



## The effectiveness of warm perineal compresses during the second stage of labor on perineal trauma and labor pain: A Systematic Review

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### Abstract

**Background:** Labor pain and perineal trauma are the most common complications during childbirth and negatively impact a woman's physical and emotional well-being. The World Health Organization recommends using warm compresses during the second stage of labor to mitigate perineal injuries. This systematic review evaluates the effectiveness of this intervention to guide informed clinical decisions.

**Methods:** Searches were conducted on PubMed, Google Scholar, and ScienceDirect from inception up to the present day (as of July 2023) for randomized and quasi-experimental trials in English, focusing on vaginal births using warm compresses and measuring outcomes related to pain and perineal trauma. The review followed PRISMA guidelines, and biases were assessed with the Cochrane risk-of-bias tools.

**Results:** The search strategy identified a total of 75 articles, of which 13 were included in the review. In most studies, pain scores in the warm group were significantly lower than in the control group. Warm compress intervention was also associated with lower rates of perineal laceration and a higher rate of intact perineum. Results in suturing-required perineal injuries, severity of perineal trauma, or episiotomy were mixed.

**Conclusion:** It is suggested that the application of warm compresses during the second stage of labor has been shown to be an effective method for reducing labor pain and perineal trauma that does not require suturing. Due to the mixed results found, considerations should be made before applying this intervention for the purpose of reducing perineal tears or episiotomies during labor.

### Article History

Received: 4 January 2024

Received in revised form: 24 April 2024

Accepted: 19 June 2024

Published online: 22 June 2024

DOI: [10.29252/jgbfmm.21.2.16](https://doi.org/10.29252/jgbfmm.21.2.16)

### Keywords

Labor stage, Second

Labor pain

Perineal trauma

Warm compresses

Article Type: Systematic Review



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### Highlights

#### What is current knowledge?

In most studies, pain scores in the warm group were significantly lower than in the control group. Warm compress intervention was also associated with lower rates of perineal laceration and a higher rate of intact perineum. Results in the suturing-required perineal injuries, severity of perineal trauma, or episiotomy, were mixed.

#### What is new here?

The application of warm compresses during the second stage of labor has been proven to be effective in reducing pain and perineal trauma that does not require suturing. Considerations should be made before applying this intervention for the purpose of reducing perineal tears or episiotomy during labor.

### Introduction

Childbirth is a physiological event that allows the fetus to be expelled from the mother's uterus and birth canal (1). The pain of childbirth is one of the most intense pains that women experience in their lifetime and is a common concern for first-time mothers (2-5). Effective pain control is critical for a satisfying childbirth experience (6). Pain that is not managed appropriately can adversely affect the woman and her fetus and can influence the labor and delivery experience (7). Pain relief gives women control and enables them to participate in the childbirth experience (8).

One of the common causes of pain during the second stage of labor is perineal injury (2,3,9). Perineal trauma is a common complication of childbirth, affecting approximately 53 to 79% of women and negatively affecting a woman's quality of life, including perineal pain, urinary incontinence, difficulty urinating, and sexual dysfunction (10,11). Perineal tears can range from first-degree to fourth-degree, with increasing severity. Most perineal tears are first- or second-degree tears, which involve the skin and muscles of the perineum. However, more severe perineal tears, such as third- and fourth-degree tears, can also occur. Third- and fourth-degree tears involve the anal sphincter and can cause significant pain and complications. A study conducted in England found that the prevalence of perineal tears among primiparous women (women who are giving birth for the first time) was 91.4%. At 8 weeks after birth, 22% of new mothers have reported continued perineal pain (12).

The World Health Organization recommends using warm perineal compresses during the second stage of labor to reduce the risk of perineal injuries (13). Warm compresses work by dilating blood vessels and improving blood supply to the perineum. This helps to reduce pain and inflammation and can also

help to prevent tears. A study found that 80.4% of midwives and 79.7% of mothers agreed with the effectiveness of warm compresses on labor pain (14). Midwives also advised continuing to use warm perineal compresses for women who give birth (15). Warm perineal compresses are commonly suggested as a safe and effective way to reduce the risk of perineal injuries during childbirth as well as the risk of labor pain. However, it should be noted that the effectiveness of this method is not always found. A clinical experiment conducted among three groups of interventions: perineal warm compress, midwife massage with lubricant, and no intervention reported that the prevalence of perineal and vaginal injury did not differ substantially across groups (16).

Researchers have been tempted to investigate the use of warm perineal compresses during labor for pain management; a meta-analysis on this topic was published in 2019 with, however, a small number of seven articles included (17). Since there is not a solid confirmation of the effectiveness of this method yet, it is worth continuing to conduct systematic reviews using the updated database to provide a clearer view of the topic. This systematic review aimed to examine the effectiveness of warm perineal compresses during the second stage of labor on 1) perineal conditions (laceration, intact, suturing required, episiotomy, intensity of perineal trauma) after delivery and 2) the relief of labor pain, from which we were expected to provide reliable evidence to help make informed decisions about the use of warm perineal compresses during childbirth. Results from this study can also be considered a comparative reference for similar research in the future.

### Methods

#### Study design:

The systematic review was conducted at the University of Medicine and Pharmacy at Ho Chi Minh City in June - July 2023 and included articles published from inception up to the present day (as of July 2023). The literature search was conducted using the following databases: PubMed, Google Scholar, and ScienceDirect.

#### Search strategy:

In PubMed, MeSH (medical subject headings) and other terms were used, and the search string was generated as follows: (randomized controlled trial OR RCT) AND (spontaneous vaginal delivery OR SVD OR vaginal delivery OR natural childbirth OR childbirth) AND (warm perineal compresses OR warm compresses OR perineal compresses OR heat compresses OR warm packs OR thermal compresses) AND (perineal trauma OR perineal tear OR perineal laceration OR perineal rupture) AND (second stage of labor OR SSL). In Google Scholar, the search string was: ("spontaneous vaginal delivery" OR "vaginal delivery" OR "natural childbirth OR childbirth") AND ("warm perineal compresses" OR "warm compresses OR perineal compresses" OR "heat compresses" OR "warm packs" OR "thermal compresses") AND ("perineal OR "perineum") AND

("trauma OR tear OR "laceration" OR "rupture" OR "pain" OR "intact" OR "episiotomy") AND ("second stage of labor" OR "uterine contractions"). In ScienceDirect, the search string was: ("randomized controlled trial") AND ("vaginal delivery" OR "natural childbirth") AND ("warm compress" OR "heat compress") AND ("trauma" OR "pain") AND ("second stage of labor" OR "uterine contractions").

**Selection criteria:**

The titles and abstracts of all articles retrieved from the literature search were screened by two independent reviewers. Full-text articles were retrieved for those that met the following inclusion criteria: 1) Randomized controlled trials (RCTs) or quasi-RCTs; 2) The study population was women who were planning to give birth vaginally; 3) The intervention was the use of warm perineal compresses during the second stage of labor; 4) The outcomes included pain measurement and/or perineal trauma and/or other perineal status after delivery. Articles that were not published in English were excluded from the research. Microsoft Excel program was used to examine the outcome variables.

**Data extraction:**

Two independent reviewers extracted data from the included studies using a standardized data extraction form. The following data were extracted: 1) The study's baseline characteristics: treatment for the control group, maternal mean age and age range, gestational mean age, and age range, 2) Pregnancy-related selection criteria, 3) Detailed information on the intervention method, 4) Outcomes: incidence of perineal laceration, intact perineum, perineum trauma required suturing, episiotomy, severity of perineum trauma (1st to 4th degree), pain score, intensity of pain by categorization (for example: mild, moderate, severe, very severe). The principal investigator made the final decision in cases of discrepancies or queries from reviewers.

**Risk of bias assessment:**

The risk of bias in the included studies was assessed using the Cochrane risk-of-bias tools for Systematic Reviews of Interventions. All studies were evaluated based on the following criteria: 1) random sequencing; 2) allocation masking (selection deviation); 3) blinding participants and staff (performance deviation);

4) blinding outcome evaluators (detection deviation); 5) incomplete outcome data (attrition deviation); 6) selective reporting of results (reporting bias); 7) other deviations. The reviews of authors' judgments were categorized as "low risk", "high risk", or "unclear risk" of bias.

**Reporting and ethical consideration:**

The results of the systematic review were reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Being designed as a systematic review extracting data from published articles, an ethical review for this study might be exempt. However, information about the ethical approval of the selected articles was reported as part of the quality assessment.

**Results**

Thirteen trials, involving 2,907 participants, met the inclusion criteria for this systematic review (Figure 1). Most studies had a low risk of bias in random sequencing, allocation, selective reporting, and incomplete outcome data, according to the Cochrane Collaboration's tool. The risk of the two blinding criteria was high due to the nature of the intervention (Figure 2). Most studies were conducted in Asia, with a 1:1 ratio of intervention and control groups (15,18-25). In most studies, the control group received routine hospital care; one study compared the outcomes of the warm compress method with perineal massage therapy (24). The mean maternal age was approximately 25 years old in all studies, and the mean gestational age was 39 weeks. Seven of the selected studies provided ethical approval for their trials (15,19,22,23,26-28) (Table 1).

Pregnancy-related selection criteria were seen in most trials, but not all these criteria were required. The most common criteria were that the women were primiparous (giving birth for the first time), had a healthy term pregnancy, and were carrying a singleton baby with cephalic presentation (head down). Two studies limited the baby's birth weight to between 2,500 and 4,000 grams. Two studies did not report their pregnancy-related criteria (21,25) (Table 2).

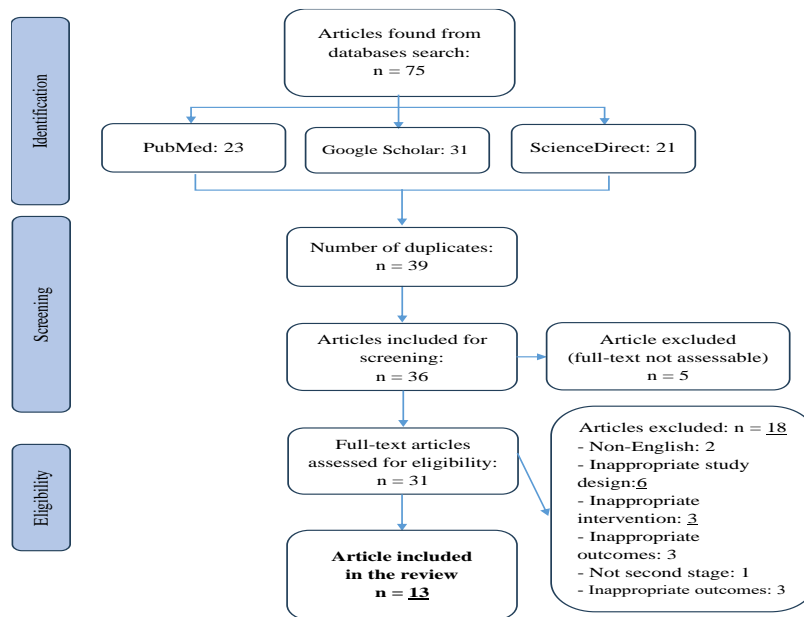
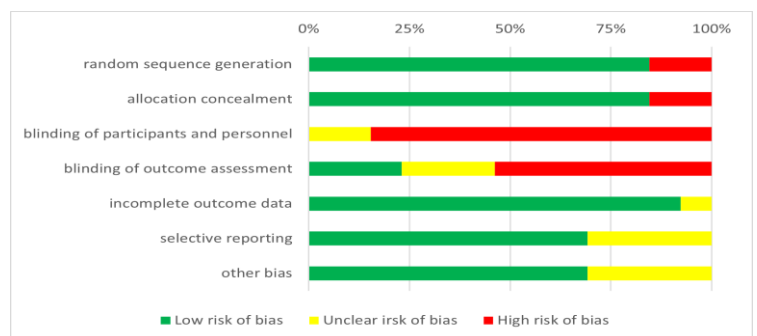


Figure 1. Study flow chart

Article	Criteria for risk of bias						
	1	2	3	4	5	6	7
Sondakh (2022)	+	+	-	+	+	?	+
Modoor (2021)	+	+	?	+	+	?	?
Farahmand (2020)	+	+	-	-	+	+	+
Alihosseni (2018)	+	+	-	-	+	+	+
Ibrahim (2017)	+	+	?	?	+	?	+
Akbarzadeh (2016)	+	+	-	-	+	+	+
Mohamed (2011)	+	+	-	-	+	?	?
Dahlen (2007)	+	+	-	+	+	+	+
Albers (2005)	+	+	-	-	+	+	+
Thenu (2019)	-	-	-	?	+	+	?
Essa (2016)	-	-	-	?	+	+	?
Turkmen (2020)	+	+	-	+	+	?	+
Ganji (2013)	+	+	-	-	+	+	+



1: Random sequence generation; 2: Allocation concealment; 3: Blinding of participants and personnel; 4: Blinding of outcome assessment; 5: Incomplete outcome data; 6: Selective reporting; 7: Other bias. +: Low risk; -: High risk;?: Unsure.

Figure 2. Assessment of the risk of bias

The application of warm compresses varied with each trial. Most studies used warm compresses made from clean washcloths immersed in warm water and applied to the perineal area (19,22-25,27). There was one study that sequentially applied warm packs and ice packs as their intervention (20) (Table 3).

The rates of intact perineum and episiotomy were the most reported outcomes. The rate of intact perineum was significantly higher in the warm compresses group than the control group in most trials (15,21,22,24,25,29). Two studies found no significant difference in the intact between the two groups (18,23).

There were eight studies that reported episiotomy outcomes, in which the rate of episiotomy was significantly lower in the warm compress group than the control group in three studies (18,22,29). The rate of perineal lacerations was reported in five trials, and there was a significant difference between the two groups in all of them (15,21,22,24,29). Four of these trials reported a lower rate of lacerations in the warm compresses group (15,21,24,29), while one reported the opposite result (22). One trial found a significantly lower rate of perineal injuries required suturing in the warm compresses group than the control group (29) (Table 4).

Table 5 shows the results of the severity of perineal trauma from the trials.

**Table 1.** Baseline characteristics of the selected articles (n = 13)

No.	Author (year)	Study location	Sample size (I:C)	Treatment for the control group	Maternal age (year)	Maternal age range (year)	Gestational age (week)	Gestational age range (weeks)	Ethical review
1	Sondakh (2022)	Indonesia	60 (30:30)	Routine care	NR	NR	NR	NR	NR
2	Modoor (2021)	Saudi Arabia	100 (50:50)	Routine care	NR	18 - 35	39 ± 1	37 - 41	Approved
3	Farahmand (2020)	Iran	150 (75:75)	Usual hospital cares	NR	18 - 35	NR	37 - 42	Approved
4	Alihosseni (2018)	Iran	107 (54:53)	Routine ritgen's maneuver	I: 23 ± 6 C: 23 ± 4	18 - 35	I: 39 ± 1 C: 39.5 ± 1	NR	NR
5	Ibrahim (2017)	Egypt	202 (102:100)	Routine care	I: 24 ± 6 C: 25 ± 6	NR	I: 38 ± 4 C: 39 ± 2	37 - 42	Approved
6	Akbarzadeh (2016)	Iran	150 (75:75)	Routine care	NR	18 - 35	NR	37 - 42	Approved
7	Mohamed (2011)	Egypt	200 (100:100)	Perineal massage with lubricant	I: 25 ± 7 C: 27 ± 6	NR	NR	≥ 37	NR
8	Dahlen (2007)	Australia	717 (360:357)	Standard care	I: 27 ± 5 C: 27 ± 5	≥ 16	NR	≥ 36	Approved
9	Albers (2005)	United States of America	808 (404:404)	No touch / Hands off	I: 25 ± 5 C: 24 ± 5	≥ 18	NR	NR	Approved
10	Thenu (2019) *	Indonesia	124 (62:62)	Without perineal warm compresses	I: 26 ± 4 C: 25 ± 4	NR	I: 38 ± 1 C: 38 ± 1	NR	NR
11	Essa (2016) *	Egypt	160 (80:80)	Routine care	NR	18 - 35	NR	NR	NR
12	Turkmen (2020) *	Turkey	65 (32:33)	Standard midwifery care	I: 24 ± 3 C: 25 ± 4	I: 17 - 32 C: 18 - 35	NR	NR	Approved
13	Ganji (2013)	Iran	64 (32:32)	Routine care	I: 29 ± 5 C: 29 ± 5	18 - 35	I: 39 ± 1 C: 39 ± 1	37 - 41	NR

I: Intervention group; C: Control group; NR: Not reported; \*: Quasi-RCTs.

**Table 2.** Selection criteria of the selected articles (n = 13)

No.	Author (year)	Primiparous/nulliparous	Healthy/Normal pregnancy	Singleton pregnancy	Cephalic presentation	Baby's birth weight (grams)
1	Sondakh (2022)			NR		
2	Modoor (2021)	Yes	Yes	Yes	Yes	NI
3	Farahmand (2020)	Yes	NI	Yes	Yes	NI
4	Alihosseni (2018)	NI	Yes	Yes	Yes	2500-4000
5	Ibrahim (2017)	NI	Yes	Yes	Yes	NI
6	Akbarzadeh (2016)	Yes	NI	Yes	Yes	2000-3500
7	Mohamed (2011)	NI	NI	Yes	Yes	NI
8	Dahlen (2007)	Yes	NI	Yes	Yes	NI
9	Albers (2005)	NI	Yes	NI	NI	NI
10	Thenu (2019)			NR		
11	Essa (2016)	Yes	Yes	Yes	Yes	NI
12	Turkmen (2020)	Yes	Yes	Yes	Yes	NI
13	Ganji (2013)	Yes	NI	Yes	Yes	NI

NR: Not reported; NI: Not included.

**Table 3.** Interventions of the selected articles (n = 13)

No.	Author (year)	Item for intervention	Immerse in warm water	Duration
1	Sondakh (2022)	Warm pad	NR	NR
2	Modoor (2021)	Sterile perineal pad (gauze)	Warm water with a temperature ranges from 45°C-59°C	Continuously until bulging of the head
3	Farahmand (2020)	Warm compresses, after being heated, were wrapped in a sterile soft towel	70°C water for 12 minutes	15-20 minutes
4	Alihosseni (2018)	Heating pad, produce heat to about 50°C continuously and up to a maximum of 12 hours	No	From the start of the second stage of labor, remove during the mother's transfer to the labor room
5	Ibrahim (2017)	Squeezed sterile dressing	Water temperature at 38°C	From the beginning of the 2nd stage until crowning
6	Akbarzadeh (2016)	Warm compresses, after being heated, were wrapped in a sterile soft towel	70°C water for 12 minutes	15-20 minutes
7	Mohamed (2011)	Soaked sterile perineal pad which temperature ranged between 38° to 44°C	Heated tap water (between 45° and 59°C)	From crowning (baby's head began to distend the perineum)
8	Dahlen (2007)	Soaked sterile perineal pad which temperature ranged between 38° to 44°C	Boiled tap water (between 45° and 59°C)	Start when the baby's head began to distend the perineum and the woman was aware of a stretching sensation
9	Albers (2005)	Squeezed warm clean wash cloths	Tap water	Start by active fetal descent or when the fetal head was visible with a uterine contraction, as continuously as possible until crowning
10	Thenu (2019)	Wash cloth	Warm water with temperature of 38-44 Celsius degrees	20 minutes cumulative time on each contraction
11	Essa (2016)	Soaked sterile perineal pad which temperature ranged between 38° to 44°C	Boiled tap water (between 45° and 59°C)	During contraction
12	Turkmen (2020)	Thermoforming (dry heat application) wrapped with a towel	No	Continuously for 20 min
13	Ganji (2013)	1) Warm water pack (temperature of 38-40°C) covered with towel and 2) icepack covered with towel	No	Warm pack for 15 mins, then ice pack for 5 mins

NR: Not reported.

One trial reported a significantly higher rate of 3<sup>rd</sup>-4<sup>th</sup> level of trauma in the control group than in the intervention group; the p-value, however, was not shown (26). Another trial reported that the warm compresses group had a higher rate of 1st-level and lower rates of 2<sup>nd</sup>- and 3<sup>rd</sup>-level of trauma, but the differences were weakly significant (22).

Table 6 shows the pain scores reported in three trials (19,20,25). The pain scores in the warm compresses group were lower than those in the control group

after the intervention was applied and after delivery (19,20,25). The differences were significant in two out of three trials (19,20).

Table 7 also shows that the pain severity was significantly different between the two groups. Specifically, the rate of severe pain or higher levels was reported to be lower in the warm compresses group than the control group in most of the selected trials (19,21,23,29).

Table 4. Perineal outcomes of the selected articles

Perineal lacerations, n (%)					Perineal injuries required suturing, n (%)				
No.	Article	Warm	Control	p	No.	Article	Warm	Control	p
1	Akbarzadeh (2016)	15 (20.3)	5 (6.7)	0.019	1	Albers (2005)	83 (20.5)	88 (21.8)	NS
2	Modoor (2021)	30 (60)	33 (66)	0.001	2	Dahlen (2007)	283 (78.6)	284 (79.9)	NS
3	Mohamed (2011)	10 (10.0)	23 (23.0)	< 0.01	3	Essa (2016)	26 (32.5)	78 (97.5)	< 0.001
4	Essa (2016)	2 (02.5)	25 (31.3)	< 0.001	4	Ibrahim (2017)	4 (3.9)	8 (8.0)	NS
5	Sondakh (2022)	10 (33.3)	24 (80)	< 0.001					
Intact perineum, n (%)					Episiotomy, n (%)				
No.	Article	Warm	Control	p	No.	Article	Warm	Control	p
1	Akbarzadeh (2016)	20 (27)	5 (6.7)	< 0.001	1	Albers (2005)	1 (0.3)	2 (0.5)	NS
2	Alihosseni (2018)	14 (26.4)	8 (14.8)	NS	2	Alihosseni (2018)	11 (20.8)	22 (40.7)	0.025
3	Modoor (2021)	11 (22)	5 (10)	0.001	3	Dahlen (2007)	39 (10.8)	41 (11.5)	NS
4	Mohamed (2011)	68 (68.0)	47 (47.0)	< 0.001	4	Ganji (2013)	31 (52.5)	28 (47.5)	NS
5	Essa (2016)	50 (62.5)	2 (2.5)	< 0.001	5	Modoor (2021)	9 (18)	12 (24)	0.001
6	Thenu (2019)	10 (16.1)	2 (3.2)	0.03	6	Mohamed (2011)	22 (22.0)	30 (30.0)	NS
7	Ibrahim (2017)	1 (1.0)	0 (0)	NS	7	Essa (2016)	26 (32.5)	50 (62.5)	< 0.001
8	Sondakh (2022)	20 (66.7)	6 (20)	< 0.001	8	Ibrahim (2017)	95 (93.1)	92 (92.0)	NS

NS: Not significant.

Table 5. Severity of perineal trauma in the selected articles (n = 4)

No.	Article	Severity of penireal trauma	Group		p-value
			Warm	Control	
1	Albers (2005)	1st	97 (24.4)	89 (22.0)	NS
		2nd	70 (17.3)	74 (18.3)	
		3rd	3 (0.7)	2 (0.5)	
		4th	0 (0.0)	4 (1.0)	
2	Alihosseni (2018)	1st	14 (26.4)	13 (24.1)	NS
		2nd	7 (13.2)	9 (16.7)	NS
3	Dahlen (2007)	3rd or 4th	15 (4.2)	31 (8.7)	Sig
4	Modoor (2021)	1st	19 (61.3)	13 (31.7)	0.043
		2nd	10 (32.3)	24 (58.5)	
		3rd	2 (6.5)	4 (9.8)	
		4th	0 (0.0)	0 (0.0)	

NS: Not significant; Sig: significant, p-value not reported.

Table 6. Pain score outcomes of the selected articles (n = 3)

No.	Article	Pain measurement	Time evaluated for pain	Group		p-value
				Warm	Control	
1	Farahmand (2020)	VAS	After intervention	3.32 ± 1.18	7.40 ± 1.29	< 0.001
2	Turkmen (2020)	Numerical rating, 10-point scale (NRS): - 0: no pain - 10: worst pain	After delivery	0.13 ± 0.34	0.16 ± 0.37	NS
3	Ganji (2013)	VAS	After delivery	Lower	Higher	< 0.001

NS: Not significant

Table 7. Pain severity of the selected articles (n = 5)

No.	Article	Pain measurement	Time evaluated for pain	Pain severity	Group		p-value
					Warm	Control	
1	Farahmand (2020)	VAS	After intervention	< 4	56 (75.7)	0 (0)	< 0.001
				4-8	18 (24.3)	24 (32)	
				> 8	0 (0)	51 (68)	
2	Modoor (2021)	NRS	After delivery	Mild pain (1,2)	20 (40.0)	26 (52.0)	< 0.001
				Moderate pain (3,4)	26 (52.0)	17 (34.0)	< 0.001
				Severe pain (5,6)	4 (8.0)	7 (14.0)	< 0.001
				Very severe (7,8)	0 (0.0)	0 (0.0)	NS
				Worst pain (9,10)	0 (0.0)	0 (0.0)	NS
3	Essa (2016)	Numerical Pain Rating Score (NPRS), 10-point scale: - 0: no pain - 10: worst pain	Immediately before the application	Mild (1-3)	20 (25.0)	0 (0)	< 0.001
				Moderate (4-6)	52 (65.0)	16 (20.0)	
				Severe (7-9)	8 (10.0)	52 (65.0)	
				Unbearable (≥10)	0 (0)	12 (15.0)	
4	Ibrahim (2017)	Pain analogue, 10-point scale: - 0: no pain - 10: worst pain	15 minutes after starting the intervention	Severe (5,6)	(60.8)	(42.0)	0.003
				Very severe (7,8)	(32.3)	(36.0)	
				Worst pain (9,10)	(6.9)	(22.0)	
5	Sondakh (2022)	NR	Somatic pain	Light	4 (13.3)	0 (0)	< 0.001
				Medium	21 (70)	1 (3.3)	
				Heavy	3 (10)	10 (33.3)	
				Very heavy	2 (6.7)	14 (46.7)	
				Heaviest	0 (0)	5 (16.7)	
			Pain frequency strain	Light	14 (46.7)	0 (0)	< 0.001
				Medium	13 (43.3)	1 (3.3)	
				Heavy	2 (6.7)	5 (16.7)	
				Very heavy	1 (3.3)	13 (43.3)	
				Heaviest	0 (0)	11 (36.7)	

NR: Not reported; NS: Not significant

## Discussion

This systematic review of thirteen studies involving 2,907 participants was conducted to assess the effectiveness of warm perineal compresses during the second stage of labor on perineal conditions after delivery and labor-related pain. The included studies were conducted in eight countries, mostly in Asia and Africa. Among the studies, seven trials recommended the use of warm compresses for pain relief and perineal preservation during the second stage of labor, and five trials specifically stated that warm compresses were effective in decreasing perineal laceration and labor pain. However, one trial found that the use of warm compresses should be based on maternal comfort and other considerations, and another trial suggested that further research is needed on this topic (18,26).

Regarding the risk of bias, at least one criterion was rated as high risk or unsure in every trial. The blinding criteria seemed unable to be reached using this intervention. It can be concluded that warm perineal compresses are effective in reducing perineal laceration and labor pain, but the results should be interpreted with caution due to the risk of bias and the small number of studies included.

### Intervention methodology and outcome measurement

The methodology of warm compress application varied across the studies, including the item used, the duration of application, the temperature, the location of application, and the time point of application. For measuring pain, most studies used a visual scale for pain, but the way pain results were classified varied from study to study. These differences can prevent making uniform judgments about the effectiveness of warm compresses on outcomes of interest. However, despite the methodological differences, most studies reported a good effect of warm compresses on one or more outcomes compared with control groups. This finding suggests that warm compresses may be an effective intervention for reducing perineal laceration and labor pain, but further research is needed to confirm these findings and standardize the interventions used.

### Effect of warm compresses on labor pain

The evaluation of labor pain by scores and when grouping pain levels showed a clear effect of warm compresses on pain relief. In most of the studies, pain scores in the warm group were significantly lower than in the control group (19,20). Similar findings were observed in pain severity studies: the warm compresses group had the majority of mild or moderate pain, while the control group had a higher percentage of severe pain (19,21-23,29). This result is consistent with the mechanism of action of passive vasodilation measures, which improve blood supply and temporarily block pain signals from reaching the brain (30). The results suggest that warm compresses can be used to relieve pain during the second phase of labor.

### Effectiveness of warm compresses on perineal injuries

Most studies showed that warm compresses were associated with lower rates of perineal laceration. However, in a trial conducted by Akbarzadeh, the author reported a higher rate of perineal laceration in the warm compresses group without a specific discussion for this result (15). In some cases, applying warm compresses to the perineum might soften the tissue and make it less resilient, potentially increasing the likelihood of tearing during childbirth. Moreover, the warm compress used in Akbarzadeh's study was put in water at 70°C; this temperature was much higher than most studies (usually ranging from 45 to 59°C). In summary, most of the intact perineum outcomes reported by the trials supported the use of warm compresses, as they helped maintain the perineum's integrity during the second stage of labor.

The rate of perineum trauma that required suturing did not differ between the warm compresses group and the control group. Results on episiotomy rates between the two groups were also inconsistent: three out of eight trials showed that the warm compresses group had a significantly lower rate of perineal tear than the control group (18,22,29); five did not find the difference between groups (20,23,24,26,27). Besides, evidence for the effectiveness of warm compresses in reducing the severity of perineal trauma was either weak or not significantly different between the intervention group and the control group. Besides the methods applied during the delivery stages, other factors might have played a larger role in determining the perineal trauma status. These could include the size and position of the baby, or the mother's anatomy. In summary, warm compresses have been shown to be effective in reducing perineal trauma that does not require suturing and without perineal tears. Considerations should be made before applying this intervention for the purpose of reducing perineal tears or episiotomies during labor.

### Limitations of the study

Quasi-experimental trials are included in this systematic review; they can introduce bias into the results. However, by carefully selecting trials and assessing the risk of bias in each study, such bias was minimized. Differences in the way the warm compresses were performed may also lead to heterogeneity and make it difficult to draw a uniform conclusion. However, the overall trend of the results among trials still supports the use of warm compresses in reducing labor pain and perineal trauma. Due to the lack of information from the selected trials, a meta-analysis was not performed in this review and may be considered in future research. This review excluded trials conducted in languages other than English; thus, a comprehensive approach to the topic may not be reached. It should also be noted that similar systematic reviews on the same topic have been

conducted (17,31,32). However, with the addition of recently published trials, our review may provide more solid evidence for the effectiveness of warm compresses on pain and perineal outcomes during labor.

## Conclusion

In conclusion, the use of warm compresses during the second stage of labor has been shown to be effective in lowering pain and perineal injuries without the need for suturing. Due to the mixed results found, considerations should be made before applying this method to reduce perineal tears or episiotomies during labor.

## Acknowledgement

We thanked the University of Medicine and Pharmacy at Ho Chi Minh City for providing the funds for conducting this research.

## Funding sources

The research received funding from the potential project of the University of Medicine and Pharmacy at Ho Chi Minh City digital contract 189/2021/HĐ - ĐHYD led by Dr. Nhan Thi Nguyen.

## Ethical statement

Ethics Council in Biomedical Research, University of Medicine and Pharmacy at Ho Chi Minh City. No. 615/HDDD-DHYD signed on July 7, 2022.

## Conflicts of interest

The authors declare that they have no competing interests.

## Author contributions

All authors contributed to the writing of the manuscript and read and approved the final manuscript.

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#### How to Cite:

Nguyen NT, Lam QM, Do HT. The effectiveness of warm perineal compresses during the second stage of labor on perineal trauma and labor pain: A systematic review. *J Res Dev Nurs Midw*. 2024;21(2):16-21.