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The effect of Pilates on pain during pregnancy and labor: a systematic review and meta-analysis

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SUMMARY

OBJECTIVE: This systematic review and meta-analysis study was conducted to reveal the effect of Pilates on pain during pregnancy and labor.
METHODS: The PubMed, ScienceDirect, MEDLINE, Ovid, EBSCO, CINAHL Plus, Cochrane Library databases, and Google Scholar databases were used to access the articles published in international journals, and the Dergipark, Turkish Clinics, and ULAKBİM databases were scanned to access the articles published in national journals between October 30 and November 30, 2022. The data were analyzed using Review Manager 5.4.
RESULTS: This study included four articles. According to the meta-analysis results, it was elucidated that Pilates exercise during pregnancy was not statistically effective in reducing pain during pregnancy (Z=0.61, p=0.54), but it was effective in reducing pain intensity during labor (Z=11.20, p<0.00001).
CONCLUSION: This study concluded that Pilates exercise was not effective in reducing pain during pregnancy but was effective in reducing labor pain. There is a need for more research on the subject.
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KEYWORDS: Obstetric labor. Pregnancy. Exercise. Meta-analysis. Pain.

INTRODUCTION

Pilates is mainly a mind-body exercise done for muscle strength, flexibility, breathing, and posture. It concentrates on actively using the trunk muscles to stabilize the pelvic-lumbar region[1,2]. Regular Pilates exercise has been shown to strengthen the transverse abdominal and pelvic floor muscles and enhance their structural function. Moreover, Pilates is considered an exercise of low-to-moderate intensity to relieve pain[3]. It ensures flexibility, dynamic balance, and muscle endurance in healthy populations. It positively affects back pain, quality of life, balance, and physical and mood states[4].

As a result of postural changes caused by weakness of joints and ligaments and muscle-tendinous stretching during pregnancy, pregnancy-related musculoskeletal problems may arise[1,2,5]. Furthermore, pregnancy-related musculoskeletal problems can be affected by the degree of physical activity, cultural influences, and environmental and hormonal changes. Relaxin, a hormone secreted by the placenta, especially in the late stages of pregnancy, loosens the ligaments in the pelvis for the labor process. Meanwhile, it triggers pregnancy-related pain by loosening the ligaments that support the spine[1,2]. Pain is seen especially in the back, lumbar, pelvic, and extremity regions[1,6-8]. Pain, which significantly affects the daily lives, mobility, and sleep of pregnant women and reduces their quality of life substantially, can reach quite serious dimensions with the progression of pregnancy[9,10]. Pilates movements can be performed according to the physiological changes during pregnancy to overcome musculoskeletal problems[3,7]. Pilates exercise during pregnancy prepares a woman for labor. Improving the flexibility of the trunk and pelvic floor muscles and ensuring correct breathing can facilitate the labor process[3]. Moreover, Pilates has been shown to reduce labor pain[3,11].

It is assumed that the pain suffered during pregnancy and labor will decrease with correctly performing muscle strengthening and breathing, which is the basis of Pilates. When the effectiveness of the method is determined, it may be recommended to be used more often to reduce low back pain in pregnant women and labor pain. This systematic review and meta-analysis study was conducted to reveal the effect of Pilates exercise on pain during pregnancy and labor.

Research questions

- What is the effect of Pilates exercise on pain during pregnancy?
- What is the effect of Pilates exercise on labor pain?

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METHODS

A systematic review and meta-analysis study was conducted to reveal the effect of Pilates on pain during pregnancy and labor. The primary outcome of this study was the level of pain during pregnancy and labor, which was measured by a valid and reliable tool. The secondary outcome was an adverse event, which was also measured by a valid and reliable tool. In the preparation of systematic review and meta-analysis, the criteria from PRISMA[12] and the Cochrane Experiments Systematic Reviews Handbook were used. Prior to the study, the subject of the study and whether it was among the previously completed or ongoing studies were checked from the PROSPERO system.

The review of the articles included, the selection of the articles, the acquisition of the data, and the quality assessment were conducted independently by the first and second researchers, and all stages were checked by the third and fourth researchers. In case of any disagreement about the study, a meeting was held in which four researchers participated together, disagreements were discussed, and a consensus was reached. Moreover, a pilot study was conducted, and a common road map was determined regarding all these stages in a session with the participation of four researchers before initiating the study.

Criteria for including studies in the review

Inclusion and exclusion criteria were set considering the components of the research problem (PICOS). Accordingly,

Population (P); Pregnant women

Intervention (I); Pilates

Comparison (C); Women who did not do Pilates during pregnancy

Outcomes (O); Pain

Study design (S); Randomized controlled trials published in Turkish and English between 1984 and 2022.

Quasi-experimental studies, reviews, case reports, qualitative studies, unpublished theses, congress papers, and descriptive studies constituted the exclusion criteria of the study.

Review strategy

This systematic review and meta-analysis study was conducted between October 30 and November 30, 2022, in the form of a retrospective review of publications on the subject. The PubMed, ScienceDirect, MEDLINE, Ovid, EBSCO, CINAHL Plus, Cochrane Library databases, and Google Scholar databases were used to access the articles published in international journals, and the Dergipark, Turkish Clinics, and ULAKBİM databases were scanned to access the articles published in national journals. The search was done in Turkish and English over Istanbul University-Cerrahpaşa Internet access network using keywords such as (pregnancy OR antenatal period OR labor OR birth) and (women OR pregnant women OR pregnancy) AND (Pilates) and (pain OR low back pain OR labor pain). Furthermore, the reference lists of the studies included in the study were reviewed to identify additional studies.

Selection of studies

Studies to be included in this study were determined and selected independently by two researchers, considering the inclusion and exclusion criteria. The titles and abstracts of all studies were reviewed. The articles selected independently by the first and second authors were compared. In case of different views on articles, a joint decision was made by considering the views of the third and fourth authors.

Acquisition of study data

A data extraction form was created by the researchers to obtain the same information from each study included in the systematic review. The data extraction form included information about the author, year of the study, country, type of study, sample size, data collection tools, mean age of the pregnant women included in the study, data on the intervention, and information about pain.

Evaluation of the evidence quality of studies

Each study selected to be included in the study was assessed by the first two authors with a critical appraisal checklist and checked by the third and fourth authors. The quality of the articles in randomized controlled trials was assessed via the Second Version of the Cochrane Risk-of-Bias tool for randomized trials (RoB 2)[13].

Data analysis

In the meta-analysis, data analysis was performed using Review Manager 5.4 (The Nordic Cochrane Center, Copenhagen, Denmark). The heterogeneity between the studies reviewed was assessed by Cochran's Q and Higgins' I^2 tests, and it was accepted that I^2 higher than 50% indicated a significant heterogeneity. Accordingly, the Random Effect result was obtained if I^2 was higher than 50%, and the Fix Effect result was obtained if it was <50%. To evaluate the study data, Standardized Mean Difference (SMD) and Mean Difference (MD) were used for continuous variables. All tests were calculated as two-tailed, and $p<0.05$ was accepted for statistical significance.

RESULTS

Review findings

As a result of the literature review, 293 studies were reached at the first stage. As a result of excluding duplicate records and the literature that met the exclusion criteria and analyzing the titles and abstracts, 29 articles were selected for full-text review. After reviewing the full texts according to the inclusion criteria and adding other studies, four studies were determined for meta-analysis: two for pain during pregnancy and two for pain during labor. The primary outcome of this study was the level of pain during pregnancy and labor. There were no studies reporting adverse effects for secondary outcome. Figure 1 shows the PRISMA flowchart for the selection process of the studies.

Quality assessment results of studies

The articles included in the study were assessed with the RoB 2 tool. While no high level of bias was observed in the studies, some concerns about bias were seen in one study, and a low risk of bias was observed in the other three studies (Table 1).

Characteristics of the studies

The total sample size of the studies included in the systematic review and meta-analysis is 204. All the studies included in this research were randomized controlled trials and published in English language (Table 1).

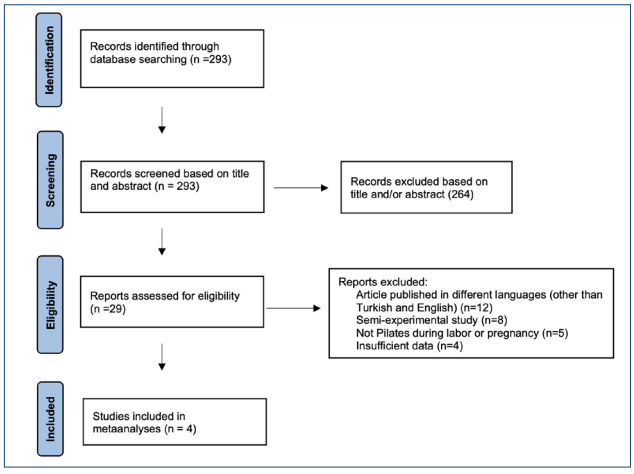


Figure 1. PRISMA flowchart.

Table 1. Characteristics of the studies.

Reference Country	Study design	Study period	Data collection tools	Age Mean±SD	Sample size	Intervention	Pain score	Risk of bias domains: ROB-2
Aktan et al., 2021 Turkey[11]	RCT	N/A	VAS	Pilates: 27.52±3.88 Control: 25.5±4.19	Pilates: 21 Control: 22	16–24 weeks of pregnancy For 8 weeks Twice a week 60 min	Pilates: 6.7±1.19 Control: 8.4±0.79	Some concerns
Ghandali, 2021 Iranian[3]	RCT	2020	VAS	Pilates: 25.16±4.41 Control: 23.81±4.30	Pilates: 51 Control: 52	26–28 weeks of pregnancy For 8 weeks Twice a week 35 min	First measurement Pilates: 5.04±0.99 Control: 6.14±1.07 Second measurement Pilates: 6.20±0.87 Control: 7.46±1.16 Third measurement Pilates: 7.44±0.81 Control: 8.51±1.14	Low risk
Mazzarino et al., 2022 Australia[14]	RCT	N/A	PMI	N/A	Pilates: 11 Control: 7	From the 18th week For 6 weeks At least 30 min	Pilates: 86.4±17.2 Control: 78.6±22.5	Low risk
Sonmezer et al., 2021 Turkey[2]	RCT	2019	VAS	Pilates: 29.00±2.75 Control: 28.00±2.10	Pilates: 20 Control: 20	From 22nd to 24th week For 8 weeks Twice a week 60–70 min	Pilates: 17.20±10.80 Control: 38.40±17.50	Low risk

RCT: randomized controlled trial; VAS: Visual Analog Scale; PMI: Pregnancy Mobility Index; N/A: not applicable; SD: standard deviation.

Characteristics of the intervention

The time of starting Pilates exercise differed in the studies. In the studies, Pilates practice during pregnancy was performed in the second and third trimesters, and in three-quarters of the studies, it was performed as two sessions per week for 8 weeks[2,3,11]. In the studies, the duration of pregnant women's Pilates exercise differed between 30 and 70 min[2,3,11,14] (Table 1).

Meta-analysis findings

The Visual Analog Scale (VAS) was used for pain evaluation in three studies included in the meta-analysis[2,3,11], and the Pregnancy Mobility Index (PMI)[14] was used in one study (Table 1).

The effect of Pilates during pregnancy on pain during pregnancy

Two studies reviewed in this study included data on pain levels in pregnant women who did and did not do Pilates during pregnancy[2,14]. According to the combined results of these studies, it was seen that Pilates exercise during pregnancy was not statistically effective in reducing pain during pregnancy (SMD: -0.55, Z=0.61, p=0.54) (Figure 2).

The effect of Pilates during pregnancy on labor pain

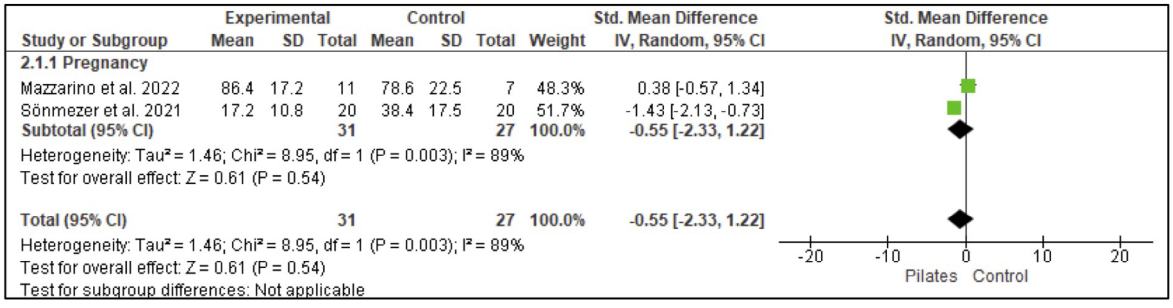
Two studies reviewed in this study included data on labor pain in pregnant women who did and did not do Pilates during pregnancy[3,11]. According to the combined results of these studies, Pilates exercise during pregnancy was found to statistically significantly reduce pain intensity during labor (MD: -1.21, Z=11.20, p<0.00001) (Figure 2).

DISCUSSION

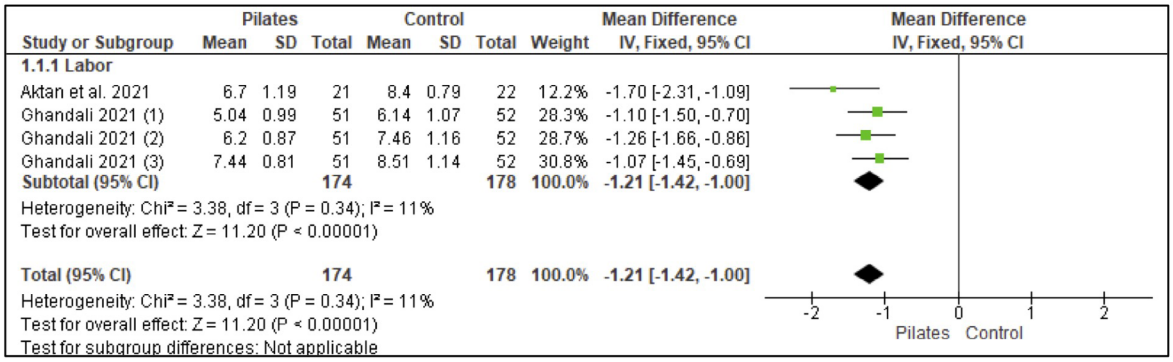
This systematic review and meta-analysis study analyzed the effect of Pilates exercise on pain during pregnancy and labor.

Pregnancy and labor are among the important and special periods experienced by women in their lives. Many changes considered normal may occur during these periods. However, these changes may lead to pain during pregnancy and labor[15,16].

Musculoskeletal system pain may be experienced during pregnancy, affecting the lower back, pelvic region, back, hip, and even wrists. As pregnancy progresses, a decrease is observed in the strength of the pelvic floor muscles and abdominal



Mean = mean of the groups; SD = standard deviation; Weight = statistical relevance of the study; IV = inverse variance; CI = confidence interval; Random = random effect; I^2 = heterogeneity index; Z = global effect test; Chi^2 = Chi-square test; Tau^2 = Kendall's Tau test; df = degree of freedom; p-value.



Mean = mean of the groups; SD = standard deviation; Weight = statistical relevance of the study; IV = inverse variance; CI = confidence interval; Fixed = fixed effect; I^2 = heterogeneity index; Z = global effect test; Chi^2 = Chi-square test; Tau^2 = Kendall's Tau test; df = degree of freedom; p-value.

Figure 2. Meta-analysis results regarding the effect of Pilates on pain during pregnancy and labor.

muscles. Pilates exercise contributes to strengthening the pelvic floor and preventing and treating dysfunctions caused by pregnancy[7]. The current guidelines recommend moderate-intensity exercise during pregnancy[17,18].

According to the results of this meta-analysis, it was seen that Pilates exercise was not effective in reducing pain during pregnancy. Similar to the results of this study, Mazzarino et al. reported that there was insufficient evidence that Pilates relieved low back pain during pregnancy[19]. However, in the meta-analysis study by Mendo and Jorge, it was expressed that Pilates was useful against pain during pregnancy[7]. The study by Sonmezer et al. stated that Pilates had a positive effect on reducing pain during pregnancy[2]. The study by Canarslan and Albayrak revealed that Pilates reduced pain during pregnancy[20]. In another study, Pilates was demonstrated to be an effective, healthy, and applicable method to reduce pain during pregnancy[1]. Although there are studies stating that Pilates provides benefits regarding its effect on pain during pregnancy[1,2,7,20], more randomized controlled trials are needed on this subject.

It is reported that Pilates exercise during pregnancy is beneficial in terms of preparing low-risk pregnant women for labor[14]. As a result of enhancing the flexibility of the trunk and pelvic floor muscles and improving proper breathing, Pilates exercise can facilitate the labor process and reduce pain during labor[3,21].

In the current meta-analysis study, Pilates exercise during pregnancy was found to be effective in reducing pain intensity during labor. In the study, Rodríguez-Díaz et al. showed that 8-week Pilates exercise during pregnancy reduced pain during labor and the use of analgesics, which resulted in significant improvements in labor[21]. A study emphasized that regular Pilates exercise during pregnancy strengthened the pelvic floor muscles, reduced pain, and decreased the need for epidural anesthesia during labor[3]. Another study elucidated that the Pilates group felt less pain during labor compared to other groups[11].

Limitations

The strengths of this study are that there is no high level of bias in the studies included in the systematic review and meta-analysis, the results are based on reliable analysis methods, the subject is evaluated from different perspectives, and the results obtained are supported by the results reported in previous studies. A limitation of this study is that the search was done only in Turkish and English languages.

CONCLUSION

As a result of this systematic review and meta-analysis, it was found that Pilates exercise during pregnancy was not effective in reducing the pain during pregnancy, but it was effective in reducing labor pain. These results are valuable since they include the results of randomized controlled trials on the subject.

Pilates, which is a low- and moderate-intensity exercise, is a low-cost, easily applicable, non-pharmacological method with no side effects. Therefore, it is important to increase the use of Pilates exercise during pregnancy and inform and educate healthcare professionals on this subject. To identify the effect of Pilates exercise on pain during pregnancy and labor, it is recommended to conduct randomized controlled quantitative and qualitative studies that reveal the experiences of pregnant women.

AUTHORS' CONTRIBUTIONS

TY: Conceptualization, Date curation, Formal Analysis, Validation, Visualization, Writing – original draft, Writing– review & editing. **ÖT:** Conceptualization, Date curation, Formal Analysis, Validation, Visualization, Writing – original draft, Writing – review & editing. **SG:** Conceptualization, Date curation, Formal Analysis, Validation, Visualization, Writing – original draft, Writing – review & editing. **HDK:** Conceptualization, Date curation, Formal Analysis, Validation, Visualization, Writing – original draft, Writing – review & editing.

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