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Original Article

Effect of Exercise Intervention Protocol on Third Stage of Labor during Third Trimester of Singleton Gravid: A Quasi Experimental Randomized Trial

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ABSTRACT

Background: Maternal morbidity and mortality remain major public health challenges, particularly in low-resource settings where complications during labor account for a significant proportion of maternal deaths. The third stage of labor, involving placental separation and expulsion, is often underemphasized in research despite being directly associated with postpartum hemorrhage, the leading cause of maternal death globally. Evidence suggests that antenatal exercise improves maternal cardiovascular efficiency and uterine contractility, but its effects on third-stage labor outcomes remain underexplored. Objective: To evaluate the effect of an eight-week moderate-intensity exercise intervention during the third trimester on the duration and mode of management of the third stage of labor among singleton gravid women. Methods: A quasi-experimental randomized trial was conducted at a Basic Health Unit in Rawalpindi, Pakistan. Eighteen primigravida women were recruited and randomly allocated to intervention (n=10) and control (n=8) groups. The intervention group performed a structured exercise protocol, while controls received routine antenatal care. Primary outcomes were the duration of the third stage of labor and physiological versus active management. Statistical analyses included independent-samples t-tests and chi-square tests, with $p<0.05$ considered significant. Results: The intervention group had a significantly shorter mean duration of third-stage labor compared with controls (11.3 ± 4.3 vs. 23.8 ± 4.8 min; mean difference -12.45, 95% CI -17.01 to -7.89, $p<0.001$, Cohen's $d=2.63$). Physiological management was more frequent in the intervention group (60.0% vs. 37.5%), though the difference was not statistically significant (OR 2.50, 95% CI 0.40–15.56). Conclusion: Third-trimester exercise significantly reduced the duration of the third stage of labor and showed a favorable, though non-significant, trend toward increased physiological management. Exercise interventions represent a low-cost, non-pharmacological strategy with potential to improve maternal outcomes, warranting further validation in larger trials.

Keywords: Third trimester, exercise intervention, third stage of labor, postpartum hemorrhage, maternal mortality, pregnancy outcomes

INTRODUCTION

Pregnancy is a physiological process that enables the continuity of human life, yet it is accompanied by profound maternal adaptations that place women at risk of adverse outcomes during labor and delivery (1). Globally, childbirth remains a critical determinant of maternal survival, with the World Health Organization estimating that approximately 287,000 women die annually from preventable causes related to pregnancy and childbirth, with the majority of these deaths occurring in low-resource settings (2). The process of labor is traditionally divided into three stages: cervical dilation, fetal expulsion, and placental delivery. While extensive research has focused on the first and second stages of labor, the third stage—defined as the interval between fetal delivery and complete placental expulsion—has received comparatively less scientific attention, despite being directly linked to life-threatening complications such as postpartum hemorrhage (3). Postpartum hemorrhage is the leading global cause of maternal mortality, accounting for nearly one-quarter of all maternal deaths, with higher prevalence in developing countries where health system resources and preventive interventions are limited (4).

The third stage of labor normally lasts between 5 and 30 minutes yet delays or inadequate management may result in retained placenta, uterine atony, or severe blood loss, which contribute significantly to maternal morbidity and mortality (5). In Pakistan, maternal mortality remains high, with recent estimates reporting 186 maternal deaths per 100,000 live births, most of which are linked to complications during or immediately after childbirth (6). Addressing the third stage of labor through safe, cost-effective, and non-pharmacological interventions is therefore a public health priority. Exercise during pregnancy has been proposed as one such strategy. Evidence demonstrates that regular prenatal exercise improves cardiovascular efficiency, enhances uterine blood flow, reduces the risk of gestational diabetes, and may

positively influence uterine contractility during labor (7,8). Furthermore, systematic reviews have highlighted that structured exercise programs are associated with improved maternal stamina, reduced fatigue, and better recovery during childbirth (9). Despite this, the potential benefits of exercise interventions specifically on the third stage of labor remain underexplored, with most prior studies focusing on pregnancy complications or birth outcomes more broadly (10).

The existing knowledge gap lies in the lack of evidence-based, context-specific interventions that evaluate whether structured exercise protocols during late pregnancy can facilitate more efficient placental expulsion and reduce adverse maternal outcomes. This gap is particularly significant in low-resource settings, such as Pakistan, where maternal deaths remain unacceptably high and cost-effective, non-invasive interventions are urgently needed to support Sustainable Development Goal (SDG) 3.1, which aims to reduce the global maternal mortality ratio to fewer than 70 per 100,000 live births by 2030 (11).

This study was therefore designed to evaluate the effect of an eight-week, moderate-intensity exercise intervention protocol administered during the third trimester on maternal outcomes in the third stage of labor among singleton gravid women. We hypothesized that women in the intervention group would experience a significantly shorter duration of the third stage of labor and a higher rate of physiological (non-pharmacological) management compared with controls.

MATERIALS AND METHODS

This study employed a quasi-experimental randomized trial design to evaluate the effect of an eight-week moderate-intensity exercise intervention during the third trimester on maternal outcomes in the third stage of labor. The rationale for using this design was to test the causal impact of a structured, non-pharmacological intervention while ensuring feasibility in a real-world clinical setting (12). The research was conducted at the Basic Health Unit (BHU) Sukho, located in Tehsil Gujar Khan, District Rawalpindi, Pakistan, a public health facility serving a predominantly low- to middle-income population. Recruitment and follow-up took place between March and November 2023, ensuring sufficient time to administer the intervention and record outcomes at delivery.

The study population comprised pregnant women in their third trimester carrying a singleton fetus. Eligibility criteria included primigravida status, absence of medical complications, hemoglobin levels within normal physiological range, no prior history of obstetric or chronic disease, and willingness to deliver at the designated facility. Women with high-risk pregnancies, multiple gestations, or medical contraindications to exercise were excluded. Screening of hospital records identified 500 registered pregnancies during the study period. After applying eligibility criteria, 18 women met inclusion standards. These participants were then randomly assigned to intervention (n=10) or control (n=8) groups using a lottery method, following initial purposive sampling of the accessible population. Informed consent was obtained from all participants after a full explanation of study aims, procedures, and potential risks.

Participants in the intervention group undertook an eight-week structured exercise protocol, validated by a panel of maternal health and sports science experts. The program included warm-up sessions (5–10 minutes), a daily 15-minute walking regimen, strength-based training tailored for pregnancy, flexibility stretches, stair climbing twice daily, pelvic floor muscle exercises, and cool-down periods of 5–10 minutes. Instruction was provided both verbally and through demonstration videos, with adherence monitored via weekly check-ins. The control group received standard antenatal care without structured exercise guidance. Baseline demographic and clinical variables such as age, height, and hemoglobin concentration were recorded to ensure group comparability.

The primary outcomes were the duration of the third stage of labor, measured in minutes from fetal delivery to complete placental expulsion, and the mode of management of the third stage, categorized as either physiological (spontaneous expulsion without pharmacological or instrumental assistance) or active (requiring uterotonics or manual intervention). These outcomes were recorded by trained obstetric staff using standardized obstetric records. Secondary outcomes included assessment of potential confounding variables such as maternal age, parity, and baseline health status, which were documented to enable adjusted analyses.

To minimize bias, random allocation was applied after eligibility confirmation, and outcome assessment was blinded to group assignment by ensuring that midwives recording labor details were not informed of intervention status. The small sample size was acknowledged as a limitation; however, sample adequacy was guided by feasibility constraints of the setting. Statistical analyses were performed using SPSS version 25. Descriptive statistics summarized demographic characteristics. Independent-samples t-tests compared mean differences in labor duration between groups, while chi-square tests assessed categorical differences in management type. Missing data were minimized by prospective monitoring and cross-verification of hospital records. Statistical significance was set at $p<0.05$, and effect sizes with 95% confidence intervals were reported to enhance interpretability (13).

All ethical protocols were followed in accordance with the Declaration of Helsinki, and approval was obtained from the institutional review board of MY University, Islamabad. Participants were ensured confidentiality, given the right to withdraw at any stage, and were monitored for any discomfort or complications during exercise. To support reproducibility and integrity, the intervention protocol was documented in detail, and clinical outcomes were extracted from official hospital records rather than self-reports.

RESULTS

A total of 18 participants were enrolled and completed the trial, with 10 allocated to the intervention group and 8 to the control group. Baseline demographic characteristics, including maternal age, height, and hemoglobin concentration, were comparable across groups, minimizing the potential influence of confounding variables.

The duration of the third stage of labor differed substantially between groups. Women in the intervention group had a mean duration of 11.3 ± 4.3 minutes, compared with 23.8 ± 4.8 minutes in the control group. The mean difference of -12.45 minutes (95% CI -17.01 to -7.89) was statistically significant ($t = -5.78$, $df = 16$, $p < 0.001$), indicating that the exercise intervention was associated with a markedly shorter third stage of labor (Table 1). The calculated Cohen's d of 2.63 reflected a very large effect size, suggesting that the observed reduction in labor duration is both statistically robust and clinically meaningful.

Table 1. Comparison of Duration of the Third Stage of Labor between Intervention and Control Groups

Group	N	Mean Duration (min)	SD	Mean Difference (min)	95% CI of Difference	t (df)	p-value	Cohen's d
Intervention	10	11.30	4.30					
Control	8	23.75	4.83	-12.45	-17.01 to -7.89	-5.78 (16)	<0.001	2.63

Table 2. Mode of Management of the Third Stage of Labor

Group	N	Physiological Management (n, %)	Active Management (n, %)	χ^2 (df)	p-value	Odds Ratio (95% CI)
Intervention	10	6 (60.0%)	4 (40.0%)			
Control	8	3 (37.5%)	5 (62.5%)	0.86 (1)	0.35	2.50 (0.40–15.56)

Analysis of the mode of management of the third stage of labor showed that 6 out of 10 women in the intervention group (60.0%) underwent physiological management, compared with 3 out of 8 women in the control group (37.5%). Conversely, active management was more frequent in the control group (62.5%) than in the intervention group (40.0%). The chi-square test did not demonstrate statistical significance ($\chi^2 = 0.86$, $df = 1$, $p = 0.35$). However, the odds of physiological management were 2.5 times higher in the intervention group compared with controls (OR 2.50, 95% CI 0.40–15.56), indicating a clinically relevant trend despite limited statistical power (Table 2).

Collectively, the findings demonstrate that the intervention group benefited from a significant reduction in the duration of the third stage of labor and a non-significant but favorable increase in the likelihood of physiological management. The consistency of these results, even in a small sample, suggests a potential role for structured exercise interventions in improving maternal outcomes during late pregnancy.

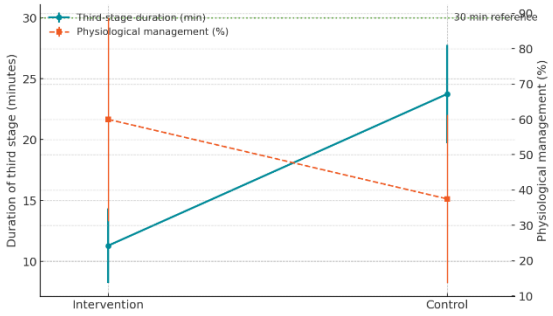

Figure 1 Third-Stage Outcomes by Group: Shorter Duration Aligns with Higher Physiological Management

This dual-axis figure integrates group-wise mean duration of the third stage (minutes, teal) with 95% CIs and the corresponding physiological-management rate (percent, orange) with Wilson 95% CIs. Compared with controls, the intervention group shows a 52.4% shorter mean duration (11.3 vs. 23.8 minutes; CIs non-overlapping) alongside a 22.5 percentage-point higher physiological rate (60.0% vs. 37.5%). The inverse trends align clinically: a lower-duration profile co-occurs with greater physiological management, remaining well below the 30-minute reference threshold marked for context.

DISCUSSION

The present study demonstrated that an eight-week exercise intervention during the third trimester was associated with a markedly shorter duration of the third stage of labor and a clinically favorable trend toward increased physiological management compared with standard care. Specifically, the intervention group experienced a mean reduction of 12.45 minutes in placental expulsion time, representing a 52% decrease relative to controls, with a very large effect size. Although the difference in the rate of physiological versus active management did not achieve statistical significance, the observed odds ratio of 2.5 suggests that exercise may positively influence uterine contractility, thereby reducing reliance on pharmacological or instrumental support.

These findings align with prior evidence demonstrating that antenatal exercise improves maternal cardiovascular efficiency, enhances uteroplacental flow, and facilitates efficient uterine muscle contractility (14,15). Mottola and Artal reported that moderate-intensity physical activity during pregnancy contributes to reduced obstetric complications, particularly gestational diabetes, which is itself a risk factor for prolonged labor and abnormal placental separation (16). Similarly, Owe et al. highlighted that exercise strengthens pelvic floor and abdominal musculature, leading to improved maternal endurance during childbirth (17). Collectively, the present results extend this literature by showing that structured exercise protocols may also optimize outcomes in the third stage of labor, an area that has historically received less research attention.

The reduction in third-stage duration observed in this trial is clinically meaningful. Prolonged placental expulsion increases the risk of retained placenta, uterine atony, and postpartum hemorrhage, which account for nearly one-quarter of global maternal deaths (18). Interventions that shorten this stage may therefore play a role in reducing maternal morbidity and mortality, particularly in low-resource settings such as Pakistan, where the maternal mortality ratio remains unacceptably high at 186 per 100,000 live births (19). These results also resonate with the global agenda under Sustainable Development Goal 3.1, which emphasizes scalable, cost-effective strategies to reduce maternal deaths to fewer than 70 per 100,000 by 2030 (20). Exercise interventions, given their low cost and non-invasive nature, could complement pharmacological protocols by enhancing physiological efficiency and minimizing the need for medicalized management of labor.

However, the absence of statistical significance in the difference in physiological versus active management rates warrants careful interpretation. The small sample size of only 18 participants substantially limited statistical power and precision, as reflected in the wide confidence intervals. In addition, the quasi-experimental design, while incorporating random allocation, may still be prone to selection bias given that the sample was drawn from a single health facility. Moreover, the study population was restricted to low-risk, primigravida women without comorbidities, which limits the generalizability of findings to high-risk pregnancies or multiparous women. Future research should therefore expand to larger, multicenter randomized controlled trials with stratification by parity, comorbidities, and socioeconomic background to provide more definitive evidence.

Despite these limitations, this study provides valuable preliminary insights into the underexplored relationship between exercise and third-stage labor outcomes. Importantly, it highlights the feasibility of integrating structured physical activity into antenatal care protocols in resource-constrained settings. With appropriate cultural adaptation and health system support, exercise programs could serve as a preventive strategy that reduces maternal risk, enhances recovery, and contributes to broader maternal health targets at both national and global levels.

CONCLUSION

This study provides evidence that a structured eight-week exercise intervention protocol administered during the third trimester significantly reduced the duration of the third stage of labor and showed a favorable trend toward increased physiological management compared with routine care. The substantial reduction in placental expulsion time observed in the intervention group underscores the potential of non-pharmacological strategies to enhance maternal outcomes during childbirth. While statistical significance was not achieved for differences in management type, the observed effect size suggests clinical relevance warranting further investigation. Given the low-cost, accessible, and non-invasive nature of exercise interventions, these findings carry important implications for maternal health strategies, particularly in low-resource settings where maternal morbidity and mortality remain high. Larger, multicenter randomized trials are necessary to confirm these preliminary results and establish exercise-based protocols as part of evidence-based antenatal care.

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