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The effect of Pilates performed during pregnancy on delivery outcomes

Pilatesin gebelikte doğum sonuçları üzerine etkisi

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ABSTRACT

Aim: The aim of this study was to investigate the effect of clinical pilates on delivery outcomes in pregnant women.

Material and Method: Eighty-three pregnant women were included in the study. The study comprised pregnant women who voluntarily agreed to perform Pilates (n: 26, age: 28.77±4.43 years) and a control group (n: 57, age: 28.18±4.69 years) that did not perform pilates. Pilates training was provided by a physiotherapist two days a week (1 h/session). Height, weight, weight gained during pregnancy, hemoglobin level, education level, duration of labor, type of delivery, birth week, induction requirement and duration, birth weight of infants, and APGAR (appearance, pulse, grimace response, activity, respiration) scores were retrospectively recorded from the patient files.

Results: It was found that Pilates did not have a negative effect on gestational age, birth week, birth weight of infants and APGAR scores. Pregnant women who performed pilates gained less weight during pregnancy compared with those in the control group ($p<0.05$).

Conclusion: This study supports the conclusion that pilates performed by pregnant women has a positive effect on delivery outcomes.

Keywords: Pregnancy, delivery, pilates

ÖZ

Amaç: Bu çalışmanın amacı, gebelerde klinik pilatesin doğum sonuçları üzerine etkisini araştırmaktır.

Gereç ve Yöntem: Çalışmaya seksen üç gebe dahil edildi. Çalışma grupları, pilates yapmayı gönüllü olarak kabul eden (n: 26, yaş: 28,77±4,43 yıl) çalışma grubu ve pilates yapmayan (n: 57, yaş: 28,18±4,69 yıl) kontrol grubundan oluşturuldu. Pilates eğitimi haftada iki gün fizyoterapist tarafından sağlandı (1 saat/seans). Retrospektif olarak boy, kilo, gebelikte kazanılan kilo, hemoglobin düzeyi, eğitim düzeyi, doğum süresi, doğum şekli, doğum haftası, indüksiyon gereksinimi ve süresi, bebeklerin doğum ağırlığı ve APGAR (görünüm, nabız, grimace yanıtı, aktivite, solunum) puanları hasta dosyalarından kaydedildi.

Bulgular: Pilates'in gebelik yaşı, doğum haftası, bebeklerin doğum ağırlığı ve APGAR skorları üzerinde olumsuz bir etkisi olmadığı bulundu. Pilates yapan gebeler hamilelikte kontrol grubuna göre daha az kilo aldı ($p<0.05$).

Sonuç: Bu çalışma, hamile kadınlar tarafından yapılan pilatesin doğum sonuçları üzerinde olumlu bir etkisi olduğu sonucunu desteklemektedir.

Anahtar Kelimeler: Gebelik, doğum, pilates

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INTRODUCTION

Although exercise during pregnancy is recommended by authorities, there are limited studies on this topic in the literature. A woman's body will experience many changes during pregnancy. These changes include changes in posture, weight gain and weakness of joints and ligaments (1). Exercise has been associated with better outcomes in mothers and their children in addition to protection against the development of chronic disease. According to the American College of Obstetricians and Gynecologists (ACOG), despite the physiologic and anatomic changes in the maternal body, physical exercise should be encouraged during pregnancy (2). Among exercise programs, the Pilates method has become more popular worldwide (3). This method was developed by Joseph Pilates in the early 1900s (4). In 2002, it was modified by Australian physiotherapists under the name of modified (clinical) Pilates and made clinically compliant. Clinical Pilates is a method used by physiotherapists (4). In Pilates, the body is defined as a system originating from a central column. This column consists of muscles that most fundamentally represent the body. Initially, these muscles are trained. Clinical Pilates develops body awareness. Because of the principles forming its philosophy, Pilates strengthens mind–body coalescence by offering a holistic approach.

Exercises are slowly ended under the control of the patient and not under the effect of gravity. This reduces the risk of injuries. The most important reason why clinical Pilates has gained popularity in recent years is its mind–body coalescence feature. With the effect of behavior training, Pilates enables women's lives to be balanced physically, physiologically and emotionally (5). Pilates is a technique that emphasizes spinal stabilization, pelvic floor control, breathing and posture. The effects of Pilates on pelvic floor muscle strength have been investigated. It has been concluded that these exercises can be used to treat pelvic floor dysfunction (6). Most pregnant women have difficulty in breathing, particularly during the second and third trimesters. Pilates increases lung capacity and reduces the feeling of shortness of breath. One of the most important issues during pregnancy is balance. There are many studies reporting that the ability to balance is decreased during pregnancy. A woman gains weight equal to 25%–30% of her total body weight during pregnancy, and therefore, her center of gravity changes. This change is caused by two conditions: changing hormonal balance and its effect on the mental state. Testosterone is important for balance, spatial perception and hand-eye coordination. When Pilates is performed, testosterone levels increase and balance improves (5).

Performing Pilates regularly during pregnancy creates body awareness, improves posture, protects the body against musculoskeletal problems caused by posture disorder, helps the body be more flexible, improves coordination along with balance, enables less weight gain, reduces the risk of premature birth and strengthens the immune system (5).

Based on this information, the aim of this study was to investigate the effects of clinical Pilates on delivery and maternal fetal outcomes.

MATERIAL AND METHOD

The study was retrospectively performed in a tertiary referral center. The study was approved by the local Institutional Review Boards (01/06/2012, acception no.8) and written informed consent of all participants were obtained. This study was conducted according to the Declaration of Helsinki. A total of 83 patients (n: 26 Pilates group and n: 57 control group) were included in this study. The Pilates group comprised 26 patients who volunteered to perform Pilates under the supervision of a physiotherapist starting from gestational weeks 16–18 until gestational weeks 34–36. The control group comprised pregnant women who were admitted for delivery during the same period, but were not included in the Pilates exercise program. Patients with systemic diseases, such as hypertension and goiter, and maternal complications, such as preeclampsia, gestational diabetes, membrane rupture, multiple pregnancy and placenta previa, were excluded from the study. In the Pilates group, exercises were taught at the hospital by a physiotherapist for at least 8 weeks, 2 days a week and 1 h per session in the form of moderate intensity exercise (Borg Scale 12–14) recommended by ACOG guidelines. The Pilates exercise program was designed so that exercise sessions included a warm-up phase, main exercise program and cooling phases. The program was held at the mat level against gravity and resistance (along with the use of an exercise band and exercise ball). The first 10 min of the 1-h exercise program consisted of warm-up exercises, mid-load period (Clinical Pilates) exercises were performed for 30-40 min and cooling exercises were performed for 10 min. Age, height, weight, weight gained during pregnancy, hemoglobin level, education level, duration of labor, type of delivery, birth week, induction requirement and duration, birth weight of infants and APGAR scores were retrospectively recorded from the patient files. Statistical analysis was performed using SPSS version 20 software (SPSS Inc, Chicago, IL, USA). For descriptive statistics, number and percentage were used to present categorical variables, whereas mean±standard deviation was used for continuous variables with normal distribution. In cases where parametric test assumptions were fulfilled, Student t-test was used for intergroup comparisons, and Mann–Whitney U test was used if parametric test assumptions were not fulfilled. Significance level (p value) was accepted as 0.05.

RESULTS

The mean age of pregnant women in the pilates and control groups was 28.77±4.43 and 28.18±4.69 years, respectively. No difference was found between the two groups in terms of mean age (p: 0.574) (**Table 1**). The mean gestational age of pregnant women in the study group at the onset of Pilates was 20 (min. 16, max. 27) weeks. There was a significant difference between the two groups in terms of education level of pregnant women. In the study, 17 (65.4%) of the pregnant women in the Pilates group were university graduates, 7 (26.9%) were high school graduates and 2 (7.7%) were primary school graduates, whereas 6 (10.5%) of the pregnant women in the control group were university graduates, 17 (29.9%) were high school graduates and 34 (59.6%) were primary school graduates (**Table 1**) (p<0.001).

Table 1. Demographic characteristics

Variables	Pilates Group (n=26)	Control Group (n=57)	P-value
Age (Years) (mean±SD)	28.77±4.43	28.18±4.69	0.574
Initial BMI (kg/cm²)	25.70±1.75	26±2.54	0.432
Weight gain (kg)	10.69±2.24	14.11±4.39	<0.001
Gestational age (weeks)	39.35±1.23	38.88±1.40	0.157
Gravida	1.54±0.72	1.84±0.80	0.21
Education (n, %)	-	-	-
Primary	2 (7.7%)	34 (59.6%)	<0.001
High School	7 (26.9%)	17 (29.9%)	<0.001
University	17 (65.4%)	6 (10.5%)	<0.001

Demographic data: age, initial body mass index, gestational age, gravida, education

Body mass index (BMI) at the beginning of pregnancy was 25.70±1.75 and 26±2.54 for pregnant women in the study and control groups, respectively. There was no significant difference between the two groups in terms of body mass index at the beginning of pregnancy (p>0.05) (**Table 1**). The mean weight gain during pregnancy was 10.69±2.24 kg for pregnant women in the study group and 14.11±4.39 kg for those in the control group. There was a significant difference between the two groups in terms of weight gained during pregnancy (**Table 1**) (p<0.001).

There was no difference between the groups in terms of gravida and parity (**Table 1**) (p: 0.21). Considering the type of delivery, there was no significant difference between the groups in terms of primary Cesarean rates (**Table 2**) (p: 0.272). However, the percentage of primary Cesarean rates was 15.4% in the Pilates group and 26.3% in the control group. There was no difference between the groups in terms of Cesarean indications (p: 1).

When labor time was compared between the groups, it was found that there was no difference in the latent phase (p: 0.313), whereas a difference was found in the active phase. The active phase was significantly shorter in the study group (**Table 2**) (p: 0.042).

There was also a significant difference between the groups in terms of induction time (**Table 2**) (p<0.01). In the study group, 46% of the patients underwent labor induction and the mean induction time was 5.33 (min 2, max 11) hours. Conversely, 26 patients in the control group underwent labor induction and the mean induction time was 10.88 (min 6, max 18) hours.

There was no significant difference between the groups in terms of gestational age (p: 0.157) (**Table 2**). There was no significant difference between the groups in terms of birth weights of infants (p: 0.498) (**Table 2**). In comparing APGAR evaluations at min 1 and 5 after delivery, no significant difference was found between the groups (p>0.05). There was a significant difference between the groups in terms of hemogram values. (p: 0.045) (**Table 2**).

Table 2. Clinical characteristics

Variables	Pilates Group (n=26)	Control Group (n=57)	P-value
Delivery Type	-	-	-
Vaginal birth (n, %)	22(84.6%)	42(73.7%)	-
Cesarean	4(15.4%)	15(26.3%)	0.272
Labor	-	-	-
Latent phase (h) (mean±SD)	7.92±2.46	9.35±4.5	0.313
Active phase (h)	3.54±1.33	4.19±1.49	0.042
Induction time (h) (Median) (min; max)	5h (2-11)	11h (6-20)	<0.001
Hb (gr/dL) (Median) (min, max)	12.57 (10.20-14.10)	12.08 (9.20-13.9)	0.045
Infant weight (g) (SD)	3454± 73.9	3378±66.6	0.498

Note: Values are presented as mean±standard deviation. (p< 0.05).

DISCUSSION

The age range of the pregnant women included in this study was 20–39 years. Fourteen studies in the ACOG guideline reported an important correlation between exercise during pregnancy and the age of pregnant women. It has been observed that young pregnant women perform high level exercises (7-10). In contrast to these studies, four studies reported that the older age group exercised with higher intensity (11-14). In these studies, it was reported that adult women (26–35 years old) were more interested in high intensity exercises and increased their level of exercise during the period from pre-pregnancy to pregnancy, and women who had been doing sports before pregnancy continued their sportive activities during pregnancy (11,12). In some studies, no correlation was found between gestational age and exercise level (15-18).

In this study, 17 (65.4%) of the pregnant women in the Pilates group were university graduates, whereas only 6 (10.5%) pregnant women in the control group were university graduates. In other words, it is noteworthy

that the education level of the pregnant group receiving exercise training was higher. In a study conducted in Portugal, despite the decrease in physical activity during pregnancy, it was shown that pregnant women with nulliparous pregnancy were working, had a higher education level and the age range was 25–34 years (19). In another study conducted with 616 pregnant women who were mostly Spanish (94.3%), the mean age was 31.3 (SD: 4.2) years and the majority of them were high school (44.3%) or university (38.5%) graduates (20). These results are consistent with those of our study.

In this study, when body mass indices at the beginning of pregnancy were examined, no statistical difference was found between the groups. When weight gained during pregnancy was compared between the groups, it was found that weight gain during pregnancy was lower in the study group than in the control group. In other words, it was concluded that the exercise program provided in this study reduced weight gain during pregnancy.

In another study, it was reported that pregnant women in the active group gained 12.4 kg of weight during pregnancy and those in the control group gained 10.5 kg of weight. There was no significant difference between the groups in terms of weight gain (21). In our study, it was found that pregnant women in the Pilates group gained 10.6 kg of weight during pregnancy and those in the control group gained 14.1 kg of weight.

When we look at studies in general, a contradictory correlation is seen between exercise during pregnancy and weight gain. In a few studies, no correlation was found between exercise and weight gain during pregnancy (22,23). However, other studies concluded that weight gain was lower in pregnant women who exercised than in those who did not exercise at all (24-26).

In the study by Clapp and Little (25) on pregnant women, it was found that weight gain was lower when exercise was performed during the first trimester, but weight gain was higher when exercise was performed during the second and the third trimesters. In our study, the exercises were started in the second trimester. The second trimester is preferred because pregnancy is definite, the risk of abortion is less, and physical changes start to occur in the body. Ideally, it may be advisable to start exercising before pregnancy and to continue the exercises during pregnancy at a personally adjusted intensity level. In fact, results of the medium-severity personal exercise program used in this study support this view.

Conversely, when the duration of labor between the groups was compared, it was found that there was no difference between the latent phases, but the active phase in the Pilates group was significantly shorter (p: 0.042). When induction times were examined, a significant difference was found between the groups ($p<0.001$). There are limited studies in the literature comparing the induction period of labor. In fact, we expected pregnant women in the Pilates group to have a shorter duration of labor. However, in many studies, there was no positive effect of exercise on shortening the duration of labor (27-32). However, our study supports the fact that pregnant women who perform Pilates require shorter induction and they have a shorter duration of labor. According to the study conducted by Horns et al. (33) it was concluded that pregnant women who exercised during the third trimester gave birth with a shorter duration of labor than those in the control group. In our study, 22 (84.6%) of the pregnant women who performed Pilates had a normal birth and 42 (73.7%) of those in the control group had a normal birth. The primary cesarean ratios were 15.4% and 26.3% in the Pilates and control groups, respectively. There was no statistically significant difference between the groups in terms of the delivery type. However, when the percentages were examined, it was noteworthy that the normal birth rate was higher among pregnant women in the Pilates group. We believe that this difference would be significant in a larger sample. In the literature, the number of studies on this subject is limited.

No significant difference was found between the groups in terms of gestational age ($p>0.157$). The mean gestational age was 275.4 days (39.3 weeks) in the Pilates group and 272.1 days (38.8 weeks) in the control group. In our study, preterm birth (before 36 weeks) or post-term birth (after 42 weeks) was not observed in any of the groups. All pregnant women in the study had term delivery, and there was no significant difference between them in terms of gestational age. This result supports the notion that there is no risk of preterm birth in pregnant women who receive Pilates exercise training. In another study that was similar to our study, it was reported that the mean gestational age of the active pregnant group was 39.2 weeks and the mean gestational week of the control group was 39.4 weeks (21). In other words, there was no preterm birth in the active group. In the study by Gollenberg et al. (34) it was emphasized that there was no difference between the active pregnant and control groups in terms of gestational age or preterm birth results.

There was no difference between the groups in terms of birth weights. In other words, exercise during pregnancy had no effect on decreasing the birth weight of infants. In the study by Pivarnik et al. (35) it was found that there was no relationship between infant birth weight and physical activity. In addition, Clapp et al. (27) reported that infant birth weight was lower in pregnant athletes who exercised 6 days a week, at least for 1 h a day, than in

those who stopped exercising after 28 weeks. Similarly, in another study, it was reported that regular exercise during pregnancy had a negative effect on infant birth weight. In this study, it was reported that infant birth weight was lower in pregnant women who attended exercise sessions regularly until 28 weeks of pregnancy and attended at least one third of the exercise sessions during the remainder of their pregnancy than in those who reduced their physical activity during pregnancy (36). In another study, it was reported that infant birth weights of pregnant women who exercised heavily during pregnancy were higher than those who did not exercise (37). In a prospective randomized controlled trial by Clapp et al. (27) severe aerobic exercises were performed from early to late term of pregnancy. It was reported that infant birth weight of pregnant women who performed this exercise program was 460 g higher than that of those in the control group (24). Bradley et al. (21) emphasized that infant birth weight was 3329 g in active pregnant women and 3308 gr in inactive pregnant women.

Considering that all pregnant women had similar levels of physical activity at the onset of the study, the fact that the exercise program did not affect birth weight supports the conclusion that this program is highly safe for pregnant women, and therefore, is a noteworthy finding.

In this study, it was found that there was no significant difference between APGAR scores at min 1 and 5 for infants of pregnant women who did or did not perform clinical Pilates. Previous studies have mostly focused on the effects of exercise during pregnancy on birth weight, birth week, and APGAR score. In these studies, aerobic dance and strengthening exercises were performed by sedentary pregnant women twice a week for a minimum of 12 weeks, and it was found that exercise training had no negative effect on AGPAR score (38,39). In this study, delivery outcomes of pregnant women performing clinical Pilates were compared with those of pregnant women not performing Pilates, and it was found that Pilates had no lowering effect on gestational age, there was no difference between infant birth weights between pregnant women in the exercise group and those in the control group, and APGAR scores were similar in both groups.

One of the limitations of this study was the small sample size. Furthermore, the physical activity level of pregnant women in the control group during pregnancy could not be determined. Prospective studies with a larger number of pregnant women will be more satisfactory in terms of study results.

Although the importance of exercise in pregnant women has been emphasized in recent years, the lack of a standardized exercise program in the literature is a serious shortcoming.

CONCLUSION

Clinical Pilates can be a suitable exercise model when applied to pregnant women within an appropriate period of pregnancy since it has a positive effect on the pregnant women and their infants. We believe that this exercise model should be given more importance by obstetricians and physiotherapists in Turkey. Dissemination of these trainings is important for the continuation of future studies.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was approved by the local Institutional Review Boards (01/06/2012, acception no.8).

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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