



**INSTITUTE OF HEALTH
DEPARTMENT OF BIOMEDICAL SCIENCES
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**FACTORS AFFECTING UMBILICAL CORD LENGTH AND ITS
ASSOCIATION WITH BIRTH OUTCOMES AMONG DELIVERIES
AT JIMMA MEDICAL CENTER, JIMMA TOWN, SOUTHWEST
ETHIOPIA.**

BY: YEHUALASHET FERENJO (B.Sc.)

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A THESIS RESEARCH SUBMITTED TO DEPARTMENT OF BIOMEDICAL SCIENCES, INSTITUTE OF HEALTH, JIMMA UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTERS OF SCIENCES IN CLINICAL ANATOMY

PRINCIPAL ADVISOR

Mr. TILAHUN ALEMAYEHU NIGATU (M.Sc., ASSISTANT PROFESSOR OF ANATOMY)

CO-ADVISORS

Mr. BEKALU GETACHEW (M.Sc. IN ANATOMY)

Mr. NIGUSE HAMBA (M.Sc. IN ANATOMY)

Dr. FEDLU ABDULHAY (ASSISTANT PROFESSOR OF OBSTETRICS AND GYNECOLOGY)

ABSTRACT

BACKGROUND: *Umbilical cord is a narrow tube-like structure that connects the developing fetus to the placenta. Placental and umbilical cord conditions have contributed to neonatal mortality and are an important factor for adverse fetal and maternal outcomes. In Ethiopia there is lack of data on quantitative measurement of umbilical cord length and its association with birth outcomes.*

OBJECTIVES: *To assess factors affecting umbilical cord length and its association with birth outcomes among deliveries at Jimma Medical Center, Jimma town, Southwest Ethiopia from October 15-November 15 2021.*

METHODS: *A hospital-based cross-sectional study was conducted at Jimma medical center among consecutively sampled 257 mothers and newborns. The data was collected by two B.Sc. midwives, under supervision of Gynecology resident. The length of the umbilical cord was measured by using non-elastic plastic tape meter. Fetal and maternal outcomes were recorded. All data were cleaned, coded and entered into EPI data version 4.6 and exported to SPSS version 23:0 for analysis. Analysis included descriptive statistics, linear and logistic regression.*

RESULTS: *A total of 257 mothers and their neonates take part in this study. The mean umbilical cord length in this study was 56.2 cm. Placental weight (β : 0.012, 95% CI 0.002, 0.021), birthweight (β : 2.173 95% CI 0.96, 3.386).and gestational age (β :-2.56, 95% CI -4.989, -0.132) were variables that showed statistically significant association with umbilical cord length in multiple linear regressions. In multiple logistic regression birth outcomes; APGAR score <7 at 5th minute (AOR=1.249, 95% CI=1.022, 1.526), Retained placenta (AOR=0.878, 95% CI=0.794, 0.971) and still birth (AOR=0.776, 95% CI=0.669, 0.899) were associated with umbilical cord length.*

CONCLUSION AND RECOMMENDATION: *The mean umbilical cord length in this study was 56.2 cm. Placental weight, birthweight, and gestational age were factors that affect umbilical cord length. APGAR score of <7, retained placenta and still birth were birth outcomes associated with umbilical cord length. Proper examination of the umbilical cord after delivery, prenatal measurement of umbilical cord length and appropriate recording of data pre-pregnancy to delivery is recommended.*

KEY WORDS: *Umbilical cord length, Birth outcomes, Jimma, Ethiopia*

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ACRONOMYS AND ABBREVIATIONS

AOR	Adjusted odds ratio
APGAR	Apperance,pulse,grimace,activity,respiration
BMI	Body mass index
COR	Crude odds ratio
CS	Cesarean section
GDM	Gestational diabetes mellitus
ELUC	Excessively long umbilical cord length
FIG	Figure
GA	Gestational age
IUGR	Intra uterine growth restriction
JMC	Jimma medical center
LSCS	Lower segment cesarean section
NC	Nuchal cord
NICU	Neonatal intensive care unit
NRFS	Non reassuring fetal status
PPH	Post-partum hemorrhage
SD	Standard deviation
SGA	Small for gestational age
SVD	Spontaneous vaginal delivery
UCL	Umbilical cord length
WHO	World health organization

1. INTRODUCTION

1.1 Background

Umbilical cord is a narrow tube-like structure that connects the developing fetus to the placenta. The cord is sometimes called the fetuses' "supply line" because it carries the fetuses' blood back and forth between the fetus and the placenta (1).

Umbilical cord development begins in the embryologic period around week 3 with the formation of the primitive umbilical ring. It is an oval reflection line that runs between the amnion and the embryonic ectoderm. In the fifth week of development, the connecting stalk, containing the allantois and the umbilical vessels, vitelline duct, accompanied by the vitelline vessels, and the canal connecting the intraembryonic and extraembryonic cavities pass through the primitive ring (Fig.1). During further development, the amniotic cavity enlarges rapidly at the expense of the chorionic cavity, and the amnion begins to envelop the connecting and yolk sac stalks, crowding them together and giving rise to the primitive umbilical cord. Distally, the cord contains the yolk sac stalk and umbilical vessels. More proximally, it contains some intestinal loops and the remnant of the allantois (2).

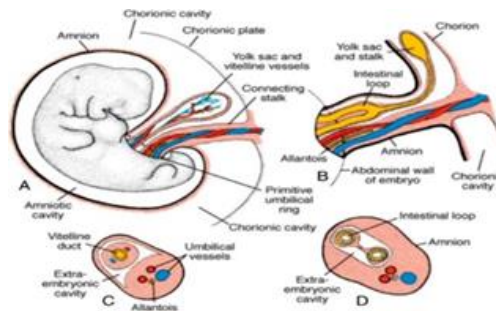


Figure 1: **A.** A5-week embryo showing structures passing through the primitive umbilical ring. **B.** The primitive umbilical cord of a 10-week embryo. **C.** Transverse section through the structures at the level of the umbilical ring. **D.** Transverse section through the primitive umbilical cord showing intestinal loops protruding in the cord (2).

Histologically umbilical cord contains mucous connective tissue, which is one of the types of embryonic connective tissue. It consists of gelatinous extracellular matrix known as Wharton's jelly externally covered by amnion; which occupies large inter-cellular spaces located between wispy collagen fibers. Wharton's jelly surrounds the two umbilical arteries and one umbilical vein. The umbilical vessels carry the fetal blood back and forth to the placenta, with the umbilical vein carrying oxygenated blood with nutrients from the placenta to the fetus and the umbilical arteries transporting deoxygenated blood with waste products from the fetus to the placenta. The spindle-shaped cells are widely separated and appear much like fibroblasts in the near-term umbilical cord (1,3).

Elongation of the umbilical cord occurs primarily in the second trimester. The umbilical cord is usually 1 to 2 cm in diameter and 30 to 90 cm in length (average, 55 cm). Abnormally long or short umbilical cords are known to result in adverse fetal and maternal outcome. For instance, Long cords have a tendency to prolapse and/or to coil around the fetus; a very short cord may cause premature separation of the placenta from the wall of the uterus during delivery. Prompt recognition of umbilical cord length can be useful to prevent adverse fetomaternal outcome and potential complications (1,4).

1.2 Statement of the problem

The umbilical cord and placenta play a significant role in perinatal outcome. However, attempts to investigate its use globally and in Africa have been limited due to scarcity of information on the value of the placenta and umbilical cord, which is exacerbated by the prevalent sociocultural belief, that the placenta and umbilical cord are handed over to relatives following delivery. As a result, the use of the placenta and umbilical cord in biomedical research has been significantly limited (5).

Umbilical cord length is one of the factors documented as a definite risk for poor fetal and maternal outcome (6). Long umbilical cords are associated with cord prolapse, torsion, true knot, and entanglement around different parts of fetuses, forming mechanical bands around fetal limbs. Furthermore, the nuchal cord (NC) or cord round neck was significantly higher in long umbilical cords than in normal cord length. Breech presentation, cord rupture, and IUGR are commonly associated with a short umbilical cord. Fetal heart rate abnormalities, low

APGAR scores, and neonatal intensive care unit (NICU) admission are all more common in babies with short or long umbilical cords (7–11).

Abruptio placenta and operative delivery were significantly more common in mothers who had newborns with short umbilical cords than normal. Previous research has linked short cords to an increased risk of retained placenta, prolonged labor, prolonged second stage of labor, and uterine inversion. Mothers who have a history of excessively long umbilical cords (ELUC) are more likely to have a long cord in a subsequent pregnancy (7,9,10,12).

Despite advances in antenatal care, surgical safety, and the use of modern monitoring tools such as ultrasonography, Doppler, and an intrapartum fetal monitor, cord problems remain one of the most unavoidable causes of fetal death. Variations in cord length have been linked to a variety of obstetric complications (13).

Globally, of the estimated 3 million perinatal deaths that occur each year, low and middle-income countries share the highest burden (more than 95%). Placental and umbilical cord conditions have contributed to some degree to neonatal mortality and are an important factor in fetal growth retardation (14).

The length of the umbilical cord is the most common cord abnormality. In neonates born with a short umbilical cord, the relative risk of death within one year was 2.4. Umbilical cord complications are thought to be responsible for about 10% of intrauterine deaths in the United States (7,12,15).

In a study conducted in Pakistan, Caesarean section cases were 33.87%, which is higher in the short-cord group than in the normal group. In a prospective hospital-based study conducted in Nigeria, the prevalence of abruptio placentae was significantly higher among mothers of newborns with short umbilical cord length than among mothers with normal umbilical cord length (17.4% vs. 0.4%). Perinatal mortality in Ethiopia is among the highest in Africa, 46 per 1000 pregnancies (9,16).

In Ethiopia, even though there are some research's done on umbilical cord complication there was lack of data on quantitative measurement of umbilical cord length and its association with birth outcomes. Currently, relatively little is known about the umbilical cord length in Ethiopia,

and there is a gap in quantifying the umbilical cord length and its association with birth outcomes. The purpose of this research is to measure umbilical cord length in Jimma medical Centre, to assess factors affecting umbilical cord length and associate umbilical cord length with birth outcomes.

1.3. Significance of the study

The human umbilical cord plays a great role. It is responsible for supplying nutrients and oxygen to the fetus during its intrauterine life. Although it isn't well understood what controls the length of the umbilical cord, it may vary from the normal length in different instances, necessitating thorough evaluation and documentation of umbilical cord length and abnormalities. Since, abnormal cord length has been linked to birth complications that affect both mothers and newborns. Thus, it is crucial to have knowledge of cord length because this will reduce adverse birth outcomes.

Therefore, this study will provide some information on umbilical cord length and its association with birth outcome. In order to detect and manage the immediate and long-term effects of abnormal umbilical cord length in newborns, it will be helpful to the mother to learn about modifiable risk factors for abnormal umbilical cord length and how to improve them in future pregnancies. In general, it will provide information regarding umbilical cord length for pediatricians, obstetricians, and other health professionals in Jimma Medical Centre in particular and those enrolled in Ethiopian health institutions at large. This study may also be a baseline for those researchers who have an interest in this area.

2. LITERATURE REVIEW

Factors affecting umbilical cord length and adverse fetomaternal outcomes associated to abnormal umbilical cord length are identified from different literature and presented as follows.

2.1. Umbilical cord length

Although reference standards for umbilical cord length have been reported, variation exists in the definition of normal, long, and short cords. For instance, a study conducted in Saudi Arabia categorizes umbilical cord length as normal, long, and short. A study found that normal length ranged from 35 to 80 cm (18). In a study conducted in India Cord lengths were measured and classified as long (> 60 cm), short (50 cm), or normal (50–60 cm) (13). In a study done in Nigeria, the length of cords was reported as long (80 cm), short (32 cm) or normal (between 32 and 80 cm) (9).

A study conducted in America, shows that the overall incidence of short cord is 4 per 1,000 live births (7). In a study done in Latin America, it was found that the prevalence of short and long umbilical cords was 5.10% and 7.41%, respectively (19). Another study in Saudi Arabia indicates a 6.5% and 2.5% incidence of short and long cords, respectively (18). In a study of the Nigerian population, the prevalence of short cords was 4.9%, while that of long cords was 3.8% (5). A study conducted in Ghana revealed 50.85%, 46.61%, and 2.54% were short, normal, and long umbilical cords, respectively (17).

2.2 Factors affecting umbilical cord length

2.2.1. Maternal factors affecting cord length

According to a study conducted in America, Washington, women who gave birth to short-cord neonates were more educated, less likely to have Medicaid insurance, and less likely to be overweight. Prim-parous women were at an elevated risk of having a short cord–infant compared with those with 1 previous delivery (7). The same is true regarding parity and BMI for studies conducted in Japan. The short-cord groups had a higher rate of prim-parity and lower BMI at delivery (18). Similarly, a Norwegian study found that increasing maternal parity and higher pre-gestational BMI increased the risk of developing a long cord. Maternal diabetes

increased the risk of a long cord, while maternal hypertension prior to pregnancy increased the risk of a long cord and decreased the risk of a short cord (19).

A short umbilical cord length is also associated with a history of smoking and alcohol consumption during pregnancy (23). A study from Saudi Arabia reveals maternal smoking was found to have a statistically significant risk of short cord. In addition, gestational diabetes mellitus was more frequent in the long-cord group (20).

In another hospital-based study conducted in Nigeria, the mean umbilical cord length was greater in neonates born to mothers in their third and fourth pregnancies (paras 3 and 4), in women aged 20–24, and in married women (9).

2.2.2. Fetal factors affecting cord length

A study conducted in the United States discovered that neonates with short cords were more likely to be female and small for gestational age (SGA). Similarly, in a Japanese case control study, the short cord groups had more female babies, lower birth weight, and a lighter placenta than the normal cord groups. A Saudi Arabian study found that the long cord group had higher birth weight and placental weight than the normal and short cord groups, and the proportion of male infants was significantly higher in the long cord groups (7, 18, 21). According to a Finland study, cord length increased with gestational age, but growth slowed post-term (21).

Hospital based study conducted in Sudan found that umbilical cord is being longer in males than female. In study conducted in Nigeria and Ghana There was a significant positive correlation between umbilical cord length and birth weight, length and head circumference of the new born (5,22,23).

2.3 Adverse fetal outcomes associated with extreme umbilical cord length

According to data obtained from several literatures, the length of the umbilical cord is known to affect fetal outcomes. Study from America reveals neonates with short cords were more likely to have hypoxic-ischemic encephalopathy and fetal distress. The risk of hypoxic-ischemic encephalopathy was especially high among infants weighing 2,500–3,999 g compared with other birth weight categories. Generally, although the overall risk estimate was not significant, term short cord neonates had higher rates of infant death in the first year of life (7).

Study from Norway shows Pregnancies with a short cord exhibited increased risk of non-cephalic presentation (19). In a study done in Saudi Arabia, it was found that NICU admission was more in the short cord group compared to other groups, as well as APGAR score < 7 at one minute was statistically significant in long and short cord groups than normal. In addition fetal death was more in short cord group with in comparison to normal and long cord groups (20). Study from Pakistan shows 22% of neonates who have long cords APGAR score in 5 min was 10/10 in 96.2% new born's and NICU admissions were required in 14.8% babies .whereas, 11.7% babies have short cord and APGAR score in 5 min was 10/10 in 100% babies. Regarding cord complication in this study 40.3% neonates were having single Nuchal cord, whereas, 21.8% had false knots in umbilical cord (24).

Study from India reveal the incidence of birth asphyxia was significantly more in long and short cords as compared to normal cord length with APGAR score of < 6. Birth asphyxia was seen maximum (56.6 %) in long umbilical cord length. Still births and early neonatal deaths are more with short- and long-cord groups than those in normal cord groups In addition the cord complications were associated with more incidence of [nuchal cord 35.7 %, true knot 25 %, and 100 % for cord prolapse and cord hematoma (10).

Previous case report reveal that ,a case in breech presentation with an excessively long umbilical cord (190 cm) which was complicated with five nuchal loops around the fetal neck and resulted in intrauterine death at the 37th week of pregnancy (25).

2.4 Adverse maternal outcomes associated with extreme umbilical cord length

Umbilical cord length is known to affect maternal outcome. Short umbilical cord may result in Abruptio placenta, retained placenta, delay in second stage of labor as well as both short and long umbilical cords have an increased risk of emergency caesarean delivery.

Placental abruption also known as ruptured placenta, is the biggest complication of a short cord because any movement of the baby can pull on the cord's insertion point on the placenta. This can cause the placenta to pull away from the uterine lining, leading to severe maternal haemorrhage. When signs of placental abruption are present, and if it is known that the cord is short ahead of time, delivery of the baby should be under taken immediately by C-section. Because, a delay in delivery in the case of a short umbilical cord can cause a tear in the cord

that affects the baby's oxygen supply. The baby must be delivered right away to prevent severe oxygen deprivation and brain damage, such as hypoxic-ischemic encephalopathy (HIE) and cerebral palsy (26,27).

Study conducted in Norway explain pregnancies with a short cord also carried an increased risk of placental complications like placenta previa, placental abruption and the need of manual removal of the placenta after birth .The associated risk of placental abruption was observed particularly in term births, but was also significant in preterm births (19). The same is true for the study conducted in America mothers with short cord neonates were significantly more likely to have Abruption placenta, higher risks of prolonged labor and prolonged second-stage labor. In addition, 60% of mothers having short cord neonates were more likely to experience retained placenta during delivery. Finally, mothers with short cord neonates were 40% more likely to have an assisted vaginal delivery than normal cord length (7).

Study conducted in India, percentage of LSCS was high (37.5%) with long cord group as compared to normal and short cord group. Correspondingly, the CS rate was higher in both short cord group and long cord group compare to normal cord group in case control study conducted in Saudi. The rate of emergency cesarean delivery significantly increased as umbilical cord length decreased (13,20). Study conducted in Nigeria reveal Abruption placentae was significantly higher among neonates with short umbilical cord than normal umbilical cord length (9).

2.5 Conceptual framework

Following a review of several literatures (5, 7, 9, 10, 13, 17-27), a conceptual framework demonstrating factors influencing umbilical cord length and its association with birth outcome developed.

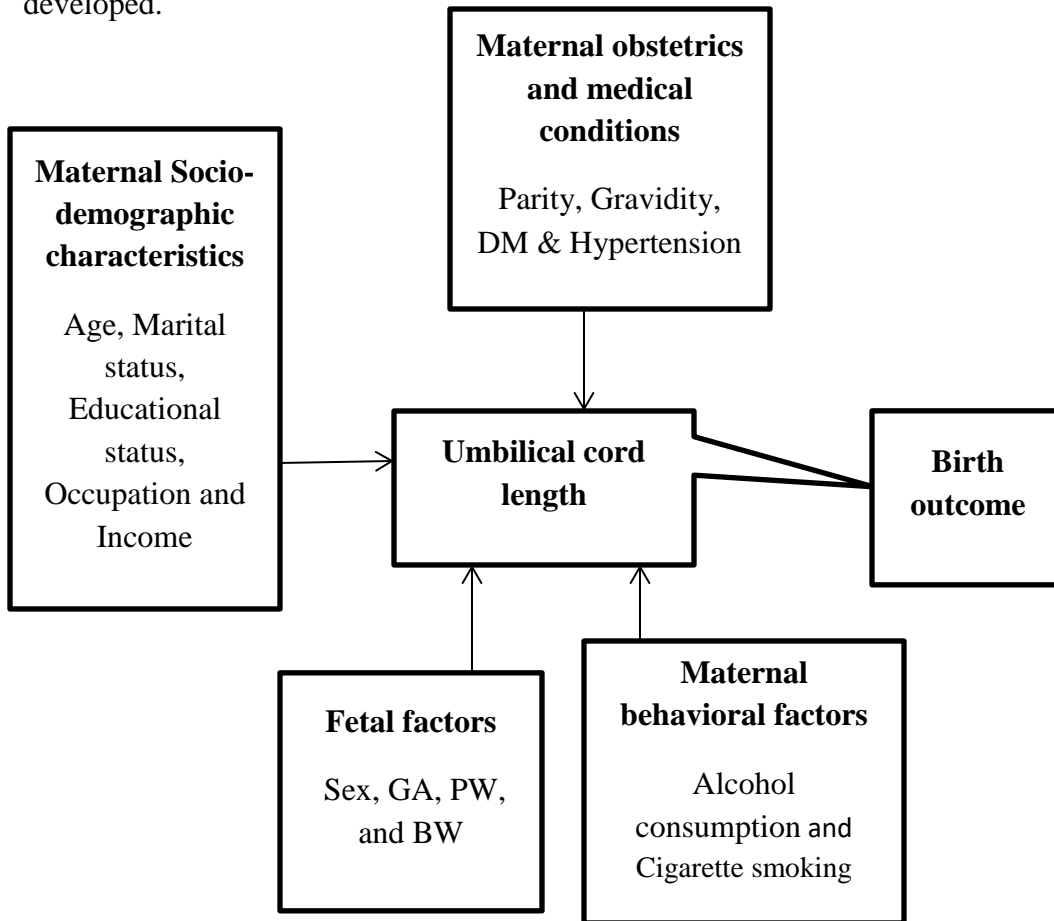


Figure 2: Conceptual frame work showing factors affecting umbilical cord length and its association with birth outcome. N.B broken lines direction weren't the focus of this study.

3. OBJECTIVES

3.1. General objective:

- To assess factors affecting umbilical cord length and its association with birth outcomes among deliveries at Jimma Medical Center, Jimma town, Southwest Ethiopia from October 15 -November 15, 2021.

3.2. Specific objectives:

- To assess the length of umbilical cord among newborn at Jimma Medical Center, Jimma town, Southwest Ethiopia from October 15-November 15, 2021.
- To describe factors affecting umbilical cord length among deliveries at Jimma medical center, Jimma town, southwest Ethiopia from October 15-November 15, 2021.
- To assess association of umbilical cord length with birth outcomes at Jimma Medical Center, Jimma town, southwest Ethiopia from October 15-November15, 2021.

4. METHODS AND MATERIAL

4.1 Study area and period

This study was conducted at Jimma Medical Center (JMC) from October 15-November 15, 2021. Jimma Medical Center (JMC) is one of the oldest public hospitals in the country with a bed capacity of 800 and a catchment population of over 20 million. Geographically, it is located about 350 km southwest of Addis Ababa. JMC provides services for approximately 15,000 inpatients, 11,000 emergency cases, and over 6,000 deliveries per year and 500 per month. The medical center has 11 departments including Obstetrics and Gynecology. The Department of Obstetrics and Gynecology has gynecology ward, maternity and labor ward, gynecology OPD, antenatal care clinic and one family planning clinic (28).

4.2 Study design

A hospital-based cross-sectional study design was used.

4.3. Source population

All new born and Mothers at JMC during the study period

4.4. Study population

All new born and mothers at JMC, labor ward during study period and fulfill the eligibility criteria

4.5. Eligibility criteria

4.5.1 Inclusion criteria

- All singleton births during study period and their mothers were included in the study

4.5.2 Exclusion criteria

- seriously ill mothers (if unable to communicate)
- Mothers who are not willing to give information

4.6 Sample size determination

Sample size was determined by using single population proportion formula based on the following assumptions: since there is no prior study regarding umbilical cord length and its association with birth outcomes in Ethiopia, to determine required sample size, the proportion (p) was taken as 0.5 at 95% confidence level and at margin of error (5%)

$$n = \frac{Z_{\alpha/2}^2 p (1 - p)}{d^2}$$

Where:

n= sample size

p = sample proportion

q = 1-p

d = margin of error (5%).

$Z_{\alpha/2}$ – Confidence interval =1.96

$n = (1.96 \times 1.96 \times 0.5 \times 0.5) / (0.05 \times 0.05)$

$n = 384.2 \approx 384$.

Since our population is less than 10, 000 we use correction formula

$n_f = \frac{n}{1 + \frac{n}{N}}$, Where n_f = final sample size, n= initial sample size, N= number of total

delivery within the same month of data collection period last year, Total =597(obtained from delivery registration book of labor ward at JMC)

Substituting the values with in the formula gives $n_f = \frac{n}{1 + \frac{n}{N}} = \frac{384}{1 + \frac{384}{597}} = 233.7 \approx 234$

After considering 10% non-respondent rate, the final sample size required was,

$234 + 23.4 = 257.4 \approx 257$

4.7. Sampling procedure

Consecutive sampling technique was used to select study participants.

4.8 Data collection tool and procedure

Data was collected through face-to-face interviews (with a structured questionnaire) and chart reviews using data collection tools adapted from different literature (5, 7, 9, 13, 17-27). The tool has five parts: the socio-demographic part, the maternal obstetrics and medical condition, maternal behavioral factors, fetal factors, umbilical cord length, and birth outcomes. (Annex-III)

The data was collected at Jimma medical center labor ward by two B.Sc. midwives under the supervision of a gynecology resident. The sociodemographic characteristics, maternal obstetric factors (parity and gravidity), and maternal behavioral factors were obtained from the mother through a face-to-face interview. Fetal presentation, maternal GDM, and maternal hypertension were obtained from chart review.

At delivery, the umbilical cord was examined for the following: the presence of any loop around the neck, trunk, and cord knots (true or false). After the delivery of the fetus, the umbilical cord was clamped in two places and cut in between. Then, the length of the umbilical cord was measured with a non-stretchable tape meter measure in cm from the cut end up to the fetal umbilicus and from the other cut end to the placental attachment, and the two measurements were added together to obtain the total umbilical cord length.

Fetal parameters were recorded after delivery, including the sex of the newborn, APGAR scores at 1st and 5th minute, and NICU admission. Still birth was also recorded. The weight of the newborn was measured by using a baby weight measuring scale, where the newborn is lying down naked or with minimal clothing in the weighting pan. Placenta was measured by using a weighing scale. An accurate weighing of the placentae was done by trimming off all membranes and removing the umbilical cord. Maternal outcome of labor and delivery, which includes prolonged labor and prolonged second stage of labor, placental abruption, and retained placenta, including mode of delivery, was also obtained from chart review.

4.9 study variables

4.9.1 Dependent variables

- ✓ Umbilical cord length
- ✓ Birth outcomes

4.9.2 Independent variables

Independent variables were maternal Socio-demographic characteristics (age, marital status, educational status and income), maternal obstetric and medical conditions (parity, gravidity, DM and hypertension), and maternal behavioral factors (alcohol consumption, cigarette smoking), fetal factors (sex, GA and placental weight).

4.10 Operational definitions

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

Birth outcomes: include the following events: APGAR score at 1st and 5th minute, admission to NICU, still birth, Abruptio placenta, retained placenta, prolonged labor prolonged second stage of labor, cord complication and mode of delivery.

Alcohol consumption: Respondents who answered “Yes” to the question “Have you ever consumed alcohol during your current pregnancy?” had alcohol use in pregnancy (29).

Maternal cigarette Smoking: A pregnant mother who was living with a smoker such as neighbors, family members are passive smokers, whereas former smokers are those, who were smoking during pregnancy and stopped currently. Current smokers are those mothers who smoke cigarette until today.

4.11 Data quality assurance

Before data collection, to assure the quality of data, the data collection tool, which was adapted from different literatures and modified according to the study objectives, was checked for clarity, understandability, uniformity, and completeness. Training was given to data collectors and supervisors for one day about the objectives and standard operating procedure. A pretest was carried out on 5% of the sample size prior to the actual data collection time. Based on the pretest result, necessary adjustments, important amendments, and logical flow of ideas were

maintained. Every day, close supervision was undertaken by a trained supervisor and every other day by the principal investigator. All necessary feedback was offered to data collectors the next morning before data collection and the quality of equipment was checked to ensure accuracy. The data collection tool was prepared in English and translated into Amharic and Afan Oromo, then translated back to English to check its consistency.

4.12 Data processing and analysis

The collected data was cleaned, edited, coded, and entered into Epi Data version 4.6 (30). And then exported to SPSS version 23.0 for analysis(31). Variables were checked for Linearity, normality and homoscedasticity. After categorizing and defining variables, descriptive analysis was carried out for each variable. Frequencies, mean standard deviation and percentages were presented in Tables and Figure. Linear regression was done to assess factors affecting umbilical cord length and logistic regression analyses were used to determine the association of umbilical cord length with birth outcomes. Model fitness for logistic regression was checked by the Hosmer-Lemshow goodness of fit test.

4.13. Ethical consideration

Ethical clearance was obtained from the Jimma University Institutional Review Board (IRB). (*Ref.no:IHRPGn/536/2021*). Permission letter was written to Jimma Medical Center Hospital administration office, and the study was initiated after receiving formal permission from them (Annex VI). The purpose, risk and benefit, privacy and confidential nature of the study and the importance of the study were explained to study participants and informed of their right to withdraw at any time during the study period (Annex I). Participants were interviewed after signing the written informed consent (Annex II). COVID 19 prevention and precaution protocol was applied during data collection.

4.14. Dissemination of the results

The final report of this paper will be presented during the thesis defense and submitted to Jimma University Department of Biomedical Sciences as partial fulfillment of MSc. in Clinical Anatomy. It will also be submitted to the Jimma University Research Unit. In addition, the

results will be disseminated to the scientific community through publication and presentation at scientific conferences.

5. RESULTS

5.1 Sociodemographic characteristics of participants

A total of 257 mothers and their neonates took part in this study. The age of respondent mothers in this study ranged between 18 and 37 years, with a mean age of 25.95 and SD of 4.68. The majority of the mothers were married 249 (96.9%) and two fifth of them (101, 39.3%) attended primary education. Almost half of the mothers were housewives (125, 48.6%) and their average monthly family income was 3100 ETB SD 1739.5 (**Table 1**).

Table 1 Sociodemographic characteristics of participants at JMC, 2021.

Variable (N=257)	Categories	Frequency (%)
Age of the mother	<35 Years	244 (94.9)
	≥35 Years	13 (5.1)
Mother's education	No formal education	40 (15.6)
	Primary education	101 (39.3)
	secondary education	64 (24.9)
	Above secondary	52 (20.2)
Mother's occupation	Housewife	125 (48.6)
	Farmer	34 (13.2)
	Government employee	65 (25.3)
	Merchant	28 (10.9)
	Unemployed	5 (1.9)
Marital status	Married	249 (96.9)
	Single	3 (1.2)
	Divorced	4 (1.6)
	Widowed	1(0.4)
Family income(ETB)	≤1000	31 (12.1)
	1001-2000	51 (19.8)
	2001-3000	75 (29.2)
	3001-4000	48 (18.7)
	≥4000	52 (20.2)

5.2 Neonatal characteristics

A total of 257 new-born (Two hundred thirty seven term, Twenty preterm) new-born were involved in this study. Most of them were delivered by spontaneous vaginal delivery. The birth weight of the new-born ranged from 1000 g to 4200 g, with a mean and (SD) of 3.04 (0.58). The mean (SD) placental weight was 534.78 g (65.3), the frequency of female (128, 49.8%) and male (129, 50.2%) neonates was almost equal (**Table2**).

Table 2 Neonatal characteristics at JMC, 2021

Variable (N=257)	Categories	Frequency (%)
Gestational age	Term	237 (92.2)
	Pre-term	20 (7.8)
Birth Weight	< 2500 g	28 (10.9)
	≥ 2500 g	229 (89.1)
Sex	Male	129 (50.2)
	Female	128 (49.8)

5.3 Maternal obstetric, behavioral and medical characteristics

As described in Table 3, 163 (63.4%) of participants were multiparous. Regarding behavioral characteristics of the mothers, 250 (97.3%) of mothers never smoked cigarettes, whereas 7 (2.7%) of mothers were passive smokers, and 10 (3.9%) of the mothers had a history of alcohol intake during the current pregnancy. Of all the participants, 23 (8.9%) of the mothers were hypertensive, but none of them were diagnosed with gestational diabetes mellitus.

Table 3 Maternal obstetrics, behavioral and medical characteristics at JMC, 2021

Variable (N=257)	Categories	Frequency (%)
Parity	Primi-parous	94 (36.6)
	Multiparous.	163 (63.4)
Gravidity	Primi-gravida	90 (35)
	Multi-gravida	167 (65)
Maternal smoking	Passive	7 (2.7)
	Never	250 (97.3)
Maternal alcohol intake	Yes	10 (3.9)
	No	247 (96.1)
Maternal hypertension	Yes	23 (8.9)
	No	234 (91.1)

5.5 Descriptive statistics of Birth outcome

Among 257 neonates, 40 (15.6%) had an APGAR score of <7 at the first minute, 20 (7.8%) had an APGAR score of <7 at the fifth minute, and 15 (5.78%) were admitted to the NICU. 95.3% of new-born were live births, whereas 4.7% were still births.

Nuchal cord and cord entanglement were reported in 6 (2.3%) and 9 (3.5%) of the neonates, respectively. About 9 (3.5%) of the mothers were diagnosed with abruptio placenta and 5(1.9%) of the mothers had retained placenta. Prolonged labor and prolonged second stage of labor were reported in 26 (10.1%) and 21 (8.2%) of the participants, respectively. The majority of the mothers, 204 (79.4%), gave birth via spontaneous vaginal delivery (SVD) (**Table 4**).

Table 4 Descriptive statistics of birth outcome at JMC, 2021

Variable (N=257)	Categories	Frequency (%)
APGAR score 1st minute	<7	40 (15.6)
	≥7	217 (84.4)
APGAR score 5th minute	<7	20 (7.8)
	≥7	237 (92.2)
Admission to NICU	Yes	15 (5.8)
	No	242 (94.2)
Abruptio placenta	Yes	9 (3.5)
	No	248 (96.5)
Retained placenta	Yes	5 (1.9)
	No	253 (98.4)
Prolonged labor	Yes	26 (10.1)
	No	231 (89.9)
Mode of delivery	SVD	204 (79.4)
	Operative delivery	53 (20.6)
Umbilical cord complication		
Nuchal cord	Yes	6 (2.3)
	No	251 (97.7)
Cord entanglement	Yes	9 (3.5)
	No	248 (96.5)

SVD=spontaneous vaginal delivery

5.6 Umbilical cord length distribution

The mean umbilical cord length in this study was 56.21 cm and ranged from 43.38 to 69.63 cm (Figure 4). Mean umbilical cord length was higher among term neonates (56.62 cm), female neonates (56.39 cm), neonates who weighed ≥ 2500 g and neonates who were delivered by cephalic presentation (56.35 cm). In addition, mean umbilical cord length was higher among mothers who were educated above secondary (56.74 cm), multigravida mothers (56.71 cm), and mothers whose age was ≥ 35 (56.46 cm), When compared with their counter parts.

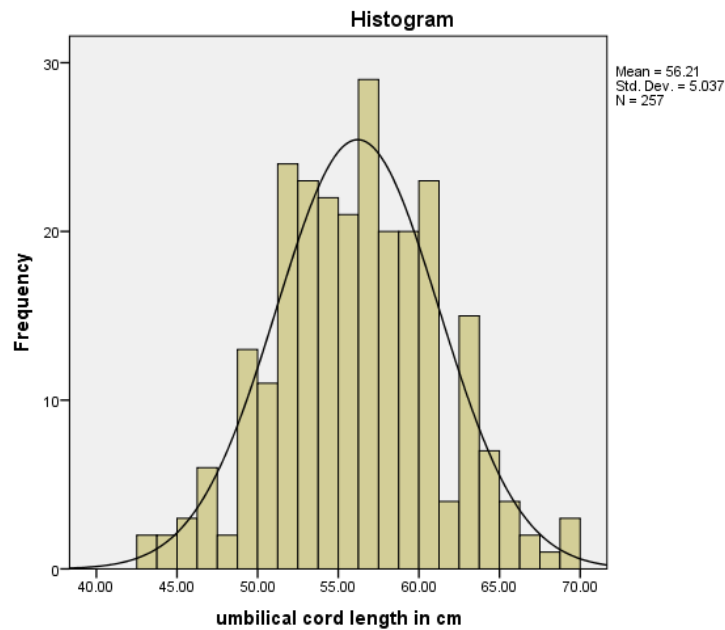


Figure 3: Umbilical cord length distributions at JMC, 2021

5.7 Factors associated with umbilical cord length

In simple linear regression analysis, nine variables were found to be candidate for multiple linear regressions. These factors were: marital status (β :-1.372, 95% CI -3.26,0.52), alcohol consumption during pregnancy (β :-2.748, 95% CI -5.9,0.4), history of maternal smoking during pregnancy (β :-1.336, 95% CI -3.23,0.562), parity (β :-1.231,95% CI-0.048,2.509), gravidity(β :0.271, 95% CI -0.13,0.672),placental weight (β :0.023, 95% CI 0.014,0.032), gestational age (β :-5.388, 95% CI-7.6,-3.17) fetal presentation(β :-1.82, 95% CI-3.91,0.26), and birth weight (β : 3.425, 95% CI 2.47, 4.42) as indicated in **Table 5**.

Before running multiple linear regression multi collinearity was checked (VIF=1.03-1.8). In multiple linear regressions, placental weight, birthweight, and gestational age were variables that showed a statistically significant association with umbilical cord length. Accordingly, for a unit increase in placental weight, umbilical cord length increased by 0.012 cm, which means as placental weight increased by 100 g, umbilical cord length also increased by 1.2 cm (β : 0.012, 95% CI 0.002, 0.021), and as birth weight increased by 1 g, umbilical cord length increased by 2.173 cm (β : 2.173, 95% CI 0.96, 3.386). Similarly, gestational age was significantly associated with umbilical cord length. The umbilical cord length of preterm neonates was 2.56 cm less than that of term neonates (β :-2.56, 95% CI-4.989, -0.132). The analytical results showed that the model regression coefficient $R^2=0.216$ and adjusted $R^2 =0.178$ indicated that the umbilical cord length is explained by independent variables by 17.8% (**Table 6**).

Table 5 Simple and multiple linear regressions for factors associated with umbilical cord length at JMC, 2021

Variable (N=257)	Categori es	UCL Mean \pm SD	Simple Linear β (95% CI)	Multiple Linear β (95% CI)
Marital status	Married	56.28 \pm 5.02	-1.372(-3.26,0.525)	5.68 (-3.39,14.76)
	Single	57.00 \pm 8.26	0.81(-4.961,6.582)	6.792 (-3.75,17.33)
	Divorced	54.03 \pm 1.64	-2.21(-7.211,2.792)	4.94 (-5.14,15.022)
	Widowed	48.75		1
Maternal Smoking history	Passive	58.8 \pm 3.99	-1.336(-3.23, 0.562)	1.97 (-1.73, 5.68)
	Never	56.1 \pm 5.05		1
Maternal Alcohol intake	Yes	58.84 \pm 4.56	2.748 (-5.93,0.44)	1.193 (-1.92,4.315)
	No	56.09 \pm 5.03		1
Parity	Primi			
	Multi	55.42 \pm 5.08	1.231(-0.048,2.509)	0.352 (-1.128, 1.832)
Fetal Presentation	Breech	54.4 \pm 5.35	-1.825 (-3.91,0.26)	2.581 (-4.184,9.346)
	Cephalic	56.35 \pm 5.01		1
Gestational Age	Pre-term	51.2 \pm 4.97	-5.38(-7.605,-3.17)	-2.56(-4.989,-0.13)*
	Term	56.62 \pm 4.82		1
Placental Weight	----	-----	0.023(0.14, 0.032)	0.012(0.002,0.021)*
Birth Weight	----	-----	3.452 (2.478,4.425)	2.173(0.96, 3.386)*
Gravidity	----	-----	0.271(-0.13,0.671)	0.109(-0.35,0.563)
* p-value<0.05, 1=Reference	-----	Continuous	Variable	UCL=umbilical cord length

Table 6: Model summary for multiple linear regressions Analysis

Model summary					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin–Watson
1	.465	.216	.178	4.56738	1.782

5.8 Association of umbilical cord length with birth outcomes

Mean umbilical cord length was lower among Abruptio placenta (54.2 ± 4.67) and still births (51.01 ± 6.19) when compared with their counter parts, but neonates with nuchal cord and cord entanglement had higher mean umbilical cord length (60.4 ± 4.96) and (56.3 ± 7.1) respectively as compared to those who don't have this complication.

The data presented in **Table 7** shows that umbilical cord length is associated with APGAR score at 5th minute, (COR = 1.259, 95% CI = 1.021, 1.554), retained placenta, (COR = 0.887, 95% CI = 0.805, 0.977) and still birth (COR = 0.783, 95% CI = 0.681, 0.900).

After adjusting for maternal age, parity and hypertension in multiple logistic regression, umbilical cord length remained associated with APGAR score at 5th minute (AOR = 1.249, 95% CI = 1.022, 1.526), retained placenta (AOR = 0.878, 95% CI = 0.794, 0.971) and still birth (AOR = 0.776, 95% CI = 0.669, 0.899). The odds of having an APGAR score of less than 7 at the 5th minute increased by 24.9% with every 1 cm increase in umbilical cord length. The odds of having retained placenta decrease by 12.2% as umbilical cord length increases by 1 cm. Similarly, the odds of having a still birth decrease by 22.4% as umbilical cord length increases by 1 cm (**Table 8**).

Table 7 Result of bivariate logistic regression for umbilical cord length associated with birth out come at JMC, 2021

Mean UCL(SD)	Conditions	Categories	COR(95% CI)
54.8(5.91)	APGAR score 1st minute	<7	0.935(0.873, 1)
56.46(4.82)		≥7	
61.79(4.11)	APGAR score 5th minute	<7	1.259(1.021, 1.554)*
56.1(5.00)		≥7	
55.64(5.71)	Admission to NICU	Yes	0.976 (0.88, 1.084)
56.24(5.00)		No	
54.25(4.67)	Abruptio placenta	Yes	0.922(0.805, 1.055)
56.27(5.04)		No	
53.53(6.75)	Retained placenta	Yes	0.887(0.805, 0.977)*
56.43(4.81)		No	
56.68(3.96)	Prolonged labor	Yes	1.021(0.942, 1.107)
56.15(5.14)		No	
56.86(5.91)	Prolonged 2nd stage of labor	Yes	1.029(0.91, 1.124)
56.14(4.95)		No	
56.35(5.18)	Mode of delivery	SVD	0.972(0.915, 1.033)
55.64(4.42)		Operative delivery	
51.01(6.19)	Still Birth	Yes	0.783(0.681, 0.900)*
56.4(4.877)		No	
	Umbilical cord complication		
60.47(4.96)	Nuchal cord	Yes	1.192(1.00, 1.408)
56.1(5.00)		No	
56.3(7.1)	Cord entanglement	Yes	1.004(0.88, 1.146)
56.2(4.96)		No	

Table 8 Result of multivariable logistic regression for umbilical cord length and maternal characteristics associated with birth outcomes at JMC, 2021

Predictor Variables	Categories	Outcome: retained placenta AOR(95% CI)	Outcome APGAR score 5th AOR(95% CI)	Outcome still birth AOR(95% CI)
Age	<35 Years	1	1	1
	≥35 Years	0.375(0.024,3.26)	0.275(0.024,3.15)	0.93(0.804,1.066)
Parity	Multi parous	1	1	1
	Prim –parous	2.543(0.855,7.56)	0.95(0.92,1.04)	1.947(0.504,7.519)
Hypertension	No	1	1	1
	Yes	0.26(0.07,1.055)	0.213(0.018,2.55)	0.113(0.024,1.526)
UCL	-----	0.878(0.794,0.971)*	1.249(1.022,1.526)*	0.776(0.66,0.89)*

* p-value<0.05, 1=Reference UCL=umbilical cord length

6. DISCUSSION

In this study, the mean umbilical cord length was 56.2 cm and ranged from 43.38 to 69.63 cm. This finding was comparable with a study done in Pakistan (56.9 cm) and in western India (57.7 cm) (11,13), and lower than previous studies in Sudan and Nigeria where the mean umbilical cord is 68 cm and 61.07 cm respectively (9,22). This discrepancy may be due to sample size difference 721 and 600 participants in Sudan and Nigerian studies respectively. The current finding was higher than studies from Ghana in which the mean umbilical cord length 41.74 cm (17). The possible reason for this discrepancy may be due to a difference in methodology. In addition umbilical cord length is influenced by environmental and genetic factors.

Despite numerous publications on cord development, it remains unclear what controls the length of the umbilical cord. Several authors, however, have discovered a link between cord length and fetal activity or movement, termed the "stretch hypothesis." "The more movement there is, the longer the cords". This hypothesis is supported by the cords of fetuses that have severely diminished motions such as osteogenesis imperfecta, thanatophoric dwarfism, and muscular dystrophy, which are remarkably short (32,33). However, recent animal model studies, have disproved the "stretch hypothesis" claiming that the umbilical cord grows in a nearly linear pattern during pregnancy (7,34).

This study shows that placental weight had statistically significant association with umbilical cord length. This means umbilical cord length increases with an increase in placental weight. A similar association was reported in a study from Japan, Saudi Arabia ,Turkey and Nigeria (9,18,20,35). This implies that factors that have a direct impact on the placental weight will have an indirect impact on the umbilical cord length. Nutrition, hypertension, maternal diabetes, and other chronic medical conditions are examples of such factors.

In this study 7.8% of neonates were preterm. Preterm birth had statistically significant association with umbilical cord length. As a result, preterm neonate's umbilical cords are shorter than term neonates. These agree with study done in Finland and western Nigeria. Cord length increased with gestational age, but growth slowed post-term (21,34).

In this present study, the mean umbilical cord length increased with increase in birth weight and umbilical cord length was strongly associated with birth weight. This finding was supported by report from a study done in Norway, Japan, Ghana and Nigeria which found that umbilical cord length increase as birth weight increase (5,23,36,37). This could be explained by the fact that as the fetus grows the umbilical cord also increases in length.

Previous studies reported that extreme umbilical cord length has been identified as a contributing factor to adverse birth outcomes. Abruptio placenta, retained placenta, prolonged labor, and prolonged second stage of labor are all linked to umbilical cord shortening. The presence of a long umbilical cord has been linked to a variety of cord complications, including nuchal cord, cord entanglement, true knot, and cord prolapse. Short and long umbilical cords have both been linked to a low APGAR score (APGAR < 7), NICU admission, emergency cesarean delivery and still birth (7–11,19,26,38).

This research also revealed that as umbilical cord length increases, the likelihood of having an APGAR score of <7 increases. This result was consistent with a case control study conducted in India, which indicated that the long umbilical cord group had a lower APGAR score (10). The mean umbilical cord length (61.79 cm) is likewise larger in infants with an APGAR score of <7 in our study.

This could be explained by the fact that as the length of the umbilical cord increases, the likelihood of cord complications such as nuchal cord and cord entanglement increases as well, and previous studies have shown that an APGAR score of <7 is significantly associated with nuchal cord and cord entanglement (39,40). Because nuchal cords and cord entanglement can cause cord compression, blood flow in the thin-walled umbilical vein is impeded while blood is pushed out through the thicker-walled umbilical arteries, resulting in hypovolemia, hypotension, and fetal hypoxia, which results in a low APGAR score (41). However, this finding was contrary to study from Nigeria in which no significant association was found between umbilical cord length and APGAR score of <7 (9). The discrepancy may be due to sample size difference and only term neonates were included in Nigerian study.

Our finding of negative association between umbilical cord length and retained placenta is supported by a study done in USA (7). This may be because of the shortening of umbilical

cord length is associated with prolonged labor, particularly in the second stage, by holding the head back and preventing its expulsion. According to studies, having a longer first and second stage of labor is significantly associated with a retained placenta (42,43).

Similar to finding to other setting (20), We observed that the odds of having a still birth decrease by 22.4% as umbilical cord length increases by 1 cm. This may be explained by shortening of umbilical cord length is risk factor for different birth related complication like birth asphyxia which is one of the cause of still birth (44).

Limitation and strength of the study

Limitation

- This study did not consider factors like preconception BMI and umbilical cord length of previous pregnancy due to the absence of recorded data.
- Institutional nature of the study over a shorter period of time may also hinder generalizability of the findings.
- This study share limitation of cross sectional studies

Strength

- Direct measurement of umbilical cord length, placental weight and birth weight was performed precisely to the nearest decimal and recorded by trained data collectors under Close supervision of the supervisor and principal investigator.

7. CONCLUSION AND RECOMMENDATIONS

7.1 Conclusion

Based on the finding of this study, the mean umbilical cord length was 56.2 cm. Mean umbilical cord length was higher among term neonates, female neonates, and neonates who weighed ≥ 2500 g. Placental weight, birthweight, and gestational age were factors that affect umbilical cord length. APGAR score of <7 , retained placenta and still birth were birth outcomes associated with umbilical cord length.

7.2 Recommendations

Based on the findings the following recommendation was made.

- To Jimma medical centre
 - ✓ Proper examination of umbilical cord after delivery should be encouraged.
 - ✓ Prenatal measurement of umbilical cord length should be considered especially for those pregnancies at high risk of abnormal cord length.
 - ✓ Data about pregnancy and obstetrical history from prepregnancy to delivery including umbilical cord length should be recorded appropriately.
- Reproductive age women's should plan follow up and consultation of physicians before pregnancy.
- Researchers should conduct a large-scale study using the current study as baseline.

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ANNEXES

Annex I. Information Sheet

Good morning /afternoon, my name is_____ I am B.Sc. Midwife in Jimma Medical Center. This study is undertaken by candidate of MSc. student in Clinical Anatomy in collaboration with Jimma University, Institute of Health, and Department of Biomedical science (Clinical Anatomy). I am also a part of data collector team to carrying out the study on Assessment of factors affecting umbilical cord length and its association with birth outcomes among deliveries in Jimma Medical Center, Jimma town, Southwest Ethiopia from September to October 2021.

Purpose: The purpose of this study is to to assess umbilical cord length, factors affecting umbilical cord length and association of umbilical cord length with birth outcomes.

Procedure: Face-to-face interview, measurement of umbilical cord length, birth weight and chart review

Benefit: no incentive but, your participation will contribute for prevention of adverse birth outcome

Risk of the study for the participants: no harm for participants

Annex II: Consent Form

VOLUNTARY PARTICIPATION

Your participation in this study is voluntary. It is up to you to decide whether/not to take part in this study. If you decide to take part in this study, you will be asked to sign a consent form. After you sign the consent form, you are still free to withdraw at any time and without giving a reason.

I selected as a participant and heard the information in the consent sheet by the language I can understand and finally I understood the possible benefit and harm of the study. I also understand that no information regarding me be transferred to the third party and I can withdraw from the study at any time without giving a reason. I voluntarily agree to take part in this study.

- Date of interview.....
- Interviewer name.....
- Signature -----
- Code -----

Annex III: Data Collection Tool

Data collection tool adapted from different literature to assess factors affecting umbilical cord length and its association with birth outcomes.

Part I. Sociodemographic characteristics of the mother			
Q 1	Age	_____ year	
Q 2	Marital Status	1. Married 2. Single 3. Divorced 4. Widowed	
Q 3	Educational status	1. No education 2. Primary 3. Secondary 4. More than secondary	
Q 4	Occupation	1. Farmer 2. House wife 3. Governmental employee 4. Merchant 5. Unemployed)	
Q 5	Income in Birr	_____ Birr/Month	
Part II. Maternal behavioral factors			
Q 6	History of maternal Smoking during pregnancy	1. Current 2. Passive 3. Former 4. Never	
Q 7	Have you ever consumed alcohol during your current pregnancy?	1. Yes 2. No	
Part III. Maternal obstetrics condition			
Q 8	Parity	1. Primi-parous 2. Multiparous	
Q 9	Gravidity	Gravida _____	
Part III. Umbilical cord and placental parameters			
Q 10	Umbilical cord length	_____ cm	
Q 11	Cord complication	1. Nuchal cord, 2. Cord prolapse 3. True knot 4. Cord entanglement 5. No complication	
Q 12	Placental weight	_____ gm	
Part IV. Fetal parameter			
Q 13	Sex	1. Female, 2. Male	

Q 14	Fetal presentation	1.cephalic 2.breech	
Q 15	Birth weight	_____ gm	
Q 16	APGAR score	1 st minute _____ 5 th minute _____	
Q17	Gestational age	1 term 2.preterm 3.post term	
Q 18	Admission to NICU	1. Yes 2.No	
Q 19	Still birth	1.Yes 2. No	
Part V. Maternal Medical Condition			
Q 20	Gestational Diabetes Mellitus	1.Yes 2. No	
Q 21	Hypertension	1.Yes 2. No	
Part VI. Maternal parameter			
Q 22	Abruptio placenta	1.Yes 2. No	
Q 23	Prolonged labor	1.Yes 2. No	
Q 24	Prolonged second stage of labor	1.Yes 2. No	
Q 25	Retained Placenta	1.Yes 2. No	
Q 26	Mode of delivery	1. Normal vaginal delivery 2. Caesarean delivery 3. Vacuum extraction 4. Forceps extraction 5. Breech assisted	

Annex IV: Amharic version data collection tools

የመረጃ ወረቀት

ደህና አደሩ / ደህነና ዋሉ ስሜ _____ ነው። በጅማ ሜዲካል ማእከል ውስጥ አዋላጅ ነርስ ነኝ። ይህ ጥናት የሚከናወነው በ MSC እጩ ክሊኒካል አናቶሚ ተማሪ ከጅማ ዩኒቨርሲቲ፣ የጤና ተቋም እና የባዮሜዲካል ሳይንስ ትምህርት ክፍል ጋር በመተባበር ነው። እኔም በጅማ ሜዲካል ማእከል ውስጥ ከሚወለዱ ጨቅላ ህጻናት እና ከሚወለዱ እናቶች መካከል፣ የእትብት ርዝመት ከወሊድ እና ከእናቶች ጤንነት ውጤት ጋር በተያያዘ ያለውን ግንኙነት ላይ ጥናቱን ለማካሄድ የመረጃ ሰብሳቢ ቡድን አካል ነኝ።

ዓላማ - የዚህ ጥናት ዓላማ ከእትብት ርዝመት ጋር የተዛመደ የወሊድ አደጋ ሁኔታዎችን የመጋለጥ ሁኔታዎችን መገምገም ነው።

የአሠራር ሂደት- ፊት ለፊት ቃለ መጠይቅ ፣ የእትብት ርዝመት ፣ የህጻኑ ክብደት እና የካርድ ግምገማ።

ጥቅማ ጥቅም - ምንም ማበረታቻ የለም ፣ ግን የእርስዎ ተሳትፎ መጥፎ የወሊድ ውጤትን ለመከላከል አስተዋፅኦ ያደርጋል።

የጥናቱ ጉዳት ለተሳታፊዎች - ለተሳታፊዎች ምንም ጉዳት የለም።

የፈቃድ ቅጽ

የበጎ ፈቃደኝነት ተሳትፎ

በዚህ ጥናት ውስጥ የእርስዎ ተሳትፎ በፈቃደኝነት ነው። በዚህ ጥናት ውስጥ ለመሳተፍ ወይም ለመሳተፍ መወሰን የእርስዎ ነው። በዚህ ጥናት ውስጥ ለመሳተፍ ከወሰኑ የስምምነት ቅጽ እንዲፈረሙ ይጠየቃሉ። የስምምነት ቅጹን ከፈረሙ በኋላ በማንኛውም ጊዜ እና ምክንያት ሳይሰጡ አሁንም ለመውጣት ነፃ ነዎት።

እኔ እንደ ተሳታፊ ተመርጫለሁ እና በፈቃድ ወረቀቱ ውስጥ ያለውን መረጃ በሚገባኝ ቋንቋ ሰምቼ እና በመጨረሻም የጥናቱን ጥቅምና ጉዳት ተረዳሁ። እኔንም የተመለከተኝ መረጃ ሁሉ ወደ ሶስተኛ ወገን እንዳይዛወር እና ምክንያቱን ሳልሰጥ በማንኛውም ጊዜ ከጥናቱ መውጣት እንደምችል እረዳለሁ። በዚህ ጥናት ውስጥ ለመሳተፍ በፈቃደኝነት እስማማለሁ።

- የቃለ መጠይቅ ቀን _____
- የመረጃ ሰብሳቢ ስም _____
- የተሳታፊ ፊርማ _____
- ኮድ _____

የመረጃ መሰብሰቢያ ቅጽ

ከእትብት ርዝመት ጋር በተያያዘ የአደጋ መንስኤዎችን እና መጥፎ የወሊድ ውጤትን ለመገምገም ከተለያዩ ጽሑፎች የተቀረጸ የመረጃ መሰብሰቢያ ቅጽ

ክፍል 1. የእናቲቱ የሶሻሎ-ዲሞክራሲያዊ ባህሪዎች			
ጥ 1	ዕድሜ	_____ ዓመት	
ጥ 2	የጋብቻ ሁኔታ	1. ያገባች 2. ያላገባች 3. የተፋታች 4. ባሏ የሞተባት	
ጥ 3	የትምህርት ሁኔታ	1. ትምህርት ያልጀመረች 2. የመጀመሪያ ደረጃ 3. ሁለተኛ ደረጃ 4. ከሁለተኛ ደረጃ በላይ	
ጥ 4	ሙያ	1. ገበሬ 2. የቤት እመባት 3. የመንግስት ሰራተኛ 4. ነጋዴ 5. ሥራ አጥ	
ጥ 5	ገቢ በብር	_____ ብር/ወር	
ክፍል 2. የእናቶች ባህሪ ምክንያቶች			
ጥ 6	በእርግዝና ወቅት የእናቶች ማጨስ ታሪክ	1. የአሁን 2. ተገብሮ 3. የቀድሞ 4. በጭራሽ	
ጥ 7	አሁን ባለው የእርግዝና ወቅት አልኮልን ጠጥተው ያውቃሉ?	1. አዎ 2. አይደለም	
ክፍል 3. የእናቶች የወሊድ ሁኔታ			
ጥ 8	ግራቪዲቲ	ግራቪዲ _____	
ጥ 9	ፓሪቲ	1. ቀዳሚ 2. ባለብዙ	
ክፍል 4. የእትብት እና የእንግዴ ልጅ መለኪያዎች			
ጥ 10	የእትብት ርዝመት	_____ ሴሜ	
ጥ 11	የእትብት አደጋዎች	1. ኑካል ኮርድ ፣ 2. ኮርድ ፕሮላፕስ 3. ትሩ ሞት 4. ኮርድ ኢንታንግልመንት 5. ሌሎች 6.	

ጥ 12	የእንግዲ ልጅ ክብደት	_____ ግራም	
ክፍል 5. የጨቅላ ሀጻን መለኪያ			
ጥ13	ጾታ	1. ሴት ፣ 2. ወንድ	
ጥ 14	ፊታል ፕረዘንቴሽን	_____	
ጥ15	የሀጻኑ ክብዳት	_____ ኪ ግ	
ጥ 16	የ APGAR ውጤት	1 ኛ ደቂቃ _____ 5 ኛ ደቂቃ _____	
ጥ17	የእርግዝና ጊዜ	1. በጊዜው የተወለደ 2. ከጊዜው ቀድሞ የተወለደ 3. ከጊዜው ካለፈ በኋላ የተወለደ	
ጥ18	ወደ NICU መግባት	1. አዎ 2. አይ	
ጥ19	ስተል በርዝ	1.አዎ 2. አይ	
ክፍል 6. የእናቶች የሕክምና ሁኔታ			
ጥ20	የእርግዝና የስኳር በሽታ	1. አዎ 2. አይ	
ጥ21	የደም ግፊት	1. አዎ 2. አይ	
ክፍል 7 የእናቶች የወሊድ ሁኔታ መለኪያ			
ጥ22	አብረጥሽ ፕላሴንታ	1. አዎ 2. አይ	
ጥ23	ፕሮሎንግድ ሌበር	1. አዎ 2. አይ	
ጥ24	ፕሮሎንግድ ሰከንድ ስቴጅ ሌበር	1. አዎ 2. አይ	
ጥ25	ሪቴይንድ ፕላሴንታ	1. አዎ 2. አይ	
ጥ26	ሞድኦፍ ደሊቨሪ	1. ኖርማል ቫጂናል ዳሊቨሪ 2. ሲዘሪያን ዳሊቨሪ 3. ቫኪዩም ኤክስትራክሽን 4. ፎርሴፕሽን ኤክስትራክሽን 5. ብሪች አሲስትድ	

Annex V: Afan Oromo version data collection tools

Guca waligaltee Afaan Oromoottiin

Akkam jirtu? Maqaan koo.....giduu gala medikaala Jimmati ogessa deesistutti. Qorannoo mata-dureen isaa dherrina umbilical cordi fi rakkoo daa’imaa fi hadhaa irratti qaqabsisu jedhu irratti raga funaanufan dhufe. Ragaan isiin kennitan iccitiidhan qabama, nama kamittuu hin dabarfamu. Isin qaama qorannoo miti. Garuu,ragaan isiin kenitan rakkoo dahumsaan wal-qabatee dhufu hir’isuuf ni gargaara. Ragaa guutuu akka nuuf kennitan abdii guddaan qabna.

Kaayyoo - Kaayyoon qorannoo kanaa dherrina “umbilical cord” fi rakkoo daa’imaan fi hadhaa irratti qaqabsisu qorachuudha.

Adeemsa- Gaafii fi deebii qaamanii, dherrina “umbilical cord” fi ulfaatina daa’imaa shaalagu, keessa deebii kaardii.

Faayidaa- Nama qoranno kana irraatti hirmaatuuf kafaltiis ta’ee keennan keenamuu homtuu hin jiru, garuu hirmaanan keessan rakkoo dahumsaa irraatii umaamuu furuf bu’aa gudda qaba.

Midhaa Qorannoo Hirmaatoota irrattii- Qorannoon Kun hirmaatoota irrattii midhaa tokkoo ilee hin qabu.

Hirmannaa Fedhiinii/ Fedhaan Hirmaachuu

Qorannoo kan irratti hirmaanan keessan fedhii keessanini. Qorannoo kan irratti hirmachuus ta'e dhisuun ni dandeesu. Yoo hirmaachuuf murtesiitaan gucaa waligaltee hirmaana armaan gadii akka nuuf mallateesiitaan ni gaafatamtuu. Ergaa walii galtee malatesitanii booda yeroo barbadanitti fi sababa tokko ilee osoo hin dhiyeessin addan kutuu ni dandesuu.

Anii akka hirmaata qorannoo kanaatti, raga fedhaan hirmaachuu keessaatii ibsaaman afaan naaf gaalun hubadhe, akkasumas carraa gaaffii gaafachuu akkan qabu hubadheen jiraa. Kana malees, yeroo hirmaana qoranno kanaa keessatti yeroon barbadee fi sababa osoon hin dhiyeesiin addaan kutu akkaan danda'u naaf gale jira. Kana irra ka'uun qorannoo kana irraatti hirmaachuuf fedha gutuun qaba.

Guyyaa gaafatame _____

Mallattoo Hirmaataa _____

Maqaa nama gaafate _____

Lakk.adda-baastuu _____

Unkaa raga ittiin sassaban

Kutaa 1: Waa'ee haala haawaassummaa fi dinagdee haadhaa			
G 1	Umrii haadhaa	Waggaa _____	
G 2	Haala Heeruma	<ol style="list-style-type: none"> 1. Kan Heerumte 2. Kan hin heerumne 3. Kan addaan baate 4. Dhiirsi kan jalaa du'ee 	
G 3	Sadarkaa barnootaa haadhaa	<ol style="list-style-type: none"> 1. Barumsaa kan hin jalqabne 2. Sadarkaa 1ffaa 3. Sadarka 2ffaa 4. Sadarkaa 2ffa oli 	
G 4	Hojii	<ol style="list-style-type: none"> 1. Hadha waara 2. Qonnaan bultu 3. Hojjetu mootummaa 4. Hojii dhabduu 5. Daldaltuu 	
G.5	Galii	_____ qarshii /Ji'aan	
Kutaa 2. Waa'ee Amallaa			
G 6	Yeroo Ulfaa haala sigaaraa fayyadamuu	<ol style="list-style-type: none"> 1. Ama 2. Namoota ollaa 3. Duran 4. Goonkuma 	
G 7	Yeroo Ulfa kanaa dhugatii alkoolii ni fayyadamtuu?	<ol style="list-style-type: none"> 1. Eye 2. Lakki 	
Kutaa 3. Haala Dahumsaa Haadhoolii			
G 8	Parititii	<ol style="list-style-type: none"> 1. Jalqaba 2. Baay'ee 	
G 9	Giraviditii	Giravidaa _____	
Kutaa 4. Safartuu "Umbilical Cord" fi "Placenta"			
G 10	Dheerina "Umbilical Cord"	_____ cm	
G 11	Koonpilikashinii "Umbilical Cord"	<ol style="list-style-type: none"> 1. Nukaal kordii 2. Kord prolapsii 3. Tiru nooti 4. Kord antangiliment 5. Kan biro 	
G 12	Ulfaatina Plasentaa	Giramii _____	
Kutaa 5. Safartuu Daa'ima kichuu			
G 13	Saala	<ol style="list-style-type: none"> 1. Durbaa 2. Dhiira 	

G 14	Fetaal Piranzantashinii	_____	
G 15	Ulfaatina Daa'ima	Kilo-giramaa _____	
G 16	Fiiirrii/bu'aa APGAR	Daaqiqaa 1ffaa _____ Daaqiqaa 5ffaa _____	
G 17	Gara NICU galu	1. Eyee 2. Lakki	
G 18	Istiil Barzii (Du'ee Dhaalachuu)	1. Eyee 2. Lakki	
Kutaa 6. Haala Fayya Haadhoolii			
G 19	Dhibee Sukaraa Yeroo Ulfaa	1. Eyee 2. Lakki	
G 20	Dhibee Dhiibaa Dhiigaa	1. Eyee 2. Lakki	
Kutaa 7. Safartuu Haala Dahumsa Haadhoolii			
G 21	Pilasenta Abirabshoo	1. Eyee 2. Lakki	
G 22	Pirolongid Lebarii	1. Eyee 2. Lakki	
G 23	Pirolongid Lebarii sadarkaa 2ffaa	1. Eyee 2. Lakki	
G 24	Ritend Pilasentaa	1. Eyee 2. Lakki	
G 25	Mod of Delivarii (Haala Dahumsaa)	1. Normal Vaginal Delivari 2. Sizeriyan Delivarii 3. Vakuum ekistirakshinii 4. Forseps ekistrakshinii 5. Birichii Asistidii	

Annex VI: Ethical Approval and support letter



Ref.No: JHRPGN/536/
Date: 12/10/2021

To Yehualashet Ferenjo (B.Sc.)

Subject: Ethical Approval of Research Protocol

The IRB of Institute of Health has reviewed your research project "Assesment Of Umbilical Cord Length In Relation To Birth Outcome Among Deliveries At Jimma Medical Center, Jimma Town, Southwest Ethiopia."

Thus, this is to notify that this research protocol has presented to the IRB meets the ethical and Scientific standards outlined in national and international guidelines. Hence, we are pleased to inform you that your research protocol is ethically cleared under the following strict conditions:

1. Any significant deviation from the methodological details indicated in the approved protocol must be communicated to the IRB before it has been implemented.
2. Approval shall be only for a period of twelve months. The principal investigator is required to submit an application for the renewal of the ethical approval.
3. The Committee must be notified, in writing, of any alteration to the project including unforeseen events/circumstances that might affect the acceptability of the approved protocol.
4. The Principal researcher is required to immediately notify the committee in the event of any adverse effects on participants or of any unforeseen events that might affect continued ethical acceptability or amendment to the original consent form.
5. The inability of the Principal Researcher to continue in that role, or any other change in research personnel involved in the project; should be communicated.

The IRB wishes you every success in your research.

IRB, Chairperson
Million Tesfaye, PhD
E-mail: ethicsjairb@gmail.com

Tel: +251-47 11 114 57 Fax: +2514711114 50 P.O.Box: 378 e-mail: ero@ju.edu.et
PBX: +251471111458-60 +251471112040 JIMMA, ETHIOPIA website: <http://www.ju.edu.et>



JIMMA UNIVERSITY

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Date 05/02/2014.

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ትብብር ስለመጠየቅ።

በጅማ ዩኒቨርሲቲ፣ ከሚካሄዱ ጥናቶች መካከል “Assessment of Umbilical Cord Length in Relation To Birth Outcome Among Deliveries At Jimma Medical Center, Jimma town, Southwest Ethiopia.” በሚል ርዕስ የምርምር ጥናታቸውን የሚሰሩ መሆኑን እየገለጹን ለተመራማሪው/ዋ ለ Yehualashet Ferenjo ለመረጃ ሰብሳቢዎቻቸው አስፈላጊው ትብብር አንዲደረግላቸው በትህትና እንጠይቃለን። በዚህ አጋጣሚ ያለንበት የCOVID-19 ወረርሽኝ በመሆኑ ለህብረተሰቡም ሆኑ ለመረጃ ሰብሳቢዎች የመከላከያ መንገዶቹን ሁሉ በአግባቡ እንዲጠቀሙ እናሳስባለን።



“ከሰላምታ ጋር”

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Declaration

I, the undersigned, graduate student, hereby declare that this thesis is my original work, and it has not been presented for a degree in any other university for academic credit and that all sources of materials used for this thesis have been duly acknowledged.

Principal Investigator:	Signature	Date
Yehualashet Ferenjo (B.Sc.)	_____	_____

The thesis entitled “*Factors affecting umbilical cord length and its association with birth outcomes among deliveries* “ is approved as the original work of Yehualashet Ferenjo and all the sources were properly acknowledged.

Principal Advisor:

Mr. Tilahun Alemayehu	_____	_____
(M.Sc., Assistant professor of anatomy)		

Co-Advisors:

Mr. Bekalu Getachew (M.Sc. in anatomy)	_____	_____
Mr. Niguse Hamba (M.Sc. in anatomy)	_____	_____
Dr. Fedlu Abdulhay	_____	_____
(Assistant Professor of obstetrics and Gynecology)		

Examiner

Mr. Asfaw Gerbi	_____	_____
(M.Sc., Assistant professor of anatomy)		