

## Birth asphyxia and associated factors among newborns delivered in Jimma zone public hospitals, Southwest Ethiopia: A cross-sectional study

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### ABSTRACT

**Background & aim:** Birth asphyxia is a serious clinical problem and a leading cause of neonatal mortality and morbidity worldwide. The majority of neonatal deaths arise in low- and middle-income countries. We sought to address birth asphyxia and its associated factors among newborns delivered in Jimma zone public hospitals, Southwest Ethiopia.

**Methods:** A cross-sectional study was conducted on 368 live newborns born at Jimma zone public hospitals, who were enrolled in the study using the systematic random sampling method. Data were collected using a structured questionnaire, an observation checklist, and chart review, which were designed to measure the birth asphyxia and its associated factors. Overall, The data were analyzed using simple and multivariable logistic regression.

**Results:** The prevalence of birth asphyxia was 32.9% in the first and 12.5% in the fifth minute. Accordingly, birth asphyxia was significantly associated with medical complications (AOR: 3.92, 95%CI: 1.62, 9.46), obstetric complications (AOR: 3.76, 95%CI: 1.71, 8.26), prolonged second stage of labor (> 3 h; AOR: 3.72, 95%CI: 1.46, 12.18), low birth weight (AOR: 4.21, 95%CI: 1.5, 12.2), meconium-stained amniotic fluid (AOR: 8.29, 95%CI: 3.6, 18.9), tight nuchal cord (AOR: 7.4, 95%CI: 1.6, 34.1), not attending antenatal care (AOR: 6.4, 95%CI: 2, 20.2), incomplete antenatal care visit (AOR: 4.6, 95%CI: 2.0, 10.5), non-cephalic presentation (AOR: 6.98, 95%CI: 2.66, 18.28), and caesarian section delivery (AOR: 2.3, 95%CI: 1.0, 5.1).

**Conclusion:** Most factors associated with birth asphyxia are manageable by means of good pre-natal care and improving antenatal, intrapartum, and neonatal care services within our limited resources.

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### Introduction

The health of future societies is hinged upon the health of today's children and their mothers. The neonatal period is considered the highest risk period (1). Birth asphyxia is a serious clinical problem worldwide, accounting for about one-fourth of the 4 million neonatal deaths that occur globally each year (2). Birth asphyxia is a condition that occurs due to impaired blood-gas exchange and results in hypoxemia and hypercapnia (3). The World Health Organi-

zation defined birth asphyxia as persistent Apgar score of 0 to 3 for more than 5 minutes, neonatal neurological sequelae such as seizure, coma, and hypotonic (neonatal encephalopathy), and multiorgan system dysfunction (4). Birth asphyxia is a leading cause of neonatal mortality and morbidity in developing countries, with an incidence rate of 100-250/1000 live births compared to 5-10/1000 live births in the developed world (5). Major causes of neonatal death are

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birth asphyxia (23%), infections (36%), and preterm complications (27%) (6).

Although birth asphyxia can be predicted in some conditions such as fetal distress and preterm birth, most cases of birth asphyxia cannot be predicted. Birth asphyxia (47.5%) is one of the leading causes of neonatal death in Jimma zone followed by neonatal infection (34.3%) and prematurity (11.1%) (7). Considering the scarcity of studies on birth asphyxia and its associated factors in the study area, this study can help those interested in the topic. Provision of such data on this highly critical subject may inform researchers, clinicians, midwives, nurses, health extension workers, the community, and individuals of the problem. We attempted to address birth asphyxia and its associated factors among newborns delivered in Jimma zone public hospitals, southwest Ethiopia, from March 1 to 30, 2015.

## Materials and Methods

The study was conducted from March 1 to 30, 2015, in Jimma zone public hospitals, Jimma, Ethiopia. Jimma zone is one of the 18 zones in Oromia regional state, which is about 354 kilometers far from Addis Ababa. This cross-sectional study was conducted among all the newborns delivered in Jimma zone public hospitals during the study period.

The inclusion criteria comprised of gestational age  $\geq 28$  weeks and live birth. The exclusion criteria consisted of stillbirth and critically ill mothers. The standard sample size was calculated at 371 live births using the formula for single population proportion, considering the prevalence of birth asphyxia in Jimma town (47.5%) (7), and the margin of error of 4% at 95% confidence interval. Further, a non-response rate of 10% and correction formula were used. The systematic sampling method was applied to select the study subjects from the target population in the four Jimma zone public hospitals. The study participants were selected based on the inclusion criteria and from the list of deliveries in each hospital by using every two intervals from delivery registration book.

At first, the study subjects were selected by the lottery method. In case of multiple

gestations, only one newborn was selected via the random sampling method. Data were collected using a structured questionnaire, an observation checklist, and chart review, which were designed to cover all the contents and achieve the objective of this study. Reliability of the instruments was checked by performing a pilot study on 5% of the samples at Bedele Hospital, and content validity of the instruments was verified by a panel of experts, and the required amendments were made to the tools.

Data collection started from the onset of labor and ended after the fifth minute of the postpartum period. The data were edited, entered into EpiData, version 3.1, and exported to SPSS, version 21, for statistical analysis. Qualitative variables were analyzed after classifying them based on frequency distributions. For quantitative variables, binary logistic regression was used to identify variables which had  $P < 0.25$  were considered for adjustment in the multivariable logistic regression. Results were reported as odds ratios (OR) with 95% CI. Finally, independent variables, which had a statistically significant association with the dependent variable  $P < 0.05$ , were entered into the regression model.

Ethical approval was obtained from the institutional review board of Jimma University College of Health Sciences to communicate with the administrative body of the hospitals. Permission letters were obtained from the administrative body of each hospital. Finally, oral consent was attained from each participant before the interviews. In addition, the respondents' right to refuse or withdraw from filling out the questionnaire was fully observed.

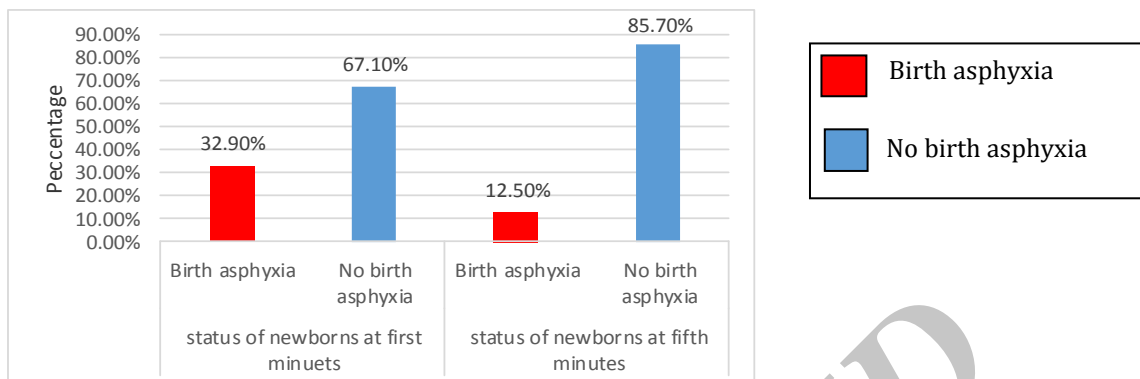
## Results

During the study period, 768 live newborns were delivered, out of whom, 371 live births were selected for the study; the response rate was 99% (368).

### **Factors associated to birth asphyxia among independent predictors**

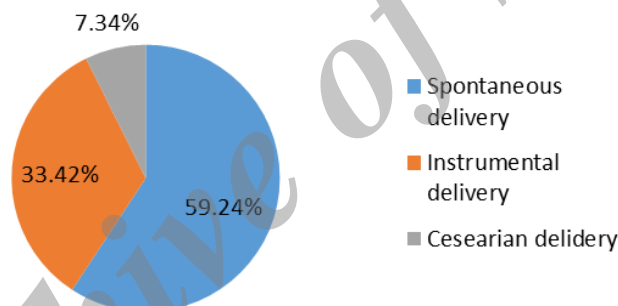
Variables with  $P < 0.25$  were entered into multivariate logistic regression. These variables were monthly income, family history of smoking and khat chewing during current deliveries, residence, gestational age, history of abortion,

fetal tone, the number of gestations, duration of **Prevalence of birth asphyxia**



**Figure 1.** The distribution of the live newborns with birth asphyxia at the first and fifth minutes and Apgar score of less than 7 in Jimma zone public hospitals from March 1 to 30, 2015

**Mode of delivery**



**Figure 2.** The distribution of route of delivery among live newborns delivered in Jimma zone public hospitals from March 1 to 30, 2015

the first stage of delivery, care provider, birth trauma, transportation, and the analgesic given during pregnancy and delivery.

Multivariate logistic regression analysis was run to identify the effect of independent variables on birth asphyxia. The study showed that neonates whose mothers had not attended antenatal care visits were 6.36 times more likely to develop birth asphyxia (AOR: 6.36, 95%CI: 2.00, 20.28) than those with complete antenatal care visit. In addition, those who had incomplete antenatal care visits were 4.58 times more likely to develop birth asphyxia (AOR: 4.58, 95%CI: 2.0, 10.47) than those who had completed antenatal care. The neonates whose mothers had medical complications were 3.92 times more prone to develop birth asphyxia (AOR: 3.9,

95%CI: 1.6, 9.5) than those had no medical complications. Mothers with obstetric complications were 3.8 times more likely to have asphyxiated infants (AOR: 3.8, 95%CI: 1.7, 8.3) than those free of obstetrics complications by adjusting other variables.

Regarding fetal presentations, newborns with non-cephalic presentation were 6.95 times more susceptible to developing birth asphyxia (AOR: 6, 95%CI: 2.7, 18.3) than those with cephalic presentation by adjusting others variable. Concerning the route of delivery, those infants born through caesarian section were 2.3 times more likely to develop birth asphyxia (AOR: 2.3, 95%CI: 1.0, 5.1) than the infants delivered through spontaneous vaginal delivery by adjusting others variables. Prolonged second

**Table 1.** Multivariate logistic regression and the corresponding P-values for the associations between birth asphyxia in the first minute and independent predictors in Jimma zone public hospitals from March 1 to 30, 2015

Model	N (%)	P-value	AOR	95%CI	
				Lower	Upper
Medical complications	No	227(75.5)	1		
	Yes	90 (24.5)	.002	3.92	1.62 9.46
Obstetrics complications	No	213(57.9)	1		
	Yes	155(42.1)	.001	3.76	1.71 8.27
Duration of the second stage of delivery	<3hrs	295(80.2)	.000	1	
	>3hrs	73(19.8)	.001	3.72	1.71 8.08
Birth weight	2500 – 4000	304(82.6)	1		
	<2500	48(13.1)	.008	4.21	1.46 12.18
	>4000	16(4.3)	.103	0.13	0.01 1.51
Color of amniotic fluid	Clear	278(75.5)	1		
	Mecoid and bloody	90(24.5)	<.0001	8.29	3.63 18.93
Tight nuchal cord	No	344(93.5)	1		
	Yes	24(6.5)	.010	7.39	1.60 34.13
Antenatal care	No ANC	52 (14.1)	.002	6.36	2.00 20.28
	1 – 3	157 (42.7)	<.0001	4.58	2.00 10.47
	≥4	159 (43.2)		1	
Fetal presentation	Cephalic	305(82.9)	1		
	Non cephalic	63(17.1)	<.0001	6.98	2.66 18.28
Route of delivery	Spontaneous	218(59.2)	1		
	Instrumental	27(7.4)	.407	0.55	0.14 2.25
	Caesarian	123(33.4)	.035	2.35	1.06 5.18

stage of delivery more than 3 hours was 3.72 times more likely to cause birth asphyxia (AOR: 3.72, 95%CI: 1.458, 12.178) by controlling other variables. Birth weight of the newborns also had a significant positive association with birth asphyxia. Low birth weight was 4.2 times more likely to cause birth asphyxia (AOR: 4.214, 95%CI: 1.458, 12.178) than normal birth weight when compared to non-asphyxiated infants by adjusting other variables. Concerning color of the amniotic fluid, mothers with meconium-stained and bloody amniotic fluid were 8.29 times more prone to having children with birth asphyxia (AOR: 8.292, 95% CI: 3.633, 18.928) than those with clear amniotic fluid by controlling other variables. Those newborns with nuchal cord were 7.39 times more likely to develop birth asphyxia (AOR: 7.389, 95%CI: 1.599, 34.131) than those without this condition compared to non-asphyxiated infants by adjusting other variables (Table 1).

## Discussion

This study showed that the prevalence rate of birth asphyxia was 32.9% in the first minute and 12.5% in the fifth minute, which are lower

than the previous report from Jimma zone (47.5%) (9). This discrepancy might be due to differences in study design and sample size, improved early identification of high-risk mothers, and increased antenatal and perinatal care. On the other hand, the prevalence rate obtained in this study was higher than what has been observed in Nigeria, Pakistan, India, Thailand, and Cameroon (29.4%, 28%, 6.6%, 7.35%, and 8.05%, respectively) (12, 13, 19, 25, 26). We found prenatal complications to be a significant risk factor for birth asphyxia, which was consistent with the reports from India, Pakistan, Thailand, and Sweden (11, 16, 22, 27). A facility-based National Baseline Assessment for Emergency Obstetric and Newborn Care performed in 2008 has revealed that 9% of cases had indirect complications leading to maternal mortality in Ethiopia. In fact, complications such as chronic hypertension, cardiovascular disease, asthma, and anemia are the risk factors for a low Apgar score.

Obstetric complications also had a significant positive association with birth asphyxia. Those complications were gestational hypertension (20; 12.9%), pre-eclampsia (28;

18.1%), eclampsia (4; 2.6%), hyperemesis gravidarum (11; 7.1%), shoulder dystocia (12; 7.7%), uterine rupture (2; 1.3%), polyhydramnios (9; 5.8%), oligohydramnios (7; 4.5%), placental abruption (13; 8.4%), placenta previa (11; 7.1%), premature rupture of membranes > 18 hours (32; 20.6%), obstructed labor (37; 23.9%), and chorioamnionitis (4; 1.1%). There were different studies that supported this finding in India, Cameron, England, Nigeria, and Thailand (21, 22, 25, 27, 31). In case of obstetric complications, taking prompt action is critical because a woman and her infant could die within a short period.

Prolonged second stage of labor (> 3 hours) is significantly associated with birth asphyxia. This result is consistent with the earlier findings in India, Cameron, Pakistan, Nigeria, and Thailand (12, 13, 16, 24, 26). This is due to the fact that prolonged second stage of labor is associated with fetal and maternal exhaustion and fetal distress resulting in birth asphyxia. Proper management of labor to reduce prolonged labor with early interventions may lower the incidence of birth asphyxia. The incidence of birth asphyxia is significantly higher in mothers with no or incomplete antenatal care visits. This finding was in line with those of studies performed in India (12), Nigeria (19), and Thailand (22, 23). This could be explained by the fact that complete antenatal care affects the survival and health of babies by providing integrated care, promoting healthy home practices, influencing care-seeking behavior, and referring women with pregnancy complications to a referral system.

There was also a strong relationship between caesarian section and birth asphyxia, 123 (33.42%) of deliveries were emergency caesarian section. Similar findings were obtained in several studies in Pakistan, Nigeria, Iran, Thailand, Uganda, and the UK (16, 19, 20, 22, 29, 32). This finding could be explained by the fact that most of the indications for caesarian section compromise adequate oxygen delivery to the fetus. Prolonged labor, arrest of labor, prenatal hypertensive disorders, and cephalo-pelvic disproportions might be due to some risk factors that are not detected early in pregnancy, which might cause

acute fetal distress, and consequently, birth asphyxia.

Low birth weight and prematurity were significantly associated with birth asphyxia. Previous studies reported similar results in Nepal, England, Iran, Thailand, and Uganda (15, 17, 20, 22, 30). The possible explanation might be that premature and low-birth-weight neonates usually have pulmonary immaturity and limited respiratory muscle strength. It is important to make a diagnosis and find the etiology to provide appropriate management to prevent preterm delivery.

We also identified that nuchal cord was significantly associated with birth asphyxia, and this finding was supported by other studies in Cameron, Iran, and the UK (14, 20, 32). Cord accidents often lead to reduced blood flow from the placenta to the fetus causing impaired gaseous exchange and asphyxia birth. In a study, meconium- and blood-stained amniotic fluid was found to be present as a factor significantly associated with birth asphyxia. This finding is in line with those of studies performed in Pakistan, England, and Thailand (16, 17, 21). Almost all studies supported that newborns delivered with meconium-stained amniotic fluid are highly prone to developing birth asphyxia. The explanation for this association could be meconium aspiration syndrome, which occurs when the fetus breathes meconium into the lungs leading to acute airway obstruction immediately after birth. To minimize the incidence of birth asphyxia, if the meconium-stained amniotic fluid is present, immediate endotracheal meconium suction after delivery could reduce the risk of meconium aspiration syndrome.

The study also identified that non-cephalic presentations such as breech and shoulder presentation were significantly associated with birth asphyxia. Similar results were reported in Cameron, Uganda, Nigeria, Thailand, and the UK (13, 18, 19, 22, 32). The assumption is that breech presentation promotes the risk of umbilical cord prolapse, and birth trauma elevated the incidence rate of birth asphyxia.

## Conclusion

The prevalence rate of birth asphyxia obtained in this study was remarkably higher



relative to those reported by other studies from different countries. Birth asphyxia was significantly associated with medical complications, obstetric complications, prolonged second stage of labor (> 3 hours), low birth weight, meconium- and blood-stained amniotic fluid, nuchal cord, no or incomplete antenatal care visits, non-cephalic presentation, and caesarian section delivery. The majority of these factors may be manageable by means of appropriate prenatal care.

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### Conflicts of interest

None declared.

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