



# The Relationship between Fetal Umbilical Cord Length and Fetal Outcome

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## ABSTRACT

**Background:** The umbilical cord develops from the extra-embryonic mesoderm and becomes the channel for blood vessels and through which all exchange and other activities of mother and fetus through placenta are carried out. At term normal umbilical cord length is about 50-70cm and with a diameter of 2.0-2.5cm. There seems to be a positive correlation between fetal umbilical cord length and fetal outcome.

**Aim:** The aim of the study was to determine the correlation between fetal umbilical cord length and the fetal outcome at the Federal Medical Center, Owerri.

**Methodology:** This was a cross-sectional study of 427 parturient at term who will meet the eligibility criteria for the study. The socio-demographic information were coded and analysed using the Statistical Packages for Social Sciences (SPSS) version 23.

**Results:** The mean fetal umbilical cord length in this study was 60.35cm  $\pm$  10.39cm. the shortest fetal umbilical cord length was 33cm and the longest umbilical cord length was 120cm.. There was poor correlation between birth length and different umbilical cord length. There was a positive correlation between birth length and normal fetal umbilical cord length( $r=0.219$ ) and between birth length and long umbilical cord length( $r=0.378$ ).The correlation between birth weight and different fetal umbilical cord length showed a positive correlation between birth weight and normal umbilical cord length( $r=0.084$ ) and long umbilical cord length( $r=0.2467$ ) There was poor positive correlation between APGAR score and short umbilical cord length( $r=0.333$ ) as well as between APGAR score and normal umbilical cord length( $r=0.034$ ). In overall, the total abnormal fetal umbilical cord length in this study was 4.9%. Also the overall prevalence of cord complication in this study was 3.7%, and the prevalence of cord complication was found to be higher in neonates with abnormal fetal umbilical cord length ( $P<0.0001$ ,  $\chi^2=1.457$ ). The fetal out come between abnormal fetal umbilical cord length and normal umbilical cord length was statistically significant ( $P<0.0001$ ).

There was significant association between different cord complication and fetal umbilical cord length status ( $P<0.0006$ ,  $\chi^2=18.288$ ).

**Conclusion;** The study showed that the fetal umbilical cord length is variable. The maximum number of cases had normal umbilical cord length. Abnormal umbilical cord length had higher prevalence of cord complication. There are significant positive correlation between fetal umbilical cord length with birth weight, birth length.

## INTRODUCTION

The umbilical cord<sup>1</sup> is a conduit between the developing embryo or fetus and the placenta. During the prenatal development, the umbilical cord is physiologically and genetically part of the fetus and normally contains two arteries (umbilical arteries) and one vein (the umbilical vein) buried within the Wharton's Jelly.

The umbilical cord develops from the remnants of the yolk sac and allantois. It forms by the fifth week of fetal development, replacing the yolk sac as the source of nutrients for the fetus. The umbilical cord is not directly connected to the mother's circulatory system but instead joins the placenta, which transfers nutrients to and from the mother's blood without allowing direct mixing<sup>2</sup>.

The umbilical cord and placenta has been considered to contribute significantly to perinatal outcome<sup>3</sup>. However, in our environment, attempts at studying the umbilical cord have been limited due to paucity of information on the importance of the umbilical cord during the antenatal period and this issue is further worsened by the prevailing socio-cultural believe which ensure that umbilical cord and placenta are handed over to the relatives after delivery. Thus using umbilical cord for studies became difficult and this is a major drawback in our environment considering the high perinatal and infant morbidities and mortalities<sup>4</sup>.

The length of the umbilical cord ranges from no cord (Acordia) to 300cm with a diameter of 1.2cm-3.0cm<sup>5</sup>. At term the average length of the umbilical cord is between 55cm – 60cm and with a diameter of 2.0cm -2.5cm<sup>6</sup>.

Umbilical cord shorter than 35cm occurs in 5-6% of cases and in about 5-6% of cases the umbilical cord length is longer than 80cm<sup>7</sup>. Though what controls the umbilical cord length is not fully understood, however various authors ascribed cord length to be due to fetal activity and movement<sup>8</sup>.

A short umbilical cord is defined as an umbilical cord length less than 30cm and it occurs in 5-6% of pregnancies. The pathogenesis of short cord remains unclear, however stretch hypothesis explains the ontogeny of the umbilical cord<sup>9</sup>. Short cords have been associated with ante-partum and intra-partum complications and occur commonly in female neonates<sup>10</sup>.

An umbilical cord longer than 70cm are said to be long and they also occur in 5-6% of pregnancies<sup>10</sup>. The complications of long umbilical length could be maternal and fetal and there ranges from cord entanglement, fetal anomalies, mal-presentation, macrosomia and respiratory distress. Long umbilical cords are commonly seen in male neonates.

In investigating the clinical significant of umbilical cord length, it was found that the umbilical cord length was significantly correlated to fetal outcome, however, various studies has conflicting reports on this issue hence the aim of this study is to determine the relationship between fetal umbilical cord length and fetal outcome in our centre.

The importance of umbilical cord length abnormalities have been under-estimated with its attendant obstetric complications contributing significantly to the high perinatal and infant morbidities and mortalities<sup>11</sup>.

Different characteristics of umbilical cord structure and function may predispose a given fetus to umbilical cord accident<sup>12</sup>. These umbilical cord characteristics include cord length, cord weight, cord tensile strength, cord circumference, cord diameter and whatons jelly content<sup>13</sup>. The umbilical cord length is the only property of the umbilical cord which is associated and documented as a definite risk factor for poor fetal outcome<sup>14</sup>. Other umbilical cord properties are linked to the umbilical cord length, hence umbilical cord length abnormalities contribute significantly to umbilical cord accident<sup>15</sup>. Umbilical cord accident has an incidence of 1.5 stillbirth per 1000 birth<sup>16</sup>. Umbilical cord accident also accounts for 15 percent of all sudden antenatal death syndrome<sup>17,18</sup>. Sudden antenatal death syndrome accounts for 30,000 fetal death per year<sup>19</sup>. The reviews of singleton birth files showed that umbilical cord accident accounts for 3.6 death per 1000 births excluding congenital malformations<sup>20</sup>. The best evidence report published as at the year 2002, umbilical cord accident accounts for 2 fetal death per 1000 births and this translates to 4000 to 8000 death per year of genetically normal fetuses in the United states of America<sup>21</sup>. The burden of abnormal cord length on the nation cannot be over emphasized,

The result of this study will highlight the clinical importance of umbilical cord length in our centre. The study will give room for other studies that will measure umbilical cord prenatally and evaluate the risk factors of umbilical cord length for poor fetal outcome.

Furthermore, the measurement of umbilical cord length to detect abnormality in umbilical cord length and relationship with fetal outcome in our centre, will encourage more studies to identify modifiable causes of abnormal umbilical cord length hence improving fetal outcome.

Therefore, I will replicate this study in our center since it has not been carried out and compare the result from other studies,.

## Aim

The aim of this study was to determine the correlation between the fetal umbilical length and the fetal outcome.

The Specific Objectives are:

- To determine the mean fetal umbilical cord length and normal fetal umbilical cord length among parturients who delivered at term in FMC Owerri.
- To compare the fetal outcome between short umbilical cord and long umbilical cord length on term babies delivered at FMC Owerri.
- To compare the fetal outcome between long umbilical cord and normal umbilical cord

length on term babies delivered at FMC Owerri.

- To compare the fetal outcome between short umbilical cord length and normal umbilical cord length on term babies delivered at FMC Owerri.
- To determine the prevalence of cord complication in abnormal and normal cord lengths on term babies delivered at FMC Owerri.
- To determine the association between cord status (normal/abnormal) and cord Complications on term babies delivered at FMC Owerri.

## Hypotheses

- There is no relationship between fetal umbilical cord length and fetal outcome
- Cord status is not associated with cord complications
- The developing fetus or embryo is connected to the placenta through the umbilical cord.

The most important part of the fetoplacental unit is the umbilical cord<sup>22</sup>. Umbilical cord length abnormalities constitute significantly to perinatal morbidities and mortalities. The length of the umbilical cord at term varies from absent cord to a length up to 300 centimeter<sup>23</sup>. At birth the average length of the umbilical cord is about 50-60 centimeters and a diameter of 12 millimeter<sup>24</sup>. Through the pathology of the variability of the umbilical cord length remains unknown<sup>25</sup>.

There are few documented studies on the correlation between fetal umbilical cord length and fetal outcome. The paucity of information on this subject may be due to the fact that it is not a common practice in most centers to examine or measure umbilical cord length after delivery of the fetus unlike the placenta which is examined after delivery.

In a study of 1000 deliveries in India, the umbilical cord length varies from 24 centimeters to 124 centimeters. In this study the mean cord length was 63.86 centimeters ( $\pm$  15.69 centimeters). The maximum cases were seen in the group of umbilical cord length between 51 centimeters and 60 centimeters the lower 5<sup>th</sup> percentile was considered as short umbilical cord and upper 5<sup>th</sup> percentile was considered as long umbilical cord. Short and long umbilical cords were associated with significant incidence of lower segment caesarean section. Umbilical cord length did not vary according to the fetal weight, baby length and sex of the newborn. This study concluded that umbilical cord length abnormality had higher incidence of cord complication, increased incidence of operative interference, intra-partum complication and consequently birth asphyxia<sup>26</sup>.

In another study of 200 cases on the relationship between umbilical cord length with fetal and maternal outcome. This study used 100 cases in the control group and the study group comprising of 20

cases of short umbilical cord length and 80 cases of long umbilical cord length. The minimal observed cord length was 28 centimeter and the maximum cord length was 198 centimeters and the average umbilical cord length was 53.7 centimeters. The study concluded that the umbilical cord length was associated with poor APGAR score and that the umbilical cord length in relation to the sex of the fetus was insignificant<sup>27</sup>.

In a study carried out in Japan on the correlation between the length of the umbilical cord and perinatal outcome. This study showed that the average length of the umbilical cord was  $56.2 \pm 11.70$  centimeters (range 19-133 centimeters). Long umbilical cord was defined as those umbilical cord measuring approximately + 1.5 SD above the mean and short umbilical cord length measuring - 1.5 SD below the mean. The mean are  $>74$  and  $\leq 38$  centimeter in length. Normal cord length was defined as those umbilical lengths measuring  $\pm 1.0$  SD of the mean which is 45 - 68 centimeters in length. The study showed that short umbilical cord length was associated with increased rate of emergency caesarean section, while long umbilical cord was associated with multiple nuchal cords and umbilical knots.

However, this study concluded that umbilical cord length abnormality might not be associated with adverse perinatal outcome in Japan<sup>28</sup>. In another study of 500 cases in India, the study showed that the umbilical cord length varies from 24-124 centimeters and the mean umbilical cord length was 61.7 centimeters. The maximum cord length was observed in the group of cord length between 61 and 70 centimeters. Lower 5<sup>th</sup> percentile was considered as short umbilical cord and upper 5<sup>th</sup> percentile was considered as long umbilical cord. The study concluded that fetal umbilical cord length did not vary according to the fetal weight, fetal length and sex of the fetus<sup>29</sup>.

In a study of 531 cases on the correlation between umbilical cord length and intra-partum complication. The umbilical cord length varies from 14 to 129 centimeters and the mean umbilical cord length was 58 centimeters. The study defined short umbilical cord length as umbilical cord length of 35 centimeter or less (lower 6<sup>th</sup> percentile). The study also showed that umbilical cord accidents were more frequent in long umbilical cord; the study further stated that abnormal cord length was associated with abnormal fetal heart pattern<sup>30</sup>.

A prospective, population based cohort study. The study involved 11,580 individual born between 1915 -1929 in Uppsala Sweden, there were 135 patient with chronic rheumatic heart disease (72 men and 64 women) with a mean age of first hospital admission of 68yrs (range 36-92). There was evidence of a positive association between umbilical cord length and risk of subsequent chronic rheumatic heart disease. The overall hazard ratio in the Sweden study (1.13: 95% confidence interval 1.01 to 1.27) was similar to the previous study with some suggestion of larger effect in men than in women, however there was

no other birth characteristics that was predictive except for weak evidence of a protective effect of higher birth weight in men<sup>31</sup>.

In a study of the relationship between umbilical cord length and chronic rheumatic disease in Sweden. This study was a prospective cohort study and it showed that there was a positive association between umbilical cord length and the risk of subsequent chronic heart disease<sup>32</sup>.

In a study of 1000 deliveries in South eastern Nigeria, the study showed that the mean umbilical cord length was 51.5 centimeters. The study further showed that there was a significant correlation of the fetal umbilical cord length with both the fetal weight and placenta weight<sup>33</sup>.

In another Nigerian study of 602 cases, study showed the average umbilical cord length was 57.56cm and the fetal outcome was not discussed<sup>34</sup>.

Another Nigerian study of 305 cases in South Western Nigeria in the study of the correlation between umbilical cord length with baby length and weight. The study showed that the minimum umbilical cord length was 29.5 centimeters and the maximum cord length in this study was 100 centimeter the mean umbilical cord length was 51.5 centimeter  $\pm$  6.67 centimeters. In this study there was positive correlation between umbilical cord length and the length of the baby and there was also positive correlation between the umbilical cord length and the weight of the fetus<sup>35</sup>.

Umbilical cord in 35,779 neonates was analysed to determine values after mid gestation and to see if abnormal values have clinical significance. Growth slowed after 28 weeks of gestation but did not stop before term. Cord length had a positive correlation with maternal height, weight, pregnancy weight gain, socio-economic status and the fetus being male.

Short cords were associated with subsequent psychomotor abnormalities, but taken alone their predictive value was low because the normal range of cord length was large. Short cords were much better predictors of subsequent impairment when they were combined with other neonatal predictors. Short cords doubled or tripled the predictive values of low APGAR scores and several other neonatal abnormalities for subsequent low IQ values and neurologic abnormalities<sup>36</sup>.

Another study investigated eight healthy term infants with short umbilical cord and 15 control term infants, mothers with pre-eclampsia or hypertension, chorioamnionitis or prolonged rupture of membrane were excluded from the study maternal birth weight, age, parity, infant gender and placenta weight were recorded. The umbilical cord length and diameter were measured as well as the newborn tubal Speed of Sound (SOS). SOS measurement (simlight Omensense 7000P instrument) were obtained at the tubal mid shaft.

The study shows that there were no difference between the two groups in the mother age, parity, newborn's gender, birth weight or placenta weight, however, infant with short umbilical cord length had lower bone (SOS) measure their infant with normal cord length  $3047 \pm 107$  m/sec vs  $3194 \pm 311$  m/sec, ( $p < 0.05$ ). The newborn's (SOS) was correlated only

with the umbilical cord length ( $R = 0.57$ ,  $p = 0.008$ ) and not with maternal age, infant gender, placenta weight, umbilical cord diameter.

The study concluded that infants with short umbilical cord have a lower tibia SOS measurement compared with infant's normal length cord and this finding is likely due to decrease level of activity<sup>37</sup>.

In the review of these few documented studies, it was observed the length of the umbilical cord varies. It was also observed that on the correlation between fetal umbilical cord length and fetal outcome. That some Authors agreed that there was a positive correlation between fetal umbilical cord length and the fetal outcome, while some authors denied this correlation. However, in the mist of this conflicting reports on this subject. It was observed that umbilical cord length abnormality was associated with various umbilical cord complications which will have significant impact on the perinatal morbidities and mortalities.

Umbilical cord length abnormalities are involved in fetal and neonatal complication. Abnormal umbilical cord length have been recognized as the most important umbilical cord features linked to unfavourable results<sup>38</sup>.

The knowledge of the length of the umbilical cord is quite useful in the physio-pathological interpretation of the placenta index<sup>39</sup>. It is also of interest to measure the length of the umbilical cord to predict dystocia and other challenges related to umbilical cord length abnormalities. However accurate measurement of the total length of the umbilical cord is a challenge.

Few authors have tried to explain how to measure the total length of the umbilical cord, but the results were not reliable because landmarks were not used in the measurement

In a study of 1000 deliveries, the umbilical cord was clamped at two places and cut in between. Then from the cord end, up to the fetal umbilical and the placenta attachment, the umbilical cord length was measured and added, this measurement was done with a flexible tape in centimeters. Landmark was not used in this study and the results of these measurements may vary from one individual to another.

In another study the umbilical cord was clamped at the maternal introitus immediately after delivery of the neonates, the umbilical cord segment was measured from the introitus to the placenta attachment<sup>40</sup>.

An observational analytic study to describe measurement of the umbilical cord length. In this study 20.3 centimeter pair of curved Rochester classic forceps were laid on the top of the umbilical cord with the handle placed against the abdomen of the neonate; then first clamp was made at a distance of 20.3 centimeter. Thereafter moving towards the body of the newborn, another clamp was made at 20.3 centimeter. The rest of the umbilical cord attached to the placenta was measured, thereafter 20.3 centimeter was added to give the total length of the umbilical cord<sup>41</sup>. Though the author believed that the measurement of the umbilical cord length through this method was simple but it seems complex and besides

the addition of 20.3 centimeter made the measurement ambiguous.

In another Nigerian study; the measurement of the fetal umbilical cord length was carried out immediately after delivery of the neonate. The umbilical cord was clamped at 5 centimeters from the abdomen of the neonate and after cutting in between clamps, the neonate was handed over to the pediatrician for APGAR scoring and immediately after the removal of the placenta the length of the umbilical cord was measured using a flexible tape. The length of the cut end attached to the fetus was added to the length of the umbilical cord attached to the placenta and this gave the total length of the umbilical cord. This method is simple and it is also the landmark recommended by the paediatricians hence in this study this landmark will be used.

### Study Design

This was a cross sectional study involving eligible parturients at term. The women were recruited consecutively and after counseling them in respect to this study, their informed consent to participate was sought. Those who consented were enrolled and data sheet completed by the researcher. The data sheet contained the Name of patient, Age, Marital status, Religion, Tribe, Occupation, Obstetric history, Medical and social history, Labour history, Umbilical cord examination, Newborn parameters.

### Study Area

The study was carried out at the Federal Medical Centre, Owerri, Imo State, South Eastern Nigeria. It is a tertiary Health Institution undertaking postgraduate medical training. The hospital is located in Owerri Metropolis the capital of Imo State with a population of about 500,000 people and estimated 140,000 (28%) of these are women of reproductive age. The hospital serves as a referral centre for both government and private health facilities for Imo State. The inhabitants of Owerri and its environs are mainly Igbos and other migrant workers mainly civil servants, traders and subsistence farmers. Most of the people are Christian by religion and few Muslims and pagans are found. The hospital provides all levels of health care services for Imo State and neighbouring parts of Rivers, Abia and Anambra States.

The study subjects were drawn from antenatal clinics, prenatal wards and labour ward of the hospital. The antenatal clinics hold every working day in a week. An average of 250 neonates are delivered per month and 5250 per year in the hospital.

### Training of Assistants

Two registrars were trained to assist the researcher in carry out this study. The registrars underwent two weeks training and after which they assisted the researcher in the study This was to ensure accuracy of data collection.

### Recruitment of parturients

All parturients at term who met the inclusion criteria after completion of the data sheet were enrolled consecutively for the study until a sample size of 427 was obtained. The study was completed in 3 months.

### Inclusion Criteria

All parturients at term in labour  
Singleton fetus

### Exclusion criteria

Parturients in preterm labour.  
Parturients with retroviral disease, diabetes mellitus, hypertensive disease of pregnancy, Intra-uterine Growth Restriction (IUGR).  
Parturients whose fetuses have congenital malformation.

### Calculation of the sample size

A sample size was selected to detect the mean cord length and correlation between the umbilical cord length and the fetal weight at 95% confidence level and a standard deviation of 0.05. the probability of achieving statistical significant with power of analysis was based on previous study of three hundred and five (305) parturient, the average birth weight  $3.23 \pm 0.50$  kilogram and the average cord length was  $50.50 \pm SD 6.67$  centimeter (There was a significant positive correlation between cord length and fetal weight) ( $r = 0.145$ ,  $p = 0.011$ )<sup>34</sup>. Thus using the formula<sup>42</sup> for sample size in a correlation studies for continuous outcomes.

$$n = \frac{z_{1-\alpha/2}^2 \sigma^2}{d^2}$$

Sample size

$Z_{1-\alpha/2}$  = standard normal value = 1.96,  
 $\sigma$  = standard deviation of babies weight from previous study = 0.5kg  
 $d$  = precision error = 5% or 0.05

Hence the sample size  $n$  is calculated as follows:

$$n = \frac{1.96^2 (0.5)^2}{0.05^2} = n = \frac{3.8416(0.25)}{0.0025} = 384$$

To account for 10% attrition, we now have  $n = \frac{384}{1-0.10}$   
=427

### METHODOLOGY

Parturients at term who met the eligibility criteria were admitted in labor ward. Obstetric examination was

carried out to confirm their gestational age, the lie, presentation, position, descent of the presenting part and the fetal heart rate will be auscultated with the pinard stethoscope. Vaginal examination was carried out to ascertain the state of the cervix, the dilatation of the cervix, the state of the membrane, the presenting part, the station of the presenting part. The presence or otherwise of caput or moulding were also be noted.

Parturients who were in active phase of labour would be admitted to the partograph and their labour managed partographically until they had the urge to bear down. Then they were encouraged to bear down with each contraction. At the delivery of the baby, third stage was managed actively.

At the delivery of the newborn the following observations regarding the umbilical cord were looked out for: the presence or otherwise of loop around the neck or shoulder, cord loops tight or loose, number of loops of cord, position, knots of cord (true or false), cord abnormalities, cysts, haematoma.

After delivery of the newborn, the umbilical cord was double clamped at 5 centimeter from the umbilicus and cut in between. Then from the cut end up to the fetal umbilicus was measured and added to the length of the cord from the cut end up to its placental attachment. The sum gave the total length of the umbilical cord. It was measured with a flexible tape in centimeters. The flexible tapes were bought from same company to ensure equal calibration of the tape rules. The number of umbilical arteries, coiling index were not be studied. Also the type of insertion of the placenta was not noted. The following parameters were recorded after delivery:

- The AGPAR scores at 1minute and 5 minutes
- The weight of the newborn
- The umbilical cord length
- Number of umbilical loop around the neck
- Number of umbilical knots
- Birth length.

### Data analysis

Statistical analysis was carried out using statistical package for the social science (SPSS) version 23. Student t-test was used for continuous variables while Chi-square was done for contiguous variables. Microsoft excel and Pearson correlation were carried out using SPSS. All charts were drawn with Microsoft Excel, statistical significance was defined as  $p < 0.05$ .

### Dissemination of result

The result of this study would be submitted to the National Postgraduate Medical College as a partial fulfillment of the requirement for the Part II Fellowship examination of the Faculty of Obstetrics and Gynecology. Relevant sections will in due course be presented in scientific conferences and be published in peer review journals.

### Limitation for the Study

There are few documented studies on this subject.

Standardization of measuring the total umbilical cord length. There has not been a standard method of measuring the total length of the umbilical cord from previous studies.

Inter-observer error

The Strength of the Study

The strength of this study lies on the following:

The sample size.

The measurement of the fetal umbilical cord was measured twice to ensure accuracy.

The data would be reliable since the measurement was taken immediately after delivery

## RESULTS

4.1 Socio-Demographic Characteristics of the Subjects, Mode of Delivery and Cord Length. Among the women used in the study, the oldest ones were at age 43years while the youngest was 18 years old. Only 4 women were less than 21 and all of them delivered babies with normal cord length. More than half of the mothers (235 or 54.0%) were between 21-30 years of age, of which clear majority(90.6%) gave birth to children with normal cord length, 3 (1.3%) gave birth to children with short cord length while 7(3%) delivered babies with long cord length (Table1). Among the mothers whose age at birth were over 41 years, None delivered an abnormal (long) cord length child. However, statistical test indicates that there values are likely to have occurred by chance since there was no significant evidence of association between mothers' age at birth and the birth cord length of a child in this study ( $p=0.987$ ,  $\chi^2 =2,386$ ).

At parity of 1, there were 3 (2.1%) short cord lengths and 7(5%), long cord lengths. Parity 2-3 children showed 1 (0.5%) short cord length and 8 (3.9%) long cord length. At parity of more than 5 children, 1 (20%) long cord length was found. Clearly no evidence of statistical association was established between parity and cord length status in this study ( $p =0.136$ ,  $\chi^2 =9.744$ ). Almost all the women studied were married with just a single mother (0.2%). The single mother delivered a baby with normal cord length. No evidence of significant association was found between marital status and cord length in this study ( $p =0.975$ ,  $\chi^2 =0.051$ ).

Those who were unbooked were 3 (0.69%), and 2 (66.7%) showed normal cord length and 1 (33.3%) had long cord length. For the booked, 1.2% have short cord length, 88.7% normal and 10.2% long. Booking status was not found as a significant associating factor of cord length status. The subjects were mainly Ibos (98.2%), with 3 (0.69%) and 1 (0.23%) respectively of Yoruba and Hausa tribes. There were also 4 (0.92%) other women from other tribes such as Ibibio, Efik and Tiv. Among the Ibos, 5 (0.9%) were of short cord length, 378 (88.8%) were normal and 44 (10.3%) were long. None of the babies from Hausa and Yoruba tribe showed abnormal cord length while only 1(25%) long cord length was observed among other tribe. Tribe was not found as a significant factor in this study ( $p =0.494$ ,  $\chi^2 =5.398$ ),

indicating that some few observed difference in cord length among different tribes may have occurred by chance.

In terms of religion, the study participants were predominantly Christians (99.8%) with only 1 (0.2%) Islam, all the abnormal cord length were found in the Christians, but religion was not found as a significant associating factor of cord length status in this study ( $p = 0.975$ ,  $\chi^2 = 0.051$ ).

In terms of mode of delivery, 292 (67%) babies were delivered by spontaneous vaginal delivery (SVD), followed by 92 (2.1%) on emergency cesarean section and 42 (9.7%) on elective cesarean section. Up to 8 (1.8%) were delivered on vacuum delivery while 1 (0.2%) was through breech delivery. The association between cord length and the mode of delivery, as well as the association between Cord length and the sex of

the baby were also computed (Table 8). For delivery mode, a total of 292 babies were born on Spontaneous vaginal delivery (SVD), 3 (1.0%) had short cord length, 258 (88.4%) had normal cord length and 31 (10.6%) had long cord length. Among 92 babies delivered with emergency cesarean section, 2 (2.2%) had short cord length and 8 (8.7%) had long cord length. For the babies delivered born on elective cesarean section, 6 (14.3%) had long cord length and the remaining 36 (85.7%) were of normal cord length. A total of 8 babies were delivered through vacuum delivery and all of them showed normal cord length. Only one baby was delivered by breech and the baby also showed normal cord length. Statistical test indicates that there was no evidence of association between mode of delivery and cord length ( $p = 0.913$ ,  $\chi^2 = 3.314$ ).

**Table 1: Distribution for Demographic characteristics and Mode of delivery**

Demographic characteristics and Mode of delivery	Total	Short		Normal		Long		Chi-square ( $\chi^2$ )	p-value (p)
		N	%	N	%	n	%		
Mother' Age (in yrs) mean =30.30 ( $\pm 4.51$ )									
less than 21	4	0	0.0	4	100	0	0.0		
21- 30	235	3	1.3	213	90.6	19	8.1		
31 -35	140	1	0.7	119	85.0	20	14.3		
36-40	47	1	2.1	41	87.2	5	10.6		
41+	9	0	0.0	8	88.9	1	11.1		
Total	435	5	1.1	385	88.5	45	10.3	2.366	0.968
Parity									
1	140	3	2.1	124	88.6	13	9.3		
2 -3	206	1	0.5	183	88.8	22	10.7		
4-5	84	1	1.2	74	88.1	9	10.7		
>5	5	0	0.0	4	80.0	1	20.0		
Total	435	5	1.1	385	88.5	45	10.3	9.772	0.135
Marital status									
Single	1	0	0.0	1	100	0	0.0		
Married	434	5	1.2%	384	88.5%	45	10.4		
Divorced	0	0	0.0	0	0.0	0	0.0		
Total	435	5	1.1	385	88.5	45	10.3	0.051	0.975
Booking Status									
Unbooked	3	0	0.0	2	66.7	1	33.3		
Booked	432	5	1.2	383	88.7	44	10.2		
Total	435	5	1.1	385	88.5	45	10.3	1.741	0.419
Tribe									
Igbo	427	5	0.9	378	88.8	44	10.3		
Hausa	1	0	0.0	1	100	0	0.0		
Yoruba	3	0	0.0	3	100	0	0.0		
Others	4	0	0.0	3	75.0	1	25.0		
Total	435	5	1.1	385	88.5	45	10.3	5.398	0.494
Religion									
Christianity	434	5	1.2	384	88.5	45	10.4		
Islam	1	0	0.0	1	100	0	0.0		
Traditional	0	0	0.0	0	0.0	0	0.0		
Total	435	5	1.1	385	88.5	45	10.3	0.051	0.975
Mode of Delivery									
Spontaneous vaginal delivery (SVD)	292	3	1.0	258	88.4	31	10.6		
Emergency cesarean section	92	2	2.2	82	89.1	8	8.7		
Elective cesarean section	42	0	0.0	36	85.7	6	14.3		
Vacuum delivery	8	0	0.0	8	100.0	0	0.0		
Breech delivery	1	0	0.0	1	100.0	0	0.0		
Total	435	5	1.1%	385	88.5%	45	10.3	3.314	0.913

### Mean Fetal umbilical cord Length and other Fetal Outcomes

There were a total of 435 deliveries studied. Clearly the mean cord length obtained in the study for the babies was 60.35cm, at a corresponding standard deviation of 10.39. The shortest cord length among the babies was 33cm while the longest one was 120cm (Table 2). The normal fetal umbilical cord length in this study is the mean fetal umbilical cord length  $\pm$  2SD, which is 60.35cm  $\pm$  20.78. Therefore a short fetal umbilical cord length is defined as a fetal umbilical cord less than 39.5cm, however, the normal fetal umbilical cord length ranges between 39.5cm to 81.1cm. A long fetal umbilical cord length is defined as an umbilical cord length longer than 81.1cm.

Also Table 2 contained summary information on other fetal outcomes such as birth weight, birth length, gestational age and APGAR scores at 1 minute and 5 minutes. The mean birth weight was 3.20kg (Standard deviation = 1.47 kg). The minimum and maximum birth weight obtained were 1.85kg and 5.30kg respectively. On the other hand, the mean birth length was 49.5 cm at a standard deviation of 2.87cm. The shortest birth length was 33cm and the longest 60cm.

The mean gestational age was 39 weeks at a corresponding standard deviation of 1.14 weeks). At 1 minute APGAR score, a mean ( $\pm$  standard deviation) score of 8.1 ( $\pm$  1.10) was obtained, with minimum and maximum scores of 3.0 and 10.0 respectively. The mean ( $\pm$  standard deviation) APGAR score of 9.8 ( $\pm$  0.80) was obtained at 5 minutes, with minimum score of 4 and maximum score of 10.

**Table 2: Mean Fetal umbilical cord Length and other Fetal Outcomes**

Fetal Outcomes	n	Minimum	Maximum	Mean	Std. Deviation
Cord Length (cm)	435	33.00	120.00	60.35	10.39
Birth Weight (kg)	435	1.85	5.3	3.20	0.49
Birth Length (cm)	435	33.00	60.00	49.50	2.87
Gestational Age (Weeks)	435	35.00	44.00	39.0	1.14
APGAR score (1 min)	435	3.00	10.00	8.11	1.10
APGAR Score (5 mins)	435	4.00	10.00	9.75	0.80

### Length of Umbilical Cord Case Distributions

The output contained on Table 3 is the case distribution according to the cord length for the babies studied. The distribution was such that clear majority 95.16% of the children have normal cord length (39.5-

81.1cm) while 3.69% showed long umbilical cord length ( $>$  81.1cm) and 1.15% was short umbilical cord lengths ( $<$  39.5cm). Hence, the total abnormal cord length (short and long) found in this study was 21 (4.84%).

**Table 3: Case distribution according to length of cord**

Length of Cord	Number of cases (n)	Percent (%)
Short cord	5	1.15
Normal cord	414	95.17
Long cord	16	3.68
Total	435	100

### 4.4 Correlation between Fetal umbilical Cord Length and other Fetal outcomes

Table 4 contained the summary statistics of fetal outcomes in relation to the cord length. The overall correlation between birth weight and cord length was found to be positive but poor ( $r = 0.244$ ). The correlation was positive in the normal and long cord lengths but negative in the short cord length ( $r = -0.4289$ ). Significant association was established between cord length and birth weight in this study ( $p < 0.0001$ ).

On sex of the baby, none of the male babies showed short cord length at birth while 10 (4.4%) and

220 (95.7%) had long cord length and normal cord length respectively. For the females, 5 (2.5%) had short cord length, 188 (95.7%) had normal cord length and 6 (3.0%) had long cord length. Slight significant association was found between baby sex and cord length ( $p = 0.048, \chi^2 = 6.028$ ).

At one minute APGAR score, the overall correlation was quite very poor ( $r = 0.008$ ). Poor positive correlation were obtained in short ( $r = 0.333$ ) and normal ( $r = 0.034$ ) cord length while it negative at long cord length ( $r = -0.156$ ). Similar poor correlations were obtained at 5 minutes APGAR score for short ( $r = 0.000$ ), normal ( $r = 0.062$ ) and long ( $r = -0.0$ ) cord lengths. However, no significant association was



found between cord length and APGAR scores in both one and five minutes.

Overall poor positive correlation was obtained between birth length and cord length ( $r = 0.256$ ). The correlations were positive in the normal cord length ( $r = 0.219$ ) and long cord length ( $r = 0.378$ ), but negative in the short cord length ( $r = -0.230$ ). Significant positive correlation was obtained in between birth length and cord length ( $p < 0.0001$ ). The correlations for gestational age were  $r = 0.589$  in short cord length,  $r = -0.0175$  in normal cord length and  $r = 0.354$  in the long cord length; but no evidence of significant association was found between cord length and gestational age in this study ( $p = 0.875$ ).

#### 4.5 Correlations between Fetal Cord Length and other Fetal outcome

Table 3 contained the summary statistics of fetal outcomes in relation to the cord length. There were poor correlations found between birth length and different cord lengths. The correlation was positive between birth length and the normal cord length ( $r=0.219$ ) and between birth length with long cord length ( $r=0.378$ ), but was negative between birth length with short cord length ( $r=0.230$ ).

In terms of correlation between birth weight and cord lengths, the correlation was positive with normal cord length (0.084), and long cord lengths (0.2467) but negative in the short cord length ( $r=0.0074$ ). For the APGAR score, poor positive correlation were obtained between APGAR score and short fetal cord length ( $r=0.333$ ), as well as between APGAR score and normal cord length ( $r=0.034$ ).

**Table 4: Correlation between fetal Cord Length and other Fetal Outcome**

Outcome	Short umbilical cord (n=5)	Normal umbilical cord (n=414)	Long umbilical cord (n=16)
Birth length (cm)	-0.230	0.219	0.378
Birth weight (kg)	-0.0074	0.084	0.2467
APGAR score	0.333	0.034	-0.156

On table 4a, the mean birth weight showed some evidence of significant difference between short and long umbilical cord lengths ( $p=0.0442$ ,  $t=-2.1556$ ), with means of 3.08kg and 3.58kg respectively in short and long umbilical cord lengths. The mean birth length was found to be 48.2cm (standard deviation = 2.05) at short umbilical cord length, while it was 51cm (standard deviation = 3.03) at long umbilical cord. The mean Apgar score was respectively 9.0 and 8.0 at short and long cord lengths. Statistical test shows that no significant difference was found between short and long umbilical cord lengths in relation to birth length ( $t=-1.9163$ ,  $p=0.0705$ ) and APGAR score ( $t=1.6863$ ,  $p=0.1081$ ).

Birth length was found to be slightly significant between long and normal umbilical cord lengths ( $t=2.0446$ ,  $p=0.0415$ ), at a mean value of 51.0cm and 49.46cm respectively for the long and normal cord lengths. None of the birth weight ( $t=0.8563$ ,  $p=0.3923$ ), and APGAR score ( $t=-0.2865$ ,  $p=0.7746$ ) was found significant between long and normal cord lengths in this study.

The result for the relationship between short and normal umbilical cord lengths in terms of fetal outcomes such as birth length, birth weight and Apgar score is also contained on Table 4c. No statistical significant difference was found between the two different umbilical cord lengths at any of the fetal outcomes at 5% level.

**Table 4a: Relation between fetal cord length and other fetal outcomes comparing fetal outcome between Short umbilical cord length and Long umbilical cord length**

Outcomes	Mean $\pm$ standard deviation	Mean $\pm$ standard deviation	t test	P value (p)
	Short umbilical cord (n=5)	Long umbilical cord (n=16)		
Birth length (cm)	48.2 $\pm$ 2.05	51.0 $\pm$ 3.03	-1.9163	0.0705
Birth weight (kg)	3.08 $\pm$ 0.19	3.58 $\pm$ 0.50	-2.1556	0.0442
Apgar score	9.0 $\pm$ 0.71	8.0 $\pm$ 1.25	1.6863	0.1081

**Table 4b: Relation between fetal cord length and other fetal outcomes comparing fetal outcome between long umbilical cord length and normal umbilical cord length**

Outcomes	Mean $\pm$ standard deviation	Mean $\pm$ standard deviation	t test	P value (p)
	Short umbilical cord (n=16)	Long umbilical cord (n=414)		
Birth length (cm)	51.0 $\pm$ 3.03	49.46 $\pm$ 2.86	2.0446	0.0415
Birth weight (kg)	3.58 $\pm$ 0.50	3.26 $\pm$ 1.49	0.8563	0.3923
Apgar score	8.0 $\pm$ 1.25	8.08 $\pm$ 1.09	-0.2865	0.7746

**Table 4c: Relation between fetal cord length and other fetal outcomes comparing foetal outcome between Short umbilical cord length and normal umbilical cord length**

Outcomes	Mean $\pm$ standard deviation	Mean $\pm$ standard deviation	t test	P value (p)
	Short umbilical cord (n=5)	Long umbilical cord (n=414)		
Birth length (cm)	48.2 $\pm$ 2.05	49.46 $\pm$ 2.86	-0.9815	0.3269
Birth weight (kg)	3.08 $\pm$ 0.19	3. 26 $\pm$ 1.49	-0.2698	0.7875
Apgar score	9.0 $\pm$ 0.71	8.08 $\pm$ 1.09	1.8812	0.0606

#### 4.5 Prevalence of Cord Complications in the Overall, Normal and Abnormal Cord Lengths

Among the group studied, 16 (3.7%) have cord complication while 419 (98.4%) do not have cord complications. Hence the overall prevalence of cord complications was found as 3.7% in this study (Table 5).

Among 21 babies that showed abnormal cord length, 4 (19%) had cord complications while 17 (81%) were without cord complications. For the ones with

short cord length, 20% have complication, and for those with long cord length, 18.7% have complications while for the babies that have normal cord length, only 2.9% have complications (Table 5).

Clearly the prevalence of cord complications was found to be higher in babies with abnormal cord length than in the ones with normal cord length. The difference in prevalence between the abnormal and normal cord length was found to be statistically significant ( $p < 0.0001$ ,  $\chi^2 = 13.35$ ).

**Table 5: Prevalence of Cord Complications in Normal and Abnormal cord length**

Cord length	Number	(Prevalence)
<b>Short Cord length</b>		
Complications	1	20%
Non-complications	4	80%
<b>Total</b>	<b>5</b>	<b>100%</b>
<b>Normal Cord length</b>		
Complications	12	2.9%
Non-complications	402	97.1%
<b>Total</b>	<b>414</b>	<b>100%</b>
<b>Long Cord length</b>		
Complications	3	18.7%
Non-complications	13	81.3%
<b>Total</b>	<b>16</b>	<b>100%</b>
<b>Overall</b>		
Complications	16	3.7%
Non-complications	419	96.3%
<b>Total</b>	<b>435</b>	<b>100%</b>
<b>Statistical Test</b>		
p-value (p)		< 0.0001
Chi-square value ( $\chi^2$ )		13.35

#### 4.7 Cord Complication Status

Clearly there were a total of 16 (3.7%) babies that had cord complications Figure 1. The frequency of the complications was such that 10 out of the 16

complications (62.5%) were nuchal cord with one loop and 2 (12.5%) were nuchal cord with two loops. The rest including severe asphyxia occurred only in one baby (6.3%) each (Figure 2).

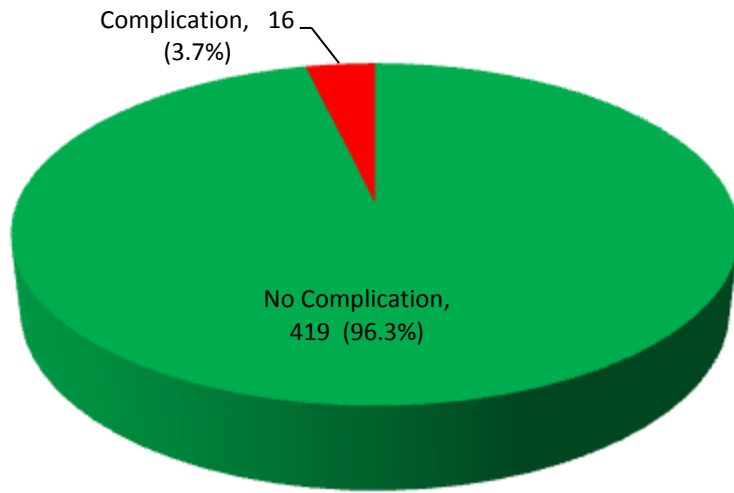


Figure 1: Cord Complication Status

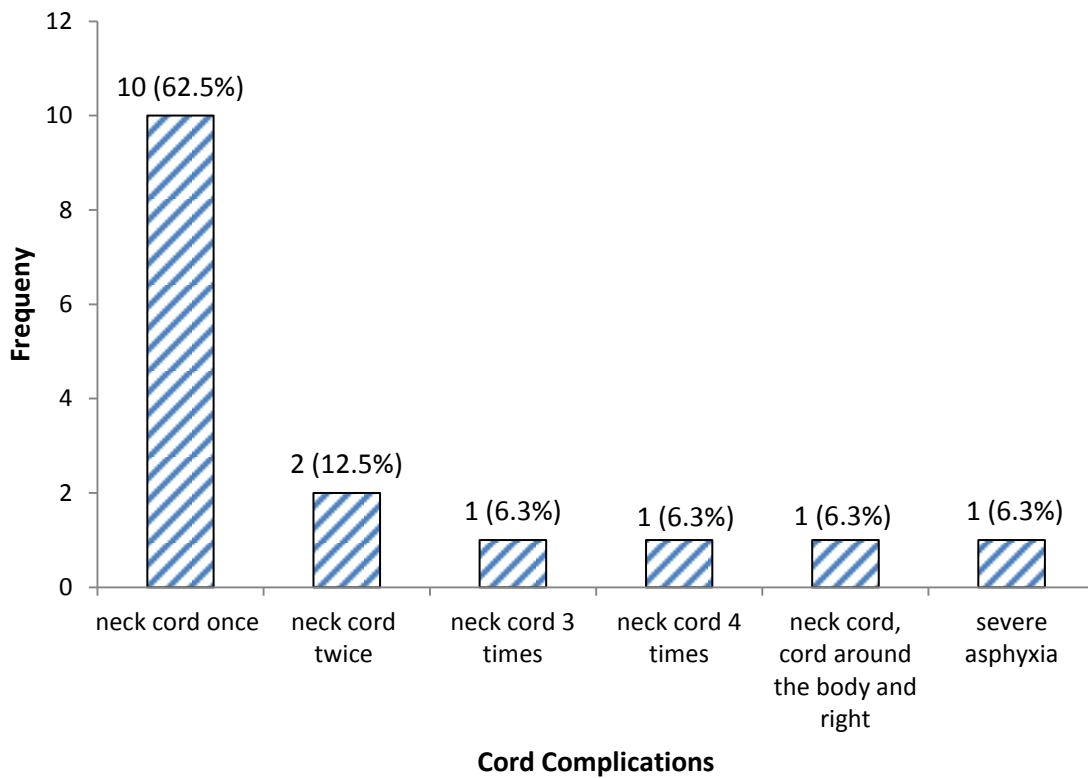


Figure 2: Distribution for different Cord complication among the Study Population

**4.8 Association between cord length status and cord complication status**

Among the babies born without cord complications, 17 (4.1%) had abnormal cord length. Similarly, for the babies that had cord complications. nuchal cord with one loop , 1 (10.0%) had abnormal cord length. Two babies showed nuchal cord with two loops, and 1

(50%) have abnormal cord length. One baby showed nuchal cord with three loops and the baby had abnormal cord length, while one baby born with severe asphyxia had normal cord length (Table 8). Significant association was found in this study at 5% level, between different cord complications and cord length status ( $p < 0.006, \chi^2 = 18.288$ ).

**Table 8: Cord length status and cord complication status**

Cord Complication Status	Total	Normal cord length	Abnormal cord length
No Complication	419	402	95.9%
nuchal cord with one loop	10	9	90.0%
Nuchal cord with two loops	2	1	50.0%
nuchal cord with three loops	1	0	0.0%
Nuchal cord with four loops	1	1	100.0%
Nuchal cord, cord around the body and right leg	1	0	0.0%
Severe Asphyxia	1	1	100.0%
Total	435	414	95.2%
		Chi-square ( $\chi^2$ ) =18.288	p=0.006

Further classifications indicate that for babies born without cord complications, 4 (1.0%) have short cord length and 13 (31.0%) have long cord short length. For the ones born with nuchal cord with a loop, 10% were short cord length while none had long cord length. The babies that have complications such as nuchal cord with three loops and nuchal cord together with cord around the body and right leg showed long cord length.

## DISCUSSION

The normal fetal umbilical cord length in this study is the mean fetal umbilical cord length  $\pm$  2SD, which is 60.36cm  $\pm$  20.78, hence the normal fetal umbilical cord length ranges between 39.5cm to 81.1cm. A short fetal umbilical cord length is defined as umbilical cord length less than 39.5cm. Also long fetal umbilical cord length is defined as an umbilical cord length greater than 81.1cm

In this study, the minimum fetal umbilical cord length was 33cm and the maximum cord length was 120cm. the result is not similar to the values of the umbilical cord length in (26). The reason may be due to racial variation and even the methodology used in the measurement of the fetal umbilical cord length. The result obtained in this study is different from the result obtained in (27) and reason could be due to the smaller sample size used in the study. The values obtained from (28) are not similar to the result obtained in this study because the normal umbilical cord length in that study was derived from mean umbilical cord length  $\pm$  1.5 SD. It could also be due to racial variations. The result is similar to the value obtained in (34), this could be due to tribal similarity. Furthermore, the result obtained in this study is not similar to the value obtained in the study (35), though same methodology was used in measuring the fetal umbilical cord length, tribal differences could account for the variation in the mean fetal umbilical cord length and perhaps more female neonates were involved in that study.

The mean weight of the neonate in this study was 3.2kg + 1.47kg which was similar to the values obtained in (35) and the mean length of the neonate

was 49.5cm + 2.87cm, which was similar to the result obtained in (35). The reason could be due to the methodology used in both studies and some cultural similarities in the study population.

In studying the relationship between fetal umbilical cord length and fetal outcome. This study compared the relationship between long umbilical cord length and short umbilical cord length, the study also compared the relationship between long umbilical cord length and the normal umbilical cord length. The study further compared the relationship between short umbilical cord length and normal umbilical cord length.

There was poor correlations found between birth length and different umbilical cord length. The correlation was positive between birth length and the normal fetal umbilical cord length ( $r = 0.219$ ) and between birth length with long fetal umbilical cord length ( $r=0.378$ ), but it was negative between birth length with short umbilical cord length ( $r=-0.230$ ).

The correlation between birth weight and different fetal umbilical cord length showed a positive correlation between birth weight and normal umbilical cord length ( $r=0.084$ ) and long umbilical cord length ( $r=0.2467$ ) but there was a negative correlation found between birth weight and short umbilical cord length ( $r= - 0.0074$ ). The correlation between APGAR score and different umbilical cord length, showed that there was poor positive correlation between APGAR score and short umbilical cord length ( $r=0.333$ ) and as well as between APGAR score and normal umbilical cord length ( $r=0.034$ ).

In comparing the fetal outcome between short umbilical cord length with long umbilical cord length, it was observed that birth weight showed evidence of slightly statistical significance ( $t = -2.1556$ ,  $p=0.044$ ). There was no evidence of statistical difference of birth length ( $p=0.0705$ ) and APGAR score ( $p= 0.1081$ ) respectively.

Also, when the fetal outcome was compared between long umbilical cord and normal umbilical cord, it was observed that the birth length was slightly statistical significant ( $t = 2.0446$ ,  $p=0.0415$ ). Birth weight ( $t=0.8563$   $p= 0.3923$ ) and APGAR score ( $t = -0.2865$ ,  $p = 0.7746$ ) were not statistically significant.

Furthermore, when the fetal outcome was compared between short umbilical cord and normal

umbilical cord, the fetal outcome, birth length ( $t = -0.9815$ ,  $p = 0.3269$ ), birth weight ( $t = -0.2698$ ,  $p = 0.7875$ ) and APGAR score ( $t = 1.8812$ ,  $p = 0.0606$ ) were not statistically significant. However there were no previous studies that compared fetal outcome with different umbilical cord length. The overall fetal umbilical cord length when compared with the fetal outcome showed that fetal umbilical cord length was statistically significant with birth length ( $r = 0.256$ ,  $p = <0.0001$ ) and birth weight ( $r = 0.240$ ,  $p = <0.0001$ ) but not statistically significant with APGAR score ( $r = 0.008$ ,  $p = 0.875$ ).

A recent Nigerian study of 305 deliveries in South west Nigeria in the correlation between fetal umbilical cord length and birth length, the mean fetal umbilical cord length was  $51.50 \pm 6.67$ cm. There was a significant correlation between fetal umbilical cord length and birth length (35). This could result from the fact that more male babies were involved in the study and may also result from the methodology used in measuring the fetal umbilical cord length.

Also in another Nigeria study of 602 deliveries in Southeast Nigeria, the mean fetal umbilical cord length was 57.50cm. There was a positive correlation between fetal umbilical cord length and the birth weight of the baby (34). This could result from tribal similarity or may be that male neonate dominated in the study.

In another Nigeria study of 1000 deliveries in Southeast Nigeria the mean fetal umbilical cord length was 51.50cm. The study showed that there was a significant correlation between fetal umbilical cord and fetal weight and placenta weight (33). Perhaps tribal similarity may account for the result in the study.

In study of 500 deliveries in India, in the correlation between fetal umbilical cord and fetal outcome, the mean fetal umbilical cord length was 61.70cm. the lower 5<sup>th</sup> percentile was considered as short umbilical cord and the upper 5<sup>th</sup> percentile was considered as long umbilical cord length. The study observed the fetal umbilical cord length did not vary according to birth weight and birth length, which is difference from what was observed in the overall fetal umbilical cord length and fetal outcome, their reason could be that, racial difference may have something to do with fetal umbilical cord.

In another study of 200 deliveries in Japan. In the relationship between fetal umbilical cord length and fetal outcome. "The mean umbilical cord length was 53.70 centimeter, the study observed that umbilical cord length was associated with poor APGAR score (27). This is not similar to what was observed in our study, the reason could be due to racial difference and probably the number of male neonates involved in their study were less".

Other important findings in our study were that normal umbilical cord length has a prevalence of 95.1%, the prevalence of long umbilical cord length and short umbilical cord length were 1.15% and 3.68% respectively, hence the prevalence of abnormal cord length in our study was 4.83%.

The other findings in our study included that the overall prevalence of cord complication was 3.7%,

however short umbilical cord length accounted for 20%, 18.7% of the cord complication was due to long umbilical cord length and 2.9% of the cord complication was found in normal cord length. The difference in prevalence between abnormal and normal cord length was statistically significant ( $P < 0.0001$ ,  $X^2 = 1.457$ ).

There was no relationship between maternal age, parity, marital status, booking status, gestational age, ethnicity, religion and the mode of delivery with the overall fetal umbilical cord length (37).

The fetal activity and genetic constitution may have impact on the fetal umbilical cord length development and growth. Various authors have ascribed umbilical cord length to be due to fetal activity and movement (8). However, what controls the umbilical cord length is not fully understood.

This study could not determine what could be responsible for the umbilical cord length. Hence evaluating for risk factor for abnormal cord length, identifying modifiable causes of abnormal cord length through a multi-centred studies is recommended in order to actually find determinants of fetal umbilical cord length thus improving fetal outcome in our centres.

## CONCLUSION

This study was primarily aimed at investigating the relationship between fetal umbilical cord length and fetal outcome. This aim was successfully achieved. This study showed that the length of the fetal umbilical cord is variable. However, maximum number of cases had normal cord length. Abnormal umbilical cord length had higher prevalence of cord complications. There are significant positive correlations between fetal umbilical cord length with birth weight and birth length of the baby, however, there was no correlation found between fetal umbilical cord length and APGAR score. The study also showed that the fetal umbilical cord length has no correlation with maternal age, ethnicity, religion, booking status, parity, marital status, gestational age, ethnicity, religion and the mode of delivery.

Thus this study shows the clinical importance of the fetal umbilical cord length. Examination of the fetoplacenta unit after delivery will not be complete without examining, measuring and documenting fetal umbilical cord length. Equipment should be developed to measure the fetal umbilical cord length antenatally to reduce the prevalence of cord complications. This will further reduce the incidence of perinatal morbidities and mortalities associated with cord complications in the future, thus helping to the realization of a healthy baby at birth. Multi centered studies are required to find the determinants of fetal umbilical cord length.

## RECOMMENDATIONS

Health education on the importance of examination, measurement and documentation of fetal umbilical cord length after delivery should be given to health care givers. There should be a standardize method of measuring fetal umbilical cord length globally. There should be training and retraining of health care providers on the accurate method of measuring fetal umbilical cord length, Equipment should be developed to measure umbilical cord length during the antenatal period ,Researchers are needed in this field to evaluate risk factors and modifiable causes of abnormal fetal umbilical cord length. More studies are required in the new ultrasonographic method of using umbilical cord length index to predict short or long umbilical cord antenatally in order to improve on the sensitivity and specificity of the method and thus improve neonatal outcome.

## Ethical Consideration

In order that ethical standards are maintained, the following steps will be ensured. The data sheet will be explained to eligible parturients. The parturients will be assured that no harm will result from participating in the study. They will be made to understand that their participation is voluntary and that their refusal to do so will not affect their management in the hospital. They will be free to withdraw their participation at any stage of the study.

Ethical approval will be obtained from the hospital's Ethical Review Committee.

## Confidentiality of data

All the information obtained from eligible parturient will be kept strictly confidential. The patient will also be assured that their identities will not be disclosed.

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– 14/4/2021

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