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The Effects of Upright Positions in the Second Stage of Labor on Perineal Trauma and Infant Health: A Systematic Review and Meta-Analysis

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Abstract

Background: The World Health Organization in its intrapartum care guide states that all women should be encouraged to use different positions according to their preference for a positive birth experience. In evidence-based practices, it is recommended to use vertical positions in which the pelvis is fully mobile and the body's harmony with gravity, movement, and blood circulation is not restricted.

Aim: This study aimed to determine the effects of vertical positions on perineal trauma and newborn health, based on primary studies on the delivery positions used in the second stage of labor.

Methods: In this study, which is a systematic review and meta-analysis, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Statement was used during the establishment of the study protocol and the writing of the article. The searches were carried out between November 2019 and January 2020 from PubMed, National Thesis Center, DergiPark, Ulakbim, MEDLINE, the Cochrane Library, and EBSCO search engines. The keywords "(mother or motherhood) and birth and position" were used in the search. In the quality assessment of the studies, Joanna Briggs Institute Critical Assessment Checklists were used in accordance with the research pattern.

Results: In this study, 16 results were reported about the effect of birth positions on perineal trauma and infant health. The combined results of the studies showed that vertical positions do not have an effect on the intact perineum ($P > .05$) and reduce the possibility of episiotomy ($P < .01$). The study showed that vertical positions increased the development of first-degree laceration 1.4 times ($P < .01$), did not affect the development of second-degree laceration ($P > .05$), and increased one-/second-degree lacerations 1.5 times ($P < .01$). In this study, it was determined that vertical positions had no effect on anal sphincter damage with third-degree and third-/fourth-degree lacerations ($P > .05$). In addition, it was found that vertical positions had no significant effect on the admission to the intensive care unit of the newborn, first minute, and fifth minute ($P > .05$) APGAR (Activity- Pulse- Grimace- Appereance- Respration) score < 7 ($P > .05$).

Conclusion: In the study, vertical positions used at birth decrease the possibility of episiotomy application, increase the development of first-degree laser 1.4 times, intact perineum 3-4. grade perineal lacerations, anal sphincter damage did not affect the neonatal APGAR score and intensive care unit admission. In the intrapartum period, the use and dissemination of vertical positions can contribute to the preservation of perineal integrity and the development of women's health.

Keywords: Perineal, trauma, episiotomy, birth injuries, labor stage, second, position, baby, mother, health, midwifery, nursing

Introduction

Upright or horizontal maternal positions can be used in labor. Vertical positions, simply expressed, include those positions in which the woman's feet are on the ground, whereas horizontal positions usually refer to those in which the woman's back is flat on the bed. Positions such as being semi-horizontal, lying on one side, sitting, squatting, kneeling, touching knee-to-chest, using a birthing stool, standing, and being supported in standing are defined as vertical positions or alternative positions for labor; the supine and lithotomy positions are accepted as horizontal positions.[1,2] The type of maternal position taken during labor affects the health of both mother and child. The position to be taken or that is taken during labor is influenced by what the mother wishes to do, the preference of the health provider, or by factors that facilitate a needed medical intervention. However, when no intervention is forthcoming and women are left to their own

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devices, they tend to lean toward the position that is most comfortable for themselves and the baby.[3-6]

It is important that a woman pays attention to her instincts during labor contractions and chooses the position that she desires. It is the mother's instincts that guide the mother and the baby through birth.[7] The intrapartum care guidelines of the World Health Organization (WHO) (2018) state that in order to ensure a positive birthing experience, all women should be encouraged to choose the position they prefer.[6] In light of this, labor positions should be carefully considered by health professionals attending to the birth since this matter is an important one that requires the accumulation of more knowledge.

All through the ages, it has been noted that women in Turkey and all around the world can benefit from the force of gravity during labor and can make use of different positions.[3,8] In 1883, George Julius Engelmann wrote in his study of labor in primitive societies that despite differences of region and country, women generally preferred to be in vertical positions during labor. Engelmann[3] stressed the importance of the central line of the body during labor, stating that, depending on which position the woman preferred, the choice should be an vertical, skewed horizontal or leaning position.[3]

Today, it is the lithotomy position that is usually preferred and used in order to accommodate fetal monitorization, intravenous treatment, and the preference of health providers. In his book, Engelmann[3] offers his view that although the science of obstetrics is considered to be a more civilized methodology than the natural and instinctive traditions of all races, human nature has moved on to practices that may be defined as savage. Indeed, with the rapid developments witnessed in obstetrics, it has almost been forgotten that childbirth is a natural act. Consequently, it can be seen that women have lost the natural empowerment of giving birth, transferring the process into the hands of health personnel, bringing about a rise in cesarean section and interventional birth rates.[9]

The widespread use of the prone position in the second stage of labor is considered an interference in the natural course of labor, even though an intervention may not be necessary.[10] It is because of this that the birthing bed is accepted as a midwifery tool. In recent years, however, with the widespread use of the prone position in labor, neither health workers nor women see this as an interference.[10] In Turkey, it is known that both midwives and pregnant women prefer and extensively make use of the lithotomy position during labor. In a study by Karaçam et al.[11] it is reported that only 0.3% of women deliver in an vertical position in Turkey. Another study reveals that 78% of mothers state that they cannot deliver in any position other than the lithotomy position, even if given the chance.[12] Still another article indicates that 39% of midwives and nurses working in maternity clinics use the lithotomy position, even though they do not think it is a requirement.[13]

It is reported that the rate of using the vertical position in labor is 0.3% in Turkey.[11] In the United States, this rate is 9%[14] and 37% in Italy[15]. In a study conducted in Sweden, the authors report that 70% primiparae and 83% of multiparae deliver in the vertical position.[16] With the increase in obstetrical interventions in recent years, the use of the horizontal position has also increased. But the indication is that at natural birth centers, it is vertical positions, especially squatting, that are widely employed.[17]

The use of the vertical position in labor and the freedom of movement that this affords help women more actively participate in the process of childbirth and become more satisfied with the birthing experience. Horizontal positions cause more pain and discomfort. With the exception of pregnant women who must undergo periodic blood pressure and electronic fetal motorization, all women should be allowed to make their own decision about the labor position they will assume. If a change of position is advised under urgent circumstances, the reason for this must be explained to the laboring woman.[6,10]

The vertical position is advised in evidence-based studies because this position does not apply pressure on the blood vessels, the pelvis is at full mobility, movements are not constrained, and the body can be in sync with the force of gravity.[10,18] The use of vertical positions is recommended and preferred to strengthen uterus contractions, shorten the second stage of labor, increase blood flow to the baby, facilitate the entry and descent of the head of the fetus, mitigate the mother's perception of pain, and enhance the feeling of having control over the event. At the same time, vertical positions reduce the risk of cesarean section, interventional vaginal delivery, episiotomy and perineal trauma rates, and all other related maternal morbidity risks that may arise. Vertical positions are therefore requisite and important in terms of maternal and infant health.[10,16,19-22]

Most women experiencing vaginal birth may suffer some degree of perineal trauma that may lead to both short- and long-term morbidities. With respect to the complications that may arise as a result of perineal trauma, the main focus of midwifery care in the second stage of labor is to ensure perineal integrity and prevent perineal trauma. There are 4 degrees of perineal trauma. First-degree perineal trauma is defined as the laceration or injury of the perineal skin and/or vaginal mucosa. Second-degree refers to laceration of the perineal muscles. Third-degree perineal trauma involves laceration of the anal sphincter. Fourth-degree pertains to the laceration of the anal sphincter complex and the anorectal mucosa. Obstetric anal sphincter injuries encompass both third- and fourth-degree perineal lacerations. The main reasons for perineal trauma are natural lacerations and episiotomy. While some maternal positions known to prevent perineal trauma include some vertical and lateral positions, the lithotomy and prone positions are recognized as risk factors for severe perineal trauma.[2]

It is known that the style of assistance and preference of midwives are instrumental in determining the position to be taken during labor. The midwife has a very important role in educating the mother about vertical positions and keeping her autonomy during labor.[23,24] In 1 study, it is reported that 69% of women giving birth at home assisted by a midwife prefer and make use of an vertical position.[25] This is valuable information that emphasizes the importance of midwives in the birthing process.

It can be seen that there are many studies in the literature on birthing positions. The articles report on the attitudes of women and health workers toward positions taken during labor and the effect of these positions on maternal and infant health.[6,10,16,25,26] It is known that the biggest barrier to midwives' preference for vertical positions is the worry that the mother might not be protected against perineal trauma and the infant's health might suffer. There is a need to produce and provide midwives with strong evidence-based knowledge on a nationwide level. The vertical positions used in the second stage of labor in the present study were examined in terms of their impact

on perineal trauma and the well-being of the infant. The results of our investigation are expected to contribute to increased use of upright positions during labor and to improved intrapartum care services and maternal/infant health.

Aim of the Study

Based on the primary studies reviewed in this systematic review and meta-analysis that treat the positions used in the second stage of labor, our aim was to determine the effects of alternative vertical positions taken during the second stage of labor on perineal trauma and infant health.

Study Questions

The questions aimed to be answered in the study are the following:

1. What are the effects of vertical positions taken in the second stage of labor on perineal trauma?
2. What are the effects of vertical positions taken in the second stage of labor on infant health?

Materials and Methods

This systematic review and meta-analysis followed the checklist of the "PRISMA Statement: Preferred Reporting Items for Systematic Reviews and Meta-Analyses" in the creation of the study protocol and in the writing of the article.[27,28]

Conformity Criteria

The studies contained in this systematic review met the following criteria of PICOS:

- Study group (P: Patient): Women giving birth and their infants.
- I: Intervention: Use of vertical positions in the second stage of labor.
- C: Comparison: Horizontal positions.
- C: Outcomes: Intact perineum, episiotomy, perineal lacerations (first-, second-, third-, and fourth-degree lacerations, anal sphincter injury), APGAR score, and admission into the Neonatal Intensive Care Unit (NICU).
- S: Study design: Experimental, cross-sectional, and prevalence studies published in Turkish or English over the period 2008-2019.

Studies published in languages other than Turkish and English, those that do not provide an exact description of the position used during the birth, those conducted with high-risk pregnant women, and studies whose full text could not be accessed were excluded from the analysis.

Search Strategy

The searches for the current study were made by the first and second authors between November 2019 and January 2020 on the PubMed, Ulusal Tez Merkezi (https://tez. yok.gov.tr/Ulusal Tez Merkezi/tarama. jsp), DergiPark, Ulakbim, MEDLINE, the Cochrane Library, and EBSCO search engines. The keywords "mother" or "motherhood" and "labor and position" were used in the scan of the literature. To reach additional articles, the reference lists of all the studies included in our project were reviewed.

Selection of Articles

The selection of the articles for this systematic review and meta-analysis was made independently by our first and second authors. The studies accessed were compiled at a meeting of the authors and repetitive studies were removed. The studies to be used were selected by the researchers after their extraction according to title, abstract, and full text. Whenever there was disagreement over a particular study, an agreement was reached through discussions with a third researcher. The number of the studies scanned in this systematic review, articles found suitable and included in the review, those excluded, and the reasons for their exclusion are given in the PRISMA flow chart (Figure 1).

Evaluation of the Methodological Quality of the Studies

The methodological quality of the articles included in this systematic review and meta-analysis was assessed independently by our first and second authors and checked by the third researcher. The Joanna Briggs Institute's Critical Appraisal Checklist for experimental, cross-sectional, and prevalence studies was used in the quality assessment of the articles.[29] The checklist contains 8 questions for cross-sectional studies, 9 questions for prevalence studies, and 13 questions for experimental studies. The responses to the questions are in the form of "Yes," "No," "Unsure," and "Not applicable." The results of the assessment for each article in this study are given as "Quality Scores" in Table 1.

Data Extraction

A data extraction instrument devised by the researchers was used to access the research data. This extraction tool allowed the collection of data contained in the articles included in the systematic review and meta-analysis regarding study design, sample size, the place and year of the study, the age of the women, and the effect of the position used on maternal, fetal, and neonate outcomes. The data extraction process was carried out independently by the first and second authors and checked at a meeting attended by both authors.

Pooling the Data

The results of the studies included in this review were pooled through meta-analysis. The data on perineal trauma were grouped for the meta-analysis in the categories of intact perineum, episiotomy, first-degree laceration, first- and second-degree lacerations, third- and fourth-degree lacerations, and anal sphincter injury. Review Manager 5.3 (The Nordic Cochrane Center, Copenhagen, Denmark) was used for the meta-analysis. The heterogeneity test, Cochran's Q test, and Higgins I^2 were used for the evaluation, and a rate of over 50% for I^2 was accepted as displaying significant heterogeneity. The odds ratio (OR) was calculated for categorical variables and mean difference for continuous variables. All of the tests were calculated on a 2-tailed basis and a *P* value of less than 0.05 was accepted to be statistically significant.

Results

Scanning Results

The scan of the literature resulted at the beginning in 19 704 articles from the database and 3 from other records. With the exclusion of the records that were repeated, the review carried out according to headings and abstracts yielded the full texts of 169 articles. The examination of the full texts resulted in the inclusion in the systematic review of 16 articles published in English on the effects of the vertical position during labor on perineal trauma and neonate health (Figure 1).

Characteristics of the Studies

Seven of the studies were experimental,[30-36] 8 were cross-sectional,[16,37-43] and 1 was prevalence research[22]; it was noted that the

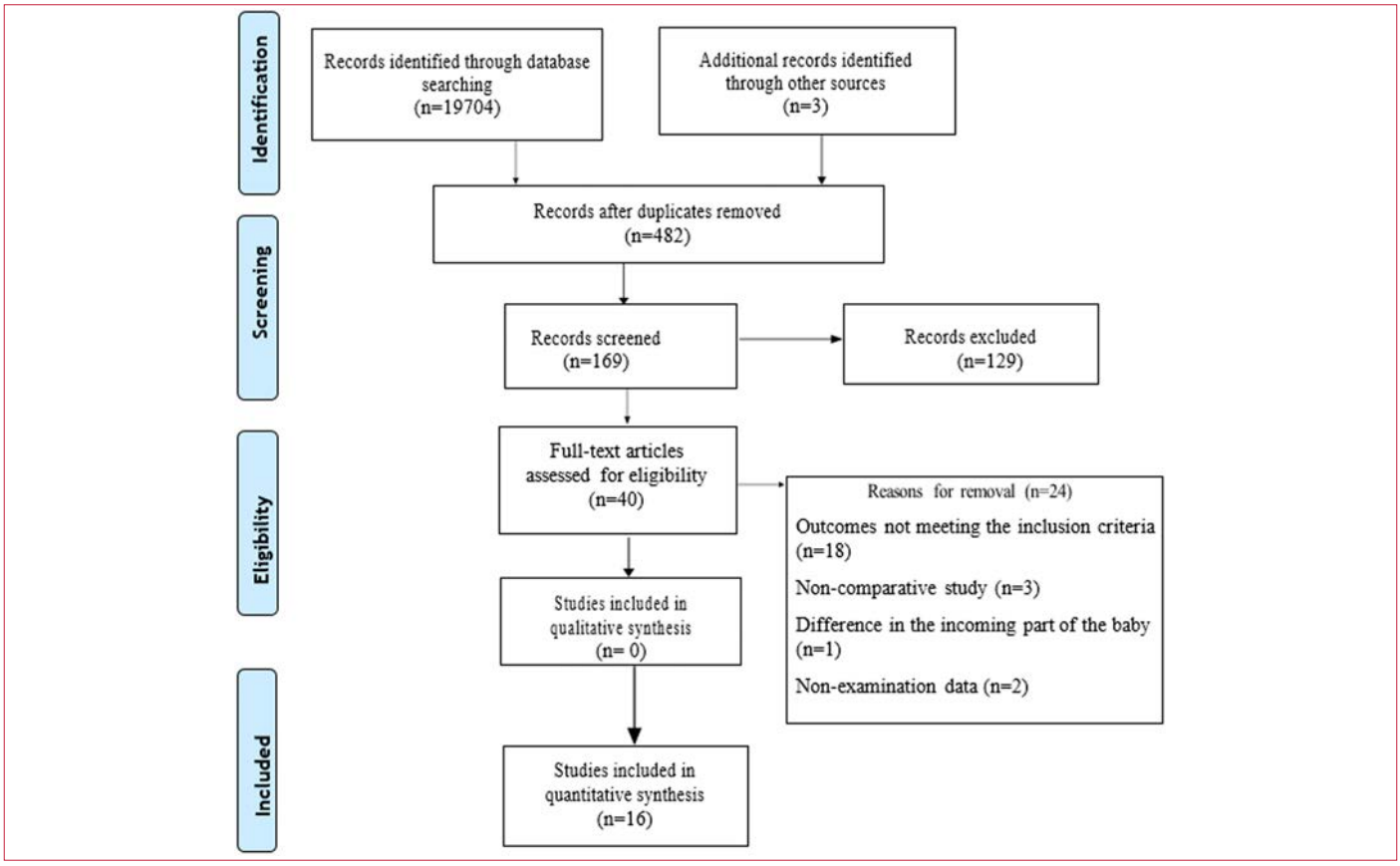

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram of the search process.

data had been obtained from hospital records and from the questionnaires drawn up by the researchers. It was seen that the studies took place over the period 2004-2016 and were published over the period 2008-2019. While 1 of the studies was from Turkey,[35] the others had been conducted in different regions of the world—North America,[39,42] Asia,[31,36] and Europe.[16,22,30,32-34,37,38,40,41] The studies included in this systematic review represented a total sample size of 19 042 (min-max: 66-113 256).

Quality Assessment Results of the Studies

The quality assessment scores for the experimental studies were yes: 8/13 in 6 studies and 9/13 in another study. The quality assessment scores for the cross-sectional studies were yes: 8/8 in 8 studies. The quality assessment score for the prevalence study was yes: 9/9 (Table 1).

Effect of the Vertical Position on Perineal Trauma

The studies examined in this systematic review and meta-analysis yielded 9 outcomes on the effect of labor positions on perineal trauma. The effect of vertical positions on the intact perineum was reported in 5 studies.[22,36,38,39,43] The pooled results of these studies showed that vertical positions did not have an impact on the intact perineum (OR: 1.33, 95% CI: 0.74-0.38, Z=0.95, $P > .05$, $I^2=91$; Table 2; Figure 2).

Ten studies reported on the effect of vertical positions on episiotomies.[22,30,31,34,36-38,40-42] The pooled results of these studies showed that vertical positions lessened the probability of having to perform an episiotomy (OR: 0.36, 95% CI: 0.18-0.72, Z=2.89, $P < .004$, $I^2=97$; Table 2; Figure 2).

The effect of vertical positions on first-degree lacerations was examined in 7 studies.[30-33,36,38,42] The present results of these 7 studies indicated that vertical positions aggravated the development of first-degree lacerations by 1.4-fold (OR: 1.42, 95% CI: 1.07-1.87, Z=2.45, $P < .01$, $I^2=68$; Table 2; Figure 3).

The effect of vertical positions on second-degree lacerations was reported in 9 studies.[30-32,34-36,38,41,42] The results of these studies revealed that vertical positions did not have an effect on the development of second-degree lacerations (OR: 1.16, 95% CI: 0.89-1.52, Z=1.09, $P > .05$, $I^2=53$; Table 2; Figure 3).

Eleven studies examined in this systematic review and meta-analysis reported on the effect of vertical positions on first- and second-degree lacerations.[22,32-34,36-38,40,41,43,45] The results of these studies showed that vertical positions increase the development of first- and second-degree lacerations by 1.5-fold (OR: 1.54, 95% CI: 1.09-2.19, Z=2.43, $P < .01$, $I^2=84$; Table 2; Figure 3).

Four studies taken into the meta-analysis reported on the effects of vertical positions on third-degree lacerations.[30,32,34,38,42] The pooled results of these studies indicated that vertical positions do not have an effect on third-degree lacerations (OR: 0.89, 95% CI: 0.52-1.53, Z=0.41, $P > .05$, $I^2=53$; Table 2; Figure 4).

Table 1. Characteristics, Data, and Quality Assessment Scores of Studies

Author/Year	Country	Year of Study	Study Design	Sample Size	Maternal Age	Maternal Data	Baby Data	Quality Score
Brocklehurst (2017)	England	2010-2014	Randomized controlled trial	3093	28.4 ± 5.7	Episiotomy: vertical: 914/1556; horizontal: 838/1537; first-degree perineal laceration: vertical: 90/1556; horizontal: 96/1537; second-degree perineal laceration: vertical: 563/1556; horizontal: 608/1537; third-degree perineal laceration: vertical: 98/1556; horizontal: 77/1537; fourth-degree perineal laceration: vertical: 6/1556; horizontal: 4/1537; anal sphincter injuries: vertical: 104/1556; horizontal: 81/1537	1-Minute APGAR score < 7: vertical: 2/1556; horizontal: 3/1537	Yes: 8/13; uncertain: 2/13; not applicable: 3/13
Dani et al (2015)	India		Randomized controlled trial	200	18-37	Episiotomy: vertical: 54/100; horizontal: 66/100; first-degree perineal laceration: vertical: 6/100; horizontal: 5/100; second-degree perineal laceration: vertical: 1/100; horizontal: 0/100; third-/fourth-degree perineal laceration: vertical: 0/100; horizontal: 0/100	NICU admission: vertical: 1/100; horizontal: 1/100	Yes: 9/13; no: 1/13; not applicable: 3/13
Elvander et al (2015)	Sweden	2008-2014	Retrospective study	113 256	>35	Third-/fourth-degree perineal laceration: vertical: 2423/87349; horizontal: 1285/25907		Yes: 8/8
Haslinger et al (2015)	Germany	2004-2011	Retrospective study	5817	30.4	Episiotomy: vertical: 48/795; horizontal: 1192/5031; anal sphincter injuries: vertical: 15/795; horizontal: 51/5031		Yes: 8/8
Meyvis et al. 2012	Germany	2008-2009	Retrospective study	557	28.1 (15-45)	Intact perineum: vertical: 96/209; horizontal: 97/348; first-degree perineal laceration: vertical: 50/209; horizontal: 58/348; second-degree perineal laceration: vertical: 42/209; horizontal: 48/348; third-degree perineal: vertical: 5/209; horizontal: 8/348; episiotomy: vertical: 14/209; horizontal: 133/348		Yes: 8/8
Moraloğlu et al (2017)	Turkey	2013-2014	Randomized controlled trial	102	23.96 ± 3.75 22.04 ± 3.46	Second-degree perineal laceration: vertical: 1/51; horizontal: 2/b51	1-Minute APGAR score < 7: vertical: 8 (7-8); horizontal: 8 (7-8); 5-minute APGAR score < 7: vertical: 10 (9-10); horizontal: 10 (9-10); NICU admission: vertical: 3/50; horizontal: 5/50	Yes: 8/13; no: 2/13; not applicable: 3/13
Peppe et al (2018)	Brazil		Retrospective study	264	25.34 ± 5.75	Intact perineum: vertical: 63/151; horizontal: 58/113; first- and second-degree perineal laceration: vertical: 87/151; horizontal: 54/113; third-/fourth-degree perineal laceration: vertical: 1/151; horizontal: 1/113		Yes: 8/8
Raisanen et al (2010)	Finland	2006	Prospective cross-sectional study	874	15-47	Episiotomy: vertical: 187/748; horizontal: 93/137		Yes: 8/8

(*Continued*)

Table 1. Characteristics, Data, and Quality Assessment Scores of Studies (*Continued*)

Author/Year	Country	Year of Study	Study Design	Sample Size	Maternal Age	Maternal Data	Baby Data	Quality Score
Serati et al (2015)	Italy	2014	Prospective study	656	30-33	Second-degree perineal laceration: vertical: 4/296; horizontal: 0/360; episiotomy: vertical: 90/296; horizontal: 146/360	1-Minute APGAR score < 7: vertical: 7/296; horizontal: 9/360; 5-minute APGAR score < 7: vertical: 1/296; horizontal: 1/360	Yes: 8/8
Silva et al (2012)	Brazil	2006-2009	Retrospective study	1079	14-44	First-degree perineal laceration: vertical: 164/191; horizontal: 651/887; second-degree perineal laceration: vertical: 18/191; horizontal: 93/887; episiotomy: vertical: 9/191; horizontal: 143/887		Yes: 8/8
Lagergren et al (2013)	Sweden	2006-2009	Randomized controlled trial	1002	<25-35		1-Minute APGAR score < 7: vertical: 6/500; horizontal: 8/502; NICU admission: vertical: 15/500; horizontal: 7/502	Yes: 8/13; no: 2/13; not applicable: 3/13
Lagergren et al (2011)	Sweden	2006-2009	Randomized controlled trial	1002	<25-35	First-degree perineal laceration: vertical: 347/500; horizontal: 339/502; second-degree perineal laceration: vertical: 85/500; horizontal: 75/502; third-degree perineal laceration: vertical: 23/500; horizontal: 30/502; episiotomy: vertical: 43/500; horizontal: 52/502		Yes: 8/13; no: 1/13; uncertain: 1/13; not applicable: 3/13
Lagergren et al (2009)	Sweden	2005-2006	Randomized controlled trial	67	<25-35	First-degree perineal laceration: vertical: 11/34; horizontal: 7/33; second-degree perineal laceration: vertical: 23/34; horizontal: 13/33; third-degree perineal laceration: vertical: 2/34; horizontal: 1/33		Yes: 8/13; no: 1/13; uncertain: 1/13; not applicable: 3/13
Tunestveit et al (2018)	Norway	2007-2008	Cross-sectional study	757	<25->35	Intact perineum: vertical: 104/128; horizontal: 557/629; anal sphincter injuries: vertical: 72/629; horizontal: 24/128		Yes: 8/8
Willemijn et al (2016)	Belgium	2005-2007	Cohort study	1196	>30	Intact perineum: vertical: 74/151; horizontal: 486/1045; first- and second-degree perineal laceration: vertical: 64/151; horizontal: 388/1045; third-/first-degree perineal laceration: vertical: 3/151; horizontal: 24/1045; episiotomy: vertical: 10/151; horizontal: 157/1045		Yes: 8/8
Zhang et al (2017)	China	2012	Randomized controlled trial	886	26.5 (±4.2); 25.9 (±3.9)	Intact perineum: vertical: 148/446; horizontal: 65/440; first-degree perineal laceration: vertical: 251/446; horizontal: 184/440; second-degree perineal laceration: vertical: 39/446; horizontal: 25/440; episiotomy: vertical: 8/446; horizontal: 166/446		Yes: 8/13; no: 2/13; not applicable: 3/13

Table 2. Meta-Analysis Results of Categorical Variables Related to the Effects of Vertical Positions on Maternal and Infant Health in Labor

Variables	Number of Studies	Vertical Position Case/Total	Horizontal Position Vaka/Toplam	Odds Ratio (95% CI)	Heterogeneity			Overall Impact
					Tau^2	χ^2/df/*P*	I^2	Z/*P*
Outcomes on perineal trauma								
Intact perineum	5	843/1835	831/1674	1.33 (0.74-0.38)	0.40	43.31/4/.000	91	0.95/.34
Episiotomy	10	1396/4757	2948/10 106	0.36 (0.18-0.72)	1.40	312.05/9/.000	97	2.89/.004
First-degree perineal laceration	7	919/3036	1340/3847	1.42 (1.07-1.87)	0.08	18.82/6/.004	68	2.45/.01
Second-degree perineal laceration	9	776/3383	874/4258	1.16 (0.89-1.52)	0.07	17.13/8/.03	53	1.09/.27
Third-degree perineal laceration	4	128/2438	116/2281	0.89 (0.52-1.53)	0.14	6.41/3/.09	53	0.41/.68
First- and second-degree perineal laceration	11	1857/3678	2601/5272	1.54 (1.09-2.19)	0.21	60.84/10/.00	84	2.43/.01
Third-/first-degree perineal laceration	7	2566/90 043	1422/29 441	1.07 (0.61-1.87)	0.35	48.21/6/.00	88	0.22/.82
Anal sphincter injuries	3	191/2980	156/6696	1.10 (0.60-2.04)	0.24	11.01/2/.004	82	0.31/.75
Baby health outcomes								
1-Minute APGAR score < 7	1	7/296	9/360	0.94 (0.35-2.57)	-	-	-	0.11/.91
5-Minute APGAR score < 7	3	9/2357	12/2399	0.76 (0.32-1.82)	-	0.14/2/.93	0	0.61/.54
NICU admission	4	26/1096	23/1092	1.13 (0.64-2.00)	-	3.85/3/.28	22	0.42/.67

NICU, Neonatal Intensive Care Unit.

The effect of vertical positions on third- and fourth-degree lacerations was treated in 8 studies.[16,22,30-32,34,38,39] The results of these studies showed that vertical positions had no effect on third- and fourth-degree lacerations (OR: 1.07, 95% CI: 0.61-1.87, Z = 0.22, $P > .05$, $I^2 = 88$; Table 2; Figure 4).

Three studies were found in this systematic review and meta-analysis on the effect of vertical positions on anal sphincter injury.[30,37,43] The pooled results of these studies displayed that vertical positions do not have an effect on anal sphincter injury (OR: 1.10, 95% CI: 0.60-2.04, Z = 0.31, $P > .05$, $I^2 = 82$; Table 2; Figure 4).

The Effect of Vertical Positions on Newborn Health

Six studies were found in this systematic review and meta-analysis on the effect of labor positions on newborn health; these studies evaluated APGAR scores and NICU admissions. One study reported a result pertaining to the effect of vertical positions on the first-minute APGAR score.[41] According to the results of this study, vertical positions did not have a significant effect on the first-minute APGAR score beyond a limit of <7 (OR: 0.94, 95% CI: 0.35-2.57, Z = 0.11, $P > .05$; Table 2). There were also 3 studies reporting on the effect on the fifth-minute APGAR score of <7.[30,33,41] The results of these studies revealed that vertical positions did not have an effect on the fifth-minute APGAR score that was beyond <7 (OR: 0.76, 95% CI: 0.32-1.82, Z = 0.61, $P > .05$, $I^2 = 0$; Table 2; Figure 5).

Four studies were found in our study in which NICU admissions occurred due to labor positions.[31,33,35,36] According to the pooled results of these 4 studies, vertical positions had no significant impact on admissions into NICU (OR: 1.13, 95% CI: 0.64-2.00, Z = 0.42, $P > .05$, $I^2 = 22$; Table 2; Figure 5).

Discussion

This systematic review and meta-analysis presents the results of 16 studies that have examined the effect of positions taken during labor on perineal trauma, the neonatal APGAR score, and admissions to NICU. The results indicate that vertical positions used during labor reduce the probability of episiotomy, exacerbate the development of first-degree lacerations, but have no impact on an intact perineum, perineal lacerations of second, third, and fourth degree, anal sphincter injury, neonatal APGAR scores, and NICU admissions. These results are valuable in that they represent evidence-based data that can be used in intrapartum care services.

The study indicated that vertical positions during labor do not affect the intact perineum. Similarly, other studies have reported the lack of a relationship between vertical positions and the intact perineum.[25,44] In the light of these results and the positive effects of vertical positions on maternal and neonatal health,[10,21] midwives must take into account the recommendation of WHO (2018) published in its intrapartum care guidelines which emphasize respectful labor, stating that *women should be encouraged to take different positions during the second stage of labor according to her own preference, including vertical positions*.[6] The Ministry of Health of the Republic of Turkey supports this approach.[24]

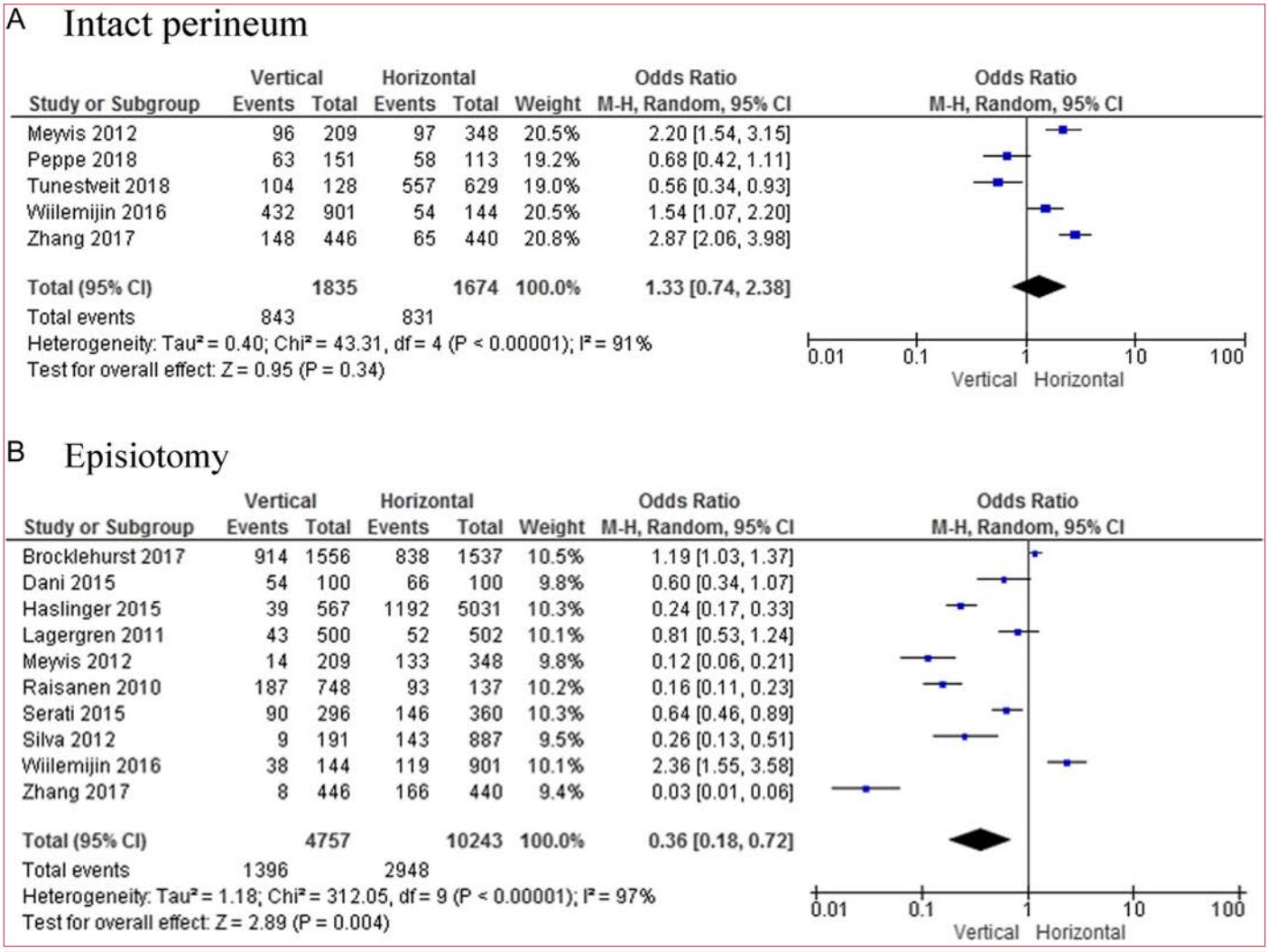

Figure 2. Meta-analysis results on the effect of vertical positions on intact perineum and episiotomy in labor.

It was found in this meta-analysis that verticalpositions reduce the probability of episiotomy. Similar results are reported in previous meta-analyses.[19,20,25,44] Differing from these findings, however, Schirmer et al[45] have reported that vertical positions increase episiotomy rates. Meanwhile, the literature also reveals that less sutures need to be used in lacerations compared to the episiotomy procedure and that complications develop but that wound healing is better.[46] In this context, vertical positions contribute to maternal health by reducing rates of episiotomy.

This systematic review and meta-analysis indicated that the frequency of first-degree lacerations in vertical positions increases 1.4-fold but that upright positions do not have an impact on second-degree lacerations. Deliktaş and Kukulu[44] report in their meta-analysis that vertical positions do not have an impact on the development of first- and second-degree lacerations, but a Cochrane systematic review conducted in 2017 reports that upright positions reduce second-degree lacerations.[20] In another study, the authors report that vertical positions reduce first-degree lacerations but increase the frequency of second-degree lacerations.[45] The differences between these reports may be explained by the different practices midwives employ to check on the birth of the fetal head.

In this study, it was found that vertical positions do not have an effect on the development of third- and fourth-degree lacerations or on anal sphincter injury. This is compatible with the results of some other studies.[2,20,44] Elvander et al[16] reported different results, stating in their study that horizontal labor positions partially increased third- and fourth-degree lacerations and anal sphincter injury. It was also found that deep perineal injury can be affected by factors such as an oversized fetal head, vulvar edema, perineal rigidity, fundal pressure,[47] a first vaginal birth, the use of regional anesthesia, the manner in which the fetal head enters the pelvis, and the weight of the neonate.[48] Based on these results, it must be said that in addition to research on labor positions, there is a need for more studies on factors that may cause perineal trauma.

It was seen in this systematic review and meta-analysis that vertical positions do not have an impact on the neonate's first- and second-minute APGAR score or on NICU admissions. Other studies also

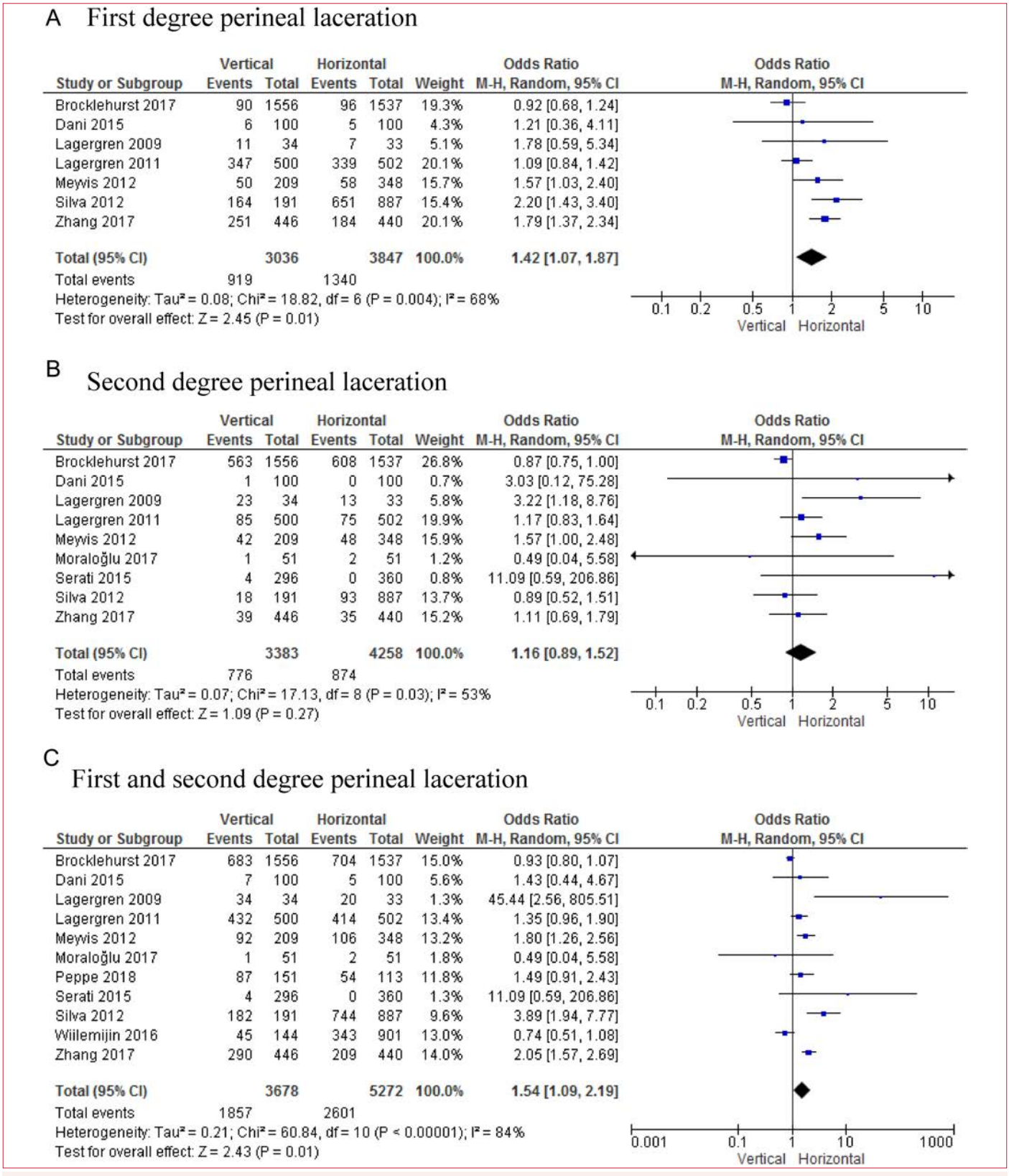

Figure 3. Meta-analysis results of the effects of vertical positions on first- and second-degree perineal lacerations in labor.

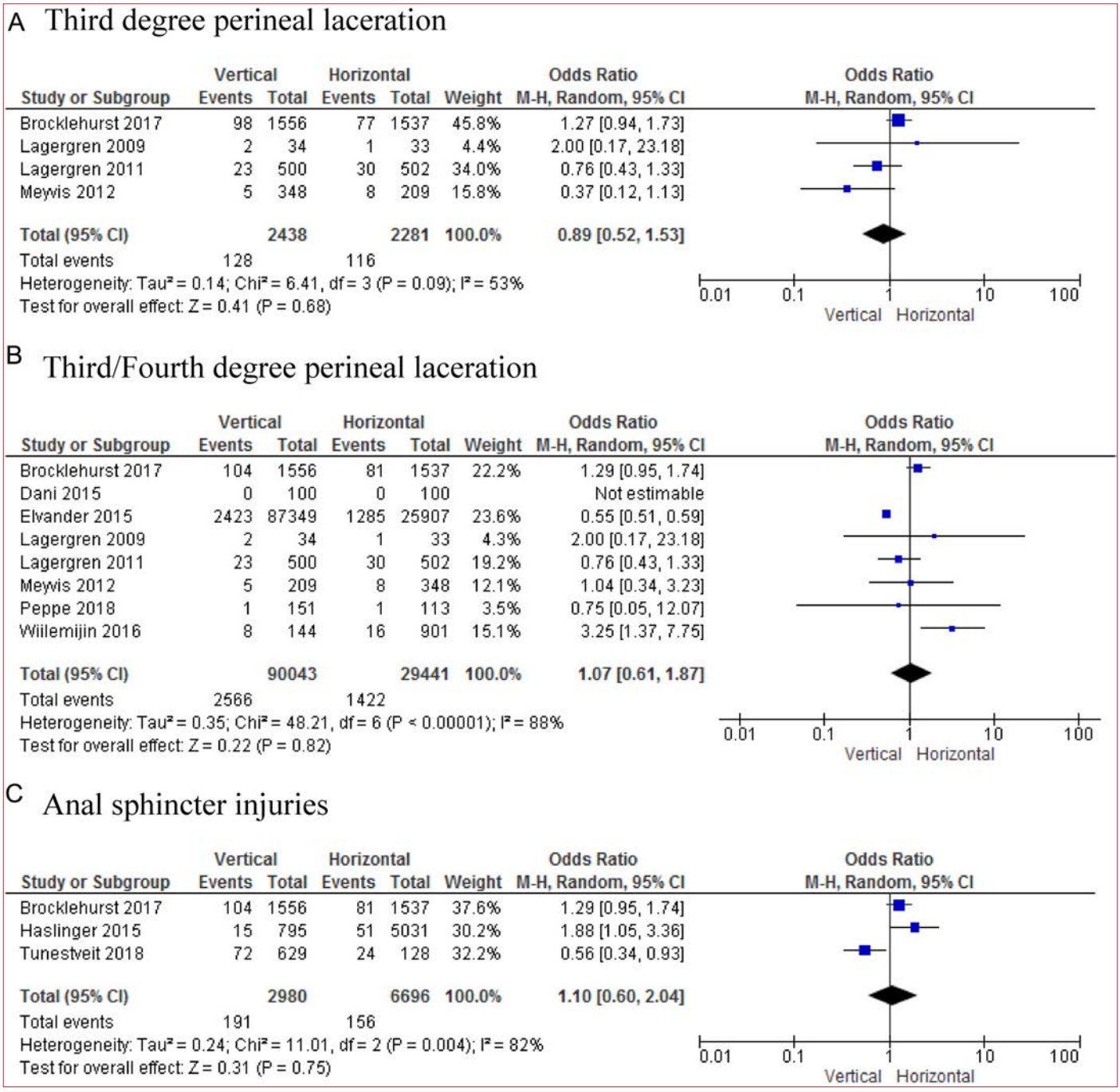

Figure 4. Meta-analysis results of the effects of vertical positions in labor on third- and fourth-degree perineal lacerations and anal sphincter injury.

indicate similarly that the APGAR score[49-52] and NICU admissions[50-53] are not affected by the use of vertical positions during labor. These results are important in that they demonstrate that positions used during labor are not a risk factor for neonatal health.

Strengths and Limitations of the Study

The strengths of this systematic review and meta-analysis can be cited as the expansive availability of additional scanning resources, the fact that most of the studies were current, had been conducted in different countries, and had high-quality assessment scores. The large size of the sampling in the meta-analysis was also a strength of the study that reinforced the results obtained. Furthermore, the findings included in the analysis were supported by a concrete and reliable methodology, the conclusions drawn were reinforced by the results of previous studies, which added to the strength of the study. Another strength of the research was that it was supported by the homogeneity of other studies that had reported results concerning the admission of neonates into NICU (4 studies) and the fifth-minute APGAR score

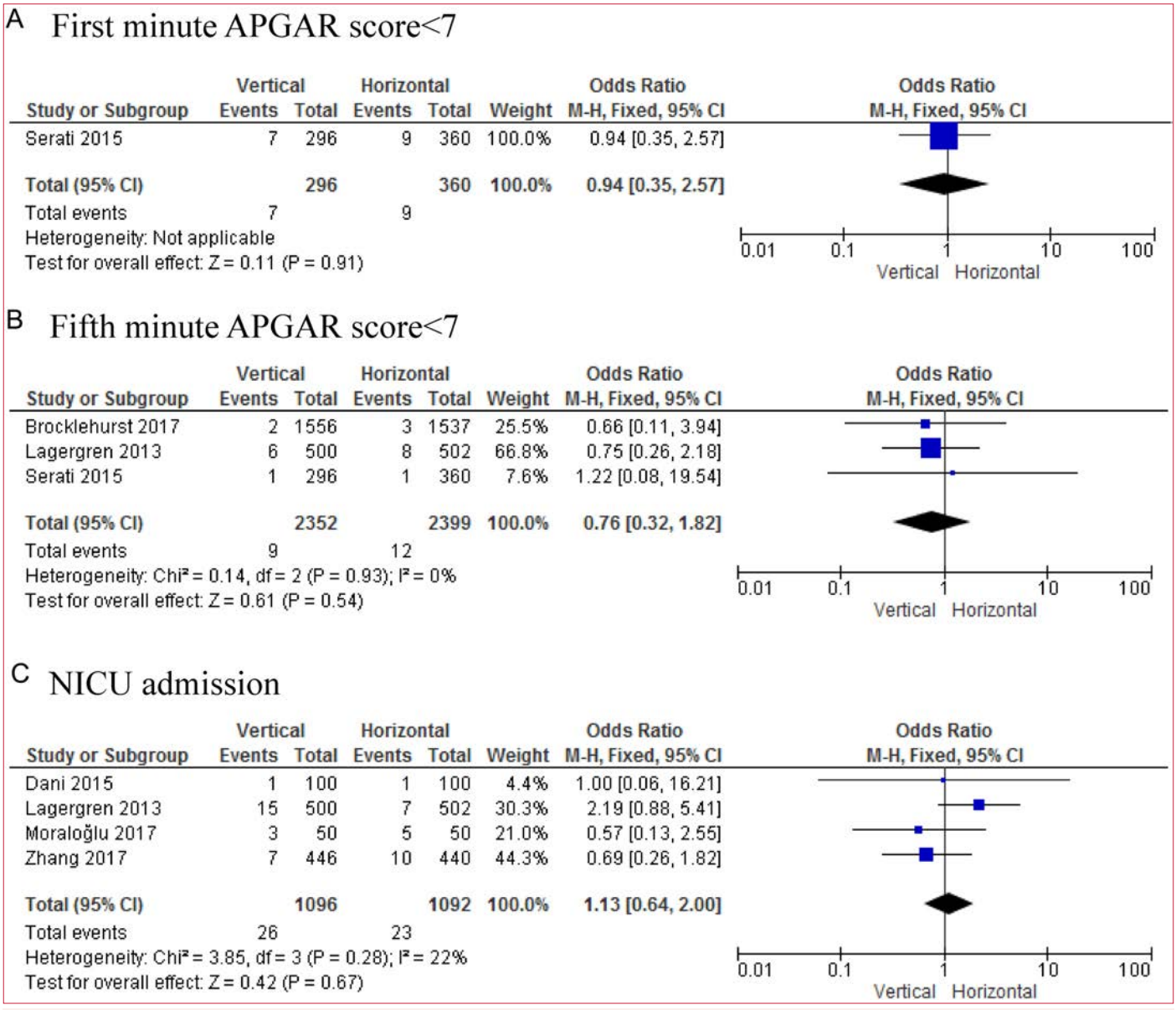

Figure 5. Meta-analysis results on the effects of vertical positions on infant health in labor.

(3 studies), which may have enhanced the strength of the evidence. It can be said, however, that the low extent of homogeneity in the studies reviewed on perineal outcomes may have weakened the power of the evidence. To keep this factor under control, the random effect model was employed in analyses where heterogeneity was high (above 50%). On the other hand, the review of only articles published in English and the exclusion of studies published in other languages constituted a limitation of the research.

Conclusion and Recommendations

The results of this systematic review and meta-analysis indicate that vertical positions used during labor reduce the probability of episiotomy, exacerbate the development of first-degree lacerations, but have no impact on an intact perineum, on perineal lacerations of second, third, and 4th degree, anal sphincter injury, or on neonatal APGAR scores and NICU admissions. These results are valuable in that they represent evidence-based data that can be used in intrapartum care services. Based on these results, our recommendations are as follows:

- Women in the second stage of labor should be permitted to use and be supported in choosing a comfortable position of their preference.
- In situations where a woman has not made an informed choice, horizontal positions (especially the lithotomy position) should be avoided.
- Midwives should be educated about different positions of labor and education programs should be planned and implemented to help midwives develop their skills in aiding labor through the use of different positions.
- Midwifery departments at universities should integrate different labor positions into their instructive content on childbirth assisting skills.

- The health system should develop policies that will make it possible for informed women to choose to take different positions during labor.
- It may also be advised that studies continue to assess the effect of labor positions on maternal and neonatal health, the factors contributing to perineal trauma, women's preferences in this context, and the positions that give them the most satisfaction.

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