


Placental and Umbilical Cord Indices and Their Association with Fetal Distress in Hadiya Zone Public Hospitals, Southern Ethiopia: A Cross-Sectional Study

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Background: The placenta and umbilical cord have been considered as significant contributors to the perinatal outcome and have contributed to some degree to neonatal mortality. The placenta has a very crucial role in normal fetal development. After about four weeks of gestation, the only link of the fetus to the placenta is the umbilical cord. Very little is known about placental and umbilical indices in Ethiopia. This study was aimed to determine placental and umbilical cord indices and their association with fetal distress in Hadiya zone public hospitals, southern Ethiopia.

Methods: This study included 249 placentae with the attached umbilical cord from normal singleton live birth with known gestational age. Bivariable and multivariable logistic regression was used, and variables with $p < 0.25$ in the bivariable analysis were entered into a multivariable logistic regression to identify the independent factors for the outcome variable. Odds ratios with 95% confidence were computed, and statistical significance was declared at p -value < 0.05 .

Results: Three-fourth (75.9%) of diameter of studied placenta was in normal range and 18.1%, 6.0% below and above normal range, respectively. About one-third (32.9%) of umbilical cords were short, 61.8% normal, and 5.2% long. Newborns with thin placenta [AOR = 3.43; 95% CI: 1.25, 9.40], short cord length [AOR = 3.43; 95% CI: 1.66, 7.09] and long cord length [AOR = 7.55; 95% CI: 2.07, 27.53] were significantly associated with fetal distress.

Conclusion: In this study, deviation of umbilical cord length from the normal range and placental thickness were significantly associated with fetal distress. In addition, fetal distress was also associated with gestation age and sex of the newborn.

Keywords: placenta, umbilical cord, fetal distress, Hadiya, Ethiopia

Plain Language Summary

The placenta and umbilical cord are two important organs during fetal development. The placenta is important for the metabolic needs of the fetus, whereas the umbilical cord is for linkage. Very little is known about placental and umbilical indices in Ethiopia besides limited study. Hence, this study aimed to explore the relationship between placental and umbilical cord parameters with fetal distress. The placentae with attached umbilical cord are collected from delivery wards. Placentae are weighed using a weighing machine. The placental shape and presence of the accessory lobe were recorded after proper observation. With a long needle, the placental thickness is measured at five different areas and the mean of five is

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considered as thickness. A standard non-elastic tape measure scaled in centimeter is used for umbilical cord length. The findings reveal thin placenta, short and long umbilical cord length have an association with fetal distress.

Introduction

The human placenta is one of the most important fetomaternal channels, providing nutritional support, excretory functions, immunological and hormonal support for the developing fetus.¹⁻³

The examination of the placenta in utero and postpartum period gives valuable information about fetal wellbeing.⁴ It is clear that a normally functioning placenta is critical for normal fetal growth and development.⁵

At term, the placenta attains an approximately circular or oval outline, with an average weight of 500gm (200–800gm), a diameter of 18.5cm (15.0–20.0cm), and a thickness of 2.3cm (10–40cm).⁶ In addition, Janthanaphan et al indicated an average placental index of 18.5cm in diameter, 2.3cm in thickness, and weight of 508gm at term.⁷

The placenta is normally considered to be round discoid in shape,⁸ however, oval, irregular, star, bi-lobate, multi-lobate, circumvallate, circummarginate shapes are also reported.^{8,9} The most common shape of placental is circular (93%) followed by an oval (7%).⁴ Abnormality in a chorionic plate shape is a useful tool in clinical practice.¹⁰

Studies have reported variations in the placental diameters and thickness. For instance, Adesina et al found placental diameters and thickness of 15–22cm and 2–4cm, respectively,³ whereas Abu et al reported it as 15–25cm for diameters and 3cm for thickness.¹¹

Despite variations in the findings from different studies, the majority of observed umbilical cord lengths are approximately similar.¹²⁻¹⁵ Accordingly, a study conducted in Japan revealed umbilical cord length (UCL) of ≥ 74 cm and ≤ 38 cm as long and short, respectively, with a normal range between (45–68cm).¹² Similarly, a study in Saudi Arabia, showed that short cord and long umbilical cords as < 35 cm and > 80 cm.¹³ Short umbilical cord was reported to be less than 40cm whereas long cord was greater than 70cm with the prevalence of 4.9% and 3.8%, respectively.¹⁴ Other studies indicated the mean short and long cord length as 44.3 and 47.04cm, respectively.¹⁵

The short umbilical cord is associated with antepartum and birth complications¹² and leads to the delayed second stage of labor, adverse perinatal outcomes like fetal growth

restriction, congenital malformations, fetal distress, and death.¹⁶ Likewise, long umbilical cords are associated with increased risk of birth weight, respiratory distress, adverse neonatal outcome, low Apgar score, and cord entanglement.^{14,16}

The umbilical cord insertion onto the placenta relies heavily on the implantation of the blastocyst and is categorized into four. Umbilical cord inserting within 2cm of the center of the chorionic plate is centric, cord inserting > 2 cm from the center and within the margin of the chorionic plate is eccentric; cord insertion into the margin of the chorionic plate is marginal and those inserting outside of the chorionic margin into the membranes are velamentous.¹⁶

In clinical areas, physicians and other health professionals encounter a variety of cord attachments as reported as 66% eccentric, 24% central, 8% marginal, and 2% velamentous.¹⁷ In contrast, a study in India reported that the most frequently observed cord attachments were central 58%, eccentric 20%, marginal 20%, and 2% velamentous.¹ It was also reported that 57.6% of cord attachments were eccentric, 32.1% central, and 8.9% marginal.¹⁸

The examination of the placenta is helpful to plan a safe pregnancy and a healthy baby outcome at its end.¹⁹ In addition, it can also yield information that is useful for immediate and late management of maternal and neonatal complications.²⁰ However, the attempt to explore its usage globally as well as in Africa has been limited due to paucity of information on the parameters of the placenta and umbilical cord, which is also sophisticated due to sociocultural belief where relatives of mother or father handle these parameters following delivery. As a result of this, using the placentae and umbilical cords for biomedical research has been significantly limited.¹⁴

As one of the developing and technological emerging countries, Ethiopia is not an exception and there is scanty evidence on placental and umbilical cord indices and their association with fetal distress in Ethiopia. Therefore, the purpose of this study was to determine placental and umbilical cord indices and their association with fetal distress in Hadiya zone public hospitals, southern Ethiopia.

Methods and Materials

The study was conducted in Hadiya zone public hospitals, southern Ethiopia. The Hadiya zone is one of the zones in southern Ethiopia with a total population of nearly

two million. The altitude of the zone ranged between 2276–3000m above sea level. There are three public hospitals, namely, Homacho and Shone primary hospitals and Wachemo University Nigist Eleni Mohammed Memorial Referral Teaching Hospital with the monthly average deliveries of 120, 123, and 350, respectively, as zonal health department report, 2018. The institution-based cross-sectional study design was conducted from October 1 to December 30, 2018.

Source and Study Population

Source Population

The source population was all women who gave birth in Hadiya zone Public Hospitals.

Study Population

All selected women gave birth in three Public Hospitals during the study period and fulfill inclusion criteria.

Eligibility Criteria

Inclusion Criteria

- Women with confirmed gestational age, women with singleton pregnancy and who gave live birth neonate, women having antenatal care card and samples labeled with the number sticker and can be read were included.

Exclusion Criteria

- Women with any maternal diseases like diabetes mellitus and hypertension, fetal congenital anomalies, and abnormalities of the placenta.

The Sample Size Determination

The sample size was determined by using single population proportion formula based on the following assumptions: since there was no prior study in Ethiopia, to calculate the required sample size (n), the proportion (p) was taken as 0.5 at 95% CI and margin of error (5%), which gave a sample size of $n=384$. Since the total of 593 deliveries on monthly average in three public hospitals were less than 10,000, the correction formula was used to determine the final sample size which was 233, expecting a 10% of non-response rate, the final sample size calculated was 256.

Sampling Procedure

All public hospitals were enrolled in the study and the study was conducted in all of them simultaneously. Before the actual implementation of the study, the case-

load of each hospital was obtained. The sample size was distributed to each selected hospital using proportional to population size. The respondents were selected by using systematic random sampling techniques until the required sample size was reached. To determine the sampling frame, the expected total number of delivery services on a monthly average (593) is divided by the total sample size (256). To determine the sampling interval (K), the number of units in the population (N) was divided by desired sample size (n). $K=N/n$, $N=593$, $n=256$, $k=593/256=2.31\sim 2$. With this proportional to the unit participant numbers (size), every 2nd mother's placenta with attached umbilical cord was enrolled in the study starting from the randomly selected (2nd) newly delivered eligible mothers' placentas and umbilical cord.

Operational Definitions

Fetal distress: compromise of a fetus due to inadequate oxygen and nutrient supply.

The irregular shape of the placenta: placental shapes other than circular and oval.

Preterm birth: Newborns with gestational age less than 37 complete weeks.

Umbilical cord length: total length of cord measured from the fetal end to its point of insertion into the placenta.

Placental indices: placental weight, placental thickness, placental shape, and placental diameter.

Umbilical Cord indices: umbilical cord length and its insertion on to placenta.

Placental weight: a placenta with a weight of 330gm and above was considered as "normal" and a weight less than 330gm was considered as the "low placental weight".

Placental thickness: a placenta with a thickness of 2cm and above was considered as "normal" and a thickness less than 2cm was considered as the "low (thin) placental thickness".

Specimen Collection and Preparation

The placentae from the delivery wards were collected and washed under normal saline to wash off blood smears and clots. The umbilical cords were tied and cut leaving 5cm towards the fetal side.^{4,21} The specimens were then placed in a plastic container filled with formalin (10%) within 20 minutes of delivery to prevent drying out.⁸ All the specimens were labeled with a number sticker after washing for differentiation purposes and stored once again in a solution of 0.5% formaldehyde in saline for further detailed examination and measurement.

Placental Variables

Initially, placentae were checked for completeness and an accurate weighing of the placentae was done after trimming off all membranes and removing the umbilical cord. Then, washed in normal saline, mopped, and tagged with the number's sticker.^{19,22} The placentae were placed in a flat tray and the following parameters were measured accordingly: First, the maximum diameter was measured with standard non-elastic tape measure graduated in centimeters (cm). Then, another maximum diameter was measured at the right angle to the first measured diameter and the mean of two measurements was taken as the diameter of the placenta expressed in centimeter.²⁰

Placentae were weighed using a weighing machine scaled in gram and the shape and presence of accessory lobe were recorded after proper observation to be categorized as round, oval, or irregular in shape.^{20,23,24} After placing each placenta on the fetal surface, with the help of a long needle, the placental thickness was measured at five different points where the placentae were arbitrarily divided into three zones by drawing two circles on the maternal side. One thickness was measured from the Center of the central zone, two from the middle zone, and another two from the peripheral zone. Finally, the mean of all five measurements was calculated and considered as the thickness of the placenta.^{20,23,24}

Umbilical Cord Length

Each umbilical cord was immediately clamped and cut with scissors leaving 5cm from its fetal site of insertion. The remaining cord from the cut end to the placental insertion was measured using a standard non-elastic tape measure labeled in centimeters and five centimeters (length of cord attached to the fetus) was added to the length of the measured umbilical cord to determine the entire length of the umbilical cord.^{3,4,14,23}

Infant Anthropometry and Maternal Indices

Infant anthropometric parameters including birth weight, body length, head circumference, and sex were determined in all infants. All measurements were measured by the same trained birth attendant within 24 hours after delivery. Data on maternal age at delivery and parity were obtained from the medical registration book. Gestational age was expressed in complete weeks from the Last Normal Menstrual Period (LNMP) confirmed by ultrasound scan.

Data Management and Analysis

Before entering and exporting collected data, it was checked manually for its completeness, and coded and entered into Epi-Data version 2.1 then exported to Statistical Package for Social Sciences (SPSS) Version 20. For further analysis, bivariate and multivariable logistic regression analyses were computed to determine the association between placental and umbilical cord parameters and the outcome variable. Variables with $p < 0.25$ in the bivariable logistic regression analysis were entered into a multivariable logistic regression to identify the independent determinants by controlling confounders. Odds ratios with 95% confidence interval were computed and statistical significance was declared if p -value < 0.05 . The collinearity between independent variables was checked.

Data Quality Assurance

Before the actual data collection process, data collecting tools were checked for clarity, understandability, uniformity, and completeness. The training was given to data collectors and supervisors for two days about the objectives, process of data collection, and standard operating procedure. The pre-test was conducted in 5% of the sample size.

Results

Maternal Socio-Demographic and Obstetric Characteristics

Out of 256 reproductive ages, childbearing women planned to be included in the study, 249 respondents were included with a response rate of 97.26%. However, a total of 7 women failed to remember their LNMP and had no ultrasound gestational age estimate documented, referral cases and placental anomalous were excluded from further analysis to maintain the unbiased effect. The age of respondents included in this study was ranged between 18 and 46 years with a mean age of 30 years ($SD \pm 6.78$). Fifty-one (20.5%) of mothers were unable to read and write, whereas fifty-eight (23.3%) of mothers had followed more than secondary education. More than half of mothers 169 (67.9%) were living in the urban area and 80 (32.1%) were rural residents. Governmental employees and housewives were the predominant maternal occupation in the study group 98 (39.4%) and 88 (35.3%), respectively. All most all of the respondents 229 (92.0%) were married and 165 (66.3%) were multiparous. One hundred and seven (43.0%) and 85 (34.1%) of mothers had 1–2 and 3–4 children, respectively (Table 1).

Table 1 Socio-Demographic and Obstetric Characteristics of the Mothers in Hadiya Zone Public Hospitals, Southern Ethiopia, 2018

Background Variables	Categories	Frequency	Percent
Maternal age	<20 years old	7	2.8
	20–34 years old	169	67.9
	35–49 years old	73	29.3
Place of residence	Urban	169	67.9
	Rural	80	32.1
Maternal educational status	No formal education	51	20.5
	Primary	74	29.5
	Secondary	66	26.5
	More than secondary	58	23.5
Occupation of the mother	Farmer	39	15.7
	Housewife	88	35.3
	Governmental employee	98	39.4
	Merchant	6	2.4
	Unemployed	18	7.2
Marital status of the mother	Married	229	92.0
	Single	14	5.6
	Divorced	6	2.4
Parity	Nulliparous	90	36.1
	Multiparous	159	63.9
Gravidity	1–2	107	43
	3–4	85	34.1
	≥5	57	22.9
Mode of delivery	Normal vaginal delivery	222	89.2
	Cesarean section	4	1.6
	Vacuum extraction	12	4.8
	Forceps extraction	11	4.4
Gestational age	<34wk	25	10.1
	34–37wk	78	31.3
	≥37wk	146	58.6

Shape of placenta

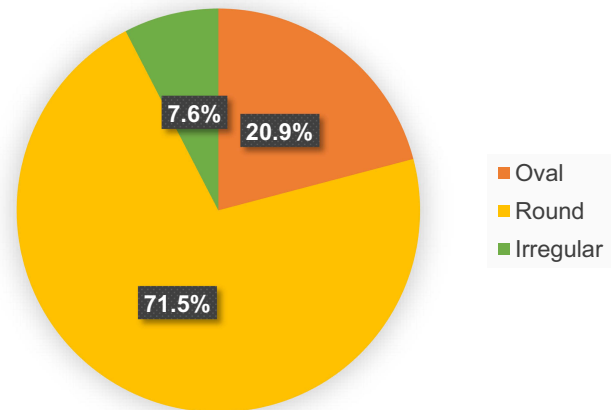


Figure 1 Distribution of the shape of the placenta in Hadiya zone public hospitals, Southern Ethiopia, 2018.

Placental Indices

The mean major diameter of placenta was 18.3 (SD±2.7; range=12.0–24.2cm) and the minor diameter was 17.2 (SD ±2.6; range=10.5–23.5cm) with mean diameter of two 17.73±2.61 (ranged =11.3–23.8cm). Three-fourth 189 (75.9%) of the diameter of the studied placenta was in the normal range and 45 (18.1%), 15 (6.0%) below and above normal range, respectively. The mean placental thickness on gross measurements was 2.43±0.41 with a range of 1.6 cm to 3.9 cm. In this study, the mean placental weight was 448.3gm (SD±100.9; range=299.0–723.0gm). More than three-fourth 204 (81.9%) of placental weight was within the normal range (330–750gm).

The placenta is normally believed to be round in shape, but its shape has also been designated in various ways like oval, irregular, star-shaped, bi-lobate, multi-lobate, and circumvallate. In this study majority (71.5%) of the shape of the placenta was round in shape with a rare case of irregular shape (7.6%) (Figure 1).

Fetal Indices

Among the 249 neonates studied, 136 (54.60%) were males and 113 (45.40%) were females. The mean gestational age (GA) was 37.03 weeks (SD=2.29, range=30.3–41.5 weeks). Over half of 60.6% (n=151) delivered babies were term whereas 98 (39.4%) were preterm, of which more than half 60.2% (n = 59) were male while remaining 39.8% (n=39) were females.

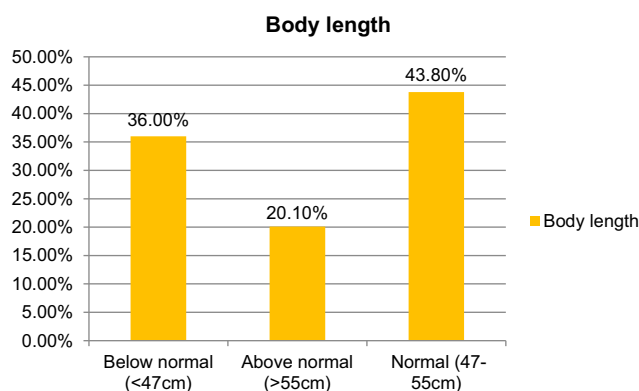


Figure 2 Distribution of newborn body length in Hadiya zone public hospitals, Southern Ethiopia, 2018.

The birth weight of the babies had a mean of 3270.68gm (SD=565.67, range=2000–4500gm). The majority, 220 (88.4%) had birth weight within the normal range. Twenty-nine (11.6%) had birth weight < 2.5kg. Of those with birth weight < 2.5kg, 89.7% (n=26) were preterm, whereas 10.3% (n=3) were delivered after complete weeks of gestational age. Concerning fetal distress, about 87 (34.9%) of babies had fetal distress and were admitted to the neonatal intensive care unit for resuscitation. Of those with fetal distress, 43 (52.4%) had short umbilical cord length, whereas 8 (61.5%) were with long cord length. Apgar scores at one and five minutes respectively ranged from 2–9 and 3–10 with a mean of 7.12±1.45 and 8.21±1.39.

In this study, newborn length was measured from the top of the head to heels positioned straight on his/her back in the center of the board head touching the headpiece and eyes looking straight up. The mean body length is 48.6cm (SD=5.9, range=38.0 to 61.0cm). Nearly half (43.8%) of the baby's body length was in the normal range followed by short or below normal and long or above normal, respectively, while the mean head circumference of babies was 33.70cm (SD=2.14, range=29.5 to 38.0cm) (Figure 2).

Umbilical Cord Indices

A total of 249 placentae with their attached umbilical cords were collected from the Hadiya zone public hospitals from October 1 to December 30, 2018. The UCL ranged from 22 to 80.1 cm with a mean of 46.34±10.72cm. Out of the 249 cords examined, 82 (32.90%) were short cord length (< 40cm), 154 (61.80%) were of normal length (40–70cm) and 13 (5.2%) were longer than normal range (> 70cm).

The insertions of the umbilical cord in those placentae with an attached cord for combined Centric and eccentric umbilical cord insertions were found in 90.8% (25.7% and 65.1% respectively) of all cord insertions into the placenta, followed by marginal which is also known as battledore 8.8%. The least occurring, 0.4% of cord insertion in this study was velamentous cord insertion (Table 2).

In the bivariable logistic regression analysis, sex, placental weight, placental thickness, UCL, the shape of the placenta, GA of a newborn, Apgar score at five minutes, Apgar score at one minute, parity, and gravidity were found to be independently associated with fetal distress at p-value <0.25.

However, multivariable logistic regression analysis showed that only placental thickness, sex of the neonate, UCL, GA, gravidity, Apgar score at five minutes and one minute were significantly associated with fetal distress at p-value <0.05. Newborns who had short cord length [AOR=3.43; 95% CI: 1.66, 7.09] and long cord length [AOR=7.55; 95% CI: 2.07, 27.53] were nearly three and eight times more likely to develop fetal distress as compared to newborns with normal cord length.

Another variable that had an association with fetal distress independently and in combined form was GA. Gestational age of delivered neonate had a significant association with fetal distress where Infants who had delivered before 34 complete weeks were 20 folds [AOR=20.77; 95% CI: 5.98, 72.15] more likely to develop fetal distress as compared with their counterparts. In addition, thin placenta (< 2cm), Apgar

Table 2 Distribution of Umbilical Cord Attachment in Hadiya Zone Public Hospitals, Southern Ethiopia, 2018

Umbilical Cord Attachment	Frequency	Percent	Cumulative Percent
Central	64	25.7	25.7
Eccentric	162	65.1	90.8
Marginal	22	8.8	99.6
Velamentous	1	0.4	100.0
Total	249	100.0	

Table 3 Result of Bivariable and Multivariable Logistic Regression for Factors Associated with Fetal Distress in Hadiya Zone Public Hospitals, Southern Ethiopia, 2018

Variable	Categories	Fetal Distress No (%)		COR (95% CI)	AOR (95% CI)
		Yes	No		
Placental weight	Low	26(57.8)	19(42.2)	3.21(1.65,6.23)**	1.71(0.65,4.46)
	Normal	61(29.9)	143(70.1)	I	I
Placental thickness	Low	18(58.1)	13(41.9)	2.99(1.39,6.45)**	3.43(1.25,9.40)*
	Normal	69(31.7)	149(68.3)	I	I
Placental shape	Oval	14(24.1)	44(75.9)	I	I
	Round	64(36.8)	110(63.2)	1.83(0.93,3.59)	1.96(0.77,5.04)
	Irregular	9(52.9)	8(47.1)	3.54(1.15,10.91)**	3.76(0.89, 15.84)
Umbilical cord length	Short	43(52.4)	39(47.6)	3.62(2.04,6.40)*	3.43(1.66,7.09)*
	Long	8(61.5)	5(38.5)	5.24 (1.62,17.03)*	7.55(2.07,27.53)*
	Normal	36(23.4)	118(76.6)	I	I
Sex	Male	57(41.9)	79(58.1)	I	I
	Female	30(26.5)	83(73.5)	0.50(0.29,0.86)**	0.38(0.18,0.81)*
Gestational Age	<34wk	20(80.0)	5(20.0)	13.70(4.77,39.30)*	20.77(5.98,72.15)*
	34–37wk	34(43.6)	44(56.4)	2.65(1.46,4.78)*	1.47(0.70,3.08)
	≥37wk	33(22.6)	113(77.4)	I	I
Apgar Score at 5 minutes	Poor	32(68.1)	15(31.9)	5.70(2.87,11.34)*	5.27(2.28,12.21)*
	Good	55(27.2)	147(72.8)	I	I
Apgar Score at 1 minute	Poor	35(47.9)	38(52.1)	2.20(1.25,3.85)**	2.30(1.11,4.77)**
	Good	52(29.5)	124(70.5)	I	I
Parity	Nulliparous	37(44.0)	47(56.0)	I	I
	Multiparous	50(30.3)	115(69.7)	0.55(0.32,0.95) **	0.76(0.24,2.40)
Gravidity	1–2	47(43.9)	60(56.1)	I	I
	3–4	27(31.8)	58(68.2)	0.59(0.33,1.08)	0.37(0.17,0.80)**
	≥5	13(22.8)	44(77.2)	0.38(0.18,0.78)**	0.38(0.13,1.06)

Note: *p-value < 0.0001; **p-value < 0.05.

Abbreviations: AOR, adjusted odd ratio; CI, confidence interval; COR, crude odd ratio.

score at five minutes and one minute, being female, and gravidity (women with 3–4 children) were also had an association with the outcome variables of interest (Table 3).

Discussion

This study aimed to assess placental and umbilical cord indices and their association with fetal distress among 249 placentae from normal singleton live birth with the

attached umbilical cord in public hospitals of Hadiya zone, southern Ethiopia.

In this study, the minimum and maximum umbilical cord lengths were 22 and 80.1cm with a mean of two 46.34 ±10.72cm. This finding is nearly similar to the previous study which reported the cord length of 47.04±12.8 cm.¹⁵

In this study, the prevalence of long and short cord was 5.2% (95% CI: 2.8–8.0%) and 32.9% (95% CI: 26.5–

38.9%) which is higher compared to previous studies, which found the prevalence of long cord (2.5% and 3.8%) and short cord (6.6% and 4.9%),^{13,14} respectively. This discrepancy might be due to existence of variation in the definition of cord length and the measurement used.^{15,25} Another possible reason can be due to methodological and sample size differences.

In this study, UCL deviation from the normal range has been associated with fetal distress. The odds of developing fetal distress among newborns with short cord length were increased by 3.43, whereas those with long umbilical cord were 7.55 times more likely to develop fetal distress as compared with their counterparts. These findings are supported by previous findings.^{14,16,26} It is believed that excessive traction on the short cord during the descent of the fetus results in occlusion of the cord vessels and leads to failed progress and cord rupture.²⁶ Similarly, long umbilical cords can cause cord prolapse²⁶ and which might be explained in the term of cord entanglement (true knots or cord loops around the neck or body parts) and cause perinatal complications like, neurological damage and fetal death.

In this study, the thin placenta was associated with an increased likelihood of fetal distress. This might be explained in the terms of structural organization of the chorionic plate vessels from a high capacitance and low resistance of fetoplacental vascularization. Hence, any potential limitation on placental ability to transfer any fetal necessities might affect the overall status of a fetus that may lead to fetal distress.

In addition to the factors identified above, delivery before 34 weeks, Apgar score <7 at five and one minutes, being female and gravidity were also associated with fetal distress. The odds of fetal distress among babies with Apgar score of <7 at five and one minutes were five times and two folds more likely to develop fetal distress as compared with their counterparts which are supported by a previous study.¹³

Conclusion

This study revealed the prevalence of short, long, and normal cord length as 32.9%, 5.2%, and 61.8%, respectively. It was also found that 75.9% of placentae had normal diameter and 18.1%, 6.0% had a diameter below and above the normal range, respectively. Deviations of UCL from the normal range (short and long cord length), thin placenta, preterm birth (<34 weeks), Apgar score <7 at five minutes and one minute were the factors associated with fetal distress.

Strength and Limitations of Study

Direct measurement of the placenta and umbilical cord parameters was performed precisely to the nearest decimal and recorded by trained data collectors under close supervision of the principal investigator. Since this study was conducted in the hospitals, the study result might not be generalized to the entire population.

Recommendations

It is recommended that the relevant training is the urge to physicians, midwives, and all concerning bodies about ultrasonography detection of the fetal status during antenatal care. Besides, proper examination of the placenta and umbilical cord after delivery should be encouraged. Moreover, it is highly recommended for researchers to conduct the further study using a larger sample size.

Abbreviations

AAU, Addis Ababa University; AMU, Arba Minch University; UCL, umbilical cord length; SPSS, Statistical Package for the Social Sciences; SD, standard deviation.

Ethical Consideration

An ethical clearance letter was obtained from Addis Ababa University (AAU), College of Health Sciences, institutional research ethics review, and integrity board before data collection. Accordingly, a letter of cooperation was obtained from the Hadiya zone health department. Moreover, written informed consent was obtained and all participants have informed of the purpose and benefit of the study along with their rights to refuse and reassured for the attainment of confidentiality.

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Author Contributions

All authors made substantial contributions to conception and design; execution and acquisition of data; analysis and interpretation of data; took part in drafting the manuscript and revising it critically for important intellectual content; agreed to submit to the current journal; gave final approval

of the version to be published; and agreed to be accountable for all aspects of the work.

Disclosure

The authors declare no competing interests in this work.

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