

The Effects of Ice Massage on the LI4 Acupressure Point for Labor Pain: A Systematic Review and Meta-analysis

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ARTICLE INFO	ABSTRACT
Article type: Review article	Background & aim: Pain management during childbirth is a key component of midwifery care, with non-pharmacological methods widely recommended. Acupressure with ice may provide pain relief, but findings remain inconsistent. Therefore, this systematic review and meta-analysis evaluated the effects of LI4 massage with ice on labor pain.
Article History: Received: 24-Jun-2025 Accepted: 02-Sep-2025	Methods: This meta-analysis study was performed on articles published up to April 07, 2025. PubMed-Medline, Web of Science, ScienceDirect, and Cochrane Library databases were searched. The potential for bias in both randomized and non-randomized trials was assessed utilizing the Cochrane Risk of Bias Tool for Randomized Trials (RoB-1) and the Risk of Bias Assessment Tool for Non-Randomized Studies (ROBINS-I). Data were analyzed using CMA software version 2. Continuous outcomes were analyzed using MD or SMD, as appropriate, with 95% CIs, and pooled estimates were calculated using a random-effects model.
Key words: Acupressure Ice Massage Hegu (LI4) Point Labor Pain Complementary Therapy	Results: Of 224 articles, 12 studies were included in the systematic review, and 9 were included in the meta-analysis. The results demonstrated that LI4 massage with ice can reduce labor pain compared with the control group 30 minutes after intervention (MD = -1.25, 95% CI: -1.96 to -0.54, P-value<0/001), and 60 minutes after intervention (SMD = -1.85, 95% CI: -2.61 to -1.10, P-value<0/001). However, no significant reduction was observed immediately after the intervention (MD = -1.89, 95% CI: -4.65 to 0.87, P-value = 0.179). Conclusion: Based on the results, the acupressure point (LI4) with ice significantly relieved labor pain. Health care providers, especially midwives, can perform this procedure at a hospital or maternity clinic due to its cost-effectiveness and simplicity.

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Introduction

Childbirth represents a fundamental biological event, and it is often associated with the most intense pain a woman may endure in her lifetime (1). Although pain can be an unavoidable part of the delivery process, persistent pain and the fear of experiencing it may negatively impact various bodily systems, including the respiratory system, cardiovascular function, endocrine glands, and other physiological processes. It can also lead to tension and anxiety during childbirth, prolonged

labor, abnormal fetal heart rate patterns, increased rates of cesarean sections, and low Apgar scores (2-3).

Pain management during childbirth is among the essential elements of midwifery care, aiming to enhance comfort and reduce anxiety. Midwifery care during childbirth not only ensures a safe delivery for the mother and baby but also provides a positive and satisfying experience. Important points that we should

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consider in reducing childbirth pain include good pain relief, safety for the mother and baby, continuous and predictable effects, ease of use, and being under the mother's control without interfering with uterine contractions and maternal mobility (4). Pharmacological methods for labor pain relief may have adverse effects on the mother and fetus; therefore, non-pharmacological methods, which are generally considered safe and may promote relaxation, should be offered as part of pain management options (5). These include a variety of complementary approaches such as acupuncture, acupressure, massage therapy, and thermal techniques (heat and cold), which are increasingly used due to their safety, accessibility, and ability to promote maternal comfort. Among these methods, acupressure is particularly notable, as it is easy to apply, non-invasive, and can be integrated into routine intrapartum care (2).

Point LI4, recognized as a key component of the Large Intestine meridian, is situated on the dorsal side of the hand, adjacent to the base of the second metacarpal bone, between the first and second metacarpals (6). Stimulating the Hegu point (LI 4) can alleviate labor pain by encouraging the release of endorphin hormones. These hormones interfere with nerve membrane function and stimulate the spinal cord, midbrain, and pituitary gland, resulting in the discharge of endorphins, serotonin, and norepinephrine. These compounds work together to block pain. Additionally, stimulating the Hegu point can also trigger the release of adrenocorticotrophic hormone (ACTH) and pituitary hormones (7). When the body releases hormones in response to stimulation at LI 4, it may reduce labor pain and calm the mother. Uncontrolled pain can lead to an increase in catecholamine, which can interfere with contractions and cause uterine inertia, a condition that can last for a long time if not resolved (8). The Gate Control Theory explains the mechanism of action of massage and cold therapy. According to the Gate Control Theory, the passage of pain signals is blocked by competitive sensations at the spinal level. Additionally, cold packs or massages during childbirth increase serotonin and dopamine levels. This results in muscle spasm relief,

increased comfort, distraction from pain, energy flow facilitation in acupuncture points, and reduced anxiety (9).

Najafi et al. (2017), in a systematic review and meta-analysis, stated that applying LI4 acupressure led to an immediate decrease in pain among the women. They also showed a shorter active phase and second stage of labor (6). Mirzaei et al. (2020) reported in their randomized controlled trial study that acupressure alone and in combination with ice effectively reduced labor pain, but acupressure without ice showed a greater reduction (1). In contrast, Afefy et al. (2015) stated that both ice massage and acupressure at the LI4 point reduced labor pain intensity and delivery duration in nulliparous women. However, ice massage was more effective at reducing pain. (10). Yildirim et al. (2018) demonstrated that the intervention group, which received ice massage by midwives on the LI4 point during active labor, was able to reduce labor pain and shorten the duration of labor compared to routine care (4). Due to differences in the magnitude of pain reduction across these interventions and the lack of any systematic review or meta-analysis examining the combined effect of ice massage on LI4, conducting a meta-analysis is essential to clarify and validate the existing evidence. This study will address these points by synthesizing the findings of previous studies and providing midwives with a clearer understanding of the effectiveness of LI4 massage combined with ice in managing labor pain. Therefore, this study aimed to systematically review and meta-analyze the effects of LI4 massage combined with ice on labor pain.

Methods

This study, comprising a systematic review and meta-analysis, focused on existing published articles until April 07, 2025. This review followed the PRISMA 2020 Guidelines (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) (11).

Search Strategy & Study Selection

Two independent reviewers (ML and Z.HT) conducted a systematic and comprehensive literature search via PubMed-Medline, Web of Science, ScienceDirect, and Cochrane Library

databases. We also searched ClinicalTrials.gov for additional trials. Then, manual searches were conducted for the comprehensiveness of the search by reading the references of selected articles and reviewing their citations in Google Scholar for articles that were not found in electronic searches, but met the inclusion criteria. The following keywords were searched in the titles and abstracts of articles: "ice massage" OR "ice pressure" OR "ice acupressure" OR "cold compression" OR "cold therapy" OR "cryotherapy" AND "LI4" OR "Hegu" OR "Large Intestine 4" AND "labor pain" OR "labour pain". All database search results were transferred into EndNote, and then duplicate records were removed. The titles and abstracts of remaining papers were screened by two authors independently (Z.HT and ML). If a decision could not be reached based on the abstract alone, the full text of the paper was reviewed. Subsequently, the full texts of the selected papers were reviewed by two authors (Z.HT and ML) independently. The reviewers resolved any discrepancies regarding the inclusion of papers through discussion and consensus at each stage.

The search was conducted using the Medical Subject Headings (MeSH) and keyword search terms based on the "Population, Intervention, Comparison, Outcome, and Study type" (PICOS) framework. (1) Participants: The target population comprised pregnant women, (2) Intervention: LI4 massage with ice (3) comparator: comparative group receiving, LI4 massage alone or sham massage point massage, or usual care; (4) outcomes: the study reported the following outcome measurements: numeric rating scale (NRS) score, visual analog scale (VAS) score, and mean changes from baseline in labor pain; (5) study type: all randomized controlled trial (RCTs) or quasi experimental studies; (6) written into Persian or English languages.

We excluded conference abstracts, single-arm studies, case reports, case series, letters, commentaries, review articles, non-peer-reviewed publications, and observational studies. Additionally, any study that failed to report on our specified outcomes of interest was excluded.

Data Extraction

Data extraction was performed by two independent authors (SA and Z.HT). To extract data, a data extraction form was designed by the research team based on the research objective. This form includes the first author's name, year of publication, country, study design, sample size, data collection tool, intervention and comparison, and overall outcome, including pain intensity. The baseline and post-intervention assessments for the outcomes were extracted in their original units, including the mean and standard deviation. Any discrepancies regarding data extraction were resolved through discussion.

Assessment of Risks of Bias

Two reviewers independently evaluated the quality of the included studies (SA and Z.HT). The potential for bias in both randomized and non-randomized trials was assessed utilizing the Cochrane Risk of Bias Tool for Randomized Trials (RoB 1) and the Risk of Bias Assessment Tool for Non-Randomized Studies (ROBINS-I) (12-13). The ROB 1 tool was utilized to evaluate each study across 7 domains, including sequencing, concealed allocation, selective reporting, participant and staff blinding, outcome assessment blinding, incomplete results, and other biases. Each domain received a rating of "yes," "no," or "unclear." Subsequently, each study was categorized as "poor" (indicating high risk of bias), "good" (reflecting low risk of bias), or "unclear". The (ROBINS-I) tool encompasses domains targeting various biases known to impact nonrandomized intervention studies' outcomes. It consists of 7 domains evaluating biases related to participant selection, confounding variables, classification of interventions, deviations from intended interventions, incomplete outcome data, measurement of outcomes, and selective outcome reporting. Each domain received a rating of "Yes"; "Probably yes"; "Probably no"; "No"; and "No information". The risk of bias is classified into four categories: "Low risk," "Moderate risk," "Serious risk," and "Critical risk". Any disagreements among researchers were resolved through discussion and the help of another author (ML).

Data analysis

Meta-analysis of pooled data was performed using CMA software (Comprehensive Meta-Analysis) V.2 on labor pain. Whenever the measurement scales were the same, the mean difference (MD) was used; whenever the instruments were different, the standardized mean differences (SMD) were calculated for continuous data by comparing the mean values before and after the intervention in both the intervention and control groups, along with their corresponding 95% confidence intervals (CI). The random effects model was applied to calculate pooled results. Statistical heterogeneity across studies was assessed using Cochran's Q test and measured by the I^2 statistic, categorizing heterogeneity levels as low ($I^2=25\%$), moderate ($I^2=50\%$), or high ($I^2=75\%$) in accordance with the Cochrane Handbook (14). When substantial heterogeneity was identified, a random-effects model was used for the meta-analysis. Potential

sources of heterogeneity were further explored through subgroup analyses and sensitivity analyses, where appropriate. Sensitivity analysis was performed using a leave-one-out approach by sequentially excluding each study and recalculating the pooled MD and SMD for pain. According to the Cochrane Handbook, tests for funnel plot asymmetry have low statistical power when fewer than 10 studies are included and may yield misleading results (14). Therefore, we did not perform these tests because fewer than 10 studies were included in the meta-analysis. The level of significance was set at $P < 0.05$.

Results

Study selection

Following the electronic search, a total of 224 studies were identified, and titles and abstracts of 208 articles were screened.

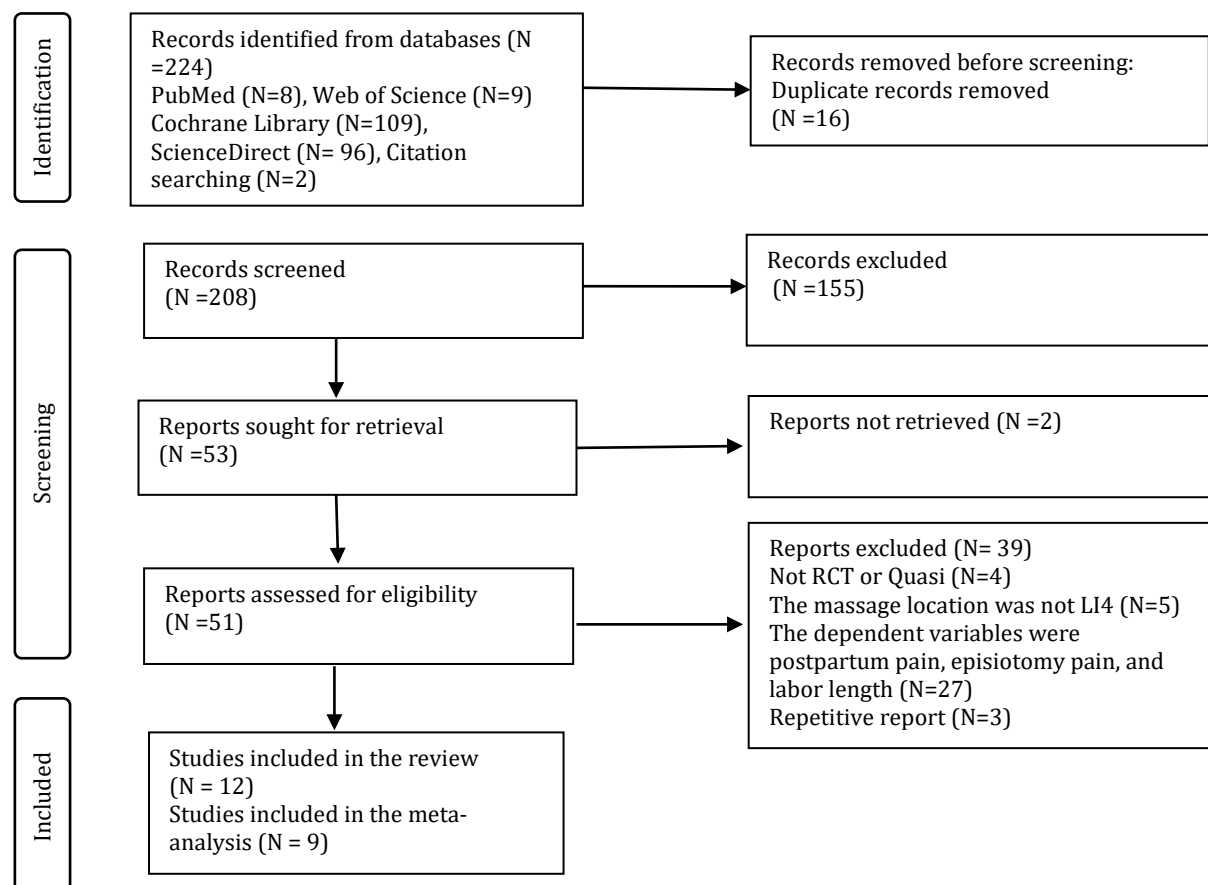


Figure 1. PRISMA 2020 flowchart illustrating the process of selecting eligible studies

Of these, 53 studies met the inclusion criteria for full-text review. Supplementary searches, including manual review of reference lists and citation searches using platforms such as Google Scholar, were conducted. Ultimately, twelve studies were incorporated into this systematic review, with nine included in the meta-analysis. Three studies were not included in the meta-analysis because their pain outcomes were reported at different stages of cervical dilatation rather than at the predefined post-intervention time points, and therefore their results could not be appropriately combined with those of the other studies (Figure 1).

Study characteristics and systematic review findings

Overall, 12 studies were included in the systematic review. Nine studies provided sufficient data for quantitative synthesis (4, 10, 15-21). The remaining three studies were included in the systematic review but could not be pooled in the meta-analysis because their outcome data were not reported at comparable post-intervention time points (1, 22, 23). The Description of the 12 studies is summarized in Table 1.

The sample sizes of the studies ranged from 30 to 100. The studies were published between 2003 and 2022. Out of 12 included studies, six were conducted in Iran (1, 15-18, 23), three in India (19, 21, 22), two in Egypt (10, 20), and one in Turkey (4). The study design in six studies was a randomized controlled trial (RCT) (1, 4, 10, 15, 18, 23), and six studies were quasi-experimental (16, 17, 19-22).

All the studies, except one (21), used the Visual Analog Scale (VAS) for assessing pain intensity. Regarding the time of intervention. All studies' interventions/control started during

the active phase of Labor. In total, the studies examined 1257 subjects in both the experimental and the control groups. In eight studies, the control group received hospital routine care. The other four studies used an ice ball without pressure or touch on LI4, Glass ball massage, sacral cold compression, and Music therapy as their control (1, 15, 16, 18). Among the 12 included studies reporting labor pain outcomes, all studies demonstrated a significant reduction in pain after ice application at the LI4 point. Two studies reported that ice massage produced a more persistent reduction in labor pain than acupressure, with significant between-group differences observed at all post-intervention time points (10, 16). Other studies reported significant reductions in pain in the ice intervention groups compared with baseline measurements or control groups at some post-intervention time points (4, 15, 17-20, 22). Just one study found that although both acupressure with and without ice significantly reduced labor pain compared with the control group, acupressure without ice produced a greater reduction in pain than acupressure combined with ice (1). Although Dehcheshmeh and Rafiei (2015) reported that the pain scores showed a greater decrease after the intervention in the music therapy group than in the LI4 point ice massage group, the difference between the two groups was not statistically significant (23). Overall, the findings of the included studies generally support a beneficial effect of ice massage at the LI4 point on labor pain, although the magnitude and persistence of the effect varied according to the comparator intervention and timing of pain assessment (Table 1).

Table 1. The characteristics of included studies

Author / Year	Country	Study design	Study sample	Intervention protocol	Comparison Protocol	Tool	Main findings
Afey (10) 2015	Egypt	Three groups, RCT	300 primigravida women (100-100-100)	Group I: During the contraction, ice massage was applied for one minute; after one minute of rest, ice massage was repeated for 20 minutes on both hands. Group II: In the acupressure group, the same procedure was done by applying direct pressure with the thumb or index finger. The ice massage began with the onset of contractions and was stopped at the end of the contractions on the left hand. This procedure was repeated for 30 minutes.	Hospital routine care	VAS	Both ice massage and acupressure were effective in reducing the intensity of labor pain, with ice massage showing greater efficacy.
Enjezab (15) 2077	Iran	Two groups, RCT	60 (30-30)	Group I: ice ball massage was performed for 10 min (2 min pressure and 15-second break). Group II: In the acupressure group, a glass ball) with the same massage procedure. Ice massage was administered exclusively to the experimental group mothers on the (LI 4) point during uterine contractions. This process involved either 3 to 4 contractions or for 20 minutes during the active phase of labor.	Touch on LI4	VAS	Ice massage at point (LI 4) successfully reduced labor pain.
Hajiamini (16) 2012	Iran	Three groups, quasi-experimental	90 (30-30-30)	Ice massage was administered exclusively to the experimental group mothers on the (LI 4) point during uterine contractions. This process involved either 3 to 4 contractions or for 20 minutes during the active phase of labor.	Ice balls on the same area, without pressure or massage.	VAS	Both ice massage and acupressure were effective in decreasing the intensity of labor pain and shortening the duration of labor, with ice massage showing greater efficacy in reducing pain.
Indumathi (22) 2018	India	Two groups, quasi-experimental	60 primigravida (30-30)	In the experimental group, ice	Hospital routine care	VAS	Ice massage at point (LI 4) was the effective method to reduce labor pain during the first stage of labor.
Kamali (17)	Iran	Two groups,	60	In the experimental group, ice	Hospital	VAS	Ice massage at point (LI 4)

Author / Year	Country	Study design	Study sample	Intervention protocol	Comparison Protocol	Tool	Main findings
2014		quasi-experimental	primigravida a (30-30)	massage was applied at the (LI 4) point for 60 minutes during contractions (30 minutes on the right hand and 30 minutes on the left hand). Group I: For 30 minutes, with the onset of each contraction, the researcher applied pressure with the thumb on both hands at the (LI 4) point at the same time. Group II: Ice massage was applied at the (LI 4) point for 30 minutes during contractions on both hands at the same time.	routine care		successfully reduced labor pain. The ice massage on the left hand was more effective than the right hand.
Kaviani (18) 2012	Iran	Three groups, RCT	165 primigravida (55-55-55)	Group I: For 30 minutes, with the onset of each contraction, the researcher applied pressure with the thumb on both hands at the (LI 4) point at the same time. Group II: Ice massage was applied at the (LI 4) point for 30 minutes during contractions on both hands at the same time.	Touch on LI4	VAS,	Both ice massage and acupressure were effective in decreasing the intensity of labor pain, with ice massage showing greater efficacy in reducing pain.
Mirzaee (1) 2020	Iran	Three groups, RCT	90 primigravida and multigravida (30-30-30)	Group I: For 30 minutes, with the onset of each contraction, the researcher applied pressure bilaterally at the (LI 4) point at the same time. Group II: Ice massage was applied at the (LI 4) point for 30 minutes during contractions bilaterally at the same time.	Touch on LI4	VAS,	Both acupressure with ice and without ice on L4 could decrease labor pain.
Dehcheshmeh (23) 2015	Iran	Three groups, RCT	90 primigravida (30-30-30)	Group I: received music therapy based on the mothers' interest Group II: ice massage was applied at the (LI 4) point for 20 minutes	Hospital routine care	VAS	Music therapy and (LI 4) point ice massage both have a similar effect in reducing labor pain.
Sharma (21) 2019	India	Two groups, quasi-experimental	60 primigravida (30-30)	The researcher alternately performed Ice massage on both hands every 10 minutes	Hospital routine care	NRS	Ice massage at point (LI 4) successfully reduced labor pain.

Author / Year	Country	Study design	Study sample	Intervention protocol	Comparison Protocol	Tool	Main findings
Yildirim (4) 2018	Turkey	Two groups, RCT	72 (36-36)	during each uterine contraction and stopped once the contraction ended. Ice massage was applied at the (LI 4) point for 80 minutes during contractions on both hands simultaneously	Hospital routine care	VAS	Ice massage at point (LI 4) successfully reduced labor pain.
Najarana (19) 2020	India	Two groups, quasi-experimental	60 primigravida and multigravida (30-30)	Ice massage was applied on LI 4 for 30 minutes	Hospital routine care	VAS	Ice massage at point (LI 4) successfully reduced labor pain.
Abdelglil (20) 2022	Egypt	Three groups, quasi-experimental	150 primigravida (50-50-50)	Group I: ice-cold massage on both hands (LI 4) during contractions from 5 to 20 minutes. Group II: ice-cold compression in the sacrum region	Hospital routine care	VAS	Both Cold compression methods can alleviate labor pain, but the hand group experienced a more consistent effect on pain intensity.

NRS: Numeric Rating Scale, VAS: Visual Analogue Scale

Risk of bias description:

Details of the risk of bias in the included RCTs with ROB 1 are shown in Figures 2 and 3. Details of the risk of bias in the included RCTs with ROB 1 are shown in Figures 2 and 3.

Assessment of risk of bias with the (ROBINS-I) tool for Nonrandomized Studies showed that four of the included studies had a moderate risk of bias (17, 19, 20, 22), and two of them showed low risk of bias(16, 21). 28.5% of studies did not clearly

define their interventions and had a moderate risk of bias in classifying interventions. 42.8% of studies did not report all their measurements and had a moderate risk of bias in the selection of the reported results. Details of the risk of bias in the included Nonrandomized Studies are shown in Table 2.

	random sequence generation	Allocation concealment	blinding of participants and personnel	blinding of outcome assessment	incomplete outcome data	selective reporting	other bias
Afey 2015	?	?	-	-	+	+	+
Enjezab 2007	-	?	+	-	+	+	+
Kaviani 2012	+	?	-	-	+	+	?
Mirzaee 2020	?	?	+	-	+	+	?
Dehcheshmeh 2015	+	+	+	-	+	+	+
Yildirim 2018	?	?	-	-	+	+	+

Figure 2. Summary of quality assessment using the Risk of Bias by ROB for RCT Study

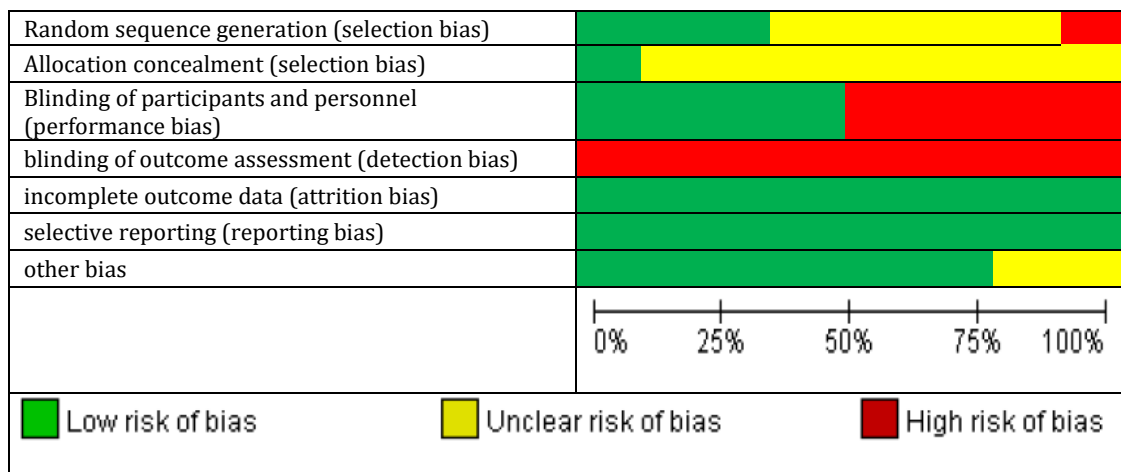


Figure 3. Review authors' judgments about each risk of bias item presented as percentages across all included studies

Table 2. Summary of quality assessment using the Risk of Bias in Non-Randomized Studies—of Interventions (ROBINS-I) tool

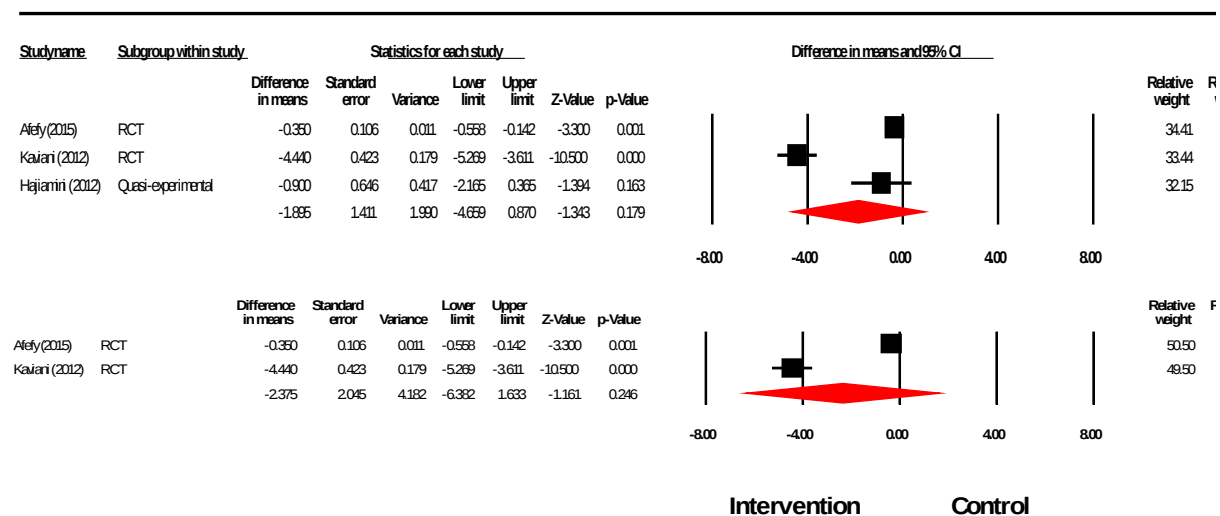
Study	Pre-intervention		At intervention		Post-intervention		
	Bias due to confounding	Bias in selection of participants into the study	Bias in classification of interventions	Bias due to deviations from intended interventions	Bias due to missing data	Bias in measurement of outcomes	Bias in selection of the reported result
Hajiamini	Low	Low	Low	Low	Low	Low	Low
Indumathi	Low	Low	Moderate	Low	Low	Low	Moderate
Kamali	Low	Low	Low	Low	Low	Low	Moderate
Sharma	Low	Low	Low	Low	Low	Low	Low
Najarana	Low	Low	Moderate	Low	Low	Low	Low
Abdelgilil	Low	Low	Low	Low	Low	Low	Moderate

Meta-analysis findings:

There was high heterogeneity among studies based on the Q-test, and I² statistics immediately after intervention (Q = 88.24, P value <0.001, and I² = 97.73%), 60 minutes after intervention (Q = 66.36, P value <0.001, and I² = 92.46%), and 30 minutes after the intervention (Q = 19.70, P value <0.001, and I² = 79.69%). Therefore, the random-effects model was used to estimate pooled results.

The forest plots of eligible articles for estimating the effect of massage therapy with

ice on labor pain intensity are presented in Figures 4-6. Also, the results of the subgroups based on the type of control group and Study design are included in the same Figures. In these plots, MD, 95% confidence interval (95% CI), and the weight assigned to each study are reported. Based on Figure 4, which included three studies in the analysis, ice massage on LI4 during the active phase of labor did not significantly reduce pain immediately after the intervention (MD = -1.89, 95% CI: -4.65 to 0.87, P-value=0.179).



Meta Analysis

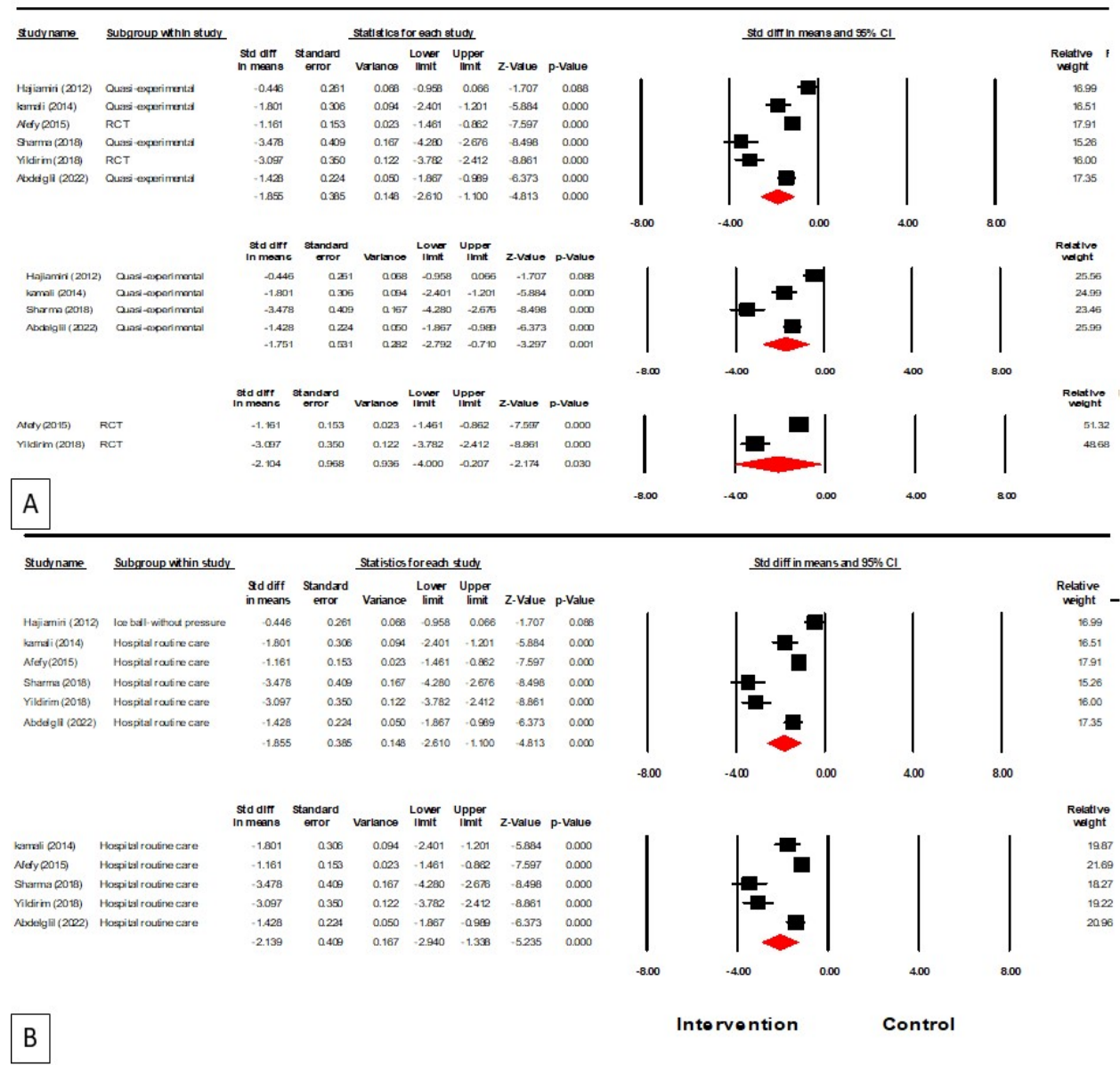
Figure 4. Forest plot of trials comparing the effect of acupressure with ice at the LI-4 point with the control group on labour pain intensity immediately after intervention with study design subgroup. The horizontal lines denote the 95% CI; ■ Point estimate (size of the square corresponds to its weight); ♦, Combined overall effect.

Based on Figure 5, the pooled analysis of five studies 30 minutes after intervention showed a statistically significant difference in favor of the intervention (mean difference [MD] = -1.252, 95% CI: -1.964 to -0.541; P = 0.001). (B) Subgroup analysis according to study design was statistically significant in both quasi-experimental studies (MD = -1.242, 95% CI: -1.918 to -0.566; P < 0.001) and randomized controlled trials (MD = -1.293, 95% CI: -2.348 to -0.237; P = 0.016). Negative mean differences indicate a lower outcome value in the intervention group compared with the control group.

Based on Figure 6, six studies showed a reduction in pain 60 minutes after the intervention (SMD = -1.85, 95% CI: -2.61 to -1.10, P-value < 0.001). In subgroup analysis based on study design (Figure 6A), both quasi-experimental studies (SMD = -1.856, 95% CI: -2.610 to -1.100, P < 0.001) and randomized controlled trials (SMD = -2.104, 95% CI: -4.000 to -0.207, P = 0.030) showed a significant reduction in labor pain in the LI4 ice massage group. Similarly, subgroup analysis by type of control intervention (Figure 6B) showed significant pain reduction in studies comparing ice massage with routine hospital care (SMD = -2.139, 95% CI: -2.940 to -1.338, P < 0.001).

The sensitivity analysis of 30 minutes and 60minutes after intervention showed that there were no obvious changes in MD and SMD of pain after excluding each of the studies one by one. Therefore, our results were reliable. However, the sensitivity analysis of labor pain

immediately after intervention showed a change in the result. Omitting Kaviani's (2012) study made the result different in a way that the intervention showed a significant effect (MD = -0.36, 95% CI: -0.57 to -0.15, P-value<0/001).



Meta Analysis

Figure 5. Forest plot of trials comparing the effect of acupressure with ice at the LI-4 point with the control group on labour pain intensity 30 minutes after intervention (A) with different types of control group subgroup, and (B) with study design subgroup. The horizontal lines denote the 95% CI; ■ Point estimate (size of the square corresponds to its weight); ♦, Combined overall effect.

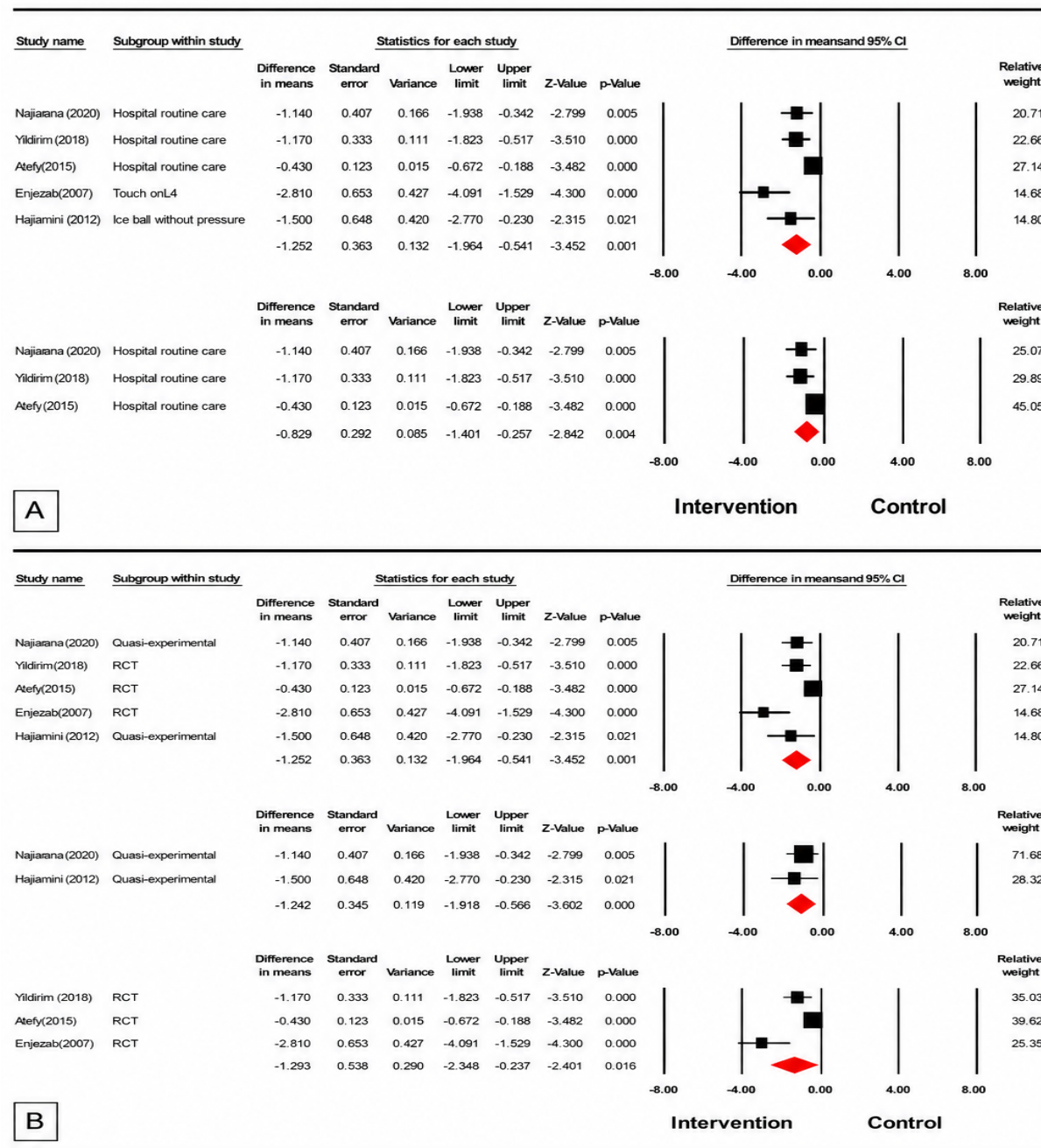


Figure 6. Forest plot of trials comparing the effect of acupressure with ice at the LI-4 point with the control group on labour pain intensity 60 minutes after intervention with (A) study design subgroup, and (B) with different types of control group subgroup. The horizontal lines denote the 95% CI; ■ Point estimate (size of the square corresponds to its weight); ♦, Combined overall effect.

Discussion

This systematic review and meta-analysis included 12 randomized controlled and quasi-experimental studies to evaluate the effects of LI4 massage with ice on labor pain. Our results showed that ice massage on LI4 reduced labor pain at 30 and 60 minutes after the intervention, but no significant effect was observed immediately after the intervention. In contrast to our findings, a meta-analysis of acupressure at LI4 for labor pain reported that three studies found no significant difference in pain between the acupressure and touch groups 30 minutes after the intervention, while a significant reduction in pain was observed immediately after the intervention (6). This difference can be explained by the different types of intervention. Ice massage may take time to stimulate energy channels and create a balance between forces and energy flows. However, some studies were consistent with our findings. Nehbandani et al. (2019) reported that cold massage at SP6 significantly reduced labor pain compared with hot massage at 30 and 60 minutes after the intervention (2). Similarly, Sirati Nir et al. (2010) found that ice massage at the LI4 point significantly reduced labor pain (24). Our meta-analysis's findings are consistent with the 2016 systematic review on the effects of cold massage on the Hegu acupuncture point for pain relief. In which twelve included articles demonstrated the multiple benefits of Hegu point ice massage, such as its safety and cost-effectiveness, absence of the requirement for specialized equipment, simplicity of teaching, ease of application, and lack of interference with medical treatments. These characteristics support the potential value of Hegu point ice massage as a simple and feasible non-pharmacological approach to labor pain management (25). An RCT conducted in 2023 in Turkey used ice massage on the LI4 pressure point for episiotomy repair. The findings demonstrated that, in comparison to women receiving routine medical treatment, ice massage performed on the LI4 during episiotomy repair significantly decreased the level of pain experienced by women (26). Khalili-Shomia et al (2019) also declared that both acupressure alone and ice massage on LI4 relieved pain after appendectomy, but the effect of ice massage was higher (27).

The Gate Control Theory accounts for the mechanism through which massage and cold therapy alleviate pain; it suggests that pain transmission is impeded by competing sensory inputs at the spinal cord level. Moreover, the application of cold packs or massage during childbirth has been shown to elevate serotonin and dopamine levels, which may contribute to muscle spasm relief, increased comfort, and distraction from pain (9).

The impact of acupressure on the intensity of labor pain has been the subject of several meta-analyses in recent years; however, none have examined the combination of acupressure and ice. When considering their interventions, the majority of researchers used points SP6 and LI4, which are consistent with our findings (6, 28-31). Acupressure significantly reduced labor pain in the intervention group compared to the control group, according to a meta-analysis of 18 RCTs conducted in 2020 (28). A meta-analysis of five trials and a total of 312 participants yielded results in 2023. The labor pain scores of the group receiving auricular acupressure were significantly reduced compared to the group receiving standard treatment. Auricular acupressure may significantly improve labor pain at cervix dilations of 6, 8, and 10 cm (31).

In general, we assessed that two RCTs and three quasi-experiments among the articles we examined were considered to have low risk in each domain. Common concerns were allocation concealment and blinding of outcome evaluation. It is critical to consider the possibility of overestimating the efficacy of therapy when interpreting results, particularly in studies where blinding and/or allocation concealment are insufficient. In order to establish the credibility of using acupressure with ice as an intervention in midwifery contexts, it is crucial to do rigorous research that focuses on these concerns. More research is required to mitigate biases by enhancing the use of standardized protocols, thereby increasing the accuracy and reliability of results to confirm the actual effectiveness of acupressure with ice during childbirth. Small sample sizes, different methodologies, or insufficient confounding factor control in the included trials may have impacted its effectiveness on pain reduction.

There are various disadvantages and advantages to this meta-analysis. While the efficacy of Ice acupressure in pain relief has been verified, there is a significant degree of heterogeneity. Various factors, such as the wide range of demographic characteristics and methodological variation, can account for the observed results. However, the clinical differences among the study participants, such as mental condition, tolerance, and perceptions of pain are the primary source of these differences. Variables like the length of the massage period and the person performing the procedure, such as a nurse, midwife, or other care provider, could also play a role. This variability may limit the generalizability, and the results should be interpreted with caution. In future research, we suggest developing and applying a standardized approach for studying labor pain, considering the differences in pressure point length of interventions seen in the analyzed studies. The inability to retrieve unreported negative findings could potentially cause publication bias. The trials enrolled low-risk, term, nulliparous, and multiparous women, primarily in spontaneous labor. A limited number of countries conducted the investigations, thereby restricting the representation of various acupressure techniques used in these studies. Finally, the overall quality of the trials was not high, particularly regarding the concealment of allocation and blinding among participants and personnel. In addition to its limitations, our study has advantages. We believe this is the first meta-analysis to objectively assess the effects of LI4 massage with ice on labor pain reduction. Another strength is the assessment of pain reduction at different time points after the intervention, allowing the temporal pattern of the intervention's effect to be examined. The independent assessment of studies by two researchers helped minimize potential errors in study selection and data extraction.

Conclusion

This meta-analysis provides evidence that Hegu point (LI4) massage combined with ice can effectively reduce the intensity of labor pain at 30 and 60 minutes after the intervention, although no significant effect was observed immediately after the intervention. Given its

simplicity, affordability, and non-pharmacological nature, this intervention may be considered a practical option for labor pain management, particularly in settings where women have limited access to pharmacological pain relief or prefer non-pharmacological approaches. Doulas, midwives, and gynecologists should consider women's individual preferences and clinical circumstances when selecting pain management strategies and may incorporate LI4 massage with ice into maternity care where appropriate. Nevertheless, larger and methodologically rigorous randomized controlled trials are needed to provide more conclusive evidence regarding its effectiveness and safety.

Declarations

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Conflicts of interest

Authors declared no conflicts of interest.

Ethical considerations

In this study, the researchers made a diligent effort to adhere strictly to all research ethics guidelines. They consciously avoided plagiarism and refrained from manipulating data for personal benefit. The research team conducted the identification, screening, extraction, and data analysis stages, ensuring full consideration of ethical principles throughout the process.

Code of Ethics

This article has a license from the Research Ethics Committee of Mashhad University of Medical Sciences (IR.MUMS.NURSE.REC.1403.033).

Use of Artificial Intelligence (AI)

None.

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Authors' contribution

SA, ML, ZHT made significant contributions to the conception and design of the study. SA, ML and ZHT conducted the data collection. ZHT and SA analyzed and interpreted the data. ZHT drafted the manuscript, while SA, and ML critically reviewed it for important intellectual content. All authors read and approved the final manuscript and agreed to be accountable for all aspects of the work, ensuring that any questions related to the accuracy or integrity of any part of the work would be appropriately investigated and resolved.

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