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Investigation of the effects of 12-week pilates exercise program on some performance tests and body composition

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Abstract

The aim of the study was to evaluate the effects of a twelve-week pilates exercise program on some performance tests and body composition. The research was a quantitative study and experimental research model was used as a model. The study group consisted of 32 female volunteer students aged between 20-23 who were educated at Kırıkkale University, Faculty of Sports Sciences, and took pilates lessons. Before starting the exercise program and after finishing the exercise program, the participants' data on anthropometric (body weight, height, body fat ratio and circumference measurements) and performance tests (sit and reach test, vertical jump test, 20 m speed and t-dril test) were collected. The arithmetic means and standard deviations of all data were calculated. The comparison of the measurement values of the participants before and after the exercise program (pre-test and post-test) was made with the paired samples t-test. A statistically significant difference was found between the anthropometric and performance tests (pre-test and post-test) of the participants. Considering the results of the study, it was determined that there were improvements in the physical appearance and physical performance of the individuals with regular pilates exercises, and that pilates exercises had significant effects on both the body composition and muscular endurance of the individuals.

Keywords: Pilates, anthropometry, performance, woman

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1. Introduction

Pilates, which has become a popular form of exercise today, is defined as muscle contraction exercises that improve the endurance and flexibility of the muscles in the core region (Curnow et al., 2009; Kloubec, 2010; Rogers and Gibson, 2009). The main reason for its popularity is the positive effects it has on health (Adams et al., 2012; Cruz-Ferreira et al., 2011; Kloubec, 2010; Yu and Lee, 2011). With the rapid development of technology in

human life, people's adopting a sedentary lifestyle increases the risk of encountering various health problems (Schmitz et al., 2015; Gülü and Ayyıldız, 2022). Pilates exercises, which are especially preferred by women, have been very effective in preventing many diseases as well as leading a healthy life (Mourrahy and Nielsen 2016).

It has been determined that Pilates exercises reduce the risk of diabetes and coronary artery disease, joint pain and depression, which are frequently observed thanks to the improvement of body composition and support for correct posture (Emery et al., 2010; Carvalho et al., 2009; Çakmakçı, 2011). Regular pilates exercises reduce the risk of obesity, which has become a common problem, by reducing the body mass index (Phrompaet et al., 2011). Pilates exercises, which aim to ensure the integrity of the mind and body by relying on the working principle of the whole body (Isacowitz and Clippinger, 2011), show an increase in life expectancy by improving the quality of life (Siqueira et al., 2010). While Pilates exercises provide important results in dynamic balance development (Johnson et al., 2007), it also plays an important role in increasing bone development, muscle strength and flexibility as a coordinate motor skill (Emery et al., 2010; Critchley et al., 2011; Irez et al., 2011). Pilates exercises, which have an important place in reducing and preventing injuries that can be experienced on the musculoskeletal system, positively support the development of self-efficacy as a result of positive changes in positive mood and performance level due to the increase in sleep quality (Burger et al., 2019; Caldwell et al., 2009).

Pilates exercises basically consist of various exercises starting from the beginner level to the advanced level (Wells et al., 2012). For these exercises, there are some special equipment (Cadillac, reformer) designed for pilates and those performed on the mat (Isacowitz, 2006). In recent years, exercises can be applied with auxiliary materials such as rubber bands, specially designed balls and hoops for pilates exercises (Karadenizli and Kambur, 2016). The main components that ensure the correct and effective implementation of these applications are; concentration, control, centering, fluency, breathing, sensitivity or sensitivity (Karter, 2007).

The positive effects of regular pilates exercises are demonstrated by literature studies. However, in addition to these effects, it is seen that the number of studies examining the effects of pilates exercise programs on various performance tests and body composition is scarce. For this reason, in this study, it is aimed to evaluate the effects of the twelve-week pilates exercise program on flexibility and body composition.

2. Method

2.1. Research Model

The aim of this study is to evaluate the effects of a twelve-week pilates exercise program on flexibility and body composition on 32 volunteer female students who do not have any

health problems and do not participate in a regular exercise program. The research is a quantitative study. Experimental research model was used as a model. Experimental research model is an explanation type research that is carried out by protecting, controlling and manipulating the important variables in the hypothesis (Aydın, 2012). With this method, data collection is easier and more economical in terms of cost (Gürbüz and Şahin, 2014).

2.2. Research Group

A total of 32 female students, aged between 20-23, studying at Kırıkkale University, Faculty of Sports Sciences, who took pilates classes, participated voluntarily. In order to learn about the health status, sports and lifestyles of the research group, the participants were asked to fill out an information form. In the preliminary examination made to the research group, it was determined that the women who participated in the exercise did not have any health problems, cigarette-alcohol habits and did not use drugs. The study was limited to 12 weeks by giving detailed information to the research group about the pilates exercise program to be applied to the research group.

2.3. Data Collection

In this study, data collection method of anthropometric and performance test measurements were taken in two days for the first and last measurements. Anthropometric characteristics (height, body weight, body fat ratio and circumference measurements) were taken in the morning on the first day. On the second day, after 15 minutes of light aerobic activity, standard warm-up movements consisting of dynamic stretching and sprint variations, the athletes completed the flexibility, vertical jump, 20m sprint and agility tests, with measurements taken one after the other, and physical and functional tests. Before performing the tests, the instruments to be used in the measurements were calibrated and their linearity checked, and after testing their reliability, the measurements were carried out on a non-slip surface at ~22°C in Kırıkkale University gymnasium and performance laboratory. Performance tests were performed twice on all groups and the best values were recorded. Pilatest sessions, which were held for 12 weeks, were completed at the same time of the day and during the regularly planned training hours of the participants. Some of the instruments used in the measurements were supported financially by Kırıkkale University BAP (scientific research projects) coordination unit with the decision taken on 31.03.2021 (project numbered 2021/042). The study was approved by Kirikkale University's non-interventional research ethics committee. It was conducted at the Faculty of Sport Sciences according to the principles of the Declaration of Helsinki. Participants were informed about the procedures of this study and signed a written consent form. Measurement protocols and study aims were presented to all participants. None of the participants were excluded from the study.

2.4. Analysis of Data

The statistics of the mean, standard deviation, delta and percentage changes of the data obtained from the female participants included in the study were calculated. IBM SPSS 25.0 package program was used for statistical analysis. "Kolmogorov Smirnov test" was applied to see that the data showed normal distribution (Yagin et al., 2021). T-test was used to evaluate the data of various variables and the significance was accepted as 0.005. In the study, pre-test and post-test measurements, percentage change values (%), and differences (Δ) of values belonging to anthropometric and performance measurements were examined. Analysis results also calculated effect sizes (Cohen's d). Cohen's d values were considered insignificant (<0.20), small (0.20–0.59), moderate (0.6–1.19), large (1.2–1.99), and very large. (Hopkins et al., 2009). A p value of < 0.05 was considered statistically significant. Variables analyzed SPSS Statistical Software (SPSS, INC, an IBM Company, Chicago, Illinois). Since the data is normally distributed in binary, it met the prerequisites for parametric testing. For this reason, t-test was applied for independent groups in paired group comparisons. American Psychological Association (APA) 6.0 style was used to report statistical differences (Yagin et al., 2021).

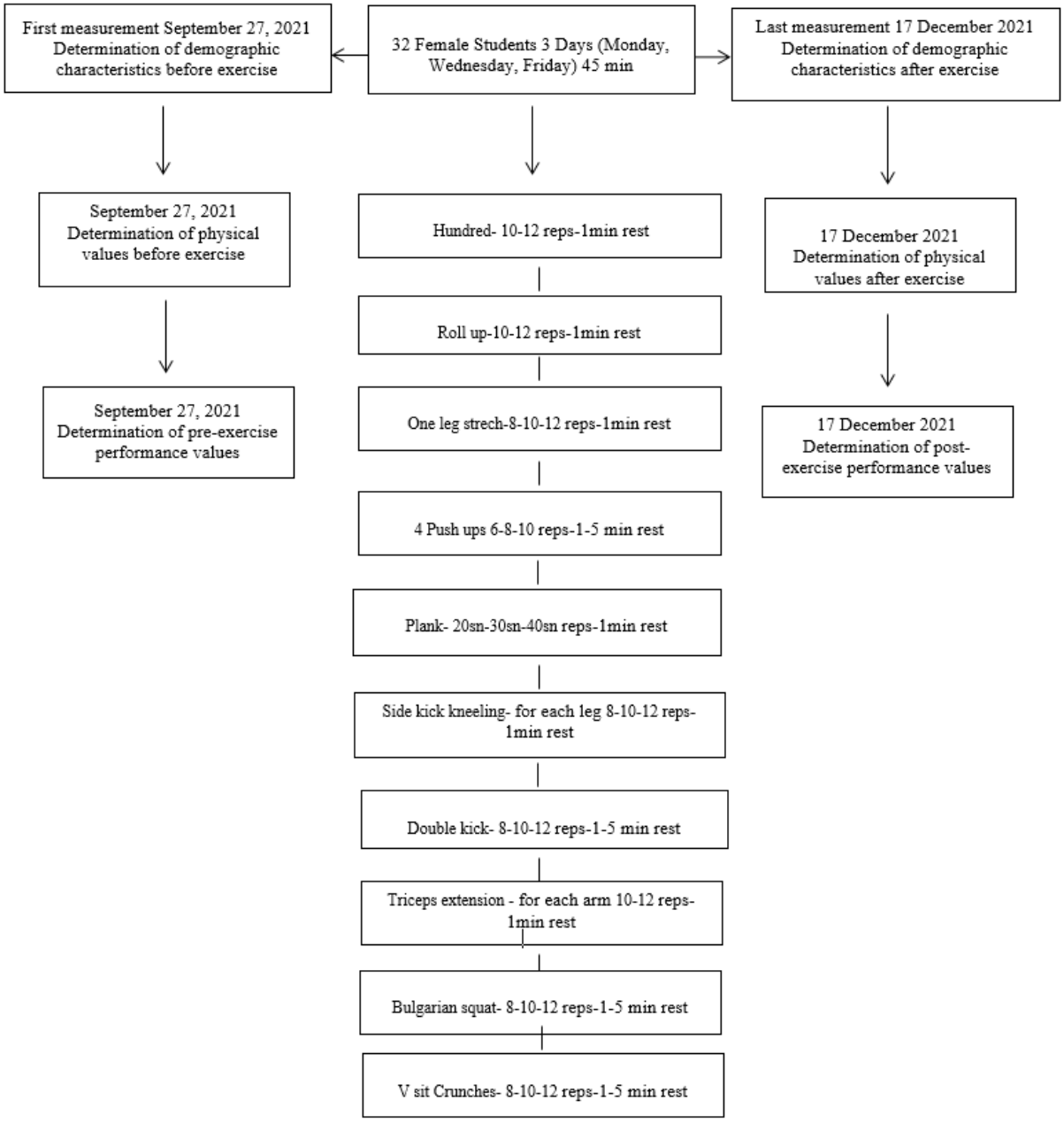

Figure 1. Flow diagram of study desing

3. Results

The following statistics were made to determine the anthropometric and performance measurements of the students who took 12-week pilates training.

Table 1. Evaluation of change and percentage values of body composition measurements before and after training

n=32	Pre	Post	T_{pre}-T_{post}				
Varaible	**M±SD**	**M±SD**	**Δ**	**%**	**p**	**Cohen's d**	**Descriptor**
Weight (kg)	71.25±9.28	68.37±8.26	2.9	4.2	0.001*	0.33	Small
Height (cm)	164.07±1.49	164.11±1.55	0.0	0.0	0.001*	0.03	Trivial
BMI (Kg/m²)	26.5±5.43	25.3±4.41	1.2	4.7	0.001*	0.02	Trivial
Fat (%)	26.22±3.11	22.61±2.41	3.6	-15.9	0.001*	1.30	Large
Heart Rate	161±7.4	152±6.3	9	5.9	0.001*	0.13	Trivial

BMI: Body mass index; **Pre:** Pretraining. **Post**: Posttraining. *p< 0.001

According to the table above, there was a statistically significant difference before and after the 12-week regular program, weight (kg), body fat percentage and heart rate (beat/min) rates excluding height (cm) of the participants (p< 0.001) (Table 1).

Table 2. Percent (%), delta (Δ) change and Mean ± standard deviation (SD) circumference measurements.

n=32	Pre	Post	T_{pre}-T_{post}				
Varaible	**M±SD**	**M±SD**	**Δ**	**%**	**p**	**Cohen's d**	**Descriptor**
Chest Circumference (cm)	93.8±6.17	91.6±6.02	2.2	2.4	0.001*	0.03	Trivial
Abdominal Circumference (cm)	92.8±8.69	88.9±9.22	3.9	4.3	0.001*	0.04	Trivial
Waist Circumference (cm)	83.00±9.17	79.18±7.68	3.8	4.8	0.001*	0.45	Small
Hip Circumference (cm)	102.5±6.29	99.0±7.06	3.5	3.5	0.001*	0.05	Trivial
Leg Circumference (cm)	56.15±4.54	54.23±4.22	1.9	3.6	0.001*	0.44	Small

Pre: Pretraining. **Post**: Posttraining. *p< 0.001

When the physical values before and after exercise were compared, significant differences were found before and after all circumference measurements (chest circumference (cm), abdominal circumference (cm), waist circumference (cm), hip circumference (cm), leg circumference (cm)) (p<0.001) (Table 2).

Table 3. Percent (%), delta (Δ) change and Mean ± standard deviation (SD) performance measurements.

n=32	Pre	Post	T_{pre}-T_{post}				
Varaible	**M±SD**	**M±SD**	**Δ**	**%**	**p**	**Cohen's d**	**Descriptor**
Flexibility Test (cm)	24.1±5.16	29.2±4.12	5.1	20.9	0.001*	0.11	Trivial
Vertical Test(cm)	19.8±2.8	23.7±6.6	3.9	3.9	0.001*	0.77	Moderate
20 m Speed Test (sec)	3.85±1.29	3.53 ± 0.28	0.3	9.1	0.001*	0.32	Small
T-drill Test (sec)	13.28±0.57	12.12±0.68	1.2	9.6	0.001*	1.85	Large

Comparing the Performance Values Before and After Exercise In the comparison of the performance values before and after the exercise, it was determined that there were positive significant differences before and after the flexibility test (cm), vertical jump (cm), 20 m sprint (sec) and T drill test (sec). $p<0.001$) (Table. 3).

4. Discussion and Conclusion

The aim of the study was to evaluate the effects of a twelve-week pilates exercise program on flexibility and body composition. When the results obtained from the research were examined, there was no change in the height of the participants with the regular pilates exercise program of twelve weeks. It was determined that there was a statistically significant difference in body weight, body fat percentage and heart rate per minute scores between the pre-test and post-test results of the twelve-week pilates exercise program applied. When the physical values of the participants before and after the exercise were compared, significant differences were found in the scores of all circumference measurements (chest circumference, abdominal circumference, waist circumference, hip circumference, leg circumference). When comparing the performance values before and after the Pilates exercise program, it was determined that there were positive significant differences in the flexibility test, vertical jump, 20 m speed and T drill test scores.

It is possible to come across different studies on pilates exercise programs in the studies conducted in the recent important exercise programs in the world and in our country. In particular, it is seen as a result of the studies that health professionals work on the effects of pilates exercises in order to increase the quality of life of individuals, to suppress or reduce the problems in chronic diseases.

According to the results of their study on pilates exercise in women, Aibar- Almazan et al., (2022) concluded that it has beneficial effects on muscle strength, physical performance and BMI. In the study conducted by Suner-Keklik et al., (2022), they stated that the pilates group had an improvement in trunk proprioception and whole core muscle endurance, and that Pilates exercises had an effect on muscle endurance even if they were performed from a distance. Choi et al., (2021), in their study, concluded that pilates exercise is a useful exercise for improving muscle strength and mobility. A Ghazali et al., (2019) stated in their study that pilates training programs were effective in reducing body fat ratio in overweight women. In their study, Poyatos et al., (2019) found that pilates was effective in improving the general functional status of elderly women, improving muscle exercise static balance, and reducing body fat ratio. Seghatoleslami et al., (2018) found that dynamic balance and speed improved significantly with pilates exercises, and there were improvements in body mass index, body fat percentage and visceral fat ratios. Özcan et al., (2018) stated in their study that aqua pilates exercises have a positive effect on body composition, flexibility,

dynamic balance, muscle strength and respiratory functions in young women, and that these exercises can be applied in different age groups because they are easy to apply and the risk of sports injury is low. . Butelli et al. (2021), in their study, found that elderly women had significant increases in gait test results and improved cardiorespiratory fitness. Fernandez et al., (2022), in their study, found that pilates was effective in reducing pain and disability, and in their study in Barbosa et al., (2021), pilates exercises were more effective than circuit-based exercise in reducing arthralgia (pain) in women during hormone therapy for breast cancer. they have detected. Melo et al., (2020) found that pilates exercises provide improvement in type 2 diabetes, Ahmadi and Mehravar (2019) found that pilates exercises are beneficial in stress management in women. Soori et al., (2021) concluded in their study that pilates exercises are more effective in depression than other aerobic exercises. Liposeki et al., (2019) found in their study that pilates programs can improve the quality of life of sedentary elderly women. Evangelou et al. (2021), in their study, found that aerobic exercise significantly improved lower extremity explosive power, left arm grip strength and body composition, while pilates exercise significantly improved flexibility. It is seen that most of these studies are similar to the data of this study.

As a result, in this study, it was concluded that the data obtained as a result of the pilates exercise program were quite positive for individuals. The decrease in body fat ratios, improvements in anthropometric circumference scores, increase in physical performance scores show that pilates exercises have positive effects on body composition and physical performance. The studies carried out support this research. It has been concluded that pilates exercises can be done in every environment for every age group due to its easy applicability, and it is thought that pilates exercises will support the healthy life processes of individuals. For this reason, it is recommended to raise awareness for each individual to do pilates exercises in schools, work environments, homes, outdoors, gyms.

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Conflicts of Interest

The authors report no conflicts of interest in this work.

Author Contributions

Conceptualization, D.U; H.Y.; M.G.; methodology, H.Y.; A.A.D; E.Ç.; M.G.; formal analysis, H.Y.; investigation, M.G.; data curation, H.Y.; C.İ.; D.U.; B.E.; writing—original draft preparation, H.Y., B.E; D.U.; writing—review and editing, H.Y., M.G.; visualization, H.Y.; supervision, D.U; H.Y.; A.A.D. All authors have read and agreed to the published version of the manuscript.

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