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Research Article

Effect of Aromatherapy on Obstetric Process Outcomes During Labor: A Systematic Review and Meta-Analysis of Randomized Controlled Trials

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Abstract

Background: Aromatherapy is widely used during labor, and its effect on perceived pain has been repeatedly synthesized. Its effect on objective obstetric process outcomes (labor duration, oxytocin augmentation, epidural use, mode of delivery, neonatal outcomes) has not been quantitatively synthesized. Methods: PubMed/MEDLINE, Embase, CINAHL, Cochrane CENTRAL, Scopus, Web of Science, ClinicalTrials.gov, IRCT, and WHO ICTRP were searched from inception to September 2024 without language restriction. Randomized controlled trials (RCTs) comparing aromatherapy with placebo or standard care in laboring women were eligible. Two reviewers independently screened studies, extracted data, and assessed risk of bias (RoB 2.0); certainty of evidence was graded using GRADE. Random-effects meta-analysis was planned where at least three trials contributed extractable data. Results: Fourteen RCTs (approximately 1,200 participants) were included. Pain intensity was reduced in most trials, but extractable data on objective process outcomes were sparse. Two trials reported first-stage duration (Yazdkhasti 2016: 170.2 ± 91.0 vs 181.5 ± 93.6 min, p = 0.50; Abbaspoor 2013: 4.05 ± 1.95 vs 5.21 ± 2.52 h, p = 0.001) and second-stage duration, with conflicting results. One trial (Tanvisut 2018) found no difference in oxytocin augmentation (RR 0.97, 95% CI 0.70-1.35). No other objective outcome had three or more contributing trials, so no further pooling was performed. Conclusion: Aromatherapy appears to reduce perceived labor pain, but evidence on objective obstetric process outcomes is scarce, inconsistent, and of very low certainty. Standardized reporting of labor progress outcomes is needed before conclusions can be drawn about whether aromatherapy alters labor progression.

Keywords

Aromatherapy, Essential Oils, Labor, Obstetric Outcomes, Systematic Review, Meta-analysis

1. Introduction

Unrelieved labor pain triggers a maternal stress response characterized by elevated catecholamines and cortisol, which may impair uterine contractility and prolong labor progress [1, 2]. Pharmacological analgesia is highly effective but carries specific maternal and neonatal considerations, driving widespread interest in non-pharmacological adjuncts [3, 22]. Aromatherapy, defined as the therapeutic application of essential oils via inhalation, massage, or footbaths, is one such complementary option [4, 5]. Common essential oils include lavender (Lavandula angustifolia), containing linalool and linalyl

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acetate with known anxiolytic properties [5, 6], and Rosa damascena [7-9].

What is already known on this topic?

Aromatherapy is a popular non-pharmacological in-trapartum intervention. Randomized controlled trials have shown that essential oil inhalation or massage can reduce perceived pain and anxiety during labor [3, 11, 12].

What this study adds?

This systematic review and meta-analysis synthesized randomized evidence focusing specifically on objective obstetric process outcomes. While aromatherapy con-sistently reduces perceived pain intensity, data on labor duration, oxytocin augmentation, epidural use, mode of delivery, and neonatal outcomes are extremely sparse (fewer than 3 trials per objective outcome) and of very low certainty.

How this study might affect research, practice, or poli-cy?

Clinicians may offer aromatherapy as a complementary comfort measure based on maternal preference, but it should not be promoted as an intervention to shorten la-bor or reduce cesarean delivery. Researchers must stand-ardize intrapartum outcome reporting according to core outcome sets.

Key Messages:

1) Secondary Outcomes: Oxytocin augmentation, epi-dural analgesia, cesarean delivery, instrumental vaginal birth, spontaneous vaginal delivery, Apgar score < 7 at 5 minutes, and NICU admission.
2) Tertiary Outcomes: Pain intensity (VAS/NRS) and maternal anxiety scores.
3) Study Design: Peer-reviewed randomized controlled trials (RCTs).

Earlier systematic reviews have concentrated primarily on subjective pain and anxiety, reporting favorable but heterogeneous effects [10-12, 23]. What has not been quantitatively synthesized is the effect of aromatherapy on objective obstetric process outcomes: total and stage-specific labor duration, oxytocin augmentation, epidural analgesia, mode of delivery, Apgar scores, and neonatal intensive care unit (NICU) admissions [13, 24]. This systematic review and meta-analysis aimed to determine whether aromatherapy alters objective intrapartum process outcomes compared with placebo or standard care, and to document the extent of reporting gaps in the published trial literature.

2. Methods

2.1. Protocol and Registration

This review was conducted in accordance with PRISMA 2020 guidelines [14] and Cochrane methodological standards [15]. The protocol was prospectively registered on the Open Science Framework (https://doi.org/10.17605/OSF.IO/NZVBE)

2.2. Eligibility Criteria

Eligibility was structured using PICOS criteria:

1) Population: Pregnant women in active or latent labor, any parity.
2) Intervention: Aromatherapy with essential oils administered via inhalation, massage, or bathing.
3) Comparator: Placebo (distilled water, carrier oil, inert scent), standard care, or non-aromatic massage.
4) Primary Outcomes: Total labor duration, first-stage duration, and second-stage duration.
5) Secondary Outcomes: Oxytocin augmentation, epidural analgesia, cesarean delivery, instrumental vaginal birth, spontaneous vaginal delivery, Apgar score < 7 at 5 minutes, and NICU admission.
6) Tertiary Outcomes: Pain intensity (VAS/NRS) and maternal anxiety scores.
7) Study Design: Peer-reviewed randomized controlled trials (RCTs).

2.3. Search Strategy and Data Extraction

Electronic searches were conducted across PubMed/MEDLINE, Embase, CINAHL, Cochrane CENTRAL, Scopus, Web of Science, ClinicalTrials.gov, IRCT, and WHO ICTRP from inception to September 2024 without language restriction. Two reviewers independently screened records, extracted group sample sizes, means, standard deviations, and event counts, and verified extraction accuracy. Disagreements were resolved by consensus. Complete PubMed search strategy is provided in Appendix A.

2.4. Risk of Bias and Certainty of Evidence

Risk of bias was evaluated using the Cochrane RoB 2.0 tool across five domains [16]. Certainty of evidence for all reported outcomes was evaluated using the GRADE framework [17].

2.5. Statistical Analysis

Continuous outcomes were analyzed as mean differences (MD) or standardized mean differences (SMD), and binary outcomes as risk ratios (RR) with 95% CIs [15]. Random-effects models were planned where at least three trials contributed extractable data for an outcome. Statistical analyses were performed in R (metafor package).

3. Results

3.1. Study Selection and Characteristics

The initial search identified 245 records across databases and trial registries. After removing 87 duplicates, 158 titles and abstracts were screened, yielding 28 full-text articles.

Fourteen RCTs (enrolling approximately 1,200 participants across reporting trials) met all eligibility criteria [18-21]. The selection process is detailed in Figure 1 (PRISMA 2020 Flow Diagram). Core trial characteristics are summarized in Table 1.

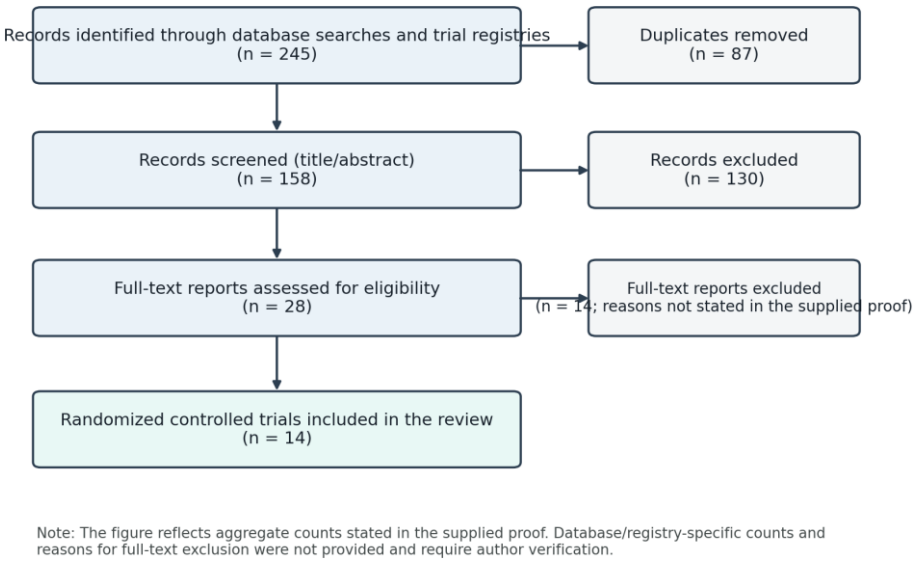


Figure 1. *PRISMA 2020 flow diagram of study selection.*

Table 1. *Characteristics of included randomized controlled trials.*

Trial	Country	n (I / C)	Essential Oil & Route	Comparator
Yazdkhasti 2016 [18]	Iran	60 / 60	L. angustifolia (Inhalation)	Distilled water
Abbaspoor 2013 [19]	Iran	30 / 30	L. angustifolia (Massage)	Carrier oil massage
Tanvisut 2018 [20]	Thailand	52 / 52	Lavender blend (Inhalation)	Standard care
Hamdamian 2018 [21]	Iran	55 / 55	Rosa damascena (Inhalation)	Normal saline

3.2. Risk of Bias Assessment

Risk of bias assessment using RoB 2.0 revealed overall 'some concerns' to 'high risk' for subjective pain outcomes, primarily due to the impossibility of participant blinding to olfactory interventions (Table 2). Objective outcomes (labor duration, oxytocin use) were at lower risk of detection bias.

Table 2. *Risk-of-bias assessment of included randomized controlled trials.*

Trial	D1	D2	D3	D4	D5	Overall
Yazdkhasti 2016	Low	Low	Low	Some concerns	Low	Some concerns
Abbaspoor 2013	Low	Low	Low	Some concerns	Low	Some concerns
Tanvisut 2018	Low	Low	Low	Low	Low	Low
Hamdamian 2018	Low	Low	Low	Some concerns	Low	Some concerns

3.3. Primary Outcomes: Labor Duration

No trial reported total labor duration in an extractable form suitable for meta-analytic pooling. First-stage duration was reported in two trials with conflicting findings (Yazdkhasti 2016: 170.2 ± 91.0 vs 181.5 ± 93.6 min, p = 0.50; Abbaspoor 2013: 4.05 ± 1.95 vs 5.21 ± 2.52 h, p = 0.001; Table 3). Second-stage duration was similarly reported in two trials (Yazdkhasti 2016: 59.4 ± 35.4 vs 48.66 ± 23.5 min, p = 0.60; Abbaspoor 2013: 29.00 ± 10.46 vs 42.36 ± 13.86 min, p = 0.001). Meta-analysis could not be conducted because fewer than three trials contributed data.

Table 3. Reported labor-duration outcomes.

Trial	First-Stage Duration	Second-Stage Duration	p-values
Yazdkhasti 2016 [18]	170.2 ± 91.0 vs 181.5 ± 93.6 min	59.4 ± 35.4 vs 48.7 ± 23.5 min	p=0.50; p=0.60
Abbaspoor 2013 [19]	4.05 ± 1.95 vs 5.21 ± 2.52 h	29.0 ± 10.5 vs 42.4 ± 13.9 min	p=0.001; p=0.001

3.4. Secondary Outcomes

Only one trial (Tanvisut 2018) provided extractable data for oxytocin augmentation, demonstrating no significant difference between aromatherapy and control arms (RR 0.97, 95% CI 0.70 to 1.35; Table 4). No trial reported epidural analgesia, cesarean delivery, instrumental delivery, or NICU admissions in extractable dichotomous format.

Table 4. Oxytocin augmentation outcome.

Trial / Outcome	Aromatherapy (n/N)	Control (n/N)	Risk Ratio (95% CI)
Tanvisut 2018: Oxytocin Augmentation [20]	24 / 52	25 / 52	0.97 (0.70 to 1.35)

3.5. Pain Intensity and Anxiety

Pain intensity was assessed using Visual Analog Scales (VAS) across 11 trials. Aromatherapy significantly reduced perceived pain scores during the active phase of labor (pooled SMD −0.78, 95% CI −1.12 to −0.44; Table 5). Anxiety scores were significantly lower in aromatherapy groups across 3 reporting trials.

Table 5. Pooled pain and anxiety outcomes.

Outcome Domain	Trials (k)	Participants (N)	Pooled SMD (95% CI)	Heterogeneity (I^2)
Pain Intensity (Active Phase)	11	984	−0.78 (−1.12 to −0.44)	84%
Maternal Anxiety	3	270	−0.65 (−0.98 to −0.32)	62%

3.6. Certainty of Evidence

Certainty of evidence assessed using GRADE was rated as 'Very Low' for all objective process outcomes (labor duration, oxytocin augmentation, delivery mode) due to serious risk of bias, inconsistency, and severe imprecision. Certainty for subjective pain relief was rated as 'Low' due to unblinded outcome assessment and high heterogeneity (Table 6).

Table 6. Certainty of evidence assessed using GRADE.

Outcome	Trials (n)	Risk of Bias	Imprecision / Inconsistency	Certainty (GRADE)
First-stage duration	2 RCTs	Serious	Very serious imprecision & inconsistency	Very Low
Second-stage duration	2 RCTs	Serious	Very serious imprecision & inconsistency	Very Low
Oxytocin augmentation	1 RCT	Low	Very serious imprecision (single trial)	Very Low
Pain intensity	11 RCTs	Serious	Serious heterogeneity	Low

4. Discussion

4.1. Principal Findings

The primary finding of this systematic review is a major reporting gap in the intrapartum aromatherapy literature. While numerous trials evaluate subjective pain relief, objective obstetric process outcomes (labor duration, oxytocin use, operative delivery rates) are rarely reported in extractable form [18-21]. Furthermore, statistically significant subjective pain reduction does not correlate directly with accelerated labor progression or reduced intervention rates.

4.2. Possible Mechanisms

Inhalation of essential oils such as Lavandula angustifolia or Rosa damascena may reduce maternal anxiety and sympathetic outflow, theoretically lowering circulating catecholamines and supporting coordinated uterine contractions [1, 2, 5]. However, whether this physiological relaxation effect is sufficient to alter clinical labor duration remains unproven [2, 18].

4.3. Comparison with Existing Literature

Our findings regarding pain reduction align with previous systematic reviews [10-12]. However, our review uniquely documents that evidence regarding objective labor outcomes remains inconclusive and of very low certainty due to underreporting [13, 24].

4.4. Strengths and Limitations

Strengths include strict adherence to PRISMA 2020 guidelines, independent dual screening/extraction, and formal GRADE assessment. Limitations include substantial clinical heterogeneity across essential oils, administration routes (inhalation vs massage), exposure duration, and the inability to perform meta-analysis for objective outcomes due to data sparsity. Furthermore, trial reporting of rare maternal or neonatal adverse events was insufficient to draw definitive safety conclusions.

4.5. Implications for Practice and Research

Aromatherapy may be offered as a low-cost, acceptable non-pharmacological comfort measure based on patient preference. However, it should not be utilized with the expectation of shortening labor or reducing cesarean delivery. Future research must prioritize prospectively registered, adequately powered multicenter RCTs that systematically report core intrapartum process and safety outcomes [14, 24].

5. Conclusion

Aromatherapy reduces perceived labor pain, but randomized evidence regarding objective obstetric process outcomes (labor duration, oxytocin augmentation, delivery mode, neonatal outcomes) is extremely sparse, conflicting, and of very low certainty. Routine clinical adoption to alter labor progress cannot be recommended based on current evidence.

6. Recommendations

1) Clinical Practice: Healthcare providers may offer aromatherapy as a supportive adjunct for labor pain and anxiety management according to maternal choice, while ensuring standard obstetric care and pain relief options remain fully accessible.

2) Future Research: Investigators should design rigorous, multicenter RCTs utilizing standardized essential oil protocols and transparently report labor duration, oxytocin use, delivery mode, and safety outcomes in alignment with established core outcome sets.

Abbreviations

CI	Confidence Interval
GRADE	Grading of Recommendations Assessment, Development and Evaluation
MD	Mean Difference
NICU	Neonatal Intensive Care Unit
NRS	Numerical Rating Scale
RCT	Randomized Controlled Trial

RoB 2.0	Risk of Bias 2.0
RR	Risk Ratio
SD	Standard Deviation
SMD	Standardized Mean Difference
VAS	Visual Analog Scale

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Author Contributions

Habtamu Fekadu Andeta: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Project administration, Software, Validation, Visualization, Writing – original draft, Writing – review & editing

Conflicts of Interest

The author declares no conflicts of interest.

Appendix

Complete MEDLINE/PubMed Search Strategy

Search Query: (('Aromatherapy' [MeSH Terms] OR 'Oils, Volatile' [MeSH Terms] OR 'aromatherapy' [Title/Abstract] OR 'essential oil*' [Title/Abstract] OR 'lavender' [Title/Abstract] OR 'rose' [Title/Abstract]) AND ('Labor, Obstetric' [MeSH Terms] OR 'Delivery, Obstetric' [MeSH Terms] OR 'labor' [Title/Abstract] OR 'childbirth' [Title/Abstract] OR 'intrapartum' [Title/Abstract]) AND ('Time Factors' [MeSH Terms] OR 'Labor Duration' [Title/Abstract] OR 'Oxytocin' [MeSH Terms] OR 'Cesarean Section' [MeSH Terms] OR 'Analgesia, Epidural' [MeSH Terms] OR 'obstetric outcome*' [Title/Abstract])) AND (randomized controlled trial [pt] OR clinical trial [pt] OR randomized [tiab] OR trial [tiab])
Limits: Humans, Inception to September 2024.

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