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ORIGINAL ARTICLE

# Investigation of the effects of clinical Pilates exercises on physical fitness and psychosocial parameters in healthy women

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**Purpose:** The aim of this study was to examine the effect of supervised and home-based clinical Pilates exercises on physical fitness, psychosocial status, and exercise beliefs in healthy women.
**Methods:** Thirty-eight healthy women (mean age=29.95±7.16 years) were divided into two groups: supervised group (N=19) and home-based group (N=19). Physical fitness was assessed with modified push-up, sit-up, sit to stand, anterior plank, lateral plank, Biering-Sorensen, trunk flexors endurance, timed up and go and 6-min walking tests. Body composition was assessed with body mass index and waist to hip ratio. Psychosocial status was assessed with Social Appearance Anxiety Scale (SAAS), Rosenberg Self-Esteem Scale (RSES), Body Image Scale and Exercise Beliefs Questionnaire. Both groups completed a 24-session exercise program for 8 weeks, 3 days a week.
**Results**: After the program, a significant improvement was seen in the modified push-up, sit-up, sit to stand, anterior plank, lateral plank, Biering-Sorensen, trunk flexors endurance tests with SAAS, RSES and Exercise Beliefs Questionnaire scores in the supervised group ($p<0.05$). In the home-based group, significant improvement was achieved in the modified push-up, sit-up, anterior plank, trunk flexors endurance tests with Exercise Beliefs Questionnaire scores ($p<0.05$). Comparing delta values, it was observed that there was a significant difference in the sit to stand and anterior plank tests with the Exercise Beliefs Questionnaire scores in favor of the supervised group ($p<0.05$).
**Conclusion:** It was seen that clinical Pilates exercises, both supervised and home-based, similarly increased endurance and muscle strength, as well as positively affected participants' perspectives on exercise in healthy women. In addition, clinical Pilates exercises performed under supervision made a difference in both lower extremity strength evaluated by sit to stand test and endurance results evaluated by anterior plank test.
**Keywords:** Exercise, Physical fitness, Anxiety, Depression.

## Sağlıklı kadınlarda klinik Pilates egzersizlerinin fiziksel uygunluk ve psikososyal parametreler üzerine etkilerinin incelenmesi

**Amaç:** Bu çalışmanın amacı, sağlıklı kadınlarda gözlem altında ve ev tabanlı klinik Pilates egzersizlerinin fiziksel uygunluk, psikososyal durum ve egzersiz inançları üzerindeki etkisini incelemekti.
**Yöntem:** Otuz sekiz sağlıklı kadın (ortalama yaş=29,95±7,16 yıl), gözlem altındaki grup (N=19) ve ev tabanlı grup (N=19) olmak üzere iki gruba ayrıldı. Fiziksel uygunluk modifiye push-up, mekik, otur-kalk, anterior köprü, lateral köprü, Biering-Sorensen, gövde fleksörleri endurans, kalk yürü ve 6 dk yürüme testleri ile değerlendirildi. Vücut kompozisyonu; vücut kitle indeksi (VKİ) ve bel kalça oranı (BKO) ile değerlendirildi. Psikososyal durum; Sosyal Görünüş Kaygı Ölçeği (SGKO), Rosenberg Benlik Saygısı Ölçeği (RBSO), Beden İmajı Ölçeği ve Egzersiz İnanışları Anketi ile değerlendirildi. Her iki grup haftada 3 gün, 8 hafta boyunca 24 seanslık egzersiz programını tamamladı.
**Bulgular:** Programdan sonra, gözlem altındaki grupta modifiye push-up, mekik, otur-kalk, anterior köprü, lateral köprü, Biering-Sorensen, gövde fleksör endurans testleri ile SGKO, RBSO ve Egzersiz İnanışları Anketi skorlarında anlamlı düzeyde gelişme görüldü ($p<0,05$). Ev tabanlı grupta ise, modifiye push-up, mekik, anterior köprü, gövde fleksör endurans testleri ve Egzersiz İnanışları Anketi skorlarında anlamlı düzeyde gelişme elde edildi ($p<0,05$). Delta değerleri karşılaştırıldığında, otur-kalk ve anterior köprü testleri ile Egzersiz İnanışları Anketi skorlarında gözlem altındaki grup lehine anlamlı düzeyde fark olduğu görüldü ($p<0,05$).
**Sonuç:** Hem gözlem altında hem de evde yapılan klinik Pilates egzersizlerinin, sağlıklı kadınlarda dayanıklılığı ve kas gücünü benzer şekilde artırdığı, katılımcıların egzersize bakış açılarını da olumlu yönde etkilediği görüldü. Ayrıca, gözetim altında yapılan klinik Pilates egzersizleri, hem otur-kalk testi ile değerlendirilen alt ekstremite kuvveti hem de anterior köprü testi ile değerlendirilen endurans sonuçlarında fark yaratmıştır.
**Anahtar kelimeler:** Egzersiz, Fiziksel uygunluk, Anksiyete, Depresyon.

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Mind-body exercises, such as Pilates, consider the person as a whole and are effective methods to help the individual cope with the musculoskeletal problems, as well as to reduce symptoms due to anxiety and stress. It also relaxes the mind and increases individual awareness.[1] Yoga, Tai Chi and Pilates are examples of exercise approaches included in this field.[2]

Pilates is a physical fitness program developed in the 1920s by Joseph Hubertus Pilates to put the body in shape, improve balance and coordination, increase flexibility and at the same time provide unity between mind and body. In the early 2000s, the Pilates Institute was established by Australian physiotherapists and Pilates exercises were adapted to the clinic by this institute. This method was called "Clinical (Modified) Pilates". Clinical Pilates exercises focus the integrity the body and the mind to develop kinesthetic awareness in the person with movements originating from the central column.[3]

Clinical Pilates uses the principles of breathing, muscle control and movement awareness and accuracy of movement to help individuals safely restore their whole-body alignment, improve their posture, reduce joint pain and increase freedom of movement.[3,4]

Physical fitness includes components such as body composition, cardiovascular endurance, strength, balance, and flexibility.[5] Literature indicated that clinical Pilates exercises increased the muscle strength and physical fitness in healthy people.[5,6-10]

Pilates has physical and psychological benefits.[10] Individuals participating in the Pilates-based exercise program reported that they felt calmer, energetic, refreshed, and increased awareness.[11] In addition, it has been reported that exercise positively affects the physical self-perception.[12] It has also been shown in the literature that Pilates is widely popular among women.[13]

In the literature, there was no study comparing the effect of clinical Pilates exercises on physical fitness, psychosocial status, and exercise belief with clinical Pilates-based home exercise. Katayıfçı et al. and Rogers and Gibson did not include any control or comparison group in their study.[5,9] In addition, in most of the controlled studies, no intervention was made on the control group.[10,14-17] Unlike the literature, our study examined the effect of clinical Pilates exercises on physical fitness, psychosocial status and exercise beliefs in healthy individuals and compared supervised and home-based clinical Pilates exercise so it differs from other studies examining the effect of clinical Pilates exercises on physical fitness, psychosocial status and exercise beliefs. Thus, our study will contribute to the literature by examining the rarely evaluated psychosocial parameters and exercise beliefs as well as physical fitness.

Physical fitness, psychosocial and exercise belief parameters were used to evaluate the above-mentioned effects of Pilates exercises with two different methods, under supervised and home-based. Our study was planned to investigate the effectiveness of both supervised and home-based clinical Pilates exercises in healthy women, and to determine whether they are superior to each other. For this purpose, we hypothesized that the supervised method would be superior in terms of the evaluated parameters to the home-based group.

## METHODS

### Study design

The participants were divided into the supervised group and the home-based group. Clinical Pilates exercises were performed by an experienced and certified physiotherapist in this field. The protocol of the present study was approved by the Scientific Research Projects Coordination Unit of Pamukkale University (issue: 2019SABE029 date: 19.04.2016).

### Participants

Thirty-eight healthy women volunteers between the ages of 25-50 who met the inclusion criteria were included in the study (mean age=29.95±7.16 years). The participants were randomly divided into 2 groups as the supervised group (n=19) and the home-based group (n=19). Randomization was done using a computer program (SPSS.v.22) for group allocation.

At the beginning of the program, the body mass index and waist to hip ratios of the women were similar in both groups. Participants were individuals living in same country and speaking the same language. All participants had similar cultural and ethnic backgrounds. All participants voluntarily agreed to participate in this study, received oral and written

information before the study and signed informed consent.

Inclusion criteria=(a) being in the 25-50 age range (b) volunteering to participate in the study. Exclusion criteria=(a) Not being able to participate regularly in the exercise program. (b) Having been diagnosed with any orthopedic, neurological, rheumatological or psychological disease. (c) Being pregnant. (d) Experiencing imbalance due to the diagnosis of peripheral vestibular disease. (e) To have a regular exercise habit. (f) Following any dietary program. (g) Being on any psychological support or medication.

**Evaluations**

All main evaluations were taken by the physiotherapist in the same place before and after the programs. Personal data such as age, gender, weight, height, body mass index, dominant limb, occupation, and educational level of women were recorded in the demographic form. Physical fitness was assessed with modified push-up, sit-up, sit to stand, anterior plank, lateral plank, Biering-Sorensen, trunk flexors endurance, timed up and go and 6-min walking tests. Body composition was assessed with body mass index and waist to hip ratio. Psychosocial status was assessed with Social Appearance Anxiety Scale (SAAS), Rosenberg Self-Esteem Scale (RSES), Body Image Scale and Exercise Beliefs Questionnaire. To avoid fatigue in the participant, body composition and psychosocial status from evaluation parameters were applied one day (40 min), and physical fitness the next day (40 min).

*Body Composition Assessment*

**Body mass index (BMI):** It is calculated by dividing the kilogram of body weight by the square of the height in meters ($kg/m^2$).[18]

**Waist to hip ratio (WHR):** Waist circumference measurement is measured from the lowest rib level on the umbilicus, and for the hip circumference from the widest part of the hip and posterior, and the waist measurement value is divided by the hip value and the result is recorded.[19]

*Physical Fitness Assessment*

**Modified push-up test:** The participant is positioned in the prone position with hands shoulder-width, elbows flexed at approximately 90 degrees and knee on the floor. She is asked to lift the head, shoulders, and trunk from the floor until knees, hips and shoulders in a straight line, so that the elbows are in full extension. Then, to lower your upper body until your elbows bend to 90 degrees and repeat within 40 seconds. The number of movements that can be completed in this period is recorded.[20]

**Sit-up test:** The participant is positioned in the supine position with hands on opposite shoulders. The knees are in flexion at approximately 90 degrees and the feet are fixed by the physiotherapist and the participants is asked to make trunk flexion. The number of repetitions it can do within 30 seconds is recorded.[21]

**Sit to stand test:** The participant is asked to stand up and sit quickly for 30 seconds from the 43 cm standard chair with his arms crossed on his shoulders and his back is leaning on the chair, and the evaluation is made by recording the number of the last repetitions in full lift.[22]

**Anterior plank test:** The participant is asked to lift the trunk by giving weight to the forearms and toes while the elbows are in the flexion position, and the evaluation is made by recording how long the position can be maintained.[23]

**Lateral plank test:** For this test, the participant is asked to lie on nondominant side, and the support surface is created by flexing the elbow with the arm under the body. The person is asked to place the upper hand on her waist and, when ready, lift her hip and knee from the ground and build a bridge. During the test, the time that the hips and knees are lifted from the ground and the position is maintained is recorded.[24]

**Biering-Sorensen test:** The participant is positioned prone, pelvis, hips and knees fixed on the bed. The person is asked to lift the upper body parallel to the body while facing the ground, and the time that the position is maintained is recorded.[25]

**Trunk flexors endurance test:** The participant is positioned so that the trunk is at 60º, knees and hips are at 90º flexion. The physiotherapist making the assessment fixes the feet on the ground by supporting from the tip of the toe. The time during which 60° trunk flexion can be maintained is recorded.[26]

**Timed up and go test:** The participant is asked to sit on a standard chair. Then she is told to stand up and walk with regular steps at 3 meters whose length is predetermined, and to

return at the end of 3 meters and sit on the chair. The walking time during the test is determined by the stopwatch in seconds.[27]

**6-min walking test:** After resting for at least 10 minutes, the participant is asked to walk for 6 minutes in a 30-meter straight and non-inclined corridor, and the maximum distance she can walk is recorded.[28]

*Psychosocial Status Assessment*

**Social Appearance Anxiety Scale:** The Social Appearance Anxiety Scale (SAAS) was created to measure anxiety about being negatively evaluated by others because of one's general appearance, including body shape. SAAS also relates to social anxiety, the greater disparity between real and ideal physical qualities, beliefs that one's appearance is inherently flawed and socially unacceptable, and that being unattractive is socially harmful, feelings of unattractiveness, an emphasis on appearance and care, and an occupation. It is a unique predictor of social anxiety above and beyond negative body image indicators. The findings show that SAAS is a psychometrically valid measure of social anxiety about one's general appearance. It consists of 16 items with responses on a 5-point Likert scale. The total score ranges from 16 to 85, and as the score increases, the social appearance anxiety score also increases. Concordance validity and test-retest reliability of the scale were calculated and reported. Turkish adaptation was done by Doğan.[29]

**Rosenberg Self-Esteem Scale:** The purpose of the 10 item RSE scale is to measure self-esteem. Originally the measure was designed to measure the self-esteem of high school students. However, since its development, the scale has been used with a variety of groups including adults, with norms available for many of those groups. It is a Likert type scale consisting of 10 items. High score indicates higher self-esteem. Turkish adaptation was done by Cuhadaroglu.[30]

**Body Image Scale:** It aims to measure how satisfied people are with various parts of their bodies and various body functions. The scale consists of 40 items. Each item describes a function such as an organ, a body part (such as arm, leg, face), or the level of sexual activity. The most positive statement gets 5 points, and the most negative statement gets 1 point. An increase in the total score obtained from the scale indicates an increase in the person's satisfaction with his body parts or function, while a decrease in the score indicates a decrease in satisfaction. In the Turkish version of the scale, the Cronbach Alpha value was found to be .91.[31]

**Exercise Beliefs Questionnaire:** This questionnaire was developed specifically for the Turkish language within the scope of a doctoral thesis to evaluate the belief of women in exercise in our country. Exercise Beliefs Questionnaire within the scope of her research on "Investigation of the Effect of Exercise Beliefs on Exercise Behavior Changes in Healthy Women"; According to the Planned Behavior Theory guideline form containing medical issues and by reviewing the literature, Küçük and Livanelioğlu in Turkish. Each question unit is answered and filled by the participant according to the 6-point Likert scale.[32]

**Procedure**

Clinical Pilates exercises were applied to both groups and both groups completed a 24-session exercise program for 8 weeks, 3 days a week. The average session duration was 60 minutes. Each session included 10 minutes of warm-up, 40 minutes of clinical Pilates exercises and 10 minutes of cool-down periods. Warm-up and cool-down exercises were chosen for the whole body by an experienced physiotherapist in line with the Pilates training received. Each exercise was done in 8-10 repetitions and one set. Since the Pilates exercises are performed in a flow, the time during the positioning of the body for the next exercise was used as the rest period.

Before starting Clinical Pilates exercises, individuals in both groups were taught 5 key elements of Pilates. These key elements are respiration, focus, rib cage placement, shoulder placement, head, and neck placement. Individuals are encouraged to use these 5 essential elements not only during exercise but also in daily routines.

While maintaining the neutral spine position; correct muscle activation, which means centering for deep abdominal muscles, pelvic floor muscles, and muscles surrounding the spine to work in harmony, was explained to the individuals. In addition, individuals were taught the Pilates resting position before starting the exercises. And the purpose of each exercise was explained to the participant and tried to make it functional in daily life. The

clinical Pilates training program is shown in Table 1. The home exercise group received a program consisting of 8 exercises based on these clinical Pilates exercises.

**Supervised Group:** Group-based clinical Pilates training was given by an experienced physiotherapist. During the clinical Pilates training, the exercises were repeated until the correct posture was achieved in different positions in line with the elements taught on the first day. For the correct application of the exercises, the physiotherapist asked the individuals to do the exercises after showing them on herself. Exercises were performed on the mat in the supine/side lying/prone and sitting positions, respectively. After four weeks, the exercise program was advanced by either moving to the difficulty level of exercise or increasing the number of repetitions, depending on the participant's tolerance.

**Home-Based Group:** After the evaluation, verbal information was given to the individuals in the control group. Home exercises based on clinical Pilates exercises were performed in one session with a physiotherapist in terms of smoothness of movements. Brochures of the program were given to use at home. The individual was asked to apply the program at home. Exercises were monitored by sending weekly reminder messages with a message group set up on social media and getting feedback on whether the exercises were applied for each participant. Participation of the women at home was provided by training, home exercise brochure, exercise follow-up form and social media follow-up.

**Statistical analysis**

As a result of the power analysis performed before starting the study, it was calculated that when 38 individuals (19 individuals in each group) were taken into the study, 80% power would be obtained with 95% confidence. Data analysis was done using SPSS (version 21.0) package program. Continuous variables were given as mean±standard deviation and categorical variables as numbers and percentages. Shapiro–Wilk test were used for testing normality. When the parametric test assumptions were provided, t test was used for comparing independent group differences. If parametric test assumptions were not provided, Mann-Whitney U test was used to compare independent group differences. For dependent group comparisons, when parametric test assumptions are provided Paired samples t test; If the parametric test assumptions were not provided, Wilcoxon signed rank test were used. Also, repeated measures Analysis of variance test was used for two-way comparison based on time and group. The level of significance in statistical test results was accepted as $p<0.05$ and interpreted.

## RESULTS

No participant left the study for any reason and the study was completed with 38 healthy volunteers. The flow chart of the study is shown in Figure 1. The two groups were compared according to the age, height, body weight, body mass index and years of education of the individuals and no difference was observed ($p<0.05$) (Table 2). There was no significant difference in BMI and WHR measurement results in terms of body composition after and before the program between groups ($p>0.05$).

While physical fitness parameters significantly improved in modified push-up, sit-up, sit to stand, anterior plank, lateral plank, Biering-Sorensen, and trunk flexors endurance tests in the supervised group; the home-based group were significantly improved in sit-up, anterior plank, and trunk flexors endurance tests after the program ($p<0.05$) (Table 3).

Psychosocial parameters significantly improved in Social Appearance Anxiety Scale and Rosenberg Self-Esteem Scale scores in the only supervised group after the program compared to the before. Exercise Beliefs Questionnaire/Benefit scores were significant in both the supervised and home-based groups after the treatment ($p<0.05$) (Table 3).

In the two-way comparison based on time and group, it was seen that the parameters of sit to stand, anterior plank, trunk flexors endurance tests and Exercise Beliefs Questionnaire/Benefit scores improved in both groups according to time ($p<0.05$) (Table 4).

Delta values were obtained by subtracting pre-program scores from post-program scores. When the delta values were compared between the groups, the results of sit and stand and anterior plank tests ($p<0.05$) (Table 5) and Exercise Beliefs Questionnaire/Benefit score ($p<0.05$) (Table 5) were significant in favor of the supervised group.

Table 1. Clinical Pilates training.

| Warm-Up / Cooling Exercises | 0-4 Weeks Exercises | 4-8 weeks exercises |
|---|---|---|
| Contralateral shoulder flexion / extension | One leg stretch (level 1) | One leg stretch (level 2) |
| Side bending | Scissors (level 1) | Scissors (level 2) |
| Fingertip rise / down | Shoulder bridge (level 1) | Shoulder bridge (level 2) |
| Mini squat | Hip twist (level 1) | Hip twist (level 1) |
| Rolldown | Arm opening (level 1) | Arm opening (level 1) |
| | Clam (level 1) | Clam (level 2) |
| | Swimming (level 1-2) | Swimming (level 3) |
| | One leg kick (level 1) | One leg kick (level 1) |

Table 2. Demographic data.

| | Supervised Group (n=19) | Home-Based Group (n=19) | |
|---|---|---|---|
| | X±SD | X±SD | p |
| Age (years) | 30.4±7.0 | 29.5±7.2 | 0.394 |
| Height (cm) | 161.0±0.1 | 161.0±0.1 | 0.972 |
| Body weight (kg) | 59.4±6.0 | 62.0±10.4 | 0.367 |
| Body mass index (kg/m$^2$) | 22.7±2.3 | 23.6±4.1 | 0.380 |
| Waist to hip ratio (WHR (cm/cm)) | 0.7±0.3 | 0.7±0.1 | 0.452 |
| Education duration (years) | 14.6±3.9 | 14.7±2.9 | 0.595 |

Table 3. Comparison of parameters before and after the program.

| | Supervised Group | | | Home-Based Group | | |
|---|---|---|---|---|---|---|
| | Pre | Post | | Pre | Post | |
| | X±SD | X±SD | p | X±SD | X±SD | p |
| Modified Push-Up Test | 12.9±5.4 | 14.8±5.9 | 0.004* | 18.9±6.3 | 20.4±7.1 | 0.050* |
| Sit Up Test | 8.8±3.8 | 10.1±4.6 | 0.012* | 10.4±6.5 | 11.7±7.2 | 0.006* |
| Sit to Stand Test | 16.7±4.8 | 18.9±4.6 | 0.001* | 19.5±6.7 | 20.2±8.3 | 0.221 |
| Anterior Plank Test(sec) | 24.7±8.8 | 30.7±9.5 | 0.001* | 22.1±8.9 | 23.0±8.9 | 0.023* |
| Lateral Plank Test (sec) | 13.7±4.4 | 15.3±4.9 | 0.008* | 15.4±6.9 | 17.2±6.7 | 0.069 |
| Biering-Sorensen Test (sec) | 24.3±7.9 | 31.0±11.5 | 0.031* | 21.2±13.5 | 22.0±13.7 | 0.126 |
| Trunk flexors endurance test (sec) | 12.0±6.2 | 17.0±6.9 | 0.017* | 8.5±6.8 | 9.9±7.3 | 0.024* |
| Timed up and Go Test (sec) | 8.6±3.1 | 8.2±2.8 | 0.061 | 8.4±1.6 | 8.0±1.7 | 0.058 |
| 6-min Walking Test (min) | 246.9±37.3 | 245.1±40.3 | 0.435 | 264.6±50.6 | 269.8±53.1 | 0.141 |
| Body mass index (kg / m$^{2)}$ | 21.6±5.3 | 22.7±2.6 | 0.388 | 23.7±4.2 | 23.6±3.9 | 0.460 |
| Waist to hip ratio (WHR (cm/cm) | 0.7±0.1 | 0.7±0.1 | 0.765 | 0.7±0.1 | 0.7±0.1 | 0.331 |
| Social Appearance Anxiety Scale (16-85) | 32.8±10.6 | 30.1±9.0 | 0.013* | 36.8±15.5 | 35.9±15.4 | 0.411 |
| Rosenberg Self-Esteem Scale (10-40) | 20.9±4.3 | 21.8±3.9 | 0.020* | 19.0±5.2 | 20.0±5.0 | 0.196 |
| Body Image Scale (40-200) | 132.5±25.4 | 142.2±17.4 | 0.135 | 151.1±33.3 | 150.2±31.0 | 0.840 |
| Exercise Beliefs Questionnaire/Benefit (13-78) | 56.4±9.7 | 60.9±9.8 | 0.001 | 63.2±12.9 | 65.4±12.1 | 0.013* |
| Exercise Beliefs Questionnaire/Disadvantage (12-72) | 31.4±7.8 | 26.7±4.4 | 0.003* | 29.9±12.5 | 28.7±14.3 | 0.123 |

*p<0.05.

Table 4. Comparison of the differences in the parameters of the time, time and groups.

| | Time | | Time x Group | |
|---|---|---|---|---|
| | F | p | F | p |
| Modified push-up Test | 13.660 | <0.001 | 0.169 | 0.684 |
| Sit Up Test | 17.388 | <0.001 | 0.000 | 1.000 |
| Sit to Stand Test | 19.438 | <0.001 | 4.86 | 0.034* |
| Anterior Plank Test(sec) | 36.600 | <0.001 | 21.277 | <0.001 |
| Lateral Plank Test (sec) | 9.647 | 0.004* | 0.059 | 0.810 |
| Biering-Sorensen Test (sec) | 5.245 | 0.028* | 2.363 | 0.133 |
| Trunk flexors endurance test (sec) | 15.770 | <0.001 | 5.222 | 0.028* |
| Timed up and Go Test (sec) | 5.667 | 0.023* | 0.005 | 0.942 |
| 6-min Walking Test (min) | 0.664 | 0.420 | 2.96 | 0.094 |
| Body mass index (kg/m$^{2)}$ | 0.870 | 0.357 | 1.305 | 0.261 |
| Waist to hip ratio (WHR (cm/cm) | 0.447 | 0.508 | 1.631 | 0.210 |
| Social Appearance Anxiety Scale (16-85) | 6.721 | 0.014* | 1.537 | 0.223 |
| Rosenberg Self-Esteem Scale (10-40) | 5.474 | 0.025* | 0.004 | 0.950 |
| Body Image Scale (40-200) | 1.278 | 0.266 | 1.893 | 0.177 |
| Exercise Beliefs Questionnaire/Benefit (13-78) | 38.814 | <0.001 | 4.586 | 0.039* |
| Exercise Beliefs Questionnaire/Disadvantage (12-72) | 10.324 | 0.003* | 3.761 | 0.060 |

*p<0.05.

Table 5. Comparison of the differences of pre and post parameters of the groups.

| | Supervised Group (n=19) ΔX±SD | Home-Based Group (n=19) ΔX±SD | p |
|---|---|---|---|
| Modified push-up Test | 1.84±2.43 | 1.47±3.06 | 0.383 |
| Sit Up Test | 1.31±2.05 | 1.31±1.82 | 0,893 |
| Sit to Stand Test | 2.21+1.43 | 0.73+2.53 | 0.036* |
| Anterior Plank Test(sec) | 6.04+4.73 | 0.811+1.42 | <0.001 |
| Lateral Plank Test (sec) | 1.51±2.31 | 1.76±3.98 | 0.457 |
| Biering-Sorensen Test (sec) | 3.72±8.24 | .73±2.03 | 0.188 |
| Trunk flexors endurance test (sec) | 4.98+6.52 | 1.34+2.36 | 0.430 |
| Timed up and Go Test (sec) | -0.43±1.26 | -0.40± 0.87 | 0.942 |
| 6-min Walking Test (min) | -1.84±10.05 | 5.15±14.61 | 0.348 |
| Body mass index (kg/m$^{2)}$ | 1.04±4.33 | -0.10± 0.60 | 0.297 |
| Waist to hip ratio (WHR (cm/cm) | 0.00± 0.3 | -0,00± 0.1 | 0.461 |
| Social Appearance Anxiety Scale (16-85) | -2.68±4.24 | -0.94±4.39 | 0.223 |
| Rosenberg Self-Esteem Scale (10-40) | 0.94±1.61 | 1.00±3.24 | 0.612 |
| Body Image Scale (40-200) | 9.68±26.94 | -0.94±20.21 | 0.849 |
| Exercise Beliefs Questionnaire/Benefit (13-78) | 4.52+3.15 | 2.21+3.50 | 0.013* |
| Exercise Beliefs Questionnaire/Disadvantage (12-72) | -4.68±6.56 | -1.15±4.43 | 0.118 |

*p<0.05.

## DISCUSSION

Our study was planned to examine and compare the effects of clinical Pilates exercises on physical fitness, psychosocial status, and exercise beliefs in healthy women when they performed individually at home-based and in groups under the supervision of a physiotherapist. Our results improved many of the physical fitness measures of both supervised and home-based Pilates exercises, while the supervised group improved more on these parameters. Psychosocial status improvement was achieved in the supervised group. While there was a positive improvement in both groups in terms of exercise beliefs, more improvement was obtained in the supervised group.

We could not obtain any change in body composition with clinical Pilates exercises. This result is consistent with the results of recent researches.[5,10] Katayıfçı et al. 2014 applied Pilates exercises to 35 healthy individuals for 8 weeks and did not achieve any significant improvement in BMI.[5] Tolnai et al 2016 found that Pilates training did not cause a significant decrease in body weight and body fat in their study with young sedentary women.[10] Parallel to the literature but contrary to our hypothesis, there was no difference between the groups. We believe that diet and aerobic exercises should be added to the program to achieve sufficient changes in body composition. We predict that these additional programs will facilitate body weight and body fat reduction and will reflect on the results of BMI and waist to hip ratio.

Clinical Pilates exercises were performed in both supervised and home-based groups. Improvements were achieved in most of the physical fitness-related performance tests (for example; push-up, sit-up, sit to stand, anterior and lateral plank, flexor and extensor trunk endurance tests); so it is consistent with previous research showing the benefits of Pilates exercise on these measures.[5,7,10,16,33-37] Katayıfçı et al. 2014 was reported that the improvement in trunk, upper and lower extremity muscle strength, endurance tests with Pilates exercises in the healthy individuals.[5] Rogers and Gibson 2009 also reported that after 8 weeks of mat Pilates training, a statistically significant increase in trunk muscle endurance was achieved.[9] Kloubec 2010 seen that Pilates exercises improved the endurance of the abdominal and upper extremity muscles and improved hamstring flexibility and reported that individuals can improve muscular endurance and flexibility by using relatively low-intensity Pilates exercises that do not require equipment or a high degree of skill and are easy to participate in a personal program.[16]

However, the supervised group was performed better in both lower extremity strength evaluated by sit to stand test and endurance results evaluated by anterior plank test. When clinical Pilates was performed under supervision, constant verbal warnings were given to ensure that all parameters for the application (for example, pelvic control, breathing...) were done properly. Individuals did their exercises by keeping themselves in proper posture all the time. In this way, we think that the muscle groups called “core” muscles or “powerhouse” that regulate body alignment, load distribution, stabilization of the body and provide mobility in the sagittal plane are activated, resulting in an improvement in muscular performance. These results supported our hypothesis in terms of physical fitness, and we can say that we may gain extra benefit by performing the exercise under supervision.

One of the effects of Pilates exercises is to improve cardiovascular fitness.[38] Eyigor, et al. reported that the functional capacity using the 6-minute walk test can be increased by showing the increase in walking distance with Pilates exercises in women with breast cancer.[39] As a result of our study, contrary to our hypothesis, it was observed that 6 min walking distance did not increase significantly in terms of cardiovascular fitness in both groups. We think that the reason for this situation may be the healthy individuals included in our study and it may also be since clinical Pilates exercise does not include aerobic character.

In a meta-analysis of the mental health impact of Pilates, few controlled studies with a small sample and variable quality supported improved mental health outcomes. However, it has been reported that more studies are needed in this field to a better understanding of the clinical effect.[40] In this study, it was observed that the psychological state improved with the clinical Pilates exercises performed under supervision. In reaching this result, the improvement in Social Appearance Anxiety

Scale and Rosenberg Self-Esteem scale of this group after treatment has guided us. The fact that the supervised group did the exercises on a group basis and that the exercises were done properly, effectively and with more motivation may have improved psychological well-being. Therefore, the supervised group showed better psychological status results supported our hypothesis. In line with these findings; on the effect of clinical Pilates exercises on psychosocial status, the effect of Pilates mat exercises on life satisfaction, physical self-confidence and health level was investigated in women in a study conducted in Portugal, and as a result of the 6-month program, life satisfaction in the clinical Pilates group and the perception of acceptance by other people, it has been reported that it has a positive effect on physical appearance perception and functionality perception.[41] On the other hand, there are also current studies that reveal the change in body awareness with Pilates exercises and psychological progress.[10,15] In fact, Tolnai et al. reported that statistically significant interactions occurred, two in psychological measures (body awareness and negative affect) with Pilates training.[10] These researchers reported that exercise is a positive indicator for those who have an excuse for lack of time.

When examining the effects of clinical Pilates exercises and verbal training on exercise beliefs and psychosocial factors in healthy women, they showed that verbal training given with clinical Pilates was effective in changing psychosocial parameters.[32] Chan and Au in which exercise beliefs were questioned in relation to the duration of the exercise, it was found that the perspective of the exercise changed positively as the exercise time increased.[42] In parallel with this result in our study, when compared with the pre-program, the belief score for the exercise benefits showed a statistically significant difference in both the supervised and home-based groups. This shows that a regular exercise program, both performed in a group in the presence of an expert or applied individually at home, strengthens the individual's belief in the benefits of exercise. Moreover, according to the delta values, exercise belief was superior in the supervised group. This again supported our hypothesis. The physical and psychological well-being of individuals with clinical Pilates exercise may be one of the important factors in the positive change in their beliefs about exercise, and individuals' awareness on this issue may have increased. Our results are a valuable result in terms of increasing awareness of exercise in the society by including individuals in appropriate exercise programs by experts.

**Limitations**

Although our study is a strength study comparing the effectiveness of clinical Pilates exercises both supervised and home-based practice. The lack of a technological evaluation was our limitation. Another limitation is that we used a questionnaire developed only for individuals living in Turkey as an exercise beliefs questionnaire. Another is that the study was conducted only in healthy people and women, preventing the generalizability of the results and no gender difference was revealed.

**Conclusion**

According to the results, both clinical Pilates exercises performed in groups under the supervision of a physiotherapist, and the home-based program have statistically significant improvement on many physical fitness parameters. However, it was observed that clinical Pilates exercises performed under supervision made a difference in both lower extremity strength evaluated by sit to stand test and endurance results evaluated by anterior plank test. Making the group more motivated can contribute positively to the development of endurance as well as strength increase. In addition to motivation, clinical Pilates training, which is conducted as a group, under the management of a physiotherapist and with the guidance based on clinical Pilates is effective in creating this difference. On the other hand, social appearance anxiety and self-esteem showed a significant improvement in the supervised group compared to the pre-program and no statistically significant improvement was observed in psychosocial parameters in the home-based group. This result again showed us that group exercise had more psychological effects. When compared with the home-based group, the group clinical Pilates exercises performed under the supervision of a physiotherapist were found to have a significant effect on exercise beliefs. For these reasons, clinical Pilates exercises can be performed in healthy women at home or under the supervision of a physiotherapist, depending on

the preference of the person. However, due to its higher effectiveness, we think and recommend that it is more appropriate to be performed in groups under the supervision of a physiotherapist.

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