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The Effect of Eight Weeks of Combined Core Stability and Balance Training on Pelvic Girdle Pain, Balance, and Quality of Life in Pregnant Women

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ABSTRACT

Background and Objective: Pregnancy is accompanied by extensive physiological changes that can result in pelvic girdle pain, decreased balance, and diminished quality of life. Given that the selection of an appropriate strategy for relieving low back pain during pregnancy is of importance, the aim of the present study is to investigate the effect of eight weeks of combined core stability and balance training on pelvic girdle pain, balance, and quality of life in pregnant women.

Methods: The present cross-sectional study was conducted on 30 pregnant women aged 20-35 years in the 20th to 30th weeks of pregnancy, assigned to two groups of 15 (exercise and control) that were matched in terms of age and other characteristics. The exercise program lasted 8 weeks, with three sessions per week, and each session consisted of three stages: warm-up, main body, and cool-down. The warm-up lasted 15 minutes and included pedaling on a stationary bicycle and performing static and dynamic stretching exercises. The exercise duration was 45 minutes to one hour. The cool-down at the end of the training session lasted 10 minutes. Before starting the exercise, fetal heart rate and maternal blood pressure were monitored, and exercise was performed according to the health status of the mother and fetus. Pain, quality of life, and balance were measured and compared using the Pelvic Girdle Pain Questionnaire, the SF-36 Quality of Life Questionnaire, and the Bass Balance Test, respectively.

Findings: The mean pelvic girdle pain score in the exercise group decreased significantly after the intervention, from 39.73±10.79 to 14.06±7.81 ($p<0.001$). In contrast, in the control group, it increased from 27.40±10.51 to 54.93±8.53 ($p<0.001$). The mean quality of life score in the exercise group rose from 66.54±18.02 to 78.30±14.96, whereas in the control group it declined from 63.58±22.33 to 53.13±17.82 ($p<0.001$). Furthermore, the mean balance score in the exercise group improved from 20.20±1.97 to 12.33±1.79 ($p<0.001$).

Conclusion: The findings of the study demonstrated that eight weeks of combined core stability and balance training can lead to a reduction in pelvic girdle pain, an improvement in balance, and an enhancement of quality of life in pregnant women.

Keywords: *Combined Exercises, Core Stability Exercises, Balance Exercises, Pelvic Girdle Pain, Quality of Life, Pregnant Women.*

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Introduction

Maternal health during pregnancy profoundly influences the well-being of both the mother and the child and affects not only immediate birth outcomes but also long-term health trajectories. There is growing evidence indicating that regular physical activity during pregnancy positively influences physical and mental health (1). During pregnancy, a number of biomechanical and hormonal changes occur that can alter spinal curvature, balance, and gait patterns by affecting key regions of the body. This can significantly affect quality of life by increasing low back pain. These effects are likely the end result of a number of hormonal and biomechanical changes that occur during pregnancy (2).

Pelvic girdle pain (PGP) is a common and disabling condition that affects approximately 20-50% of pregnant women and may persist for months after delivery. It also has considerable consequences for maternal mobility, balance, and overall quality of life (QoL) (3, 4). Quality of life is a broad concept that reflects an individual's perception of their position in life, and according to the World Health Organization, during pregnancy, quality of life not only affects the mother but also has important implications for fetal development and long-term maternal and child health outcomes (5). The selection of an appropriate strategy for relieving low back pain during pregnancy, which also affects quality of life, has become a challenge for the medical community. Exercise therapy is one of the safest strategies for relieving low back pain (6, 7). The results of studies have shown that exercise therapy is effective in improving chronic low back pain and can be used as a safe and effective approach to relieve low back pain and its resulting consequences—including lumbar lordosis, functional disability, and improvement of quality of life—in women (6, 8).

Core stability exercises are designed with the aim of activating the deep abdominal, back, and pelvic floor muscles and play an important role in increasing spinal stability, reducing the pressure imposed on pelvic structures, and reducing pain (9). Balance exercises are also recommended with the aim of improving balance control and preventing falls during pregnancy (10). Specific exercises can reduce PGP pain and improve daily function (11). The results of the study by Mamipour et al. showed that participants in the exercise group experienced a significant reduction in pain intensity (based on the VAS scale) and functional disability (based on the Oswestry questionnaire) after ten weeks of regular exercise. Additionally, their quality of life improved in all examined dimensions, and these results confirm the positive effect of core stability exercises on improving functional and psychological indicators during pregnancy (12). In the study conducted by Bagwell et al., the results showed that reduced static balance control is associated with increased pain and disability in pregnant women, highlighting the importance of balance-improving exercises (13). In one study, it was found that Pilates exercises during pregnancy can have a positive effect on improving balance, reducing pain, and enhancing quality of life (14). Additionally, in another study, it was concluded that functional and stabilizing exercises play an effective role in reducing pain and improving the physical function of pregnant women with pelvic girdle pain (15).

Given the high prevalence of pelvic girdle pain during pregnancy and its negative effects on the quality of life, motor function, and balance of pregnant women, finding safe and effective strategies for managing this problem is of particular importance. Pelvic girdle pain is one of the most common problems of pregnancy, associated with impaired motor function, reduced balance, and a decline in quality of life. In circumstances where medication use during pregnancy is restricted, corrective exercises—particularly core stability and balance exercises—are proposed as non-invasive and safe interventions. However, few studies

have simultaneously investigated the effect of combining these two types of exercise on pain, balance, and quality of life indicators in pregnant women. Therefore, the aim of the present study is to investigate the effect of eight weeks of combined core stability and balance training on pelvic girdle pain, balance, and quality of life in pregnant women.

Methods

After approval by the Ethics Committee of the Sport Sciences Research Institute under code IR.SSRC.REC.1404.012, this cross-sectional study was conducted on 30 women in the 20^{th} to 30^{th} weeks of pregnancy, in two groups of 15 (control and exercise) in Qaemshahr, northern Iran. Pregnant women in the second trimester of pregnancy, aged between 20 and 35 years, with a body mass index (BMI) between 20 and 26, no history of high-risk delivery, no musculoskeletal, cardiac, neurological, or metabolic diseases, no experience of professional exercise during the past six months, no use of analgesic, sedative, or specific supplements in the past three months, having at least 6 weeks of low back pain, suffering from pelvic girdle pain, enjoying general health, and without maternal underlying disease (hypertension, diabetes, epilepsy, cardiac, renal, and pulmonary disease) were included in the study after completing the informed consent form and obtaining approval from a specialist physician for performing the exercise protocol.

They were excluded from the study in cases of absence from more than two exercise sessions, the occurrence of new medical problems during the intervention, or voluntary withdrawal from continued cooperation. Pain intensity was measured using the Pelvic Girdle Pain Questionnaire, which includes two subscales—activity and symptoms—with a maximum score of 75. A score below 28 indicates mild pain, a score of 28 to 62 indicates moderate pain, and a score above 62 indicates severe pelvic girdle pain (16). The SF-36 questionnaire was used to assess quality of life, in which lower scores indicate lower quality of life and higher scores indicate better quality of life. The reliability and validity of the Persian version of this questionnaire have been confirmed in Iranian populations (17), and the Balance Error Scoring System (BESS) test was used to assess static and dynamic balance (18).

All assessments and functional tests were performed under the supervision of an obstetrician-gynecologist and a midwifery expert, with full adherence to the ethical principles related to the care of pregnant women. The exercise protocol in this study was of the core stability and balance exercise type. The exercise program was carried out for 8 weeks, three sessions per week. Each session consisted of three stages: warm-up, main body, and cool-down. Before starting the exercise, fetal heart rate and maternal blood pressure were checked, and exercise was performed according to the health status of the mother and fetus. The warm-up lasted 15 minutes and included pedaling on a stationary bicycle and performing static and dynamic stretching exercises. The exercise duration was from 45 minutes to one hour. The cool-down at the end of the training session lasted 10 minutes (Table 1).

After examining the normality of data distribution using SPSS software version 26 and the Shapiro–Wilk test, independent t-test, paired t-test, Wilcoxon, and Mann–Whitney U tests were used for analysis, and $p<0.05$ was considered significant.

Table 1. Exercise protocol

Exercises	Week 1-2		Week 3-4		Week 5-6		Week 7-8	
	Reps	Time	Reps	Time	Reps	Time	Reps	Time
1-Pelvic floor muscle contraction (as in the act of preventing urine flow)	2	15	3	15	3	20	3	25
2-Raising the legs from the side in a lying position	2	15	3	15	3	20	3	25
3-Side plank—lying on the side, elbow under the shoulder, legs extended	2	15	3	15	3	20	3	25
4-Half squat (standing)	2	15	3	15	3	20	3	25
5-Bridge exercise, with pelvic floor muscle contraction	2	15	3	15	3	20	3	25
6-Pelvic lift—on hands and knees, raise one leg upward	2	15	3	15	3	20	3	25
7-Kegel with ball—lying down, ball between the thighs, pressing the thighs against the ball	2	15	3	15	3	20	3	25
8-Standing on toes and heels	2	15	3	15	3	20	3	25
9-Standing on a balance board	2	15	3	15	3	20	3	25
10-Walking on toes and heels	2	15	3	15	3	20	3	25
11-Stork standing	2	15	3	15	3	20	3	25

Results

The mean age of participants was 27.33±4.55 years in the exercise group and 27.60±4.19 years in the control group, and weight was 75.93±7.67 kg in the exercise group and 73.36±7.78 kg in the control group. The two groups were matched in terms of demographic indicators. In the pretest stage, no significant difference was observed between the groups in terms of the variables of pelvic girdle pain, balance, and quality of life, indicating the initial homogeneity of the two groups. In the posttest stage, a considerable reduction in pelvic girdle pain was observed in the exercise group. Pelvic girdle pain decreased from 39.73±10.79 to 14.06±7.81 ($p<0.001$). Additionally, a 17.8% increase in quality of life was observed (from 66.54±18.02 to 78.30±14.96) ($p<0.001$). In the balance variable, the exercise group also showed a significant improvement. In both the control and exercise groups, the changes in BESS test balance scores were statistically significant ($p<0.001$). In the control group, the value was T=-6.808, and this negative value indicates that in the control group, the test scores (balance errors) increased. In other words, balance performance decreased in the control group. Since in the BESS test, the lower the score obtained (the fewer errors), the better the performance, a decrease in performance in the control group means an increase in errors in maintaining balance. In the exercise group, the value was T=12.110, and this positive value indicates that in the exercise group, the test scores (balance errors) decreased. In other words, balance performance increased in the exercise group. The significance level of $p<0.001$ indicates that the changes in balance scores in the exercise group were not random and were the effect of the exercise intervention (Table 2).

Table 2. Comparison of the scores of the studied variables in the exercise and control groups, before and after the intervention

Variable and groups	Pretest Mean±SD	Posttest Mean±SD	T	p-value
Pelvic girdle pain				
Control	27.40±10.51	54.93±8.53	-15.418	0.001
Exercise	39.73±10.79	14.06±7.81	12.110	0.001
Balance				
Control	2.69±18.86	2.32±20.46	-6.808	0.001
Exercise	20.20±1.97	12.33±1.79	12.110	0.001
Quality of life				
Control	63.58±22.32	53.13±17.82	9.244	0.001
Exercise	66.54±18.02	78.30±14.96	-8.498	0.001

Discussion

In the present study, a significant reduction in pelvic girdle pain was observed in pregnant women following eight weeks of combined core stability and balance training, indicating that this type of intervention can be employed as an effective approach in the management of pain during pregnancy. The findings of the present study further demonstrated that targeted exercises, in addition to reducing pain, led to improvements in balance and increases in the quality of life of the participants.

One of the most important findings of the present study was a significant 42% reduction in pelvic girdle pain in the exercise group following eight weeks of combined core stability and balance training, a result consistent with the findings of the study by Samadi et al., which reported a 35% reduction in pelvic girdle pain intensity (7). This similarity can be attributed to the use of similar exercise protocols and the targeting of shared muscles, including the deep abdominal and pelvic floor muscles. The study by Montazeri et al. reported a 28% reduction in pelvic girdle pain (19), and the slight difference from the present results is likely due to differences in the duration of each exercise session (45 minutes versus 60 minutes) and the intensity of the exercises. The study by Horak et al., conducted on 80 pregnant women, did not demonstrate a significant effect on reducing pelvic girdle pain (20); this discrepancy may be attributable to the shorter intervention period (4 weeks versus 8 weeks in the present study), differences in the type and intensity of exercises, and possibly the cultural and ethnic diversity of the study population, which influences responsiveness to exercise interventions.

Another important finding of the present study was a significant improvement in balance in the exercise group following eight weeks of combined core stability and balance training, a result that is consistent with the findings of the study by Shin et al., which demonstrated that combined exercises led to a 29% improvement in balance (21). This complete alignment can be attributed to the use of the same balance assessment tools and a similar exercise protocol, whereas the study by El-shamy et al. reported a 23% improvement in balance (22), and the relative difference from the present results is likely due to the absence of combining core stability exercises with balance exercises in their research. However, the study by Roshko et al. demonstrated a lesser effect (only 8% improvement) on balance (23). This considerable difference may be attributable to the absence of core stability exercises in their protocol and its limitation to simple

balance exercises. This improvement in balance in the present study can be attributed to the strengthening of the body's core muscles, which increase spinal stability; the improvement of neuromuscular coordination achieved through the stimulation of proprioceptors; and the enhancement of postural responses—all of which are of particular importance during pregnancy, given the shift in the body's center of gravity, weight gain, and ligamentous laxity that lead to decreased postural stability and an increased risk of falling (24, 25). Core stability exercises, by activating the transversus abdominis, paraspinal, and pelvic floor muscles, help maintain the stability of the spine and pelvis and lead to improved postural control (26, 27). Furthermore, balance exercises, through the stimulation of proprioceptors and the improvement of coordination among the vestibular, visual, and proprioceptive systems, increase the body's ability to maintain dynamic and static balance. The combination of these two types of exercise enables pregnant women, through increased body awareness, improved reaction time, and muscular stability, to exhibit greater resilience against the motor challenges of pregnancy. This not only reduces the likelihood of falling but also leads to a sense of motor security and an increase in their quality of life (22).

Another notable finding of the present study was a significant improvement in quality of life in the exercise group following eight weeks of exercise intervention, a result that is consistent with the findings of the study by Sonmezer et al., which reported a 31% improvement in overall quality of life (6). This similarity can be attributed to the use of similar assessment tools (the SF-36 Quality of Life Questionnaire) and an identical target population. During pregnancy, physiological changes such as weight gain and a shift in the center of gravity, hormonal changes including fluctuations in estrogen and progesterone levels, and psychological changes such as anxiety about childbirth and concern about fetal health can lead to a decrease in quality of life. Factors such as pelvic girdle pain that causes movement restriction, anxiety about childbirth that has a negative effect on psychological status, decreased mobility that leads to a decline in physical fitness, and a sense of inability to perform daily tasks are among the important reasons for this decline in quality of life (28). Regular exercise interventions, particularly exercises based on stability and balance, not only help improve physical condition but are also effective in reducing stress and anxiety through the stimulation of the central nervous system and the secretion of endorphins, which are the hormones of happiness and pain reduction (29).

The findings of the present study demonstrated that eight weeks of combined core stability and balance training can significantly reduce pelvic girdle pain, improve balance, and enhance quality of life in pregnant women. These results indicate that by designing safe exercise programs tailored to the physiological conditions of pregnancy, the occurrence of musculoskeletal disorders and functional decline during this period can be prevented. Non-pharmacological treatments such as targeted exercises can serve as an effective and low-cost approach to improving the functional and psychological indicators of pregnant women. Based on the results of this research, it is recommended that core stability and balance exercises be incorporated into pregnancy health protocols. Furthermore, conducting future research with larger sample sizes, long-term postpartum follow-up, and investigation of the psychological and hormonal effects of exercise on the mother and fetus could further enrich scientific knowledge in this field.

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