary	Left Foot Anterior	Experimental	60.27	4.773	-1.680	.104
			Control	63.25	5.092		
		Left Foot Posterolateral	Experimental	88.60	7.199	-.237	.814
			Control	89.25	7.996		
		Left Foot Posteromedial	Experimental	84.07	9.161	-.352	.727
			Control	85.31	10.442		
	Left Foot Stationary	Right Foot Anterior	Experimental	60.67	5.094	-1.006	.323
			Control	62.69	6.019		
		Right Foot Posterolateral	Experimental	86.53	8.634	-.398	.694
			Control	87.63	6.571		
		Right Foot Posteromedial	Experimental	85.60	8.749	-.054	.958
			Control	85.75	6.758		
Post test	Righ tFoot Stationary	Left Foot Anterior	Experimental	65.47	5.842	-.105	.917
			Control	65.69	5.862		
		Left Foot Posterolateral	Experimental	95.87	7.463	1.161	.255
			Control	92.69	7.761		
		Left Foot Posteromedial	Experimental	90.60	8.542	.552	.585
			Control	88.81	9.425		
	Left Foot Stationary	Right Foot Anterior	Experimental	64.13	4.340	-.756	.456
			Control	65.50	5.598		
		Right Foot Posterolateral	Experimental	94.33	7.335	.865	.394
			Control	92.06	7.280		
		Right Foot Posteromedial	Experimental	91.33	8.474	.895	.378
			Control	88.94	6.351		

**p<.05*

When the table was examined, in the analysis results made to compare the y balance values of the groups, it was seen that there was no statistically significant difference between the groups in all measurements in both the pre-tests and post-tests (p>.05).

4. DISCUSSION

This study observed that mini-trampoline exercise significantly impacted the body mass indexes and balance exercises of women over 18 years old (p < .05). Various prior studies exist concerning this matter. Aalizadeh et al. (2016) discussed the impact of trampoline exercise on the anthropometric measurements and motor performance of adolescent students. The study determined that 20 weeks of trampoline training, comprising four physical activity sessions per week for students aged 11-14 years, significantly impacted body fat percentage reduction and anaerobic physical fitness improvement. They noted that trampoline exercises can enhance students' health and motor performance levels. The findings of Cogoli et al. (1979) indicate that elevated G-force enhances lymphocyte activity. The lymphatic system transports immune cells throughout the body and facilitates immune function. Consequently, trampoline exercise is frequently advocated as a detoxifying and immune-enhancing activity. Much of the scientific literature on trampolining highlights its enhancement of functional skills. Moreover, mini trampoline exercise is advantageous for individuals with type 2 diabetes and may be an effective method for managing cardiovascular risk in diabetic patients. Research indicates that exercises conducted on a mini trampoline present a minimal risk of injury (Grapton et al., 2013). Research endorses the recommendation for the safe utilization of trampolines to reduce injury risk in educational settings (Johnson et al., 2011).

The introduced exercises enhance muscular capacity in various manners, and researchers advocate for the inclusion of both strength and trampoline training programs in fighter pilots' physical training regimens (Kidgell et al., 2007). Another study indicates that mini trampoline exercises effectively enhance balance following a lateral ankle sprain (Aragao et al., 2011). Mini trampoline training enhanced seniors' capacity to recover balance during forward falls, with the improvement ascribed to an increased rate of hip moment generation (Kasmire et al., 2016). Heitkamp et al. (2001) previously reported that mini-trampoline exercises enhance balance and leg strength. Atılgan (2013) discovered that 1.5 hours of trampoline training, conducted twice weekly for 12 weeks, markedly enhanced the vertical jump, leg strength, and both dynamic and static balance in male gymnasts.

5. CONCLUSION AND RECOMMENDATIONS

While research on the impact of mini-trampoline exercise on waist-hip ratio has been limited, prior studies have examined its effects on BMI values and reported favorable outcomes. This study differs from prior studies in that the measurements were assessed as pre-test and post-test, both before the study and 12 weeks subsequent to its conclusion. The study demonstrated that 12-week mini-trampoline exercises for women over 18 years of age significantly improved BMI values and balance ($p < 0.05$). Consequently, mini-trampoline exercise is believed to aid individuals in fat reduction while preserving and enhancing muscle mass. This exercise should be conducted under the guidance of a qualified trainer to prevent injuries.

Author Contributions

Conception and design of the study: A.E, M.S.E., Data collection: A.E., Data analysis and interpretation: A.E., M.S.E., Drafting the article and/or its critical revision: A.E., Final approval of the version to be published: A.E., M.S.E.

Conflict of Interest

The authors declare any conflict of interest regarding the study and its publication.

Ethical Statement

The approval of the social and humanities research and publication ethics board was obtained from Kütahya Dumlupınar University (18.05.2022, 2022/05).

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Submitted : 26.07.2024
Accepted : 21.11.2024