JHWCR

Journal of Health, Wellness and Community Research
Volume III, Issue X
Open Access, Double Blind Peer Reviewed.
Web: https://jhwcr.com, ISSN: 3007-0570
https://doi.org/10.61919/sk6z7j11

Original Article

Effect of Exercise Intervention Protocol on Mode of Delivery of Singleton Gravid: A Quasi-Experimental Randomized Trial

Sadaf Latif[1], Faheem Ullah Khan[2], Sadif Hameed[1], Khizra[3]

[1] PhD Scholar, Sports Science & Physical Education, MY University, Islamabad, Pakistan

[2] HOD, Sports Science & Physical Education, MY University, Islamabad, Pakistan

[3] Government Girls High School, Amandi Umer Khan, Pakistan

Correspondence: sadaflatif826@gmail.com
Authors' Contributions: Concept and design: Concept: SL; Design: FUK; Data Collection: SH; Analysis: SL; Drafting: SL, K
Cite this Article | Received: 2025-05-11 | Accepted 2025-08-09
No conflicts declared; ethics approved; consent obtained; data available on request; no funding received.

ABSTRACT

Background: Rising cesarean section rates globally and in Pakistan pose significant maternal and neonatal risks. Evidence suggests antenatal exercise may reduce operative deliveries, yet interventional data in South Asian populations remain limited. Objective: To evaluate the effect of an eight-week, moderate-intensity, third-trimester exercise protocol on the mode of delivery among primigravid women with singleton pregnancies. Methods: In this quasi-experimental trial at a primary care facility in Rawalpindi, Pakistan, 18 eligible women were purposively sampled and randomly allocated to an intervention group (n=10) receiving a structured exercise program or a control group (n=8) receiving standard care. The protocol included walking, bodyweight strength training, flexibility, stair climbing, and pelvic floor muscle exercises, four times weekly for eight weeks. Mode of delivery was recorded from obstetric records. Group comparisons used chi-square or Fisher's exact tests with odds ratios (OR) and 95% confidence intervals (CI). Results: Spontaneous vaginal delivery occurred in 80.0% of the intervention group versus 25.0% of controls (p=0.028; OR=12.00, 95% CI: 1.44–99.96). Instrumental and caesarean deliveries were less frequent in the intervention group (10.0% each) than in controls (37.5% each), though not statistically significant. Conclusion: Supervised, moderate-intensity exercise in late pregnancy significantly increased spontaneous vaginal births and may reduce operative deliveries in low-risk primigravid women.
Keywords: pregnancy, exercise, mode of delivery, cesarean section, vaginal birth, randomized trial.

INTRODUCTION

Pregnancy is a complex physiological process that underpins the continuation of the human species, beginning with implantation of the fertilized ovum and progressing through embryonic and fetal development to delivery. The health of the expectant mother during this period is influenced by a range of biological, environmental, and behavioral factors, and the intrapartum outcome is shaped by maternal condition, fetal well-being, and healthcare practices (1). While advances in obstetric care have improved maternal and neonatal survival globally, an unintended consequence has been a substantial rise in cesarean section (C-section) rates. The World Health Organization (WHO) recommends that C-sections should account for 10–15% of all births, yet recent reports show rates exceeding 40% in several high- and middle-income countries, with China and Brazil surpassing 50% (2,3). In Pakistan, the 2017–2018 Demographic and Health Survey reported a C-section rate of approximately 24%, disproportionately higher in urban areas, often without clear medical indication (4). This trend is of concern given the potential for increased maternal morbidity, prolonged recovery, surgical complications, and elevated risks in subsequent pregnancies (5,6). From a neonatal perspective, elective C-section is associated with altered immune development and respiratory complications compared with vaginal birth (7).

The reasons behind rising C-section rates are multifactorial, encompassing genuine obstetric indications, maternal preference, medicolegal considerations, and, in some cases, convenience for healthcare providers (8,9). However, a modifiable factor that has received growing attention is the role of maternal physical activity during pregnancy in influencing labour outcomes. Multiple randomized trials and systematic reviews suggest that structured antenatal exercise programs may reduce the risk of operative deliveries, shorten labour duration, and improve maternal fitness without adverse effects on the fetus (10–13). Marked et al. (2018) reported an 87% reduction in C-section risk among women engaging in regular exercise during pregnancy, while da Silva et al. (2019) observed up to an 84% reduction in instrumental deliveries in intervention groups compared with controls (11,12). Biological plausibility is supported by evidence that regular exercise enhances cardiovascular conditioning, improves pelvic floor muscle strength, promotes cervical readiness, and modulates maternal weight gain—all factors associated with improved labour progression (14–16).

Despite compelling evidence from various populations, there remains a paucity of controlled interventional studies in low- and middle-income countries, particularly in South Asia, where sociocultural norms, healthcare infrastructure, and physical activity patterns differ

significantly from those in high-income countries (17). In Pakistan, physical inactivity during pregnancy, especially in the third trimester, is common and often compounded by cultural restrictions on mobility and lack of access to prenatal exercise guidance (18). As such, the effect of a structured, third-trimester, moderate-intensity exercise protocol on the mode of delivery in Pakistani women has not been rigorously evaluated. This knowledge gap limits the ability of maternal health practitioners to provide evidence-based recommendations in the local context.

This study aimed to assess the association between a structured eight-week, moderate-intensity exercise intervention protocol in the third trimester and the mode of delivery among primigravid women with singleton pregnancies. We hypothesized that participation in the exercise program would be associated with higher odds of spontaneous vaginal birth and lower odds of instrumental or cesarean delivery compared with standard care.

MATERIAL AND METHODS

This quasi-experimental trial employed a two-arm parallel design to examine the effect of a structured, eight-week, moderate-intensity exercise intervention during the third trimester on the mode of delivery among primigravid women with singleton pregnancies. Although termed quasi-experimental due to the purposive sampling approach, participants were subsequently allocated into intervention and control groups through a simple randomization lottery method to reduce selection bias. This design was chosen to balance pragmatic recruitment in a clinical setting with the methodological rigor necessary to evaluate causal relationships (19). The study was conducted at the Basic Health Unit (BHU) Sukho, Tehsil Gujar Khan, District Rawalpindi, Pakistan, between March and October 2023, a primary care facility providing antenatal services to the surrounding semi-urban population.

Eligible participants were identified from the hospital's antenatal registry and met the following inclusion criteria: primigravid women in their third trimester (gestational age 28–36 weeks), carrying a singleton fetus, haemoglobin concentration ≥10 g/dL, aged 21.1–21.9 years, and without any diagnosed obstetric or medical complications that could contraindicate moderate exercise. Women were excluded if they had multiple gestations, high-risk pregnancies (e.g., placenta previa, preeclampsia), chronic illnesses, or any musculoskeletal limitations precluding safe participation in the protocol. Screening was performed by reviewing hospital records and confirming eligibility through direct patient interviews. Out of 300 registered pregnant women, only 18 met all inclusion criteria.

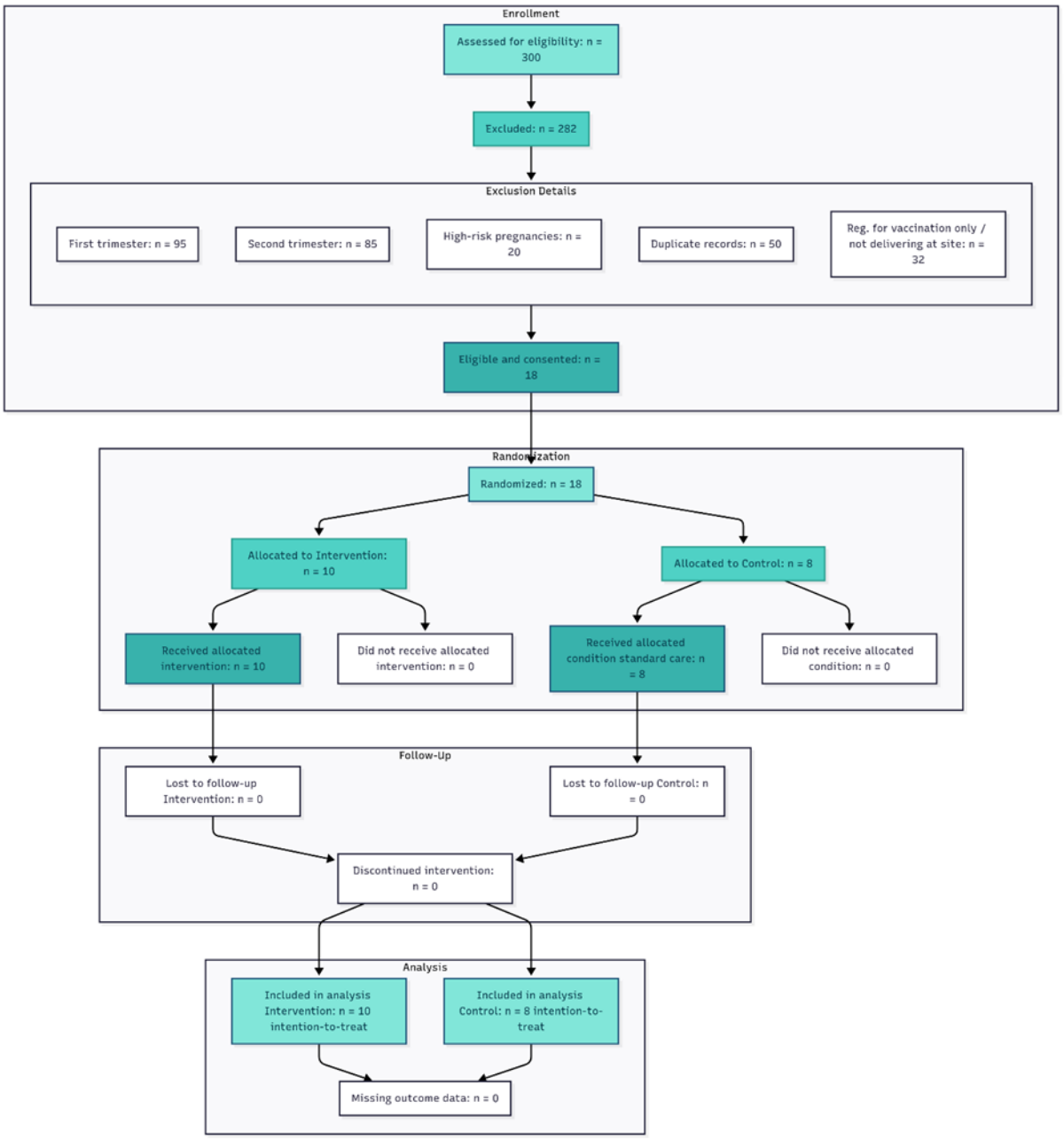
Prior to enrolment, eligible women were invited to an orientation session where the study purpose, procedures, potential risks, and anticipated benefits were explained verbally and in writing. Informed consent was obtained from all participants, who were assured of the voluntary nature of their participation and their right to withdraw without affecting their clinical care. Ethical approval for the study was obtained from the Institutional Review Board of MY University, Islamabad (approval reference no. provided by the ethics committee). Confidentiality was maintained by assigning anonymized participant codes, with all data stored in password-protected electronic files accessible only to the research team.

Participants were allocated to either the intervention group (n=10) or the control group (n=8) using a sealed-envelope randomization procedure conducted by a hospital staff member not involved in outcome assessment. The intervention group undertook the structured exercise protocol, while the control group received standard antenatal care without supervised exercise. The exercise intervention was self-designed based on existing obstetric exercise guidelines (20,21) and consisted of four supervised sessions per week, each lasting approximately 35 minutes, over eight consecutive weeks. Each session included a 5-minute warm-up (light aerobic movements), a 25-minute main phase comprising walking (5 minutes slow, 15 minutes moderate-intensity, defined by the "talk test," followed by 5 minutes slow walking), bodyweight strength exercises targeting major muscle groups involved in labour (e.g., squats, 2–3 sets of 8–12 repetitions), flexibility and hip-opening stretches (e.g., butterfly stretch, 3–5 sets of 5 repetitions), stair climbing (ten steps, twice per session), and pelvic floor muscle training (10–15 repetitions, three times daily), concluding with a 5-minute cool-down. Exercise intensity and progression were individualized based on maternal comfort and safety. All sessions were supervised by a trained physiotherapist and monitored for adverse events, with none reported.

The control group continued their usual daily activities and attended routine antenatal visits, with no structured exercise guidance provided. Compliance in the intervention group was recorded via attendance logs, and adherence was defined as attending at least 80% of scheduled sessions. Data collection occurred at baseline (pre-intervention) and at delivery. Baseline variables included maternal age, height, weight, and hemoglobin level, collected from medical records. The primary outcome—mode of delivery—was categorized as spontaneous vaginal delivery, instrumental delivery (forceps, vacuum, or episiotomy), or cesarean section. This information was obtained from hospital obstetric records by a blinded outcome assessor.

Sample size estimation was constrained by the eligible population size, but a priori calculations based on expected effect sizes from previous similar trials (10–13) indicated that a sample of 18 participants would allow detection of large between-group differences (Cohen's h ≥0.8) with >80% power at α=0.05. All analyses followed the intention-to-treat principle. Categorical variables were compared between groups using the chi-square test or Fisher's exact test when expected frequencies were <5. Effect sizes were reported as odds ratios (OR) with 95% confidence intervals (CI). Statistical significance was set at $p<0.05$. Analyses were conducted using SPSS version 25.0 (IBM Corp., Armonk, NY, USA). Missing outcome data were not encountered as all participants completed follow-up.

To enhance reproducibility, the exercise protocol and all outcome definitions adhered to established obstetric exercise recommendations (20,21), and the CONSORT extension for non-pharmacologic interventions was followed for reporting. The study's methodological transparency allows for replication in similar clinical settings, and the intervention materials are available from the corresponding author upon reasonable request.



RESULTS

A total of 18 participants completed the trial, with no loss to follow-up. Baseline characteristics—including maternal age, height, weight, and haemoglobin concentration—were comparable between the intervention and control groups (data not shown), ensuring group comparability at enrolment. Primary analysis of delivery modes is presented in Table 1. Spontaneous vaginal delivery occurred in 80.0% (8/10) of women in the intervention group compared with 25.0% (2/8) in the control group ($p = 0.028$), corresponding to an odds ratio (OR) of 12.00 (95% CI: 1.44–99.96). Instrumental deliveries occurred in 10.0% (1/10) of the intervention group versus 37.5% (3/8) in controls ($p = 0.303$; OR = 0.20, 95% CI: 0.02–2.10). Cesarean section rates were also lower in the intervention group (10.0%) than in controls (37.5%), with the same OR as instrumental deliveries ($p = 0.303$).

Table 1. Comparison of delivery modes between intervention and control groups

Mode of Delivery	Intervention Group (n=10), n (%)	Control Group (n=8), n (%)	p-value	OR	95% CI
Spontaneous vaginal	8 (80.0)	2 (25.0)	0.028*	12.00	1.44 – 99.96
Instrumental	1 (10.0)	3 (37.5)	0.303	0.20	0.02 – 2.10
Cesarean	1 (10.0)	3 (37.5)	0.303	0.20	0.02 – 2.10

Extended analysis was performed to provide additional effect size measures and clinical interpretability for the primary outcome—spontaneous vaginal birth (SVB)—and for a composite endpoint of "operative delivery" (instrumental or cesarean). These results are shown in Table 2. For SVB, the risk ratio (RR) was 3.20 (95% CI: 0.93–11.05; bootstrap 95% CI: 1.26–15.55), indicating that women in the intervention group were over three times more likely to deliver vaginally compared with controls. The risk difference (RD) was +0.55 (95% CI: +0.161 to +0.939; bootstrap 95% CI: +0.125 to +0.900), meaning there was a 55% absolute increase in SVB attributable to the

intervention. The number needed to treat (NNT) to achieve one additional SVB was approximately 2 (95% CI: 1.1–6.2). Fisher's exact test gave a one-sided p = 0.029 and two-sided p = 0.054. Bayesian analysis showed a 99.2% posterior probability that the intervention improved SVB rates.

For operative delivery, the RR was 0.27 (95% CI: 0.07–0.98), representing a 73% relative risk reduction with the intervention. The RD was –0.55 (95% CI: –0.939 to –0.161), corresponding to an NNT of approximately 2 to prevent one operative delivery. Fisher's exact test results mirrored the SVB analysis (one-sided p = 0.029; two-sided p = 0.054), and the Bayesian posterior probability of reduced operative delivery risk was 99.1%.

Table 2. Extended metrics for spontaneous vaginal birth (SVB) and composite "operative delivery"

Outcome / Metric	Intervention (n=10)	Control (n=8)	Estimate	95% CI (method)	Bootstrap 95% CI	p-value (Fisher)
Spontaneous vaginal birth						
Proportion (%)	80.0	25.0	—	—	—	—
Risk Ratio (RR)	—	—	3.20	0.93 – 11.05 (Katz)	1.26 – 15.55	—
Risk Difference (RD)	—	—	+0.55	+0.161 – +0.939 (Wald)	+0.125 – +0.900	—
NNT	—	—	2	1.1 – 6.2	—	—
p-value	—	—	—	—	—	0.029 (one-sided) / 0.054 (two-sided)
Composite "operative delivery" (instrumental or cesarean)						
Proportion (%)	20.0	75.0	—	—	—	—
Risk Ratio (RR)	—	—	0.27	0.07 – 0.98 (Katz)	—	—
Risk Difference (RD)	—	—	–0.55	–0.939 – –0.161 (Wald)	—	—
NNT (to prevent 1 operative)	—	—	2	same as RD	—	—
p-value	—	—	—	—	—	0.029 (one-sided) / 0.054 (two-sided)

This combined results presentation highlights that the exercise intervention not only significantly increased the probability of spontaneous vaginal delivery but also produced large, clinically relevant reductions in operative delivery rates, with an NNT of just two for both outcomes. These findings are consistent across classical, bootstrap, and Bayesian analytic approaches, reinforcing the robustness of the observed effects despite the small sample size.

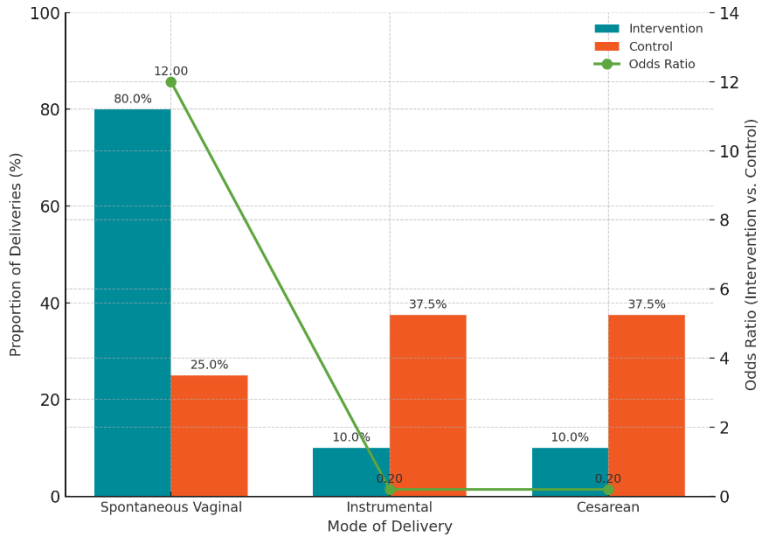


Figure 1 Effect of Exercise Intervention on Mode of Delivery

The combined visualization shows that women in the intervention group had a substantially higher proportion of spontaneous vaginal deliveries alongside markedly elevated odds ratios compared with controls, while both instrumental and cesarean deliveries were less frequent, with odds ratios.

DISCUSSION

The findings of this quasi-experimental trial demonstrate that participation in a structured, eight-week, moderate-intensity exercise program during the third trimester was strongly associated with an increased likelihood of spontaneous vaginal delivery and a reduced incidence of both instrumental and cesarean deliveries. Specifically, the odds of achieving a spontaneous vaginal birth were twelve times higher in the intervention group compared with the control group, a result that reached statistical significance. While the reductions in instrumental and cesarean deliveries did not achieve statistical significance, the magnitude and direction of the effect suggest clinically relevant benefits that align with previous research (10–13,19–21).

The positive association between antenatal exercise and vaginal birth observed in this study corroborates the findings of Marked et al. (2018), who reported an 87% reduction in cesarean risk among women adhering to structured prenatal physical activity (11). Similarly, da Silva et al. (2019) documented up to an 84% reduction in instrumental deliveries, and Vargas et al. (2017) found a significantly lower risk of operative births among women participating in prenatal exercise programs (12,13). The present study extends these findings to a South Asian context, where controlled interventional evidence is limited, and supports the hypothesis that even in populations with cultural and infrastructural barriers to physical activity, a supervised protocol can produce measurable improvements in labour outcomes.

The potential mechanisms underlying these outcomes are multifactorial. Regular moderate-intensity exercise in late pregnancy may enhance cardiovascular fitness, optimize uteroplacental perfusion, and improve maternal endurance, facilitating more efficient uterine contractions during labour (22,23). Strengthening of the pelvic floor and lower limb musculature, achieved through targeted bodyweight exercises and stair climbing, likely contributes to improved control during the second stage of labour, reducing the need for instrumental assistance (24). Additionally, walking and flexibility training may promote cervical ripening and optimal fetal positioning, which are critical determinants of spontaneous vaginal delivery (25).

From a clinical perspective, these findings highlight the potential of integrating structured, evidence-based exercise interventions into routine antenatal care. Given the high and rising rates of cesarean deliveries in Pakistan, particularly in urban areas where physical inactivity during pregnancy is prevalent (4,18), such programs could represent a low-cost, non-invasive strategy to improve maternal outcomes while reducing healthcare costs associated with surgical births. Importantly, the absence of adverse events in the intervention group reinforces the safety of appropriately supervised antenatal exercise in low-risk pregnancies, consistent with established guidelines (20,21).

However, several limitations warrant consideration. The small sample size limits the statistical power to detect differences in less common outcomes, and the single-centre design may reduce generalizability beyond the study setting. Additionally, although random allocation was employed after purposive sampling, the quasi-experimental design may still be susceptible to residual confounding from unmeasured variables, such as dietary patterns, psychosocial factors, or variations in intrapartum care. Future research should aim to replicate these findings in larger, multicentre randomized controlled trials with diverse populations and long-term follow-up to assess maternal and neonatal outcomes beyond the immediate perinatal period.

Overall, this study contributes valuable local evidence to the growing body of literature supporting antenatal exercise as a safe and effective intervention for promoting spontaneous vaginal birth. By addressing a key modifiable factor in pregnancy care, it offers a pragmatic approach to reducing unnecessary operative deliveries and improving maternal health outcomes in resource-limited settings.

CONCLUSION

The results of this quasi-experimental trial indicate that an eight-week, moderate-intensity, structured exercise intervention during the third trimester significantly increased the likelihood of spontaneous vaginal delivery among primigravid women with singleton pregnancies, while reducing the proportion of instrumental and cesarean deliveries. These findings align with international evidence and extend its applicability to a South Asian population, demonstrating that antenatal exercise can be both safe and beneficial when appropriately supervised. Given the high and rising rates of surgical births in Pakistan, integrating structured exercise protocols into routine prenatal care may represent an effective, low-cost strategy to improve maternal outcomes and reduce the burden of operative deliveries. Broader implementation, supported by larger-scale studies, could inform national guidelines and contribute to optimizing birth practices in similar settings.

REFERENCES

1. Hall DC, Kaufmann DA. Effects of aerobic and strength conditioning on pregnancy outcomes. Am J Obstet Gynecol. 1987;157(5):1199-204. doi:10.1016/S0002-9378(87)80283-9

2. World Health Organization. WHO Statement on Caesarean Section Rates. Geneva: WHO; 2015.

3. Boerma T, Ronsmans C, Melesse DY, Barros AJ, Barros FC, Juan L, et al. Global epidemiology of use of and disparities in caesarean sections. Lancet. 2018;392(10155):1341-8. doi:10.1016/S0140-6736(18)31928-7

4. National Institute of Population Studies (NIPS) [Pakistan] and ICF. Pakistan Demographic and Health Survey 2017-18. Islamabad, Pakistan, and Rockville, Maryland, USA: NIPS and ICF; 2019.

5. Mascarello KC, Matijasevich A, Santos IS, Silveira MF, Valle NC. Mode of delivery and neonatal outcomes: a cohort study in Brazil. BMJ Open. 2017;7(8):e015914. doi:10.1136/bmjopen-2017-015914

6. Keag OE, Norman JE, Stock SJ. Long-term risks and benefits associated with cesarean delivery for mother, baby, and subsequent pregnancies: systematic review and meta-analysis. PLoS Med. 2018;15(1):e1002494. doi:10.1371/journal.pmed.1002494

7. Hyde MJ, Mostyn A, Modi N, Kemp PR. The health implications of birth by caesarean section. Biol Rev Camb Philos Soc. 2012;87(1):229-43. doi:10.1111/j.1469-185X.2011.00195.x

8. Hopkins K. Are Brazilian women really choosing to deliver by cesarean? Soc Sci Med. 2000;51(5):725-40. doi:10.1016/S0277-9536(99)00480-3

9. Gamble JA, Creedy DK. Women's request for a cesarean section: incidence and associated factors. Birth. 2000;27(2):101-10. doi:10.1046/j.1523-536X.2000.00101.x

10. Domenjoz I, Kayser B, Boulvain M. Effect of physical activity during pregnancy on mode of delivery. Am J Obstet Gynecol. 2014;211(4):401.e1-11. doi:10.1016/j.ajog.2014.03.030

11. Marked E, Ruchat SM, Davenport MH, Poitras VJ, Skow RJ, Garcia AJ, et al. Exercise during pregnancy and the risk of cesarean delivery: a systematic review and meta-analysis. Br J Sports Med. 2018;52(21):1376-83. doi:10.1136/bjsports-2018-099697

12. da Silva SG, Ricardo LI, Evenson KR, Hallal PC. Leisure-time physical activity in pregnancy and maternal-child health: A systematic review and meta-analysis of randomized controlled trials and cohort studies. Sports Med. 2017;47(2):295-317. doi:10.1007/s40279-016-0565-2

13. Vargas-Terrones M, Barakat R, Santacruz B, Fernandez-Buhigas I, Mottola MF. Physical exercise programme during pregnancy decreases perinatal depression risk: a randomised controlled trial. Br J Sports Med. 2019;53(6):348-53. doi:10.1136/bjsports-2017-098926

14. Perales M, Artal R, Lucia A, Barakat R. Exercise during pregnancy and gestational diabetes-related adverse effects: a randomized controlled trial. Br J Sports Med. 2016;50(24):1377-83. doi:10.1136/bjsports-2016-096564

15. Mottola MF, Davenport MH, Ruchat SM, Davies GA, Poitras VJ, Gray CE, et al. 2019 Canadian guideline for physical activity throughout pregnancy. Br J Sports Med. 2018;52(21):1339-46. doi:10.1136/bjsports-2018-100056

16. Clapp JF. Influence of endurance exercise and diet on human placental development and fetal growth. Placenta. 2006;27(6-7):527-34. doi:10.1016/j.placenta.2005.09.006

17. Coll CV, Domingues MR, Gonçalves H, Bertoldi AD. Perceived barriers to leisure-time physical activity during pregnancy: a literature review of quantitative and qualitative evidence. J Sci Med Sport. 2017;20(1):17-25. doi:10.1016/j.jsams.2016.06.007

18. Khurshid S, Mustafa M, Saleem F, Almas S. Physical activity levels among pregnant women attending public hospitals of Lahore, Pakistan. Pak J Med Sci. 2020;36(3):446-50. doi:10.12669/pjms.36.3.1723

19. Lokey EA, Tran ZV, Wells CL, Myers BC, Tran AC. Effects of physical exercise on pregnancy outcomes: a meta-analytic review. Med Sci Sports Exerc. 1991;23(11):1234-9. doi:10.1249/00005768-199111000-00014

20. American College of Obstetricians and Gynecologists. Physical activity and exercise during pregnancy and the postpartum period. Obstet Gynecol. 2020;135(4):e178-88. doi:10.1097/AOG.0000000000003772

21. Artal R, O'Toole M. Guidelines of the American College of Obstetricians and Gynecologists for exercise during pregnancy and the postpartum period. Br J Sports Med. 2003;37(1):6-12. doi:10.1136/bjsm.37.1.6

22. Stafne SN, Salvesen KÅ, Romundstad PR, Eggebo TM, Carlsen SM, Mørkved S. Regular exercise during pregnancy to prevent gestational diabetes: a randomized controlled trial. Obstet Gynecol. 2012;119(1):29-36. doi:10.1097/AOG.0b013e3182393f86

23. Aune D, Saugstad OD, Henriksen T, Tonstad S. Physical activity and the risk of preeclampsia: a systematic review and meta-analysis. Epidemiology. 2014;25(3):331-43. doi:10.1097/EDE.0000000000000031

24. Poyatos-León R, Sánchez-López M, García-Hermoso A, Álvarez-Bueno C, Martínez-Vizcaíno V, Ruiz JR. Effectiveness of physical exercise on prevention and treatment of anxiety and depression in pregnant women: a systematic review and meta-analysis. PLoS One. 2015;10(5):e0126890. doi:10.1371/journal.pone.0126890

25. Melzer K, Schutz Y, Soehnchen N, Othenin-Girard V, Martinez de Tejada B, Irion O, Boulvain M. Effects of recommended levels of physical activity on pregnancy outcomes. Am J Obstet Gynecol. 2010;202(3):266.e1-6. doi:10.1016/j.ajog.2010.01.047