Araştırma Makalesi
Research Article

Adnan Menderes Üniversitesi Sağlık Bilimleri Fakültesi Dergisi 2023: 7(3); 530-540
Journal of Adnan Menderes University Health Sciences Faculty
doi: 10.46237/amusbfd.1253720

Pilates Egzersizlerinin Gebelikte Postüral Stabilite ve Doğum Korkusu Üzerine Etkisinin Araştırılması

Investigation of the Effect of Pilates Exercises on Postural Stability and Fear of Birth in Pregnancy

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ÖZ

Amaç: Gebelik döneminde kadın vücudunda fizyolojik ve psikolojik değişiklikler gözlenmektedir. Bu değişiklikler kadınlarda gebelik sürecini etkileyebilecek bazı değişikliklere yol açabilmektedir. Çalışmamız pilates eğitiminin gebelerde core stabilite, denge ve doğum korkusu düzeylerini nasıl etkilediğini anlamayı amaçlamaktadır.

Yöntem: Randomize kontrollü çalışmamıza, gebeliğin ilk 12 haftasını tamamlamış 31'i pilates, 27'si kontrol grubu olmak üzere 18-35 yaş arası elli sekiz gönüllü gebe dahil edildi. Pilates grubuna sekiz hafta boyunca haftada iki gün, günde bir saat fizyoterapist tarafından pilates egzersizleri verildi. Kontrol grubuna ise 8 haftalık solunum egzersizlerinden oluşan ev programı verildi. Kor stabilite, denge ve doğum korkusu sekiz haftalık eğitimden önce ve sonra değerlendirildi.

Bulgular: Pilates grubunda Sahrman Core stabilite testi puanlarında istatistiksel olarak anlamlı iyileşme ($p<0.05$), kontrol grubu sonuçlarında ise azalma gözlendi ($p<0.05$). Pilates grubunda postural stabilite korunmuş hatta sağ ayak testinde iyileşme sağlanmıştır ($p<0.05$). Kontrol grubunda herhangi bir değişiklik gözlenmedi ($p>0.05$). Wijma doğum beklentisi/deneyimi ölçeği A versiyonu ölçüm sonuçları karşılaştırıldığında, etki büyüklüğü büyük ($F=27.693$; $p<0.001$, $\eta p2=0.374$) ile pilates grubu lehine istatistiksel olarak anlamlı fark bulunmuştur.

Sonuç: Sonuçlar, gebelikte uygulanan pilates egzersizlerinin kadınların core stabilite ile denge düzeylerini iyileştirebileceğini ve doğum korkularını azaltabileceğini göstermiştir.

Anahtar Kelimeler: Pilates eğitimi, Postural denge, Doğum.

ABSTRACT

Objective: Physiological and psychological changes are observed in the female body during pregnancy. These changes can lead to some changes that can affect the pregnancy process in women. Our study aims to understand how pilates training affects core stability, balance, and fear of childbirth levels in pregnant women.

Method: In our randomized controlled study, fifty-eight volunteer pregnant women aged 18-35 years, who completed the first 12 weeks of pregnancy, 31 in the Pilates and 27 in the control group, were included. The Pilates group was given pilates exercises for eight weeks, two days a week, 1 hour a day, by a physiotherapist. An 8-week home program consisting of breathing exercises was given to the control group. Core stability, balance, and fear of birth were assessed before and after eight weeks of training.

Results: Statistically significant improvements were observed in the Sahrman Core stability test scores in the Pilates group ($p<0.05$), while a decrease was observed in the control group results ($p < 0.05$). Postural stability was preserved in the Pilates group even improved in the right foot test ($p<0.05$). No change was observed in the control group ($p > 0.05$). When the The

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Geliş Tarihi: 20.02.2023 – Kabul Tarihi: 24.07.2023
* Gazi Üniversitesi Sağlık Bilimleri Enstitüsü, 2019/ Doktora Tezi. Gebelikte Pilates Eğitiminin Etkilerinin İncelenmesi
Yazar Katkıları: A) Fikir/Kavram, B) Tasarım, C) Veri Toplama ve/veya İşleme, D) Analiz ve/veya Yorum, E) Literatür Taraması, F) Makale Yazımı, G) Eleştirel İnceleme

Wijma Delivery Expectancy/Experience Questionnaire A measurement results were compared, a statistically significant difference was found in favor of the pilates group with a large effect size ($F=27.693$; $p<0.001$, $\eta p2=0.374$).
Conclusion: The results showed that pilates exercises applied during pregnancy could improve women's core stability and balance levels and reduce their fear of childbirth.

Key words: Pilates training, Postural balance, Birth.

1. INTRODUCTION

Pregnancy affects all body systems; it is a physiological stress situation that requires women's physical, mental, and social harmony (1). In this process, an adaptation to pregnancy occurs in the female metabolism and systems (2). This adaptation continues as a process in which physiological and psychological processes and fluctuations are seen. The adaptation process of the mother can be facilitated by interventions that can be made in this process (3). Exercise, one of these interventions, has been shown to affect the fetus, mother, and pregnancy process positively (4).

As a result of the physiological processes experienced by the mother during pregnancy, changes in her posture are observed. These postural changes may affect the musculoskeletal system structure of the mother and may change the postural balance. Muscle imbalances come at the beginning of the physical changes and may result in increased stability problems that may be a problem in the pregnancy process of women. That may cause some problems in the mother during and after pregnancy (5). Balance changes can affect pregnant women psychologically as well as physically (6). A balanced posture increases the woman's self-confidence, makes her feel more robust, and will play a vital role in managing the psychological changes that may occur in this process (7). During pregnancy, women always have the process of labor in mind. This can sometimes cause women to be afraid of the moment of birth (8). Fear can create a vicious circle by harming the posture. The fact that women feel stronger and more confident in themselves plays an essential role in reducing these fears (9).

Published guidelines state that mothers should do moderate-intensity exercise for at least half an hour most days of the week during pregnancy. Exercises such as pilates, yoga, and swimming are recommended as safe exercises that can be done in these guidelines (10). Pilates exercise method, which is an exercise system that develops lumbopelvic stability, strengthens the endurance of core muscles, and improves posture and balance with breath coordination harmony, is an exercise system that is widely used in pregnant women. (11). The Pilates method makes the woman feel more comfortable and active in this temporary body (12). When the literature is examined, it is seen that although there are studies on the effects of pilates in pregnancy, it is still insufficient (13-16). All these studies examining the effects of pilates training in pregnant women show us that pilates training can provide positive contributions to pregnant women. However, it is stated in all studies that the effects of pilates on different aspects of pregnancy should be examined, and studies with solid evidence value are needed. In addition, although it is a core stability-based exercise method, the effects of Pilates on core stability and balance during pregnancy have not been investigated. Therefore, in our study, we planned a randomized, controlled, blind study to investigate the effects of Pilates training on core stability, balance, and fear of childbirth in pregnant women to ensure a healthier and more comfortable pregnancy period.

2. METHOD

Study Design

Our study was planned as randomized, controlled, evaluator-blind. Fifty-eight pregnant women who completed the first trimester of pregnancy were included in the study. Computer drawing randomly assigned participants to the Pilates group (PG; n=31) or the control group (CG; n=27). Before starting the study, the participants were informed, and the consent form was filled out. The group to which the participants belonged was not disclosed until the end of the initial assessment, after which the participants were randomly assigned to their groups. During the final assessment, the participants were asked not to inform the evaluator which training they had attended. Pilates exercise training was completed under the supervision of an experienced, certified physiotherapist. In the post hoc power analysis conducted for the study, which was completed with 58 participants, the effect size calculated by considering the core stability values was 1.218. We found the power of the study to be 0.81 when 31 people were included in PG and 27 people in CG. Ethics committee approval was obtained from Gazi University Non-Interventional Clinical Research Ethics Committee before starting the study (Date: 27/03/2017 Decision No: 86). Our study was conducted in accordance with the CONSORT 2010 guidelines and regulations (Clinical Trials.gov No NCT05720403, registration date 09/02/2023) and the Declaration of Helsinki.

Participants

The criteria for inclusion in the study, carried out at Gazi University Faculty of Health Sciences Department of Physical Therapy and Rehabilitation, were between the ages of 18-35, having completed the first twelve-week period, having a Body Mass Index score of 30 and below, under the guidance of a specialist obstetrician. Exclusion criteria are multiple pregnancies; a history of cardiovascular disease; medical complications (bleeding, preeclampsia, placenta previa) or cognitive impairments; contraindications for physical exercise (e.g., severe musculoskeletal diseases, high-risk pregnancies, balance deficits), and participation in different activity programs.

Intervention

Pilates training was planned for eight weeks, two days a week for one hour. The one-hour training included 15 minutes of warm-up and 15 minutes of cool-down and stretching exercises. During the training, the exercise program recommended by the Australian Pilates and Physiotherapy Institute during pregnancy was used (16). The pilates exercise program is given in Table 1. During the Pilates exercises, the exercises were explained using different imagery techniques. The intensity of the exercises was increased by using elastic bands (Theraband Elastic Band Hygienic Corporation, Akron, Ohio). Exercises were performed by sitting on the exercise ball, especially during the exercises in which the upper body was performed. The pregnant women were carefully observed during the training, and their mistakes were corrected. They were also told to stop exercising if they experienced side effects such as breathing problems and fatigue. No side effects were observed in any of our participants during our study. Breathing exercises were given to the pregnant women in the control group as part of the eight-

week home program. After the first evaluation, a 50-minute program consisting of diaphragmatic breathing and respiratory control was given. The first applications were made under the instructor's supervision, and in the fourth week, they were called by phone to check whether they had completed the program. The flow of participants is shown in Figure 1 in accordance with the CONSORT 2010 guidelines.

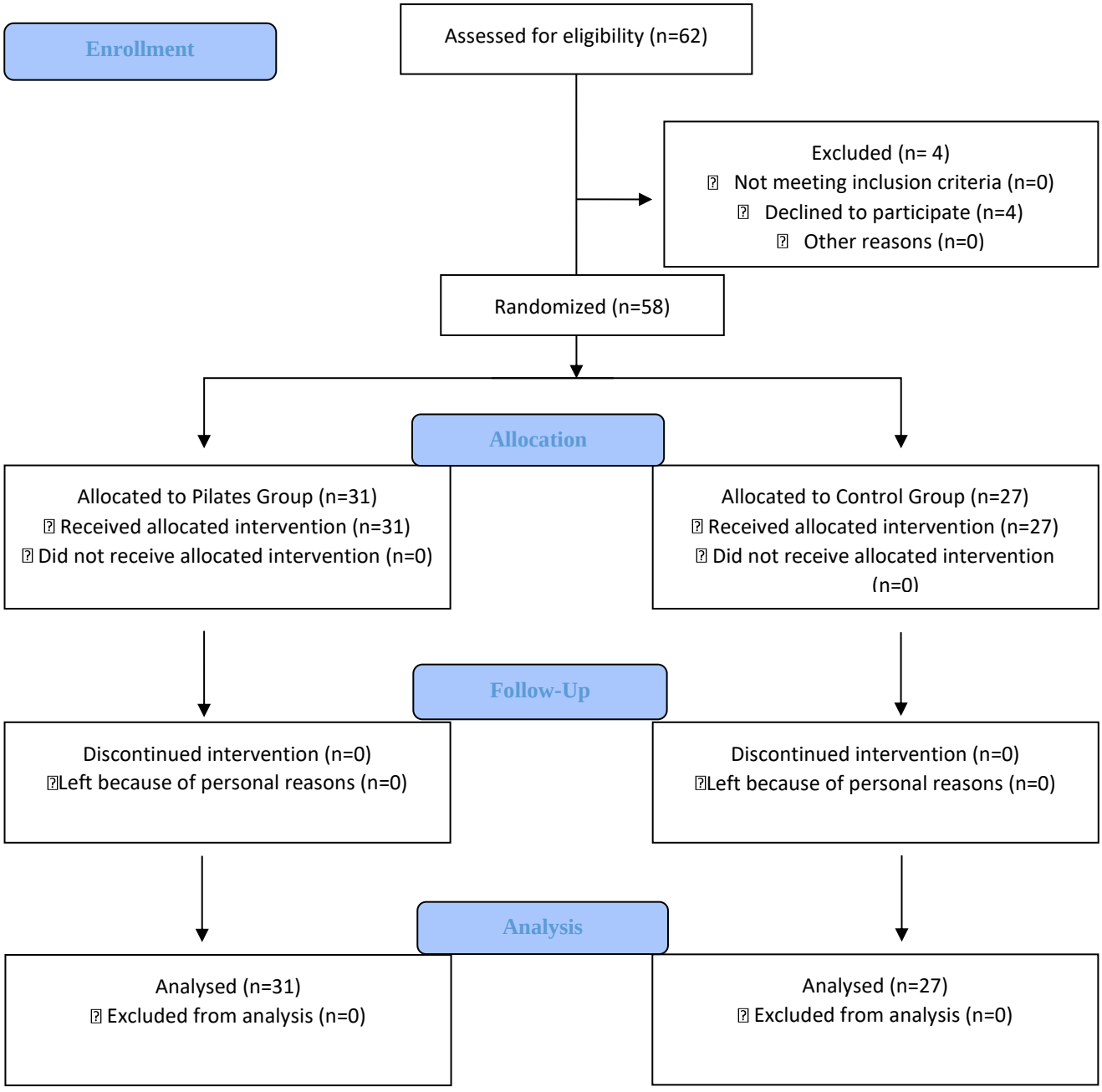

Figure 1. Flow diagram showing patient randomization and allocation processes.

Table 1. Pilates exercises program

Movements	0-4 weeks	4-8 weeks
1. Thread The Needle 2. Breast Stroke Preparation 3. Bend & Stretch With Theraband 4. Lift & Lower With Theraband 5. Clam Variations 6. Lower & Lift From The Ball 7. Side Leg Circles With Theraband 8. Roll Up With Band 9. Scapula Isolations 10. Chest Stretch 11. Arm Scissors 12. Wind Mills 13. Chicken Wings 14. Pillow Squeeze	2 set 6-8 repetition	2 set 8 -12 repetition

Outcome Measurements

Participants were assessed twice, before and after the program. Participants' demographic information (age, body weight, and height) was obtained.

Core stability was evaluated by the Sahrmann core stability test (17). The Sahrman Core Stability Test, developed by Sahrmann to assess core stability, is widely used and consists of 5 levels. Core stability must be maintained by activating M. Transversus abdominis at each level. Level 1 was applied to pregnant women because it was thought that the application of all Sahrmann core stability test levels might that pregnancy was a factor affecting the reliability of the test. The pregnant woman was laid on her back and knees flexed for the test. The biofeedback device (Stabilizer™, Chattanooga Group Inc., Chattanooga, TN) was placed in the lumbar region. Then the pressure biofeedback was inflated to 40 mmHg. In this position, the abdominal draw-in maneuver provided remote activation of M. transversus abdominis was taught. The pregnant woman slowly brought her leg to 90 degrees of hip and knee flexion. Then she tried to bring the other leg to the same position. The pressure change in the device was recorded during the test.

The Biodex-BioSway ™ (Biodex Medical Systems, Shirley, NY, USA) Portable Balance System evaluates balance with three tests: postural stability test, stability limit test, and modified sensory organization test, was used in our study (18). In our study, a postural stability test was used. The postural stability test evaluates the individual's ability to hold the center of gravity on the support surface during standing. In our study, total stability index scores of the right, left, and double legs were used for statistical analysis.

Fear of Birth symptoms was assessed with the Wijma Birth expectation/Experience Questionnaire Version A (W-DEQ-A) (19). The W-DEQ was developed to measure fear of childbirth before (version A) and after (version B). The 33-item scale is numbered from 0 to 5 and is a six-point Likert-type scale. 0 is expressed as "extremely frightful" and five as "not at all frightful". As the scores increase, the fear of childbirth experienced by women increases. In our study, the Turkish version of W-DEQ-A was used (20). The Cronbach's alpha value of the validity and reliability study of Korukcu was 0.89, while that of this study was 0.861.

Statistical Analysis

SPSS 21.0 (SPSS Inc., Chicago, IL, USA) for Windows software program was used in all statistical analyses. Whether measurements from the pilates and control groups display normal distribution was tested with the Shapiro-Wilk test. Normally distributed numerical variables are shown as mean ± standard deviation, and non-normally distributed variables are shown as the median and interquartile range (IQR). The Mann-Whitney u test and Independent Samples T-test were used for demographic characteristics. The Repeated Measure ANOVA test was used to compare the data of the study and control groups that changed over time, and the Wilcoxon signed-rank test was used for in-group comparisons. The statistical significance level was set at $p<0.05$ in all tests.

3. RESULTS

The study was completed with 58 patients. Demographic characteristics of pregnant women can be seen in Table 2.

Table 2. Pregnants demographic characteristics

	PG (n=31)	**CG (n=27)**	**p**
Age (years) Median (IQR)	30 (28-31)	28 (27-30)	**0.005** [b]*
Height (cm) X ± SD	167.55 ± 5.12	164.89 ± 5.9	0.482[a]
Weight (kg) X ± SD	65.23 ± 10.51	62.3 ± 7.35	0.265 [a]

a: Independent sample t test, b: Mann-Whitney u test, X: mean, SD: Standart deviation, cm: centimeters, kg: kilograms, PG: Pilates group, CG: Control group, n: sample size, *p < 0.05 significant difference.

When the results of the Sahrman Core stability test before and after pilates were compared; While a statistically significant improvement was observed in both single and double leg tests in the Pilates group ($p<0.05$, Table 3), a decrease in the results of the control group was observed ($p<0.05$, Table 3).

When the results before and after the postural stability test in the Pilates group were compared, it was observed that the postural control was preserved in both feet and the left foot, improved in the right foot test, and decreased postural sway ($p<0.05$, Table 3). At the same time, a significant negative increase was observed in all results of the control group ($p<0.05$, Table 3).

In table 4, a statistically significant difference was found with a large effect size in favor of the pilates group when the changes in the before and after W-DEQ-A measurement results of the study and control groups were compared ($F=27.693$; $p<0.001$, $\eta p2=0.374$).

Table 3. A comparison of previous and subsequent measurement of core stability and postural stability for groups.

		PG Median (IQR) (n=31)			CG Median (IQR) (n=27)		
		Before	**After**	**p[1]**	**Before**	**After**	**p[1]**
Sahrman Core Stability Test							
Single leg (mmHg)	Right	7 (6-8)	5 (4-6)	**0.001***	6 (5-6)	8 (6-8)	**0.001***
	Left	7 (6-9)	6 (5-7)	**0.001***	6 (6-8)	8 (7-9)	**0.001***
Double leg (mmHg)		12 (10-14)	10 (8-12)	**0.001***	10 (8-12)	14 (11-14)	**0.001***
Postural Stability							
Double Leg (score)		0.3 (0.2-0.4)	0.3 (0.2-0.3)	0.146	0.3 (0.2-0.3)	0.5 (0.4-0.6)	**0.001***
Right Leg (score)		0.6 (0.4-0.7)	0.5 (0.4-0.6)	**0.034***	0.4 (0.3-0.5)	0.6 (0.6-0.7)	**0.001***
Left Leg (score)		0.5 (0.4-0.6)	0.5 (0.4-0.6)	0.069	0.4 (0.3-0.5)	0.7 (0.6-0.8)	**0.001***

*p < 0.05 significant difference, [1]: Wilcoxon signed-rank test, mmHg: millimeter mercury, PG: Pilates group, CG: Control group, n: sample size

Table 4. Comparison of the change over time in the fear of childbirth data of the study and control groups

	Group	**Pre-test (X ±SD)**	**Post-test (X ±SD)**	**p[2]**	**ηp2**
W-DEQ-A (0-165)	**PG (n=31)**	56.41 ± 21.98	51.87 ± 18.27	**0.001***	0.374
	CG (n=27)	52.89 ± 14.53	57.96 ± 12.5		

*p < 0.05, [2:] Repeated Measures Anova Test, ηp2: partial eta squared, X: mean, SD: Standart deviation, n: sample size, PG: Pilates group, CG: Control group, W-DEQ-A: Wijma Birth expectation/Experience Questionnaire Version A

4. DISCUSSION

This study has shown that pilates exercises applied to pregnant women can improve postural stability and balance and reduce the fear of childbirth.

Although no study shows the effect of Pilates exercises applied during pregnancy on postural stabilization, studies have shown that various practices are effective in protecting and improving the postural stability of pregnant women (21,22). A study of 90 pregnant women noted that the maternity support belt could stabilize the pelvis and improve the postural stability and balance of pregnant women (21). However, the size of this effect needed to be increased. They also stated that stabilization and balance-enhancing interventions are necessary for their studies. In another study, the effects of lumbar stabilization and stretching exercises on postural stability and balance were examined, and it was seen that both exercise types were effective (22). As it can be understood from the studies, improving the stability of the pelvis and lumbar region will also affect postural stability and balance. Biomechanical changes occur in the musculoskeletal system due to the adaptation processes in pregnant women. These changes can reduce the stability of the core muscles. Considering the relationship between core and postural stability (23), this situation may also affect postural stability. When the literature is examined, no study has been found examining the effect of pilates, a core-based training, on core stability

in pregnant women. However, studies show that pilates improves the strength and endurance of core muscles in healthy individuals (24,25). In light of these studies, the improvements we have achieved in the pilates group stem from the exercises aimed at strengthening the core area of pilates. The improvement of core stability in the Pilates training group after eight weeks of training and the lack of improvement in the control group support this hypothesis.

One of the most striking results of our study is that the balance can be achieved in individuals who receive Pilates training despite the pregnancy period, and the balance is gradually deteriorating in the control group. When the literature is examined, it is seen that studies are showing that balance and postural control decrease with pregnancy (26-28). Cakmak et al. found that postural control and balance decreased in pregnant women due to physical changes such as increased weight, increased lumbar lordosis, forward displacement of the center of gravity, increase in the hormone relaxin, and looseness in the joints (26). Nagai et al. reported that anteroposterior oscillations increase as pregnancy progresses (27). In another study, a decrease in the balance of pregnant women was reported as the weeks progressed (28). When we compared our study with the studies above, it was seen that the balance decreased in the control group, similar to the progression of pregnancy. A study has stated that loss of balance is a leading cause of injuries during pregnancy. Women try to prevent balance losses by doing exercises such as pilates and yoga (29). In our study, with pilates training, it was found that the balance in the pregnant women could be maintained for eight weeks, and even the balance in the right foot improved. Considering the role of the core muscles on postural control and balance (24), we think that the result obtained in our study results from the increase in the strength and endurance of the core muscles with pilates. In addition, Pilates training is an exercise method that improves body smoothness and increases body awareness. This means the preservation of biomechanics, which is one of the most critical factors in maintaining balance. This effect of pilates is related to the balance in our Pilates group. Based on these results, we believe that pilates is the correct exercise intervention to maintain balance, strength-endurance, and body smoothness of the core muscles in pregnant women.

Our study observed that the fear of childbirth of pregnant women in the Pilates group decreased during the process.

Sarpkaya Güder, as a result of their study on the fear of childbirth with 108 pregnant women, stated that Pilates training reduced the fear of childbirth (30). The result of the study is similar to the results of our study. It is known from previous studies that regular exercise is effective in stress management, reduces depression, and improves personal self-esteem and body image (31). In our study, we observed that thanks to Pilates methods principles, pregnant women's self-perception improved; thus, their self-confidence increased, and they had a better body image. We think that these effects of pilates affect the birth fear levels of pregnant women. In addition, pilates training minimizes musculoskeletal problems, especially during pregnancy. This may have contributed to improving emotions by enabling pregnant women to have a more comfortable pregnancy in our study. The gradual worsening of the fear levels of the pregnant women in the control group allows us to see more clearly the benefits of exercise on psychological factors.

The strength of our study is that it was a randomized, controlled, evaluator-blind study, and an experienced physiotherapist gave Pilates training. Pregnancy involves the lives of two living things. All applications should be performed by a trained and experienced professional

who will protect the health of the mother and the baby. With this study, we want to draw attention to this issue. The limitation of our study is that Pilates training is not continued until the end of pregnancy, and postnatal effects have not been studied. Therefore, the effects of the pregnancy process could not be given.

5. CONCLUSION

In conclusion, we think that our study will guide the literature and pilates training under the guidance of a physiotherapist is an exercise method that can be used to reduce the problems that occur during pregnancy, to make the pregnancy more enjoyable, and to keep the mother's quality of life at the highest level.

Ethical Considerations

Ethics committee approval was obtained from the Gazi University Non-Interventional Clinical Research Ethics Committee. It was conducted in accordance with the principles of the Declaration of Helsinki. The informed consent of the participants were also obtained.

Conflict of interest statement

The authors declare that there is no conflict of interest for this research.

Funding

This work was not financially supported by any person or organization.

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