



# Investigation of the Effects of Reformer Pilates Exercises on Posture Disorder in Sedentary Women

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## Abstract

Sedentary people have some chronic diseases such as diabetes, hypertension and obesity also postural disorders. Postural disorders effect the quality of life of the person negatively and increase the risk of musculoskeletal problems. The aim of this study was to investigate the effect of reformer pilates excersise on posture in sedentary women with posture disorders. The study included 18 sedentary women with posture disorder (age mean. 21.11±.832 years; height mean. 162.22±5.745 cm; body weight mean. 55.94±9.352 kg) were included. An exercise programme was applied to the participants 3 days a week (90 minutes/day) for 8 weeks. Posture assessment of the participants for pre- and post-tests was performed using computerised photogrammetry and the obtained photographs were analysed in PostureScreen® (PostureCo Inc., Trinity, FL, USA) mobile application. The data obtained as a result of the study were analysed with SPSS 23.0 statistical package programme. Shapiro-Wilks test was used to determine the conformity of the variables to normal distribution, and Paired Samples T-Test was used for pre- and post-exercise comparisons. As a result of the analysis; a statistically significant difference was found in the total posterior angle values of the participants ( $p<0.05$ ). In conclusion, it is thought that regular reformer pilates exercises can provide positive effects in improving posture in sedentary women with postural disorders.

**Keywords:** Woman, posture, anthropometry, exercise, health

## Özet

### Sedanter Kadınlarda Reformer Pilates Egzersizlerinin Postür Bozukluğuna Etkilerinin Araştırılması

Sedanter kişilerde diyabet, hipertansiyon, obezite gibi kronik hastalıkların yanı sıra postür bozuklukları da sıklıkla görülmektedir. Postür bozuklukları kişinin yaşam kalitesini olumsuz yönde etkileyerek kas iskelet sistemi rahatsızlıklarının görülme riskini artırmaktadır. Bu çalışmanın amacı, postür bozukluğu olan sedanter kadınlarda reformer pilates egzersizlerinin postür bozukluğuna etkisinin araştırılmasıdır. Çalışmaya gönüllülük esasına dayalı olarak postür bozukluğu tespit edilen 18 sedanter kadın (yaş ort. 21.11±.832 yıl; boy uzunluğu ort. 162.22±5.745 cm; vücut

ağırlığı ort. 55.94±9.352 kg) dahil edilmiştir. Katılımcılara 8 hafta boyunca haftada 3 gün (90 dakika/gün) egzersiz programı uygulanmıştır. Katılımcıların egzersiz öncesi ve sonrası postür değerlendirmesi bilgisayarlı fotogrametri kullanılarak yapılmış ve elde edilen fotoğraflar PostureScreen® (PostureCo Inc., Trinity, FL, USA) mobil uygulamasında analiz edilmiştir. Çalışma sonucunda elde edilen veriler SPSS 23.0 istatistik paket programı ile analiz edilmiştir. Değişkenlerin normal dağılıma uygunluk durumunu belirlemek için Shapiro-Wilks testi; egzersiz öncesi ve sonrası karşılaştırmalarında ise, Paired Samples T-Testi kullanılmıştır. Analiz sonucunda; katılımcıların total posterior açı değerlerinde istatistiksel olarak anlamlı fark bulunmuştur. ( $p < 0,05$ ). Sonuç olarak, düzenli yapılan reformer pilates egzersizlerinin postür bozukluğu olan sedanter kadınlarda postürün iyileştirilmesinde olumlu etkiler sağlayacağı düşünülmektedir.

**Anahtar Kelimeler:** Kadın, postür, antropometri, egzersiz, sağlık

## INTRODUCTION

Physical activity is defined as any body movement produced by skeletal muscles that result in energy expenditure can be measured in kilocalories. Exercise is not synonymous with physical activity: It is a subcategory of physical activity. Exercise is a physical activity that is planned, structured, repetitive, and purposive for the improvement or maintenance of one or more parts of physical fitness (7). Pilates exercises, created by Joseph Pilates in the 1920s, are an exercise approach that aims to control the body, consisting of stretching and strengthening exercises (16;23). The pilates method, which consists of 6 basic principles: centering, concentration, control, precision, flow and breathing, can provide core stabilization (23). The pilates exercises has become popular in recent years, complex and effective exercises with a focus on muscle strength and realignment, core stability and control, flexibility, and posture (11). Lee et al. found that pilates exercises applied 3 times a week for 10 weeks reduced pain and disability and improved the craniovertebral angle in their study on people with forward head posture (17). In another study, the effects of 16 sessions of pilates exercises to the postural alignment in healthy adults was evaluated. In the study, where they found that pilates exercises had a positive effect on postural alignment, it was stated that more studies are necessary about the effects of pilates on posture.

Posture expressed as “positura” in Latin and “posture” in French; it is the placement of each part of the body in the most appropriate position relative to the adjacent segment and the whole body (19). Good posture is stated as the balance between musculoskeletal components and is related to movement without pain and other musculoskeletal health (21;25;32). Sedentary lifestyle, lack of ergonomic equipment and body awareness, emotional stress may cause postural alignment problems (8). Physiotherapists and physicians commonly evaluate posture in people with musculoskeletal, neurological, and cardiopulmonary diseases (12). Visual observation, plumbline, goniometer, photography, radiography, 3D motion analysis systems, photogrammetry are posture analysis methods that are commonly used (28). Recently, smart mobile devices such as phones and tablets are widely used in posture analysis due to their widespread accessibility, ease of use, and affordable (13;14). PostureScreen Mobile (PSM) (PostureCo, Inc., Trinity, Florida) is an economic, user-friendly app available for iOS platforms (eg, iPad, iPhone) that is created as a screening tool for healthcare professionals who evaluate patients for postural misalignments.

The effects of Pilates as an exercise type on body composition parameters (1;29), many health parameters (2;20;26;31) have been investigated. However, there is limited research examining the effects of reformer Pilates exercises on posture. The aim of this study is to evaluate the changes in posture of reformer pilates exercises applied to healthy young women for 8 weeks. The findings of this study will inform basic knowledge and provide new evidence about the selection of appropriate exercise protocols in reformer Pilates applications in sedentary women.

## MATERIAL AND METHOD

**Research model:** Our research was carried out in a quasi-experimental model. In accordance with the study design, a control group was not formed.

**Participants:** The study included 40 women studying at a university, who were diagnosed with postural impairment as a result of physiotherapist assessment and who met the inclusion and exclusion criteria. Inclusion criteria were being between 18-30 years old, be willing to participate in the study and be woman. Exclusion criteria were having orthopedic, neurological, cardiopulmonary problems and being pregnant. 2 participants declared that they wanted to stop the research due to personal reasons. One participant could not continue the exercise program as a result of an accident, and a total of 22 participants were excluded because the other 19 participants did not participate in the program regularly and were not included in the compensation training. 18 participants completed the study this research was approved by The Ethics Committee of Dumlupınar University. Written informed consent form was obtained from all participants.

**Protocol:** Before the exercise program, age, height, and weight of the participants were evaluated. After postural analysis the subjects were included in the exercise program. After the content of the exercise program was determined individually by the experienced trainer, the exercises were performed individually in the pilates hall of the Faculty of Sport Sciences in accordance with the health and safety rules. An instructor is designated for each participant. Trainings were held at times that were convenient for the participant and the trainer. In the first stage, as stated in the exercise program (Table 1), it was started from the lowest levels and the repetition, duration and spring levels were increased over time. The participants were free to out of any part of the study with their consent. The study data has not been used in any way other than for scientific purposes. With the financial support provided by the Kütahya Dumlupınar University Scientific Research Projects Unit with the project number 2022-26, the necessary materials for the study were procured.

**Exercise Program:** The reformer pilates intervention consisted of three 90-min sessions per week for 8 weeks. Each session was planned as 20 minutes of warm-up, 55 minutes of exercise and 15 minutes of cool-down (Table 1). The exercise program was continued by changing the number of springs and repetitions and it was completed after 8 weeks.

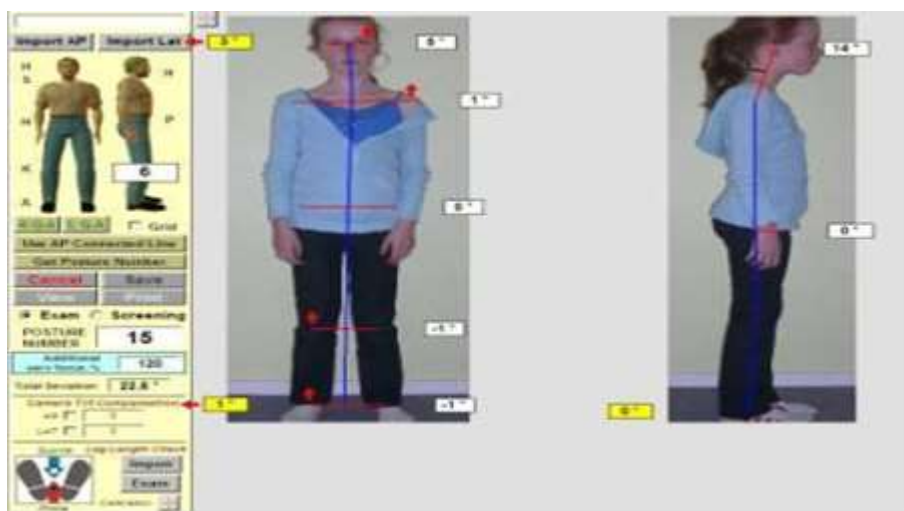
**Table 1.** Exercise program

| EXERCISE PROGRAM   |                                |               |
|--|--------------------------------|---------------|
| Exercises  | Coil Spring                    | Repeat        |
| <b>Double Leg Press Dorsiflexed</b>                      |                                |               |
| Close Stance   | 2-4 Spin                       | 8-12 repeat   |
| Close Stance External Rotation                           | 2-4 Spin                       | 8-12 repeat   |
| Wide Stance External Rotation                            | 2-4 Spin                       | 8-12 repeat   |
| <b>Double Leg Press High Toe</b>                         |                                |               |
|  | <b>Position Plantar Flexed</b> | <b>Repeat</b> |
| Close Stance   | Position Plantar Flexed        | 8-12 repeat   |
| Close Stance External Rotation                           | Position Plantar Flexed        | 8-12 repeat   |
| Wide Stance External Rotation                            | Position Plantar Flexed        | 8-12 repeat   |
| <b>Single Leg Press Series</b>                           |                                |               |
|  | <b>Coil Spring</b>             | <b>Repeat</b> |
| Table Top (Bent Knee) Feet Dorsiflexed or Plantar Flexed | 2-4 Spin                       | 8-12 repeat   |
| Table Top (Single Leg Kick) Flex and Point               | 2-4 Spin                       | 8-12 repeat   |
| <b>Leg is Straps</b>                                     |                                |               |
|  | <b>Coil Spring</b>             | <b>Repeat</b> |
| Double Leg Extension                                     | 1-2 Spin                       | 8-12 repeat   |
| Double Leg Press   |                                |               |
| Leg Circles (Feet Turned Out – Feet Turned In)           | 1-2 Spin                       | 8-12 repeat   |
| Frogs (Ball Between Knees – Hells Circutor Frogs)        | 1-2 Spin                       | 8-12 repeat   |
| <b>Seated Long Box Series</b>                            |                                |               |
|  | <b>Coil Spring</b>             | <b>Repeat</b> |
| Open Rhomboid Squeeze (Cross Straps)                     | 1-2 Spin                       | 8-12 repeat   |
| Latissimus Dorsi Row                                     | 1-2 Spin                       | 8-12 repeat   |
| Half Swan (Prone Long Box)                               | 1-2 Spin                       | 8-12 repeat   |

|                              |                    |               |
|------------------------------|--------------------|---------------|
| Swan (Prone Long Box)        | 1-2 Spin           | 8-12 repeat   |
| Latissimus Dorsi (Pull Down) | 1-2 Spin           | 8-12 repeat   |
| Pulling Straps               | 1-2 Spin           | 8-12 repeat   |
| Reverse Fly on the Box       | 1-2 Spin           | 8-12 repeat   |
| <b>Abdominal</b>             | <b>Coil Spring</b> | <b>Repeat</b> |
| 100's Prep                   | 1-2 Spin           | 8-12 repeat   |
| Curl Up                      | 1-2 Spin           | 8-12 repeat   |
| Frogs with Curl Up           | 1-2 Spin           | 8-12 repeat   |
| <b>Quadruped</b>             | <b>Stretch</b>     | <b>Repeat</b> |
| Cat / Cow                    | Stretch            | 8-12 repeat   |
| Chest                        | Stretch            | 8-12 repeat   |
| Triceps                      | Stretch            | 8-12 repeat   |
| Eva Lunge                    | Stretch            | 8-12 repeat   |

### Data Collection Tools

**Posture Assessment:** Posture was evaluated with the Posturescreen Mobile (PostureCo, Inc., Trinity, Florida) application. Anatomical points which are bilateral pupils, sternal notch, bilateral acromioclavicular joints, bilateral T8 ribs, bilateral anterior superior iliac spines, midpoint of bilateral anterior ankles, bilateral external auditory meatus, bilateral greater trochanters of femur, bilateral inferior ear lobes, bilateral posterior superior iliac spines, bilateral posterior superior iliac spines, bilateral Achilles tendons were marked with colored markers. Digital photographs were taken of the anterior, posterior, left and right lateral view of the participant with iPhone attached on tripods directly in front of the participant one meter away. Digital photographs were taken of the anterior, posterior, left, and right lateral view of the participant with an iPhone attached to a tripod in front of the participant one meter away. The marked anatomical points were determined on the PSM app. PSM then calculated the following 8 quantitative data points using proprietary algorithms: total anterior translation, total anterior angle (right), total lateral translation (right), total anterior angle (left), total lateral translation (left), total posterior translation, total posterior angle.



Picture 1. Posture analysis

**Statistical Analysis:** The data of the participants were analysed using IBM SPSS 23 package program. Pre- and post-test distributions of the variables were analysed according to the groups and the normality of the distributions and homogeneity of the variances were determined by Shapiro-Wilks Test. In-group pre-test and post-test comparisons regarding the training effect were analysed by Paired-Sample T-test. The significance level was accepted as  $p < 0.05$ .

## RESULTS

Demographic information of the participants is shown in Table 2.

| Demographic information | N  | Mean $\pm$ sd      |
|-------------------------|----|--------------------|
| Age (years)             |    | 21.11 $\pm$ .832   |
| Height (cm)             | 18 | 162.22 $\pm$ 5.745 |
| Weight (kg)             |    | 55.94 $\pm$ 9.352  |

The values of the participants pre- and post-exercise program application are shown in Table 3.

| Parameters                        | Pre- Test          | Post- Test        | t      | p     |
|-----------------------------------|--------------------|-------------------|--------|-------|
|                                   | Mean $\pm$ sd      | Mean $\pm$ sd     |        |       |
| Total Anterior Translasyon        | 2.91 $\pm$ 1.656   | 2.90 $\pm$ .844   | .014   | .989  |
| Total Anterior Angle              | 6.27 $\pm$ 3.357   | 4.96 $\pm$ 2.784  | 1.379  | .186  |
| Total Lateral Translasyon (Right) | 9.39 $\pm$ 4.254   | 8.73 $\pm$ 2.896  | .519   | .610  |
| Total Anterior Angle (Right)      | 20.65 $\pm$ 7.407  | 18.53 $\pm$ 5.996 | 1.047  | .310  |
| Total Posterior Translasyon       | 6.139 $\pm$ 2.696  | 5.87 $\pm$ 1.403  | .403   | .692  |
| Total Posterior Angle             | 42.37 $\pm$ 14.899 | 22.31 $\pm$ 5.982 | 4.902  | .000* |
| Total Lateral Translasyon (Left)  | 6.85 $\pm$ 3.128   | 7.77 $\pm$ 2.412  | -1.290 | .214  |
| Total Lateral Angle (Left)        | 15.86 $\pm$ 4.931  | 16.86 $\pm$ 5.440 | -.793  | .439  |

\*p<0.05

In Table 3, intra group posture analysis values were compared. In the table, it was seen that there was a statistically significant change between the total posterior angle values of the participants ( $p < 0.05$ ). No statistically significant difference was found in other posture analysis values ( $p > 0.05$ ).

## DISCUSSION

In this study, the effects of reformer pilates exercises on posture were investigated in sedentary women with posture disorders. In this study, pilates exercises were applied to participants with posture disorders using a reformer device. Posture was evaluated before and after the exercise program. At the end of the 8-week exercise, it was determined that there were significant differences in the total posterior angle parameter, which is one of the posture components of the participants. Although there was no statistically significant difference in other parameters, improvements were observed.

Today, with the development of technology, people's daily physical activity levels are gradually decreasing. Pilates exercises are recommended by many physicians and physiotherapists in order to prevent, reduce or completely eliminate the discomforts associated with a sedentary lifestyle. It has been stated that pilates exercises strengthen the deep trunk muscles and increase their activities, provide lumbar and pelvic stability (10; 23), increase body awareness, flexibility, aerobic capacity and balance (4; 5; 30).

A limited number of studies have been found in the literature evaluating the effect of reformer pilates on posture. Otto et al. (24) applied reformer pilates exercises to one group and resistance exercises to the other group and determined that there were significant improvements in the total postural scores of the participants at the end of 12 weeks. Adıgüzel and Doğru (2) reported that 10-week reformer exercises had positive effects on scoliosis in their study on 23 sedentary women. Servililer (27) concluded that an 8-week reformer exercise program positively affects postural disorders in middle-aged and older individuals. Lee et al. (18) had 36 middle-aged female participants do pilates exercises 3 days a week for 12 weeks and showed that the postural alignments of the participants in the exercise group improved in the sagittal and horizontal planes at the end of the exercises. Researchers have stated that pilates exercises are performed symmetrically and strengthen the deep muscles, and that the preservation of the trunk postural alignment increases with the development of muscle mass. In a study by Kloubec (15), 12 weeks of pilates exercises were applied to young adults. At the

end of the study, there was no improvement in posture, but he reported that when postural deviations are large, exercise may have a positive effect in correcting misalignment.

In a study by Kloubec (15), 12 weeks of pilates exercises were applied to young adults. At the end of the study, there was no improvement in posture and the results were said to be stable, but when the postural deviations were large, he reported that exercise had a positive effect in correcting the misalignment, and even though the postural data were stable, a significant change in the height of the participants might have some structural changes in spinal alignment with exercise. According to McGill (22), improving muscular endurance has a more protective effect than improving muscular strength, and this ensures maintaining neutral vertebral posture under load. The Pilates method also advocates this approach (6; 9). According to McGill (22), improving muscular endurance has a more protective effect than improving muscular strength, and this ensures maintaining neutral vertebral posture under load. The effects of the Pilates method are similar to this approach (6; 9).

As a result, it is thought that reformer pilates exercises may be effective in improving postural disorders. It is thought that postural disorders can be improved with such reformer exercises applied to sedentary women. In addition, it is thought that reformer exercises will have a positive effect on women's health and improve their daily physical activity abilities, as well as their effects on posture. Therefore, sedentary women can be recommended to practice reformer exercises for a more comfortable daily life. However, due to the limited number of studies in the literature, the inconsistency in the results of existing studies and the need for randomized controlled studies, more studies are needed in this area.

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