

## The Effect of Maternal Position on Maternal, Fetal and Neonatal Outcomes: A Systematic Review

Kobra Mirzakhani (MSc)<sup>1</sup>, Fatemeh Zahra Karimi (PhD)<sup>2</sup>, Atieh Mohamadzadeh Vatanchi (PhD)<sup>3</sup>, Fakhera feroz Zaidi (PhD)<sup>4</sup>, Khadijeh Mirzaii Najmabadi (PhD)<sup>2\*</sup>

<sup>1</sup> PhD candidate in Reproductive Health, Nursing and Midwifery Care Research Center, Mashhad University of Medical Sciences, Mashhad, Iran

<sup>2</sup> Assistant Professor, Nursing and Midwifery Care Research Center, Mashhad University of Medical Sciences, Mashhad, Iran

<sup>3</sup> Assistant Professor, Department of Obstetrics and Gynecology, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran

<sup>4</sup> Academic Health Science Center (AHSC) for reproductive maternal newborn and child health (RMNCH), London, U.K

<sup>5</sup> Associated Professor, Nursing and Midwifery Care Research Center, Mashhad University of Medical Sciences, Mashhad, Iran

ARTICLE INFO	ABSTRACT
<p><b>Article type:</b> Review article</p>	<p><b>Background &amp; aim:</b> Maternal care during the different stages of labor should be targeted towards the promotion of maternal, fetal, and neonatal health status. Maternal position is very important in labour and delivery Care. Nevertheless, there is controversial results regarding the effect of maternal position in labor. The present study reviewed the effect of maternal position on maternal, fetal, and neonatal outcomes.</p> <p><b>Methods:</b> In this systematic review, databases including PubMed, Web of Science, Scopus, Google Scholar as well as Persian databases of Magiran and SID, were searched and all related articles between 2005 to 2018 were retrieved. The quality of the studies was examined using the Joanna Briggs Institute tool.</p> <p><b>Results:</b> 17 clinical trials performed on 4,848 subjects were reviewed. Maternal position during the labour were the upright and lying positions. The outcome measures included duration of the different stages of labor, persistent posterior position, postpartum hemorrhage, maternal pain, anxiety and fatigue. The fetal and neonatal outcomes entailed Apgar score, umbilical venous blood pH, need for neonatal resuscitation, and need for hospitalization in NICU. The results revealed that different maternal positions during the first- and second-stage of labor did not affect maternal, fetal, and neonatal outcomes. However, all studies stated that low-risk mothers should have the chance for choosing a comfortable position in the different stages of labor.</p> <p><b>Conclusion:</b> In order to propose an evidence-based care plan concerning maternal position in labor, it is required to perform further studies with higher quality regarding the effect of maternal position on maternal, fetal, and neonatal outcomes.</p>
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### Introduction

Maternal health promotion plans should facilitate the provision, maintenance, and enhancement of their health status. In addition, these plans should address the improvement of the quality of labor care, mitigation of side effects, reduction of maternal and neonatal mortality, and satisfaction of mothers with the provided services. The care plans must be evidence-based and prioritize the prevention

and health promotion programs over the expensive diagnostic and therapeutic strategies (1).

Maternal position is one of the obstetric care in the labour wards (2). Consideration of maternal position in the labour wards is indicative of a supportive environment for delivery leading to an improved sense of competence and personal

\* Corresponding author: Khadijeh Mirzaii Najmabadi, Associated Professor, Nursing and Midwifery Care Research Center, Mashhad University of Medical Sciences, Mashhad, Iran. Tel: 00989155591536; Email: mirzaeikh@mums.ac

success in mothers during the intrapartum and postpartum periods (3).

Maternal position is a remarkable point of maternal care during the labor process, which is neglected in many cases by the care providers of the labour wards. Placement of mothers in a lying position during the course of delivery is one of the common interventions in the current century (4). Before the 17<sup>th</sup> century, delivery at the upright position was popular in the Western countries (5), and the lying position was performed only in cases with an indication of operative delivery (3).

Afterward, the lying position became common due to the comfort of the birth companion (6). Nonetheless, delivery at the upright position is still common in the societies lacking modern medicine (7-9). In this regard, Naroll et al. reported that out of 76 studied traditional cultures, only 14 cases chose the maternal supine lying position for labor (10).

Consideration of maternal rights obligates the care providers to give the choice of childbirth position to the mothers. The position that mothers choose for delivery depends on several complicated factors and the norms of their society. In societies that labor is carried out in the health centers and hospitals, the social norms are affected by the expectations and requests of the obstetricians.

In addition, the limitations imposed by the medical procedures, such as fetal monitoring, intravenous therapy, analgesics, and medical examinations affect such choices. During the second stage of labor, various factors, including perineal support and assistance for delivery, limit the selection of a suitable position by the mothers (3, 11, 12).

In a cohort study conducted on 12,782 parturients in Sweden, it was shown that 83.9% of the births were given in the lying position (13) and the upright positions, such as squatting, were rarely applied. In countries with modern medicine, less than 1% of the women are posed upright in the course of delivery. Furthermore, in a study carried out in Brazil on 1,079 women, it was demonstrated that 82.3% of the individuals completed the delivery in a lying position (11).

In another study, the frequencies of left-side lying, squatting, all-fours, and standing labor

positions were reported as 16%, 0.8%, 0.7%, and 0.2%, respectively (14). Although the lithotomy position seems to be proper for monitoring and interventions during delivery, it negatively affects the labor duration and maternal comfort. Nonetheless, as indicated by the evidence, women prefer to change their position from lying to non-lying during childbirth in case they have a chance.

In recent decades, lying delivery position has gained higher popularity and acceptance (16). This popularity is due to the fact that this position facilitates easier fetal heart rate (FHR) monitoring, maternal monitoring and examination, serum therapy, regional anesthesia and perineal support (15).

Lying delivery results in the elevation of stress hormones in mothers, in addition to the reduction of effective contractions and delivery stage progress (17). Some of the probable benefits mentioned in the literature for non-lying childbirth positions include the positive impact of gravity on delivery, more effective and stronger uterine contractions (18), and more efficient maternal strains during labor. Moreover, the enhanced fetal position, diminished risk of pressure on aorta, improved neonatal acid-base consequences, and decreased abnormal FHR pattern have been pointed out as the advantages of this position (19).

However, some studies have not confirmed these benefits. Other profits proposed for maternal upright childbirth position are increased pelvic diameters (5), modified birth canal (18, 20), labor duration, pain intensity, epidural anesthesia, and postpartum hemorrhage (PPH) (4, 15).

According to the mentioned findings, the upright delivery position was proposed as a cheap and simple intervention that augments the probability of vaginal delivery in the World Health Organization guidelines for vaginal birth (1995). Nevertheless, the mentioned data were presented by controversial, dispersed, or unofficial evaluations, in which the researchers recommend further studies in order to prove and execute their proposed intervention as a care plan (5, 21).

In conclusion, it is required to continuously perform systematic comprehensive investigations in order to propose an evidence-

based care plan for mothers, obtain information, and introduce a practical and comprehensive program based on the ethnicity and culture of a society. With this background in mind, the present systematic review aimed to assess the impact of Maternal position during the labor stages on maternal, fetal, and neonatal outcomes.

## Materials and Methods

This systematic review was designed considering the criteria of the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) (22). Data collection was gathering through a comprehensive and systematic review of the articles published during 2005-2018.

The articles related to the objective of study were searched in databases such as PubMed, Web of Science, Scopus, Magiran, SID, and Google Scholar using Persian and English keywords, such as "Parturition", "Birth", "Delivery", "Obstetric", "Labor", "Labor stage", "First labor stage", "Second labor stage", "Maternal position", "Mothers' position", "Delivery outcome", "Maternal outcome", "Maternal-fetal outcome", "Fatal outcome", "Newborn infant outcome", and "Neonate outcome". Moreover, the Boolean operators of "AND" and "OR" were applied.

After the retrieval of the related articles, their reference lists were also checked, and the reference articles were also searched. In order to avoid bias and assure the inclusion of all studies meeting the inclusion criteria, the search process was performed independently by two of the researchers, and the discrepancies were reevaluated by the corresponding author.

All the English and Persian randomized controlled clinical trials addressing care plans or the interventions related to childbirth position during the first and second stages of labor at

labour wards and investigating maternal, fetal, and neonatal outcomes were included in the study.

The papers to which we did not have full access, as well as the review articles, letters to the editor-in-chief, case reports, qualitative articles, and these were excluded from the study. After searching for the studies related to the issue under investigation, the papers that lacked the inclusion criteria were excluded by two authors independently evaluating the manuscripts.

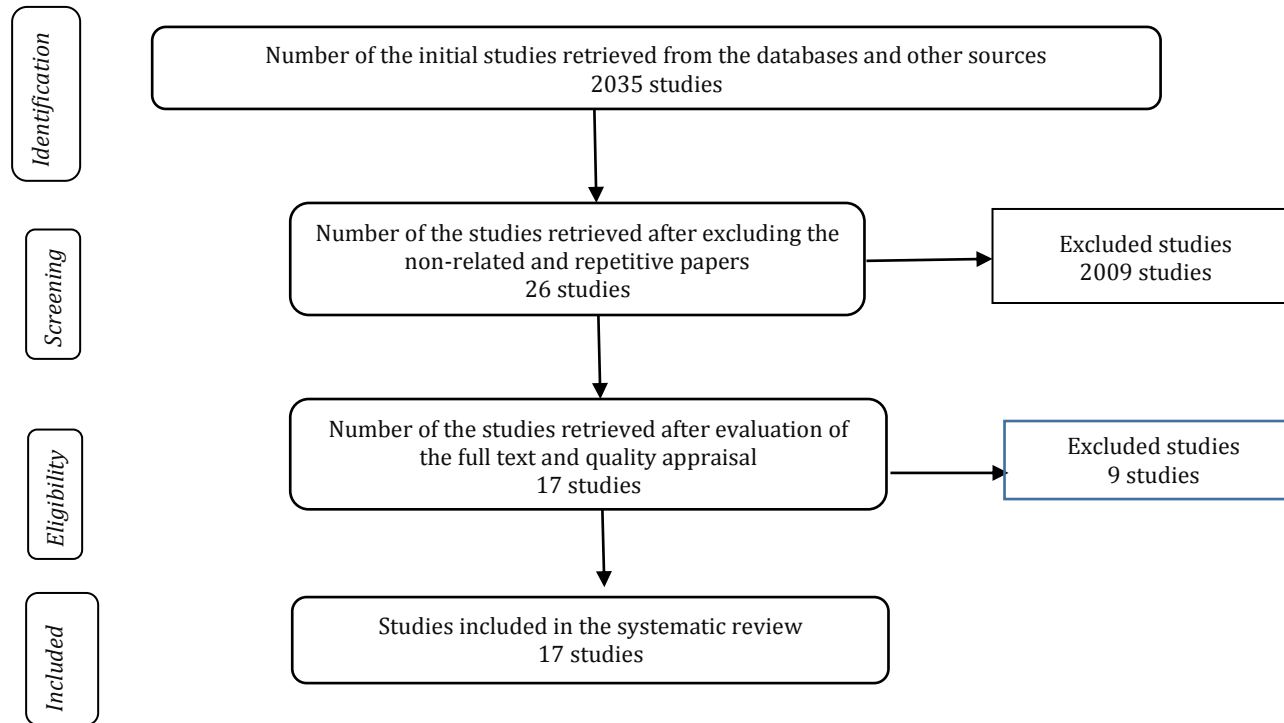
In the next stage, the full-text versions of the retrieved articles were assessed by two authors using the *Joanna Briggs Institute* checklist. This tool is specific for the appraisal of the randomized clinical trials and includes 13 items (23). In this instrument, each item is scored as 0 (lacking the intended criterion) or 1 (having the criterion). Based on the appraisal scores, the papers with the scores of  $\geq 75\%$ , 50-75%, and  $< 50\%$  are divided into three groups of high-, moderate-, and low-quality, respectively. Finally, the low-quality studies were excluded from the review.

Data extraction was carried out using a checklist based on the predefined criteria. This data extraction checklist entailed such information as the study title, authors, publication year, country, sample size, study design, inclusion and exclusion criteria, assessment instruments, participants' characteristics, intervention, and maternal, fetal, and neonatal outcomes, in addition to the quality score of the study.

## Results

The search process resulted in the identification of 17 clinical trials, including 9 English and 8 Persian papers the study population of the included studies consisted of 4,848 parturients who were under clinical trials. Figure 1 illustrates the process of study selection in this review (Figure 1).

**Figure 1.** Flow chart representing the process of study selection for the systematic review



Tables 1 and 2 summarize the characteristics of the reviewed studies and quality scores, respectively.

**Table 1.** Characteristics of the studies included in the systematic review

Author (Year) Country	Objective	Sample	Intervention	Instrument	Results
Zhang et al. 2017 China	Determination of the differences in maternal and neonatal outcomes of labor between kneeling and supine lying positions during the second stage of labor among the low-risk women	1400 parturients from 11 hospitals, China	Kneeling delivery position at the initiation of the second stage of labor; every 15-30 min of kneeling position, mother rested at the side-lying position for 5-10 min.	Available electronic notes, data collection questionnaire	The results showed a longer second stage ( $P<0.001$ ) and shorter third stage ( $P=0.02$ ). No significant difference was reported between the groups in terms of postpartum hemorrhage ( $P=0.525$ ), neonatal Apgar score ( $P=0.137$ ), and neonatal asphyxia ( $P=0.446$ ) (20).  Pain score did not change significantly 15 min post-intervention ( $P=0.72$ ). Moreover, 1 h post-intervention and at the end of the first stage, no significant change was reported in the anterior rotation of the fetal head.
Guittier et al. (2016) Switzerland	Evaluation of the impact of kneeling maternal position during the first stage of labor on the fetal head rotation in the occiput posterior position	439 women referring to the teaching hospitals of Geneva, Switzerland	All-fours position for at least 10 min at the initiation of the active phase of the first labor stage and evaluating the fetal head position by ultrasonography after 1 h or at delivery	Demographic and social questionnaire, visual analog scale for pain, maternal comfort assessment tool, ultrasonography report for the fetal head position	Duration of the first and second stages did not alter significantly ( $P=0.39$ and $P=0.17$ , respectively). Need for regional anesthesia, operative delivery, and PPH intensity were not significantly different between the two groups. Overall, the two groups were not significantly different concerning the maternal outcomes; however, hospitalization was longer in the intervention group ( $P=0.03$ ). One-minute Apgar, umbilical vein pH, and need for neonatal resuscitation did not show significant changes (24).

Author (Year) Country	Objective	Sample	Intervention	Instrument	Results
Abdolahian et al. (2014) Iran	Investigation of the effect of dance (pelvic rotation movements) at the first labor stage on reducing delivery pain	60 parturients referring to a teaching hospital affiliated to Shiraz University of Medical Sciences, Iran who were randomly divided into two groups of dance and control at the first stage of labor	Mothers of the dance group were in the upright position for at least 30 min at 4-10 cm dilation and had pelvic rotational movements around a circle. Their spouses spontaneously massaged their back and sacrum. The control group received physiological delivery management. Group one included the pregnant women with the fetal head station of -5 to -3 in all-fours position or leaning on the birthing ball; group two entailed pregnant women with the fetal head station of -2 to 0, at side-lying position to the side of fetal vertebral column so that the inferior leg was bent 90 degrees; group three consisted of pregnant women with the fetal head station of over 0, at the side-lying position to the side of fetal vertebral column so that the upper leg was bent 90 degrees with support. Ultrasonography was	Visual analog scale for pain	Pain intensity score improved significantly 30 and 60 min post-intervention (P=0.012 and P=0.036, respectively). The two groups were not significantly different during the second stage of labor.
Desbriere et al. (2013) France	Examination of the effect of maternal position on prevention from persistent occiput posterior the fetal position	220 parturients referring to a level 3 hospital in Marseille, France with A dilation of over 3 cm and occiput posterior position of the fetal head confirmed by ultrasonography	at the side-lying position to the side of fetal vertebral column so that the upper leg was bent 90 degrees with support. Ultrasonography was	Ultrasonography results	The fetal head position before C-section (P=0.558), the fetal head position at delivery (P=1), inferior rotation of the fetal head (P=0.748), length of the first labor stage (P=0.436), length of the second labor stage, perineal injuries (P=0.757), five-minute Apgar score (P=0.121), ten-minute Apgar score (P=0.309), umbilical vein pH (P=0.886), and newborn hospitalization rate at NICU (P=0.498) did not change significantly in the study groups (27).

Author (Year) Country	Objective	Sample	Intervention	Instrument	Results
Amiri Farahani et al. (2012) Iran	Comparison of the effect of different maternal positions during the second stage of labor on pain, anxiety, fatigue, and maternal experience with delivery	148 pregnant women referring to the teaching hospitals of Arak, Iran	done every 1 h to confirm the inferior rotation of the fetal head. The participants were allocated randomly into three groups since complete dilation and cervical effacement until baby's head crowning. The three groups were lithotomy, squatting, and kneeling. In all the three groups, mothers took the intended position at the time of the uterine contractions and pushed along with the increase of the abdominal pressure. The subjects were allocated randomly into three groups since complete dilation and cervical effacement until baby's head crowning. The three groups included lithotomy, squatting, and kneeling. In all the three groups mother took the intended position at the time of the uterine contractions and pushed along with the increase of the	Researcher-made questionnaire, visual analog scale for pain, anxiety, and fatigue	Maternal pain intensity with getting close to delivery (P=0.98), pain (P=0.22), anxiety (P=0.61), and fatigue (P=0.43) were not significantly different between the groups. Moreover, the three groups did not indicate significant difference regarding the duration of the second stage of labor, as well as one- and five-minute Apgar scores (P>0.05) (29, 41).
Amiri Farahani et al. (2012) Iran	Comparison of different maternal positions during the second stage of labor on delivery length	148 pregnant women referring to the teaching hospitals of Arak, Iran	done every 1 h to confirm the inferior rotation of the fetal head. The participants were allocated randomly into three groups since complete dilation and cervical effacement until baby's head crowning. The three groups included lithotomy, squatting, and kneeling. In all the three groups mother took the intended position at the time of the uterine contractions and pushed along with the increase of the	Chronometer	Duration of the second stage of labor (P=0.82), one-minute Apgar score (P=0.74), five-minute Apgar score (P=0.84) were not significantly different between the two groups (29).

Author (Year) Country	Objective	Sample	Intervention	Instrument	Results
			abdominal pressure.		
Thies-lagergren et al. (2011) Sweden	Study of the effect of using a birthing chair in the second stage of labor on hemorrhage intensity among healthy primiparous women	1020 parturients referring to two hospitals in Sweden	Use of birthing chair for less than 20 min at the second stage of labor	Questionnaires of personal data and delivery outcomes	Hemorrhage of <1000 mL was significantly higher in the intervention group (P=0.007). However, occurrence in the volumes of over 1000 mL and the mean blood loss did not have a significant difference between the groups (P=0.225 and P=0.109, respectively) (39).
Motamedi et al. (2009) Iran	Evaluation of the impact of the position chosen by the mother on labor outcomes in primiparous women	100 pregnant women referring to the maternity hospital	The mothers with a dilation of 4 cm were randomly assigned into two groups of lying on the bed (control) and choosing a comfortable position (intervention)	Burford pain thermometer, demographic form, scale, clock, observation, and medical examination, and questionnaire	The mean cervical dilation in cm/h, labor pain score and one-minute Apgar score were all significantly better in the intervention group (P=0.001) (42).
Khavandizadeh aghdam et al. (2009) Iran	Investigation of the influence of maternal position in active labor phase on delivery outcome in the first pregnancy	150 mothers referring to the Hospital of Social Security Organization, Ardabil, Iran	The samples were divided into two groups after 4-cm dilation: 1. Intervention group: the chosen positions of standing, sitting, walking, etc; 2. Control group: the usual position of the hospital (i.e., lying on the bed)	Questionnaire of the demographic data, examinations, and observations filled by the researcher	The mean active phase length (P=0.002), and mean pain score (P=0.028) were significantly lower in the intervention group. The mean duration of the second labor stage (P=0.231) and five-minute Apgar score did not demonstrate significant difference between the two groups. Breastfeeding rate at the first 1-5 minutes was higher in the intervention group (P=0.001) (30).



Author (Year) Country	Objective	Sample	Intervention	Instrument	Results
Reyhani et al. (2008) Iran	Determination of the effect of maternal position during the active labor phase on delivery duration and newborn Apgar score	200 women hospitalized in Imam Khomeini Maternity Hospital, Falavarjan, Iran	The samples were randomly allocated into four groups of moving, sitting, side lying, and free since the 4-cm dilation and for more than 2 h	Questionnaire and parturients' medical records	The mean length of active labor phase was significantly higher in the side-lying group ( $P < 0.01$ ). Duration of the second labor stage in the side-lying and sitting groups was significantly longer than that of the moving and free groups ( $P < 0.01$ ). The five-minute Apgar score increased significantly in the side-lying group ( $P < 0.001$ ) (33).
Miquelutt et al. (2007) Brazil		107 women referring to the Center for Integral Assistance to Woman's Health of the Universidade Estadual de Campinas (UNICAMP), Campinas, Brazil	Changing maternal position to upright after 30 min of supine lying	Demographic and social characteristics instrument, visual analog scale for pain, and fetal and newborn health determination tool	The two groups of intervention and control did not have a significant difference regarding pain score ( $P = 0.23$ ), duration of the first and second stages ( $P = 0.59$ , $P = 0.75$ ), need for uterotonics ( $P = 0.89$ ), fetal health score ( $P = 0.32$ ), and newborn health score ( $P = 0.37$ ) (25).
Altman et al. (2007) Sweden	Comparison of the impact of two upright maternal positions in the second stage of labor on delivery outcomes	218 parturients referring to the Hospital of Vasteras, Sweden	Random division of mothers with the initiation of the second labor stage into two positions of all-fours and sitting on the bed with an angle of 60 degrees until the fetal head crowning At a dilation of 3-4 cm, mothers were randomly allocated into two groups of the chosen positions (upright, kneeling, walking, sitting, and lying), and the usual group (supine and side-lying)	Maternal-fetal data based on the partographs of delivery for each individual	duration of the second labor stage and postpartum hemorrhage were not significantly different between the two groups ( $P = 0.03$ ) (28).
Nazari et al. (2007) Iran	Investigation of the influence of chosen maternal position on pain intensity at the first stage of labor	60 parturients referring to Hazrat Zeynab Clinic, Mashhad, Iran		Survey and visual analog scale for pain filled by the researcher	The mean pain was significantly lower in the intervention group than in the controls ( $P = 0.007$ ) (48).
Ragnar et al.	Comparison of two	271 women referring 1996	Comparison of two	Questionnaires of	During the second stage, the maternal- <i>Midwifery Reprod Health. 2020; 8(1): 1988-2004.</i>

Author (Year) Country	Objective	Sample	Intervention	Instrument	Results
(2006) Sweden	upright maternal positions at the second stage of labor	to the Hospital of Vastra, Sweden	upright positions of kneeling and birthing bed with a 60-degree angle (semi-sitting) since the beginning of the second labor stage (cervical dilation and effacement) until the fetal head crowning	maternal experience with delivery and labor outcomes	fetal-neonatal outcomes and hospitalization duration were not significantly different between the two groups. The semi-sitting position during the second stage was accompanied by higher pain and perineal pain (P=0.01 and P=0.001, respectively) (26).
Kordi et al. (2006) Iran	Investigation of the impact of maternal chosen positions on the length of the active phase of the first delivery stage	60 women referring to Hazrat Zeynab Hospital, Iran	Mothers were randomly assigned into two groups of chosen positions (upright, kneeling, walking, sitting, and lying) and common positions (supine- and side-lying) at a dilation of 3-4 cm.	Survey and observation form completed by the researcher	The mean length of the active phase of the first labor stage was significantly lower in the group with chosen positions, compared to that in the common group (P=0.002). Apgar scores of all samples were over 7 (31).
Stremmler et al. (2005) Argentina, Australia, England, Israel, and the United States of America	Investigation of the influence of kneeling maternal position on the fetal head rotation	147 women with an improper fetal head position (occiput posterior) confirmed by ultrasonography referring to 13 maternity wards in teaching hospitals of Argentina, Australia, England, Israel, and the United States of America	Intervention group was subjected to the all-fours maternal labor position for at least 30 min (60 min or more) and the control group could have any preferred positions.	Ultrasonography result for diagnosing the fetal head position, short-form McGill pain questionnaire	Fetal head rotation to inferior position 1 h post-intervention (P=0.18) and at labor (P=0.35), as well as one-minute Apgar score < 7 (P=0.16) did not show a significant difference. However, maternal persistent backache enhanced (P=0.008) (36).
Golmakani et al. (2005) Iran	Comparison of the impact of side-lying position and lithotomy during the second stage of labor on labor duration among primiparous women	100 primiparous women referring to the maternity hospitals of Neyshabur, Iran	Since the appearance of 2 cm of the fetal head in the vagina, the mothers of the intervention group were posed in a left-side lying position (i.e., left leg was	Use of data forms filled by interview, observation, and examination for strengthening the pelvic muscles	The mean active phase length of the second labor stage was significantly higher in the side-lying group (P=0.03 and P=0.004, respectively). None of the studied newborns had one-minute Apgar score of 7 or lower and the two groups did not have a significant difference.

Author (Year) Country	Objective	Sample	Intervention	Instrument	Results
			positioned on a smooth surface, and mother lying on her left side. She pulled her superior leg toward her stomach at the contractions and put it on the left-side pedal of the birthing bed or her other leg.). The control group was posed in the lithotomy position.		Most of the newborns had five-minute Apgar scores of 9-10 (34).

**Table 2.** Methodological appraisal of study quality for randomized controlled clinical trials

No.	Study	Criteria for the metodological appraisal of study quality													Score	Quality
		1	2	3	4	5	6	7	8	9	10	11	12	13		
1	Zhang et al. (2017)	+	+	+	-	-	-	-	+	+	+	-	+	+	8	Moderate
2	Guittier et al.(2016)	+	+	+	-	-	-	+	+	+	+	+	+	+	10	High
3	Abdolahian (2014)	+	-	+	-	-	+	-	+	+	+	-	-	+	7	Moderate
4	Desbriere et al.(2013)	+	-	+	-	-	-	-	+	+	+	-	+	+	7	Moderate
5	Amiri farahani (2012)	+	-	+	-	-	-	+	+	+	+	+	+	+	9	Moderate
6	Amiri farahani (2012)	+	-	+	-	-	-	+	+	+	+	-	+	+	8	Moderate
7	Thies-lagergren et al.(2012)	+	-	+	-	-	-	-	+	+	+	-	+	+	7	Moderate
8	Motamedi et al. (2009)	+	-	+	-	-	-	+	+	+	+	-	+	+	8	Moderate
9	Khavandizade Aghdam et al. (2009)	+	-	+	-	-	-	+	+	+	+	-	+	+	8	Moderate
10	Reyhani et al. (2008)	+	-	+	-	-	-	+	+	+	+	-	+	+	8	Moderate
11	Miquelutti et al.(2007)	+	+	+	+	-	-	+	+	+	+	-	+	+	10	High
12	Altman et al.(2007)	+	+	+	-	-	+	+	+	+	+	-	+	+	10	High
13	Nazari et al. (2007)	+	-	+	-	-	-	+	+	+	+	+	+	+	9	Moderate
14	Ragnar et al.(2006)	+	+	+	-	-	+	+	+	+	+	-	+	+	10	High
15	Kordi et al. (2006)	+	-	+	-	-	-	+	+	+	+	+	+	+	9	Moderate
16	Stremler et al.(2005)	+	+	+	+	+	+	+	+	+	+	+	+	+	13	High
17	Golmakani et al.(2005)	+	-	+	-	-	+	+	+	+	+	-	+	+	9	Moderate

Maternal position during the first and second stages of labour were the upright positions (all-fours, squatting or kneeling, sitting, birthing chair, walking, and waist rotation movements or dancing) and lying positions (supine, lateral decubitus, and lithotomy). The evaluated maternal outcomes were length of the different stages of labor, persistent occiput posterior (OP) position, postpartum hemorrhage, maternal pain, anxiety and fatigue. According to the results of this systematic review, 13 clinical trials investigated the effect of maternal position on duration of labor. In addition, in 7 studies investigating 1,463 women who had recently given birth reported that maternal position had no effect on duration of labor (2, 24-29). On the other hand, 2 studies performed on 210 Iranian parturients revealed that the upright, freedom and elective of position chosen by the mother led to the shortening of labor stages (30, 31). In another study conducted on 1400 women in China, it was concluded that the kneeling position during the second stage of labor resulted in a longer second stage and a shorter third stage of labor (32). Moreover, in 2 studies carried out on 300 Iranian women, it was shown that the side-lying position significantly prolonged the first (33) and second (34) stages of labor.

Persistent OP fetal position as another labor outcome increases the risk for operative delivery or cesarean section (C-section) and is observed in 18% of the C-sections (35). In the present systematic review, three studies evaluated the influence of maternal position (e.g., kneeling and all-fours) on fetal head rotation and prevention from persistent OP. The mentioned studies did not find a significant difference between the intervention and control groups concerning fetal head rotation and stated there is no policy or plan addressing maternal labor positioning to facilitate the management of labor in case of fetal OP position (24, 27, 36).

The PPH as a leading cause of mortality and morbidity in mothers is the labor outcome (37,38). Three of the reviewed studies involved the evaluation of hemorrhage intensity in two groups (intervention and control). In two of these studies, the rate of hemorrhage was not significantly different between the two groups (20, 28). Thies-lagergren et al (2011) claims that

bleeding of < 1000 ml was more frequent in the intervention group. However, they observed no significant difference between the two groups regarding the mean blood loss at a volume of over 1,000 ml (39).

In terms of the fetal and neonatal labor outcomes, the reduced risk of pressure on the aorta and improved acid-base outcomes in the newborn were introduced as the benefits of upright position in the maternity ward (40). On the other hand, maternal lying position was reported to negatively affect the FHR pattern (2). However, the latter point was not confirmed in the reviewed studies. Out of 11 investigations reporting the fetal and neonatal health, 9 (81.8%) studies investigating a total of 2,480 participants reported no significant difference between the control and intervention groups in this regard

The assessed fetal and neonatal outcomes included the one- and five-minute Apgar scores, umbilical venous pH, fetal health score, need for neonatal resuscitation, and need for hospitalization in the NICU. These features had been evaluated in the two groups of lying and upright positions at the first and second stages of labor (20, 24, 25, 27, 29-31, 34, 36, 41). Only in two studies (18.2%) on 300 Iranian parturients, it was reported that one-minute Apgar was higher in the group in which the position was selected by the women. In addition, in the mentioned study, the 4-7 minute Apgar score was higher in the side-lying and sitting position groups (33, 42).

Silva et al (2017) pointed out that altered maternal position from the left side to lying leads to the reduction of the resistance of the middle cerebral artery, while no change is observed in the resistance of the umbilical artery. They stated that the variations in the cerebral blood flow are seen in the first 5 min and do not persist more than 10 min. Moreover, the change caused in oxygen saturation decreases following maternal position alteration to supine is not sufficient for changing the pressure of the umbilical venous blood flow (43).

This study involved the review of the psychological outcomes, such as maternal pain experience, anxiety, and fatigue, in addition to the physiologic outcomes. The effect of labor

position on pain is yet a controversial subject. Miquelut et al (2007) reported that even though the groups were not significantly different in terms of maternal pain score and satisfaction, mothers preferred the upright position (25). This author stated that the selection of the labor position by the mother improves the maternal physiologic and psychologic outcomes (2, 26, 42). Stremler et al (2005). Demonstrated that persistent backache was improved as a result of the all-fours position (36). On the other hand, some studies reported no significant differences among the lithotomy, squatting, and kneeling positions during the second stage of labor in terms of pain, anxiety, and fatigue in mothers (41).

## Discussion

The current systematic review aimed to assess the effect of maternal position on the maternal, fetal, and neonatal outcomes. Maternal positions at the first and second stages of labor included the upright (i.e., all-fours, squatting or kneeling, sitting, birthing chair, walking, and waist rotation movements or dancing) and lying positions (i.e., supine, lateral decubitus, and lithotomy position). Duration of the interventions varied from 10 min to the length of the first and second stages. The outcomes were evaluated in two categories of maternal and fetal-neonatal outcomes.

The results of the studies included in the current systematic review were found to be controversial. Moreover, the findings of our systematic review were not consistent with those of the systematic reviews published before 2005. The reviews performed prior to 2005 in countries other than Iran reported that the upright or lateral Maternal positions were accompanied by changes in labor outcomes, such as shortened first and second labor stages, diminished NICU hospitalization, labor pain, and abnormal FHR pattern compared to the lying or lithotomy positions (5, 17, 44, 45).

Increased rate of operative delivery and C-section due to persistent OP position were among the evaluated maternal outcomes. The present systematic review did not find a significant difference between the intervention and control groups regarding the fetal head rotation (24, 27, 36). Based on the evidence,

there is no maternal labor position-based policy or plan facilitating delivery management in case of fetal OP position (27).

The PPH was another maternal outcome assessed in the studies. In this systematic review, three studies had evaluated hemorrhage intensity in the two groups of intervention and control. In addition, in two studies, no significant difference was observed between the two groups in terms of hemorrhage (20, 28). However, Thies-lagergren et al (2011) claimed that a hemorrhage volume of < 1000 mL was more frequent in the intervention group than in the control group. In the mentioned study, the two groups were not significantly different regarding the mean blood loss at a hemorrhage volume of > 1000 mL (39).

Concerning the effect of maternal position on duration of labor, the studies evaluating the non-Iranian women reported that labor position does not effect on duration of labor. However, the two studies carried out in the Iranian society observed that the free upright position chosen by mother may result in shorter labor stages (30, 31). This difference could be due to the larger sample size and higher number of the studies on non-Iranian women. Therefore, further clinical trials with larger sample sizes in the Iranian population are recommended to examine the effect of maternal position on duration of labor.

A meta-analysis conducted on 5,218 women indicated that in 25% of the studies, the first labor stage was shortened as a result of the upright positions with a mean of about 90 min, compared to that after the lying positions. Furthermore, the maternal position at the first stage of labor was not found to affect the duration of the second stage of labor. On the other hand, the upright maternal position during the second stage of labor caused a four-minute decline in the duration of this stage, which is not of clinical significance. It has been mentioned in this study that due to the low quality of the studies included in the systematic reviews, the results should be interpreted cautiously and further studies with higher quality are recommended (44). Accordingly, in the present review, we entered the randomized clinical trials with proper quality because this type of study has the least bias and is considered

as the best evidence-based study design for finding the evidence related to an intervention. The fetal-neonatal outcomes investigated in the present study entailed the one- and five-minute Apgar scores, umbilical venous pH, fetal health score, need for neonatal resuscitation, and need for hospitalization in the NICU. All the mentioned outcomes were evaluated among the two groups of lying and upright positions at the first and second labor stages (20, 24, 25, 27, 29-31, 34, 36, 41). Theoretically, the diminished risk of pressure on the aorta and inferior vena cava might contribute to the improvement of fetal-neonatal outcomes at the upright position, compared to the lying position (2, 40). However, the investigations reviewed in the present study did not confirm the latter theory.

Out of the 11 studies on fetal and neonatal health, in 9 (81.8%) studies investigating 2,480 samples in two groups of intervention and control, no significant difference was observed. Only in 2 (18.2%) studies performed on 300 pregnant mothers, it was reported that one-minute Apgar score was higher in the group in which the position was selected by the women and the 4-7 minute Apgar score was higher in the side-lying and sitting positions group (33, 42).

Evidence-based performance involves the adoption of the best existing evidence in clinical decision-makings. More comprehensively, evidence-based performance can be defined as the secure, accurate, and efficient application of the best available evidence in making decisions about taking care of all the patients individually (46). Blinding omits the observer bias in the clinical trials (47); however, in the present review, the blinding of the care provider and mothers was not possible because of the intervention nature. As a result, the appraisal of the studies included in the current systematic review showed that 76.47% of the articles were of moderate quality because the studies did not obtain the score related to the blinding item. It should be mentioned that in some studies the person who completed the analyses was blind. Moreover, the present review study indicated that the data extracted from the studies carried out in and out of Iran were controversial, which could be due to the difference in the study design and intervention type.

The results of the reviewed studies demonstrated that various maternal positions during the first and second stages of labor, has no effect on maternal, fetal-neonatal outcomes. It should be noted that further studies using suitable methods in terms of randomization, blinding, and sample size are required for making decisions regarding the delivery position at the first and second stages of labor.

The selection of randomized clinical trials, in addition to the search of international and local databases, could be considered as the strength of the present systematic review, because the Cultural, local, and ethnic contexts can all influence the results of the studies.

On the other hand, the inclusion of studies limited to the two languages of Persian and English and the lack of possibility of performing a meta-analysis are among the limitations of this review.

## Conclusion

According to the findings of this systematic review, maternal position during the first and second stages of labor do not affect the maternal, fetal, and neonatal outcomes. However, all studies have concluded that the low-risk mothers should have the possibility to choose a comfortable position in the labour wards. In order to propose an evidence-based care plan for maternal position in the labour, it is recommended to perform further studies with higher quality concerning the effect of maternal position at the first and second stages of labor on maternal, fetal, and neonatal outcomes.

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## Conflicts of interest

The authors declare no conflicts of interest.

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