LETTERS IN BIOMATHEMATICS
**An International Journal**

RESEARCH ARTICLE

OPEN ACCESS

# Effectiveness of Labour Supportive Measures on Labour Pain Among Parturient Mothers Admitted to Selected Hospitals: A Comparative Study

**D. Regina Rabello[1], Dr.Binsha Pappachan*[2], Dr. Anjana Agarwal[3]**

Ph D Scholar, Yenepoya ( Deemed to be ) University, University Road, Deralakatte, Mangaluru, Karnataka 575018. Contact e-mail: joeaugus2020@gmail.com, University ID ddphd@yenepoya.edu.in
Professor and HoD, Yenepoya Nursing College, Yenepoya ( Deemed to be ) University, University Road, Deralakatte, Mangaluru, Karnataka 575018, Contact E-mail: binshadennis@yenepoya.edu.in
MBBS. MS, Professor & Head, Dept. Obstetrics & Gynaecology, Hind Institute of Medical sciences, Safedabad, Barabanki, UP 225003, Contact E-mail anjana.agarwal98@gmail.com

## ABSTRACT

**Background:** Labour supportive measures may improve women's coping and pain experience during childbirth. Their effectiveness requires comparison with routine maternity care.
**Objectives:** To compare labour pain between mothers receiving labour supportive measures and routine maternity care, and examine associations between pain and selected demographic and obstetric variables in the supportive-measures group.
**Material and Methods:** An open-label, parallel-group randomized controlled study included 300 parturient mothers, with 150 per group. The intervention comprised birth ball exercises, birth bar-assisted positioning, breathing exercises and massage alongside routine care. Pain scores on a 0–10 scale were assessed at baseline and every 60 minutes. Between-group comparisons used baseline-adjusted analysis of covariance with HC3 robust standard errors. Exploratory within-group associations were assessed using Kruskal–Wallis tests, with Holm adjustment across 12 comparisons.
**Results:** Mean baseline pain scores were 6.84 ± 0.98 and 6.81 ± 1.06 in the supportive-measures and routine-care groups, respectively. At every 60 minutes, corresponding scores were 5.63 ± 1.69 and 7.61 ± 1.59. The adjusted difference was −2.01 points (95% CI −2.30 to −1.71; $p < 0.001$). No exploratory association remained statistically significant after Holm adjustment.
**Conclusion:** Labour supportive measures were associated with lower pain at every 60 minutes than routine maternity care. Interpretation is limited by the short assessment period and incomplete documentation of allocation concealment, intervention fidelity and concomitant treatment.

**ARTICLE HISTORY**
Received October 15, 2026
Accepted November 19, 2026

**KEYWORDS**
Labour pain; supportive care; parturient mothers; maternity nursing; numerical rating scale; comparative study.

## 1. Introduction

Labour pain is a central concern in maternity nursing because women require both clinical surveillance and care that supports comfort, autonomy and participation. The World Health Organization recommends relaxation and manual techniques for healthy women requesting labour pain relief, according to their preferences.[1] These recommendations provide a rationale for studying supportive measures while preserving access to requested pharmacological analgesia.

Evidence for individual techniques is encouraging but varies across interventions and settings. Chang and colleagues reported lower behavioural pain reactions with massage in a randomized trial.[2] In a smaller trial, Janssen and colleagues observed lower massage-group pain scores without statistically significant between-group differences.[3] Gallo and colleagues found that sequential exercises, massage and showering reduced pain at specified stages of labour.[4] A Cochrane review also identified benefits of continuous labour support for several childbirth outcomes.[5] These interventions differ in content, personnel, timing and comparison care; their results cannot establish the effectiveness of an undescribed local package.

The present study addressed two objectives: to compare labour pain among parturient mothers receiving labour supportive measures and those receiving routine maternity care in selected hospitals; and to determine the association between labour pain and selected demographic and obstetric variables among mothers receiving supportive measures. The first objective concerned the between-group difference at every 60 minutes; the second concerned exploratory within-group associations.

**CONTACT** D. Regina Rabello: ddphd@yenepoya.edu.in

# 2. Material and Methods

## Design and setting

This two-group comparative study involved 300 parturient mothers, with 150 in the supportive-measures group and 150 in the routine-care group. The study adopted a quantitative evaluative approach using an open-label, parallel-group randomized controlled design. It was conducted in the Department of Obstetrics and Gynaecology at Community Health Centre, Sidhauli, which operates 24 hours a day with a women's maternity wing at Sitapur, Uttar Pradesh, India. Eligible parturient mothers were selected using simple random sampling. Following eligibility confirmation and informed consent, participants received unique identification numbers and were randomly allocated using a computerized random-number table generated before recruitment. The main study comprised 300 mothers, with 150 allocated to labour supportive measures alongside routine care and 150 to routine maternity care. The trial was open label; separate blinding of outcome assessors and data analysts was not documented.

## Participants and sample size

Eligible participants were parturient mothers aged 18–35 years with low-risk, uncomplicated pregnancies at 37–41 weeks of gestation, anticipating vaginal delivery of a singleton fetus in cephalic presentation. Additional inclusion criteria were a body mass index below 30 kg/m² and the ability to understand Hindi and English. Women were excluded if they declined consent, had high-risk pregnancy complications, previous uterine scarring, gynaecological disorders, complications during the first stage of labour, medical contraindications to the interventions, fetal malpresentation or malposition, or physical limitations preventing sitting or semi-sitting positions. Written informed consent was obtained before enrolment and group allocation.

The report specifies a main-study sample of 300 mothers, with 150 in the experimental group and 150 in the control group. The supplied analysis tables also report 150 mothers per group. The pilot study comprised a separate sample of 60 mothers, with 30 in each group.

## Intervention and routine care

The experimental group received routine maternity care supplemented by a package comprising birth ball exercises, birth bar-assisted positioning, breathing exercises, effleurage massage and counter-pressure massage, together with continuous support throughout labour. Birth ball exercises, effleurage massage and counter-pressure massage were provided during the first stage of labour. Birth bar-assisted positioning involved upright positioning during the transition phase and moderately upright positioning during the second stage. Breathing exercises formed part of the package, although their timing and prescribed pattern were not specified.

The comparator group received routine intrapartum care according to institutional protocols without the study intervention package. The documented routine-care protocol included assessment by a staff nurse or medical officer, maternal vital-sign and fetal heart-rate monitoring, partograph assessment, infection-prevention measures and clinically indicated obstetric care. It also allowed a female birth companion of the mother's choice, walking, changes in position, regular bladder emptying and preferred birthing positions. Thus, companionship and mobility were components of routine care rather than exclusive features of the experimental intervention.

## Pain assessment and participant variables

Labour pain was reported in the analysis tables using a 0–10 numerical rating scale at baseline and every 60 minutes, with higher scores indicating greater pain intensity. Pain reduction was calculated by subtracting the 60-minute score from the baseline score; positive values indicated improvement, zero indicated no change, and negative values indicated increased pain. A reduction of at least two points was reported descriptively and was not interpreted as a validated threshold for clinically important improvement in this population. Scores were additionally grouped into descriptive bands of 0, 1–3, 4–6, 7–9 and 10.

Baseline participant characteristics included age, recorded parity category, weight, education and number of previous abortions. The recorded parity categories were primipara, multipara and grand multipara. Additional exploratory variables comprised food habits, fruit and vegetable intake, physical activity, sleep duration, alcohol consumption, smoking and other tobacco use. These variables were analysed using the categories presented in the study tables 3.

## Statistical analysis

Continuous variables were summarized using means and standard deviations, with medians and interquartile ranges used additionally to describe pain distributions. Categorical variables were presented as frequencies and percentages. Between-group differences in 60-minute pain scores were evaluated using analysis of covariance (ANCOVA), with study group as the explanatory variable and baseline pain score as a covariate. HC3 heteroscedasticity-robust standard errors were used. The adjusted difference was expressed as supportive measures minus routine maternity care, together with its 95% confidence interval and p value. Negative differences favoured supportive measures. The group means presented in Table 2 are unadjusted descriptive values.

Pain-category distributions at every 60 minutes were compared using Pearson's chi-square test, excluding the zero-pain category because it contained no observations in either group. Cramér's V summarized the magnitude of the categorical association. Within the supportive-measures group, Kruskal–Wallis tests assessed differences in 60-minute pain across categories of demographic, obstetric and lifestyle variables. Holm adjustment was applied across the family of 12 exploratory tests. Categories containing no participants were excluded from the corresponding analyses, and findings involving sparse categories were interpreted cautiously. Statistical significance was assessed at the 0.05 level, using two-sided tests where applicable.

### Ethics and reporting

Ethical approval was obtained from the Institutional Human Ethics Committee, Hind Institute of Medical Sciences, Safedabad, Barabanki, Uttar Pradesh, India. The approval communication was dated 18 June 2025, following review on 15 June 2025, and carried the reference "HIMS/IHEC/2024-25/Faculty/Prof. Dr. Anjana Agarwal." and received No Objection Certificate from the Office

Community Health Centre Sidhauli - Sitapur, Dated 03.07.2025 and Letter No.: Adhi./Praka./Shodh Adhyayan/2025-26/63 (Note: "Adhi." stands for Superintendent, "Praka." for Office/Section, and "Shodh Adhyayan" for Research Study). Written informed consent was obtained from participants before enrolment and group allocation. Participant confidentiality, anonymity, privacy and rights were maintained throughout the study.

The approval conditions required immediate notification of adverse effects and serious adverse events to the ethics committee, notification of changes to study procedures, sites or investigators, and submission of annual reports. These requirements describe reporting obligations; the specific method used to identify and assess harms requires separate documentation.

The study report records registration with the Clinical Trials Registry–India under CTRI/2025/07/090476, dated 8 July 2025.

## 3. Results

The outcome analyses included 300 mothers, with 150 in each group. As shown in Table 1, mothers aged 25–31 years constituted 47.3% of the supportive-measures group and 41.3% of the routine-care group. The recorded primipara category accounted for 50.7% and 41.3%, respectively. Mothers weighing 76–90 kg represented 18.7% of the supportive-measures group and 8.0% of the routine-care group.

Mean baseline pain scores were 6.84 ± 0.98 in the supportive-measures group and 6.81 ± 1.06 in the routine-care group. At every 60 minutes, the corresponding scores were 5.63 ± 1.69 and 7.61 ± 1.59. The reported baseline-adjusted between-group difference favoured supportive measures by 2.01 points (supportive measures minus routine care: −2.01; 95% CI −2.30 to −1.71; $p < 0.001$). Mean pain reduction, calculated as baseline minus 60-minute score, was 1.21 ± 1.26 with supportive measures and −0.79 ± 1.29 with routine care. A reduction of at least two points occurred in 63 mothers (42.0%) and nine mothers (6.0%), respectively (Table 2).

The distribution of pain-score categories differed between groups at every 60 minutes ($\chi^2 = 67.47$, $df = 3$; $p < 0.001$; Cramér's V = 0.474). Scores of 7–10 were recorded in 47 mothers (31.3%) receiving supportive measures and 114 mothers (76.0%) receiving routine care (Table 3).

Within the supportive-measures group, the recorded delivery category was associated with 60-minute pain before adjustment for multiple comparisons (Kruskal–Wallis $H = 8.34$, $df = 2$; $p = 0.015$). Median scores were 6 (Q1–Q3: 5–7), 5 (4–6) and 5 (5–6) in the primipara, multipara and grand multipara categories, respectively. This association did not remain statistically significant after Holm adjustment (adjusted $p = 0.185$). None of the other exploratory associations remained statistically significant after adjustment (Table 4).

## 4. Discussion

The principal finding was lower reported labour pain at every 60 minutes in mothers receiving supportive measures. The adjusted difference of approximately two NRS points was accompanied by a larger proportion reporting pain reduction and fewer mothers in the higher pain-score bands. These converging descriptions support a short-term association, although the categorical results are secondary descriptions of the same pain endpoint rather than independent confirmation.

The direction of the difference agrees with the massage trial by Chang and colleagues and the sequential-intervention trial by Gallo and colleagues.[2,4] However, Janssen and colleagues did not detect statistically significant pain differences in their smaller study.[3] Differences in intervention dose, childbirth stage, provider contact and measurement instruments limit direct comparison. The continuous-support review addresses a broader model of care and cannot identify which component of the present package contributed to the observed difference.[5]

Clinical interpretation should consider women's preferences and concurrent treatment. A two-point threshold was reported descriptively; its importance cannot be established solely by a small p value. The control group's increasing pain may reflect labour progression, but cervical dilatation, contraction timing and analgesic exposure are needed to evaluate that explanation. Supportive nursing care should be integrated with individualized pain management consistent with WHO guidance.[1]

For the second objective, delivery category provided an exploratory signal before multiplicity correction. Its adjusted result did not support a statistically significant association. Sparse categories, including only five mothers recorded as grand multipara, limit precision. These within-group

comparisons do not test whether the intervention works differently by parity; that question requires a group-by-parity interaction analysis. Findings for age and other variables likewise should not be interpreted as equivalence across subgroups.

The main limitations are the short observation period, reliance on subjective pain ratings and the need to establish allocation and intervention fidelity. Baseline-adjusted analysis does not account for all possible differences in obstetric status, hospital practice or concomitant analgesia. HC3 robust errors address heteroscedasticity, not hospital clustering. The 60-minute endpoint cannot establish sustained pain relief, improved delivery outcomes, satisfaction or safety. Replication requires a clearly specified package and transparent reporting of exclusions, missing data, harms and analysis decisions.

In conclusion, labour supportive measures were associated with lower pain at every 60 minutes than routine maternity care. No demographic or obstetric association remained significant after correction across the exploratory tests. Confirmation of the study methods and source analyses is required before interpreting the findings as evidence of causal effectiveness.

## References

World Health Organization. WHO recommendations: intrapartum care for a positive childbirth experience. Geneva: World Health Organization; 2018.

Chang MY, Wang SY, Chen CH. Effects of massage on pain and anxiety during labour: a randomized controlled trial in Taiwan. J Adv Nurs. 2002;38(1):68–73. doi:10.1046/j.1365-2648.2002.02147.x.

Janssen P, Shroff F, Jaspar P. Massage therapy and labor outcomes: a randomized controlled trial. Int J Ther Massage Bodywork. 2012;5(4):15–20. doi:10.3822/ijtmb.v5i4.164.

Gallo RBS, Santana LS, Marcolin AC, Duarte G, Quintana SM. Sequential application of non-pharmacological interventions reduces the severity of labour pain, delays use of pharmacological analgesia, and improves some obstetric outcomes: a randomised trial. J Physiother. 2018;64(1):33–40. doi:10.1016/j.jphys.2017.11.014.

Bohren MA, Hofmeyr GJ, Sakala C, Fukuzawa RK, Cuthbert A. Continuous support for women during childbirth. Cochrane Database Syst Rev. 2017;7:CD003766. doi:10.1002/14651858.CD003766.pub6.

Hoffmann TC, Glasziou PP, Boutron I, Milne R, Perera R, Moher D, et al. Better reporting of interventions: template for intervention description and replication (TIDieR) checklist and guide. BMJ. 2014;348:g1687. doi:10.1136/bmj.g1687.

Hopewell S, Chan AW, Collins GS, Hróbjartsson A, Moher D, Schulz KF, et al. CONSORT 2025 statement: updated guideline for reporting randomised trials. BMJ. 2025;389:e081123. doi:10.1136/bmj-2024-081123.

**Tables**

**Table 1. Selected demographic and obstetric characteristics**

| Characteristic | Category | Supportive measures (n=150) | Routine care (n=150) |
|---|---|---|---|
| Age | 18–24 years | 63 (42.0) | 71 (47.3) |
| | 25–31 years | 71 (47.3) | 62 (41.3) |
| | 32–38 years | 16 (10.7) | 17 (11.3) |
| Delivery category | Primipara | 76 (50.7) | 62 (41.3) |
| | Multipara | 69 (46.0) | 77 (51.3) |
| | Grand multipara | 5 (3.3) | 11 (7.3) |
| Weight | 46–60 kg | 50 (33.3) | 62 (41.3) |
| | 61–75 kg | 72 (48.0) | 76 (50.7) |
| | 76–90 kg | 28 (18.7) | 12 (8.0) |
| Education | Uneducated | 18 (12.0) | 24 (16.0) |
| | Primary school | 42 (28.0) | 45 (30.0) |
| | High school and above | 90 (60.0) | 81 (54.0) |
| Number of abortions | Never | 121 (80.7) | 125 (83.3) |

| | | | |
|---|---|---|---|
| | One | 22 (14.7) | 22 (14.7) |
| | More than one | 7 (4.7) | 3 (2.0) |

Values are n (%). Characteristics are reproduced using the source categories. The clinical definition and timing of delivery category require confirmation. Percentages may differ from 100 because of rounding.

**Table 2. Labour pain and pain reduction by study group**

| Outcome | Supportive measures (n=150) | Routine care (n=150) |
|---|---|---|
| Baseline NRS, mean±SD | 6.84±0.98 | 6.81±1.06 |
| 60-minute NRS, mean±SD | 5.63±1.69 | 7.61±1.59 |
| Pain reduction, mean±SD | 1.21±1.26 | −0.79±1.29 |
| Any pain decrease, n (%) | 109 (72.7) | 19 (12.7) |
| Reduction ≥2 points, n (%) | 63 (42.0) | 9 (6.0) |

NRS, numerical rating scale; SD, standard deviation. Reduction=baseline minus 60-minute score. Reported adjusted 60-minute difference (supportive measures minus routine care): −2.01 points (95% CI −2.30 to −1.71), p<0.001; ANCOVA adjusted for baseline NRS with HC3 robust standard errors. Displayed means are unadjusted; adjusted and crude differences need not agree.

**Table 3. Pain score bands at every 60 minutes**

| NRS score | Supportive measures (n=150), n (%) | Routine care (n=150), n (%) |
|---|---|---|
| 0 | 0 (0.0) | 0 (0.0) |
| 1–3 | 18 (12.0) | 2 (1.3) |
| 4–6 | 85 (56.7) | 34 (22.7) |
| 7–9 | 46 (30.7) | 96 (64.0) |
| 10 | 1 (0.7) | 18 (12.0) |

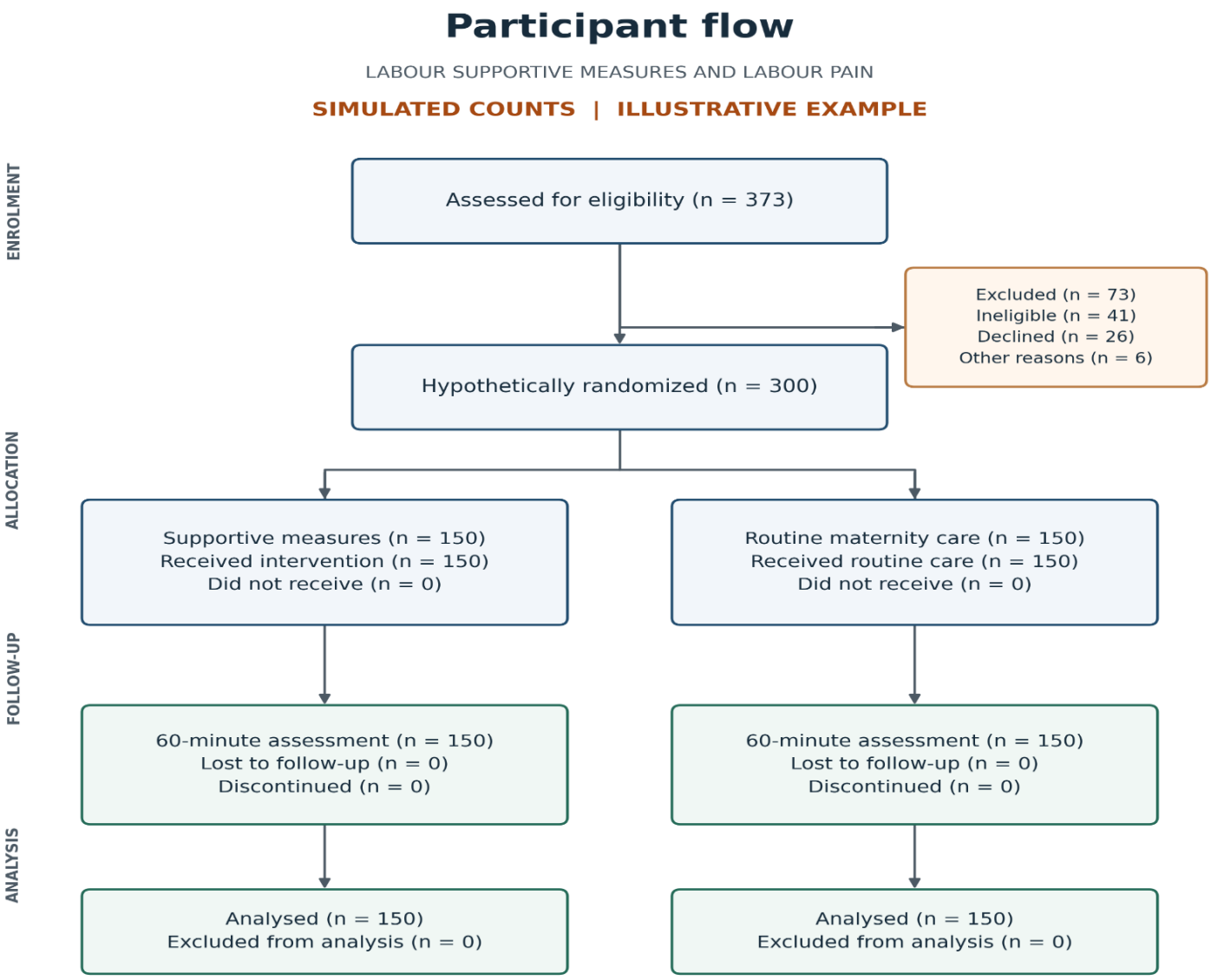
Pearson $\chi^2$=67.47, df=3, p<0.001; Cramér's V=0.474. The empty score-0 category was excluded from testing. Bands are descriptive study categories. Percentages may differ from 100 because of rounding.

**Table 4. Exploratory associations with every 60-minute pain in the supportive-measures group**

| Variable | Kruskal–Wallis H (df) | Unadjusted p | Holm-adjusted p |
|---|---|---|---|
| Age | 0.06 (2) | .970 | 1.000 |
| Delivery | 8.34 (2) | .015 | .185 |
| Weight | 1.44 (2) | .487 | 1.000 |
| Education | 3.08 (2) | .215 | 1.000 |
| Abortions | 1.85 (2) | .397 | 1.000 |
| Food | 0.62 (2) | .733 | 1.000 |
| Fruit/vegetables | 0.91 (2) | .634 | 1.000 |
| Activity | 0.11 (2) | .948 | 1.000 |
| Sleep | 1.21 (2) | .546 | 1.000 |
| Alcohol | 1.21 (1) | .272 | 1.000 |
| Smoking | 1.47 (2) | .481 | 1.000 |
| Tobacco | 2.25 (2) | .325 | 1.000 |

n=150. Holm adjustment covers 12 tests. Age, delivery category, weight, education and abortions address the demographic and obstetric objective; remaining variables are additional exploratory analyses. Alcohol has two nonempty categories. Sparse groups limit asymptotic inference. A nonsignificant result does not establish equivalence.

**Figure legends 1**




s