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Structured Antenatal Physical Activity and Gestational Weight Gain: A Randomized Controlled Trial

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Abstract **Objective:** To compare gestational weight gain between pregnant women receiving a structured antenatal physical activity program and those receiving standard antenatal care with routine daily activity. **Methods:** This parallel-group randomized controlled trial included 100 pregnant women with singleton pregnancies between 20 and 24 weeks of gestation. Participants were allocated equally to a structured physical activity group (n=50) or a routine activity group (n=50). The intervention comprised supervised low- to moderate-intensity exercise totalling 150 minutes per week from recruitment until delivery. Gestational weight gain was the primary outcome; gestational age at delivery and adverse maternal events were secondary outcomes. **Results:** All randomized participants were included in the final analysis. The structured physical activity group demonstrated significantly better regulation of gestational weight gain than the routine activity group ($p<0.001$). No exercise-related maternal complications or adverse neonatal events were reported during the study period. **Conclusion:** A structured, supervised antenatal exercise program may help regulate gestational weight gain without compromising maternal or neonatal safety. The findings support the inclusion of physiotherapist-guided exercise as an adjunct to routine antenatal care, although future studies should report detailed effect sizes, adherence, dietary monitoring and neonatal indicators.

Key Words Antenatal Exercise, Gestational Weight Gain, Pregnancy, Randomized Controlled Trial, Structured Physical Activity

INTRODUCTION

Pregnancy is accompanied by substantial anatomical, metabolic and hormonal adaptations that support foetal growth and maternal physiological adjustment. Appropriate gestational weight gain is clinically important because both excessive and inadequate gain are associated with adverse outcomes, including gestational diabetes mellitus, hypertensive disorders, caesarean delivery, postpartum weight retention, macrosomia and low birth weight. Structured lifestyle approaches that support healthy weight gain therefore remain a priority in antenatal care.

Physical activity is a well-established non-pharmacological strategy for improving cardiometabolic health, insulin sensitivity, musculoskeletal function and psychological well-being. During pregnancy, appropriately prescribed exercise can support healthy gestational weight gain and reduce the risk of selected pregnancy-related complications without compromising fetal safety. However, many pregnant women remain insufficiently active and routine daily activities such as household work or casual walking may not provide the frequency, intensity or progression needed to influence weight-related outcomes meaningfully.

In India, participation in antenatal exercise is often limited by safety concerns, cultural beliefs, inconsistent counselling and the absence of widely implemented locally adapted protocols. In routine practice, women are frequently advised to remain generally active, but they may not receive a clear exercise prescription regarding weekly duration, supervision, progression or warning signs. Structured physical activity programs address these gaps by defining exercise dosage, improving monitoring and enabling safer implementation by trained professionals.

Although international guidance supports regular physical activity during uncomplicated pregnancy, randomized evidence from Indian clinical settings remains

limited. The present study was therefore designed to compare gestational weight gain between women receiving a structured antenatal physical activity program and those receiving standard antenatal care with routine activity. The primary outcome was gestational weight gain, while maternal safety and gestational age at delivery were secondary outcomes. It was hypothesized that structured physical activity would improve gestational weight gain regulation without adversely affecting maternal or neonatal safety.

METHODS

Study Design

This study was designed as a prospective, parallel-group randomized controlled trial conducted at a tertiary care teaching hospital in South India between January 2023 and January 2025. The study followed the ethical principles of the Declaration of Helsinki and was reported in line with key CONSORT recommendations.

Participants

A total of 100 pregnant women with singleton pregnancies were recruited between 20 and 24 weeks of gestation. Eligible participants were aged 20-35 years, had no pre-existing medical comorbidities and were willing to provide written informed consent. Women with high-risk pregnancies requiring activity restriction, pre-existing diabetes mellitus, hypertension, cardiac disease, orthopaedic or neurological limitations to exercise or any obstetric contraindication to exercise were excluded.

Randomization and Allocation

Participants were randomized in a 1:1 ratio to the intervention and control groups using a computer-generated allocation sequence. Allocation concealment was reported to have been maintained using sealed opaque envelopes. The source manuscript did not provide additional information regarding the personnel responsible for sequence generation, enrolment or assignment; this has been acknowledged as a reporting limitation.

Intervention

The intervention group received a structured antenatal physical activity program totalling 150 minutes per week of low- to moderate-intensity exercise from recruitment until delivery. The program included warm-up and stretching, low-impact aerobic activity such as brisk walking, body-weight strengthening exercises and cool-down/relaxation components. Sessions were supervised by trained physiotherapy professionals and adjusted according to gestational age, maternal tolerance and safety considerations. Participants were monitored for discomfort, warning signs and adverse events throughout the intervention. The control group received standard antenatal care and was advised to continue routine daily activity, including household work and walking, without a structured exercise prescription.

Outcome Measures and Data Collection

The primary outcome was gestational weight gain measured from baseline to the end of the intervention period. Secondary outcomes included gestational age at delivery and the incidence of adverse maternal events. Baseline demographic and clinical data were recorded at recruitment. Maternal weight was measured using standardized procedures. However, the source manuscript did not specify scale calibration, clothing standardization, timing of measurement or whether assessors were blinded; these items have been retained as methodological limitations rather than inferred.

Statistical Analysis

Data were analysed using SPSS software. Continuous variables were summarized as mean +/- standard deviation and between-group comparisons were performed using appropriate statistical tests. Because the original manuscript reported only p-values and did not provide arm-wise summary estimates, mean differences, confidence intervals, effect sizes or adherence rates, those metrics could not be inserted without access to the primary dataset. This limitation has been stated explicitly.

RESULTS

All 100 randomized participants were included in the final analysis according to the source manuscript. Baseline demographic and obstetric characteristics were reported to be comparable between the two groups, with no statistically significant differences in age, gestational age at recruitment or baseline weight.

Women in the structured physical activity group demonstrated significantly better regulation of gestational weight gain than those in the routine activity group ($p<0.001$). The intervention group was also described as being more likely to achieve gestational weight gain within recommended ranges. Because the uploaded manuscript did not include arm-wise mean gestational weight gain values, mean differences, 95% confidence intervals or effect sizes, these data could not be added in the revised manuscript without introducing unsupported numerical information.

Table 1: Summary of outcomes reported in the source manuscript

Outcome	Finding	Reporting note
Gestational weight gain	Significantly better regulation in structured activity group ($p<0.001$)	Arm-wise means, mean difference and 95% CI not reported in source file
Gestational age at delivery	Secondary outcome listed	Numerical results not provided in source file
Maternal safety	No exercise-related maternal complications reported	No adverse-event table provided
Neonatal safety	No adverse neonatal outcomes reported	Specific neonatal indicators not provided

No exercise-related maternal complications were reported. The source manuscript also stated that no adverse neonatal outcomes occurred during the study period; however, specific neonatal indicators such as birth weight, Apgar score, neonatal intensive care unit admission or mode of delivery were not presented in tabular form (Table 1).

DISCUSSION

This randomized controlled trial suggests that a structured antenatal physical activity program may improve regulation of gestational weight gain when compared with routine daily activity alone. The finding is biologically plausible because regular moderate exercise can improve insulin sensitivity, energy expenditure and overall metabolic efficiency while also supporting musculoskeletal conditioning during pregnancy.

The present findings are broadly consistent with prior randomized and systematic evidence showing that supervised antenatal exercise may reduce excessive gestational weight gain and improve selected maternal outcomes. Structured programs differ from unstructured routine activity because they specify exercise dose, provide supervision and allow progressive monitoring of safety and adherence. These features are especially relevant in clinical settings where pregnant women may otherwise receive only generic advice to remain active.

The study also has practical relevance for the Indian antenatal context. Cultural caution toward exercise during pregnancy, lack of formalized exercise counselling and limited access to physiotherapist-guided programs may all reduce participation in beneficial activity. A structured program delivered by trained physiotherapy professionals offers a feasible model for integrating exercise into antenatal care, provided that screening, warning signs and obstetric clearance are observed.

Nevertheless, the interpretation of these findings should remain conservative. The source manuscript did not provide detailed arm-wise outcome estimates, adherence or fidelity data, dietary monitoring or standard neonatal outcome tables. Diet is a particularly important potential confounder in gestational weight studies and the absence of nutritional monitoring limits causal interpretation. Similarly, the manuscript referred to maternal metabolic health, but metabolic markers such as blood glucose and blood pressure were not reported. These claims have therefore been narrowed in the revised version to focus on gestational weight gain and safety.

Additional limitations include the single-centre setting, the lack of postpartum follow-up and incomplete reporting of assessor blinding and trial registration. Larger trials with detailed intervention reporting, adherence tracking, dietary assessment, subgroup analysis by baseline body mass index and postpartum follow-up are needed to strengthen the evidence base and support local antenatal exercise protocols.

CONCLUSIONS

Structured, supervised antenatal physical activity appears to support better regulation of gestational weight gain than routine daily activity alone in women with uncomplicated singleton pregnancies. On the basis of the available manuscript data, the program was not associated with reported maternal or neonatal harm. Moderate-intensity antenatal exercise totaling 150 minutes per week may therefore be considered a useful adjunct to routine antenatal care when delivered with appropriate screening and supervision, while future studies should provide detailed quantitative outcomes, adherence data and neonatal indicators.

Strengths and Limitations

The main strengths of the study are its randomized controlled design, structured supervised intervention, clinically relevant primary outcome and complete follow-up as stated in the source manuscript. Its principal limitations are incomplete quantitative outcome reporting, lack of dietary monitoring, lack of adherence/fidelity reporting, absence of detailed neonatal outcome data and no postpartum follow-up.

Clinical Implications

The findings support the integration of structured, supervised exercise counselling into routine antenatal care for eligible women. Physiotherapists may play a central role in prescribing safe, moderate-intensity exercise, screening warning signs and reinforcing adherence.

Ethical Statement

Ethical approval was obtained from the Institutional Ethics Committee. Written informed consent was obtained from all participants.

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