ORIGINAL RESEARCH

The effectiveness of sitting position during second stage of labor among primiparae on maternal and neonatal outcomes

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ABSTRACT

Background: There is longstanding debate concerning the most advantageous labor positions. Lithotomy position is the most common position used in tertiary settings, but the sitting position has been recommended more recently. Labor position in the second stage of labor affects maternal and neonatal outcomes. Therefore, the current study aims to compare the effectiveness of lithotomy and sitting positions during the second stage of labor on maternal and neonatal outcomes using a quasi-experimental design with purposeful sampling.

Methods: Sample size: 120 low-risk primiparae, divided equally in sitting and lithotomy positions. Setting: Labor and delivery unit at King Abdulaziz University Hospital (KAUH), Jeddah. Sampling: Data collected over six months, from January to June 2020. Tool: A structured, five-part questionnaire. Data analysis: Chi-square test with post hoc Bonferroni test to examine significant differences between the two groups, using SPSS version 24.0.

Results: Significant positive effects of sitting position are observed in reduced episiotomy rate and newborn transfer to the intensive care unit, shortened second stage of labor, improved mode of delivery, newborn arterial cord PH, Apgar score at one and five minutes of life, and maternal satisfaction (p-value < .05).

Conclusions: The sitting position during the second stage of labor has more positive effects than the lithotomy position for maternal and neonatal outcomes. Recommendation: Women should have the right to be educated about the benefits of the sitting position during the second stage of labor.

Key Words: Sitting position, Lithotomy position, Maternal outcomes, Neonatal outcomes, Second stage of labor

1. INTRODUCTION

Labor is divided into four stages (first, second, third, and fourth).[1] The second stage of labor is the period of the time between full cervical dilatation and the expulsion of the fetus, during which women have an involuntary urge to bear down, as a result of expulsive uterine contractions.[1–3] This study focuses on the second stage of labor because it is the most stressful of the four stages, with profound impacts on maternal and neonatal outcomes.

There have been longstanding debates on the optimum maternal second stage position. Women commonly delivered in an upright position in earlier times, and adoption of the litho-

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tomy position for birth was attributed to the mid-seventeenth century advent of forceps.[4,5] The World Health Organization recommended an upright position in 1996.[6] The position at labor is divided into horizontal and upright positions. In horizontal positions, the mother mainly lies on the bed with her weight supported by her back, as in the supine, semi-recumbent, and lithotomy positions. In upright positions, the mother's feet are on the ground, such as standing, sitting, or squatting.[5–8]

Today, the lithotomy position is widely used as a standard birth position in hospitals.[6] In lithotomy position the direction of the woman's womb entails that she pushes against gravity.[9] This counter-intuitive position seems to have been adopted without consideration of maternal and neonatal physiological consequences.[5,10] It is generally justified based on its utility primarily for healthcare professionals rather than service users; for instance, it is claimed that this position enables the healthcare provider to monitor the neonate, and facilitates a hands-on approach to perineal management.[10,11] Negative consequences associated with lithotomy position include that it: promotes loss of control; damages the lower extremity nerves; narrows the pelvis, thereby constricting the birth canal by up to a third; and puts the neonate in an unfavorable drive angle related to the maternal pelvis, which makes it difficult for the fetus to descend.[8,11] The lithotomy position in the second stage of labor has inherent risks and disadvantages for maternal and neonatal outcomes.[9,12]

The advantage of sitting position includes facilitating the body's natural physiological process to enhance the delivery of the neonate, promoting the use of gravity and the woman's urge to bear down, with fewer instrumental deliveries, decreased perineal tears, reduced rate of episiotomy, and enhanced neonatal circulation (and thereby oxygenation).[13] Subsequently, psychological advantages involve increasing the maternal feeling of control, minimizing the experience of pain and therefore satisfaction.[5,14,15] Additionally, good condition Apgar scores are reported in the first minute for neonatal outcomes.[16,17] However, there are some disadvantages, including that women may experience more labial and second degree tears, and increased risk of postpartum hemorrhage.[13,16]

The primary goal of midwifery care during the second stage of labor is to ensure the best possible outcome for mothers and neonates,[18] by understanding the benefits and risks of labor positions that can facilitate the birthing process and improve maternal and neonatal outcomes.[19] Midwives can make a positive change in the lives of women, newborns, families, and communities, and prevent negative experiences associated with childbirth, by offering more supportive and consultative birthing experiences, such as improved choices for the second stage of labor.[6]

1.1 Significance of the problem

The maternal position during labor is a significant factor that directly affects maternal and neonatal outcomes.[19] The sitting position may serve as a non-medical intervention to facilitate labor progress;[6] it is safe, simple, and practical. It is an effective way to minimize maternal and neonatal morbidity and mortality, enhance childbirth outcomes, and improve maternal and neonatal quality of life and service user satisfaction. Furthermore, giving birth is a profound experience that carries significant meanings for mothers and their families.[14] Limited research has considered the effect of sitting and lithotomy position on maternal and neonatal outcomes in Saudi Arabia. Therefore, the present study examines the effects of sitting position during the second stage of labor on maternal and neonatal outcomes.

1.2 Objective

1) To examine the effect of the sitting position when assumed by primiparae during the second stage of labor on maternal outcomes.
2) To examine the effect of the sitting position when assumed by primiparae during the second stage of labor on neonatal outcomes.
3) To compare the effects of the sitting position and the lithotomy position during the second stage of labor on maternal and neonatal outcomes.

2. METHODS

2.1 Research design

The study was conducted using a quasi-experiment design.

2.2 Setting

The present study was conducted in labor and delivery unit at King Abdulaziz University Hospital in Jeddah, Saudi Arabia.

2.3 Subjects

Purposeful sampling included 120 primiparous women selected according to certain inclusion criteria for all primiparae: second stage of labor; aged 20-35 years; normal body mass index ($18 \leq 25$ kg/m2); gestational age ≤ 37 and < 42 weeks; single viable fetus, with an occipital anterior position, with a normal course of pregnancy; spontaneous onset of labor or induction; free from any medical or obstetrical problems, and neonatal or maternal pelvis anomalies. Stephen Thompson's formula was used to calculate sample size, considering key statistics [CI = 95.0%, power = 0.8, confidence limit = 0.05]. Based on the sample size formula and total number of primiparae admitted in the above setting over the

last three months, 120 primiparae were selected. The sample was divided by days into two groups: the first two days for the lithotomy position (n = 60), and the remaining two days for the sitting position (n = 60).

2.4 Tool for data collection

The researcher used a structured questionnaire for data collection, consisting of five parts:

Part (I) Socio-Demographic Data: To assess maternal demographic characteristics (age, educational level, residence, occupation, etc.).

Part (II) Maternal and Neonatal Initial Assessment: To assess maternal and neonatal condition during the first stage of labor (gestational age, body mass index, duration of first stage, fetal heart rate, types of analgesia, and augmentation, etc.).

Part (III) Maternal Outcomes Checklist: It was divided into three parts: (1) Perineum condition after birth, (2) Duration of second stage, and (3) Mode of delivery.

(1) Perineal condition after birth was classified as first, second, third, and fourth degree perineal tears according to the classification system set out by the Royal College of Obstetricians and Gynecologists.[21] The researcher added no tear for intact perineum, episiotomy, and other (referring to para-urethral, urethral, and labial tears).

(2) Duration of the second stage of labor was noted in minutes (< 60, 60 < 90, 90 < 120, 120-180 minutes), according to recommendations set out in the WHO's latest update of 2018.[3]

(3) Mode of delivery included spontaneous vaginal delivery (SVD), Caesarian section (C-section), and assisted vaginal delivery.

Part (IV) Neonatal Outcomes Checklist: Included sex, weight, Apgar score (at first and fifth minutes after birth), arterial cord PH, and incidence of newborn admission to NICU.

The Apgar score system uses the classifications of ≤ 4 indicating severe asphyxia, 5-7 indicating moderate asphyxia, and 8-10 indicating good condition.[22] Arterial cord PH was adopted from Perveen et al., with the PH classifications of < 7.0 indicating severe acidemia, $7.0 \leq 7.24$ indicating mild to moderate acidemia, and $7.24 \leq 7.35$ and > 7.35 indicating normal arterial cord blood gases.[23]

Part (V) Maternal Satisfaction with Labor Position: To assess mothers' satisfaction level with the labor position. Two attached questions assessed maternal opinions regarding satisfaction with the delivery position, and preferred position for next labor.

2.5 Pilot study

A pilot study was conducted involving 10% of the total number of the study sample, comprising 12 primiparae who met the inclusion criteria (6 primiparae in each group). These participants were not included in the main study sample.

2.6 Tool validity and reliability

The tool was revised by five faculty members in maternity nursing sciences to ensure validity. Modifications included changing some phrasing to be more easily comprehensible were considered according to their comments.

The reliability test was done during the pilot study (described above) and involved inter-rater reliability, to examine the internal consistency of the tool's questions. Inter-rater reliability was 95%.

2.7 Ethical considerations

The study was approved by the ethical committee of the studied tertiary hospital, to facilitate access to the participants to gather the necessary data, while ensuring confidentiality and fully respecting the privacy of the participants' records and information. Permission from participants was also ascertained via a written consent form, when those identified as being eligible to participate were invited to take part voluntarily, after a full explanation of the study's purposes and their rights. The researcher obtained their written informed consent at the commencement of the data collection process and ensured that they had a clear understanding of the purpose of the study and knew at any time they had the right to withdraw from the study and that their decision to decline to participate or subsequently withdraw would not affect the care they or their infants received or their statutory rights. After collecting data, the questionnaires were stored in locked filing cabinets (for paper forms) and password-protected computer files (for electronic data) accessible only to the researcher.

2.8 Process of data collection

Phase I: Preparatory phase

The researcher prepared and designed the data collection tool after reviewing the literature related to the current study.

The ethical committee at King Abdulaziz University hospital approved the study. The researcher met with the head of the obstetrics and gynecology department to briefly explain the purpose of the study, and inform her about the value of the research. The researcher then met with the head nurse in the labor and delivery room to discuss facilitation of the study.

Finally, a pilot study was conducted in the previously mentioned setting with 10% (n = 12) of the total study participants, who were excluded from the study sample that underwent subsequent analysis to ensure the clarity of the study

tool.

Phase II: Implementation phase

The data collection was carried out from beginning of January 2020 to the end of June 2020, during the day shift from 8 am to 4 pm.

The researcher visited the labor room at the hospital, and met the participants during their first stage of labor. The phase commenced by selecting 120 participants matching the study inclusion criteria and clarifying the nature of the study to them. The researcher introduced herself and explained the purpose of the study. The researcher discussed and explained how to perform the position for each woman in the study and control groups, and described the benefits and risks of the allocated positions, and what to expect during the second stage of labor, to help each woman to fully understand the process.

Participants who were willing to participate in the study were asked to sign the informed consent form. The participants were selected and divided by days equally into two groups (intervention group and control group). The tool was completed by the researcher for all participants in both the intervention and control groups in the labor and delivery room. The women were interviewed during the first stage of labor, and data were collected regarding their socio-demographic characteristics using maternal and neonatal assessment tools.

The researcher placed the women in the delivery position during the second stage of labor. In the control group, women were positioned in the bed, resting on their backs, with flexed hips and legs supported by stirrups, from the fully dilated and vertex at zero station until neonatal delivery, facilitated by the hospital bed. They remained in this position for a maximum of two hours. For the study group, women were put in the bed with their heads and back raised at least 60 degrees from the pelvis,[6, 19] from the fully dilated and vertex at zero station until newborn delivery, facilitated by the hospital bed, also for a maximum of two hours. The researcher stayed with every woman until the completion of delivery. Throughout this period, the Apgar score was determined immediately after newborn delivery, with repeated measurement after 5 minutes. Also, 3 ml blood was drawn from the umbilical artery by the researcher in a pre-heparinized plastic syringe using an ABL800 Basic blood gas and electrolyte analyzer, and the results of the analysis were recorded in the neonatal checklist. Also, the second stage duration, mode of delivery, and the perineum condition after birth were recorded after repairing perineal tears or episiotomy by the researcher in the maternal outcome checklist, together with maternal satisfaction about the delivery position.

Phase III: Evaluation phase

At the end of this phase, the participants in both groups were evaluated immediately for maternal outcome (perineum condition, duration of the second stage, and mode of delivery) and neonatal outcomes (Apgar score and arterial cord pH), after implementing position during the second stage of labor, using the same tool throughout the current study period for both groups.

2.9 Statistical analysis

A statistical software SPSS IBM for Windows version 24.0 was used to perform the statistical analysis. Qualitative data were presented as frequencies, percentages, means, and standard deviation (SD).

Chi-square test, and post hoc Bonferroni test were used to estimate the degree of association, and p-value was considered statistically significant at the level .05.

3. RESULTS

Table 1 shows the demographic characteristics of the homogenous study groups. More than three-quarters of the women in the sitting group were Saudi nationals, as were the vast majority of the women in the lithotomy group. The mean age of women in the sitting group was 25.78 years, slightly younger than the 27.07 years of the lithotomy group. Regarding residency, the majority of the study participants in both groups live in Jeddah. More than two-thirds of women in the sitting group have a bachelor's degree, compared to more than three-quarters of women in the lithotomy group. Concerning occupational status, the results show that more than two-thirds of the women in the sitting position were housewives, compared to three-quarters of women in the lithotomy group.

Table 2 shows the effect of labor position on the women's perineum condition after birth. There were no statistically significant differences between both groups regarding perineum condition after birth in relation to all type of tears. However, there were statistically significant differences in relation to the effect of labor position on episiotomy ($p <$ .05), indicating that a sitting position has a significant effect on minimizing the episiotomy rate. Additionally, post hoc Bonferroni test showed that the number and percentage of episiotomies increases significantly in the lithotomy position.

Table 3 displays the effect of sitting position on the duration of the second stage of labor and mode of delivery in the lithotomy and sitting position groups. There were statistically significant differences in relation to the effect of maternal delivery position in the duration of the second stage ($p <$ .00). A current result reveals that a sitting position has a signifi-

cant effect on shortening the second stage of labor. Post hoc test showed that the duration of the second stage of labor decreases significantly with the sitting position. Moreover, there were statistically significant differences in relation effect of maternal delivery position in the mode of delivery ($p < .001$). Post hoc tests showed that sitting position was more effective and significant to facilitate SVD than lithotomy position, the latter of which is more significantly likely to lead to delivery by C-section. Hence, there is no statistical effect of labor position on the reason for assisted delivery or C-section between both groups ($p > .05$).

Table 1. Sample distribution according to participants' demographic characteristics

Variables		Lithotomy, n (%)	Sitting, n (%)	Total, n (%)
Nationality	Saudi	54 (90.0)	47 (78.3)	101 (84.2)
	Non-Saudi	6 (10.0)	13 (21.7)	19 (15.8)
Age groups (yrs)	20 - 25	18 (30.0)	33 (55.0)	51 (42.5)
	25 < 30	27 (45.0)	14 (23.3)	41 (34.2)
	30 - 35	15 (25.0)	13 (21.7)	28 (23.3)
Mean ± SD	20 - 35	27.07 ± 3.74	25.78 ± 4.48	120
Residency	Jeddah	56 (93.3)	57 (95.0)	113 (94.2)
	Other	4 (6.7)	3 (5.0)	7 (5.8)
Education	< High school	3 (5.0)	1 (1.7)	4 (3.3)
	High school	11 (18.3)	18 (30.0)	29 (24.2)
	Bachelor	46 (76.6)	41 (68.3)	87 (72.5)
Occupational status	Housewife	45 (75.0)	42 (70.0)	87 (72.5)
	Student	4 (6.7)	10 (16.7)	14 (11.7)
	Working	11 (18.3)	8 (13.3)	19 (15.8)

Note. Sample n = 120 (lithotomy n = 60, sitting n = 60)

Table 2. Sample distribution according to the effect of maternal position on perineum condition after birth

Perineum condition after birth		Lithotomy n (%)	Sitting n (%)	Chi-square	*p*-value
Tear	Yes	13 (21.7)	10 (16.7)	0.484	.487
	No	47 (78.3)	50 (83.3)		
Episiotomy	Yes	31 (51.7)	17 (28.3)	6.806	.009
	No	29 (48.3)	43 (71.7)		
1st degree tear	Yes	6 (10.0)	14 (23.3)	3.840	.050
	No	54 (90.0)	46 (76.7)		
2nd degree tear	Yes	11 (18.3)	17 (28.3)	1.677	.195
	No	49 (81.7)	43 (71.7)		
3rd degree tear	Yes	1 (1.7)	0 (0.0)	1.008	.315
	No	59 (98.3)	60 (100.0)		
4th degree tear	Yes	0 (0.0)	1 (1.7)	1.008	.315
	No	60 (60.0)	59 (98.3)		
Others	Yes	9 (15.0)	17 (28.3)	3.142	.076
	No	51 (85.0)	43 (71.7)		

Note. Sample n = 120 (lithotomy n = 60, sitting n = 60)

Table 4 displays the effect of lithotomy and sitting position during the second stage of labor on neonatal outcome. There were statistically significant differences in relation to arterial cord PH ($p < .00$), Apgar score at 1 minute ($p < .00$), Apgar score at 5 minutes ($p < .00$), and newborn transfer to NICU or nursery ($p < .00$). Post hoc tests showed a notably higher

prevalence of newborns with normal neonatal arterial cord PH among those delivered in the sitting position. Moreover, post hoc test showed that more newborns delivered in the sitting group had significantly improved Apgar score (8-10) than those delivered in the lithotomy position, and significantly more newborns delivered in lithotomy position had severe asphyxia (≤ 4). In addition, post hoc tests showed that newborns delivered by women allocated to the lithotomy position were significantly more liable to NICU admission than newborns delivered in the sitting position.

Table 3. Sample distribution according to the effect of maternal position on the duration of the second stage of labor and mode of delivery

Variables		Lithotomy n (%)	Sitting n (%)	Chi-square	*p*-value
Duration of 2nd stage (mins.)	< 60	7 (11.7)	42 (70.0)	42.707	0.000
	60 < 90	26 (43.3)	9 (15.0)		
	90 < 120	13 (21.7)	3 (5.0)		
	120 - 180	14 (23.3)	6 (10.0)		
Mean ± SD	45 - 180	101.23 ± 37.58	70.72 ± 34.15		
Mode of delivery	SVD	40 (66.7)	55 (91.7)	13.009	.0001
	AVD	8 (13.3)	4 (6.7)		
	C-section	12 (20.0)	1 (1.7)		
Reason for assisted/C-section	Fetal distress	11 (55.0)	2 (40.0)	1.298	0.523
	Failure to progress	8 (40.0)	2 (40.0)		
	Maternal fatigue	1 (5.0)	1 (5.0)		

Note. Sample n = 120 (lithotomy n = 60, sitting n = 60)

Table 4. Sample distribution according to the effect of maternal position during the second stage of labor on neonatal outcomes

Neonatal outcomes		Lithotomy n (%)	Sitting n (%)	Chi-square	*p*-value
Arterial cord PH	< 7.0	9 (15.0)	0 (0.0)	65.891	0.000
	7.0 ≤ 7.24	42 (70.0)	7 (11.7)		
	7.24 ≤ 7.35	9 (15.0)	46 (76.7)		
	≥ 7.35	0 (0.0)	7 (11.7)		
Mean ± SD	6.85 – 7.38	7.16± 0.12	7.31± 0.03		
APGAR score at 1 minute	8-10 (good condition)	21 (35.0)	53 (88.3)	36.268	.0000
	5-7 (moderate asphyxia)	30 (50.0)	6 (10.0)		
	≤ 4 (severe asphyxia)	9 (15.0)	(1.7)		
Mean ± SD	4- 10	6.75± 1.53	8.47± 0.89		
APGAR score at 5 minute	8-10 (good condition)	47 (78.3)	60 (100.0)	14.579	.0000
	5-7 (moderate asphyxia)	13 (21.7)	(0.0)		
Mean ± SD	7- 10	9.00± 1.20	9.92± 0.33		
Newborn Transfer to	NICU	15 (25.0)	0 (0.0)	17.143	.0000
	Nursery	45 (75.0)	60 (100.0)		

Note. Sample n = 120 (lithotomy n = 60, sitting n = 60)

4. DISCUSSION

Positions that may contribute to optimal and poor maternal and neonatal outcomes have been identified. The findings of this study are consistent with those of Edqvist et al., who conducted a prospective cohort study among 2992 low-risk women.[7] The prevalence of perineal tear was 60.9% among primiparae mothers, while no association was found between flexible sacrum positions (including sitting position) and spontaneous perineal tear. Flexible sacrum positions were associated with fewer episiotomies. Furthermore, contrary

to earlier findings, Rezaie et al. reported that the effect episiotomy was not significantly different among three different positions (including lithotomy and sitting position) in the second stage of labor on perineum status, and some birth outcomes among 96 primiparae women ($p > .05$). Nevertheless, the same study reported that the frequency distribution of perineal tears was not significantly different among the three groups ($p > .05$).[24]

Additionally, in the current study, only one woman in each group suffered from a severe perineal tear, due to assisted vaginal delivery in both groups. These relationships may partly be explained by the episiotomy protocol performed in the hospital, which depends on the physician's assessment of the perineal area and estimated neonatal weight, or the possibility of assisted vaginal delivery due to restrictive episiotomy policy. This finding corroborates Mohamed et al., who found an association between sitting position with shortened duration of the second stage of labor compared to standard care among 279 primiparae cases in Egypt.[18] However, contrary to the earlier findings, the Epidural and Position Trial Collaborative Group studied 3093 primiparae cases with two main delivery positions, including sitting as one of the upright groups, and lithotomy as one of the recumbent ('lying down') groups, and found a statistically significant difference at the 1% level in the recumbent group, with a shorter duration of labor.[16]

A possible explanation of this might be that in the sitting position the direction of maternal pushing works with gravity, which decreases the bearing down efforts and enhances fetal descent, thereby facilitating labor progress and shortening the second stage of labor. However, in lithotomy position, the direction of maternal pushing is against gravity. Moreover, consistent with the present results, previous studies among 5840 women in Australia to investigate the factors that improve or inhibit normal birth reported that women are more likely to have a normal vaginal birth if they use a non-supine birth position.[25] In contrast to earlier findings, the incidence of spontaneous vaginal birth was reported, with 35.2% of women achieving spontaneous vaginal birth in the upright group compared to 41.1% in the recumbent group. This represents a 5.9% absolute increase in the chance of spontaneous vaginal birth in the recumbent group.[16] A possible explanation of this might be the effects of gravity in sitting position promoting labor progress, and facilitating fetal descent, therefore facilitating spontaneous vaginal birth.

In contrast to the current results, the Epidural and Position Trial Collaborative Group's study of 3093 primiparae cases found cord artery pH < 7.05 reported among 35.5% of women in the upright position, compared to 40.4% of women in the recumbent group.[16] This result may be explained by the fact that the sitting position avoids compression of the inferior vena cava, thereby increasing venous returns to the blood perfusion of the placenta, which affects the fetus oxygen supply, as reflected in the normal pH of the umbilical arterial blood. Lithotomy position comparatively compromised the intra-abdominal vessels, thereby decreasing uteroplacental perfusion, thus lowering neonatal Ph.

Similarly, these results are in agreement with a Souza et al.'s findings, which showed that the APGAR score 7-10 at one minute was 94.7%, and 99.1% at the fifth minute. Additionally, consistent with the current results, da Rosa dos Reis et al. reported that (87.7%) of the newborns had higher than 7 Apgar scores in the first minute of life, and 96.7% in the fifth minute.[26] Edqvist et al. reported that only 0.6% of newborns had an Apgar score below 7 at five minutes.[27] Similar findings were also reported by the Epidural and Position Trial Collaborative Group, with few babies at five minutes of life experience a low Apgar score (upright group two newborns, and recumbent group three newborns). This result may be explained by the fact that no assisted or operative delivery cases were included, which are usually performed during the second stage of labor in case of fetal distress.

In conclusion, the findings revealed that the sitting position was effective during the second stage of labor in improving maternal and neonatal outcomes compared to the lithotomy position, except with regard to perineal tear. Based on these findings, it is recommended that all women with low-risk labor should be educated about the benefits of assuming sitting positions during the second stage of labor, and be encouraged and supported to use them. Increasing health professionals' awareness of the delivery position, especially for those in low-risk groups, is also advisable.

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CONFLICTS OF INTEREST DISCLOSURE

The authors declare that there is no conflict of interest.

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