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Spontaneous Pushing in Lateral Position versus Valsalva Maneuver During Second Stage of Labor on Maternal and Fetal Outcomes: A Randomized Clinical Trial

Farideh Vaziri,[1,*] Amene Arzhe,[2] Nasrin Asadi,[3] Saeedeh Pourahmad,[4] and Zeinab Moshfeghy[1]

[1]Department of Midwifery, Shiraz University of Medical Sciences, Shiraz, IR Iran
[2]Student Research Committee, Shiraz University of Medical Sciences, Shiraz, IR Iran
[3]Department of Obstetrics and Gynecology, Shiraz University of Medical Sciences, Shiraz, IR Iran
[4]Department of Biostatistics, Shiraz University of Medical Sciences, Shiraz, IR Iran

[*]*Corresponding author*: Farideh Vaziri, Department of Midwifery, School of Nursing and Midwifery, Shiraz University of Medical Sciences, Shiraz, IR Iran. Tel: +98-71136474254, Fax: +98-71136474252, E-mail: Roose82003@yahoo.com

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Abstract

Background: There are concerns about the harmful effects of the Valsalva maneuver during the second stage of labor.
Objectives: Comparing the effects of spontaneous pushing in the lateral position with the Valsalva maneuver during the second stage of labor on maternal and fetal outcomes.
Methods: Inclusion criteria in this randomized clinical trial conducted in Iran were as follows: nulliparous mothers, live fetus with vertex presentation, gestational age of 37 - 40 weeks, spontaneous labor, and no complications. The intervention group pushed spontaneously while they were in the lateral position, whereas the control group pushed using Valsalva method while in the supine position at the onset of the second stage of labor. Maternal outcomes such as pain and fatigue severity and fetal outcomes such as pH and pO2 of the umbilical cord blood were measured.
Results: Data pertaining to 69 patients, divided into the intervention group (35 subjects) and control group (34 subjects), were analyzed statistically. The mean pain (7.80 ± 1.21 versus 9.05 ± 1.11) and fatigue scores (46.59 ± 21 versus 123.36 ± 43.20) of the two groups showed a statistically significant difference ($P < 0.001$). Moreover, the mean duration of the second stage in the intervention group was significantly higher than that in the control group (76.32 ± 8.26 minutes versus 64.56 ± 15.24 minutes, $P = 0.001$). The umbilical cord blood pO_2 levels of both groups showed a statistically significant difference (28.29 ± 11.76 versus 18.83 ± 9.86, $P < 0.001$), whereas their pH levels were not significantly different ($P = 0.10$).
Conclusions: Spontaneous pushing in the lateral position reduced fatigue and pain severity of the mothers. Also, it did not worsen fetal outcomes. Thus, it can be used as an alternative method for the Valsalva maneuver.

Keywords: Second Labor Stage, Valsalva Maneuver, Nulliparity, Fetal Outcomes, Natural Childbirth, Fatigue, Labor Pain

1. Background

The second stage of delivery, which starts from complete cervical dilation and is called the out driving stage, is one of the crucial stages for both mother and fetus. This stage is known as the emergency, acceleration, and instruction-to-push stage, with the assumption that shortening its length is beneficial (1).

In the traditional method and according to well-known obstetrics textbooks such as Williams Obstetrics, the Valsalva maneuver is used for managing the second stage of labor. The mother is asked to take a deep breath, hold the breath (closed glottis), and push downward when uterine contraction starts. In this maneuver, the mother is in the supine position and is encouraged to pull her knees onto her abdomen and press them while pushing (2, 3).

Recent scientific publications do not support the use of the Valsalva maneuver during the second stage of labor, and evidence suggests that it might be harmful. A relationship has been observed between the Valsalva maneuver and reduction of oxygen supply to the fetus, maternal fatigue, and damage to the perineum (4, 5).

The findings of two studies showed that an extended period of apnea (long closed glottis) associated with the Valsalva maneuver during the expulsive stage of labor led to increased lactate concentration in the mother and fetus, negatively affecting the fetal acid-base balance, as demonstrated by the umbilical vein pH (6, 7).

A strong Valsalva maneuver causes the mother to increase abdominal pressure, which can result in a pressure

higher than that of uterine blood perfusion, thus reducing the uterus-placental blood flow. This effect could alter the oxygen supply available to the fetus and cause fetal acidemia secondary to anaerobic metabolism (4, 5, 8).

A proposed alternative to the traditional approach for handling the second stage is spontaneous pushing, also known as passive descend or second-stage physiologic stage. In this way, the mother does not have to push from the beginning of the contractions. She pushes as she desires based on the pressure resulting from fetal descent. The glottis is open and the mother has three attempts for pushing during a uterine contraction. When pushing with open glottis, the pressure on the chest does not increase and there are fewer hemodynamic effects. Therefore, fetal placental circulation is maintained (5, 9, 10).

Brancato et al. and Roberts et al. found that spontaneous pushing leads to greater release of oxytocin, effective uterine contractions, better rotation and descent of the fetal head in the maternal pelvis, rapid progress of labor, and, as a result, increase in spontaneous vaginal delivery. Each of these factors can lead to improved maternal and fetal outcomes (11, 12). In a study conducted by Simpson et al. the effects of immediate versus delayed pushing during the second stage of labor on fetal outcomes was investigated. In the immediate pushing group (immediately after complete cervical dilatation), there were fewer instances of fetal oxygen saturation, reduced fetal heart rate, and more perineal laceration (9). In a study by Bloom et al., women who were encouraged to push during uterine contraction had a shorter second stage in comparison with the women in spontaneous pushing group (13), whereas the opposite was found in a study by Yildirim and Beji (14).

Maternal position in the second stage of labor plays an important role in maternal and fetal outcomes. Maternal position influences blood flow to the uterus and feeling of pain by laboring women (15). Furthermore, a study showed maternal influence on birth positions was one of the significant predictors of sense of control in women (16). Unlike traditional practices, the supine position is common in modern maternity units, with which most mothers and caregivers are familiar. A retrospective study showed that among 606 laboring women who were in midwifery-led care, 462 (76.23%) women used the supine position during the second stage of labor (17). In a study by Downe et al., delayed pushing in the lateral position resulted in reduced instrumental delivery and episiotomy rates compared with the corresponding rates in the sitting position (18). In contrast, in another study non-recumbent positions (upright, sitting, or squatting positions) were associated with significantly shorter first and second labor stages, lower pain scores and analgesia request rates, and increased normal delivery rate (19).

2. Objectives

In Iranian maternity centers, similar to those in many other countries, during the second stage of labor, mothers are asked to use the Valsalva maneuver in the supine position with the onset of uterine contractions. Caregivers ask mothers to change their position to lateral during uterine rest to prevent fetal hypoxia. Frequent position change itself is a factor for maternal fatigue and is possibly a very disruptive experience for mothers. Therefore, we decided to examine the changes in the management of the second stage of labor and compare the impact of these changes, which include the position and the pushing method, in comparison to the conventional technique.

3. Methods

3.1. Research Environment and Participants

This study was performed as a clinical trial on nulliparous mothers in two government teaching hospitals, namely, Hafez and Hazrat Zeinab, affiliated to Shiraz University of Medical Sciences. sampling was carried out between March 2014 and late May 2014. This study was approved by the ethics Committee of Shiraz University of Medical Sciences, and the ethics code number is CT-92-6920. Moreover, the present study has been recorded in the Iranian registry of clinical trials, and the registration number is IRCT2014051210327N6.

Inclusion criteria of the study were as follows: nulliparous mothers; live fetus with vertex presentation; gestational age of 37 - 40 weeks; spontaneous labor; and lack of chronic diseases, pregnancy complications such as preeclampsia and placental abruption, and premature rupture of membranes. If the mother underwent Caesarean section during labor or refused to participate in the study, she was excluded from the study.

In this study, data collection was performed by one observer only, who was a member of the research team. The participants were selected based on the inclusion criteria by studying records and interviewing the mothers. Then, by describing the study aims, the mothers were encouraged to participate in the study, and if willing to do so, written consent was obtained. All participating mothers received routine care in the maternity unit until the beginning of the second stage of labor.

3.2. Intervention Method

In the second stage of labor, the mothers in the intervention group pushed when they felt the urge to push while being in the lateral position during pushing, whereas the mothers in the control group pushed from the

onset of the second stage using the Valsalva method while being in the supine position, according to the routine practice in the maternity unit. Other treatments in both groups were similar.

3.3. Maternal Outcomes

Duration of the second stage of labor, duration of pushing, pain, and fatigue severity in the second stage were recorded as maternal outcomes. The Visual Analogue Scale (VAS) was used for determining pain severity. The VAS comprises a 100-mm line positioned horizontally with the extremes labeled "no pain" and "worst possible pain." The pain VAS has been shown to be highly correlated with the other pain scales, with correlation coefficients ranging from 0.71 to 0.95 (20, 21). Intra-class correlation coefficients between VAS scores taken 1 minute apart were between 0.95 and 0.98 (22).

Fatigue intensity was also determined using the VAS. Fatigue VAS was correlated with the Multi-Dimensional Assessment of Fatigue (MAF) at 0.80 and with the Short Form 36 vitality subscale (SF-36 VT) at 0.71. The intra-class correlation coefficient of fatigue VAS was 0.74 within 1 - 2 days (23). According to Pugh's study, we measured fatigue intensity in the subjective, cognitive, and physiological domains. In doing so, three sequential 100-mm rulers were shown to the participants. Each ruler measured one of the subjective, cognitive, and physiological domains. These visual analogs had the following endpoints: alert to drowsy, feeling rested to extremely tired, and full of energy to completely exhausted. Thereafter, the sum of the three domains' scores was analyzed; the range of possible scores was from 0 to 300 (24). Pain and fatigue severity were measured as soon as possible after delivery.

3.4. Fetal Outcomes

Fetal heart rate patterns such as late deceleration, variable deceleration, bradycardia and tachycardia, Apgar score, and pH and pO_2 of the umbilical cord blood were studied as fetal consequences. For determining fetal heart rate patterns, continuous fetal heart monitoring devices were used (2).

3.5. Measurement of pH, and pO2 of Umbilical Cord Blood

One milliliter of arterial blood from the umbilical cord was drawn into an insulin syringe previously treated with 1000 units/mL of heparin; then, within a maximum of 60 minutes after delivery, pH and pO_2 were measured using a Gazometeric device, Opticca-TS model (25).

3.6. Sample Size and Statistical Analysis

The required sample size was estimated according to a previous study (14) based on the Apgar score at 5 minutes, considering α = 0.05 and power of 85%, and using the following formula. Mean and standard deviation in groups 1 and 2 were 9.9 $\pm$ 0.3, and 9.5 $\pm$ 0.6, respectively. Statistical analysis revealed that 23 subjects were needed in each group. Given the 20% shedding rate and for ensuring higher accuracy, the final sample size was set to 36 per group, a 72-subject sample size in total. Stratified random sampling was employed in this study. Two hospitals with maternity wards were considered as the strata. In the strata, each eligible laboring woman was assigned to the control group or the intervention group using block randomization. The block randomization strategy was as follows: the intervention and control groups were labeled as A and B, respectively. The researcher formed 6 blocks (ABAB, AABB, BBAA, BABA, ABBA, and BAAB). One block was selected randomly and participant assignment was performed according to the selected block. After filling this block, another block was selected randomly and participant assignment was continued until the sample size of the study was exhausted. Half of the sampling was done in one of the hospitals and the other half in the other hospital.

$$x_1 = \frac{2\left(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta}\right)^2 SD^2}{\left(\mu_2 - \mu_1\right)^2} \quad (1)$$

The data were analyzed using SPSS statistical software (v. 16). P values $<$ 0.05 were considered as statistically significant. At first, normality of distribution of quantitative variables was assessed using the One-Sample Kolmogorov-Simirnov Test. If the variables followed normal distribution, an independent samples T-test was performed; else, its equivalent non-parametric test, that is, the Mann-Whitney U Test, was employed.

4. Results

A total of 102 laboring women were interviewed and their medical records were assessed, and 33 laboring women dropped out of the study. The excluded cases along with reasons are shown in Figure 1. Overall, 69 participants completed the study. The maximum age was 36 years, and the minimum was 15 years. The total mean age was 22.20 $\pm$ 4.33. The independent samples t-test showed no significant differences between the two groups in terms of the mean age (P = 0.961). The majority of the participants in both groups held a high school diploma, and statistical tests showed no significant difference between the two groups

(P = 0.475). In terms of employment, 89.9% (62) of the total participants were housewives, and the two groups were not significantly different (P = 0.216) (Table 1). In total, 33.3% (23) of the sampling collection was performed in the morning shift, 34.8% (24) in the evening shift, and 31.9% (22) in the night shift. The two groups of control and intervention were not significantly different in terms of sampling time (P = 0.76).

The means of pain severity in the second stage of labor and fatigue scores between the two groups showed statistically significant differences (P < 0.001). Moreover, it was found that the two groups differed statistically significantly in terms of pushing duration and second stage length (P = 0.001). There were no significant differences between the two groups regarding the number of contractions/20 minutes (P = 0.66) (Table 2).

Maternal pain and fatigue severity were highly interdependent, so feeling more pain led to higher fatigue intensity and vice versa (P = 0.001). During the study, one Caesarean delivery was performed in the intervention group due to bleeding, and two Caesarean deliveries were performed in the control group due to second-stage arrest and fetal distress. There was no significant difference between the two groups in terms of the Caesarean delivery rate.

Fetal stations were investigated through vaginal examination using the station classification that divides the pelvis above and below the ischial spines into thirds. In all participants, the most common fetal stations, 76.8% (53), with which the second stage of labor started were -1 and 0. The two groups were not significantly different in terms of the stations at the start of the second stage (P = 0.76). In the intervention group, at the onset of spontaneous pushing, the most common fetal stations (85.7%, 30 subjects) were 0 and 1, and no subject was at fetal station -2 or lower.

The two groups did not differ significantly in terms of fetal heart rate pattern such as late and variable deceleration, and tachycardia and bradycardia (Table 3). The first- and fifth-minute Apgar scores were not statistically different between the two groups. The two groups showed statistically significant differences in the level of cord blood po2, whereas the pH levels were not significantly different between the two groups (Table 4).

5. Discussion

The second stage of labor is divided into two parts for describing its physiology. In the initial phase, also called the pelvic phase, rotation, alignment, and descent of the presentation part occurs. Ferguson reflex occurs in the late or active phase and the mother pushes spontaneously (5, 26, 27). Lack of attention to the natural physiology of the second stage leads to maternal fatigue and increases labor disorders (27, 28). Moreover, maternal fatigue affects maternal perceived pain severity and decreases maternal satisfaction. Reduction in maternal satisfaction affects the subsequent choice of delivery method (29, 30). Maternal fatigue in the second stage of labor may continue in postpartum hours or days and interfere with breastfeeding and the mother–infant relationship (29, 31).

This study showed that spontaneous pushing in the lateral position, compared with the Valsalva maneuver, reduced pain severity in the second stage of labor and fatigue level, but did not shorten the duration of the second stage of labor. Fetal outcomes such as fetal heart rate patterns, Apgar scores, and umbilical cord blood pH levels did not differ between the two groups, but the level of umbilical cord blood pO_2 of the spontaneous pushing group was higher than that of the Valsalva maneuver group.

In the present study, in the spontaneous pushing group, whether during uterine rest or uterine contractions, the mothers were in the lateral position for as long as they wished. Probably, the stability of position in the mothers was effective in decreasing fatigue severity in the intervention group compared with the control group. The relationship between pain and fatigue suggested that fatigue severity reduction could be effective for reducing pain perception. In the present study, subjects of not only the spontaneous pushing group but also the Valsalva maneuver group were transferred to a delivery room and assigned in the lithotomy position for the expulsion phase of labor. The lithotomy position in the expulsion phase of labor is probably a reason for the absence of differences in pH of the umbilical cord blood and newborn Apgar scores between the intervention and the control groups. The duration for which the subjects were in the lithotomy position was not recorded in this study. Therefore, the effect of duration of said position on maternal and fetal outcomes was not reportable.

The protocols used in previous studies comparing the two methods of managing the second stage of labor, namely, delayed pushing and the Valsalva maneuver, were not completely the same as those used in this study. Those studies differ from our study in terms of the position in the second stage, onset time of pushing, position at delivery, and the use of epidural anesthesia. For example, in the study of Hansen et al., in one group, pushing was delayed until the fetus' head appeared at the entrance of the vagina, and in the other group, the Valsalva maneuver was used from the start of the second stage of labor. Fatigue severity was measured one hour after delivery using a VAS. Fatigue severity in the delayed pushing group was significantly lower than that in the other group (32). A recent study compared maternal pain and fatigue severity

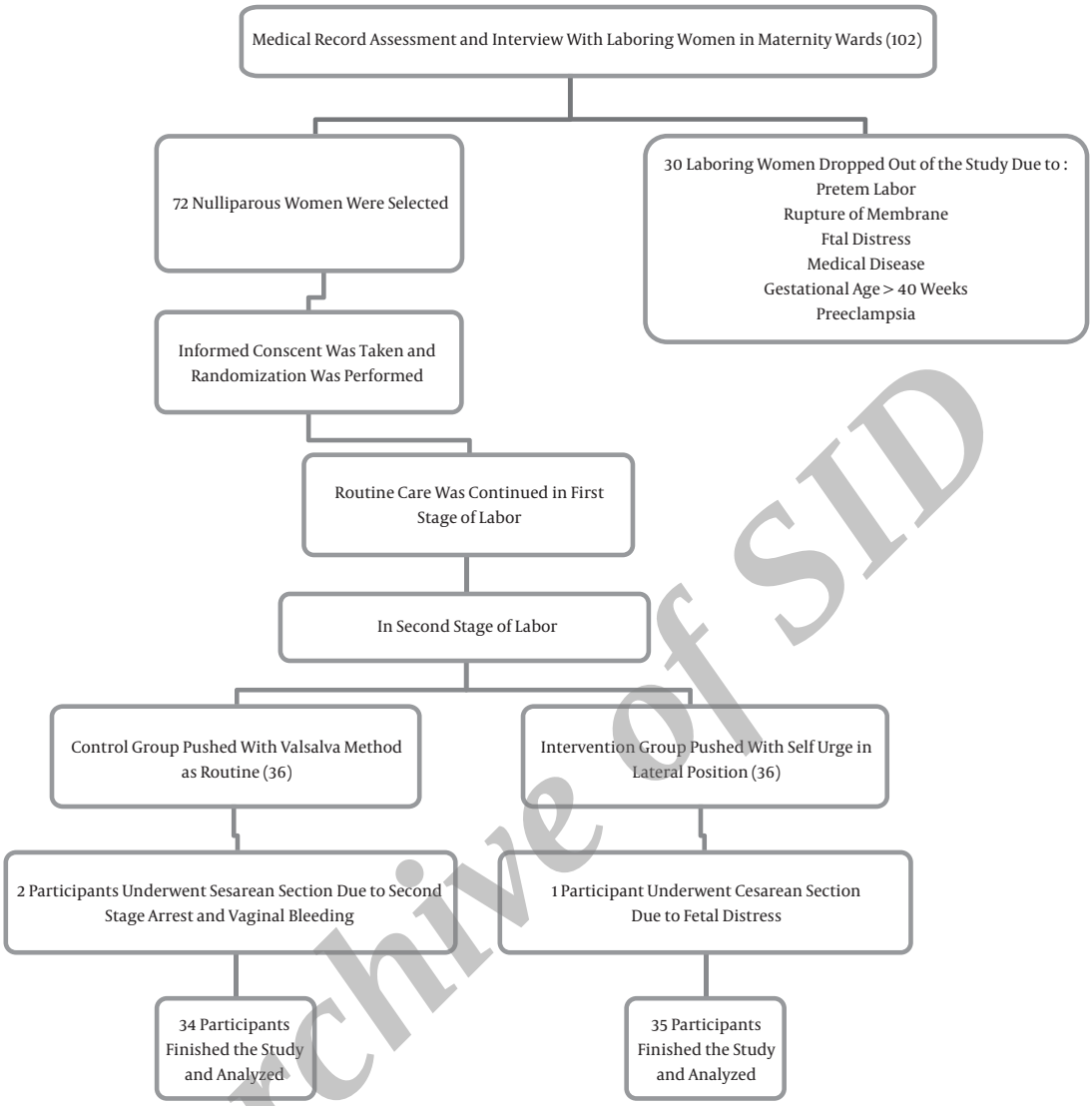

Figure 1. Flow Chart of Study

in the spontaneous pushing group in an upright position with those in the Valsalva maneuver group in the supine position. In that study, pain severity of the second stage and fatigue level at 1 - 4 hours after delivery in the spontaneous pushing group were found to be lower than the corresponding values in Valsalva maneuver group (33). Furthermore, in a study by Yildirim and Beji, maternal satisfaction in the spontaneous pushing group was higher than that in the Valsalva maneuver group (14). However, in the study by Kelli et al., in nulliparous women with epidural anesthesia, fatigue severity did not differ between the two groups of delayed pushing and Valsalva maneuver (34). According to Ebrahimzadeh et al.'s study, fatigue can influence the uterine pattern during labor (35)

The Williams obstetrics textbook limits the duration of the second stage and considers up to 2 hours for this stage in nulliparous women (2). Thus, birth attendants desire to shorten this stage. However, numerous studies in line with the present study have shown that delayed pushing increases the duration of the second stage compared with the Valsalva maneuver (9, 13, 32). Prins et al. reviewed information related to 425 nulliparous women without epidural anesthesia and concluded that the second stage of labor in women with delayed pushing is much longer than in those who pushed with the Valsalva maneuver (4).

In contrast to the above-mentioned studies, in the

Table 1. Demographic Characteristics of Intervention and Control Groups

Variables	Intervention Group (35)	Control Group (34)	P Value
Age (years) (mean ± SD)	22.23 ± 4.12	22.18 ± 4.60	0.961
Education, N (%)			Fisher's exact test
Under high school diploma	20 (57.1%)	24 (70.6%)	0.475
High school diploma	11 (31.4%)	8 (23.5%)	
Gh Above diploma	4 (11.2%)	2 (5.9%)	
Employment, N (%)			Fisher's exact test
Housewife	33 (94.4%)	29 (86.1%)	0.259
Others	2 (5.6%)	5 (13.9%)	
Sampling time			Chi - Square test
Morning	13 (37.1%)	10 (29.4%)	0.762
Evening	11 (31.4%)	13 (38.2%)	
Night	11 (31.4%)	11 (32.4%)	

Table 2. Comparison of Maternal Outcomes in Intervention and Control Groups

Variables	Intervention Group Mean ± SD[a]	Control Group Mean ± SD	P Value
Pain severity	7.80 ± 1.21	9.05 ± 1.11	< 0.001
Fatigue score	46.59 ± 21	123.36 ± 43.20	< 0.001
Duration of second stage of labor	76.32 ± 8.26	64.56 ± 15.24	< 0.001
Duration of pushing	49.14 ± 11.66	64.56 ± 15.24	< 0.001
Contractions/20 min	4.69 ± 0.83	5.03 ± 0.90	0.66

[a]Standard deviations

study by Yildirim and Beji, the use of the Valsalva maneuver led to elongation of the second stage of labor compared with spontaneous pushing (14). In Sampselle et al.'s study of 20 nulliparous women, duration of the second stage of labor did not differ between the two groups of spontaneous pushing and Valsalva maneuver (3). Furthermore, in Kelly et al.'s study of nulliparous women with epidural anesthesia, the duration of the second stage of labor in the delayed pushing group was not significantly different from that in the Valsalva maneuver group (34). Although the association between prolonged labor and postpartum fatigue has been shown (36), the studies by Hansen et al. (32), Chang et al. (33), and Haseeb et al. (37) showed that even with a longer second stage of labor in the delayed pushing group, fatigue severity is decreased compared with that in the Valsalva maneuver group. Intense muscular activity, frequent change in position from lateral to supine, and holding breath leading to an increase in blood lactic acid are reasons for increased fatigue severity in the Valsalva maneuver group (14, 22).

In several studies, similar to the present study, fetal outcomes such as mean pH of the umbilical cord blood, newborn Apgar score, and need for resuscitation were not significantly different between the Valsalva maneuver and the delayed pushing groups (9, 13, 32), while in the study by Yildirim and Beji, mean pH of the umbilical cord blood and newborn Apgar scores in the spontaneous pushing group were better than those in the Valsalva maneuver group (14). In a study, women with epidural anesthesia who used delayed pushing with a mean duration of 80 ± 5 min showed no significant difference in terms of fetal heart rate compared to the Valsalva maneuver group (34). On the contrary, in a study by Hansen et al., the occurrence of fetal distress was lower in the spontaneous pushing group than that in the Valsalva maneuver group (32).

Although in the present study the duration of the second stage in the spontaneous pushing group was higher, it did not cause an increase in maternal fatigue severity. Moreover, the longer second stage of labor in the spontaneous pushing group did not worsen fetal outcomes

Table 3. Comparison of Fetal Heart Rate Pattern in Intervention and Control Groups

Variables	Intervention Group N (%)[a]	Control Group N (%)	P Value
Late deceleration			Fisher's exact test
None	34 (49.27)	31 (44.92)	0.31
Mild	1 (1.44)	3 (4.33)	
Variable deceleration			Fisher's exact test
None	28 (40.57)	27 (39.13)	0.80
Mild	6 (8.69)	5 (7.24)	
Severe	1 (1.44)	2 (2.88)	
Tachycardia			Fisher's exact test
None	33 (47.82)	32 (46.37)	0.97
Mild	2 (2.88)	2 (2.88)	
Bradycardia			Fisher's exact test
None	33 (47.82)	27 (39.13)	0.06
Mild	2 (2.88)	7 (10.12)	

[a]Number and percentage.

Table 4. Comparison of Fetal Outcomes in Intervention and Control Groups

Variables	Intervention Group, Mean ± SD[a]	Control Group, Mean ± SD	P Value
pH	7.31 ± 0.04	7.29 ± 0.07	0.10
pO_2	28.29 ± 11.76	18.83 ± 9.86	< 0.001
Apgar (1 min)	8.91 ± 0.28	8.79 ± 0.53	0.25
Apgar (5 min)	9.97 ± 0.16	9.91 ± 0.37	0.40

[a]Standard deviations.

such as fetal heart rate patterns, pH level of umbilical cord blood, and newborn Apgar score compared to the Valsalva maneuver group. Therefore, the present study focused on the physiology of the second stage of labor, that is, providing an interval between the onset of the second stage and pushing.

To the best of our knowledge, the present study is a rare investigation of two different pushing methods in two specified positions, namely, supine and lateral. Most previous studies did not define the position in the second stage of labor or employed a variety of positions for the intervention and control groups. The limitation of the present study was interruption of the study protocol because both study groups spent the final phase of childbirth in the dorsal lithotomy position, the routine position in delivery rooms in maternity units in Iran. We suggest that a further study be conducted in which the present study protocol is continued until delivery.

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Footnotes

Authors' Contribution: Farideh Vaziri: designed and supervised all stages of the study; Amene Arzhe: assisted in designing the study and collected the data; Nasrin Asadi and Zeinab Moshfeghy: assisted in designing the study and writing the manuscript; Saeedeh Pourahmad: performed the statistical analyses; All authors read and approved the final version of the manuscript.

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