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Determinants of Birth-Asphyxia among Newborns in Dessie Town Hospitals, North-Central Ethiopia, 2018

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Abstract

Background: Despite having, many evidences that birth asphyxia has been a major problem in developing countries like Ethiopia, the determinants of birth asphyxia among newborns has not been systematically investigated particularly in the study setting. This study hence aimed to identify determinants of birth Asphyxia among newborns in Dessie Town Hospitals, North-central Ethiopia, 2018.

Methods: This study followed a facility based unmatched Case control design among 380 (76 incident asphyxia cases and 304 non-asphyxia controls) randomly selected newborns from March 9 to April 15, 2018 at 5-Hospitals of Dessie Town, North-central Ethiopia. Ethical clearance was obtained from Institutional Review board of Bahir Dar University. A structured questionnaire was used to gather data on socio demographic and risk factors by trained Midwives. The data were entered and cleaned using Epi-info version 7 and analyzed with SPSS Version 22. In the analysis: proportions, frequencies, and averages were calculated for study variables. Variables with P-value ≤ 0.2 in the bivariable analysis were included in the multiple variable logistic regression. Finally, variables with P-value ≤ 0.05 were considered as potential determinants of birth Asphyxia.

Results: About 76 asphyxia, (cases), and 296 non-asphyxia (controls) newborns were included in the study. Newborns from short statured mothers had 6.43-fold odds of developing birth asphyxia compared to those from non-short statured mothers [AOR=6.43, 95%CI: 2.392-17.291]. The odds of developing birth asphyxia were 4.67 times more likely among newborns whose mothers had below 23cm Mid-Upper Arm Circumference compared to those whose mothers had ≥23cm MUAC [AOR=4.67,95%CI: 1.842-11.835]. Newborns delivered with assisted/Instrumental delivery had 3.5 times increased odds of developing birth asphyxia compared to those delivered with spontaneous delivery [AOR=3.5, 95%CI: 1.365-8.981]. Prolonged labor [AOR=5.102, 95%CI: 2.151-12.099] and any complication during labour [AOR=3.424, 95%CI: 1.351-8.678] were also determinants of birth asphyxia.

Conclusion and Recommendation: This study identified that the major determinants for birth asphyxia were maternal (Height, Mid-Upper Arm Circumference) and intrapartum factors (Instrumental delivery, Prolonged Labour and Labour complications). However, the fetal factors werenot identified to be significant determinant of birth asphyxia. Further research is recommended on the determinants of prolonged labor and other complications.

Keywords: Birth Asphyxia; newborns; Dessie Town Hospitals; Risk factors; case-control; Ethiopia

List of Abbreviations

AOR	Adjusted Odds Ratio
CPD	Cephalo-Pelvic Disproportion
COR	Crude Odds Ratio
DALY	Disability Adjusted Life Years
DM	Diabetes Mellitus
EDHS	Ethiopian Demographic Health Survey
ENAP	Every Newborn Action Plan
GP	General Practitioner
HIE	Hypoxic Ischemic Encephalopathy
HTN	Hypertension
IRB	Institutional Review Board
NGO	Non-Governmental Organization
NICU	Neonatal Intensive Care Unit
PIH	Pregnancy Induced Hypertension
PNC	Post Natal Care
SDG	Sustainable Development Goals

Background

Asphyxia, the inability of the newborn to initiate and sustain adequate respiration after delivery; is characterized by a marked impairment of gas exchange; if prolonged leading to progressive hypoxemia, hypercapnia, and significant metabolic acidosis [1]. A neonate is asphyxiated if the umbilical cord arterial pH is <7; the Apgar score is 0-3 for longer than 5 minute; has neurological manifestations such as seizures, coma, or hypertonia; and multisystem organ dysfunctionincluding cardiovascular, gastrointestinal, hematological, pulmonary or renal system [2].

Perinatal asphyxia, due to lack of adequate fetal-neonatal oxygenation in peripartum, at birth, and in the first minutes of life, is a sensitive measure of the quality of care provided in the perinatal period, both to the pregnant woman and the newborn, with high potential for prevention of death through early diagnosis and treatment [3]. In line with this fact the Sustainable Development Goal (SDG) states that by 2030, end preventable deaths of newborns and aimed atreduce neonatal mortality to at least as low as 12 per 1,000 live births in all countries [4].

Globally, intra-partum asphyxia accounts for 814,000 deaths/ year, and it is the 5th most common cause of death in under 5 children and is responsible for 42 million disability adjusted life years [5, 6]. Birth asphyxia is one of the major causes of neonatal deaths [7].The deaths of under-five children have decreased dramatically, with 3.6 million fewer deaths in2013 compared to 2000.However, the neonatal deathsin 1990, accounted for 37.4% of deaths in under-five children compared with 41.6% in 2013 [8,9].

Deaths in the first month of life are mostly preventable but according to child mortality estimates of the Untied Nation (UN) Inter-Agency Group in 2014, globally 2.8 million babies die in the first four weeks of life. The large majority of newborn deaths (80 %) are due to complications related to preterm birth [10]. The "Every New-Born Action Plan" (ENAP) calls for an increased focus on the time of birth with targeted intervention strategies amongst is reducing newborn deaths [11].

Neonatal mortality is declining globally, with drop of deaths from 5.1 million in 1990 to 2.6 million in 2016. However, this decline of 49 % is slower than the rate of decline in children aged 1-59 months (62 %). Moreover, in Africa, the under-five mortality rate of 76 deaths per 1,000 live births is 67% above the recommended SDG target of 25 deaths per 1,000 indicating that to meet the SDG target by 2030, the annual rate of reduction should be 4.5% or more [12].

Although Ethiopia reached its child mortality reduction goal two years earlier than the set target, the neonatal mortality rate has remained high. One of the major and direct causes of newborn deaths was intra-partum related complications (birth asphyxia) 25% [13]. In the era of SDG an increased focus is given to reduce child mortality by 75%focusing at reduction of neonatal mortality to 12 per 1000 live births [14]. Currently, being the highest in the world with 27 deaths per 1,000 live birthsin Africa, neonatal mortality rate contributes nearly 40% to the global burden and 29% of under-5 mortalities: the main causes of which include birth Asphyxia, preterm birth complications, and sepsis. In Ethiopia, it is mentioned Infant mortality increased from 28/1000 in 2014/15 to 29/1000 in 2015/16 [15]. Birth Asphyxia was assumed to be among the three most contributors [16]. Recent reports from Dessie Referral hospital shows an average of 350-500 deliveries/month, where 30-40 neonates face birth Asphyxia [17].

A global report investigating when, where and why four million neonatal deaths have occurred showed that 99% of these neonatal deaths take place in the developing countries where perinatal asphyxia contributes to almost 23% of these deaths [18]. According to statistics by WHO in developing countries 35 of infants (3.6 million) suffer from moderate to severe asphyxia of whom 23%(840,000) die, and almost the same number suffer from the associated consequences [19].

A study from Bangladesh reported 56.9% overall prevalence of perinatal Asphyxia ; 35% of neonates death from birth Asphyxia and 1-6 per 1000 births incidence of asphyxia in developed versus 5-10 per 1000 births in developing countries [20-22]. Another study from Iran reported that 1% of infants born had presented with asphyxia and 22% of deaths are due to perinatal asphyxia [23, 24]. A similar study from Nigeria reported 29.4% prevalence of perinatal asphyxia [25]. Another study from Ghana reported that among 468 (48.4%) term neonates about 283(61.8%) were admitted for asphyxia [26]. A study from Cameroon found out from 332 neonates admitted to the neonatology unit, birth Asphyxia accounted for 14. 5% [27].

Data concerning birth Asphyxia in Ethiopia is rarely monitored but the Ethiopian Demographic Health Survey (EDHS) 2016 Key Indicators Report narrated in Ethiopia there has been a steady decline in infant, child, and under-5 mortalities over the last decades. In the recent 4 years preceding the EDHS 2016 survey the neonatal mortality rates was 29 per 1000 live births [28].

Factors Associated Birth Asphyxia

Maternal Characteristics and Antepartum Risk Factors

A study from Colombia identified that premature placental abruption and mothers without a partner were risk factors for the development of perinatal asphyxia [29]. Another study at Pakistan stated one of the Antepartum risk factors was non-attendance for antenatal care, and multiple births also increased

risk by 4.8% [30]. A study from Hyderabad, India identified that maternal young age and Primiparity as significant maternal and antepartum risk factors [20]. Another study from India reported the maternal or antepartum factors were maternal age, gestational age, hypertension, diabetes mellitus and Antenatal Clinic (ANC) visits less than three [31]. A study from Nepal reported maternal nutritional status specifically short stature and mid upper arm circumference were determinants of Asphyxia [32,33]. Another study from Nigeria reported that though poor obstetric outcomes are relatively common among short statured women (≤152cm) the study adds however a higher rate of poor Apgar score among mothers with normal stature [34]. A dissertation conducted in Naivasha district hospital Kenya reported that the only maternal risk factors identified was the presence of edema [35]. Findings of a study in Malawi revealed that there were no maternal associated risk factors for birth asphyxia [36]. A study from Ethiopia, Dire Dawa spotted age ranges between 15 to 25 and illiterate mothers were important maternal determinant factors for birth asphyxia [37].

Intrapartum Risk Factors

A study in Colombia identified premature placental abruption, labor with a prolonged expulsive phase and lack of oxytocin use were risk factors for the development of perinatal asphyxia in the study population [29]. A study from Hyderabad, India identified significant intrapartum risk factors as meconium stained amniotic fluid, obstructed labour, and home vaginal delivery by local professionals and midwives [20]. Studies from India and Iran reported the intrapartum factors included mal-presentation, mode of delivery, meconium stained amniotic fluid, Chorio-amnionitis, and prolonged rupture of membranes [31,38]. It was also reported that instrumental delivery causing birth trauma can in turn leads to Asphyxia [39]. However, a study from special administration of china Hong Kong reported a significant decrease of Birth Asphyxia related to instrumental delivery [40]. A study from Brazil concluded that most mothers and newborns did not have risk factors for perinatal asphyxia, this fact could be attributed to the structural conditions of service, especially in the care during labor, delivery and immediate assistance newborn [41].

According to a study in Nigeria, the commonest intrapartum risk factors identified were Cephalopelvic Disproportion (CPD) in the mothers and abnormal presentation predominantly breech in the fetus [25]. A dissertation done in Kenya mentioned the major risk factors identified were duration of labour and meconium stained liquor [35]. Findings of a study conducted in, Malawi revealed fetal distress and prolonged first and second stage of labour were significant associative factors for birth asphyxia [36]. Prolonged labor makes the baby to be involved in labor for a long time that carries higher risk of birth trauma and in addition, many conditions associated with prolonged labor that can cause the baby to have birth asphyxia [42]. An Institution based study from DireDawa, Ethiopia highlighted neonates born with vacuum, forceps and duration of labour <18 hours were significantly associated Intrapartum events with birth asphyxia [37].

Fetal Risk Factors

A study from Tanzania indicated female gender of baby was significantly associated with delivery of low birth weight infants. Moreover, in turn, LBW infants had increased risk of Apgar score of less than 7 at fifth minute [43]. Another descriptive study in Bangalore, India indicated males tend to be affected by birth asphyxia than females. In addition, appropriate for gestation age newborns were less likely to be affected by birth asphyxia as well as post maturity has less effect for the occurrence of perinatal asphyxia [44]. A study conducted in Indonesia identified low birth weight and prematurity and postdate delivery as a significant fetal factors contributing to birth Asphyxia [45]. It was reported that maternal under nutrition predisposing low birth weight baby and intrauterine growth restriction in turn has impact on birth asphyxia [46]. In Ethiopia a study from DireDawa, showed there were no fetal factors independently associated with birth asphyxia [37].

Methods and Materials

Study Design and Settings

Institution based unmatched case-control study design was employed considering neonates with Asphyxia as cases and those without Asphyxia as controls among hospitals in Dessie town. The town has a total Population of 245,129 with 121,177 males (49.43%). A total of 209,226 people live in the Urban part of the town with 103,429(49.43%) Male whereas35, 903 people live in the rural part (male 49.4%) This study was conducted from February 15-March 15, 2017 in all the Hospital found in the town. There were two government and three private hospitals, eight Health centers, seven specialty clinics and two medical and surgical centers in the town.

Populations and Sample Size

The source population was neonates who stayed in the Post Natal Care (PNC) clinics after being born in the Delivery unit of the hospitals under study and the study population was neonates diagnosed with birth asphyxia and comparative control neonates without birth asphyxia. The sample size was determined using Epi- info 7 by taking a confidence level of 95%, power (80%) and a control to case ratio of 4. The proportion of non-asphyxia neonates (controls) [39.5%] and Asphyxia cases [59.1%] with maternal age exposure were obtained from a previously conducted study with the factor that produced the highest sample size i.e. maternal age(20) and the total sample size was obtained

after adding 10% non-response rate on 344 which was 380 (76 cases and 304 controls).

Study Variables

The dependent Variable was presence of Birth Asphyxia (Yes/No). While the independent Variables includes maternal characteristics and obstetric history related variables (Mother's Age, Education, number of pregnancy, Parity, History of pregnancy outcome, Gestational Age; Antepartum factors (Prime parity, Maternal fever, Pregnancy induced Hypertension, Anemia, peripartum Hemorrhage, History of Previous Neonatal Deaths); Intrapartum factors (Mal-presentation, Prolonged labour, Meconium stained liquor, Pre-eclampsia, Eclampsia, Oxytocin Augmentation of labour, Complicated Labour, Mode of delivery); Fetal factors (Sex, Birth Weight, Maturity of the newborn.

Operational Definitions

- Birth asphyxia: the inability of the newborn to initiate and sustain adequate respiration after delivery with an Apgar score of below within 5 minutes.
- Cases (Birth Asphyxia): Neonates born in the studied Hospitals and diagnosed as Asphyxia by the attending Midwife using an Apgar score of less than 7 at 5th minute.
- Controls- Neonates born in the studied Hospitals and classified as not Asphyxiated ones by the attending Midwife using an Apgar score of less than 7 at 5th minute.

Sampling Procedure

All the governmental and private hospitals were included in the sample giving us a total of 5 Hospitals [2 governmental and 3 privates]. All the cases diagnosed as birth asphyxia were included without sampling in the study during the study period for which it was estimated to attain the required sample size. Whereas controls were selected, using systematic random sampling technique immediately after each Asphyxia case is diagnosed by Appling the concept of risk set sampling. That means when a single case of birth asphyxia was noted in any of the five hospitals the data collectors had investigated a comparable control longitudinally.

Method and tools of data collection

A structured interviewer administered questionnaire was used for data collection. It was prepared in English and translated to Amharic for data collection; finally, it was translated back to English to check the consistency. The questionnaires were filled by 5 midwives in the study hospitals. Medical records like ANC chart of the mother was also reviewed to obtain additional data on the factors that are only present during pregnancy.

Data Quality Assurance

To maintain data quality, 5 data collectors, Midwives by profession and were not working in the study Hospitals recruited and given training for 1 day. Prior to the data collection, the questionnaire was tested in 20 newborns (5%) of the samples taken from health centers and private clinics (4 Cases and 16 controls). The clarity, understand ability and flow of each question and the time to fill the questionnaire were assessed and found satisfactory. Daily all the collected data were checked for completeness by the principal investigator. Every day, 10% of the computed questionnaires were reviewed and checked for completeness by the supervisors and principal investigator and the necessary feedback were provided to data collectors in the next morning before the actual procedures began.

Data Analysis

Data was entered to Epi-info 7 and transferred to SPSS 20 for analysis. Using descriptive statistics, we characterized the socio demographic factors. Bivariable logistic regression model was used to screen out possible factors and finally factors independently associated with the outcome variable were identified and the strength of association was shown using their AOR with the corresponding 95% CI.

Result

Socio-Demographic Characteristics

A total of 380 Newborn (76 cases and 304 controls) were included in the analysis. Of whom 31% of the mothers who gave birth to these neonates are aged between 25-29 years. From

Table 1: Sampling procedure of newborns for birth asphyxia among hospitals in Dessie town, Ethiopia, May 2018, May 2018 (N = 76 case & 304 controls)

Hospital name	Previous year birth			Proportional allocated &selected Size		
	Cases	Controls	Total	Cases	Controls	Total
Selam	6	24	30	4	16	20
Boru-Meda	26	104	130	18	72	90
Dessie	70	280	350	48	192	240
Ethio	5	17	22	3	12	15
Bati	5	17	22	3	12	15
Total	112	442	554	76	304	380

Table 2: Socio demographic characteristics of Cases and Controls of Birth Asphyxia among hospitals in Dessie town, Ethiopia, May 2018

Characteristics	Cases (n=76)		Controls (n=304)		Total (n=380)	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Age of the mother						
<=19	4	5.26	14	4.61	18	4.74
20-24	21	27.63	92	30.26	113	29.74
25-29	27	35.53	91	29.93	118	31.05
30-35	18	23.68	85	27.96	103	27.11
>35	6	7.89	22	7.24	28	7.37
Height of the mother						
<153 cm (short statured)	23	30.26	38	12.50	61	16.05
>153 cm (normal)	53	69.74	266	87.50	319	83.95
Educational status of the mother						
Primary	23	30.26	87	28.62	110	28.95
Secondary	19	25.00	74	24.34	93	24.47
college/university	17	22.37	63	20.72	80	21.05
None	17	22.37	80	26.32	97	25.53

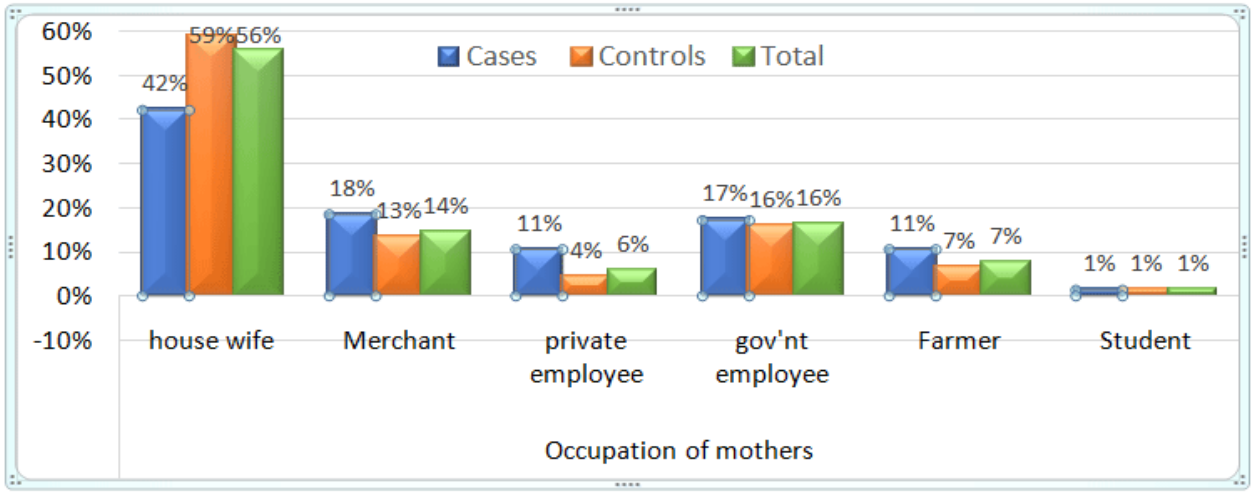

Figure 1: percentage distribution of Mothers occupation among cases and controls of newborns in hospitals of Dessie town Ethiopia, May 2018

the cases, about 35.5% of the mothers who gave birth to these neonates were in the age range between 25-29 years. In addition, from the controls 30.3% of the responding mothers that gave birth to the neonates were aged between 20-24 years

Maternal and Antepartum Related Factors

Table 3 shows a relatively higher proportion of maternal MUAC category of 19-22 cm (moderate malnutrition) among cases (31.6%) than controls (12.8%), conversely a higher proportion of mothers with MUAC category of >=23 cm (normal) was observed among controls (87.2%) than that of cases (63.2%). Pregnancy duration of <37 weeks was more common among cases (18.4%) than controls (11.2%) whereas Term pregnancy (37-42 weeks) was slightly more common among controls (84.2%) than cases (81.6%). A higher rate of ANC 4 visits was recorded among controls (72.7) than cases (63.2).and the presence of illness during pregnancy among cases (18.4%) was higher in proportion than controls (9.2%) (Figure 2 and Table 3)

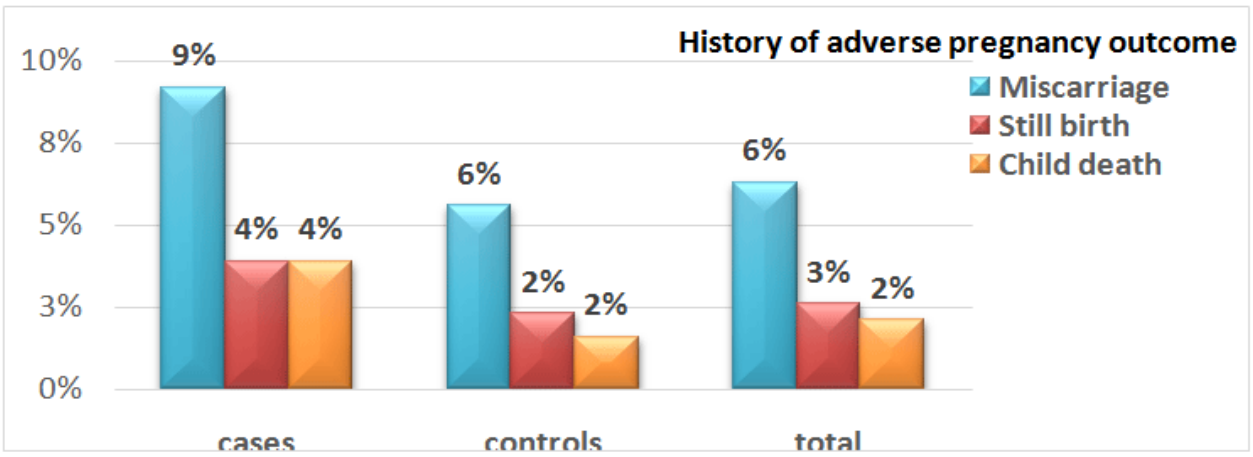

Figure 2: Percentage distribution of history of adverse pregnancy outcome among cases and controls of newborns in hospitals of Dessie town Ethiopia, May 2018

Table 3: Characterization of cases and controls by maternal obstetric factors of Birth Asphyxia among hospitals in Dessie town Ethiopia, May 2018

Characteristics	Cases (n=76)		Controls (n=304)		Total (n=380)	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Pregnancy Status						
Singleton	69	90.8	281	92.4	350	92.1
Multiple (>2)	7	9.2	23	7.6	30	7.9
Parity						
Primi	46	60.5	155	51.0	201	52.9
Multi	30	39.5	149	49.0	179	47.1
Duration of pregnancy						
<37 weeks	14	18.4	34	11.2	48	12.6
>42 weeks	0	0	14	4.6	14	3.7
37-42 weeks	62	81.6	256	84.2	318	83.7
Have a spouse curently						
Yes	70	92.1	290	95.4	360	94.7
No	6	7.9	14	4.6	20	5.3
MUAC						
≤18(severe)	4	5.3	0	0	4	1.1
19-22(mild)	24	31.6	39	12.8	63	16.6
≥23(normal)	48	63.2	265	87.2	313	82.4
Did you have ANC visit						
Yes	74	97.4	298	98.0	372	97.9
No	2	2.6	6	2.0	8	2.1
Number of ANC visit						
one	4	5.3	6	2	10	2.6
two	4	5.3	19	6.3	23	6.1
three	16	21.1	52	17.1	68	17.9
four	48	63.2	221	72.7	269	70.8

Any illness during pregnancy						
Yes	14	18.4	28	9.2	42	11.1
No	62	81.6	276	90.8	338	88.9
Which type of illness						
None	70	92.1	276	90.8	346	91.1
Hypertension	1	1.3	6	2.0	7	1.8
Anemia	3	3.9	14	4.6	17	4.5
Cardiac disease	0	0	2	0.7	2	0.5
DM	1	1.3	4	1.3	5	1.3
APH	1	1.3	2	0.7	3	0.8

Intrapartum Factors

Non-cephalic presentation of the fetus was relatively common among cases (11.8%) than controls (8.6%). Higher rate of caesarian section was recorded among cases (43.4%) than controls (38.8%). Asphyxia cases born after an assisted vaginal birth (25%) were higher in proportion when compared to the controls (9. 2%).A difference in proportion was also noted in terms of prolonged labour (>12 hrs.), where (51.3%) of the cases were born after prolonged labor and only (16.1%) of the controls were born after a prolonged labour. Complications during labour were also common among the cases where (35.5%) of the cases were born after a prolonged labor and only (9.9%) of the controls are born after a prolonged labour. Breech presentation took the highest proportion among cases (9.2%) but it was only (1.3%) among controls (Table 4 and Figure 3).

Table 4 : Characterization of cases and controls by Intrapartum factors Birth Asphyxia among hospitals in Dessie town Ethiopia, May 2018 hospitals in Dessie town Ethiopia, May 2018

Characteristics	Cases (n=76)		Controls (n=304)		Total (n=380)	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Presentation of the fetus						
Cephalic	67	88.2	278	91.4	345	90.8
None cephalic	9	11.8	26	8.6	35	9.2
Oxytocin Augmentation						
Yes	8	10.5	38	12.5	46	12.1
No	68	89.5	266	87.5	334	87.9
Duration of Labour						
>12 hours (prolonged)	39	51.3	49	16.1	88	23.2
<=12 hours (not prolonged)	37	48.7	255	83.9	292	76.8
Duration of rupture of membrane						
>12 hours	10	13.2	40	13.2	50	13.2
<=12 hours	66	86.8	264	86.8	330	86.8
Any complication during Labour						
Yes	27	35.5	30	9.9	57	15.0
No	49	64.5	274	90.1	323	85.0
Type of complication						
None	51	67.1	274	90.1	325	85.5
Pre-Eclampsia	3	3.9	12	3.9	15	3.9
Eclampsia	5	6.6	2	0.7	7	1.8
Fever	2	2.6	0	0	2	0.5

Excessive bleeding	4	5.3	6	2.0	10	2.6
Breech delivery	7	9.2	4	1.3	11	2.9
Cord around the fetal neck	2	2.6	0	0	2	0.5
Cord prolapse	2	2.6	4	1.3	6	1.6
Other (specify)	0	0	2	0.7	2	0.5

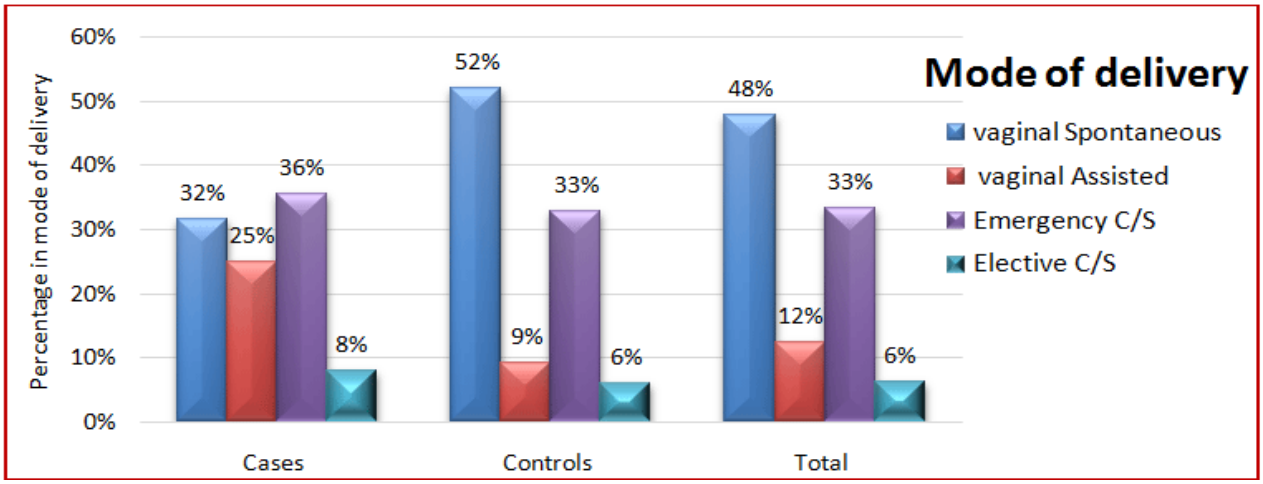

Figure 3: Percentage distribution of mode of delivery among cases and controls of newborns in hospitals of Dessie town Ethiopia, May 2018

Neonatal/ Fetal Factors

The proportion of cases and controls by sex of the fetus was slightly different, where females are relatively higher in proportion (46.1%) among cases than males (51. 6%). Gestational age of <32 weeks (preterm newborns) was relatively higher among cases (19.7%) than controls (10.9), whereas controls were >=37 weeks (term) in gestation. There were also a higher proportion of cases (21.1%) in terms of facing an Intra uterine Growth Restriction than controls (5.3%) (Table 5)

Determinant Factors of Birth asphyxia

Bivariable analysis was conducted to screen the possible determinants of birth asphyxia and variables with a p-values of <=0.2 were included in the multivariable model. Namely Height of the mother, Occupation, MUAC category of the mother, Parity, Duration of the current pregnancy, the number of ANC visit and illness during pregnancy were filtered from the Maternal and Antepartum category, while Assisted vaginal delivery, the duration of labor, complication during labour were selected from the Intrapartum category. The variables selected from fetal category were Newborn age of gestation and IUGR. Finally, Birth Asphyxia was only found to be associated with labour complication, duration of labor, Height of the mother, assisted vaginal delivery, and MUAC category of the mother.

Mothers who had short stature (<=153 cm) were 6.43 times at greater risk to have a newborn with Asphyxia than mothers who had a normal height (>153cms) [AOR=6.430, 95%CI: 2.392-17.29].Assisted vaginal delivery (vacuum or Forceps) poses 3.5 times higher risk of having an Asphyxiated newborn when compared to mothers that had a spontaneous vaginal delivery. [AOR=3.501, 95%CI: 1.365-8.981].

As the duration of labour increases the risk of a newborn to acquire Asphyxia also increases, a newborn born after a prolonged labour (>12 hours) is about 5.1 times more likely to develop Birth Asphyxia than the one born with in the normal duration of labour (<=12 hours) [AOR=5.102, 95%CI: 2.151-12.099].The presence of complication during labour is a factor associated with Birth asphyxia, a newborn with a mother who suffered from any type of complication during labour had a 3.42 times greater risk of developing Birth Asphyxia than a newborn with a mother who had no labour complication [AOR= 3.424, 95%CI: 1.351-8.678].

Maternal MUAC category of <23cm (undernourished) increased the risk of having an Asphyxiated neonate by 4.67 folds than a mother with a MUAC measurement of >=23cm (normal) (AOR= 4.670, 95%CI: 1.842-11.835] (Table 6).

Table 5 : characterization of cases and controls by Fetal factors Birth Asphyxia among hospitals in Dessie town Ethiopia, May 2018

	Cases (n=76)		Controls (n=304)		Total (n=380)	
Characteristics	**Frequency**	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**
Sex of the newborn						
Male	35	46.1	157	51.6	192	50.5
Female	41	53.9	147	48.4	188	49.5
Weight of the new-born						
<2.5 kg	29	38.2	31	10.2	60	15.8
2.5-3.5 kg	45	59.2	200	65.8	245	64.5
3.5-4.0 kg	2	2.6	69	22.7	71	18.7
>4.0 kg	0	0	4	1.3	4	1.1
Newborns age of gestation						
<32 weeks	15	19.7	33	10.9	48	12.6
32-37 weeks	21	27.6	44	14.5	65	17.1
> 37 weeks	40	52.6	227	74.7	267	70.3
IUGR						
Yes	16	21.1	16	5.3	32	8.4
No	60	78.9	288	94.7	348	91.6

Table 6: Bivariable and multivariable results for the determinants of birth asphyxia among hospitals in Dessie town Ethiopia, May 2018G.C

Variables	**Case**	**Control**	**COR[95%CI]**	**AOR[95%CI]**
Height of the mother				
<153 cm (short statured)	23	38	3.038[1.674-5.512]	6.430[2.392-17.291]
>153 cm (normal)	53	266	1	1
Occupation Categorized				
house wife	32	179	2.098[.893-4.925]	-
Merchant	14	40	1.071[.403-2.850]	-
private employee	8	13	0.609[.190-1.958]	-
government employee	13	48	1.385[.519-3.693]	-
Farmer and student	8	20	1	-
Parity				
Primi	46	155	1.474[.883-2.459]	0.821[0.329-2.053]
Multi	30	149	1	1
Duration of this pregnancy(categorized)				
<37	14	34	3.915[2.162-7.090]	2.144[.763-6.026]
>=37	62	270	0	0
Any illness during pregnancy				

No	62	276	1	1
Yes	14	28	2.226[1.107-4.474]	2.180[.644-7.372]
If vaginal delivery was it				
Spontaneous	24	158	1	1
Assisted	19	28	4.467[2.166-9.212]	3.501[1.365-8.981]
Duration of labor				
>12 hours(prolonged)	39	49	5.485[3.184-9.449]	5.102[2.151-12.099]
<=12 hours(not prolonged0	37	255	1	1
Any complication during labour				
No	51	274	1	1
Yes	25	30	3.446[1.881-6.314]	3.424[1.351-8.678]
New-borns age of gestation				
<32 week	15	33	2.580[1.285-5.178]	.807[.240-2.716]
32-37 weeks	21	44	2.709[1.458-5.030]	.468[.129-1.704]
>37 weeks	227	40	1	1
IUGR				
No	60	288	1	1
Yes	16	16	4.800[2.275-10.128]	3.015[.664-13.683]
Maternal MUAC category				
1.00(<23 cm-undernourished)	24	39	3.136[1.740-5.652]	4.670[1.842-11.835
2.00(>=23 cm-normal)	52	265	1	1

Discussion

The risk of having Asphyxia was 7.24 times higher in newborn whose mothers were ≤153cm (short in stature) [AOR=7.248, 95%CI: 2.656-19.781]. This was in line with findings from Nepal [32, 33].This may be due to poor obstetric outcomes are relatively common among short statured women (≤152cm).In contrary, a study from Nigeria reported a higher rate of poor Apgar score among mothers with normal stature [34]. This contradiction can be due to the higher rate of caesarean section among the cases which could be an early measure to prevent Birth asphyxia.

Newborn delivered after assisted vaginal birth was 3.2 folds at higher risk to develop Birth Asphyxia [AOR=3.200, 95%CI: 1.206-8.491]. This finding is similar with findings from India and Iran [31, 38]. The possible explanations for this can be instrumental delivery causing birth trauma which in turn leads to Asphyxia [39]. Despite this a study from special administration of china Hong Kong reported a significant decrease of Birth Asphyxia related to instrumental delivery, this discrepancy may have resulted from the Hawthorn effect or method variation [40].

The odds of Birth Asphyxia were 5.43 folds greater in newborn after a prolonged labor [AOR=5.435, 95%CI: 2.315-12.764]. This finding agrees with findings from Dire Dawa and Malawi [36, 37].This may be due to prolonged labor makes the baby to be involved in labor for a long time that carries higher risk of birth trauma and in addition, many conditions associated with prolonged labor make it more likely that the baby will be exposed to Pitocin, cytotec, forceps/vacuum extractors. All of this issues can cause the baby to have birth asphyxia [42].

Babies born after a complicated labor were 3.47 times more likely to develop Birth Asphyxia [AOR= 3.470, 95%CI: 1.364-8.829]. This finding is compatible with studies from Colombia and India [29, 30]. This can be due to the fact labour complications such as umbilical cord problems, hypertension, and others that can decrease the blood and oxygen supply to the infant leading to Asphyxia. The risk of developing Birth Asphyxia was 2.79 times higher in newborn whose mothers MUAC measurement was <23cm (undernourished) [AOR= 2.791, 95%CI: 1.033-7.541]. This result is in line with result from Nepal [32]. This may be due to maternal under nutrition predisposing to low birth weight baby and intrauterine growth restriction which in turn has its own impact on birth asphyxia [43, 44, 45, 46].

Conclusion

Birth asphyxia was more common in newborns with short statured mothers, mothers who had below normal MUAC measurement, newborns delivered after assisted/Instrumental delivery, prolonged labor and those encountered any complication during labour among hospitals in Dessie town. In contrast, fetal factors were not independently associated with birth asphyxia.

The hospitals under study should give special focus for mothers with MUAC measurement of <23cms and those who are short stature, work to minimize if not avoid labor complications, try to identify the root causes of prolonged labour and manage them accordingly. The concerned Bodies (Government offices and NGOs) should work on improving the maternal nutritional status in the area, promote, and support studies on the factors that contribute to birth asphyxia in newborns delivered after Instrumental/assisted delivery and work with the hospitals and government bodies to manage issues related to prolonged labour

Ethics Approval and Consent to Participate

Ethical clearance was obtained from Institutional Review board of College of Medicine and Health Sciences, Bahir Dar University. Then, an official letter was written to Amhara regional health bureau, south Wollo zonal health department, and the study was started after written consent obtained from the Woreda health office. Written consent was obtained from mothers of newborn after they were informed about objectives and procedures of the study and their rights to refuse participation any time they want were assured. For this purpose, a one-page consent letter was attached as a cover page of each questionnaire stating about the objective of the study and issues of confidentiality which was discussed by the data collectors before proceeding with the interview. At the end of each interview, participants who were cases were advised to follow their treatment

Consent for Publication

Consent for publication is not applicable- this study did not take individual person's detail such as name, images, or videos.

Availability of Data and Material

All the data generated or analyzed during this study are included in this published article

Competing interests

The authors declare that we have no competing interests.

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Authors' Contributions

Suleyman Aragaw wrote the proposal, participated in data collection, and analyzed the data. Getachew Hailu and Yihun Mulugeta approved the proposal with some revisions, and participated in data analysis. Getachew Hailu wrote the manuscript. We revised drafts of the paper. All authors read and approved the final manuscript.

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