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Maternal and New-Born Outcomes When Using Upright and Supine Birth Positions During Labour and Delivery: A Quasi-Experimental Study

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Abstract

Purpose: The purpose of the study is to assess the effects of upright and supine birth positions on maternal and new-born outcomes including maternal blood losses, duration of labor, perineum tear or intact, and APGAR score of the new-born in the first and fifth minutes in two District hospitals in Tanzania.

Methodology: A quasi-experimental study design using a quantitative approach was conducted to assess the maternal and new-born outcomes in the intervention study group (upright) and non-intervention group (supine). A convenient sample of 150 parturient were included, among them 73 formed an intervention group and 77 were in the non-intervention group. Data analysis was done using SPSS version 23 whereby STATA software was used to assess the effect of the independent variables (birth positions) to the dependent variables (maternal and new-born outcomes). Results were compared using chi-square test at P-value <0.05.

Findings: Among of women who assumed upright birth position were experienced good maternal and new-born outcomes more than those in supine position. 93% and 96% of women in upright had short labour in 1st and 2nd stage respectively compared 24.68% and 44% in supine respectively (P-value <0.001). Maternal blood loss and perineum status had no significant differences in both positions while the APGAR score of the new-born in upright (p=0.018) were more advanced than those in supine group. The study revealed that, Upright birth positions provides positive effects to maternal and new-born more than supine positions. The findings of this study will help pregnant women to have choice on birthing position they feel comfortable to use during labour and delivery.

Recommendation: The Ministry of Health should build capacity of midwives to be able to conduct labour using alternative birthing positions including upright position.

Keywords: *Upright, Supine, birth positions, maternal and new-born outcomes.*

Background

The position a woman assumes during labour and delivery has an important outcome on maternal and new-born health. World Health Organization (WHO) recommends women to deliver in a position that feels much comfortable(1). Supine birth position is one of the horizontal birth positions which has been used for long time and commonly encouraged by midwives as it is perceived to facilitate observation and delivery(2). When supine position is used, it makes easier for midwives to monitor the progress of labour and support perineal in the second stage of labour including carrying out operative vaginal deliveries(3). However, supine birthing position has many negative birth outcomes including long duration of labour, perineal trauma (PT) and low Apgar score of the new-born (3). For example, in Italy more than 95% of women who gives birth in supine position sustained perineal trauma and in Sub-Sahara Africa the incidences of women who gives birth and susceptible to the same problem ranges from 19-80.4% (4–6). In Tanzania, 80% of women in the public hospitals assume supine position during delivery, however the effects on maternal and new-born outcome is not known(7,8).

Upright positions including squatting, kneeling, hand-and-knees, standing, and sitting are rarely used birthing positions although they are related to positive maternal and new-born outcomes. Using upright birthing positions are likely to result in short duration of labour in the first and second stage of labour, minimal perineal trauma and satisfactory APGAR score of the new-born in the first minute (9). However, upright position such as squatting may increase the possibility of spontaneous perineum tear, because it does not permit manual support of the perineum during the second stage of labour leading to the tissue edema caused by constant pressure on the pelvic floor (10). Most of East African countries including Tanzania information about the positive effects of upright birth positions on maternal and new-born outcome are so limited. Therefore, this study describes the effects of upright and supine birth positions on maternal and new-born outcomes i.e. duration of labour, blood loss, perineum status and Apgar score of a new-born in first minute.

Methods

Study Design and Setting

A quasi-experimental design was conducted for 2 months to compare an intervention group of women in labour using alternative birth positions (upright) and the non-intervention group used supine birth position which is the common mode of delivery in the study setting. The intervention involved instructing the labouring women to assume the upright position during labour and delivery. The outcomes measure was duration of labour, perineal trauma and amount of blood loss and the baby's Apgar score at the first and fifth minutes. In the intervention study setting, nurse-midwives received a two days training on how to provide instruction to women who were in labour and support them to use upright birth positions during labour and delivery. The study was conducted in two district hospitals in Simiyu Region that were purposeful selected because they had higher numbers of maternal deaths (Simiyu data base 2019 and Regional Reproductive Health Co-ordinator). Specifically, the data was obtained from the labour rooms of the 2 hospitals that had an average of 12 nurse-midwives. Before the study begun the ethical clearance was granted by the research and publication review board of Muhimbili University of Health and Allied Science (Ref. MUHAS-REC-06-2020-304).

Sampling and Participants

The study involved a purposive method to select two district hospitals and convenient sampling method to obtain 156 women in labour admitted in labour ward, 78 in intervention hospital and 78 in non-intervention hospital obtained by using the following formula.

$$n = (Z_{\alpha/2} + Z_{\beta})^2 * (p_1(1-p_1) + p_2(1-p_2)) / (p_1 - p_2)^2,$$

Whereby, n = number of total study participants, $Z_{\alpha/2}$ is the critical value of the Normal distribution at $\alpha/2$ when confidence level is 95% and α is 0.05 and the critical value is 1.96. Z_{β} is the critical value of the Normal distribution at β (e.g. for a power of 80%, β is 0.2 and the critical value = 0.84) and p_1 and p_2 are the expected sample proportions of the two groups. The prevalence of 95% and 80.4% of perineum trauma from a study done in Italy and Ghana (11,12) respectively were used given that in East Africa and Tanzania included the information is very limited.

The inclusion criteria were as shown in figure 1, while exclusion criteria depend on women with high risk conditions including preterm delivery, fetal distress, PROM > 12 hours, severe PIH, severe anaemia, heart diseases, obesity ($BMI \geq 30 \text{ kg/m}^2$), multiple pregnancies (twins or triple lets), malposition of the fetus women with previous caesarean delivery and those with previous perineum trauma and induction of labour.

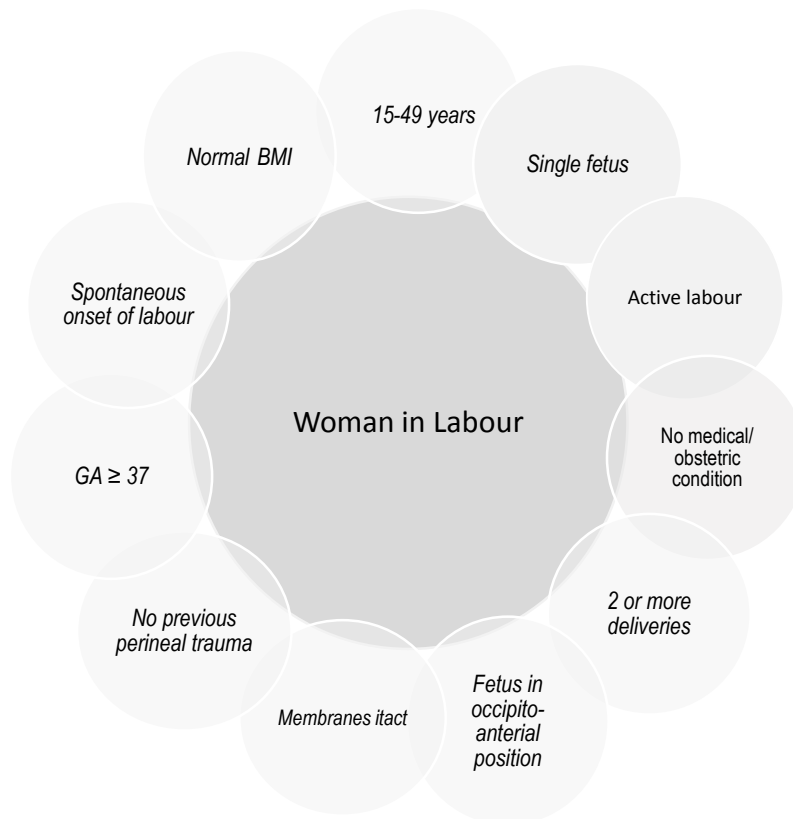


Figure 1: Inclusion criteria

Participants were informed about the study aim, procedure of data collection, voluntary nature of their participants, their freedom to withdraw from the study at any time even after they have signed a consent form and issues of confidentiality. Women who agreed to participate in the study were requested to sign a consent form that was written in Kiswahili after their questions and concerns were answered.

Data Collection Procedure

Three research assistants were trained to collect data, two at an intervention setting and one non-intervention setting. The research assistants had diploma in nursing and midwifery who worked in the labour room. The training covered how to identify eligible participants, obtaining baseline data of the progress of labour including observation of uterine contractions (duration, interval, frequency and intensity), cervical dilation, descent of the fetal head including fetal heart rate were assessed by the researcher. Using an observation checklist, research assistant documented maternal age, parity, gestation age and gravity, time when cervical dilation was 4-6cm, first felt urge to push, expulsion of the baby, APGAR score, status of the perineum and amount of blood loss (Table 1). The amount of blood loss after birth, was collected using a 500cc measurement kidney dish together with the Pathfinder International wall chart for visual estimation of blood loss through pieces of soggy gauze(13). This information was collected in both intervention and non-intervention settings. In the non-intervention group, only women who used supine birthing position were included but were not restricted to get out of bed for stretching and attending toilet if they wish to do so.

Intervention

Women in labour were encouraged by the nurse-midwife to assume different types of upright positions including walking, sitting, standing and kneeling to accompany the selected upright position (hands-and-knees or kneeling) as she feels fit. The midwife provided explanations on the importance of maintaining the upright position. The woman can also walk around, eat and drink and return to bed if medical or midwife's interventions were needed, when membranes ruptured or felt the urge to push. The nurse-midwife was required to adjust the delivery bed at the level that she feels comfortable to assist delivery. She has to ask the woman to kneel on the bed while supported by the bedsides rails and push when she feels the urge to do so. The nurse-midwife to note the time of expulsion of the baby and APGAR score. The procedure was the same for the woman who used a hands-and-knees position with the additional that the head of delivery bed is raised to a certain level to allow the disproportional of the upper and lower parts of the bed. In this position, the woman instructed to turn her head direct to the raised part of the bed and foot on the lower part of the bed, then kneels while separating her thighs and support herself by her fists or palms on the bed and push with contraction.

Table 1: Observation and recording labour progress, maternal and fetal conditions

Stages	Observe and record
1	Time and dilation of the cervix Progress of labour until the end of the first stage using the partograph
2	Time at which the woman felt the first urge to push up to when the expulsion of the baby Monitor the woman to keep on the chosen birth position Score the baby's Apgar score as per WHO chart.
3	Assess the perineum status after delivery of the placenta Measure and estimate the amount of blood loss by counting all gauzes soaked with blood or its portion and comparing with the pathfinder international wall chart.
4	Weigh the baby's body weight Resuscitate the baby with APGAR score less than 7 Monitor the mother's condition and take appropriate action Repair perineum if appropriate

Data Analysis

The SPSS version 23 software was used to determine the frequency and proportional between variables whilst chi-square test measures of the association were used for categorical variables to indicate statistically significant differences. We created the following categorical variables from continuous data: age group (15-20, 21-25, 26-30, those above 30 years) and birth weight (2.5-3.0, 3.1-3.5, 3.6-4.0 and above 4 kgs). All variables with p-values < 0.2 were re-analysed by logistic regression and the adjusted odds ratio (aOR) at 95% confidence interval (CI) were calculated using STATA software. The p-values < 0.05 indicated the statistical significant association

Results

Socio-demographic Characteristics of the Participants

Among the 156 parturient involved in the study, 150 (97%) finished the study. The 6 participants who did not complete, two had emergency caesarean section due to foetal distress in the first stage of labour, one from intervention group and another from non-intervention group. The other four (4) withdrew from the study due to knees pain and discomfort during the second stage, these were from the intervention group. Participant's age, level of education, employment, marital status, gestation age, and parity were considered in the analysis and are shown in table1. Maternal age ranged between 17 and 42 years, with a mean of 26.38 and the dominated maternal age group was 21-25 year (34.0%). All women had the gestational age of 37weeks or more with a mean of 39.8 and most of participants 81 (54%) were above Para two (table 2).

Table 2: Socio-demographic characteristics of the participants (n=150)

	Birth Position					
	1(supine)		2(upright)		Total	
	No.	(%)	No.	(%)	No.	(%)
Age group in years						
15-20	16	20.8	13	17.8	29	19.3
21-25	31	40.3	20	27.4	51	34
26-30	14	18.2	19	26	33	22
>30	16	20.8	21	28.8	37	24.7
Education level						
Illiterate	3	3.9	8	11	11	7.3
Primary	64	83.1	47	64.4	111	74
Secondary & above	10	13	18	24.7	28	18.7
Women's Occupation Status						
Some sort of employment	10	13	27	37	37	24.7
Unemployed	67	87	46	63	113	75.3
Woman's Marital Status						
Married	73	94.8	68	93.2	141	94
Not married	4	5.2	5	6.8	9	6
Parity of the woman						
2 or less	50	64.9	51	69.9	101	67.3
3 or more	27	35.1	22	30.1	49	32.7

The outcome of birth position on duration of labour with Chi-square test

Table 2, shows the effects of birth positions on maternal and new-born outcomes, 68 (93.15%) women who gave birth in upright position had faster dilation of cervix (less than 4hrs) as compared to 19 (24.68%) women who delivered in non-upright birth positions (p-value <0.001). Out of 73 women delivered in upright position 70 (95.89%) had faster expulsion of the baby in second stage of labour (less than 20minutes) as compared to 34 (44.16%) women in supine (non-upright) birth position (p<0.001). This difference was found to be statistically significant in a model that is unadjusted for other confounders.

Predictors of maternal outcome using multivariate logistic regression analysis

The upright group were 0.11times (aOR (CI) P), (0.11(0.05-0.26), P<0.001) and 0.03 times (aOR (CI) P), (0.03(0.01-0.11), P<0.001) more likely to have faster dilation of the cervix and expulsion of the baby than those who applied supine birth position respectively whilst birth weights, parity, and maternal age were not statistical significant in the dilation of the cervix, although the birth weight of 3.0 to 4.0kgs shows statistically significant association with the faster expulsion of the baby. Participants in upright position group were 0.41 times more likely to have perineum intact more than those who in supine position arm (aOR (CI) P), (0.41(0.13-1.26) p=0.121).

Table 3: Maternal outcomes of birth positions frequency and on multivariate analysis (n=150)

Variables	Upright birth positions N=73 (100%) n (%)	Supine birth position N=77(100%) n (%)	P-value	aOR (95%CI)	P-value
Faster dilatation of CX	68 (93.15)	19 (24.68)	0.001	0.11(0.05-2.33)	<0.001
Faster expulsion of the baby	70 (95.89%)	34 (44.16%)	0.001	0.03(0.01-0.11)	<0.001
Maternal blood loss <500ml	69 (94.52%)	66 (85.71%)	0.102	0.33(0.09-1.16)	0.083

Perineum trauma and maternal blood loss

About 21(14.00%) women out of 150 who were to finish the study on their participation had first- and second-degree perineal trauma, 13 (16.88%) of them were those who assumed supine birth position and 8 (10.96%) those in upright birth position group, however this difference was not statistically significant (p-value of 0.296). In both intervention and non-intervention groups, the frequency of intact and degree of perineal trauma were the same. Out of 15 (10.00%) of parturient who lost blood more than 500mls, 11(14.29%) were those in supine position compared to 4 (5.48%) in upright birth position. This difference was not statistically significant (p-value 0.102).

Table 4: New-outcomes on birth positions frequency and on multivariate analysis (n=150)

Variables	Upright birth positions N=73 (100%) n (%)	Supine birth position N=77(100%) n (%)	P-value	aOR (95%CI)	P-value
Apgar score of the baby in one minute					
Score more than 7	72 (98.63%)	68 (88.31 %)	0.018	0.08(0.01-0.87)	0.038
Birth weight (kgs) 3.1-3.5				0.08(0.01-0.87)	0.038

Apgar score of the baby in one minute after birth

Table 3 shows that majority of participants (98.63%) in upright birth position group had their babies with Apgar score of more than seven in the first minute after birth compared to 88.31% of those assumed supine birth position (P=0.018).

Discussion

The aim of the study was to assess the effect of upright and supine birth positions on maternal and new-born outcomes. Specifically, to assess their effects on the duration of labour, maternal blood loss, perineum status (tear or intact) and Apgar score of the baby. Finding of this study demonstrates that upright birth position is associated with short duration of labour in first and second stage and reduced risk of maternal blood loss after third stage of labour.

Duration of labour

The study revealed that upright birthing position is associated with faster dilation of the cervix among multiparous parturient as compared to the women who assumed supine birthing position. This difference is supported by finding of other studies which have demonstrated similar effect of upright position on cervical dilation during child birth (2,4,9,14–16). However, this is contrary to finding of the systematic review from Cochrane database which suggested lack of sufficient empirical evidence to conclude difference between the two birthing positions on cervical dilation (17). This different finding could be attributed with different designs used by researchers of articles that were reviewed. It could also be due to differences in study settings, ethnicity of participants and the sample size used. From clinical observation, the women who assumed the upright position during labour, were freely walking around and sitting on the chair without laying horizontally on bed. Theoretically, there is association between upright position and the force of gravity which act during uterine contraction causing faster descent of the foetus in birth canal during each contraction.

On the other hand, women who were in supine position were mostly not self-motivated to move out of their beds especially when the cervical dilation is 5-6cm since this stage is accompanied by moderate to strong contractions which are painful. The faster expulsion of the baby has an advantage for maternal and new-born as it reduces the risk of maternal and foetal distress and other related complications. Child birth in supine birth position was found to correlate with delayed cervical dilation and expulsion of the baby. Similar findings have been reported by Dabral and Gupta in their studies titled Upright kneeling position during second stage of labor and Position in the second stage of labour for women without epidural analgesia respectively(2,18). However, if upright positions will be applied in labour room to parturient with no or minimal risks to maternal and new-born, the positive outcomes for both are expected.

Maternal blood loss

Finding of this study demonstrated lack of statistical evidence to support presence of association between maternal birth positions with maternal blood loss of more than 500mls. The study did not find unusual maternal blood loss in both upright and supine birth positions according to WHO standard of maternal blood loss. However, the findings are not different from the study report by Huang and colleagues in their comparison study of common maternal positions during the second stage of labour that showed no differences in blood loss for women giving birth in hand and knees position and those birthing in supine position(19). This finding is similar to the report by Huang and colleagues who in their paper review on comparison of common despite the fact that in this study, the findings didn't reveal statistical differences in amount of blood loss when upright or supine birth positions is applied. In Tanzania's hospitals (8), majority of women use supine birth position during labour and delivery. Since PPH is very observed during clinical practices, this

study suggests that the association between supine and upright birth position should be observed and more studies in this area is much needed.

This study revealed that an upright birth position is associated with less amount of blood loss compared to the supine position. However, this results is different with the conclusion of the meta-analysis study review which reported that the use of upright position without epidural analgesia is likely to result into slight increase of PPH (19,20). The differences among of these studies may be due to different types of upright birth position assumed, designs used, sample size and ethnicity of participants in the study. The World health organization (WHO) defined any blood loss more than 500mls post-delivery to be considered as non-standard and therefore such loss is not acceptable in Tanzania and various guidelines have been prepared to prevent PPH. The study suggests midwives to encourage women to use upright positions that results into minimal blood loss.

Perineum trauma

This study found that participants in the interventional group had a low rates of perineal trauma, were women sustained fist degree tear compared to women in the non-intervention group. Further, women who give birth in the supine position were more likely to get perineal trauma than those gave birth in upright position. This is likely the outcome of perineum swelling during the pushing because the supine position causes delays in cervical dilation than using the upright position. With supine position, the advanced baby's head causes compression on the floor of birth canal and result in easily torn during expulsion of the baby. The results of this study is consistent with studies in China (12,21,22). The negative effects of supine position on perineum trauma could be mitigated if the woman shifts to the hands-and-knees or the kneeling position to prevent prolonged direct compression on the perineal wall. The upright positions applied in this study correlates with low frequency of perineum trauma compared to the supine position. Nevertheless, Cochrane review study reports that the upright position reduces episiotomy but increases risk of second-degree perineum tears. This finding is also different from finding of Haslinger's study which was done in Switzerland and looked at the effect of position at birth on occurrence of anal sphincter tears and found that kneeling position at birth was associated with anal sphincter tears (17,23). Another study by Shunji on birth posture and canal laceration reported that the incidence of severe perineal laceration in women gave birth in hands-and-knees posture were significantly higher than in women gave birth with supine posture (13). These differences could be attributed to the sample size of participants, time of data collection, design used and the type of upright birth position used.

APGAR score of the new-born

In our study we found significant differences in APGAR score of the new-born in the first minute of birth on different position assumed during child birth. Our observations are in line with Debral et al who also informed the significant differences in APGAR score at 1minute in newborn of women delivered in upright position compared to supine position(3).Supine birth position was associated with higher proportional Apgar score of less than seven compared to those in upright birth position. Supine position is the potential supine hypotension which may cause the poor blood supply to the uterus and lead to fetal distress and birth asphyxia. Despite the leading cause of neonatal death being birth asphyxia, which may be associated with the effect of birthing position, majority of women gives birth in supine. (24). Moreover, there were few new-borns with Apgar score of less than seven from women who assumed upright position compared to those in supine.

Similarly, Huang and Moraloglu reported that, there is no difference in apgar score of a new-born for women assumed upright and supine birth position in the fifth minutes (19,25). However, another study by H. Zhang gave recommended that the upright birth position is the suggested position for improving the new-born (neonatal) outcome, thus supine birth position should be avoided due to its possible harmful effects (21).

Limitation of the study

- The study design was not a controlled randomized trial and therefore internal validity is not guaranteed. This may affect the generalizability of the findings. However, quasi-experimental design provides strong evidence second to clinical trial and suggests these findings could still be used to inform practice.
- The small sample size could limit the power of the study to estimate the effect of position during birth leading to null effect. This suggests the positive finding of this study are conservative and implies an increase in effect size with increase in sample size.
- The study measured few potential confounders and hence the multivariate models were accounted for only available parameters, could lead to biased results. This is partly reflected in the balance table which shows variations in socio-demographics characteristics of the participants in the two groups.

Conclusion

Based on the findings of this study, the duration of labour in first and second stage including the Apgar score of the new-born within the first minute after birth has rejected its null hypothesis which stated, “There is no difference in maternal and new-born outcomes when upright or supine birthing positions are used during labour and delivery” since the P-value 0.001 is less than 0.05. Besides the result on the perineum status and maternal blood loss has accepted the null hypothesis (H_0). The upright birth position has shown the positive effect on duration of labour during first and second stage by promoting faster dilatation of the cervix, faster expulsion of the baby and high Apgar score of the newborn in the first minute. However, this study suggests that, there were no differences in terms of sustaining perineal trauma and amount of blood loss, when women assume supine or upright positions during labour and delivery. The findings from this study suggest that, midwives should encourage the parturient to assume upright birth position that facilitates shorter duration of the first and second stage of labour, improving the APGAR score of the baby while protecting maternal blood loss more than 500mls and preventing perineum trauma.

Recommendation:

- Ministry of Health Community Development Gender Elderly and Children should build capacity of midwives to be able to conduct labour using alternative birthing positions including upright position.
- For sustainability, midwifery curricular should realise competencies of alternative birthing positions and not much encouraging it is for supine position during labour and delivery and a large study with large sample size is recommended for generalization of the results.

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Competing interests

We declare that no competing interest in this study.

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