Original Article

THE EFFECT OF PILATES EXERCISES ON BODY COMPOSITION AND DYNAMIC BALANCE PERFORMANCE IN SEDENTARY WOMEN

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Abstract

Objective: The aim of this study was to determine the effect of Pilates exercises on body composition and dynamic balance performance in sedentary women.

Methods: The sample of the study was composed of 16 (n=8 test group, and n=8 control group) volunteer sedentary women in the age range of 21-44 who were living in Kırıkkale district of Turkey. The women in the test group participated in a 45-minute Pilates exercise program 3 days a week and for 8 weeks. The women in the control group continued their daily lives for the 8-week period. In determining the body composition of the participants, height measurements, circumference measurements, and Bioelectric Impedance Analysis (BIA) method were used; whereas in determining their dynamic balance performances, Y Balance Test was used. The measurements were applied to the participants in the test and control groups before and after the 8-week Pilates exercise program. The data obtained from the measurements were evaluated by using SPSS 25.0 statistical package program.

Results: As a result of the statistical analyses, it was found that there was a significant difference in the body composition values and dynamic balance performance values of the women in the test group ($p<0.05$); while there was no significant difference in the values of the women in the control group ($p>0.05$).

Conclusions: According to the findings obtained from the statistical analyses in the study, it was concluded that the 8-week Pilates exercise program contributed to the development of body composition and dynamic balance performance in sedentary women. For this reason, Pilates exercises can be recommended for sedentary women to be able to maintain their health and perform normal daily tasks that require the control of dynamic movements more easily.

Keywords: Dynamic balance, Pilates, Body Composition.

INTRODUCTION

Pilates exercises, first introduced by Joseph Pilates (1880-1967), are used in sick and healthy populations today. Pilates training aims to combine the movement originating from a central core with the mind and body. The central core of the body is formed by the diaphragm, multifidus, transversus abdominis, and pelvic floor muscles. Breathing control activates the central core, and thus the exercises involving the arms and legs performed with the help of visual imagery increase the individual's neuromuscular control and kinesthetic awareness of the movement. Pilates exercises consist of multiple muscle synergies that include isometric, eccentric, concentric muscle contractions, and co-contractions (Jago et al., 2006).

They focus on lumbopelvic stabilization, stability, segmental mobilization of the spine, mobilization and stability of the shoulder, elbow, hip, knee, and ankle, coordination, and balance. Breathing by posterior and lateral expansion of the thorax facilitates the natural movement of the vertebrae, arms, and legs in inhalation and exhalation, and prevents Valsalva (Smith & Smith, 2004).

Pilates is a type of exercise that is a combination of the movement styles and philosophy of gymnastics, martial arts, yoga, and dance, which aims to develop and maintain a perfect mind and body balance based on six fundamental principles (concentration,

the control of all aspects of movement, centering, fluid movement, precision, and breathing) (Wells et al., 2012). Significant improvements are achieved in performance thanks to traditional strength exercises (Aras et al., 2020; Gülü & Doğan, 2021). On the contrary, the purpose of Pilates exercises is to strengthen the abdominal and back areas equally and create a solid skeletal structure in the upper part of the body. In Pilates, the center of the body is composed of the deep muscles and the muscles closest to the backbone. In classical exercises, weak muscles tend to weaken, while strong muscles tend to get stronger. This situation leads to unbalanced muscle structure within the body and causes chronic back pain and injuries. The muscle structure is brought into a whole in Pilates (Segal et al., 2014). Pilates training plays an important role in regaining and sustaining muscular strength, flexibility, endurance, and the functioning of proprioceptive mechanisms (Jago et al., 2006).

Body composition is one of the key components of physical fitness that are related to health. Appropriate body composition contributes to the optimal development of physical fitness (Mayooran et al., 2014). There are also studies reporting that Pilates has positive effects on body composition (Garcio Pastor & Aznar Lain, 2011; Jago et al., 2006; Singh & Singh, 2014).

Although Pilates exercises are not designed to reduce body weight, they are a good option for sedentary, overweight, and obese people who have difficulty doing traditional exercises (Mazzarino et al., 2015). Thanks to Pilates exercises, which do not require a high amount of money, it becomes available to burn fat and lose weight. Pilates exercises are implemented as a worldwide model to provide and maintain physical improvements, especially in women (Vancini et al., 2017).

In recent years, it has been stated that balance ability is an extremely necessary parameter to increase the quality of life and athletic performance. Besides, it is also known that deterioration in balance performance is a risk factor for injuries (Ateş et al., 2017). In order to evaluate the risk of injury and the recovery time after an injury treatment, there are many studies that frequently include the evaluation and improvement of balance performance, and the exercises required for this development (Lee et al., 2014; Lee et al., 2015; Chimera et al., 2015; Freund et al., 2018). By increasing dynamic balance performance, lower extremity injury risks can be prevented (O'Malley et al., 2014). In addition to this, Huxham et al. (2011) also stated that the ability of the individual to maintain balance will be a determinant factor in the development of other motor systems.

Dynamic balance is considered to be an important ability at all ages and is deemed necessary for normal daily tasks that require the control of dynamic movements. Dynamic postural control involves voluntary movement levels around a support basis (Ringhof & Stein, 2018). It is stated that a screening system to be used in individuals with muscle imbalance, decreased chorea stability, and abnormal movement patterns can be beneficial in preventing future injuries (Engquist et al., 2015).

Physical activity is effective in improving the quality of life by reducing fat mass and obesity, and in preventing a rapid reduction in the size and number of muscle fibers (Hayes et al., 2013, Bayer et al., 2021, Eken et al., 2022, Duyan et al., 2022, Ilkım et al., 2021). However, there are several barriers to participation in physical activity. According to the results of a research conducted, as the perceived health status decreases, the barriers to physical activity increase significantly, and the barriers to physical activity and participation of women are higher when compared to men and increase with age (Gülü & Ayyıldız, 2021). It has been reported that doing moderate-intensity exercise by women from the middle age period onwards reduces their health risks. The American College of Sports Medicine (ACSM) focuses on resistance, strength, aerobic capacity, and flexibility exercises in the exercise training used after the middle age period and accordingly, recommends these exercises as a guide (Uysal, 2016). As part of this content, the 'Pilates Method' has been emphasized, and it has been mentioned that the mind can be stimulated through the activation of brain cells and that this situation has a positive effect on the body (Chang, 2000). For this reason, it was aimed in the current study to determine the effect of the 8-week Pilates exercises on body composition and dynamic balance performance in sedentary women. It is thought that the conclusions to be obtained as a result of this study can guide to provide appropriate body composition in sedentary women through Pilates exercises and prevent the injuries that may occur due to deterioration in balance performance.

METHODS

Research type

This study is an experimental research with pre-test – post-test control groups.

Sample

The sample of the study was composed of 16 (n=8 test group, and n=8 control group) volunteer sedentary women in the age range of 21-44 who were living in Kırıkkale district of Turkey. The participants were randomly assigned to the test and control groups (Yağin et al., 2021, Yağin et al., 2021).

Inclusion criteria in the study

- Being 18 years old or older

- Being a volunteer
- Being sedentary (not doing exercise for at least 3 days a week and at least 30 minutes a day)

Exclusion criteria in the study

- Not participating in the exercises within the scope of the research (at least for two 2 days)
- Leaving the research voluntarily
- Having a health problem that prevents the participation in an exercise program

Data collection tools

Height, weight, and circumference measurements and Bioelectric Impedance Analysis (BIA) method were used to determine the body composition of the participants. The dynamic balance performances of the participants were determined by Y Balance Test. The measurements were applied to the participants in the test and control groups before and after the 8-week Pilates exercise program. Measurement protocols and the 8-week Pilates exercise program were explained to the participants in detail. The questions of the participants in terms of the measurements and the Pilates exercise program were answered. Before the measurements, the participants were made to sign an Informed Voluntary Consent Form. Circumference measurements of the participants were made with a tape measure. In order to be able to obtain objective values from the measurements, the following points were taken into consideration:

- The measurements were made by the same person.
- All the measurements were made on the right side of the body.
- The measurements were made twice.
- Maximum attention was paid to the determination of the baseline points.
- Atrophy, hypertrophy, and edema, all of which may affect the measurements, were taken into account.

Height measurement

The distance between the vertex of the head and the foot was measured following a deep inspiration while the head was in the Frankfort plane (Köklü et al., 2009).

Body weight measurement

A platform scale was used to determine body weight. The measurements were made with the clothes (shorts, t-shirts) that would not weigh too much with bare feet (Köklü et al., 2009).

Body mass index

The body mass index (BMI) values of the participants were calculated according to the formula presented below (Köklü et al., 2009).

BMI = Body weight (kg) / Height (cm2)

Circumference measurements

Shoulder circumference measurement

The measurements were performed at the end of the expiration from the most prominent area of the deltoids, under the acromion, while standing and with the arms at the sides (Tükenmez, 2018).

Chest circumference measurement

The measurement was made standing, with the arms in abduction. At the end of the expiration, the measurement was made from the line of the 4th cartilage rib anteriorly and from the infrascapular posteriorly by surrounding the chest (Tükenmez, 2018).

Biceps circumference measurement in the flexion

Following the contraction of the biceps muscle while the elbow was in the flexion position, the measurement was taken at the point where the biceps presented the greatest circumference (Tükenmez, 2018).

Waist circumference measurement

The measurement was made while standing, with the arms at the sides and the legs combined together. Due to the fact that the measurements were difficult in overweight participants, the measurements were made from the narrowest area between the ribs and the crista iliaca (Tükenmez, 2018).

Hip circumference measurement

The maximal protrusion level of the hip muscles was measured at the level of the symphysis pubis line anteriorly and also posteriorly (Tükenmez, 2018).

Abdominal circumference measurement

The measurement was made standing with the arms at the sides. The measurement was made as the tape measure was parallel to the ground by surrounding the umbilicus level and the body at the subcostal level on the sides (Tükenmez, 2018).

Thigh circumference measurement

The measurement was made 10 cm above the patella while standing (Tükenmez, 2018).

Calf circumference measurement

The measurement was made by surrounding the tape measure perpendicular to the long axis of the leg from the thickest part of the calf area (Tükenmez, 2018).

Bioelectrical impedance analysis

In the measurements, BC-418 Tanita Body Composition Analyzer bioelectrical impedance analyzer device was used. Prior to the measurement, the participants were asked to take off their shoes and socks, and the metal objects on them, and wear as light clothes as possible. The participants were also warned about not eating or drinking anything at least 4 hours before, not doing any exercise 12 hours before, and avoiding alcohol and food and beverages including caffeine 24 hours before the measurements. Therefore, it was aimed to make more valid and reliable measurements. After entering the data regarding the participants' gender, height, and age into the device, the measurements were performed. Thanks to the measurements, body fat percentage (%), fat mass (kg), and lean body mass (kg) values of the participants were obtained (Sampei & Sigulem, 2009).

Y Balance Test

Dynamic balance performances of the participants were determined by Y Balance Test. The test was applied to the participants in the test and control groups before and after the 8-week Pilates exercise program. A star shape was drawn on the floor at an angle of 45 degrees, with a total of 8 directions (anterior, anteromedial, medial, posteromedial, posterior, posterolateral, lateral, and anterolateral). During the application, necessary attention was paid in order for the participants not to lose balance, not to keep their heel off the ground, to gently touch the toes of the outstretched foot, and to bring them next to the stable foot without touching the ground. The test was performed for both the dominant and non-dominant foot, it was repeated 3 times with 15-second rest intervals for each direction, and the best score was recorded in cm (Plisky et al., 2006).

Pilates exercise program

The women in the test group participated in the Pilates exercises each of which lasted for 45 minutes, 3 days a week, and for an 8-week period. The women in the control group continued their daily lives for 8 weeks. All the individuals were taught the key elements of Pilates for one session before the Pilates exercise training. These key elements were; breathing, focusing, chest cage placement, shoulder placement, and head and neck placement. In the teaching phase of the exercises, prior to beginning the exercise training, a device named "stabilizer" was used in order to teach the individuals the correct functioning of the deep neck flexors, transversus abdominus, and lumbopelvic posture. Visual imagery was utilized while explaining the exercises. The exercises were done with 15 repetitions. The intensity of the exercise was increased when the participants performed the exercises properly for 10 repetitions (once in about two weeks) by maintaining the key elements. The exercises start from the closed kinetic form and go towards the open kinetic form. After ensuring the spinal smoothness in each movement, the next phase was started. The Pilates exercise program performed with the participation of the women in the test group is presented below:

Pilates exercise program

	BASIC MOVEMENTS	**LEVEL I - II MATTE EXERCISES**	
Time: 45 minute	Imprinting	Spine twist	Hundred
Intensity: Modarete	Pelvic curl	Open leg rocker	Roll up
Frequency: 3 * 15	Bridging / Pelvic lift	Teaser	Leg Circle
Method: Repetition Training Method	Toe touch	Hip circle	Rolling like a ball
Rest between sets: 1minute	Chest lift	Roll over	Single staright leg stretch
	Hundred prep	Cork screw	Double staright leg stretch
	Pregnant cat	Neck pull	Criss cross

Mini swan	Leg pull front	Spine stretch
Side leg banana	Leg pull back	Saw
Side lying arm circles	Kneeling side kick	Swan
	Side bend	Single leg kick
	Swan dive	Double leg kick
	Swimming	Hip escalator
	To-touches from chair position	Leg lifting
	One leg strech	Side leg front back
	Double leg strech	One leg kick
	Side inner leg lifting	Squad
	Leg open close	Neck curl

Data analysis

The data obtained from the measurements were evaluated by using the SPSS 25.0 package program at a 0.05 significance level. Due to the fact that the number of observations was few, the Wilcoxon test, one of the non-pa1rametric tests, was performed to test the significance of the difference between the two dependent groups (Yağin et al., 2021).

RESULTS

Table 1. The comparison of the pre-test and post-test results regarding the body composition values of the women in the test group

Variables	Pretest			Posttest				
	n	**X̄**	**Sd±**	**n**	**X̄**	**Sd±**	**z**	**p**
Shoulder	8	104.87	17.01	8	104.25	16.56	-2.23	0.026*
Chest	8	101.93	7.90	8	101.43	8.05	-2.30	0.021*
Flexed biceps	8	34.06	17.59	8	33.62	17.73	-2.64	0.008*
Waist	8	91.75	8.35	8	90.68	8.19	-1.97	0.048*
Abdomen	8	103.12	14.14	8	102.18	14.14	-2.95	0.003*
Hip	8	111.12	9.51	8	110.00	9.40	-3.14	0.002*
Thigh	8	56.75	3.60	8	56.06	3.58	-2.81	0.005*
Calf	8	46.00	9.74	8	46.12	9.24	-0.63	0.527
Body fat percentage	8	38.46	5.30	8	36.08	4.83	-3.57	0.000*
Fat mass	8	30.54	8.70	8	28.20	8.28	-3.55	0.000*
Fat free mass	8	47.50	5.40	8	49.68	5.60	-3.57	0.000*
BMI	8	28.01	12.93	8	27.98	12.79	-2.58	0.010*

* Significance at 0.05 level

Table 1. indicates that there is a statistically significant difference between the pre-test and post-test results (except for the calf circumference) regarding the body composition values of the women in the test group ($p<0.05$). Accordingly, it can be stated that the 8-week Pilates exercise program had a positive effect on the body composition values of the women in the test group.

Table 2. The comparison of the pre-test and post-test results regarding the body composition values of the women in the control group

Variables	Pretest			Posttest				
	n	**X̄**	**Sd±**	**n**	**X̄**	**Sd±**	**z**	**p**
Shoulder	8	104.36	16.08	8	104.92	15.47	-1.799	0.073
Chest	8	101.52	7.86	8	101.89	8.66	-1.648	0.100
Flexed biceps	8	34.28	17.06	8	33.96	16.38	-0.104	0.917
Waist	8	92.04	8.59	8	92.84	8.94	0.520	0.604
Abdomen	8	103.70	14.42	8	103.91	14.59	-1.355	0.177
Hip	8	112.23	9.18	8	111.84	9.06	-0.689	0.491

Thigh	8	56.41	3.71	8	56.18	3.88	-0.724	0.536
Calf	8	46.19	9.83	8	46.37	9.55	-1.420	0.157
Body fat percentage	8	39.14	6.14	8	38.81	4.37	-0.882	0.378
Fat mass	8	30.14	8.94	8	29.16	8.28	0.816	0.402
Fat free mass	8	48.39	5.85	8	50.26	6.89	-0.180	0.858
BMI	8	27.58	11.96	8	28.42	12.64	-0.294	0.770

According to Table 2. there is no statistically significant difference between the pre-test and post-test results regarding the body composition values of the women in the control group ($p>0.05$). When the mean values are examined, it can be understood that there are just tiny and insignificant changes in the body composition values of the women in the control group as a result of the 8-week period in which they continued their daily lives.

Table 3. The comparison of the pre-test and post-test results regarding the dynamic balance performance of the women in the test group

Variables	**Pretest**			**Posttest**				
	n	$\bar{X}$	Sd±	n	$\bar{X}$	Sd±	z	p
Anterior	8	55.06	6.21	8	56.25	6.03	-3.412	0.001*
Anteromedial	8	60.81	7.48	8	61.68	6.92	-2.814	0.005*
Medial	8	61.81	8.51	8	62.87	8.20	-3.311	0.001*
Posteromedial	8	61.93	7.11	8	62.68	6.95	-2.546	0.011*
Posterior	8	59.56	6.49	8	60.50	6.40	-3.038	0.002*
Posterolateral	8	59.31	7.56	8	60.25	7.30	-3.212	0.001*
Lateral	8	51.18	4.70	8	52.75	4.46	-3.603	0.000*
Anterolateral	8	56.43	8.84	8	57.31	8.45	-2.484	0.013*

* Significance at 0.05 level

When Table 3. is examined, it can be acknowledged that there is a statistically significant difference between the pre-test and post-test results regarding the dynamic balance performance of the women in the test group ($p<0.05$). Accordingly, it can be stated that the 8-week Pilates exercise program has contributed to the development of the participants' dynamic balance performance.

Table 4. The comparison of the pre-test and post-test results regarding the dynamic balance performance of the women in the control group

Variables	**Pretest**			**Posttest**				
	n	$\bar{X}$	Ss±	n	$\bar{X}$	Ss±	z	p
Anterior	8	54.92	6.18	8	55.22	6.21	-0.747	0.455
Anteromedial	8	60.24	7.56	8	60.56	6.28	-1.013	0.312
Medial	8	61.72	8.34	8	61.46	8.56	1.288	0.199
Posteromedial	8	61.34	7.62	8	61.76	6.58	-0.921	0.358
Posterior	8	59.43	6.91	8	59.26	6.08	-0.703	0.090
Posterolateral	8	59.96	7.64	8	60.14	7.06	-1.798	0.073
Lateral	8	50.98	4.46	8	51.25	4.89	-1.450	0.148
Anterolateral	8	56.72	8.48	8	57.01	8.63	-0.856	0.526

As can be in Table 4, there is no statistically significant difference between the pre-test and post-test results regarding the dynamic balance performance of the women in the control group ($p>0.05$). It can be stated that the changes in the dynamic balance performances of the women in the control group as a result of the 8-week period in which they continued their daily lives are not remarkable.

DISCUSSION AND CONCLUSION

In the current study, which was conducted with the aim of determining the effect of the 8-week Pilates exercises on body composition and dynamic balance performance in sedentary women, significant changes were found in the values of the participants regarding their body composition. It was observed that the 8-week exercise program applied to the women in the test group had positive effects on their body composition. It was also observed that there was no significant difference in the body composition values of the women in the control group. When the literature is examined, it is possible to access studies

supporting the conclusion obtained in this study.

Baştuğ et al. (2014) reported that the 12-week Pilates exercise program for women caused a decrease in the BMI and body weight values of the women in the test group. In another similar study, Aslan (2019) found that the 12-week training program including mat Pilates and reformer Pilates exercise caused a decrease in the women's chest circumference, waist circumference, abdominal circumference, hip circumference, right arm circumference, left arm circumference, right leg circumference, left leg circumference, body weight, and BMI values. In the study conducted by Çakmakçı (2012) aiming to determine the effect of mat Pilates exercise program on body composition in sedentary women, it was observed that there was a decrease in the values of the women in the test group regarding their body weight, BMI, waist circumference, and waist-hip ratio; whereas there was no change regarding the body composition values of the women in the control group. Aydemir and Dağ (2021) found that there was a decrease in the women's body weight, BMI, and body fat mass values after the 12-week Pilates exercise program for sedentary women. In their study on the adult athletes who had just started doing Pilates, Rogers and Gibson (2009) revealed that the participants in the test group, to whom the 8-week Pilates exercise program was applied, experienced a greater decrease in their body fat when compared to those in the control group. Besides, in the study by Fourie et al. (2013) examining the effect of the Pilates mat exercises on body composition in sedentary women over 60 years of age, it was found that there was a significant decrease in the body fat percentage and fat mass of the women in the test group at the end of the 8-week Pilates exercise program. In the study conducted by Jago et al. (2006) investigating the effect of the 4-week Pilates mat exercises on body composition in 11-year-old girls, it was found that there was a 3.1% decrease in the BMI values of the test group. Furthermore, in the study by Katayifçı et al. (2014) examining the effects of clinical Pilates exercises on physical fitness parameters in healthy individuals, it was concluded that the Pilates exercises performed for 45-60 minutes each day, 3 days a week, and for an 8-week period which was accompanied by a physiotherapist caused a significant difference in the individuals' triceps, abdominal, suprailiac skin folds, fat measurement ratio, waist circumference, hip circumference, and waist-hip ratio values. In their study conducted in order to observe the physical fitness changes caused by Zumba exercises in sedentary women, Beyaz and Oktay (2021) found that the lower extremity leg strength of the participants in the test group was 34% significant.

In the study conducted by Abanoz (2011) so as to examine the effect of the Pilates exercises on the physical fitness levels of middle-aged, healthy, and sedentary obese women, it was determined that the Pilates mat-work exercise program, which continued for 55 minutes, 3 days a week and for an 8-week period, caused a significant decrease in the body weights and waist circumference values of the participant women.

Baltacı et al. (2005) compared the Pilates exercises with clinical-based physical therapy in 34 female patients with bilateral osteoarthritis diagnoses. In the study, the Pilates group was given a 45-minute exercise for 5 days a week and for a 4-week period; whereas the clinical-based physical therapy group was given neuromuscular electrical stimulation for 30 minutes and isometric exercise for 20 minutes. After the training, it was observed that the body weights of the participants decreased significantly in both groups (2.27% in the Pilates group; 1.58% in the clinical-based physical therapy group) ($p<0.05$). Besides, the decrease in body fat percentage was significantly higher in the Pilates group ($p<0.05$).

In the study examining the effects of walking and Pilates on body composition in sedentary, non-menopausal, non-smoker, and healthy women aged between 30-45 years who do not use alcohol, Ersoy (2008) classified 28 female subjects into three groups as the control group (n=9), the 10.000-step group (n=11), and the Pilates group (n=8). The subjects in the 10.000-step group were encouraged to take 10.000 steps every day for an 8-week period, whereas the subjects in the Pilates group were presented with Pilates exercises for 60 minutes and 2 days a week. The control group was composed of sedentary subjects who continued their daily lives during the study. Pilates exercises involved mat, ball, and elastic band exercises. The exercises were performed as 32 different exercises in the first 4-week period, and 32 different exercises in the last 4-week period, based on compliance with the 4-week periods, and before and after each exercise, a 7.5-minute warm-up and cool-down periods were also included. In the study, it was concluded that there was a significant decrease in the weight, BMI, body fat ratio, waist circumference, and hip circumference values in both the Pilates group and the 10.000 step group ($p<0.05$).

Altıntaç (2006) applied the Pilates reformer and Pilates mat-work program 3 times a week for an 8-week period in order to determine the effects of the Pilates exercises with (reformer) and without tools (mat-work) on physical fitness levels. When the body weight, BMI, body transmission resistance, body fat ratio, lean body mass, waist circumference, hip circumference, and waist-hip ratio values of the participants before and after the training were compared in the mat-work group, it was determined that there was an insignificant decrease in their body fat mass ($p<0.05$). It was also found that there was a significant decrease in the body weight, waist circumference, hip circumference, BMI, lean body mass, waist-hip ratio values of the participants in the reformer group after the training ($p<0.05$); whereas there was an insignificant decrease in their body transmission resistance, body fat ratio, and body fat mass values ($p>0.05$).

Baylan (2008) included 64 sedentary women subjects in the study which was conducted in order to determine the effects of Pilates exercises in different age groups. In the study, it was recorded that there was a significant decrease in the fat percentage, triceps, subscapula, suprailiac, abdomen, thigh, skinfold thickness, biceps, chest, hip, calf, and waist circumference

measurement values of the participants calculated according to the Yuhaz formula after the exercise program ($p<0.05$).

In their study, Sekendiz et al. (2007) investigated the effects of the Pilates exercises on abdominal and back muscle strength, abdominal muscle endurance, and posterior body flexibility in sedentary adult women. In the study, Body fat and BMI values were considered as secondary outcomes. 21 women aged between 26-47 were included in the Pilates group, whereas 17 women aged between 26-47 were included in the control group. 8 warm-up and 27 modern Pilates mat exercises (Stott Pilates) were performed for 60 minutes, 3 days a week, and for a 5-week period. At the end of the study, it was revealed that there were positive effects on abdominal muscles and back muscle strength, abdominal muscle endurance, and posterior body flexibility in the sedentary adult women in the Pilates group ($p<0.05$), while there was no significant change in the body weight and fat percentage measured independently of these parameters ($p>0.05$). One of the prominent reasons why there was no significant change in body composition in the study, which was not in parallel with the conclusion obtained as a result of this study, can be stated as the fact that the 5-week exercise program was a really short period to create a change in the body composition of the participants, and that there were no restrictions in terms of their diets. In addition to this, the reason why there was no significant change in the body weight and fat percentage of the participants in the study may be due to the fact that the mean BMI values of the participants in the Pilates group were 22±2.5 before the training. This situation can be explained by the fact that individuals with normal weight tend to lose weight more slowly when compared to those who are overweight or obese.

In the current study, it was observed that the 8-week Pilates exercises applied to sedentary women contributed to the increase in their dynamic balance performance. It was also determined that there was no significant change in the dynamic balance performance values of the women in the control group. When the literature is examined, it is possible to access studies the conclusions of which are parallel with this study.

In their study conducted with the aim of determining the effect of the 11-week Pilates exercises on static and dynamic balance performance in elderly individuals, Bird et al. (2012) randomly divided the participants into 2 groups, and the first group did one hour of Pilates exercise for 2 days a week and for a 5-week period; whereas the second group, which was the control group, was applied an exercise program that was composed of the activities specified by the "healthy activity model program committee for the elderly" for a 5-week period. Both groups were included in a 6-week detox program after the 5-active-week period ended. When the pre-training and post-training periods were compared, it was found that there was a significant improvement in the static and dynamic balance parameters in the participants of the Pilates group.

Newell et al. (2012) reported in their study, in which they applied Pilates exercises accompanied by a trainer for one hour, once a week and for an 8-week period to 9 individuals aged between 60-76 years old, that there was a decrease in the anterior-posterior oscillations in their balance parameters and a decrease of 2 points in their fall risk index.

Danneels et al. (2001) provided isodynamic fitness and Polestar Pilates training to the individuals for one hour, twice a week, and for a 10-week period. In their study, it was found that there was a significant difference in Medio-lateral oscillation on behalf of the group that was given Pilates training. It was also stated that the individuals experienced an increased awareness of body movements and spatial movement abilities in Pilates-based exercises. Furthermore, it was reported that postural stability could be improved with both balance exercises and Pilates-based exercises in addition to the increase in the awareness of movement ability and in movement speed.

In their study, İrez et al. (2011) made 60 women do one hour of Pilates exercise three times a week and for a 12-week period. In the study, it was determined that there were significant improvements in the dynamic balance, flexibility, reaction time, and muscle strength performances of the women in the test group.

Cruz-Ferreira et al. (2011) reported in their compilation study examining the effect of Pilates exercises in healthy individuals that there were strong pieces of evidence revealing that the use of Pilates exercises to improve dynamic balance was effective.

Ateş and Öztürk (2019) reported in their study in which they compared the dynamic balance performances of women who regularly did Pilates exercises and those who did not participate in a regular exercise program that the Pilates exercises performed regularly had positive effects on dynamic postural control.

According to the results of the research conducted by Akuthota and Nadler (2004) and De Souza and Vieira (2006), Pilates exercises strengthened the core muscles and increased the muscular strength with co-contraction, and accordingly the pelvis and lumbar stability. In addition to this, in the study by Lange et al. (2000) it was revealed that Pilates exercises provided positive effects in terms of increasing the speed and awareness of body movements, as well as postural stability.

Another study demonstrating the positive effects of Pilates exercises on balance values was conducted by Johnson et al. (2007). This research was carried out with 40 individuals (n=20 control group, n=20 test group), and 10 Pilates exercise sessions were applied in a 5-week period. These applications (tall arm, open leg rocker, leg press series, and tall kneel arm) were performed by using a reformer. Following the Pilates exercise session, the dynamic balance values of healthy adults were determined by the functional reach test. The results of the research, which compared the dynamic balance values of the control and test groups,

revealed that there were significant changes in the dynamic balance values of the test group (before the exercise= 13.61±2.53; after the 5-week exercise period= 14.84±2.43). As a result of the study conducted by Suarez-Iglesias et al. (2019) it was stated that Pilates exercises provided beneficial effects on fitness and balance.

In their study examining the effect of the 12-week Pilates mat exercises on static and dynamic balance performances of elderly women, Hyun et al. (2014) found that Pilates mat exercises were effective in increasing balance performance. Moreover, Kalron et al. (2017) reported that Pilates, as a treatment method, was effective in improving the abilities of walking and balance.

In accordance with the findings obtained as a result of the current study, it was concluded that the 8-week Pilates exercises for sedentary women contributed to the development of their body composition values and dynamic balance performances. For this reason, it can be recommended for sedentary women to do Pilates exercises for 30-60 minutes at least 3 days a week. Therefore, depending on the fact that body composition reaches ideal values, it will be possible to stay healthy. Besides, with the improved dynamic balance performance, the injuries due to falling can be prevented, and normal daily tasks that require the control of dynamic movements can be performed more easily.

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