

Investigation of the effect of Pilates combined exercise program with mat and equipment on fatigue and physical self-perception in sedentary women: A randomized controlled study

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Abstract

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In this study, the effect of the combination of mat and equipment-based Pilates exercise method applied to sedentary female individuals on fatigue and physical self-perception was examined. 70 women between the ages of 18 and 45, defined as sedentary according to the International Physical Activity Questionnaire, were included in the study. Participants were randomized into combined Pilates exercise (PG=35) and control (CG=35) groups. Pilates exercises were given three days a week, 50 minutes each session, for 10 weeks. No intervention was made to CG. Fatigue Severity Scale and Physical Self Inventory evaluations were repeated for pre- and post-intervention (10th week). The initial data of the participants showed a homogeneous distribution. In the results, in intragroup comparison, a statistically significant improvement in fatigue severity ($p=0.001$; $p<0.05$) and total and subgroup parameters of the physical self-perception scale (for all $p=0.001$; $p<0.05$) was observed only in the PG. In the intergroup comparison, a statistically significant improvement was seen only in fatigue severity in favor of the Pilates group ($p=0.019$; $p<0.05$). A 10-week combined Pilates exercise program can improve the fatigue and physical self-esteem of sedentary women.

Introduction

According to the World Health Organization (WHO), physical activity is defined as "physical movement that requires energy expenditure". People who live below a certain level of physical activity on certain days of the week are called 'sedentary individuals'. Studies indicate that one in every four adults worldwide leads a sedentary life (WHO Physical Activity, 2022).

Women have different physiological structures compared to men, their roles in society, and the resulting responsibilities and daily life activities (childcare, housework, etc.). For this reason, women prefer to rest instead of doing physical activity in their free time. In this context, their tendency to live sedentary lives is higher (Saltan, 2018). According to the results of the Ministry of Health's Turkey Nutrition and Health Survey published in 2019 in our country, it has been shown that 78.8% of women in the 30-44 age group in our country do not do physical activity in their

entertainment and free time (Ministry of Health's Turkey Nutrition and Health Survey 2024).

Physical fitness is defined as the ability to successfully perform and continue occupational, recreational, and daily living activities without fatigue. Physical fitness consists of components such as body composition, cardiovascular endurance, strength, power, balance, and flexibility. It is not possible to achieve physical fitness, which is closely related to health and performance, without regular physical activity. Low physical fitness level reduces muscle strength and energy levels, thus reducing resistance to fatigue (Pescatello, 2014). In addition, the level of fatigue was found to be higher in women when compared on a gender basis, and it was observed that depression and anxiety accompanied fatigue (Seo & Park, 2018). Physical activity is a successful and healthy behavior in combating low energy and fatigue (O'Connor & Puetz, 2005).

Physical self-perception is how the individual perceives himself in physical and psychological

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dimensions (e.g. strength, endurance, sports ability, appearance). An individual's positive and negative feelings about his body directly affect his self-esteem and behavior (Ozerkan, 2004). In this context, it has been determined that individuals' physical activity preferences and participation are closely related to their physical self-perception. This relationship has been proven by observing improvements in one's physical self-perception by improving body appearance as a result of participation in planned physical activities (Hayes et al., 1999). When examined in terms of gender, it was revealed that women's physical self-perception was significantly lower than men's and physically active individuals (Asci, 2004). Studies aimed at improving physical self-perception encourage people to engage in physical activity (Babic et al., 2014).

Pilates, a type of physical activity, was first introduced by Joseph Hubertus Pilates of German origin in the 1900s under the name Contrology and is a mind-body combination focused on core stability, posture, power, strength, muscle control, and breathing, which includes more than fifty exercises at different intensity levels. It is a defined exercise method. This exercise method focuses on issues such as improving physical health (breathing, muscle strength, core stability, endurance), mental health (psychological state, motivation, body awareness), and motor functionality (muscle control, balance, and coordination, dynamic postural control) (Mazzarino et al., 2015).

The Pilates exercise method is performed using the commonly known mat-based or specially designed equipment. While mat-based Pilates consists of ground-based exercises, the only equipment required is a mat and the person's body weight for resistance. Thus, it forms the basis for Pilates with equipment to ensure muscle control (Hornsby & Johnston, 2020). Equipment-based Pilates is performed with special equipment to stabilize and strengthen deep muscle groups. Equipment (Reformer, Cadillac, Chair, and Ladder Barrel tools) focuses on gradually increasing the complexity or difficulty of motor control and increasing the load using gravity or resistive springs. It may take time for the person to adapt to the devices, but the devices provide the advantage of additional resistance to increase muscle strength (Hornsby & Johnston, 2020; Phuphanich et al., 2020). Using one or more of both the mat and Pilates equipment in a Pilates workout is called 'Combined Pilates' (Phuphanich et al., 2020).

To our knowledge, the number of studies examining the effects of Pilates exercises on physical self-

perception (Cruz-Ferreira et al., 2011; Kucukapan & Civan, 2021; Tolnai et al., 2016) and fatigue (Akbas & Unver, 2018; Amzajerdi et al., 2023) in sedentary healthy women is limited. In addition, these studies use either mat-based or equipment-based Pilates methods alone. We think that the effect of combined Pilates exercise programs should be examined so that the person can adapt to carrying his or her body weight and adapt better to Pilates equipment. Our study aims to investigate the effect of a Pilates combined exercise program with mat and equipment on fatigue and physical self-perception in sedentary women. We think that the combined Pilates exercise program will reduce the severity of fatigue and increase physical self-perception.

Methods

This study was designed as a single-center, randomized, controlled, prospective study to examine the effects of 10-week combined Pilates exercises on fatigue and physical self-perception of sedentary women. The population of the research was determined as the female population living in Iğdır province of Türkiye and between the ages of 18-45. Evaluations of the participants included in the study were made at Iğdır Pilates & Gymnastic Hall. Female individuals defined as sedentary according to the International Physical Activity Questionnaire (IPAQ) were included in the study. The participants included in the study were randomized into two groups, the Pilates group (PG) and the control group (CG), using a sealed envelope method. The training duration for the PG was determined as 150 minutes of physical activity per week, as recommended by the World Health Organization for adults (Rosenfeld, 2017). Since a 10-week Pilates exercise program is successful both physically and psychologically in healthy and sedentary women (Tolnai, 2016), PG was given a combined Pilates exercise program of 50 minutes, three days a week, for 10 weeks. No intervention was made to CG. Control group participants were allowed to participate in the training program given to the PG at the end of the follow-up period.

All evaluation methods were repeated before and after the study in the 10th week for both PG and CG. The data collection period was between. The details of the study were verbally explained to all participants, and they were informed about the possible benefits and risks of the study. After verbal declaration, a written informed consent form prepared according to the

Declaration of Helsinki was given to all participants, and their consent was obtained. In addition, the study was conducted by the ethical principles of the European Convention on Human Rights and the Declaration of Helsinki (ethical principles of human experimentation) (World Medical Association, 2013) and was approved by the Bahçeşehir University of Scientific Research and Publication Ethics Committee (No: 2023/01).

Participants

70 women aged between 18 and 45, who were defined as sedentary according to the IPAQ-short form, were included in the study. Participants whose physical activity score is below 600 Metabolic Equivalent of Task (MET) minutes/week according to the IPAQ-short form are considered sedentary (Saglam et al., 2010). The sample size of our study was determined using the G*power program (v3.1.7, Germany). The sample size was calculated as a total of 70 participants, 35 each in the PG and CG, with an effect size of 0.80, a margin of error of 0.05, a confidence level of 0.95, and a power of 0.90. Criteria for inclusion in the study require being a sedentary female individual between the ages of 18-45, according to the IPAQ-short form, not having undergone any orthopedic surgery, and volunteering to participate in the study. Participants who do not meet the criteria for inclusion and those who, for any reason,

cannot maintain regular training have been excluded from the study. The CONSORT flow chart of the study is shown in Figure 1.

Procedure

International Physical Activity Survey-Short Form:

The scale aims to compare the physical activity levels of individuals between the ages of 18-65 in the last week. The long form of the questionnaire contains 27 items that enable a detailed evaluation of housework, occupational activity, gardening, transportation, and leisure activities. The short form of the questionnaire has 7 items that determine the time spent on walking, sitting, and moderate and vigorous activities (Craig et al., 2003). Individuals' physical activity level is reached by multiplying the time allocated to activities, the day, and the MET values determined for each criterion. Calculations are concluded with a MET-minute/week score. Based on the results obtained, the participants were divided into three groups according to their physical activity levels: sedentary, moderately active, and very active (Liden et al., 2002). The reliability and validity study of the Turkish version of the scale was conducted by Sağlam et al. in 2010. The Turkish version of the short and long forms of the questionnaire was found to be valid and reliable in determining the physical activity level (Saglam et al., 2010).

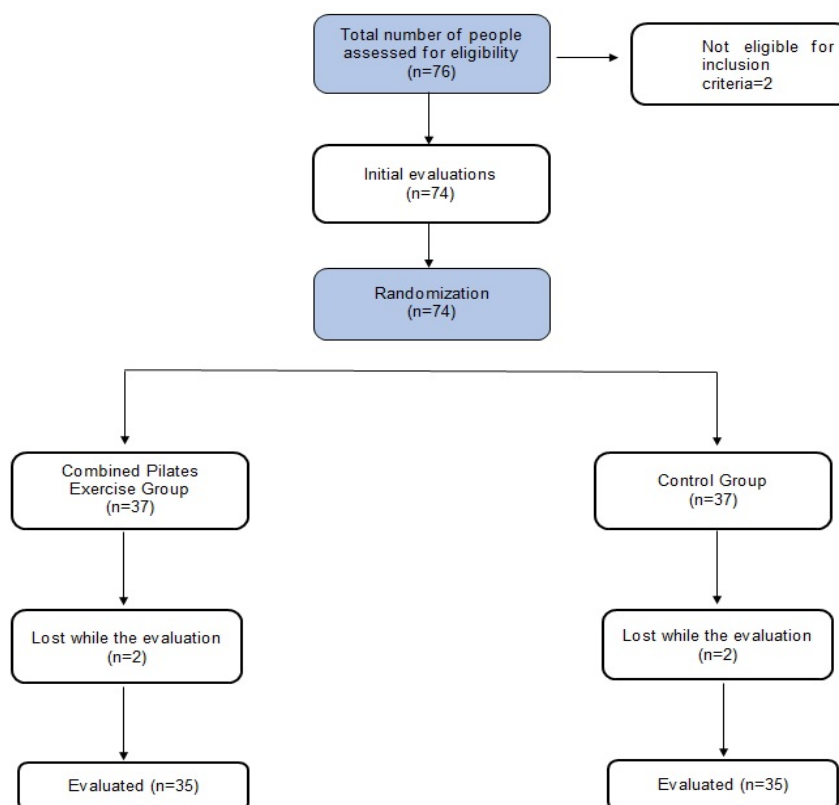


Figure 1. CONSORT flow chart of the study.

Fatigue Severity Scale: The scale reveals the results regarding the inhibition of functionality due to fatigue. It evaluates the severity of fatigue based on the individual's last week. The first version was developed by Krupp et al. in 1989 (Krupp et al., 1989). It is a 7-point Likert-type scale with items ranging from 'strongly disagree' to 'strongly agree' (Kleinman et al., 2000). There are nine items in total and each item consists of 7 points. The total score is calculated by the average of these nine items. 5 is considered as the cut-off value. Individuals with a score above 5 are classified as 'tired', and those with a score below 5 are classified as 'not tired' (Yorulmaz et al., 2020). The validity and reliability study of the Turkish version of the scale was conducted by Gencay-Can and Can in 2012 with individuals diagnosed with fibromyalgia (Gencay-Can & Can, 2012).

Physical Self Inventory: The scale evaluates the person's perception and evaluation of himself/herself in the psychomotor dimension (Caglar et al., 2017). The latest version of the scale that we use today was developed and published by Ninot et al. in 2000. This version of the scale was found to be shorter and more understandable. The scale consists of 25 items and 6 subheadings. These 6 subheadings are listed as general self-concept (5 criteria), sports competence (4 criteria), physical self-worth (5 criteria), physical condition (5 criteria), physical strength (3 criteria), and physical attractiveness (3 criteria) (Ninot et al., 2000). Items are calculated according to a 6-point Likert scoring between 1 (not at all) and 6 (completely). Some items in the subheadings of the scale are scored in reverse. In scoring, items 5, 7, 13, 17, 19, and 25 were calculated in reverse. A high score indicates a high physical self-perception. The Turkish version of the scale was made by Caglar et al. in 2017 (Caglar et al., 2017).

Interventions - Combined Pilates Exercise Program

The combined Pilates exercise program was carried out in 50-minute sessions, three days a week, for 10 weeks, as a combination of mat-based and Reformer-based exercises. Each session was conducted one-on-one with the participant or in groups of a maximum of two people. Template for Intervention Description and Replication (TIDieR) was developed to explain interventions in detail to indicate that the checklist and guided practices are beneficial to clinicians and patients (Hoffmann et al., 2014). The Pilates exercise program prepared with the TIDieR Control List is summarized in Table 1.

Data Analyses

The data obtained from the study was used with the NCSS (Number Cruncher Statistical System) 2007 (Kaysville, Utah, USA) program. While evaluating the study data, the distribution of the data was evaluated with the Shapiro-Wilk Test as well as descriptive statistical methods (Mean, Standard Deviation, Median, Frequency, Ratio, Minimum, and Maximum). Mann Whitney U Test was used to compare quantitative data between Pilates and control groups. Wilcoxon test was used to determine the differences between the two periods' quantitative data. Chi-square analysis was used to determine the relationship between qualitative data. Significance was evaluated at $p < 0.01$ and $p < 0.05$ levels.

Results

The average age of individuals participating in the Pilates and control groups is 30.91 ± 8.04 and 28.6 ± 6.16 years, respectively, while their body mass indexes (BMI) are 22.16 ± 2.53 and 21.41 ± 2.52 (kg/m^2), respectively. The international physical activity questionnaire of individuals participating in the Pilates and control groups is 295.01 ± 176.97 and 230.73 ± 140.61 MET/min, respectively. The demographic data of the participants showed a homogeneous distribution, and the initial values of the demographic data are summarized in Table 2.

The fatigue severity of individuals participating in the Pilates and control groups was found to be 4.59 ± 1.23 and 4.68 ± 1.12 units, respectively, and the groups showed a homogeneous distribution in terms of fatigue severity ($p = 0.874$; $p < 0.05$). The total physical self-perception scale scores of individuals participating in the Pilates and control groups were found to be 97.63 ± 13.96 and 91.14 ± 12.88 units, respectively, and the groups showed a homogeneous distribution in terms of fatigue severity ($p = 0.054$; $p < 0.05$). The initial parameters of the groups are summarized in Table 3.

The initial data of the participants showed a homogeneous distribution. In the results, in intragroup comparison, a statistically significant improvement in fatigue severity ($p = 0.001$; $p < 0.05$) and total and subgroup parameters of the physical self-perception scale ($p = 0.001$ for all; $p < 0.05$) was observed only in the PG. In the intergroup comparison, a statistically significant improvement was seen only in fatigue severity in favor of the PG ($p = 0.019$; $p < 0.05$).

Table 1
Pilates exercise program.

| Week | Exercise | Frequency | Time | Progression |
|--------------------------------|--------------------------------|-------------------|---|--|
| 1-2 | Pelvic Clock | 3 times a week | 8 repetitions and 1 set to 10 repetitions 2 sets. | <i>Strength exercise:</i> Addition of 2 repetitions in the 2 nd week <i>Stretch exercises:</i> Stretch to the limits as much as can be tolerated. |
| | Footwork | | | |
| | Bridging | | | |
| | Supine Arm Series | | | |
| | Chest Lift | | | |
| | Short Box Arm Series | | | |
| | Long Box: Prone Shoulder Press | | | |
| | Mermaid | | | |
| 3-4 | Standing Hip Stretch | 3 times a week | 10 repetitions 2 sets and 12 repetitions and 2 sets | <i>Strength exercise:</i> Addition of 2 repetitions in the 4 th week. Combination of arm and foot positions relating to exercise variation. <i>Stretch exercises:</i> Stretch to the limits as much as can be tolerated. |
| | Footwork | | | |
| | Bridging + Femur arc | | | |
| | Supine Arm Series | | | |
| | Abdominal Arm Series | | | |
| | Feet in Straps | | | |
| | Short Box Series Tree Hug | | | |
| | Long Box: Prone Shoulder Press | | | |
| 5-6 | Mermaid | 3 times in a week | 12 repetitions 2 sets to 14 repetitions 2 sets. | <i>Strength exercise:</i> Addition of 2 repetitions in the 6 th week <i>Stretch exercises:</i> Stretch to the limits as much as can be tolerated. |
| | Standing Hip Stretch | | | |
| | Footwork | | | |
| | Bridging + Femur arc | | | |
| | Supine Arm Series | | | |
| | Abdominal Arm Series | | | |
| | Feet in Straps | | | |
| | Short Box Series Tree Hug, | | | |
| Long Box: Prone Shoulder Press | | | | |
| 7-8 | Saw | 3 times a week | 14 repetitions and 2 sets to 16 repetitions and 2 sets. | <i>Strength exercise:</i> Addition of 2 repetitions in the 8 th week. Combination of arm and foot positions relating to exercise variation. <i>Stretch exercises:</i> Stretch to the limits as much as can be tolerated. |
| | Scooter | | | |
| | Footwork- single leg | | | |
| | Bridging + upper extremity | | | |
| | Feet in Straps Side back | | | |
| | Short Box Abdominal Series | | | |
| | Quadruped Series | | | |
| | Kneeling Arm | | | |
| Facing Back | | | | |
| 9-10 | Standing Side Splits | 3 times a week | 16 repetitions and 2 sets to 18 repetitions 2 sets | <i>Strength exercise:</i> Addition of 2 repetitions in the 10 th week. Combination of arm and foot positions relating to exercise variation. <i>Stretch exercises:</i> Stretch to the limits as much as can be tolerated. |
| | Prone Press Up | | | |
| | Footwork- Single leg | | | |
| | Bridging + upper extremity | | | |
| | Feet in Straps Side back | | | |
| | Short Box Abdominal Series | | | |
| | Reserve Abdominals | | | |
| | Kneeling Arm, Facing Back | | | |
| Long Box: Prone Pulling Straps | | | | |
| Swimming | | | | |

Table 2

Comparisons of initial demographic data of the groups (Mann Whitney U).

| Parameters | Control (n=35) | | Pilates (n=35) | | p |
|--------------------------|-----------------|------------------|-----------------|-------------------|-------|
| | Mean ± SD | Min-Max (Median) | Mean ± SD | Min-Max (Median) | |
| Age (years) | 28.6 ± 6.16 | 19-43 (27) | 30.91 ± 8.04 | 18-45 (29) | 0.269 |
| BMI (kg/m ²) | 21.42 ± 2.52 | 18-27.24 (20.81) | 22.16 ± 2.53 | 18.7-28.65 (21.5) | 0.192 |
| IPAQ (MET/min) | 295.01 ± 176.97 | 0-715 (294) | 230.73 ± 140.61 | 0-512.4 (294) | 0.190 |

BMI: Body Mass Index; IPAQ: International Physical Activity Questionnaire; SD: Standard Deviation

Table 3

Pre- and Post-Evaluation Values of the Scales (Mean ± SD).

| Variables | Groups | Pre-intervention | Post-intervention | p Value ^a |
|-------------------------|----------------------|------------------|-------------------|----------------------|
| Fatigue Severity Scale | PG | 4.68±1.12 | 3.99±0.89 | 0.001** |
| | CG | 4.59±1.23 | 4.5±1.07 | 0.111 |
| | p Value ^b | 0.874 | 0,019* | |
| Physical Self Inventory | PG | 91.14±12.88 | 101.4±11.21 | 0.001** |
| | CG | 97.63±13.96 | 98.69±12.25 | 0.108 |
| | p Value ^b | 0.054 | 0.518 | |
| Global Self-Concept | PG | 23.54±3.17 | 25.89±3.11 | 0.001** |
| | CG | 24.86±3.24 | 25.09±2.49 | 0.397 |
| | p Value ^b | 0.085 | 0.111 | |
| Physical Self-Worth | PG | 20.66±3.53 | 22.89±2.84 | 0.001** |
| | CG | 22.23±3.5 | 22.6±3.11 | 0.462 |
| | p Value ^b | 0.053 | 0.934 | |
| Physical Condition | PG | 11.29±2.54 | 12.57±2.52 | 0.001** |
| | CG | 12.34±2.88 | 12.49±2.51 | 0.630 |
| | p Value ^b | 0.132 | 0.948 | |
| Sport Competence | PG | 12±2,91 | 13.69±2.47 | 0.001** |
| | CG | 12.94±4.04 | 12.91±3.88 | 0.901 |
| | p Value ^b | 0.249 | 0.566 | |
| Physical Attractiveness | PG | 13.8±2.52 | 15.11±2.03 | 0.001** |
| | CG | 14.83±2.01 | 15.2±1.86 | 0.079 |
| | p Value ^b | 0.116 | 0.863 | |
| Physical Strength | PG | 9.86±2.52 | 11.26±2.05 | 0.001** |
| | CG | 10.14±2.61 | 10.4±2.25 | 0.154 |
| | p Value ^b | 0.484 | 0.178 | |

SD: Standard Deviation; PG: Pilates Group; CG: Control Group; ^a: Mann Whitney U; ^b: Wilcoxon Test; *p<0.05; **p<0.01.

Discussion

Our study aimed to examine the effect of the combined Pilates exercise method given to sedentary female individuals on fatigue and physical self-perception. In the results, in intragroup comparison, a statistically significant improvement in fatigue severity and physical self-perception was observed only in the PG. In the intergroup comparison, a statistically significant improvement was seen only in fatigue severity in favor of the PG.

Pilates has become a form of exercise aimed at improving physical and mental health and is also considered one of the essential exercises worldwide, especially for women (Citil & Kaya, 2021). However, when we examine the studies examining the effect of Pilates exercises on fatigue in women, we see that they focus on breast cancer (Eyigor et al., 2010; Leite et al., 2021; Torres et al., 2023), postpartum (Ashrafinia et al., 2015), post-menopause (Aibar-Almazán et al., 2019) and fibromyalgia (Gulsen et al., 2022). We see that there are very few studies conducted on the healthy sedentary

female population where it will also serve rehabilitation (Akbas & Unver, 2018; Amzajerdi et al., 2023). Similarly, when we examine the studies examining the effect of Pilates exercises on the physical self-perception of women, we find a limited number of studies (Amzajerdi et al., 2023; Kucukapan & Civan, 2021; Tolnai et al., 2016). The sedentary and healthy female population targeted in our study is a population that is relatively lacking in the literature and needs more study, and our study contributes to the literature in this respect.

It has been stated that the most appropriate option for fatigue will be physical activity, considering that an increase in the amount of physical activity provides an improvement in the course of diseases and parameter values such as pain and fatigue (Katz et al., 2020), a decrease in financial expenses and minimal complications (Aibar-Almazán et al., 2019). Akbas & Unver randomized 51 women between the ages of 18 and 25 to the Pilates exercise (n = 25) and control (n = 26) groups. While the PG performed the Pilates mat exercise protocol twice a week for six weeks, with each session lasting 40-50 minutes, the CG did not participate in any regular physical activity for six weeks. The results showed that the 6-week Pilates mat exercise protocol contributed to the physical and psychological well-being of young women in terms of anthropometric characteristics, emotional state, some quality-of-life areas, and fatigue (Akbas & Unver, 2018). Amzajerdi et al. aimed to investigate the effects of Pilates exercises on sleep and fatigue in female university students living in dormitories. They randomized 67 female students between the ages of 18-26 into Pilates (n=32) and control (n=37) groups. The Pilates group received three one-hour Pilates exercise sessions, per week for eight weeks and the CG maintained their routine activities. Sleep quality and fatigue levels were evaluated at baseline, 4th, and 8th weeks. In the results, the effect of Pilates exercises on fatigue showed a significant improvement starting from the fourth week. Significant improvement in most components of sleep quality was seen after the 8th week of the Pilates exercise program (Amzajerdi et al., 2023). It has been shown that the perception of fatigue is reduced by Pilates exercises in healthy women with four- and six-week Pilates exercise programs. The decrease in the feeling of fatigue as a result of Pilates exercises may occur through a decrease in body mass index, people being able to use their muscles more effectively during their daily activities when they learn to contract their muscles correctly during training, acceleration of physical activity, and

increasing the fatigue threshold by increasing endurance. Another mechanism may be the adoption of deep, relaxing breathing associated with Pilates exercises. Increasing air flow and lung capacity can make it easier to perform any activity (Akbas & Unver, 2018). The combined Pilates exercise program applied in our study, given for a total of 150 minutes a week and 10 weeks, caused a statistical improvement in the feeling of fatigue of the PG participants. Our results are similar to the literature.

Society today suffers from the consequences of inactivity. Deteriorating body composition and fitness levels due to a sedentary lifestyle harms the physical and psychological health of the population (de Souza & Vieira, 2006; Runfolo et al., 2013). The importance of the relationship between physical activity participation and physical self-perception, which is the most effective way to correct this situation, has become an accepted concept (Hayes et al., 1999). Considering the positive effects of physical activity on physical self-identification and self-esteem, it has been recommended that children be directed to sports according to their interests (Baydemir et al., 2018). However, very few studies have been found in the literature examining the relationship between physical self-perception and the Pilates exercise method (Cruz-Ferreira et al., 2011; Kucukapan & Civan, 2021; Tolnai et al., 2016). In a study by Cruz-Ferreira et al. examining the effects of the Pilates exercise method on life satisfaction, perception of appreciation, perception of physical appearance, physical self-perception, and health, 62 healthy women were included in the study. A mat Pilates exercise program was applied to the intervention group for 60 minutes, two days a week, for 6 months. No intervention was made in the control group. Measurements were repeated in the third and sixth months. When the results were examined, no difference was observed between the intervention group and the control group, but improvements were noted in life satisfaction, perception of functionality, perception of appreciation, perception of physical appearance, total physical self-concept, and perception of health status in the intervention group (Cruz-Ferreira et al., 2011). In another study, Kucukapan & Civan aimed to examine the effect of a 10-week Pilates exercise program on the body perception of sedentary women. 104 sedentary women participating in the study were included in the Pilates (n=52) and control (n=52) groups. In the study program, the experimental group was given for 10 weeks; Pilates training was performed for 50 minutes, 2 days a week. As a result, as a result of comparing the

body perception pre-test and post-test scores of the Pilates group, it was determined that there was a statistically significant difference in terms of appearance evaluation, appearance orientation, evaluation of physical competence, physical competence orientation, health evaluation, health orientation, satisfaction in body areas and total score. It has been shown that Pilates exercises have a positive effect on the body image of sedentary women (Kucukapan & Civan, 2021). Tolnai et al. examined the effects of Pilates training performed once a week, at a very low frequency, on various physical and psychological parameters during a 10-week intervention in young, healthy, and sedentary women. The results showed that a single session of 60-minute Pilates exercises performed once a week increased body awareness. The results of this study have been interpreted as saying that it can eliminate the 'lack of time' excuse for not exercising, even if it is below the level of exercise required for health, and that the tangible benefits of physical activity can positively affect a person's desire to do more physical activity (Tolnai et al., 2016). Our study results, in parallel with the literature, resulted in an improvement in the physical self-esteem of the Pilates group after the 10-week Pilates exercise method. However, there was no statistically significant change in the evaluation between the Pilates and control groups. This result made us think that not performing an initial mood assessment of our participants while assessing their physical self-perception was a limitation.

Limitations

The lack of an evaluator blind to the interventions and groups, the lack of measuring the amount of physical activity of the control group at the end of the study, and the lack of initial mood assessment of our participants are considered as limitations.

Conclusion

A 10-week mat and equipment-based combined Pilates exercise program can improve the fatigue and physical self-esteem of sedentary women. In future studies, there is a need for studies that also evaluate the emotional states of the participants to increase the effect of the improvement in physical self-esteem.

Authors' Contribution

Study Design: DS, PP; Data Collection: DS; Statistical Analysis: DS; Manuscript Preparation: PP; Funds Collection: --.

Ethical Approval

The study was approved by the Bahcesehir University of Scientific Research and Publication Ethical Committee (2023/01) and it was carried out in accordance with the Code of Ethics of the World Medical Association also known as a declaration of Helsinki.

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Conflict of interest

The authors hereby declare that there was no conflict of interest in conducting this research.

References

- Aibar-Almazán, A., Hita-Contreras, F., Cruz-Díaz, D., de la Torre-Cruz, M., Jiménez-García, J. D., & Martínez-Amat, A. (2019). Effects of Pilates training on sleep quality, anxiety, depression and fatigue in postmenopausal women: A randomized controlled trial. *Maturitas*, *124*, 62-67.
- Akbas, E., & Unver, B. (2018). A six-week Pilates exercise protocol for improving physical and mental health-related parameters. *Malaysian Journal of Movement, Health & Exercise*, *7*(2), 65-79.
- Amzajerdi, A., Keshavarz, M., Ezati, M., & Sarvi, F. (2023). The effect of Pilates exercises on sleep quality and fatigue among female students dormitory residents. *BMC Sports Sci Med Rehabil*, *15*(1), 67.
- Asci, F. H. (2004). Comparison of physical self-perception with regard to gender and physical activity level. *Hacettepe J Sport Sciences*, *15*(1), 39-48.
- Ashrafinia, F., Mirmohammadali, M., Rajabi, H., Kazemnejad, A., Haghghi, K. S., & Amelvalizadeh, M. (2015). Effect of Pilates exercises on postpartum maternal fatigue. *Singapore Med J*, *56*(3), 169-173.
- Babic, M. J., Morgan, P. J., Plotnikoff, R. C., Lonsdale, C., White, R. L., & Lubans, D. R. (2014). Physical activity and physical self-concept in youth: Systematic review and meta-analysis. *Sports Med*, *44*, 1589-1601.
- Baydemir, B., Yurdakul, H. O., & Ozer, K. (2018). Physical activity level in elementary education second level children, physical self description and self-esteem. *Journal of Human Sciences*, *15*(2), 1049-1057.
- Caglar, E., Asci, F. H., & Bilgili, N. (2017). Psychometric properties of Physical Self Inventory Turkish version among university students. *Anatolian Journal of Psychiatry*, *18*(6), 594-601.
- Citil, E. T., & Kaya, N. (2021). Effect of pilates exercises on premenstrual syndrome symptoms: a quasi-experimental study. *Complement Ther Med*, *57*, 102623.
- Craig, C. L., Marshall, A. L., Sjöström, M., Bauman, A. E., Booth, M. L., Ainsworth, B. E., Pratt, M., Ekelund, U., Yngve, A., & Sallis, J. F. (2003). International physical activity questionnaire: 12-country reliability and validity. *Med Sci Sports Exerc*, *35*(8), 1381-1395.
- Cruz-Ferreira, A., Fernandes, J., Gomes, D., Bernardo, L. M., Kirkcaldy, B. D., Barbosa, T. M., & Silva, A. (2011). Effects of Pilates-based exercise on life satisfaction, physical self-

- concept and health status in adult women. *Women Health*, 51(3), 240-255.
- de Souza, M. v. S., & Vieira, C. B. (2006). Who are the people looking for the Pilates method? *J Bodyw Mov Ther*, 10(4), 328-334.
- Eyigor, S., Karapolat, H., Yesil, H., Uslu, R., & Durmaz, B. (2010). Effects of pilates exercises on functional capacity, flexibility, fatigue, depression and quality of life in female breast cancer patients: a randomized controlled study. *Eur J Phys Rehabil Med*, 46(4), 481-487.
- Gencay-Can, A., & Can, S. S. (2012). Validation of the Turkish version of the fatigue severity scale in patients with fibromyalgia. *Rheumatol Int*, 32(1), 27-31.
- Gulsen, C., Soke, F., Eldemir, K., Apaydin, Y., Ozkul, C., Guclu-Gunduz, A., & Akcali, D. (2022). Effect of fully immersive virtual reality treatment combined with exercise in fibromyalgia patients: A randomized controlled trial. *Assist Technol*, 34(3), 256-263.
- Hayes, S. D., Crocker, P. R., & Kowalski, K. C. (1999). Gender differences in physical self-perceptions, global self-esteem and physical activity: Evaluation of the physical self-perception profile model. *J Sport Behav*, 22(1), 1-14.
- Hoffmann, T. C., Glasziou, P. P., Boutron, I., Milne, R., Perera, R., Moher, D., Altman, D. G., Barbour, V., Macdonald, H., & Johnston, M. (2014). Better reporting of interventions: template for intervention description and replication (TIDieR) checklist and guide. *BMJ*, 348.
- Hornsby, E., & Johnston, L. M. (2020). Effect of Pilates intervention on physical function of children and youth: a systematic review. *Arch Phys Med Rehabil*, 101(2), 317-328.
- Katz, P., Andonian, B. J., & Huffman, K. M. (2020). Benefits and promotion of physical activity in rheumatoid arthritis. *Curr Opin Rheumatol*, 32(3), 307-314.
- Kleinman, L., Zodet, M., Hakim, Z., Aledort, J., Barker, C., Chan, K., Krupp, L., & Revicki, D. (2000). Psychometric evaluation of the fatigue severity scale for use in chronic hepatitis C. *Qual Life Res*, 9, 499-508.
- Krupp, L. B., LaRocca, N. G., Muir-Nash, J., & Steinberg, A. D. (1989). The fatigue severity scale: Application to patients with multiple sclerosis and systemic lupus erythematosus. *Arch Neurol*, 46(10), 1121-1123.
- Kucukapan, H., & Civan, A. (2021). Effect of pilates exercises on body image. *Turkish Journal of Sports Science*, 5(2), 54-62.
- Leite, B., de Bem Fretta, T., Boing, L., & de Azevedo Guimarães, A. C. (2021). Can belly dance and mat Pilates be effective for range of motion, self-esteem, and depressive symptoms of breast cancer women? *Complement Ther Clin Pract*, 45, 101483.
- Liden, C. B., Wolowicz, M., Stivoric, J., Teller, A., Kasabach, C., Vishnubhatla, S., Pelletier, R., Farrington, J., & Boehmke, S. (2002). Characterization and implications of the sensors incorporated into the SenseWear armband for energy expenditure and activity detection. *Bodymedia Inc. White Papers: 1, 7*.
- Mazzarino, M., Kerr, D., Wajswelner, H., & Morris, M. E. (2015). Pilates method for women's health: systematic review of randomized controlled trials. *Arch Phys Med Rehabil*, 96(12), 2231-2242.
- Ministry of Health's Turkey Nutrition and Health Survey (2024). https://krtknadmn.karatekin.edu.tr/files/sbf/TBSA_RAPOR_KITAP_20.08.pdf
- Ninot, G., Delignières, D., & Fortes, M. (2000). L'évaluation de l'estime de soi dans le domaine corporel. *Staps*, 21(53), 35-47.
- O'Connor, P. J., & Puetz, T. W. (2005). Chronic physical activity and feelings of energy and fatigue. *Med Sci Sports Exerc*, 37(2), 299-305.
- Ozerkan, K. N. (2004). *Spor psikolojisi giriş*. Nobel Yayınları, Ankara. [In Turkish]
- Pescatello, L. S. (Ed.). (2014). *ACSM's guidelines for exercise testing and prescription*. Lippincott Williams & Wilkins.
- Phuphanich, M. E., Droessler, J., Altman, L., & Eapen, B. C. (2020). Movement-based therapies in rehabilitation. *Phys Med Rehabil Clin N Am*, 31(4), 577-591.
- Runfola, C. D., Von Holle, A., Trace, S. E., Brownley, K. A., Hofmeier, S. M., Gagne, D. A., & Bulik, C. M. (2013). Body dissatisfaction in women across the lifespan: Results of the UNC-SELF and gender and body image (GABI) studies. *Eur Eat Disord Rev*, 21(1), 52-59.
- Saglam, M., Arikan, H., Savci, S., Inal-Ince, D., Bosnak-Guclu, M., Karabulut, E., & Tokgozoglu, L. (2010). International physical activity questionnaire: reliability and validity of the Turkish version. *Percept Mot skills*, 111(1), 278-284.
- Saltan, A. (2018). Investigation of the effects of pilates based exercise on posture, quality of life, depression symptoms and pain in women. *Firat University Journal of Health Sciences*, 32(1), 31-36.
- Seo, J. G., & Park, S. P. (2018). Significance of fatigue in patients with migraine. *J Clin Neurosci*, 50, 69-73.
- Tolnai, N., Szabó, Z., Köteles, F., & Szabo, A. (2016). Physical and psychological benefits of once-a-week Pilates exercises in young sedentary women: A 10-week longitudinal study. *Physiol Behav*, 163, 211-218.
- Torres, D. M., de Menezes Fireman, K., Fabro, E. A. N., Thuler, L. C. S., Koifman, R. J., Bergmann, A., & da Silva Santos, S. (2023). Effectiveness of mat pilates on fatigue in women with breast cancer submitted to adjuvant radiotherapy: randomized controlled clinical trial. *Support Care Cancer*, 31(6), 362.
- WHO Physical Activity. (2022). <https://www.who.int/news-room/fact-sheets/detail/physical-activity>
- World Medical Association. (2013). World Medical Association Declaration of Helsinki: Ethical principles for medical research involving human subjects. *JAMA*, 310(20), 2191-2194.
- Yorulmaz, H., Mehmetoğlu, N., Aksu, K., & Eser, E. (2020). The investigation of fatigue in patients with sleep apnea. *Journal of Academic Research in Nursing*, 6(2).