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REVIEW PAPER

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A meta-analysis of the effect on maternal health of upright positions during the second stage of labour, without routine epidural analgesia

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Abstract

Aim: To detect the effect on maternal health of upright positions during the second stage of labour.

Background: Maternal position during labour has an important effect on maternal and foetal health.

Design: A meta-analysis was used based on the Cochrane Handbook.

Data sources: Randomized/non-randomized clinical trials were searched with English and Turkish key words in databases (CINAHL, Medline, Science Direct, Springer Link, Ovid, Cochrane Central Register of Controlled Trials, Networked Digital Library of Theses & Dissertations, Proquest, ULAKBİM (Turkish Academic Network and Information Center) and YÖK (Turkish Council of Higher Education) (1970-December 2015).

Review methods: According to inclusion criteria, eligible studies were identified. Data extraction was performed and the bias risks of the studies were assessed independently by two authors. The publication bias of the main outcomes was examined. The overall effect size was calculated by risk ratio with a random effects model. Statistical heterogeneity tests and sensitivity analyses were performed.

Results: The criteria for the meta-analysis were met by 22 articles. It was detected that the ratio of instrumental labour and episiotomy was lower but the haemorrhage ratio was higher in women. There was no statistical effect of upright position on the other maternal outcomes.

Conclusion: The reductions in these ratios improved comfort. Due to methodological shortcomings of the studies, the increased ratio of postpartum haemorrhage should be interpreted with caution. Researchers are recommended to conduct studies rigorously. In addition, healthcare professionals are recommended to decide the appropriate birth position by considering the individual risk factors and preferences of the women.

KEYWORDS
delivery nursing care, labour positions, maternal health, meta-analysis, nursing, parturition, recumbent positions, systematic review, upright positions

1 | INTRODUCTION

Childbirth marks the end of the long wait of pregnancy and the start of extrauterine life for the newborn. The labour experience and process should leave pleasant memories for the mother to create a healthy start to the maternal experience (Mathew, Nayak, & Vandana, 2012). The position of the mother during labour is a significant factor that directly affects maternal and foetal health (Kömürcü & Ergin, 2008). The recommendations for birth positions during labour are as follows: the mother should be encouraged by allowing mobility and position changes during the first stage of labour and birth in the supine position should be avoided in the second stage (Balaskas, 2001, CIMS, 1997, NICE, 2007; RCM, 2008, WHO, 1996).

Upright positions during the second stage of labour include sitting, squatting, use of an obstetric birth chair, the hand-knee position and the semi-sitting position (Zwelling, 2010). Mobility and changes in position can be used as non-pharmacological methods of maternal pain relief. In addition to their many physiological benefits, they also help prevent the mother from suffering excessive fear, thus fulfilling the psychological and emotional aspects of nursing (Ganapathy, 2012). However, immobility during the course of birth is currently applied as a common intervention due to some obstacles to the use of upright positions during labour (Zwelling, 2010). These barriers include increased medical management, exhaustion due to the use of epidural analgesia and continuous foetal monitoring (Layer, 2011).

1.1 | Background

There are some experimental studies in the literature that examine the effect of maternal position. Previous experimental studies have revealed that the use of the upright position decreases the incidence of instrumental labour (Nasir, Korejo, & Noorani, 2007), episiotomy and perineal laceration (Zaibunnisa, Ara, Kaker, & Aslam, 2015) and reduces the duration of the second (Dani, Badhwar, Sawant, & Salian, 2015) and third stages of birth (Jahanfar, Amini, & Jamshidi, 2004). However, other studies have specified that the upright position is also associated with postpartum haemorrhage (Ganapathy, 2012; Turner, Romney, Webb, & Gordon, 1986) and perineal laceration (Thies-Lagergren, Kvist, Christensson, & Hildingsson, 2011).

Among the meta-analysis conducted on this subject, the study by Gupta, Hofmeyr, and Shehmar (2012) examined the second stage of birth and established that the upright position results in a significant decrease in the incidence of instrumental labour and episiotomy. The study also demonstrates that the incidences of second-degree perineal laceration and postpartum haemorrhage increase in women using the upright position. This result that the widely recommended upright position increases postpartum haemorrhage is very important, as postpartum haemorrhage is the leading cause of maternal mortality (WHO, 2017). For this reason, it is of great importance to clarify the dangers and benefits of the upright position, which is recommended to improve the birth process, based on previous studies.

Why is this review needed?

- The recommendation for birth positions applied during delivery is that delivery in the supine position should be avoided at the second stage. However, staying immobile during the course of delivery is currently applied as a common intervention.
- A previous meta-analysis found that widely recommended upright position increases the postpartum haemorrhage ratio. Postpartum haemorrhage is one of the first causes among the primary aetiology of maternal mortality. For this reason, it is of great importance to clarify the harms and benefits of the upright position, which is recommended to improve the birth process in the studies that have been conducted.
- Some results of studies conducted after the Cochrane review do not match the results of the Cochrane review.

What are the key findings?

- The upright position may slightly decrease the ratio of instrumental birth/episiotomy and slightly increase the ratio of postpartum haemorrhage.
- However, the increased ratio of postpartum haemorrhage should be interpreted with caution because the estimation of blood loss may be influenced by the methodological shortcomings of the studies.
- After the sensitivity analysis, the overall effect of the upright position on the caesarean birth ratio changed significantly.

How should the findings be used to influence practice?

- Until the effect of upright position on maternal health is better understood with well-designed studies, women should choose the position they find comfortable.
- Decide the appropriate delivery position taking into consideration individual risk factors.

How should the findings be used to influence research?
Rigorous methods are required for future studies. There is a need for studies with rigorous methods, especially studies analysing effects of upright position on the caesarean birth and postpartum haemorrhage ratio. The points that researchers should pay attention to that;

- Use a common terminology in the classification and rating of the upright and recumbent positions applied during birth,
- Provide information on details of the interventions applied in the study (e.g. period, form of intervention),
- Consider that the positions used during the first stage of labour may be effective in studies conducted on positions during the second stage of labour,
- Measure the parameters examined in the study by means of commonly used and concrete assessment instruments,
- Perform “intention-to-treat” analysis that takes into account the loss data in studies.

Ensuring the appropriate positioning of the mother and eliminating conditions that may disturb her comfort are significant aspects of good midwife/nursing care (Mathew et al., 2012). Consulting on different labour positions protects the mother from possible perineal trauma and helps to identify a position that will not negatively affect the foetus. Nurses and midwives have a significant responsibility to ensure that mothers use the appropriate position (Karaçam, 2001).

This study will inform healthcare professionals who will be consulted about determining labour positions. Unlike the previous meta-analysis study on this topic, contact was established with the authors of some publications that did not include detailed data and three additional studies were included in the analysis (Thies-Lagergren & Kvist, 2009; Thies-Lagergren et al., 2011; Thies-Lagergren et al., 2013). Additionally, some studies were excluded due to the following reasons: a congressional report was not natured the full text (Hillan, 1984; Radkey, Liston, Scott, & Young, 1991), no information was provided on participant details (Chan, 1963), or the study included women with some characteristics that affect labour progression, such as breech presentations and twin pregnancies (Waldenstrom & Gottvall, 1991), or not available full text (Suwanakam, Linasmita, Phuapradit, & Pongruengphant, 1988). Additionally, the effect of the upright position has continued to be analysed since 2012. Some studies conducted after the Cochrane review and were therefore not included in it do not corroborate the results of the Cochrane review. For example, Thies-Lagergren & Kvist (2009); Thies-Lagergren et al. (2011) and Dani et al. (2015) found that the upright position did not affect the instrumental birth incidence in their studies, while Zaibunnisa et al. (2015) found that there were fewer postpartum haemorrhages in the squatting position. The authors of the present study also focused on the methodological differences of studies conducted on the subject and their effect on conclusions in this meta-analysis. As a result, the study should be of service to researchers.

2 | THE REVIEW

2.1 | Aim

The purpose of this evidence-based practice (EBP) review was to examine and determine the following: (1) What is the effect of the upright position (I) on women without routine epidural analgesia during the second stage of labour (P) on mode of birth (O) vs. the recumbent position (C)? and (2) What is the effect of the upright position (I) on perineal health (O) in women without routine epidural analgesia during the second stage of labour (P) vs. the recumbent position (C)?

2.2 | Design

The recommendations of the Cochrane Collaboration's "Cochrane Handbook for Systematic Reviews of Interventions" were taken into account (Higgins & Green, 2011).

2.3 | Search methods

The literature search was carried out using the following keywords: "position and second stage of labour", "maternal position and labour", "labour position and second stage", "labour and position" and "mother position and labour" (1970-December 2015). Because no MeSH terms that reflected the maternal position during labour were found, the keywords were determined by reviewing the reference articles related to the topic. EbscoHost CINAHL Complete, Medline, Science Direct, Springer Link, Ovid, Cochrane Central Register of Controlled Trials, Networked Digital Library of Theses & Dissertations and Proquest databases were used to identify English studies for the review. The ULAKBİM (Turkish Academic Network and Information Centre) and YÖK (Turkish Council of Higher Education) National Thesis Centre databases were used for Turkish studies.We attempted to control for differences in each of these databases by creating various filters, taking into account the inclusion criteria (see Supplementary Data File S1 for the MEDLINE and EbscoHost CINAHL complete search strategy). The literature search was conducted using the agreed on databases and filters by two independent researchers (KK, AD). The electronic search was also supplemented by cross-checking the reference lists of published papers. Studies were searched via a three-stage screening process based first on the title, then the abstract and finally the full text. Several studies with data that were appropriate for the research topic could potentially have been included in the meta-analysis, but the full text could not be accessed. We contacted the author (s) of these studies and tried to access the specified studies and other existing related studies.

2.4 | Inclusion criteria

The following criteria were considered in the selection of studies included in the analysis:

1. Characteristics of the sample group: (1) women in whom the upright and recumbent positions were applied during the second stage of labour; (2) women with a single foetus and vertex presentation; (3) women planning to have a vaginal birth; (4) women without maternal and obstetric complications; (5) primiparous or multiparous women; (6) women not having any type of planned epidural analgesia; and (7) women having a spontaneous or induced birth.
2. Characteristics of the intervention: We included the following intervention characteristics in the study: for the experimental group, women who adopted an upright position (sitting, squatting, birth chair, hand-knee position and semi-sitting position) during the second stage of labour and did not receive routine epidural analgesia and for the control group, women who adopted a recumbent position (supine, supine-lithotomy, dorsal, lateral and bed restriction).
3. Characteristics of the results: The results addressed in the study include the type of birth (normal vaginal birth, instrumental vaginal birth [forceps or vacuum birth], caesarean birth), perineal

traumas (perineal integrity, first-, second- and third-degree lacerations, episiotomy ratio) and postpartum haemorrhage (blood loss ≥ 500 mL).
4. Characteristics of study types: Randomized/non-randomized clinical trials were included in the analysis. The analysis included the following: (1) full-text articles that were accessible by screening specified databases, and published master's and PhD theses; (2) studies conducted between 1970 and 2015; (3) studies that clearly specified binary data on the sample size of the experimental and control groups; and (4) Turkish and English articles and theses.

2.5 | Exclusion Criteria

1. Characteristics of the sample group: Women carrying foetuses in the occiput posterior position, women with maternal and obstetric complications, women with foetuses in the breech presentation and women with twin pregnancies.
2. Characteristics of the intervention: Use of the recumbent position in the experimental group, lack of sufficient details on the sample group and use of different interventions in addition to position.
3. Characteristics of the results: Failure to clearly specify the number of individuals by incidence data.
4. Characteristics of the study types: Cross-sectional design and studies without full text availability.

2.6 | Assessment of the bias risk of studies

The bias risk of every study was independently assessed using the Cochrane Collaboration's tool for assessment of risk in trials by two reviewers (AD, KK) (Higgins & Green, 2011). The bias risk of studies was assessed using six different categories (random sequence generation, allocation concealment, blinding of participants/personnel/outcome assessment, incomplete outcome data, selective reporting and other). Each category of risk of bias was classified into one of three levels: low, unclear and high. In the case of disagreements, consensus was reached by discussion.

2.7 | Data abstraction

The literature review was conducted by independent researchers using a double-screening procedure. The studies identified by the literature review were coded using the coding protocol prepared by the researchers (AD, KK). The coding system used in the study was composed of three categories. These categories included the identifying features of the study (author, year and country), content of the study (characteristics of participants, details of the intervention and main outcomes) and the necessary study data to be included in the meta-analysis. This coding process was performed independently by two researchers (AD, KK). The compatibility between codings was assessed by the researchers and was found to be 92.6% (good agreement). When there were disagreements, consensus was reached through discussion. We also contacted several researchers about questions related to study methods and data. For example, we emailed Thies-Lagergren et al. (2009) to ask for details about the positions used for the control groups.

2.8 | Data synthesis and analysis

The Comprehensive Meta-Analysis (CMA) statistical package program, licensed version 2, was used to perform the calculations in this meta-analysis. The analyses performed during the meta-analysis implementation process were as follows:

2.8.1 | Evaluation of publication bias

The Cochrane guidelines state that at least 10 studies are necessary to evaluate publication bias. The publication bias analysis in this research included more than 10 studies (Higgins & Green, 2011).

2.8.2 | Effect size calculation

The risk ratio (RR) with the 95% confidence interval was used because it provides more sensitive results for binary data (experimental-control) in effect size calculations (Borenstein, Hedges, Higgins, & Rothstein, 2009).

2.8.3 | Model selection

It is argued that a random effects model should be used in meta-analyses conducted to evaluate the effect of an initiative in various populations, as the fixed effects model is more restrictive in nature (Borenstein et al., 2009). For this reason, the random effects size was used to calculate both random faults and the real differences in the initiatives and populations between various studies in the present analysis.

2.8.4 | Evaluation of heterogeneity

It has been stated that not only the Q statistic but also the I^2 statistic, which specifies the quantity of heterogeneity, should be considered when evaluating heterogeneity (Borenstein et al., 2009). In this study, Q and I^2 tests were conducted to evaluate heterogeneity. A value of 0.10 was considered statistically significant for the Q test, while a result of 25% or above was considered to indicate the existence of heterogeneity in the I^2 test.

2.8.5 | Sensitivity analysis

Sensitivity analysis was conducted to determine the sensitivity of the overall average effect size that was obtained as a result of the analyses. Methods of sensitivity analysis involve the inclusion or exclusion of studies with a high bias risk and the inclusion or exclusion of studies with outliers. Studies with a high bias risk in two or more fields were considered to have a high bias risk in the research assessed, according to Cochrane's tool for assessing risk of bias.

However, outliers were specified by considering the uncombined effect size of the studies included in the analysis.

2.9 | Reporting the study results

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement was used during the reporting process (Moher, Liberati, Tetzlaff, & Altman, 2009). Moreover, standard statements to describe the results were used according to a report by Glenton et al. (2010). To provide a summary of the main results of the review together with an assessment of the quality or certainty of evidence (assessed using the GRADE tool), a Summary of Findings (SoF) table was presented in accordance with Cochrane's reviews of Ryan, Santesso, and Hill (2016).

3 | RESULTS

The findings from the systematic review are presented first, followed by the results of the meta-analysis component of this review.

3.1 | Search outcomes

Unpublished master's/PhD theses and articles were screened in 10 databases using the previously specified keywords. A total of 10,464 studies were accessed; 84 studies were examined in detail in accordance with the inclusion criteria; and 22 articles with full text availability were included in the analysis. The studies included in the analysis were identified in accordance with the "PRISMA Flow Diagram Instructions" provided in Figure 1.

3.2 | Characteristics of the included studies

A total of 19 randomized and three non-randomized clinical trials were included in the analysis. The characteristic features of the studies are presented in Table 1. Among the studies, nine were published between 1980 and 1990 and 13 were published between 2000 and 2015. Some studies included primiparous and multiparous mothers, but the data were presented separately. The studies include 12 sets of data for primiparous, six for multiparous and nine for both primiparous and multiparous mothers. The start of labour was spontaneous in six studies, while the remaining studies included both spontaneous and induced labours. The types of upright positions applied in the studies included nine cases of sitting in an obstetric birth chair, five cases of squatting and eight cases of adopting an upright position in bed. Recumbent positions included supine-lithotomy and the traditional position.

3.3 | Characteristics of bias risk of studies

The 22 studies in the analysis were assessed to determine whether they had an uncertain, low or high level of bias according to the Cochrane Collaboration's tool for assessing risk of bias. The results are provided in Table 2.

Nine studies conducted using randomized numbers generated by a computer or by shuffling envelopes were associated with a low level of bias in the process of random sequence generation. We found that 10 studies had high levels of bias due to the use of odd-even numbers, hospital numbers, registration numbers or assignment according to other variables. Some studies had a low level of bias by means of allocation concealment with opaque, sealed envelopes. It was determined that studies without allocation concealment had a high level of bias. Due to the nature of the intervention, it was decided that blinding was not applicable to women and healthcare professionals. However, it should be noted that the lack of blinding may result in bias. Some articles presented the number of caesarean deliveries but not the number of spontaneous deliveries (Gupta, Brayshaw, & Lilford, 1989) and in others, the number of second-degree lacerations was given but not the number of cases without perineal trauma or first-degree lacerations (Gupta et al., 1989). There was postrandomization loss of data in some studies, but the bias level was specified as low because intention-to-treat analysis was conducted after the data loss. It was found that the previously specified primary and secondary results were provided in all the studies being evaluated in terms of bias at the reporting stage. Some studies did not specify their method in detail and did not provide necessary information about how the intervention was implemented, how the results were evaluated and which criteria were used. Therefore, these studies were considered to have a high level of bias in the "other" category of bias. Additionally, postpartum haemorrhage was evaluated visually and this measurement error was noted as having a high risk of bias (Table 2).

3.4 | Meta-analysis outcomes

A summary of the main outcomes of the review and quality of evidence (SoF table) is provided in Table 3.

3.5 | Mode of birth

The effect of the upright position was not significant with respect to the incidence of vaginal birth (RR: 1.022; 95% CI = 0.963–1.085, N = 5, heterogeneous distribution Q = 8.432, I^2 = 52.562%) (Figure 2). After the sensitivity analysis, the overall effect size was not significantly affected (RR = 0.978, 95% CI = 0.935–1.024); however, the heterogeneity value significantly decreased (Q = 0.407, I^2 = 0%).

It was determined that the effect of the upright position was significant with respect to the instrumental birth incidence (RR = 0.682, 95% CI = 0.504–0.924, N = 17, heterogeneous distribution Q = 48.769, I^2 = 67.193%, no publication bias) (Figure 3). This result suggests that the application of the upright position at the second stage of labour probably slightly decreases the instrumental birth incidence. In the sensitivity analysis, the overall effect size was not significantly affected (RR: 0.583, 95% CI = 0.435–0.782). However, it should also be considered that the confidence interval became narrow after the sensitivity analysis.

The effect of the upright position was not significant with respect to the caesarean birth incidence (RR = 1.029, 95% CI = 0.448–2.363,

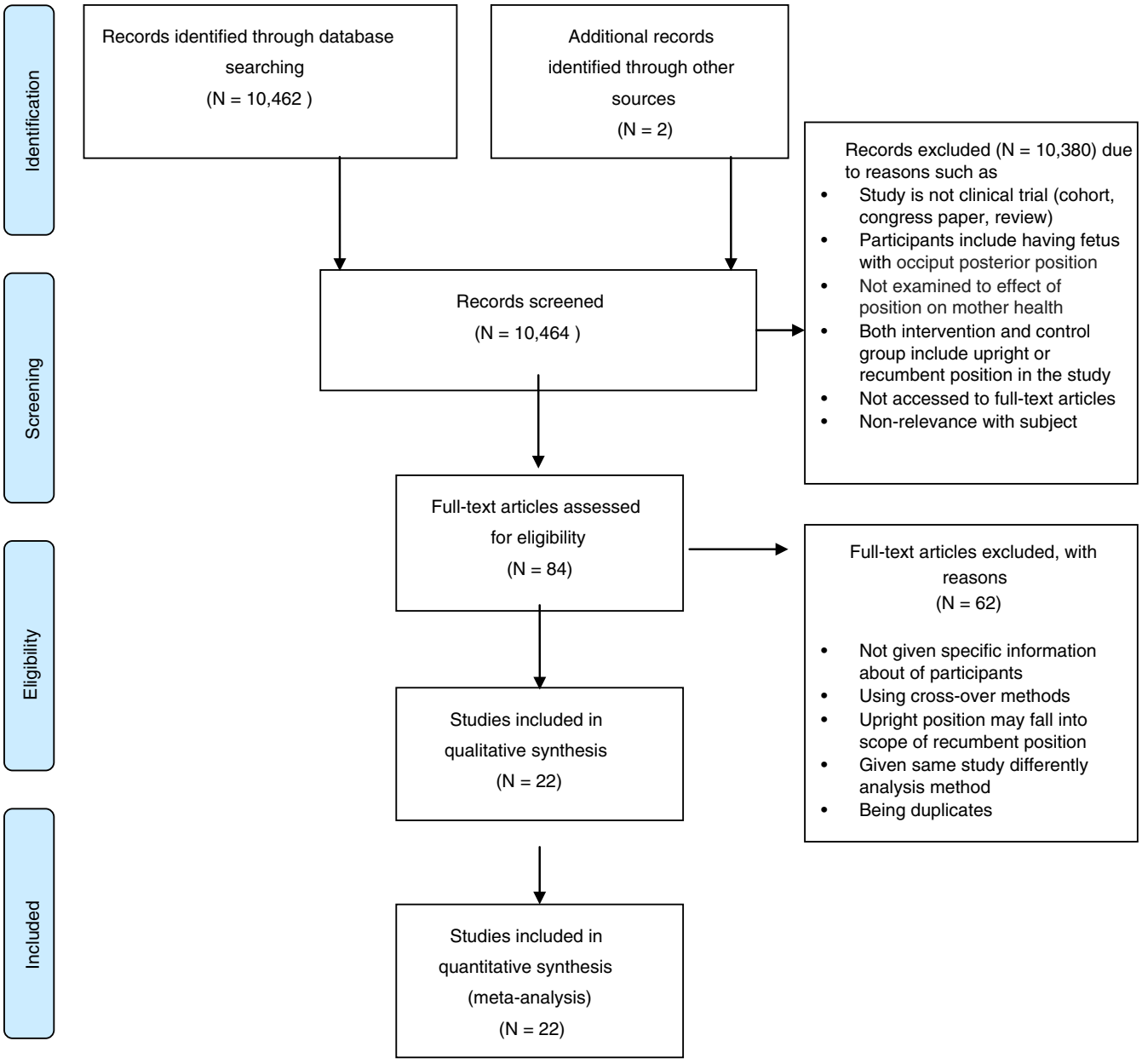

FIGURE 1 Study flow diagram of literature selection. Abbreviation of RCT: Randomized controlled trial. *Source:* Moher et al. (2009) [Colour figure can be viewed at wileyonlinelibrary.com]

N = 7, heterogeneous distribution Q = 8.712, I^2 = 31.132%) (Figure 3). After the sensitivity analysis, the overall effect size significantly changed in favour of the upright position (RR = 0.240, 95% CI = 0.059–0.984) and the heterogeneity in the distribution of the effect size was significantly decreased (Q = 0.961, I^2 = 0%).

3.6 | Perineal health

It was determined that the effect of the upright position was non-significant with respect to the continuity of perineal integrity (RR = 1.096, 95% CI = 0.847–1.419, N = 8, heterogeneous distribution Q = 43.331, I^2 = 83.845%) (Figure 2). After the sensitivity analysis, the overall effect size was not significantly affected (RR = 0.952, 95% CI = 0.764–1.186).

The effect of the upright position was not significant with respect to the first-degree perineal laceration incidence (RR = 1.064, 95% CI = 0.857–1.320, N = 8, heterogeneous distribution Q = 15.365, I^2 = 54.441%) (Figure 4). In the sensitivity analysis, the overall effect size was not significantly affected (RR = 1.036, 95% CI = 0.958–1.119).

Additionally, the effect of the upright position was not significant with respect to the second-degree perineal laceration incidence (RR = 0.943, 95% CI = 0.651–1.365, N = 12, heterogeneous distribution Q = 46.754, I^2 = 76.473%, no publication bias) (Figure 4). As a result of the sensitivity analysis, the overall effect size was significantly affected (RR = 1.295, 95% CI = 1.020–1.643).

It was determined that the effect of the upright position was not significant with respect to the third-degree perineal laceration

TABLE 1 Characteristic of included studies to meta-analysis

Study	Country	Participants intervention/ Control group	Intervention	Outcomes
Marttila, Kajanoja, & Ylikorkala, 1983	Finland	*N* = 30/30 Primiparous *N* = 20/20 Multiparous	Half sitting in birth chair vs. supine position	Duration of second stage of labour, vacuum birth
Stewart & Spiby, 1989	England	*N* = 61/56 Primiparous *N* = 96/91 Multiparous	Birth chair vs. wedged dorsal position	Duration of second stage of labour, mode of delivery (spontaneous, instrumental and caesarean birth), average blood loss, postpartum haemorrhage, perineal trauma (null, first- and second-degree lacerations, episiotomy)
Gardosi et al., 1989	England	*N* = 218/209 Primiparous	Squatting vs. conventional recumbent position	Duration of second stage of labour, mode of delivery (spontaneous, instrumental, caesarean birth), postpartum haemorrhage, perineal trauma (null, first, second and third degree, episiotomy, perineal oedema)
Gardosi & Sylvester, 1989	England	*N* = 73/78 Primiparous	Upright vs. conventional recumbent position	Mode of delivery (spontaneous, forceps, caesarean birth), average blood loss, perineal trauma (null, first- and second-degree lacerations, episiotomy)
Gupta et al., 1989	England	*N* = 20/24 Primiparous *N* = 29/20 Multiparous	Squatting vs. conventional way	Duration of second stage of labour, mode of delivery (forceps birth, caesarean birth), average blood loss, perineal trauma (second-degree lacerations, episiotomy), requirement of epidural analgesia
Turner et al., 1986	England	*N* = 111/140 Primiparous *N* = 115/173 Multiparous	Birth chair vs. dorsal position	Duration of second stage of labour, mode of birth (spontaneous, forceps and caesarean birth), average blood loss, postpartum haemorrhage, perineal trauma (null, first-degree lacerations, episiotomy)
Chen, Aisaka, Mori, & Kigawa, 1987	Japan	*N* = 22/23 Primiparous *N* = 19/20 Multiparous	Sitting position vs. supine positions	Duration of second stage of labour, rate of forceps birth
Liddell & Fisher, 1985	New Zealand	*N* = 27/21 Primiparous	Birth chair vs. supine	Duration of second stage, mode of birth (spontaneous, instrumental birth), perineal trauma (first-, second- and third-degree lacerations, episiotomy)
Hemminki et al., 1986	Finland	*N* = 88/87 Primiparous–multiparous	Birth chair vs. supine position	Mode of delivery
De Jong et al., 1997	South Africa	*N* = 257/260 Primiparous–multiparous	Squatting vs. supine position	Duration of second stage of labour, instrumental birth, postpartum haemorrhage, perineal trauma (null, first-, second- and third-degree lacerations, episiotomy), pain, perineal oedema, vulva haematoma
Thies-Lagergren & Kvist, 2009	Sweden	*N* = 34/33 Primiparous	Birth chair vs. any other position (include supine position according to email of author)	Duration of second stage of labour, instrumental birth, postpartum haemorrhage, perineal trauma (first-, second-, third- and fourth-degree lacerations, episiotomy, perineal oedema), rate of Oxytocin augmentation

(Continues)

TABLE 1 (Continued)

Study	Country	Participants intervention/ Control group	Intervention	Outcomes
Nasir et al., 2007	Pakistan	*N* = 100/100 Primiparous–multiparous	Squatting position vs. supine in lithotomy	Forceps birth, postpartum haemorrhage, perineal trauma (second-, third- and fourth-degree lacerations, episiotomy)
Zaibunnisa et al., 2015	Pakistan	*N* = 151/151 Primiparous–multiparous	Squatting position vs. lithotomy	Mode of birth (spontaneous, forceps and caesarean birth), postpartum haemorrhage, perineal trauma (third- and fourth-degree lacerations, episiotomy)
Ganapathy, 2012	India	*N* = 100/100 Primiparous	Sitting position vs. supine-lithotomy position	Duration of second stage of labour, instrumental birth, requirement of epidural analgesia, pain
Terry, Westcott, O'Shea, & Kelly, 2006	United States	*N* = 98/100 Primiparous–multiparous	Non-supine (sitting, squatting, or kneeling/ hands-and-knees) vs. supine (design of the study is non-randomized clinical trial)	Perineal trauma (null, first-, second- and third-degree lacerations, vulvar oedema), estimated blood loss
Thies-Lagergren et al., 2011	Sweden	*N* = 500/502 Primiparous	Birth chair vs. any other position (include supine position according to email of author)	Instrumental birth, average blood loss, postpartum haemorrhage, perineal trauma (null, first-, second- and third-degree lacerations, episiotomy, perineal oedema
De Jonge, Van Diem, Scheepers, Buitendijk, & LagroJanssen, 2010	Netherland	*N* = 119/922 Primiparous–multiparous	Sitting and recumbent position *design of the study is non-randomized clinical trial *only used sitting position (because semi-sitting position is supported by pillows or a bedrest)	Duration of second stage of labour, perineal trauma (null, first, second and third degree, episiotomy)
Bomfim-Hyppolito, 1998	Brazil	*N* = 127/121 Primiparous–multiparous	Sitting vs. a lying position	Average blood loss (mL), incidence of first and second-degree lacerations
De Jonge, Van Diem, Scheepers, Der Palde Bruin, & LagroJanssen, 2007	Netherlands	*N* = 119/922 Primiparous–multiparous	Sitting position vs. recumbent *design of the study is non-randomized clinical trial *only used sitting position (because semi-sitting position is supported by pillows or a bedrest)	Postpartum haemorrhage
Crowley et al., 1991	Ireland	*N* = 634/596 primiparous	Birth chair vs. bed (semi-recumbent, dorsal, or left lateral)	Duration of second and third stage of labour, rate of caesarean birth, postpartum haemorrhage, perineal lacerations (null, second and third degree), episiotomy
Dani et al., 2015	India	*N* = 100/100 Primiparous–multiparous	Squatting position vs. dorsal recumbent position	Mode of birth (instrumental and caesarean birth), duration second stage of labour, perineal trauma (first- and second-degree lacerations, episiotomy), duration of second stage of labour
Jahanfar et al., 2004	Iranian	*N* = 50/50 multiparous	Sitting position in a chair vs. lithotomy	Duration of second and third stage of labour, average blood loss during the third stage, perineal oedema

TABLE 2 Risk of bias summary of included studies

	Random sequence generation	Allocation concealment	Blinding of participant and personnel	Blinding of outcome assessment	Incomplete outcome data	Selective reporting	Other bias
Marttila et al., 1983	?	?	—	?	+	+	+
Stewart & Spiby, 1989	+	+	—	?	+	+	+
Gardosi et al., 1989	—	—	—	?	+	+	+
Gardosi & Sylvester, 1989	—	—	—	?	+	+	+
Gupta et al., 1989	+	+	—	?	—	+	—
Turner et al., 1986	?	+	—	?	+	+	+
Chen et al., 1987	—	—	—	?	?	—	?
Liddell & Fisher, 1985	+	+	—	?	+	+	+
Hemminki et al., 1986	+	—	—	?	—	—	+
De Jong et al., 1997	+	+	—	?	+	+	+
Thies-Lagergren & Kvist, 2009	+	+	—	?	+	+	?
De Jonge et al., 2007	—	—	—	?	+	+	+
Nasir et al., 2007	—	—	—	?	+	+	+
Zaibunnisa et al., 2015	?	?	—	?	+	+	?
De Jonge et al., 2010	—	—	—	?	+	+	+
Ganapathy, 2012	+	?	—	?	+	+	?
Terry et al., 2006	—	—	—	?	+	—	+
Thies-Lagergren et al., 2011	+	+	—	?	+	+	?
Bomfim-Hyppolito, 1998	—	—	—	?	+	+	+
Crowley et al., 1991	+	+	—	?	—	+	+
Dani et al., 2015	—	?	—	?	+	—	—
Jahanfar et al., 2004	—	—	—	?	—	+	+

+ = low risk; ? = unclear risk; — = high risk.

incidence (RR = 0.536, 95% CI = 0.269–1.068, N = 6, homogenous distribution Q = 5.837, I^2 = 14.336%) (Figure 4). After the sensitivity analysis, the overall effect size was not significantly affected (RR = 0.765, 95% CI = 0.463–1.266).

The effect of the upright position was significant with respect to the episiotomy incidence (RR = 0.811, 95% CI = 0.723–0.910, N = 13, heterogeneous distribution Q = 20.394, I^2 = 41.158%, no publication bias) (Figure 5). This result suggests that the upright position applied to mothers without routine epidural analgesia during the second stage of labour probably slightly decreased the episiotomy risk. As a result of the sensitivity analysis, the overall effect size was not significantly affected (RR = 0.817, 95% CI = 0.687–0.973). Moreover, the confidence interval became wider and the heterogeneity increased after the sensitivity analysis (Q = 16.880, I^2 = 52.60%).

3.7 | Postpartum haemorrhage

The effect of the upright position was significant with respect to the postpartum haemorrhage incidence; however, its effect was negative (RR = 1.389, 95% CI = 1.123–1.717, N = 12, heterogeneous distribution (Q = 20.259, I^2 = 50.640%) (Figure 5). This result suggests that the application of the upright position to mothers without routine epidural analgesia during the second stage of labour may slightly increase the postpartum haemorrhage risk. As a result of the sensitivity analysis, the overall effect size was not affected (RR = 1.525, 95% CI = 1.078–2.157; RR = 1.252, 95% CI = 1.067–1.469). The heterogeneity value increased on the exclusion of studies with a high bias risk, while the heterogeneity value decreased on the exclusion of studies with outliers.

4 | DISCUSSION

The purpose of this meta-analysis was to determine the effect of the upright position applied to mothers without routine epidural analgesia during the second stage of labour on the mode of birth and perineal health. Unlike previous meta-analysis, the effects of the upright position on vaginal birth, perineal integrity and incidence of first-degree perineal laceration were analysed in the present study.

4.1 | Effect of the upright position on mode of birth

It was determined that the upright position had a significant effect only on instrumental birth incidence; its effect on other types of births was non-significant. Please see Supplementary File S2 for the discussion section about effect of the upright position on vaginal birth.

TABLE 3 Summary of findings (SoF) table for the main comparison according to Cochrane collaboration

Comparison: Effect on maternal health of upright positions during the second stage of labour, without routine epidural analgesia vs. recumbent positions
Patients or population: Women without routine epidural analgesia during the second stage of labour
Intervention: Upright position
Comparison: Recumbent position

	Illustrative comparative risks[g] (95% CI)					
Outcomes	Assumed risk Recumbent position	Corresponding risk Upright position	Risk Ratio	Number of participants (studies)	Quality of evidence (GRADE)	Comments
Instrumental birth	147 per 1,000	100 per 1,000 (82-135)	RR 0.682 (0.504-0.924)	5,589 (17 studies)	Moderate[a,b]	—
Caesarean birth	17 per 1,000	17 per 1,000 (7-40)	RR 1.029 (0.448-2.363)	2,382 (7 studies)	Low[a,c,d,e]	—
Episiotomy	319 per 1,000	258 per 1,000 (230-290)	RR 0.811 (0.723-0.910)	5,834 (13 studies)	Moderate[a,b]	—
Postpartum haemorrhage	222 per 1,000	299 per 1,000 (242-371)	RR 1.389 (1.123-1.717)	5,706 (12 studies)	Low[a,b,e,f]	—

CI: Confidence interval; RR: Risk ratio.
GRADE Working Group grades of evidence
High quality: Further research is very unlikely to change our confidence in the estimate of effect.
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Very low quality: We are very uncertain about the estimate.
[a]Limitations in the design and implementation of available studies suggesting high likelihood of bias.
[b]No publication bias.
[c]Publications bias was not analysed.
[d]Inconsistency due to changes of results after the sensitivity analysis.
[e]Wide confidence intervals.
[f]Evaluation of the result was made by using observation in some studies.
[g]The basis for the assumed risk (e.g. the median control group risk across studies) is provided in footnotes. The corresponding risk (and its 95% confidence interval) is based on assumed risk in the comparison group and the relative effect of the intervention (and its 95% confidence interval).

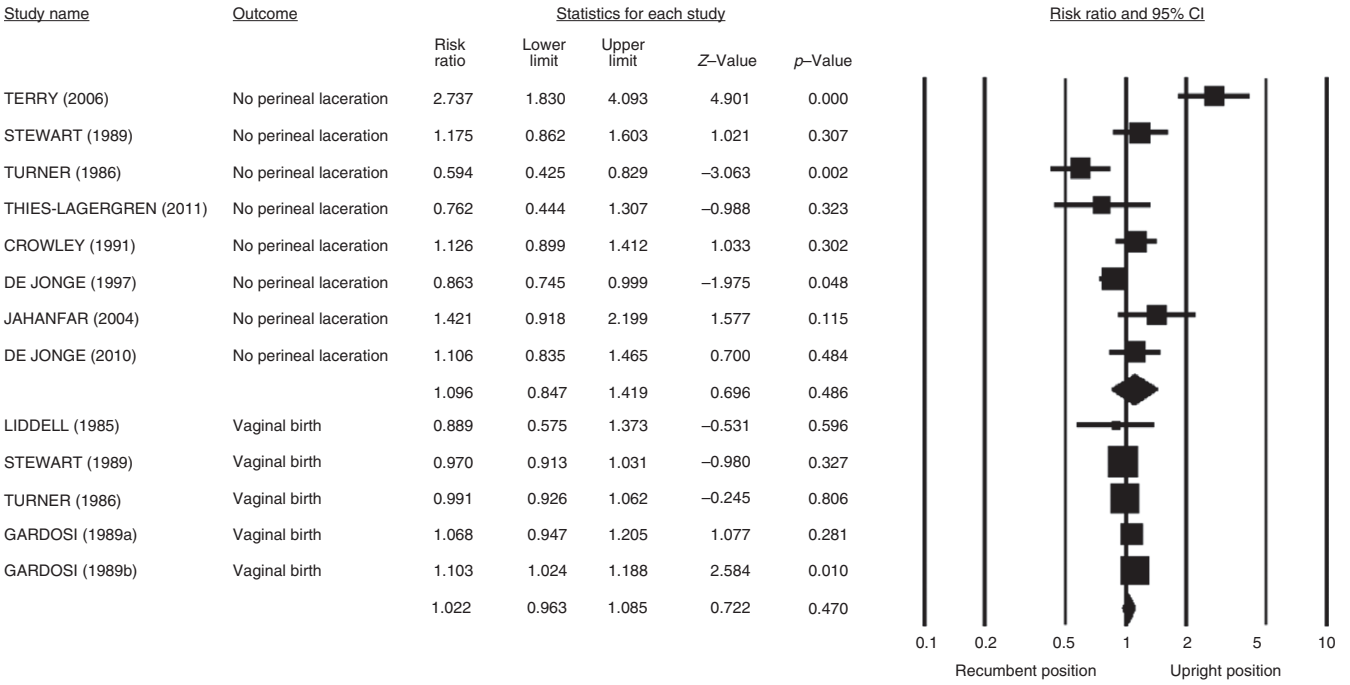

FIGURE 2 Forest plot of risk ratios for effect of upright position on spontaneous vaginal birth and no perineal laceration rates.

The meta-analysis study conducted by Gupta et al. (2012) indicated that the effect of the upright position on the instrumental birth probability is similar to our result (RR = 0.78, 95% CI = 0.68–0.90). Five studies established that the incidence of instrumental births in the upright position was significantly lower (Figure 3). When the characteristics of the studies that found significant

Study name	Outcome	Statistics for each study				
		Risk ratio	Lower limit	Upper limit	*Z*–Value	*p*–Value
STEWART (1989)	Cesarean birth	0.312	0.013	7.605	–0.715	0.475
TURNER (1986)	Cesarean birth	1.385	0.350	5.479	0.464	0.643
GARDOSI (1989b)	Cesarean birth	0.192	0.009	3.971	–1.068	0.285
GUPTA (1989)	Cesarean birth	0.082	0.005	1.439	–1.711	0.087
ZAIBUNNISA (2015)	Cesarean birth	3.000	0.990	9.093	1.942	0.052
DE JONGE (1997)	Cesarean birth	0.506	0.046	5.544	–0.558	0.577
DANI (2015)	Cesarean birth	1.500	0.437	5.155	0.644	0.520
		1.029	0.448	2.363	0.068	0.946
LIDDELL (1985)	Instrumental birth	1.222	0.573	2.605	0.520	0.603
STEWART (1989)	Instrumental birth	1.739	0.713	4.238	1.217	0.224
TURNER (1986)	Instrumental birth	1.020	0.646	1.612	0.087	0.931
GARDOSI (1989a)	Instrumental birth	0.623	0.260	1.496	–1.058	0.290
GARDOSI (1989b)	Instrumental birth	0.536	0.316	0.909	–2.315	0.021
GUPTA (1989)	Instrumental birth	0.060	0.008	0.435	–2.783	0.005
CHEN (1987)	Instrumental birth	0.117	0.015	0.880	–2.084	0.037
GANAPATHY (2012)	Instrumental birth	0.190	0.094	0.385	–4.620	0.000
MARTTILA (1983)	Instrumental birth	0.333	0.071	1.573	–1.388	0.165
NASIR (2007)	Instrumental birth	0.458	0.237	0.885	–2.325	0.020
ZAIBUNNISA (2015)	Instrumental birth	0.472	0.278	0.803	–2.770	0.006
THIES-LAGERGREN (2009)	Instrumental birth	0.555	0.179	1.719	–1.021	0.307
THIES-LAGERGREN (2011)	Instrumental birth	0.833	0.619	1.120	–1.211	0.226
CROWLEY (1991)	Instrumental birth	0.845	0.638	1.119	–1.177	0.239
DE JONGE (1997)	Instrumental birth	1.089	0.222	5.350	0.106	0.916
HEMMINKI (1986)	Instrumental birth	2.260	0.978	5.220	1.908	0.056
DANI (2015)	Instrumental birth	4.000	0.455	35.163	1.250	0.211
		0.682	0.504	0.924	–2.475	0.013

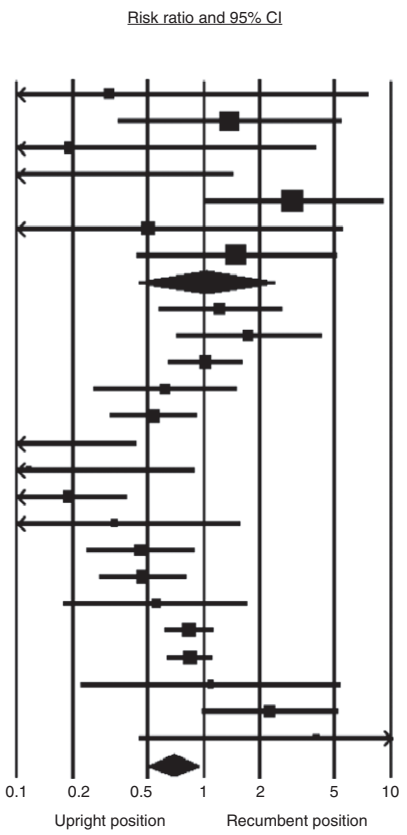

FIGURE 3 Forest plot of risk ratios for effect of upright position on caesarean and instrumental birth rates.

differences were examined, they were found to include different intervention processes. The number of individuals using this position was lower in one study (Gupta et al., 1989), while the number of individuals using this position was considerably higher in another study (Zaibunnisa et al., 2015). Moreover, the experimental and control groups were mobile during the first stage of labour in some studies (Ganapathy, 2012; Nasir et al., 2007), while the experimental and control groups were in a recumbent position during the first stage of labour in one study (Gardosi, Hutson, & Chris, 1989). It should also be considered that all the studies have uncertain or high levels of bias risk in multiple fields. There are studies with different effect sizes in favour of the recumbent position. Heterogeneity was found to increase on the exclusion of studies with a high bias risk in multiple fields of the analysis. The heterogeneity in the studies may have emerged from the sample and intervention diversity.

The meta-analysis study performed by Gupta et al. (2012) established that the upright position had a similar level of effect on caesarean birth incidence (RR = 0.97, 95% CI = 0.59–1.59). Some of the studies included in the analysis determined that the caesarean birth incidence was lower in the upright position. However, it was found that the inter-group difference was not significant in all studies (Figure 3). The result of the sensitivity analysis showed that the upright position decreased the caesarean birth incidence. It is considered that the high bias risk in the studies may have caused the existence of outliers and increase in heterogeneity. This result may be promising in efforts to reduce the rates of caesarean birth, which are increasing worldwide and pose a significant threat to maternal health.

4.2 | Effect of the upright position on perineal health

It was determined in this study that the upright position was effective in significantly decreasing the episiotomy risk, but it was not significant with respect to other results.

Some studies determined that perineal integrity is preserved to a lower extent in the upright position, while some studies determined that perineal integrity is preserved to a greater extent in the upright position (Figure 2). It is noted that the studies that found significant inter-group differences are those that determined that perineal integrity is preserved to a greater extent in the upright position (Figure 2). Because a change in heterogeneity was not found to result from the sensitivity analysis, sample and intervention diversity is considered as the reason for the heterogeneity. It should also be noted that there may be statistical heterogeneity because the randomization was performed at different times and different approaches were adopted for lost data in the studies. Please see Supplementary File S3 for the discussion section about effect of the upright position on perineal lacerations.

Even though all the studies included in the analysis had different effect sizes, they all yielded results in favour of the upright position.

Study name	Outcome	Statistics for each study				
		Risk ratio	Lower limit	Upper limit	*Z*-value	*P*-value
TERRY (2006)	First degree laceration	2.690	1.425	5.080	3.051	0.002
LIDDELL (1985)	First degree laceration	0.778	0.293	2.067	−0.504	0.614
STEWART (1989)	First degree laceration	0.786	0.461	1.343	−0.880	0.379
THIES-LAGERGREN (2009)	First degree laceration	1.525	0.673	3.455	1.012	0.312
THIES-LAGERGREN (2011)	First degree laceration	1.028	0.945	1.118	0.637	0.524
DE JONGE (1997)	First degree laceration	1.146	0.902	1.456	1.113	0.266
DANI (2015)	First degree laceration	1.200	0.378	3.805	0.310	0.757
JAHANFAR (2004)	First degree laceration	0.690	0.456	1.043	−1.762	0.078
		1.064	0.857	1.320	0.562	0.574
TERRY (2006)	Second degree laceration	0.157	0.079	0.313	−5.258	0.000
STEWART (1989)	Second degree laceration	1.097	0.742	1.622	0.463	0.643
GARDOSI (1989a)	Second degree laceration	0.986	0.627	1.553	−0.060	0.952
GARDOSI (1989b)	Second degree laceration	0.706	0.521	0.957	−2.242	0.025
GUPTA (1989)	Second degree laceration	0.870	0.350	2.163	−0.299	0.765
NASIR (2007)	Second degree laceration	0.091	0.005	1.623	−1.631	0.103
THIES-LAGERGREN (2009)	Second degree laceration	1.717	1.060	2.783	2.195	0.028
THIES-LAGERGREN (2011)	Second degree laceration	1.138	0.856	1.513	0.889	0.374
DE JONGE (1997)	Second degree laceration	1.868	0.973	3.587	1.876	0.061
DANI (2015)	Second degree laceration	3.000	0.124	72.771	0.675	0.500
JAHANFAR (2004)	Second degree laceration	1.000	0.147	6.823	0.000	1.000
BOMFIM-HYPOLITTO (1998)	Second degree laceration	2.449	0.648	9.254	1.321	0.187
		0.943	0.651	1.365	−0.313	0.754
TERRY (2006)	Third degree laceration	0.157	0.036	0.678	−2.482	0.013
LIDDELL (1985)	Third degree laceration	0.262	0.011	6.121	−0.833	0.405
GARDOSI (1989a)	Third degree laceration	0.214	0.010	4.374	−1.002	0.316
THIES-LAGERGREN (2009)	Third degree laceration	0.770	0.454	1.306	−0.970	0.332
THIES-LAGERGREN (2011)	Third degree laceration	1.941	0.185	20.399	0.553	0.580
DE JONGE (1997)	Third degree laceration	0.337	0.014	8.239	−0.667	0.505
		0.536	0.269	1.068	−1.772	0.076

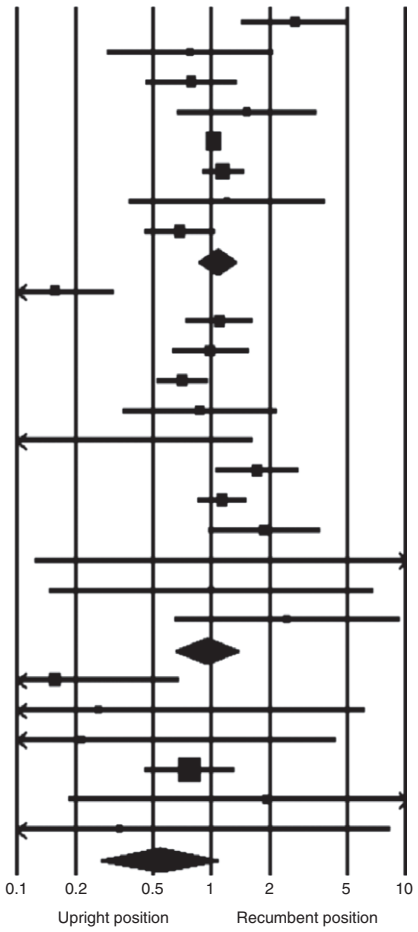

FIGURE 4 Forest plot of risk ratios for effect of upright position on perineal laceration rates.

Inter-group differences were found to be statistically significant in only a few studies (Figure 5). There was a high bias risk in multiple fields in the studies and the number of women who applied the intervention is considerably low in some studies. It was determined that in the study performed by Gupta et al. (2012), the effect of the upright position on the episiotomy rate was similar to that in our study (RR = 0.79, 95% CI = 0.70–0.90, in the random effects model). The present study also established that the upright position decreased the episiotomy rate (Figure 5). Mother-friendly hospital criteria specified by the Ministry of Health for Turkey include the statement that women should be allowed freedom of mobility during the labour process and that the lithotomy position should not be routinely applied if a woman does not wish to use the lithotomy position (www.tkhk.gov.tr, Date of access: 28.11.2016).

4.3 | Effect of the upright position on postpartum haemorrhage

In the study performed by Gupta et al. (2012), the effect of an upright position on the incidence of postpartum haemorrhage was found to be similar to that in our study (RR = 1.65, 95% CI = 1.32–2.06). The studies analysed established that the upright position increased the postpartum haemorrhage risk in mothers. In three studies analysed, the postpartum haemorrhage risk was lower in the upright position, although this difference was insignificant (Figure 5). In studies included in this analysis in which women actively used the upright position (Nasir et al., 2007; Zaibunnisa et al., 2015), it is noted that women were not controlled and used any position they wished in one study (Gardosi & Sylvester, 1989) (Figure 5). Nevertheless, the studies had similar effect sizes. Heterogeneity was found to increase in the sensitivity analysis conducted by excluding three studies with a high bias risk, while the heterogeneity considerably decreased on the exclusion of two studies with outliers. Heterogeneity may result from the high diversity of participants and interventions in the studies. The present study established that the upright position applied to mothers during the second stage of labour decreased the incidences of episiotomy and interventional birth, while it increased the postpartum haemorrhage risk. For this reason, it may be suggested that the appropriate birth position should be chosen by evaluating the risks of any particular position during the second stage of labour.

Study name	Outcome	Risk ratio	Lower limit	Upper limit	Z-value	P-value
LIDDELL (1985)	Episiotomy	0.972	0.701	1.348	−0.169	0.866
STEWART (1989)	Episiotomy	0.843	0.571	1.245	−0.860	0.390
TURNER (1986)	Episiotomy	0.911	0.716	1.159	−0.760	0.447
GARDOSI (1989a)	Episiotomy	0.784	0.501	1.227	−1.067	0.286
GARDOSI (1989b)	Episiotomy	0.995	0.718	1.378	−0.031	0.975
GUPTA (1989)	Episiotomy	0.627	0.426	0.923	−2.368	0.018
NASIR (2007)	Episiotomy	0.896	0.661	1.214	−0.709	0.478
THIES-LAGERGREN (2009)	Episiotomy	0.485	0.095	2.473	−0.870	0.384
THIES-LAGERGREN (2011)	Episiotomy	0.830	0.565	1.220	−0.948	0.343
CROWLEY (1991)	Episiotomy	0.884	0.799	0.977	−2.406	0.016
DE JONGE (1997)	Episiotomy	0.370	0.225	0.607	−3.930	0.000
DANI (2015)	Episiotomy	0.818	0.651	1.029	−1.716	0.086
DE JONGE (2010)	Episiotomy	0.509	0.307	0.844	−2.618	0.009
		0.811	0.723	0.910	−3.578	0.000
STEWART (1989)	Postpartum hemorrhage	3.611	1.622	8.040	3.145	0.002
TURNER (1986)	Postpartum hemorrhage	2.375	1.112	5.073	2.233	0.026
GARDOSI (1989a)	Postpartum hemorrhage	0.534	0.168	1.699	−1.062	0.288
GARDOSI (1989b)	Postpartum hemorrhage	1.220	0.567	2.626	0.509	0.611
NASIR (2007)	Postpartum hemorrhage	0.333	0.014	8.086	−0.675	0.500
ZAIBUNNISA (2015)	Postpartum hemorrhage	0.500	0.154	1.625	−1.152	0.249
THIES-LAGERGREN (2009)	Postpartum hemorrhage	1.387	0.599	3.208	0.764	0.445
THIES-LAGERGREN (2011)	Postpartum hemorrhage	1.165	1.038	1.307	2.592	0.010
JAHANFAR (2004)	Postpartum hemorrhage	2.333	0.975	5.582	1.904	0.057
CROWLEY (1991)	Postpartum hemorrhage	1.367	0.804	2.326	1.154	0.248
DE JONGE (1997)	Postpartum hemorrhage	1.012	0.206	4.966	0.014	0.989
DE JONGE (2007)	Postpartum hemorrhage	1.472	1.262	1.717	4.923	0.000
		1.389	1.123	1.717	3.035	0.002

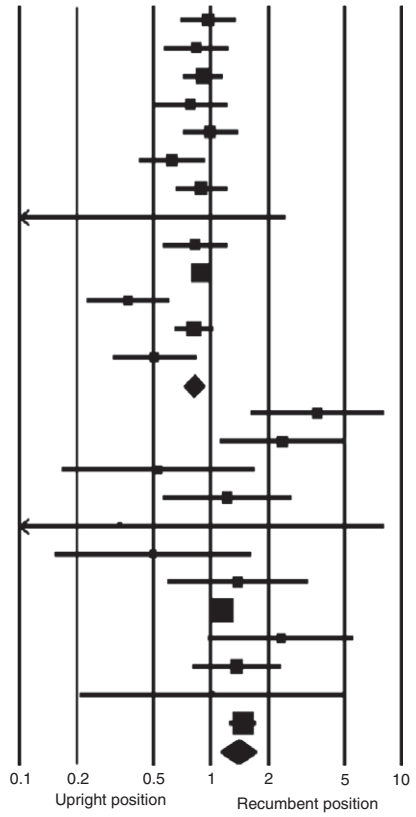

FIGURE 5 Forest plot of risk ratios for effect of upright position on episiotomy and postpartum haemorrhage.

4.4 | Strengths and limitations

The strengths of the study are as follows: the data were renewed with up-to-date studies and we examined how the studies with outliers and high bias risk affect the results with the sensitivity analysis. Moreover, bias risks of the research were found and discussed in the discussion of the study results; in this process, how the study methodology affected the results was examined.

This review has some limitations. Some of the studies that could have been included were not included in the analysis due to the lack of full text availability. Because there was a language restriction in the screening process, only English and Turkish articles were screened. Therefore, the results of the study reflect only English studies. There are differences in the duration of active implementation of the positions in the studies. Some conclusions were evaluated based on observation techniques that were not available. Some of the included studies had high or unclear bias in the randomization generation, allocation concealment and blinding of participant/staff or non-randomized clinical trials.

4.5 | Implications for clinical practice

It is recommended to:

- Until the effect of upright position on maternal health is better understood with well-designed studies, women should choose the position they find comfortable.
- Decide the appropriate birth position by taking into consideration individual risk factors.

4.6 | Implications for future research

Many studies have a high or unclear risk of bias at numerous domains. Furthermore, some studies did not provide details about their methods and interventions. Thus, there is a need for studies with rigorous methods, particularly studies analysing the effect of the upright position on caesarean birth, second-degree perineal laceration and postpartum haemorrhage risk, because the overall effect size of the caesarean birth and second-degree perineal laceration risks changed after the sensitivity analysis. Moreover, the postpartum haemorrhage ratio was not evaluated using concrete methods. Thus, it is recommended for rigorous methods to:

- Use a common terminology in the classification and rating of the upright and recumbent positions applied during birth,
- Provide information on details of the interventions applied in the study (e.g. period, form of intervention),

- Consider that the positions used during the first stage of labour may be effective in studies conducted on positions during the second stage of labour,
- Measure the parameters examined in the study by means of commonly used and concrete assessment instruments,
- Perform "intention-to-treat" analysis that takes into account the loss data in studies.

5 | CONCLUSIONS

We used a meta-analysis method to evaluate the effect of the upright position on the mode of birth and perineal health in women without epidural analgesia in the second stage of labour. The upright position applied to mothers without routine epidural analgesia during the second stage of labour probably slightly decreases the risk to the mother of instrumental birth and episiotomy. The reductions in such risks have some effects on the improvement of the comfort of birth. However, it is also concluded that the upright position may slightly increase the ratio of postpartum haemorrhage. For this reason, researchers are recommended to conduct concrete studies with well-designed methodology to quantitatively measure the postpartum haemorrhage amount. In addition, healthcare professionals providing care during birth are recommended to determine the appropriate birth position by taking into consideration the individual risk factors of women, reduce the barriers/obstacles that may arise in position preferences and identify positions that make women dependent on a bed in accordance with evidence-based guidance. Furthermore, after the sensitivity analysis, the overall effect of the upright position on the caesarean birth incidence changed significantly. This result can cause researchers to be hopeful despite the increasing incidence of caesarean birth. Thus, there is a need for new, well-designed studies on this topic.

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CONFLICTS OF INTEREST

No conflict of interest has been declared by the author(s).

AUTHOR CONTRIBUTIONS

All authors have agreed on the final version and meet at least one of the following criteria (recommended by the ICMJE [http://www.icmje.org/recommendations/]):

- substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data;
- drafting the article or revising it critically for important intellectual content.

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SUPPORTING INFORMATION

Additional Supporting Information may be found online in the supporting information tab for this article.

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