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Original Research

Health Promotion: Home Core and Flexibility Exercises to Manage Low Back Pain in Pregnancy

Saifudin Zuhri[1*], Marti Rustanti[1], Sri Suwarni[1]

[1] Department of Physiotherapy, Poltekkes Kemenkes Surakarta, Indonesia

ABSTRACT

Background: *Low back pain is a common complaint among pregnant women and is related to biomechanical adaptations, weight gain, and hormonal changes during pregnancy. Health promotion efforts, such as structured home exercise programs that focus on core stability and flexibility, can help alleviate these symptoms. The aim of this study was to evaluate the effectiveness of a structured home exercise program in preventing and managing low back pain in pregnant women in the second and third trimesters.*

Methods: *A pre-experimental design with a single group and pretest-posttest approach was utilized, involving 42 pregnant women chosen through purposive sampling. The participants engaged in a Structured Home-Based Core Stabilization and Flexibility Exercise Program twice a week, with each session lasting 30–45 minutes over a span of eight weeks. Pain intensity was measured using the Visual Analog Scale (VAS). Due to the non-normal distribution of the pre- and post-intervention scores, the Wilcoxon Signed Rank Test was used for analysis.*

Results: *The VAS score significantly decreased from 4.81 ± 1.44 to 1.93 ± 0.84 ($p < 0.001$), with an average reduction of 2.88 points. The effect size was very large ($r = 0.87$; 95% CI: 0.86–0.88), indicating a strong intervention effect on pain reduction.*

Conclusion: *These findings indicate that the program is an effective non-pharmacological health promotion strategy and can be recommended for routine implementation in maternal health services to prevent and manage low back pain during pregnancy.*

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CONTACT
Saifudin Zuhri
zuhriphysio@gmail.com
Department of Physiotherapy, Poltekkes Kemenkes Surakarta. Jl. Kapt. Adisumarmo Tohudan Colomadu, Karanganyar, Indonesia.

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INTRODUCTION

Pregnancy induces substantial anatomical, hormonal, and systemic changes that support fetal development but simultaneously impose mechanical stress on the musculoskeletal system, particularly the lumbar spine. Increased body mass, uterine enlargement leading to lumbar hyperlordosis, and elevated relaxin levels contribute to ligamentous laxity and reduced spinal stability. Collectively, these adaptations heighten susceptibility to low back pain (LBP), making it one of the most common complaints during the second and third trimesters (Sun et al., 2021). A recent review emphasizes

ligamentous laxity, postural changes, and a shifted center of gravity as key contributors to pregnancy-related LBP (Lee et al., 2021).

Globally, LBP remains a significant public health burden and a leading cause of disability (Cieza et al., 2020). Prevalence estimates vary widely among pregnant women, ranging from 60% to 90% (Sun et al., 2021). A recent meta-analysis reported a global prevalence of LBP of 40.5%, increasing to 47.8% in the third trimester (Salari et al., 2023). Persistent LBP impacts sleep, daily functioning, mobility, and overall quality of life. LBP can also contribute to obstetric complications, underscoring the need for health promotion through ergonomics in daily activities and home exercise programs as safe and effective conservative treatment options.

The multifactorial nature of pregnancy-related LBP is well established. Forward displacement of the center of gravity due to uterine growth increases mechanical load on the lumbar spine, leading to postural stress (Lee et al., 2021). Hormonal changes, particularly elevated relaxin and progesterone, loosen pelvic ligaments and connective tissue, reducing spinal stability (Wu et al., 2020). Additional risk factors include higher maternal BMI, poor ergonomics, sedentary behavior, and prolonged sitting or standing (Sun et al., 2021; Salari et al., 2023). Collectively, these risk factors increase the likelihood and persistence of LBP during pregnancy.

Given potential fetal dangers related with pharmacological treatment, proficient rules emphatically emphasize non-pharmacological procedures, especially organized work out. The American College of Obstetricians and Gynecologists, (2020) It is exhorted that people lock in in a least of 150 minutes of physical action each week at a direct concentrated. Supporting this, multiple meta-analyses confirm that targeted exercise programs, especially core stabilization and flexibility regimens significantly reduce both the intensity and the risk of lumbopelvic pain during pregnancy (Santos et al., 2023; Thabet et al., 2021). Consistent with these findings, core stabilization exercises have been shown to effectively lessen pregnancy-related low back pain and improve functional outcomes (H. Mamipour et al., 2023). Thus, effectively promoting maternal health in controlling the incidence of LBP.

However, many pregnant women face challenges when accessing supervised physiotherapy—such as limited time availability, transportation barriers, and reduced access to healthcare facilities. Therefore, structured home exercise health promotion programs offer a practical and accessible alternative. Recent evidence indicates that structured home-based regimens focusing on core stabilization and flexibility can improve neuromuscular control, enhance lumbar stability, and reduce pregnancy-related lumbopelvic pain when implemented with clear guidance and standardized dosage (Salari et al., 2023; Santos et al., 2023). These programs are particularly relevant for women in the second and third trimesters who require safe, feasible, and low-risk interventions that can be performed independently.

Despite strong evidence supporting exercise programs as a non-pharmacological treatment, previous studies have shown significant inconsistencies, including variations in exercise type (strengthening, stretching, or combination programs), unclear dosage and frequency, heterogeneity in program duration, and limited adherence monitoring. Many interventions are also supervised and clinic-based, limiting their generalizability to the real-life home environment (Lee et al., 2021). This study addresses this evidence gap by implementing a structured, home-based protocol with a clearly defined dosage—performed twice weekly for 30–45 minutes for eight weeks—specifically designed for pregnant women. Therefore, this study aimed to evaluate the effectiveness of the

Structured Home-Based Core Stabilization and Flexibility Exercise health promotion program in reducing low back pain intensity in second- and third-trimester pregnant women.

MATERIALS AND METHOD

This study employed a pre-experimental single group pretest–posttest design, which allows researchers to evaluate changes within the same participants before and after an intervention. The design was selected because randomization and the use of a control group were not feasible in the community setting and withholding exercise from pregnant women experiencing pain would be ethically inappropriate. The research was conducted from July to September 2025 in the Posyandu/Primary Health Post area of Gondangrejo District, Central Java, Indonesia.

A total of 42 pregnant women participated in the study through purposive sampling, chosen based on specific characteristics relevant to the research. The sample size exceeded the minimum of 30 participants commonly recommended for pre–post intervention designs to ensure adequate statistical power and to anticipate possible dropouts. Participants were included if they were in the second or third trimester (14–32 weeks), reported low back pain with a VAS score ≥ 3, were able to communicate effectively, and provided written informed consent. Individuals were excluded if they experienced pregnancy complications (such as bleeding or preeclampsia), had contraindications to physical activity, presented with severe neuromuscular or musculoskeletal disorders, or chose to discontinue participation before completing the intervention.

The independent variable was the Structured Home-Based Core Stabilization and Flexibility Exercise Program, while the dependent variable was low back pain intensity. Pain was assessed using the Visual Analog Scale (VAS), a 10 cm line anchored with “no pain” (0) and “worst possible pain” (10). The VAS is widely used in musculoskeletal research and demonstrates excellent reliability; prior studies reported an intraclass correlation coefficient (ICC) of 0.97, the evidence substantiates its appropriateness for evaluating pain severity in pregnant individuals.

Health promotion with a structured home exercise program developed in accordance with the 2020 American College of Obstetricians and Gynecologists pregnancy exercise guidelines. The program comprised core activation, lumbar stabilization, pelvic mobility, and flexibility exercises. Participants performed the program twice weekly for 30–45 minutes per session over eight consecutive weeks at light to moderate intensity, monitored using the talk test. To ensure correct execution and safety, the first two sessions were supervised directly by the research team. For home practice, participants were provided with printed instructional modules and video demonstrations.

Adherence to the program was monitored through weekly follow-up telephone calls and exercise logbooks completed by participants, documenting session frequency, duration, and perceived intensity. Participants who completed at least 80% of the prescribed sessions were classified as adherent. Baseline (pretest) pain intensity was recorded before the intervention, and posttest VAS scores were obtained after the eight-week program using the same standardized procedure.

The distributional characteristics of the data were assessed employing the Shapiro–Wilk test. Given that the findings demonstrated that the scores did not conform to a normal distribution, the variations between pretest and posttest VAS measurements were

examined utilizing the Wilcoxon Signed Rank Test. A p-value of less than 0.05 was deemed to be statistically significant. To assess the strength of the intervention's effect, the effect size (r) and its 95% confidence interval were computed, and the value was subsequently transformed into Cohen's d to support clinical interpretation.

Ethical authorization was secured from the Health Research Ethics Committee (KEPK) of FK UMS (Approval No.: 5876/B.2/KEPK-FKUMS/IX/2025, granted in 2025). All study participants were duly apprised of the research objectives, methodologies, potential advantages, and associated risks. The ethical principles of beneficence, non-maleficence, autonomy, and justice were meticulously adhered to throughout the research process, and all participants provided formal written informed consent prior to their inclusion in the study.

RESULTS

The results of the research are presentedin the following table:

Tabel 1. Distribution of characteristics of research subjects (n =42)

Characteristics	n	%
Maternal age (years)		
<25	12	28.6
25-34	27	64.3
≥ 35	3	7.1
Total	**42**	**100**
Gestational age (weeks)		
Trimester II (14–27)	19	45.2
Trimester III (28–32)	23	54.8
Total	**42**	**100**

Note: n = number of observations; % = percentage

Table 1 shows the characteristics of respondents. The majority of pregnant women were in the 25–34 age group, accounting for 64.3% of the total, indicating that most participants were in their optimal reproductive age. In addition, the majority of respondents were in their third trimester of pregnancy, accounting for 54.8% of the total, while the rest were in their second trimester. The Shapiro–Wilk normality test indicated that the VAS scores in both the pre-test ($p < 0.001$) and post-test (p-value = 0.002) were not normally distributed (p-value < 0.05). Therefore, the differences in pain intensity before and after the intervention were analyzed using the non-parametric Wilcoxon Signed Rank Test.

Table 2. Changes in Visual Analog Scale (VAS) Scores Before and After the Intervention (n = 42)

Variable	Min	Max	Mean ± SD	p-value*
VAS Pre test	3	7	4.81 ± 1.44	
VAS Post test	1	4	1.93 ± 0.84	<0.001
Difference	-	-	2.88	

Note: SD = Standard Deviation; *Wilcoxon signed-rank test

Table 2 summarizes the changes in VAS scores before and after completing the Structured Home-Based Core Stabilization and Flexibility Exercise Program. There was a notable reduction in pain intensity following the intervention. The mean pretest VAS

score was 4.81 ± 1.44, with values ranging from 3 to 7. After eight weeks of exercise, the mean posttest score declined to 1.93 ± 0.84, with a range of 1 to 4. The average decrease of 2.88 points demonstrates a clinically meaningful improvement in low back pain intensity.

The analysis conducted utilizing the Wilcoxon Signed Rank Test revealed a statistically significant disparity between the scores obtained in the pretest and those acquired in the posttest ($Z = –5.685$, $p < 0.001$). This finding indicates that participants experienced consistent and meaningful pain reduction after completing the exercise program. The effect size calculation yielded $r = 0.87$ (95% CI: 0.86–0.88), which falls into the "very large" category, reflecting a substantial magnitude of change resulting from the intervention. This strong effect size highlights the clinical relevance of the home-based exercise program, suggesting that it provides not only statistically significant but also practically important benefits.

DISCUSSION

This study demonstrated a significant reduction in low back pain intensity among pregnant women after participating in a Structured Home-Based Core Stabilization and Flexibility Exercise Program for eight weeks, performed twice per week with a duration of 30–45 minutes per session. These findings support the use of a structured home-based exercise program an effective physiotherapy intervention for reducing musculoskeletal complaints during pregnancy. The findings align with recent international research.

A systematic review and meta-analysis by Santos et al. (2023) indicated that structured exercise programs, especially those focusing on core stabilization and flexibility, significantly alleviated lumbopelvic pain in pregnant women. Additionally, a global analysis by Salari et al., 2023 evealed that targeted physical activity reduced both the prevalence and intensity of pregnancy-related low back pain. Likewise, Mamipour et al., 2023 verified that core stabilization exercises decreased pain intensity and enhanced the quality of life for pregnant women experiencing lumbopelvic pain.

These outcomes support the expanding international research body that demonstrates the effectiveness of exercise-based interventions in managing pregnancy-related back pain. Earlier meta-analytic evidence, like that from Davenport et al. (2019) is consistent with these findings, although more recent research offers even stronger validation. The physiological mechanisms underlying these improvements can be explained by several factors.

Low back pain during pregnancy is associated with increased lumbar lordosis, ligamentous laxity due to elevated relaxin, and changes in spinal load from uterine enlargement (Lee et al., 2021; Wu et al., 2020). Core activation and stabilization exercises enhance neuromuscular control of the lumbopelvic region and improve postural alignment, while flexibility exercises reduce muscle tension and improve spinal mobility. These combined effects reduce mechanical stress on spinal structures, optimize load distribution, and ultimately lower pain intensity.

Home-based exercise health promotion programs are efficient and effective (Santos-Rocha et al., 2022). An important advantage of the home-based program is its simplicity, practicality, and feasibility to be performed independently with written and video guidance. This is crucial as many pregnant women face barriers to attending structured exercise sessions due to time, accessibility, or cultural factors.

Such a program supports the recommendations of theAmerican College of Obstetricians and Gynecologists (2020), which advocate for regular moderate-intensity

physical activity during pregnancy as a safe and sustainable approach. From a physiotherapy perspective, these findings highlight that structured home-based exercise protocols can be integrated into antenatal physiotherapy services as a practical alternative to supervised clinic-based sessions. Physiotherapists can utilize this program to improve accessibility, promote patient self-management, and expand physiotherapy services to community settings such as Posyandu and primary health centers.

This study has several, however, has some limitations. The pre-experimental design without a control group limits the strength of causal conclusions. The relatively small sample size and reliance on self-reported adherence may also have influenced the outcomes. Factors such as ergonomic behavior, body mass index, and daily physical activity were not controlled. Future health promotion research should consider ergonomic behavior, use randomized controlled trials with larger and more diverse sample populations, consider additional outcomes such as functional disability and quality of life, as well as functional capacity, and compare different exercise dosages or supervised versus home-based program interventions to strengthen the evidence base.

In conclusion, the present research substantiates that a health promotion intervention, specifically a systematically organized home-based exercise regimen referred to as the Home Program Back Exercise, administered biweekly over a duration of eight weeks, significantly alleviates low back pain among pregnant women. Supported by international evidence, this intervention is safe, accessible, and practical, making it a valuable non-pharmacological recommendation for maternal health care and physiotherapy practice. This program may also enhance maternal comfort and support daily functional activities throughout pregnancy.

CONCLUSION

Research shows that participating in a structured, home-based health promotion program of core stabilization and flexibility exercises twice weekly for eight weeks can significantly control low back pain in pregnant women during the second and third trimesters. This exercise program helps strengthen core and back muscles, increase flexibility, improve postural alignment, and reduce mechanical stress on the lumbar region. Overall, this exercise program has been shown to be safe, practical, and feasible for stand-alone use, making it a viable non-pharmacological option that can be integrated into maternal health promotion and physiotherapy services for managing pregnancy-related low back pain.

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DECLARATION OF USE OF AI IN SCIENTIFIC WRITING

AI tools were used solely for grammar and language editing. The authors take full responsibility for the content and integrity of the manuscript.

CONFLICT OF INTERESTS

The authors declare no conflicts of interest.

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