REVIEW ARTICLE

Efficacy of warm compresses in preserving perineal integrity and decreasing pain during normal labor: A systematic review and meta-Analysis

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Abstract

The objective of the study was to assess the effect of warm compresses in preserving perineal integrity in women who delivered a single baby vaginally with cephalic presentation. We searched PubMed, Scopus, and the ISI Web of Science databases. Two researchers worked independently and conducted the study's search, selection, and extraction. We calculated the pooled risk ratio (R.R.)- for our categorical outcomes- and mean difference (M.D.)-for our continuous outcomes- using random or fixed-effect meta-analysis according to heterogenicity status. I^2 test was used to detect heterogenicity. Studies were assessed for methodological quality using the Cochrane risk of bias assessment tool. Our study analyzed 13 controlled trials (n= 3947) to compare warm compresses versus not using it during vaginal delivery. The analysis revealed that warm compresses group had better outcomes regarding episiotomy, degree of perineal trauma (third and fourth degree), perineal trauma requiring suturing, and also in behavioral pain scales (severe muscle tense, being very restless, and constant grimacing) with the following R.R. and confidence intervals: (R.R.= 0.56, 95% C.I.[0.23, 1.37]), (R.R.= 0.69, 95% C.I.[0.54, 0.89], p= 0.004),((R.R.= 0.37, 95% C.I.[0.18, 0.77], p= 0.004), and ((R.R.= 0.42, 95% C.I.[0.23, 0.78], p= 0.006) respectively. We conclude that among primiparous women, warm compresses group showed better outcome in improving perineal comfort than a the good of women who did not receive warm compresses after delivery. *(Afr J Reprod Health 2023; 27 [4]: 96-123).*

Keywords: Warm compresses; perineal integrity; decreasing pain; normal labor; primiparous women

Résumé

L'objectif de l'étude était d'évaluer l'effet des compresses chaudes sur la préservation de l'intégrité périnéale chez les femmes ayant accouché d'un seul bébé par voie basse avec présentation céphalique. Nous avons effectué des recherches dans les bases de données PubMed, Scopus et ISI Web of Science. Deux chercheurs ont travaillé de manière indépendante et ont mené la recherche, la sélection et l'extraction de l'étude. Nous avons calculé le risque relatif (R.R.) groupé - pour nos résultats catégoriels - et la différence moyenne (M.D.) - pour nos résultats continus - à l'aide d'une méta-analyse aléatoire ou à effets fixes en fonction du statut d'hétérogénéité. Le test I2 a été utilisé pour détecter l'hétérogénéité. La qualité méthodologique des études a été évaluée à l'aide de l'outil Cochrane

d'évaluation du risque de biais. Notre étude a analysé 13 essais contrôlés (n = 3947) pour comparer les compresses chaudes à l'absence d'utilisation pendant l'accouchement vaginal. L'analyse a révélé que le groupe des compresses chaudes avait de meilleurs résultats concernant l'épisiotomie, le degré de traumatisme périnéal (troisième et quatrième degré), le traumatisme périnéal nécessitant une suture, ainsi que les échelles de douleur comportementale (forte tension musculaire, être très agité et grimaçant constant) avec le R.R. et intervalles de confiance suivants : (R.R.= 0,56, 95% C.I.[0,23, 1,37]), (R.R.= 0,69, 95% C.I.[0,54, 0,89], p= 0,004),((R.R.= 0,37, 95% C.I.[0,18, 0,77], p= 0,004) et ((R.R.= 0,42, 95 % C.I. [0,23, 0,78], p= 0,006) respectivement. Nous concluons que chez les femmes primipares, le groupe des compresses chaudes a montré de meilleurs résultats dans l'amélioration du confort périnéal que a le bien des femmes qui n'ont pas reçu de compresses chaudes après l'accouchement. *(Afr J Reprod Health 2023; 27 [4]: 96-123).*

Mots-clés: Compresses chaudes ; intégrité périnéale; diminuer la douleur; travail normal; femmes primipares

Introduction

Over 600,000 women worldwide lose their lives every year as a direct result of pregnancy or childbirth-related issues. Most of these were found to be prevalent in developing countries[1]. For everyone who dies, several others suffer severe complications. Thus, medical professionals emphasize the importance of preventing maternal perineal trauma and the related morbidity that might result from it[2,3]. Genital trauma is more prevalent among primiparous women because of the tightness of their perinea, not having delivered previously. Any injury to the genitalia during delivery is known as perineal trauma. Perineal traumas are classified into two categories: spontaneous perineal trauma (tears) and episiotomy, called intentional trauma[4]. Episiotomy is an intentional procedure done to the perineal body to expand the vaginal orifice during delivery. While episiotomy only damages the perineal body, the region between the vagina and the anus, may be damaged when tears develop resulting in severe damage to the perineal body[5,6].

Perineal tears are typically categorized into four groups: first degree: damage to the skin (includes fourchette, hymen, labia, vaginal epithelium); second degree: damage that may impact the posterior vaginal wall, subcutaneous fat, perineal skin layer, superficial muscles, (bulbocavernosus and superficial transverse perinea) and deep muscles (pubococcygeus); third-degree: this entails disruption of the vaginal epithelium, perineal skin, perineal body, and anal sphincter muscles; and fourth-degree: involving the full disruption of external and internal anal sphincter complex and the anal epithelium[7,8].

Knowing that perineal trauma is linked to severe short- and long-term morbidity, it is important that midwives and obstetricians work to ensure their patients' comfort throughout the second stage of labour[9]. A woman's perspective on giving birth may be affected by the perinatal pain she endured during the second stage of labour.

There has been a lot of study on labor pain, but much of it has only looked at the beginning of the process, ignoring the discomfort that occurs during the process of giving birth. In the final moments before giving birth, the discomfort associated with the fetal head advancing and stretching the perineum can be excruciating[10]. In the second stage of labor, non-pharmacological treatments such as Hands-on or Hands-off[11,12], perineal massage[13], and warm packs were used by midwives and obstetricians to alleviate genital tract damage and perineal discomfort. For years, warming the perineum with warm packs or compresses to help discomfort and lessen the risk of injury has been recommended during the second stage of labour[9,10].

Musgrove *et al*. performed the first randomized controlled trial in Australia using warm packs on the perineum[14,15]. Seventy-one women who had previously given birth vaginally and were not experiencing complications were included in the trial. The results showed that in the treatment group, 70% of women did not need suturing, while only 54% of women in the comparison group did not require suturing. Eighty percent of the women reported that the warm packs helped ease their pain. However, this study's generalizability is limited by its small sample size and its focus on women who had given birth several times. A recent meta-analysis found that warm compresses applied during the second stage of the labour improved perineal integrity and decreased episiotomy rate and severe perineal injuries in 2103 pregnant women expecting spontaneous normal labor at term with a single fetus in cephalic presentation[16].

According to the Cochrane literature review, warm compresses effectively decrease perineal injuries during the 2nd labour stage. This procedure is accessible at every delivery, non-invasive, affordable, produces no damage, and women find it

relaxing[17]. A recent randomized clinical trial research indicated that utilizing a warm compress in the second stage of delivery might prevent perineal injuries and alleviate pain during this time[18].
Our meta-analysis aims to assess the effect of warm compresses regarding episiotomy, perineal trauma, and behavioral pain scales on pregnant women who delivered a single baby vaginally with cephalic presentation.

Methods

Cochrane Handbook for Systematic Reviews of Interventions served as the gold standard for our systematic review and meta-analysis[19]. This study followed the guidelines laid out in the PRISMA declaration[20]. Also please refer to the Prisma table here.

Literature search

Using this search strategy, we searched PubMed, Scopus, and the ISI Web of Science extensively during June 20202: ("warm compression" OR "warm packs" OR "warm compresses" OR "warm compress" OR "hot compress" OR "hot compresses") AND ("second stage" OR "labor" OR "labour" OR "delivery," OR "perineum" OR "perineal" OR "episiotomy" OR "perineal trauma" OR "perineal lacerations" OR "perineal tears" OR "postpartum pain"). Only publications written in English were included in the research.

Eligibility criteria

The articles that met the following inclusion criteria were included in the systematic review and meta-analysis: 1) population: Pregnant women who were planning to deliver a singleton baby vaginally with cephalic presentation 2) Intervention: warm compression 3) Comparison: no warm compression 4) Outcomes: Primary outcomes include: Episiotomy, Perineal trauma requiring suturing, Perineal trauma degree, Location of Lacerations or trauma, and secondary outcomes include: 2nd stage labor duration, Infant birthweight, Progress of labor, and behavioral pain parameters 5) Study design: Randomized and non-randomized control trials. We didn't include studies published before 2000 or in a language other than English. Also, we didn't include reviews, letters to the editor, high-risk research, brief reports, and studies that lacked a full-text version.

Data extraction

Two researchers worked separately on the study data search, selection, and extraction. When there was disagreement, a consensus method was used. After deleting duplicates, we manually reviewed each remaining article's title and abstract to ensure it met our inclusion criteria, and papers that did not meet the criteria were removed. At the end, we reviewed the articles' full texts. Subsequently, using the study's data extraction form, the necessary information was gathered in an Excel sheet. The collected data included: First Author, site, inclusion criteria, warm temperature of the jug, intervention and comparison groups, pregnancy presentation, primary outcome, gestation at enrolment, time to start warm peak, number of participants, and their age.

Risk of bias evaluation

To analyze the potential for bias in the comprised studies, we used the Cochrane risk of bias assessment methodology[21]. Cochrane risk of bias assessment tool comprises the following items: selection bias, performance bias, detection bias, attrition bias, reporting bias, and other potential causes of bias. Authors' assessments are rated as "Low," "High," or "Unclear" risk of bias. Refer to the table.

Data synthesis

We pooled continuous data as mean difference (M.D.) and categorical data as risk ratio (R.R.), with matching 95 percent confidence intervals (CI). All statistical analysis was conducted using RevMan software. We investigated the statistical heterogeneity between studies using the I squared (I^2) statistics chi-square test, and results of ≥50 percent were suggestive of substantial heterogeneity. When heterogeneity was considerable, we employed a random-effect model for meta-analysis. Fixed effect meta-analysis was employed where there was no substantial heterogeneity. P-value < 0.05 was deemed statistically significant.

Results

Results of literature search

Our search method from four databases resulted in 300 studies. After duplicates elimination, 163 studies were eligible for screening. After title and abstract screening, 28 articles were reliable for full-text screening. We rejected 15 of them; eventually, 13 articles fit our inclusion criteria and were included in the final analysis. The PRISMA flow diagram for study selection is shown in *Figure* 1

Study characteristics

Our meta-analysis comprised 13 studies with a total of 3947 patients from nine countries[9,15,30–32,22–29]. Women expecting a single baby in a cephalic presentation who planned to give birth vaginally were included in all studies. Women in the intervention group were given warm compresses of clean clothes or perineal pads soaked in warm water (between 38 and 70°C). During the second stage of labour, compresses were kept on the patient's perineum and replaced as needed to ensure warmth and hygiene. Warm compresses are typically applied during the crowning of the or during active fetal descent. Baseline characteristics and the summary of the included studies are shown in Tables 1 and 2.

Risk of bias assessment

The summary and graph of the risk of bias in our included studies are shown in *Figure* 2. Most studies showed a low risk of bias regarding incomplete outcome data and random sequence generation. However, many studies showed a high risk of bias regarding blinding, but this could be difficult regarding the intervention used. The authors' judgments were according to the Cochrane risk of bias assessment tool[21].

Outcomes:

Location of Lacerations or trauma:

No (Intact):

No lacerations were reported in nine studies. The pooled risk ratio (R.R.) favoured the warm compress group over the comparison group (R.R.= 2.77, 95% C.I. [1.38, 5.57], p= 0.04), *Figure* 3. Significant heterogeneity was detected in the pooled studies (p <0.00001, I^2= 82%).

Vagina and perineum

Vaginal and perineum lacerations were reported in seven studies. The pooled R.R. did not detect any significant difference between the warm compress arm and the comparison arm (R.R.= 0.70, 95% C.I. [0.41, 1.21], p=0.21), *Figure*3. Significant heterogeneity was detected in the pooled studies (p<0.000001, I^2=89%).

Labia and clitoris:

Labia and clitoris lacerations were reported in seven studies. The pooled R.R. didn't detect any important difference between the warm compress arm and the comparison arm (R.R.= 0.92, 95% C.I. [0.66, 1.28], p=0.62), *figure* 3. The pooled studies were homogenous (p = 0,33, I^2=13%).

Episiotomy:

Episiotomy was reported in nine studies. The pooled risk ratio (R.R.) favoured warm compress arm over comparison arm (R.R.= 0.70, 95% C.I. [0.52, 0.96], p= 0.03), *Figure* 4. Significant heterogeneity was detected in the pooled studies (p <0.00001, I^2= 89%).

Perineal trauma degree:

First and/ or second-degree perineal trauma was reported in seven studies. The pooled R.R. did not detect any significant difference between the warm compress arm and the comparison arm (R.R.= 0.95, 95% C.I. [0.76, 1.20], p=0.67), *Figure* 5. Significant heterogeneity was detected in the pooled studies (p = 0,0003, I^2=76%).

Third and/ or Fourth

Third and/or fourth perineal trauma was reported in seven studies. The pooled risk ratio (R.R.) favoured warm compress arm over comparison arm (R.R.= 0.56, 95% C.I. [0.23, 1.37], p= 0.20) *figure* 5. The pooled studies were homogenous (p= 0.09, I^2= 46%).

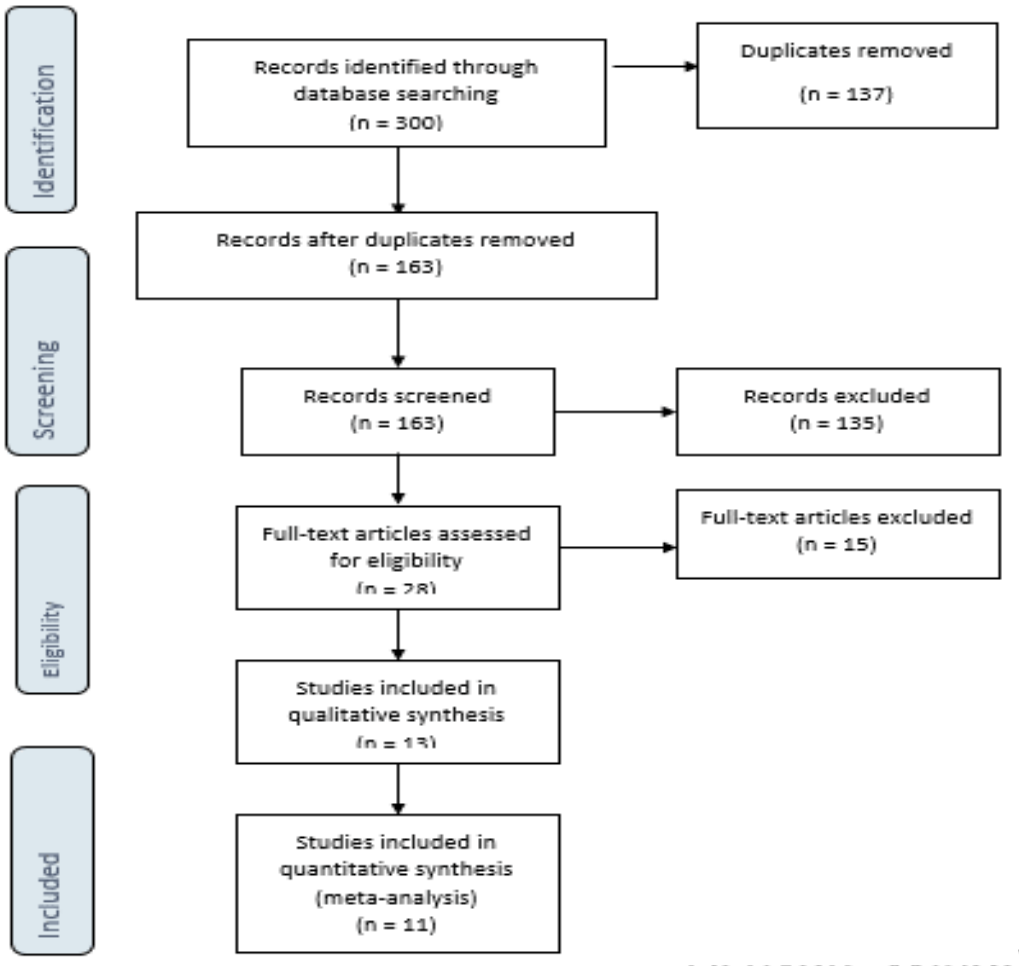


Figure 1: PRISMA flow chart of screening and selection of the studies included in the meta-analysis

Perineal trauma requiring suturing

Perineal trauma demanding suturing was reported in seven studies. The pooled risk ratio (R.R.) favoured warm compress arm over comparison arm (R.R.= 0.69, 95% C.I. [0.54, 0.89], p= 0.004) *figure* 6. Significant heterogeneity was detected in the pooled studies (p <0.00001, I^2= 90%).

Second stage labour

The duration of the second stage of labour was reported in seven studies. The pooled mean difference did not detect any important difference between the warm compress arm and the comparison arm (M.D.= -0.44, 95% C.I. [-2.57, 1.68], p=0.68), *figure* 7. Significant heterogeneity was detected in the pooled studies (p = 0,08, I^2=46%). The heterogenicity was resolved after excluding Zhu et al. (p=0.36, I^2= 8%)[29]. However, there was no significant difference between the warm compress arm and the comparison arm (M.D.= -1.32, 95% C.I. [-2.89, 0.25], p=0.10), as shown in supplementary *figure* 1.

Infant birth weight

Infant birth weight was reported in five studies. The pooled mean difference did not detect any important difference between the warm compress arm and the comparison arm (M.D.= 24.56 95% C.I. [-3.85, 52.98], p=0.09), *figure* 8. The pooled studies were homogenous (p = 0,46, I^2=0%).

Progress of spontaneous labour:

Spontaneous progression of labour was reported in four studies. The pooled R.R. did not detect any

significant difference between the warm compress arm and the comparison arm (R.R.= 1.06, 95% C.I. [0.97, 1.17], p=0.20), *figure* 9. Significant heterogeneity was detected in the pooled studies (p = 0,05, I^2=61%). The heterogenicity was resolved after excluding Gaheen et al. (p=0.26, I^2= 0%)[23]. However, there was no significant difference between the warm compress arm and the comparison arm (R.R.= 1.02 [0.97, 1.07], p=0.43), as shown in supplementary *Figure* 2.

Progress of induced labour

Induced progression of labour was reported in four studies. The pooled R.R. did not detect any important difference between the warm compress arm and the comparison arm (R.R.= 0.76, 95% C.I. [0.46, 1.26], p=0.28), *Figure* 9. Significant heterogeneity was detected in the pooled studies (p = 0,09, I^2=54%). The heterogenicity was resolved after excluding Gaheen *et al*. (p=0.49, I^2= 0%)[23]. However, there was no significant difference between the warm compress arm and the comparison arm (R.R.= 0.98, 95% C.I. [0.84, 1.14], p=0.75), as shown in supplementary *Figure* 2.

Behavioral pain parameters-Tense muscle:

Slightly tense muscles:

Slightly tense muscles outcome was reported in two studies. The pooled R.R. did not detect any important difference between the warm compress arm and the comparison arm (R.R.= 3.76, 95% C.I. [0.71, 19.95], p=0.12), *Figure* 10. Significant heterogeneity was detected in the pooled studies (p = 0,003, I^2=89%).

Moderately tense muscles:

Moderate tense muscles were reported in three studies. The pooled R.R. did not detect any important difference between the warm compress arm and the comparison arm (R.R.= 1.11, 95% C.I. [0.47, 2.61], p=0.81), *Figure* 10. Significant heterogeneity was detected in the pooled studies (p = 0,0001, I^2=89%).

Severely tense muscles:

Severe tense muscles outcome was reported in three studies. The pooled R.R. favoured warm compress arm over comparison arm (R.R.= 0.37, 95% C.I. [0.18, 0.77], p= 0.008) *figure* 10. Significant heterogeneity was detected in the pooled studies (p =0.004, I^2= 82%).

Behavioral pain parameters-Restlessness:

Moderate restlessness:

The moderate restless outcome was reported in three studies. The pooled R.R. did not detect any important difference between the warm compress arm and the comparison arm (R.R.= 1.44, 95% C.I. [0.71, 2.90], p=0.31), *Figure* 11. Significant heterogeneity was detected in the pooled studies (p = 0,005, I^2=81%).

Severe restlessness:

The very restless outcome was reported in three studies. The pooled R.R. favoured warm compress arm over comparison arm (R.R.= 0.37, 95% C.I. [0.18, 0.77], p= 0.004) *figure* 11. Significant heterogeneity was detected in the pooled studies (p =0.004, I^2= 82%).

Behavioral pain parameters-Grimacing:

Moderate grimacing:

Moderate grimacing was reported in three studies. The pooled R.R. did not detect any important difference between the warm compress arm and the comparison arm (R.R.= 1.38, 95% C.I. [0.50, 3.77], p=0.53), *Figure* 12. Significant heterogeneity was detected in the pooled studies (p = 0,0003, I^2=88%).

Constant grimacing

Constant grimacing was reported in three studies. The pooled R.R. favoured warm compress arm over comparison arm (R.R.= 0.42, 95% C.I. [0.23, 0.78], p= 0.006), *Figure* 12. Significant heterogeneity was detected in the pooled studies (p =0.004, I^2= 82%).

Behavioral pain parameters-Patient sounds:

Groans/moans:

Groans/moans outcome was reported in three studies. The pooled R.R. did not detect any important difference between the warm compress

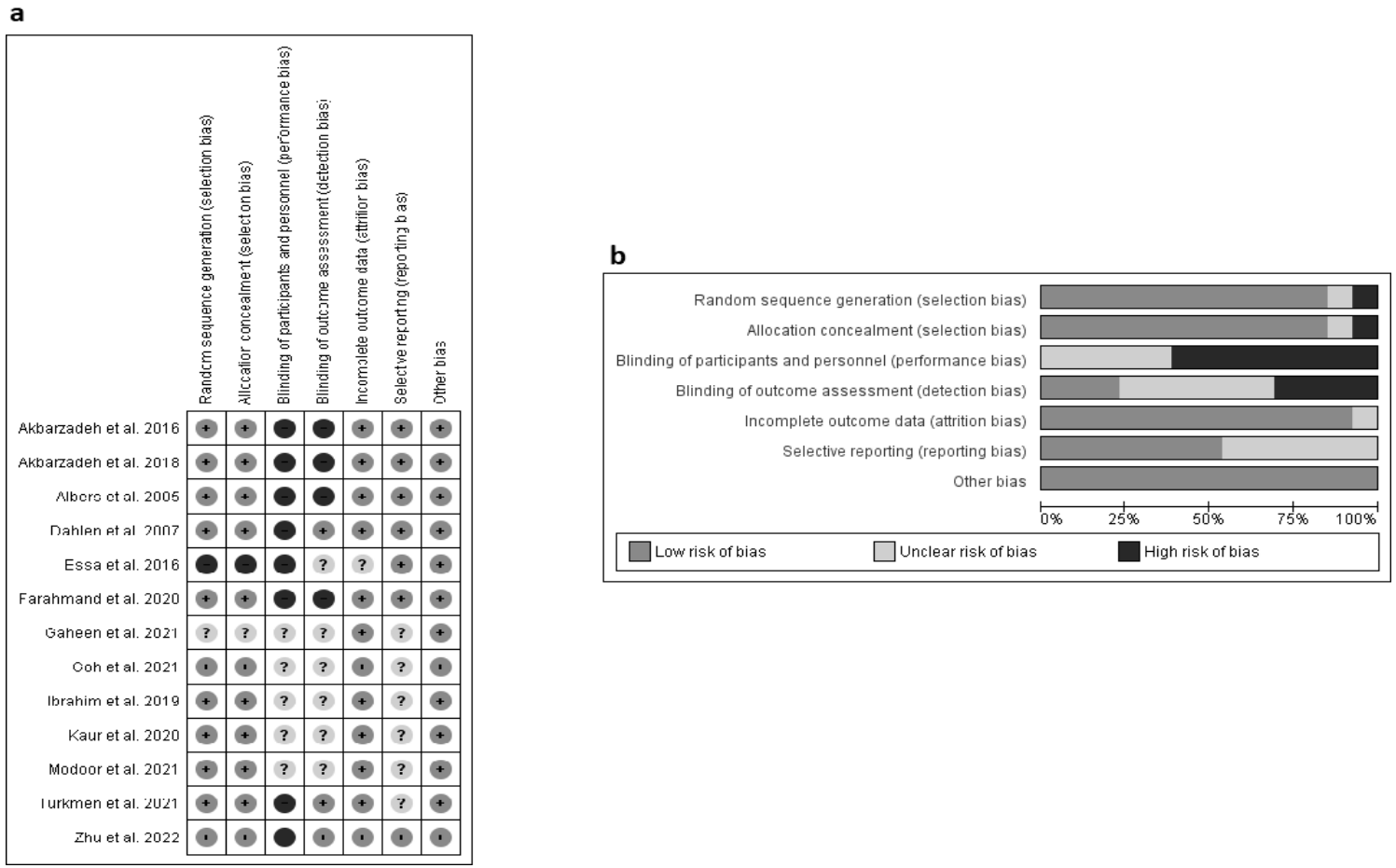


Figure 2: Assessment of risk of bias. (a) Summary of risk of bias for each trial; Plus sign: low risk of bias; minus sign: high risk of bias; question mark: unclear risk of bias. (b) The risk of bias graph about each risk of bias item is presented as percentages across all included studies.

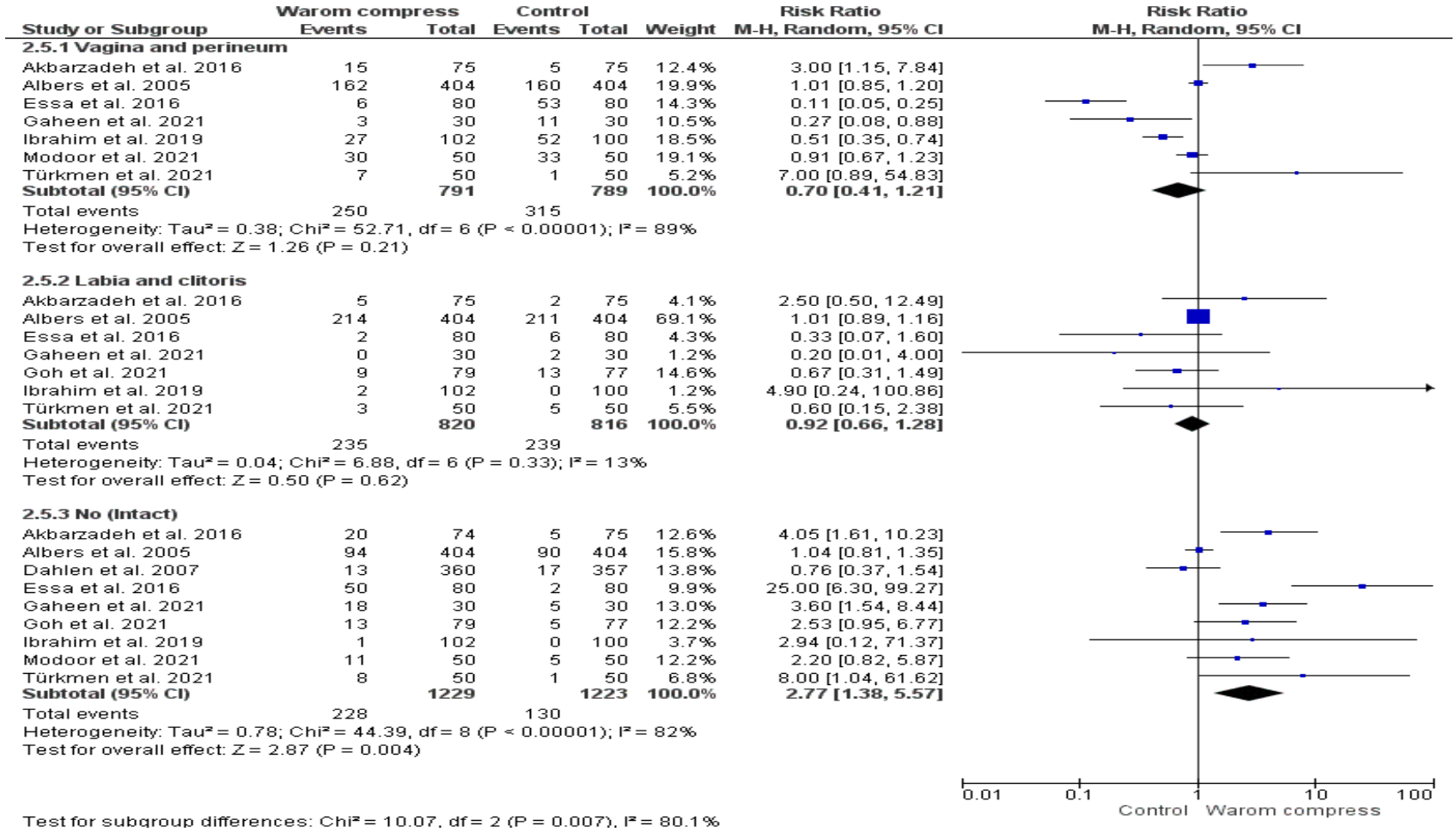


Figure 3: Forest plot comparing warm compress group and control group regarding the location of laceration or trauma.

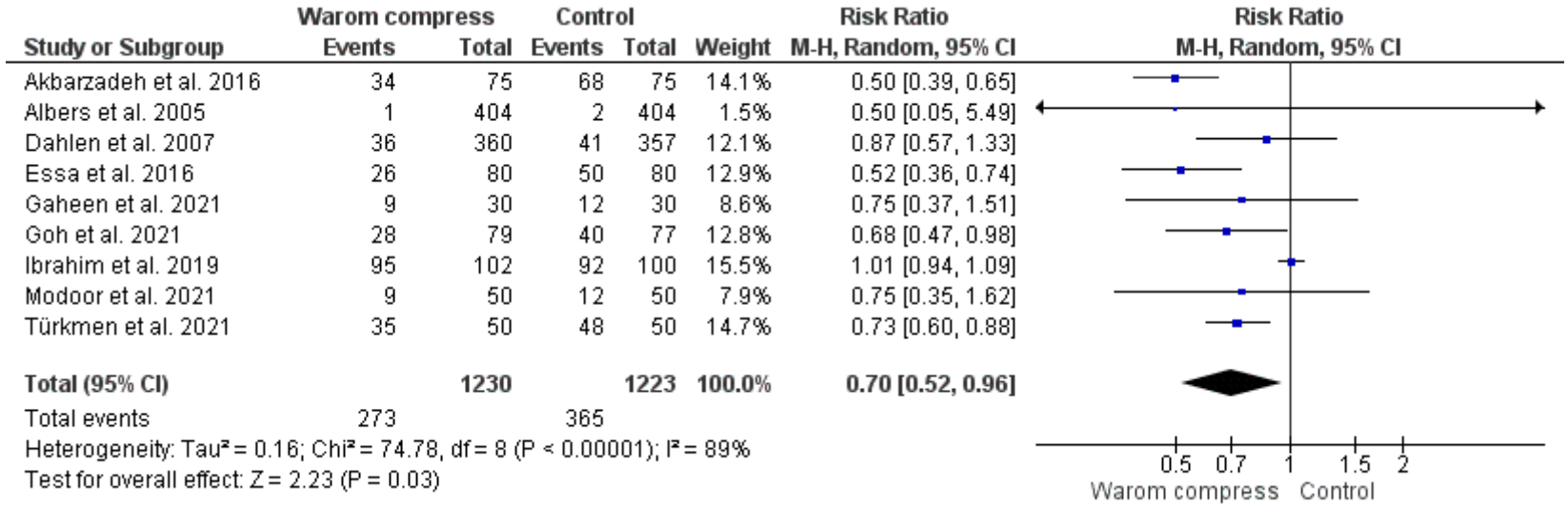


Figure 4: Forest plot comparing warm compress group and control group regarding episiotomy.

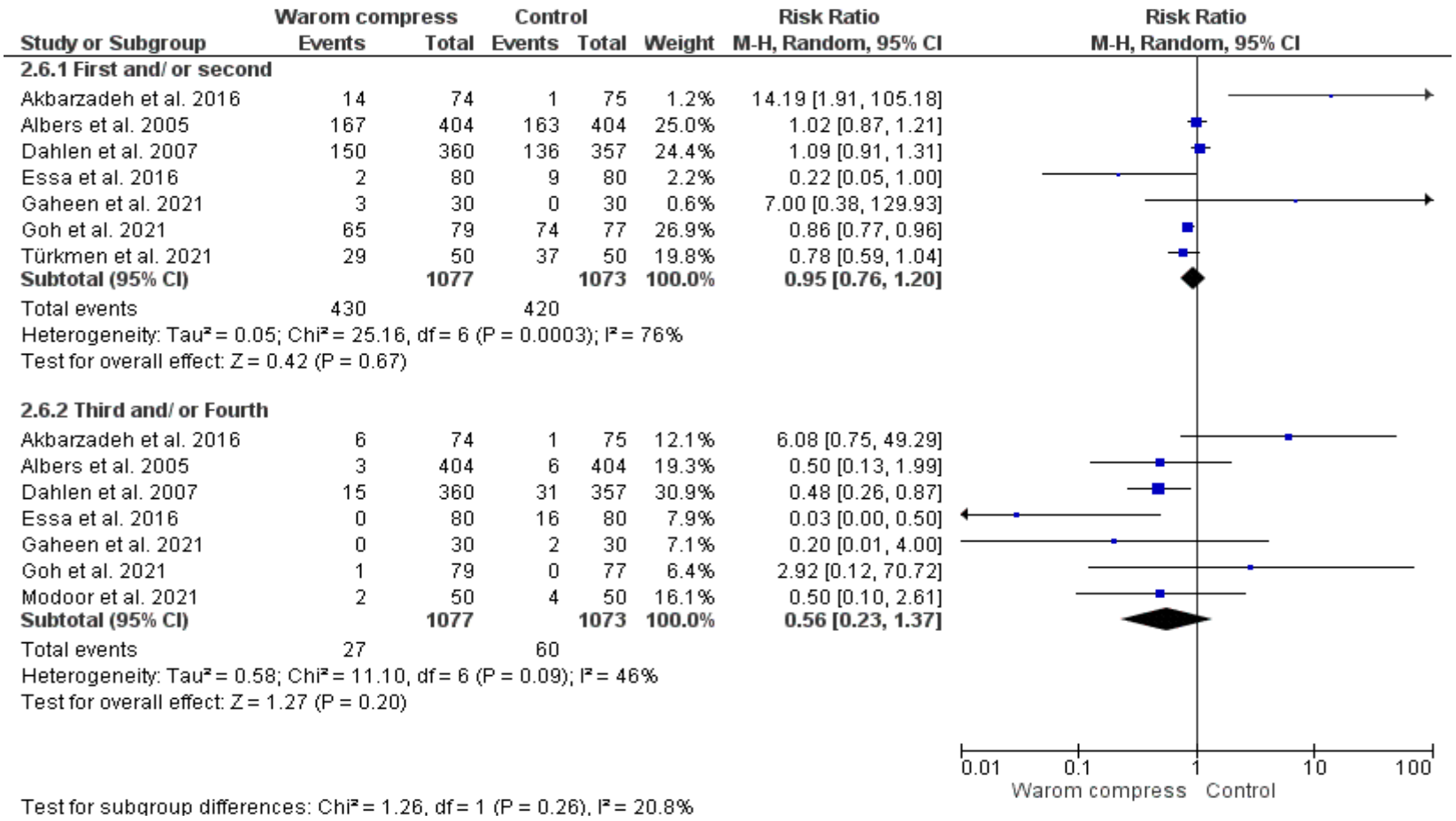


Figure 5: Forest plot comparing warm compress group and control group regarding perineal trauma degree.

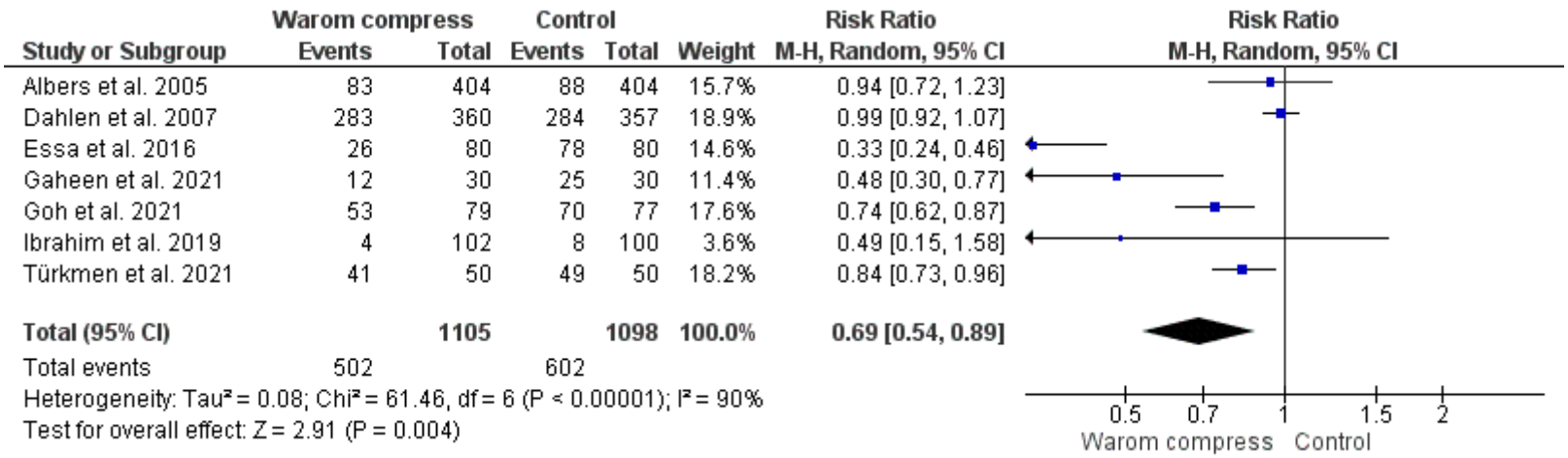


Figure 6: Forest plot comparing warm compress group and control group regarding perineal trauma requiring suturing.

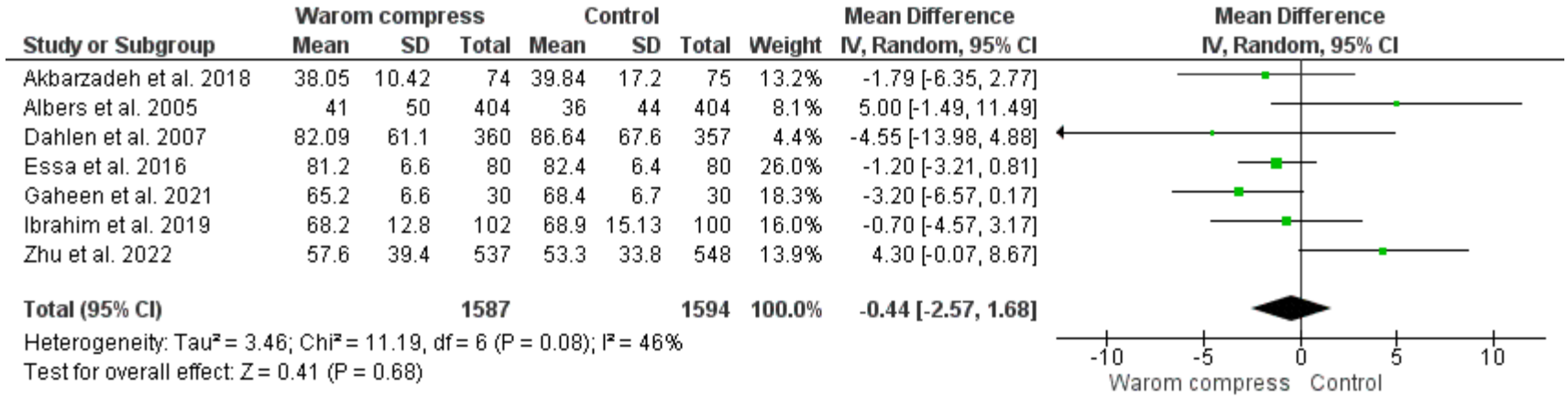


Figure 7: Forest plot comparing warm compress group and control group regarding the second stage of labor duration, min.

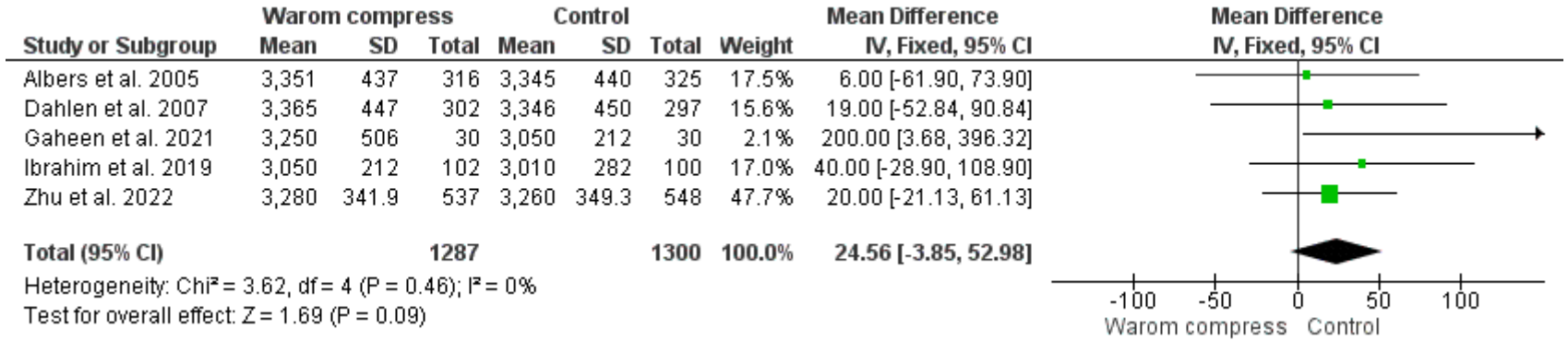


Figure 8: Forest plot comparing warm compress group and control group regarding infant birth weight (g).

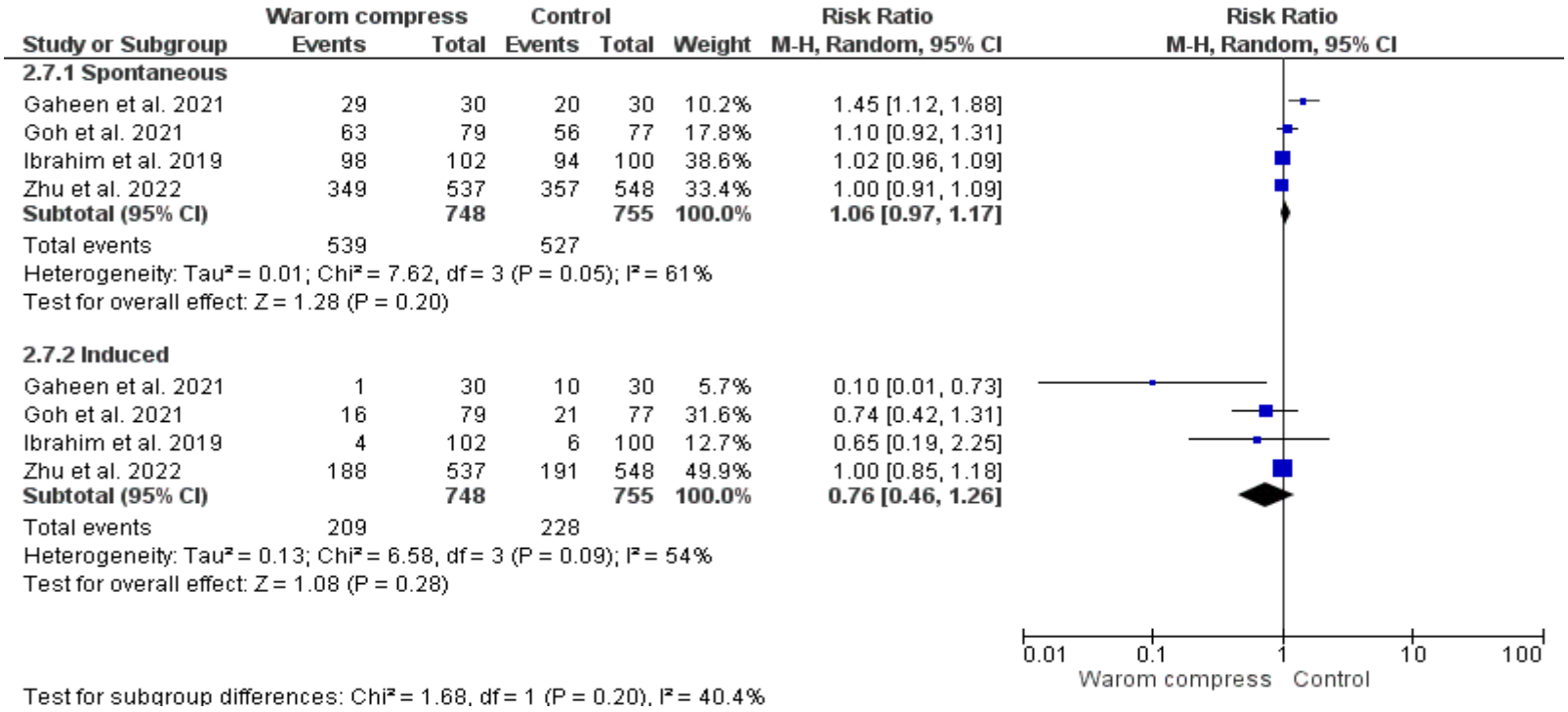


Figure 9: Forest plot comparing warm compress group and control group regarding the progress of labor

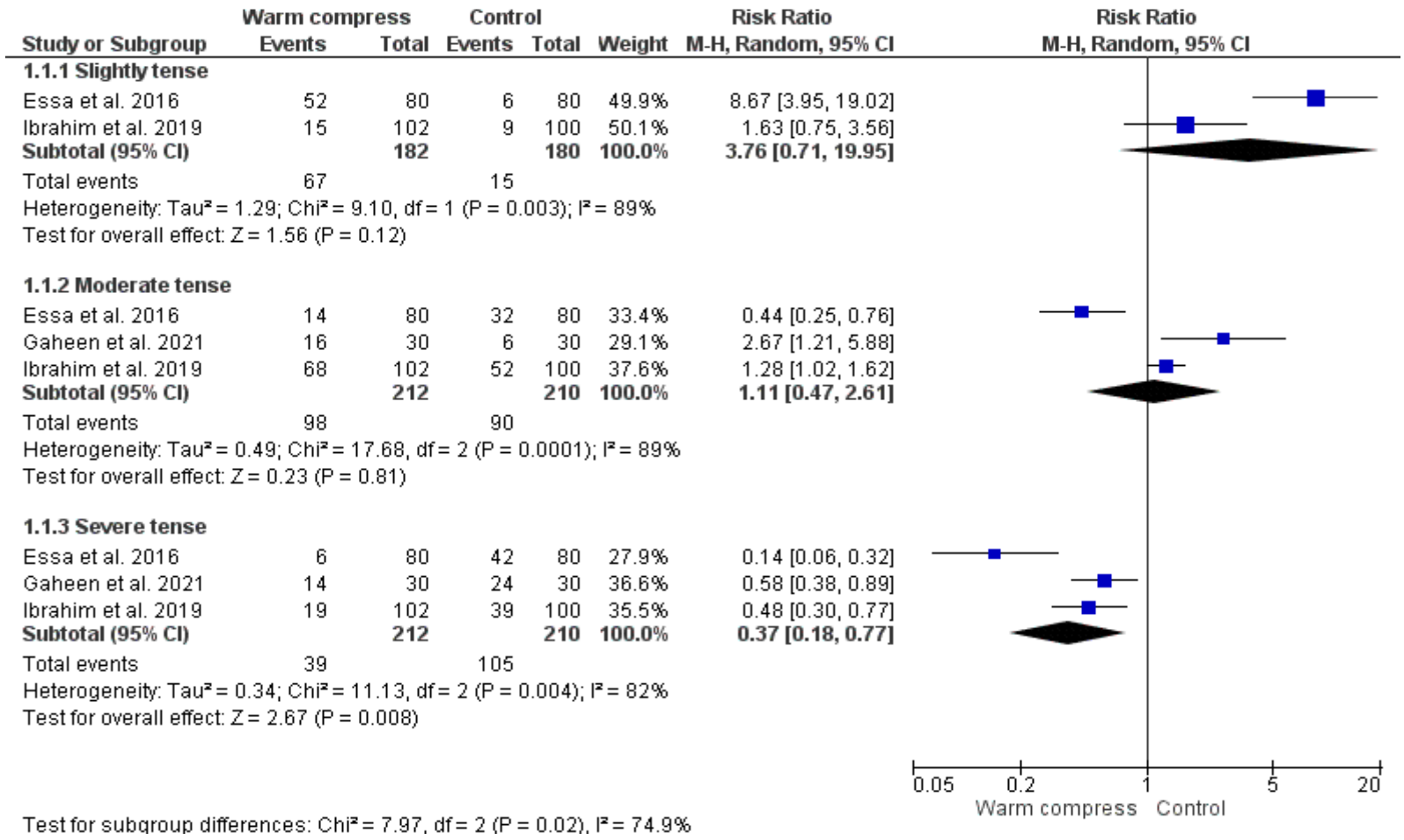


Figure 10: Forest plot comparing warm compress group and control group regarding behavioral pain parameters (Tense muscle).

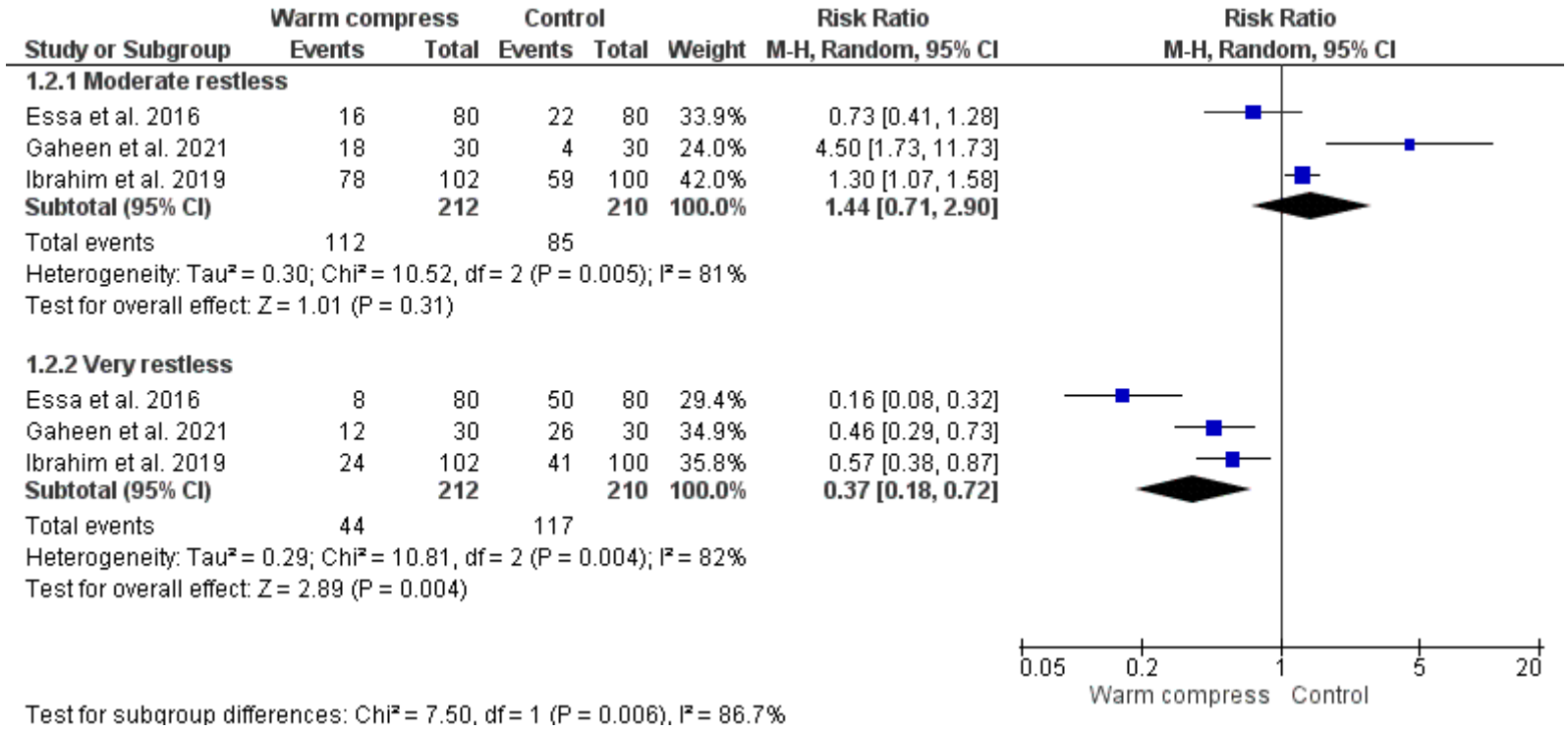


Figure 11: Forest plot comparing warm compress group and control group regarding behavioral pain parameters (Restless).

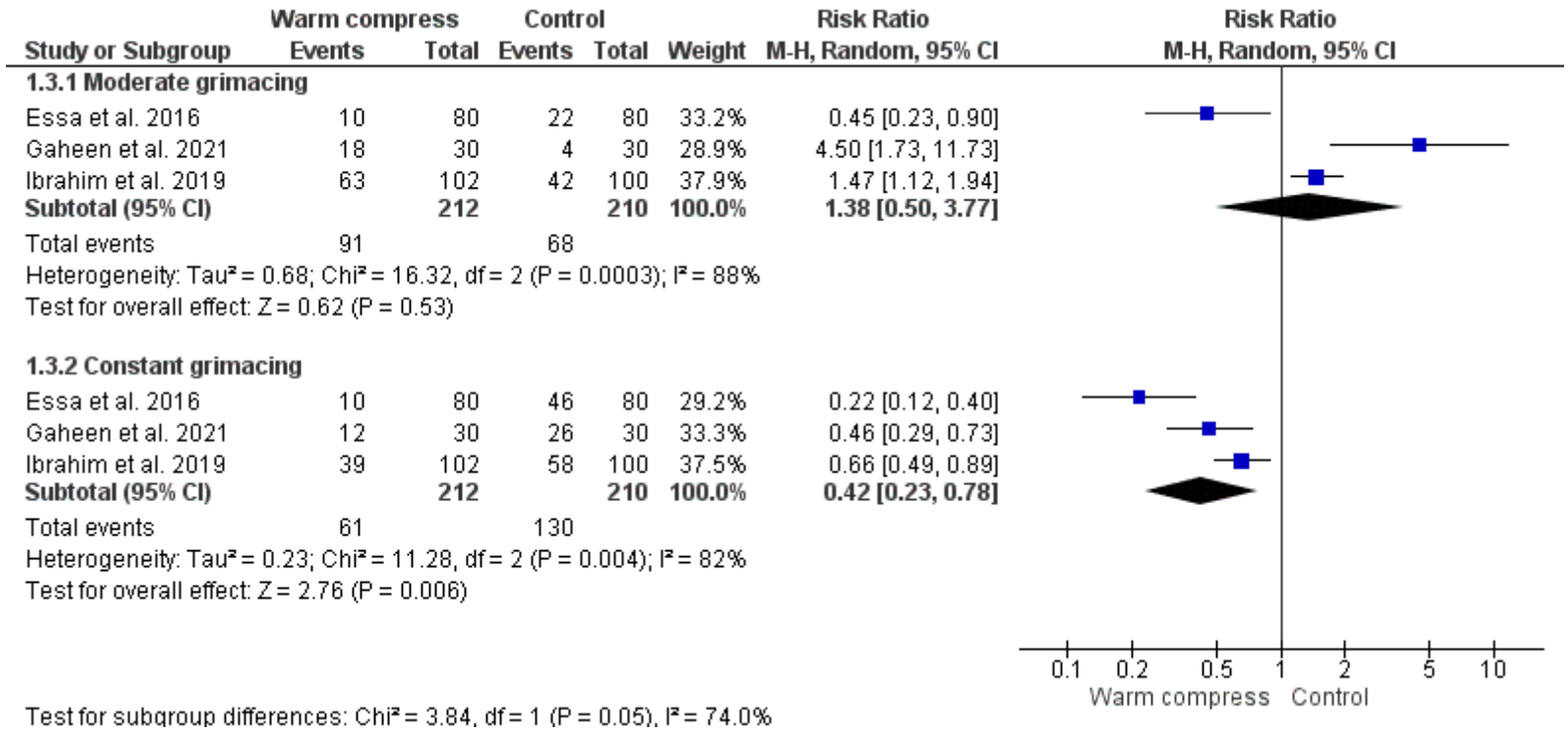


Figure 12: Forest plot comparing warm compress group and control group regarding behavioral pain parameters (Grimacing).

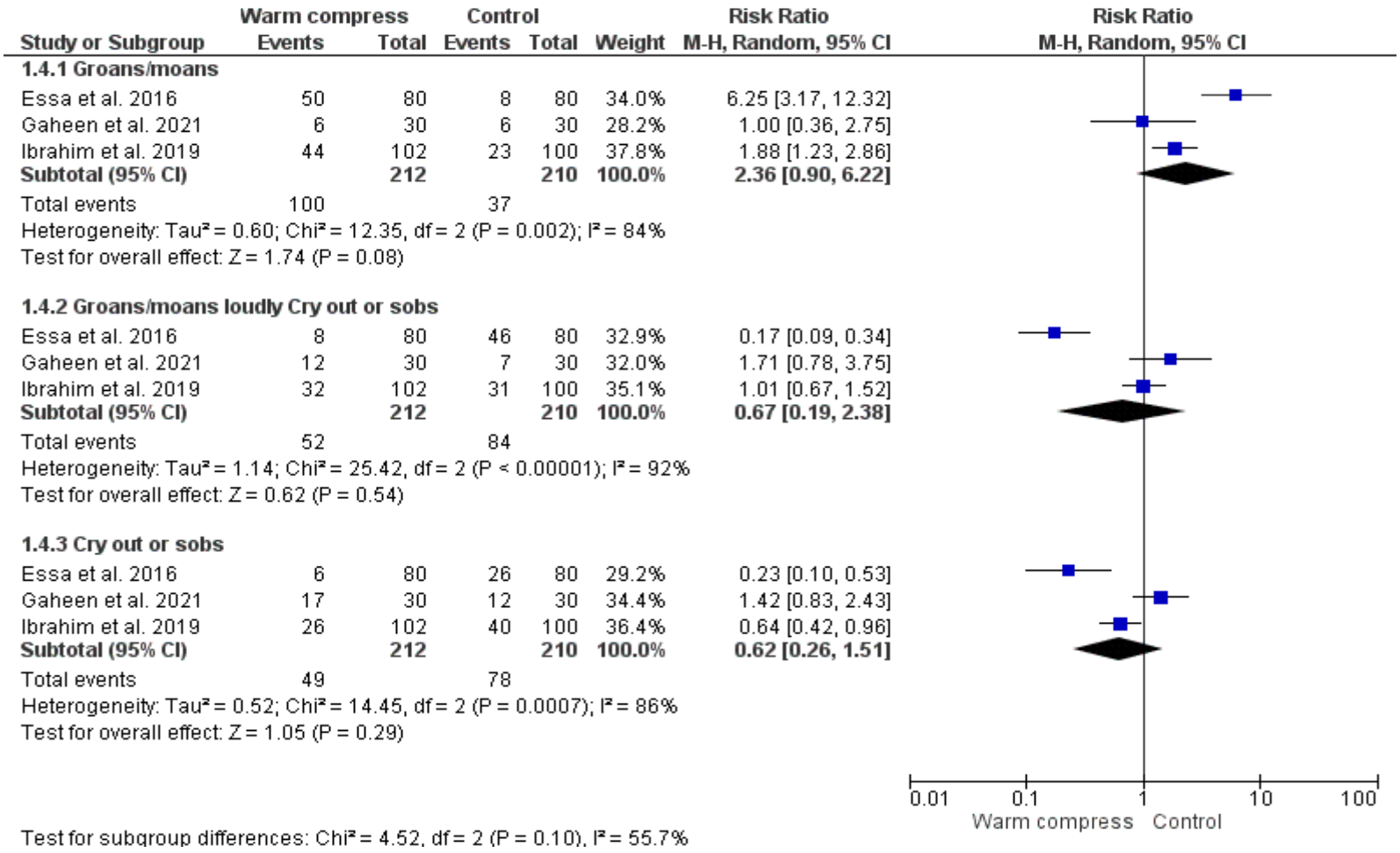
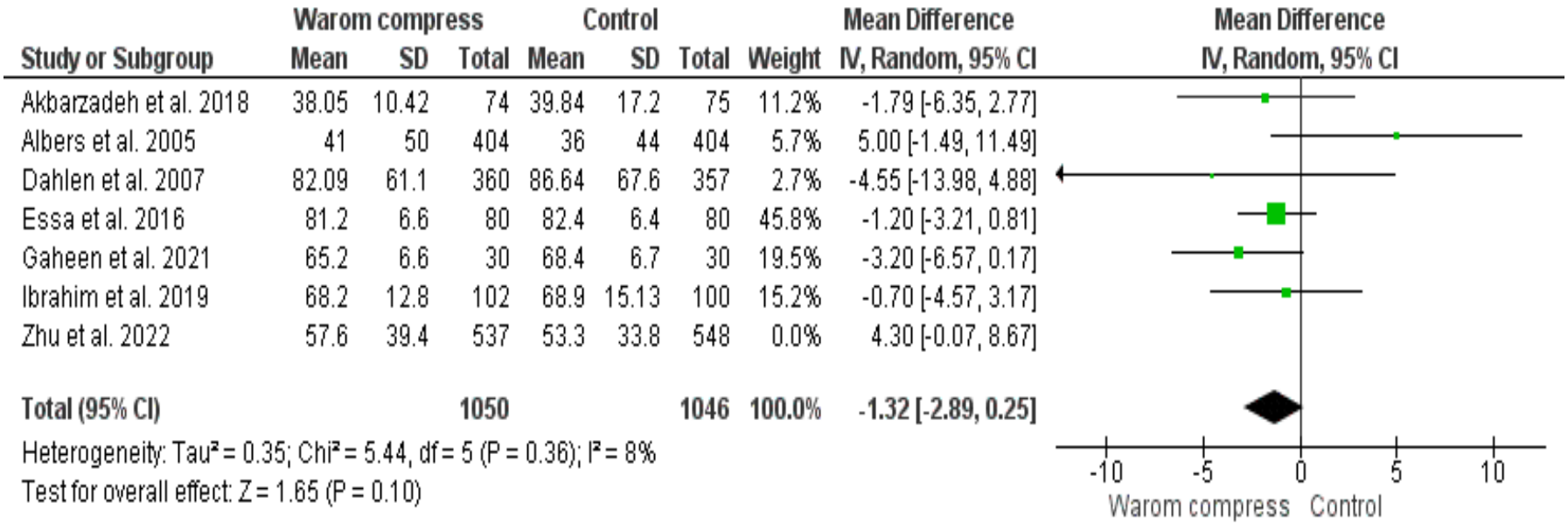
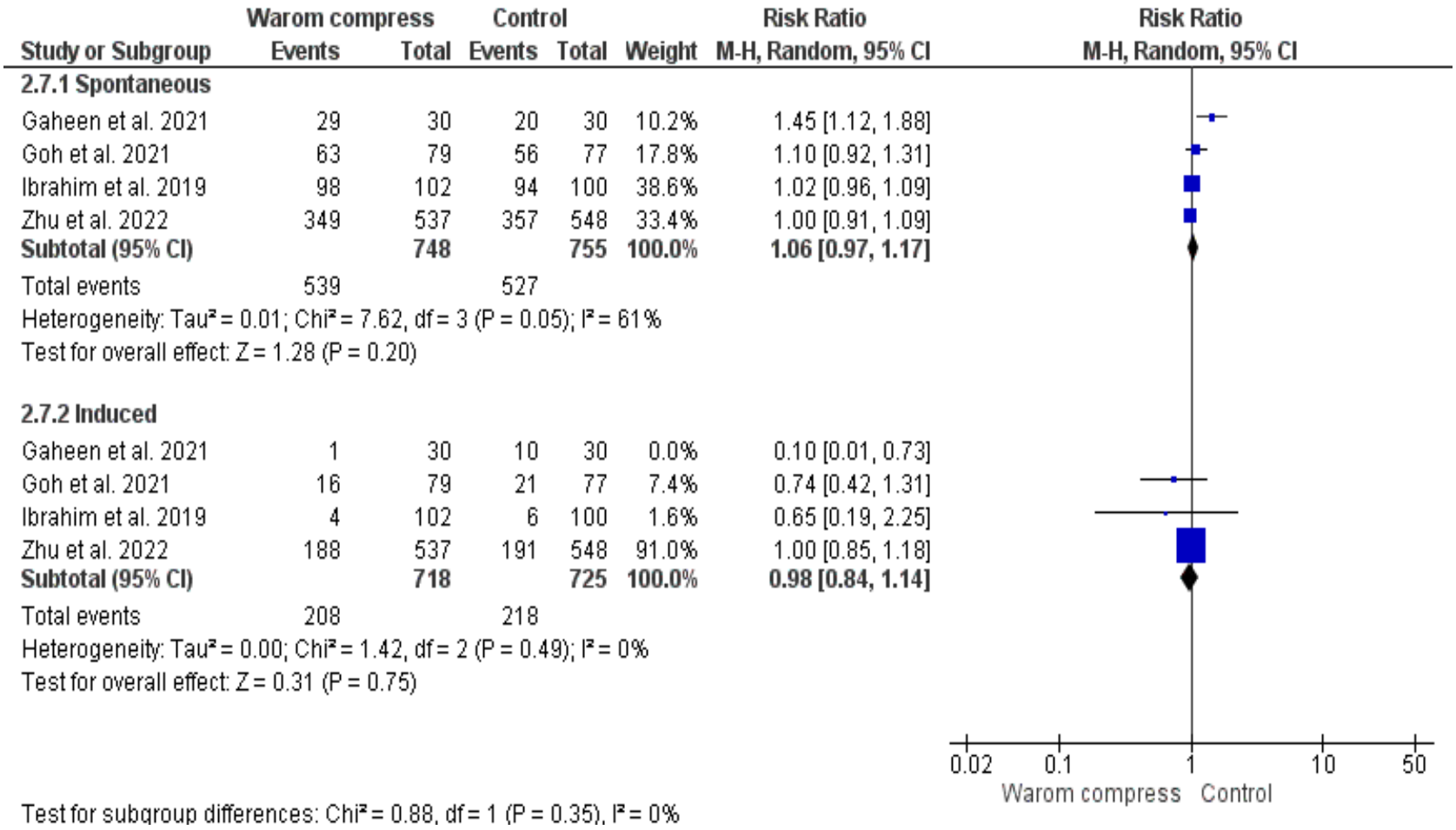


Figure 13: Forest plot comparing warm compress group and control group regarding behavioral pain parameters (patient sounds).



Supplementary Figure 1: Forest plot comparing warm compress group and control group after heterogeneity resolved regarding the duration of the second stage of labor



Supplementary Figure 2: Forest plot comparing warm compress group and control group after heterogeneity resolved regarding the progress of labor

Table1: Summary of the included studies

Study ID	Site	Inclusion criteria	Intervention group	Control group	Water temperature of the jug	Pregnancy presentation	Singleton	Time to start warm packs	Gestation at enrollment (weeks)	primary outcomes	Conclusion
Akbarzadeh et al. 2016	Iran	Primiparous status, ages 18 to 35, and fetal weight between 2000 and 3000 g. 3500 g.	Warm compresses	Standard care	70 ℃	Cephalic presentation	Yes	In the second stage of labor	37 to 42 weeks	Perinea Status	Warm compress bi-stage intervention reduced episiotomies and the mean length of episiotomy incision, reduced discomfort after delivery, and increased the incidence of intact perinea. However, the rate of ruptures rose marginally in the intervention group compared to the control group.
Akbarzadeh et al. 2018	Iran	Primiparous status, ages 18 to 35, and fetal weight between 2000 and 3000 gr. 3500 g, doesn't suffer from pelvic stenosis or other disorders, hemoglobin level more than or equal to 11 mg/dL, absence of any disease's occiput anterior posture, no perineal or vaginal lesions utilized analgesic and local analgesia approaches	Warm compresses	Standard care	70 ℃	Cephalic presentation	Yes	In the second stage of labor	37 to 42 weeks	Duration of the first stage and second stage	This intervention seemed to be a beneficial technique for minimizing labor time during the second stage of parturition, according to the data.
Albers et al. 2005	USA	Women who previously consented and had no medical concerns	Warm compresses	Hands-off	NR	Vertex presentation	Yes	When the baby's head was seen during a uterine contraction or active fetal descent	At term	Intact perineum	The frequency distribution of genital tract trauma in all three groups was equal. Individual women and their doctors should determine whether or not to employ these procedures

											based on mother comfort and other factors.
Dahlen et al. 2007	Australia	Patients who expected a standard delivery; had not undergone perineal massage, did not plan to practice perineal massage antenatally and were over 16 years old.	Warm compresses	Standard care	45 ℃ -59 ℃	Cephalic presentation	Yes	When the fetus's head distended the perineum, the patient felt a stretching feeling.	At least 36 weeks	Need for suturing	In the late second stage, perineal warm packs did not diminish the risk of nulliparous women needing perineal suturing. Still, it does reduce third- and fourth-degree lacerations, discomfort during the delivery and on days 1 and 2, and urine incontinence considerably.
Essa et al. 2016	Egypt	Patients were between 18 and 35, primigravida, had a normal pregnancy, were full-term, had no contraindications for a vaginal birth, had not conducted perineal massage, and were willing to participate in the research.	Warm compresses	Standard care	45 ℃ -59 ℃	Cephalic presentation	Yes	In the second stage of labor	At term	Perineal trauma and need to repair Warm	Perineal warm compresses were suggested as part of the pain treatment and perineal maintenance choices accessible to women during the second stage of labor.
Farahmand et al. 2020	Iran	Primiparous status, ages 18 to 35, and fetal weight between 2000 and 3000 gr. 3500 g, doesn't suffer from pelvic stenosis or other disorders, hemoglobin level more than or equal to 11 mg/dL, absence of any disease's occiput anterior posture, no perineal or vaginal lesions utilized analgesic and local analgesia approaches	Warm compresses	Standard care	70℃	Cephalic presentation	Yes	In the second stage of labor	37 to 42 weeks	VAS Score in the First, Second Stage of Labor and Postpartum	Using warm compress bi-stage at 7 and 10 cm dilatations, the study participants noticed reduced discomfort throughout labor and after delivery. Consequently, this approach might help minimize perineal discomfort caused by episiotomy.

Gaheen et al. 2021	Egypt	The women's ages varied from 20 to 35, with no history of medical or obstetrical disorders and normal vaginal birth, and they were willing to participate in the research.	Warm compresses	Standard care	NR	Cephalic presentation	Yes	In the second stage of labor	37 to 42 weeks	Pain	It may be stated that the employment of supportive perineal approaches was successful in enhancing perineal outcomes, with lubricated perineal massage being the most effective.
Goh et al. 2021	Malaysia	Patients who were expected vaginal delivery and a reassuring fetal electrocardiogram were selected for labor ward enrollment.	Warm compresses and massage	Hands-off	38°C to 44°C	Cephalic presentation	Yes	In the second stage of labor	At least 37 weeks of gestation	Perineum suturing	Warm compresses during pushing reduced perineal suturing, significant perineal injury, and episiotomy rates while increasing mother satisfaction.
Ibrahim et al. 2019	Egypt	The research included parturient women experiencing vaginal birth who met the following inclusion criteria: normal pregnancy (did not have medical complications), no contraindications for routine labor, in the active stage of labor, and willing to participate in the study	Warm compresses	Standard care	38°C	Vertex presentation	Yes	In the second stage of labor	37 to 42 weeks	Perineal outcomes	All public hospitals should offer appropriately designed in-service training programs for maternity nurses on the advantages of warm compresses and lubricated massage during the second stage of labor.
Kaur et al. 2020	India	Nulliparous mothers with 4-5 cm of cervical dilation, ages 18 to 35 years, spontaneous commencement of labor pain, and an interest in participating.	Warm compresses	Standard care	70°C	NR	Yes	The first time, the second time, and the third time, warm compression	NR	Labor pain intensity score	Warm compression was shown to be an effective strategy for reducing labor pain in nulliparous moms during the initial stage of labor, and mothers expressed pleasure with the intervention.
Modoor et al. 2021	Saudi Arabia	Patients range in age from 18 to 35 years old, are primigravida, have a healthy pregnancy, are full-term, and have no contraindications to vaginal birth.	Warm compresses	Standard care	45°C-59°C	Cephalic presentation	Yes	In the second stage of labor	At term	Labor pain	Warm compresses given to the perineum region reduced second and third-degree perineal tears and pain severity during the

											second stage of labor and after delivery.
Türkmen et al. 2021	Turkey	The research comprised pregnant women anticipating a vaginal birth who were term and primiparous and were in the second stage of labor (10 cm cervical dilatation).	Warm compresses	Standard care	40℃-45℃	NR	Yes	In the second stage of labor	At term	Labor pain	Warmth was observed to reduce perineal discomfort, preserve perineal integrity, and increase postpartum comfort during the second stage of labor.
Zhu et al. 2022	Multicenter	Inclusion criteria included being above 18, being a primiparous woman, and nursing after birth.	Acupoint Hot Compress	Standard care	45℃	NR	Yes	After labor	At term	Postpartum urinary retention	According to the findings of this study, I was using an acupoint heat compress after vaginal birth to reduce postpartum urine retention, uterine contraction discomfort, and depression symptoms while increasing nursing milk production.

Abbreviations: VAS, visual analog scale; NR, not reported.

Table **2**: Baseline characteristics of the enrolled patients in the included studies

Study ID	Study arms	Sample	Age, years, M±SD	Housewife/ Employee	Rural/ Urban	Illiterate/ educated	Income/month, enough/ not enough
Akbarzadeh et al. 2016	Intervention	74	22.57 (Average)	-	-	-	-
	Control	75		-	-	-	-
Akbarzadeh et al. 2018	Intervention	74	22.57 (Average)	-	-	-	-
	Control	75		-	-	-	-
Albers et al. 2005	Intervention	404	24.9±5.3	-	-	-	-
	Control	404	24.5±5.1	-	-	-	-
Dahlen et al. 2007	Intervention	360	27±5.5	-	-	-	-
	Control	357	27.2±4.9	-	-	-	-
Essa et al. 2016	Intervention	80	Reported as age groups	68/12	30/80	24/56	62/18
	Control	80		62/18	20/60	26/54	54/26
Farahmand et al. 2020	Intervention	74	22.57 (Average)	-	-	-	-
	Control	75		-	-	-	-
Gaheen et al. 2021	Intervention	30	24.40±1.81	19//11	18//12	0/30	24/6
	Control	30	25.03±2.40	19//11	22//8	1//29	20/10
Goh et al. 2021	Intervention	90	28.8±4.3	20/70	-	0/90	-
	Control	90	28.3±4.0	20/70	-	0/90	-
Ibrahim et al. 2019	Intervention	102	23.76±6.21	58/44	36/66	10//92	-
	Control	100	24.78±5.57	50/50	40/60	12//88	-
Kaur et al. 2020	Intervention	44	-	-	-	-	-
	Control	44	-	-	-	-	-
Modoor et al. 2021	Intervention	50	Reported as age groups	37/13	9//41	0/50	46/4
	Control	50		38/12	7//43	0/50	47/3
Türkmen et al. 2021	Intervention	50	23.44±3.91	36/14	9//41	0/50	-
	Control	50	24.74±4.07	39/11	6//44	0/50	-
Zhu et al. 2022	Intervention	537	26.3±3.7	157/380	103/434	0/537	-
	Control	548	26.3±3.7	196/352	107/441	0/548	-

arm and the comparison arm ((R.R.= 2.36, 95% C.I. [0.90, 6.22], p= 0.08), *Figure* 13. Significant heterogeneity was detected in the pooled studies (p = 0,002, I^2=84%).

Groans/moans loudly Cry out or sobs

Groans/ moans loudly cry out, or sobs outcome was reported in three studies. The pooled R.R. did not detect any important difference between the warm compress arm and the comparison arm (R.R.= 0.67, 95% C.I. [0.19, 2.38], p= 0.54), *Figure* 13. Significant heterogeneity was detected in the pooled studies (p <0.00001, I^2=92%).

Cry out or sobs

Cry out, or sobs outcome was reported in three studies. The pooled R.R. did not detect any important difference between the warm compress arm and the comparison arm (R.R.= 0.62, 95% C.I. [0.26, 1.51], p=0.29), *Figure* 13. Significant heterogeneity was detected in the pooled studies (p = 0,0007, I^2=86%).

Discussion

Our study analyzed 13 controlled trials (n= 3947) to compare using warm compresses versus not using them during vaginal delivery. Our study revealed that the warm compress arm showed better outcomes regarding episiotomy, degree of perineal trauma (third and fourth degree), perineal trauma requiring suturing, and behavioral pain scales (severe muscle tense, being very restless, and constant grimacing). Our results are in concordance with Magoga *et al*., who also found that warm compresses were associated with lower rates of episiotomy, perineal trauma not requiring suturing, and higher rates of intact perineum[16]. These findings may be explained by vasodilatation caused by warm compresses that modulate inflammatory mediators and decrease the painful stimulations caused by stretching of the perineum by the in-coming fetal head and local ischemia caused by muscle spasm and tension.

Additionally, our results are enforced by the American College of Obstetricians and Gynecologists recommendation about using warm compresses during the second stage of labour[33]. On the contrary, Aashiem et al. reported no difference with warm compresses use regarding intact perineum, perineal trauma requiring or not requiring suturing, and first and second-degree perineal tear. Still, they revealed a significant decrease in the third and fourth degrees of perineal laceration with warm compresses[17].

Additionally, when Hastings-Tolsma *et al*.[34] utilized warm compresses during the second stage of labour, they found fewer perineal lacerations, and the warm compresses positively affected the integrity of the perineum. In addition, placing the warm pack on the perineum lessened the discomfort felt when touching the region, which, in turn, decreased the amount of bruising that took place. Dahlen et al. [35] conducted research in Australia looking at the usage of perineal warm packs during the 2nd stage of the laboring process. They demonstrated no adverse side effects and were found to be relatively affordable. Additionally, it reduced the risk of severe perineal injury. Likewise, using a warm pack on the perineum in the second stage can reduce the likelihood of sustaining a perineal laceration, according to Mohamed *et al*.[36]. The results of our study and the studies mentioned above support the usefulness of applying a warm compress to the perineum and its integrity during labor.

The measurement of pain during childbirth is important because the alleviation of perineal pain throughout the second stage of labour and postpartum can contribute to good labour, delivery experience, and natural birth[28]. Thus, we assessed the pain through a behavioural pain scale, which showed a decrease in the following parameters in the warm compresses group: severe muscle tense, being very restless, and constant grimacing. Essa *et al*. and Ibrahim *et al*. were in line with our results, but Gaheen *et al*. didn't detect any important difference regarding any items of the behavioral pain scale[15,23,25]. Our results regarding the behavioural pain scale could be explained by warm application to the perineum during the second stage of labour, which has been shown to lower the pain intensity, according to the previous literature[37–39]. Additionally, the stimulation of the touch and temperature receptors, which creates a pleasurable experience, takes place when warmth is administered; these pleasurable sensations compete with pain signals for access to the spinal cord, ultimately resulting in a diminished sensation of pain[40]. Another possible explanation for pain alleviation with the warm application is that they

cause endorphins to be produced in the body. According to Mamuk and Gencalp *et al*. [41], the pain level of the warm application group was lower than the comparison group within 2 hours of the delivery. This was the case even though both groups had the same overall pain. Additionally, Dahlen et al. declared a decrease in the amount of perineal pain experienced by participants in the intervention group on the first and second day after birth [9,35]. Concisely, our study and above mention studies revealed the role of warm application during labor and, consequently the good impact of this on vaginal delivery.

Strength and limitations

Our study is a systematic review and meta-analysis design with a high level of evidence. It also had a relatively large number of participants (n=3947) from nine countries. However, the water temperature, the timing and duration of the application, and the variances in the approach utilized in the second stage posed challenges for our research. Because studies recorded temperatures of up to 70 ° C, this water temperature variation was a particular source of concern. There was also variability in when the warm packs were used and for how long they were applied. Some women had the warm packs placed on them only after the fetal head distended the perineum, while others had them placed on them as soon as the 2nd stage began. Also, different gestational times at administration may affect the warm compress effect.

Conclusion

Our study found that warm compresses groups showed good outcomes regarding episiotomy, degree of perineal trauma (third and fourth degree), perineal trauma requiring suturing, and behavioral pain scales (severe muscle tense, being very restless, and constant grimacing). We recommend using warm compression pads during labor for their good outcomes. Further studies should do further stratification for warm compresses regarding the optimum water degree used, the advantages and disadvantages of using it during assisted vaginal delivery, or even following caesarean section.

Conflicting Interests

The authors declared no conflicts of interest with respect to the research, authorship, and publication of this study.

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Ethical approval

This study is not required.

Author contributions

The authors in this study contributed to the drafting of this work. Conception and design: HF; Acquisition of data: MA; Analysis and Interpretation of data: HM; Drafting of the manuscript: AA; Critical revision of the manuscript for important intellectual content: MM; Statistical analysis: IA; Supervision: AM; AB; RO Acquisition of data: AS; Drafting of the manuscript: MB; AA; NA; Interpretation of data: BS; data curation, Drafting of the manuscript: AO; HY; HH; Acquisition of data, software: AE; Supervision: AM. All authors revised and approved the manuscript for this study before submission.

References

1. Sonmez Y. The Prenatal Care Services. *STED/Journal of Continuing Medical Education*.
2. Albers LL and Borders N. Minimizing Genital Tract Trauma and Related Pain Following Spontaneous Vaginal Birth. *Journal of Midwifery & Women's Health* 52, 246–253 (2007).
3. Dönmez S and Kavlak O. Effects of Prenatal Perineal Massage and Kegel Exercises on the Integrity of Postnatal Perine. *Health* 07, 495–505 (2015).
4. Zhou F, Wang XD, Li J, Huang GQ and Gao BX. Hyaluronidase for reducing perineal trauma. *Cochrane Database of Systematic Reviews* (2014) doi:10.1002/14651858.CD010441.pub2.
5. Nkwabong E and Kouam L. Episiotomies During Deliveries of Singletons in Cephalic Presentation: The Incidence can be Reduced. *The Journal of Obstetrics and Gynecology of India* **62**, 641–643 (2012).

6. Pitangui ACR, Carvalho NHMG, Siqueira CV, Castro FJ. de L, and Araújo RC. de. Ocorrência e fatores associados à prática de episiotomia. *Revista de Enfermagem UFPE On Line* 8, 4–10 (2014).
7. Lone F, Sultan A and Thakar R. Obstetric pelvic floor and anal sphincter injuries. *The Obstetrician & Gynaecologist* 14, 257–266 (2012).
8. Cunningham FG, Leveno KJ, Bloom SL Spong CY, Dashe JS, Hoffman BL, Casey BM and Sheffield JS. Williams Obstetrics. 24rd ed. New York: McGraw-Hill Medical. 2014; 433-452.
9. Dahlen HG, Homer CS, Cooke M, Upton AM, Nunn R and Brodrick B. Perineal outcomes and maternal comfort related to the application of perineal warm packs in the second stage of labor: A randomized controlled trial. *Birth* 34, 282–290 (2007).
10. Sanders J, Peters TJ and Campbell R. Techniques to reduce perineal pain during spontaneous vaginal delivery and perineal suturing: a UK survey of midwifery practice. *Midwifery* 21, 154–160 (2005).
11. Rezaei R, Saatsaz S, Chan YH and Nia HS. A Comparison of the "Hands-Off" and "Hands-On" Methods to Reduce Perineal Lacerations: A Randomised Clinical Trial. *The Journal of Obstetrics and Gynecology of India* 64, 425–429 (2014).
12. Petrocnik P and Marshall JE. Hands-poised technique: The future technique for perineal management of second stage of labour? A modified systematic literature review. *Midwifery* 31, 274–279 (2015).
13. Zare O, Pasha H and Faramarzi M. Effect of perineal massage on the incidence of episiotomy and perineal laceration. *Health* 06, 10–14 (2014).
14. The M. H. P. preservation and heat application during & 1(33)., second stage of labor. M. T. E.-N. 1999; Musgrove H. Perineal preservation and heat application during the second stage of labor. Midwifery Today E-News. 1999; 1(33).
15. Essa RM and Ismail NIAA. Effect of second stage perineal warm compresses on perineal pain and outcome among primiparae. *Journal of Nursing Education and Practice* **6**, (2015).
16. Magoga G, Saccone G, Al-Kouatly HB, Dahlen G H, Thornton C, Akbarzadeh M, Ozcan T and Berghella V. Warm perineal compresses during the second stage of labor for reducing perineal trauma: A meta-analysis. *European Journal of Obstetrics & Gynecology and Reproductive Biology* 240, 93–98 (2019).
17. Aasheim V, Nilsen ABV, Reinar LM and Lukasse M. Perineal techniques during the second stage of labour for reducing perineal trauma. *Cochrane Database of Systematic Reviews* 2018, (2017).
18. Vaziri F, Farahmand M, Samsami A, Forouhari S, Hadianfard MJ and Sayadi M. The effects of warm perineum compress during the second phase of labor on first- birth outcomes. *MODERN CARE JOURNAL* 11,.
19. C. Book Series, J.P. Higgins, S. Green, C. H. for S. R. of & Interventions. C. Book Series, J.P. Higgins, S. Green, Cochrane Handbook for Systematic Reviews of Interventions.
20. Moher D, Liberati A, Tetzlaff J and Altman DG. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLoS Medicine* 6, e1000097 (2009).
21. O.D.A. Green S, Higgins P, TJ, Alderson P, Clarke M, Mulrow D C, C. H., Cochrane, C. R. C. 8: A. risk of bias in included studies. 2011. I. & Handbook for: Systematic Reviews of Interventions. pp 3–10., 2011. O.D.A. Green S, Higgins P, TJ, Alderson P, Clarke M, Mulrow D C, Cochrane Handbook: Cochrane Reviews: Ch 8: Assessing risk of bias in included studies. 2011. In: Cochrane Handbook for: Systematic Reviews of Interventions. pp 3–10., 2011.
22. Farahmand M, Khooshab E, Hasanzadeh F, Amooee S and Akbarzadeh M. The effect of warm compress Bi-stage on pain strength in labor stages and after delivery. *International Journal of Women's Health and Reproduction Sciences* 8, 46–52 (2020).
23. Gaheen M and Abo-Hatab T. Effect of Utilizing Perineal Massage, Warm Compresses and Hands on Techniques during the Second Stage of Labor on Perineal Outcomes. *Tanta Scientific Nursing Journal* 23, 36–60 (2021).
24. Goh YP, Tan PC, Hong JGS, Sulaiman S and Omar SZ. Combined massage and warm compress to the perineum during active second stage of labor in nulliparas: A randomized trial. *International Journal of Gynecology and Obstetrics* 155, 532–538 (2021).
25. Sarhan E, Qasem E, Gamal A and Khalil A. Effect of Warm Compresses Versus Lubricated Massage During the Second Stage of Labor on Perineal Integrity Among Primiparous Women. *Menoufia Nursing Journal* **7**, 111–135 (2022).
26. Kaur J, Sheoran P, Kaur S and Sarin J. Effectiveness of Warm Compression on Lumbo-Sacral Region in Terms of Labour Pain Intensity and Labour Outcomes among Nulliparous: an Interventional Study. *Journal of Caring Sciences* 9, 9–12 (2020).
27. Modoor S, Fouly H and Rawas H. The effect of warm compresses on perineal tear and pain intensity during the second stage of labor: A randomized controlled trial. *Belitung Nursing Journal* 7, 210–218 (2021).
28. Türkmen H, Çetinkaya S, Apay E, Karamüftüoğlu D and Klllç H. The Effect of Perineal Warm Application on Perineal Pain, Perineal Integrity, and Postpartum Comfort in the Second Stage of Labor: Randomized Clinical Trial. *Complementary Medicine Research* 28, 23–30 (2021).
29. Zhu Y, Wang F, Zhou J, Gu S, Gong L, Lin Y, Hu X, Wang W, Zhang A, Ma D, Hu C, Wu Y, Guo L, Chen L, Cen L, He Y, Cai Y, Wang E, Chen H, Jin J, Huang J, Jin M, Sun X, Ye X, Jiang L, Zhang Y, Zhang J, Lin J, Zhang C, Shen G, Jiang W, Zhong L, Zhou Y, Wu R, Lu S, Feng L, Guo H, Lin S, Chen Q, Kong J, Yang X, Tang M, Liu C, Wang F, Hu XM, Lee HW, Xu X, Zhang R, Robinson N, Lee MS, Han J and Qu F. Effect of Acupoint Hot Compress on Postpartum Urinary Retention After Vaginal Delivery. *JAMA Network Open* 5, e2213261 (2022).
30. Akbarzadeh M, Vaziri F, Farahmand M, Masoudi Z, Amooee S and Zare N. The Effect of Warm Compress Bistage Intervention on the Rate of Episiotomy, Perineal Trauma, and Postpartum Pain Intensity in

Primiparous Women with Delayed Valsalva Maneuver Referring to the Selected Hospitals of Shiraz University of Medical Sciences in . *Advances in Skin and Wound Care* 29, 79–84 (2016).
31. Akbarzadeh M, Nematollahi A, Farahmand M and Amooee S. The Effect of Two-Staged Warm Compress on the Pain Duration of First and Second Labor Stages and Apgar Score in Prim Gravida Women: a Randomized Clinical Trial. *Journal of Caring Sciences* 7, 21–26 (2018).
32. Albers LL, Sedler KD, Bedrick EJ, Teaf D and Peralta P. Midwifery care measures in the second stage of labor and reduction of genital tract trauma at birth: A randomized trial. *Journal of Midwifery and Women's Health* 50, 365–372 (2005).
33. Practice Bulletin No. 165: Prevention and Management of Obstetric Lacerations at Vaginal Delivery. *Obstetrics & Gynecology* 128, e1–e15 (2016).
34. Hastings-Tolsma M, Vincent D, Emeis C and Francisco T. Getting Through Birth in One Piece. *MCN: The American Journal of Maternal/Child Nursing* 32, 158–164 (2007).
35. Dahlen HG, Homer CS, Cooke M, Upton AM, Nunn RA and Brodrick BS. 'Soothing the ring of fire': Australian women's and midwives' experiences of using perineal warm packs in the second stage of labour. *Midwifery* 25, e39–e48 (2009).
36. Mohamed ML, Mohamed SL and Gonied AS. Comparative study between two perineal management techniques used to reduce perineal trauma during 2nd stage of labor. *The Journal of American Science* 7, 228–232 (2011).
37. Fahami F, Behmanesh F, Valiani M and Ashouri E. Effect of heat therapy on pain severity in primigravida women. *Iranian journal of nursing and midwifery research* 16, 113–6 (2011).
38. Turky, E. R. A. & H. A. Effect of Applying Warm Perineal Packs During the. 8, 1–26 (2010).
39. Yazdkhasti M, Moghimi HS and Mehdizadeh TZ. The Effect of Localized Heat and Cold Therapy on Pain Intensity, Duration of Phases of Labor, and Birth Outcomes Among Primiparous Females: A Randomized, Controlled Trial. *Shiraz E-Medical Journal* 19, (2018).
40. Perl ER. Pain and Nociception. in *Comprehensive Physiology* 915–975 (Wiley, 1984). doi:10.1002/cphy.cp010320.
41. Mamuk R and Gençalp NS. Effect of warm application to the perineum in vaginal labor on perineal integrity and pain. *Journal of Human Sciences* 10, 48–66 (2013).