Chapter One

Chapter One

1.1 Introduction

Birth weight is an important indicator and prognostic factor for the health of newborns, as it reflects the nutritional and metabolic conditions of the mother, as well as fetal development during pregnancy. The World Health Organization (WHO. 2020) defines birth weight as the first measurement obtained from the newborn and that defines the classification of weight strata. Globally 2.4 million children died in the first month of life in 2019. There are approximately 7 000 newborn deaths every day, amounting to 47% of all child deaths under the age of 5-years, up from 40% in 1990 (UNICEF. 1990).

According to this measure, newborns are classified as “macrosomic” a term used for newborns weighing more than 4000 g; “adequate birth weight” (ABW), which refers to the birth weight of 3000–3999 g; “inadequate or insufficient birth weight” (IBW), indicating the range between 2500 and 2999 g; and “low birth weight” (LBW), if the weight is less than 2500 g. It should be noted that the last classification includes two complementary and non-exclusive categories: “very low birth weight” (VLBW), when the weight is less than 1500 g, and “extremely low birth weight” (ELBW), which indicate less than 1000 g (WHO. 2020). Birth weight, besides the gestational age and sex of the newborn, has a close relationship with infant mortality and its components (neonatal mortality—NM and postnatal mortality—PNM). The lower the birth weight and the gestational age, the greater the chance of death in the first year of life (Watkins W.J, et al. 2016).

Newborns weighing less than 2500 g have a higher risk of neonatal morbidity and mortality, malnutrition in the first year of life, susceptibility to infections, respiratory distress and traumas during childbirth, and development of chronic non-communicable diseases (NCDs) (Watkins W.J, et al. 2016), (McCormick. 1985). The estimated relative risk of low birth weight for neonatal mortality is almost 200 times higher when compared with newborns with adequate birth weight (Sarinho, et al. 2001). Low birth weight alone can be considered an important predictor of child mortality risk, and its temporal evaluation at a given location is relevant for the monitoring, planning, and execution of public policies in the field of maternal and child health

Assessment of fetal weight is a vital and universal part of antenatal care, not only in the management of labor and delivery but often during the management of high risk pregnancies and growth monitoring (Ugwu, et al. 2014). Birth weight of an infant is the single most important determinant of newborn survival (Ugwu, et al. 2014), (Bajracharya, et al. 2012). Both low and excessive fetal weights at delivery are associated with an increased risk of newborn complications during labor and puerperium. The high perinatal morbidity and mortality associated with low birth weight are attributable to preterm delivery, intrauterine growth restriction, or both. For excessively large fetuses, the potential complications associated with vaginal delivery include shoulder dystocia, brachial

plexus injury, bone injuries, and intrapartum asphyxia, while the maternal risks include birth canal and pelvic floor injuries, increased rate of operative vaginal and caesarean deliveries, and postpartum haemorrhage (Ekele, et al. 2006). Limiting the potential complications associated with the birth of both small and excessively large fetuses requires that accurate estimation of fetal weight occurs before decision to deliver is made (Kehinde, et al. 2013).

Both low birth weight and excessive fetal weight at delivery are associated with an increased risk of newborn complications during labor and the puerperium. The perinatal complications associated with low birth weight are attributable to either preterm delivery or intrauterine growth restriction (IUGR), or both. For excessively large fetuses, the potential complications associated with delivery include shoulder dystocia, brachial plexus injuries, bony injuries, and intrapartum asphyxia. The maternal risks associated with the delivery of an excessively large fetus include birth canal and pelvic floor injuries, as well as postpartum hemorrhage. The occurrence of cephalopelvic disproportion is more prevalent with increasing fetal size and contributes to both an increased rate of operative vaginal delivery and cesarean delivery for macrosomic fetuses compared with fetuses of normal weight. Depending on many factors, the optimal range for birth weight is thought to be 3000-4000 grams (Westerway. 2012). Decreasing the potential complications associated with the birth of both small and excessively large fetuses requires that accurate estimation of fetal weight occur in advance of delivery. A review of the methods that can be used for the accurate estimation of fetal weight is the focus of this article.

The two main methods for predicting birth weight in current obstetrics are clinical and ultrasonographic methods (Ashrafganjooei, et al. 2010). Increasing attention is being paid to the accuracy of using various ultrasound measurements in estimating fetal weight. Multiple fetal parameters for prediction of fetal weight are employed. These are the parietal diameter, head circumference, abdominal circumference, and femoral length. Ultrasound estimation of fetal weight, while being accurate to a degree, is associated with error ranging from 6 to 11% depending on parameters measured and the equation used for estimation. Although some investigators consider sonographic estimates to be superior to clinical estimates, others in

comparing both techniques concurrently concluded that they confer similar level of accuracy (Dudley. 2005).

In developing countries, it is important to note that ultrasound fetal weight estimation requires expensive equipment and trained personnel and is time consuming, while clinical methods can be carried out at no cost and are easy to perform especially for less experienced examiners (Ugwu, et al. 2014).

Estimated fetal weight:

Ultrasonographically estimated fetal weight is obtained from measurements of fetal parts and the use of these measurements in a regression formula to derive a birth weight. Over the past 30 years there are many published formulas for ultrasonographic estimated fetal weight (EFW). Mostly used formulas in USA are those from Hadlock and colleagues w7x, which will be used in this study. In Great Britain formulas from Campbell and Wilkin w2x and from Shepard w17x, and in Germany the formula from Merz w11x. With a different priority all of them are used in most of the ultrasound diagnostic centers. The accuracy of predicting birth weight by variety of different formulas, incorporating different ultrasonic measurements, has been studied extensively (Kurmanavicius, et al. 2004).

Regardless of the fact, that in most of studies the ultrasound examinations were obtained by a single or several experienced examiners, the mean absolute percent error (APE) of sonographically predicted birth weight ranges between 6 and 15%. Majority of the studies have had relatively small samples with a narrow range of birth weights (mostly term fetuses), and the influence of examiner on EFW was not yet investigated.

1.2 Problem of the Study

One of the most important reasons for prenatal visits and for doing an ultrasound examination is to estimate the fetal size of your baby. If the fetus is too small, there may be a problem with the placenta or with the fetus. If it's too big, the mother could have gestational diabetes.

Traditionally, doctors or midwives estimate fetal size by measuring the height of your uterus in centimeters or by placing their hands on the outside of the uterus and feeling for the fetus. However, measuring the uterus or estimating fetal weight manually is not foolproof because many factors can affect the examination, such as the mother's weight and height, the thickness of the uterus, the size of the placenta, and the amount of amniotic fluid. Ultrasound measurements of the fetus's head, abdomen, and upper thighbone provide a more accurate way to determine size.

1.3 Justification:

Information on fetal weight is of importance to obstetricians in the management of pregnancy and delivery. Ultrasound estimation of fetal weight at term provides vital information for the skilled birth attendants to make decisions on the possible best route of delivery of the fetus. The aim of this study is to determine the accuracy of sonographic estimation of fetal weight, this will help in appropriate decision making in the management of the pregnant ladies.

1.4 Objectives:

General Objectives:

To compare the accuracy of sonographic method of predicting fetal weights at term pregnancies in compare to immediate post parturition weight.

Specific Objectives:

1. To estimate the fetal weight by ultrasound in relation to the immediate after birth weight.
2. To determine the association between expected fetal weight and parity.
3. To identify the association between maternal weight at delivery and fetal birth weight.
4. To find if any relationship between estimated fetal weight using ultrasound and parity.

Chapter Two

Chapter Two

LITERATURE REVIEW

2. Literature Review:

2.1 Ultrasound and fetal position:

Intrapartum assessment of fetal occiput position is of major relevance in the management of the second stage of labor. Indeed, fetal head malposition is associated with higher risk of operative delivery and maternal and perinatal morbidity (Carseldine, et al. 2013). Although sonographic assessment of fetal occiput position alone may not predict the mode of delivery accurately, it may be of great value in certain clinical situations, such as before instrumental delivery (Verhoeven, et al. 2012).

To ascertain if fetal head position on transabdominal ultrasound is associated with delivery by Cesarean section in nulliparous women with a prolonged first stage of labor, a study was conducted by (Eggebø, et al. 2015), they found out that OP fetal head position assessed by transabdominal ultrasound was significantly associated with delivery by Cesarean section

2.2 Ultra-sound and obesity:

The prediction of EFW before delivery during the third trimester plays a pivotal role in obstetric practice, with a major impact on antenatal management. Many important clinical decisions depend upon a precise and accurate assessment of sonographic EFW. For example, overestimation of fetal weight before delivery can lead to unnecessary obstetric interventions. Conversely, underestimation of fetal weight can cause delays in essential obstetric interventions (Aksoy, et al. 2015).

Most of the studies focused on the detection of fetal anomalies during the first and second trimesters, but a little known but clinically important challenge for obstetricians is the impact of maternal obesity on sonographic fetal weight estimation. A limited number of studies investigated the effects of obesity on sonographic estimated fetal weight (EFW) measurement during the third trimester prior to delivery (Aksoy, et al. 2015) (Horton, et al. 2014) (Field, et al. 1995).

Although the accuracy of estimated fetal weight by ultrasound in overweight and obese women has been verified in prior studies, many of them were performed 10 or more years ago and ultrasound technology continues to improve. A recent study in USA by (Nitsche, et al. 2018) concluded that the accuracy of the estimation of fetal weight is not affected by maternal size even in morbidly obese patients. Thus, ultrasound estimations of fetal weight in morbidly obese women can be relied upon when making clinical decisions.

Relevant publications:

- A systematic review done by (Milner and Arezina. 2018), to assess the accuracy the accuracy of ultrasound estimation of fetal weight in comparison to birth weight. Although substantial research has investigated the most accurate ultrasound formula for calculating estimated fetal weight, current evidence in their study indicates significant error levels. The aim of the study was to identify the most accurate method, whilst identifying sources of inaccuracy in order to facilitate recommendations for future practice. Seven studies met the inclusion criteria and 11 different formulae were assessed; ultrasound calculation of fetal weight was most commonly overestimated. The Hadlock A formula produced the most accurate results, with the lowest levels of random error. Methods incorporating just two measurement parameters were inconsistent, producing large random errors across multiple studies. Key sources of inaccuracy included difficulties obtaining accurate fetal measurements in late gestation; the remainder were operator dependent, including lack of experience and insufficient training and audit. The accuracy of ultrasound estimated fetal weight has improved in the last decade, though a lack of consistency remains evident. National implementation of a rigorous audit program would likely improve accuracy further, and increase the confidence and clinical value of the method.

- Another review done by (Dudley. 2005). Because there is considerable evidence that ultrasound-estimated fetal weight is inaccurate. The aim of the study was to review the literature on the efficacy of estimated fetal weight in the early prediction of low birth weight. Seven studies met the inclusion criteria. Most studies used an estimated fetal weight threshold of the 10th percentile, where sensitivity for predicting small-for-gestational-age infants in low-risk groups is low and specificity is high. The sensitivity of estimated fetal weight is higher where the prevalence of small-for-gestational-age is higher or a higher detection threshold is used. Fetal weight estimation is more sensitive and specific than other measures in detecting small-for-gestational-age, but is limited by large random errors. Random errors reduce sensitivity with less effect on specificity. High sensitivity is useful where further discriminatory tests are available; this may be the case here, where Doppler ultrasound is of proven value in high-risk groups. High specificity is required where invasive or expensive procedures will be performed on the selected group. In order to achieve sensitivity approaching 100%, a threshold 3 standard deviations of estimated fetal weight error above the 10th percentile of fetal weight is required. Smaller random errors will allow the threshold to be reduced and will increase specificity.

- In South Nigeria (Njoku, et al. 2014), conducted a study to determine the accuracy of fetal weight using ultrasound and clinical fetal weight estimations. The study participants were mothers with singleton term pregnancy admitted for delivery. The mean absolute percentage errors of both clinical and ultrasound methods were 11.16% ± 9.48 and 9.036% ± 7.61, respectively, and the difference was not statistically significant (P = 0.205). The accuracy within 10% of actual birth weights was 69.5% and 72% for both clinical estimations of fetal weight and ultrasound, respectively, and the difference was not statistically significant (P = 0.755). The accuracy of fetal weight estimation using Dare's formula is comparable to ultrasound estimates for predicting birth weight at term.
- In the South East Nigeria study was done by (Okafor, et al. 2019), to evaluate the accuracy of estimation of fetal weight with ultrasound machine at term. It was a cross sectional study conducted at a private specialist hospital in Nigeria. A coded questionnaire was used to retrieve relevant information which included the last menstrual period, gestational age, parity, and birth weight. Other information obtained includes Ultrasound-delivery interval, maternal weight, and route of delivery. The ultrasound was used to estimate the fetal weight. The actual birth weight was determined using a digital baby weighing scale. The data were inputted into Microsoft excel and analyzed using STATA version 14. Statistical significance was considered at p-values less than 0.05. Measures of accuracy evaluated in the statistical analysis included mean error, mean absolute error, mean percentage error, and mean absolute percentage error. Pearson correlation was done between the estimated ultrasound fetal weight and the actual birth weight. The proportion of estimates within ±10% of actual birth weight was also determined. A total of 170 pregnant women participated in the study. The

mean maternal age was 30.77 years ± 5.54. The mean birth weight was 3.47 kg ± 0.47, while the mean estimated ultrasound weight was 3.43 kg ± 0.8. There was positive correlation between the ultrasound estimated weight and the actual birth weight. The mean ultrasound scan to delivery interval was 0.8 days (with range of 0-2 days). The study recorded a mean error of estimation of 41.17 grams and mean absolute error of 258.22 grams. The mean percentage error was 0.65%, while the mean absolute error of estimation was 7.56%. About 72.54% of the estimated weights were within 10% of the actual birth weight. In conclusion the ultrasound estimated fetal weight correlated with the actual birth weight. Ultrasound estimation of fetal weight should be done when indicated to aid the clinician in making decisions concerning routes of delivery.

- In a prospective study conducted by (Mgbafulu, et al. 2019) to compare the accuracy of the clinical and ultrasound methods of fetal weight estimation. The study involved 110 terms cephalic singleton pregnancies delivered within 24 hours of clinical fetal weight estimation using Johnson's and Dare's formulae and ultrasound estimation at a Tertiary hospital in Abakaliki, Nigeria. The data were analysed with Stata 11 software. The sonographic estimation within 10% of the actual birth weight (ABW) of 68.2% was significantly greater than the accuracy of Johnson's (23.6%), Dare's (26.4%), and the combined clinical formulae (27.1%). The clinical methods overestimated the fetal weight. Both methods showed a positive correlation with the ABW. In conclusion, the sonographic method had a better accuracy than the clinical methods. However, fetal weight overestimation by clinical methods warrants their usefulness in resource-poor settings such that the clinical determination of a normal weight foetus will exclude fear of complications from macrosomia. Impact statement What

is already known on this subject? An accurate estimation of fetal weight is important in the management of labour and delivery. However, there is limited evidence that any of the available methods of fetal weight estimation is more accurate than the others. What do the results of this study add? This study showed that the clinical methods using Johnson's and Dare's formulae had a significantly higher mean percentage and absolute mean percentage error compared to the sonographic estimation of fetal weight. The sonographic estimation within 10% of actual birth weight (ABW) of 68.2% was significantly greater than that of Johnson's and Dare's formulae with 23.6% and 26.4%, respectively. All of the methods showed a positive correlation with the ABW. What are the implications of these findings for clinical practice and/or further research? This implies that the sonographic method has a better accuracy than the clinical methods in estimating the fetal weight. However, the overestimation of fetal weight by the clinical methods warrants their usefulness in resource-poor settings such that the clinical determination of a normal weight foetus will exclude the fear of complications from macrosomia.

- Moreover, study was conducted by (Ugwu, et al. 2014) to compare the accuracy of clinical and ultrasound methods of fetal weight estimation at term. Clinical and ultrasound fetal weights were estimated on 200 consecutive term pregnancies (37 completed weeks of gestation - 41 weeks and 6 days) at the University of Nigeria Teaching Hospital, Enugu, Nigeria from 1st April to 30th November 2012. Accuracy was determined using percentage error, absolute percentage error, and proportion of estimates within 10% of actual birth weight. Actual birth weight had strong positive correlation with both clinical and ultrasound estimated fetal weights ($r = 0.71$, $P < 0.001$ and $r = 0.69$, $P < 0.001$, respectively). Overall, both the

clinical and ultrasound methods systematically overestimated the actual birth weight. The proportion of the clinical estimated weights that were within 10% of the actual birth weight was significantly lower than that of ultrasound method for babies of all birth weights (35.0 vs. 67.5%; $P < 0.001$) and for macrosomic babies (76 vs 100%, $P = 0.009$). For babies with normal birth weights (2.5-3.9 kg), ultrasound method error values were significantly lower than those of clinical method for both the mean % error (5.4 vs 19.6%; $P < 0.001$) and the mean absolute % error (9.97 vs 20.6%; $P < 0.001$). In conclusion, the ultrasound method is generally a better predictor of the actual birth weight than the clinical method, and thus should be used in estimating the actual birth weight when accessible.

- In North-west Nigeria a prospective study was done by (Ugwa, et al. 2015) to compare the accuracy of sonographic versus clinical methods of fetal weight estimation in a low-resource setting. Two hundred (200) women admitted for delivery were assessed. Questionnaires and data collection forms were used to obtain socio-demographic and other clinical information. The actual weight was determined at birth. Estimated fetal weight (EFW) was compared with the actual weight (BW). The data obtained were analyzed using SPSS version 16.0 statistical software. The accuracy of clinical and sonographic fetal weight estimation was compared using Students t-test, Chi-square test and Pearsons' coefficient of correlation and $p < 0.05$ was considered statistically significant. The mean of absolute percentage error was smaller for ultrasonic (9.8 ± 7.2) than clinical (10.5 ± 7.5) estimation, but the difference was not statistically significant ($p = 0.083$). In the 2.5-3.99 kg group there was no statistically significant difference between the mean absolute percentage errors for the two methods ($p = 0.096$). In the <2.5 kg group, clinical method overestimated birth-

weight while in ≥4.0 kg, the sonographic method underestimated the birth weight. For birth weight 2.5-3.99 kg, sensitivity, specificity, positive predictive value and negative predictive value were 96.9, 76.9, 98.1, 66.7% and 96.8, 75, 96.8, 75% for sonographic and clinical estimates, respectively. The predictive powers of sonographic and clinical methods were better for low birth weight and macrosomic fetuses, respectively. So in conclusion, clinical method of fetal weight estimation can only be recommended for use as screening tool for normal weight and macrosomic fetuses.

- A prospective study was conducted at Obafemi (Shittu, et al. 2007) to compare the accuracy of clinical and ultra-sonographic estimation of fetal weight at term. One hundred pregnant women who fulfilled the inclusion criteria had their fetal weight estimated independently using clinical and ultra-sonographic methods. Accuracy was determined by percentage error, absolute percentage error, and proportion of estimates within 10% of actual birth weight (birth weight of +10%). Statistical analysis was done using the paired t-test, the Wilcoxon signed-rank test, and the chi-square test. The study sample had an actual average birth weight of 3,255+622 (range 2,150–4,950) g. Overall, the clinical method overestimated birth weight, while ultrasound underestimated it. The mean absolute percentage error of the clinical method was smaller than that of the sonographic method, and the number of estimates within 10% of actual birthweight for the clinical method (70%) was greater than for the sonographic method (68%); the difference was not statistically significant. In the low birthweight (<2,500 g) group, the mean errors of sonographic estimates were significantly smaller, and significantly more sonographic estimates (66.7%) were within 10% of actual birthweight than those of the clinical method (41.7%). No statistically significant difference was observed in all the measures of accuracy for the normal birthweight range of 2,500-<4,000 g and in the macrosonic group (≥4,000 g), except that, while the ultrasonographic method underestimated birthweight, the clinical method overestimated it. Clinical estimation of birthweight is as accurate as routine ultrasonographic estimation, except in low-birthweight babies. Therefore, when the clinical method suggests weight smaller than 2,500 g, subsequent sonographic estimation is recommended to yield a better prediction and to further evaluate foetal well-being.

- Lastly, a study conducted by (Francis, et al. 2011). Accuracy of ultrasound estimation of fetal weight at term. The data were derived from a regional database of routinely collected information from 19 regional maternity units, and included dates and measurements of ultrasound scans and the date and weight of the baby at birth. An ultrasound scan was performed within 3 days of delivery in 2296 pregnancies, including 606 preterm (<37 weeks) and 1690 term deliveries. EFW was calculated by standard Hadlock formulae programmed into the respective units' scanners. Presumed weight gain during the 1, 2 or 3-day delay between scan measurement and birth was adjusted for by a previously described ‘proportionality’ formula. Overall, EFWs at term were at least as good and in fact marginally better than scans done in the preterm period, with 73% of EFWs falling within a +/−10% margin of error.

Chapter Three

Chapter Three

3. Material and Methods:

3.1 Study design:

This prospective cross-sectional study was carried out at the Obstetrics and Gynecology Department of Khartoum North Teaching Hospital

Healthy term pregnant ladies attending delivery room either vaginally or elective cesarean section.

3.2 Study population: pregnant ladies attending delivery room in Khartoum North Teaching Hospital within the period of the study.

3.3 Sample size:

The data was collected from 60 ladies attending the delivery room in Khartoum North Teaching hospital

3.4 Place and duration of the study:

Khartoum North Teaching hospital in period from September 2015 to April 2016.

3.5 Material:

Ultrasound machine Mindray DP10 with 3.5 MHz convex probe, through trans-abdominal scan, ultrasound gel used, participants were laying flat comfortable in medical couch, left mild tilting to reduce pressure of the term uterus on the inferior vena cava considered.

3.6 Study variables:

Age, parity, delivery mode, patient weight and fetal weight.

3.7 Inclusion criteria:

All healthy pregnant ladies coming for vaginal delivery or elective cesarean section for obstetric cause in Khartoum North Teaching Hospital during the period of the study

3.8 Exclusion criteria:

All pregnant ladies coming for vaginal or elective cesarean section but has one or more health problem like diabetes, hypertension, thyroid, etc.

3.9 Data analysis:

Data was analyzed by computer using statistical package for social science (SPSS) software version 23 and the results were expressed in tables and figures.

3.10 Ethical approval:

Informed was obtained from all participants before the study, who voluntarily decided whether or not to be enrolled in the study, after the approval by hospital and university Research and Ethics Committee.

Chapter Four

Chapter Four

4. Results:

Table [1]: Sample size

N	Valid	60
	Missing	0
	Total	60

Table [2]: Demographic characteristics

Variable	Mean ± S.D	Median	Range
Maternal Age	28.30 ± 6.484	27.50	(18-44)
Maternal weight (kg)	69.795 ± 6.9815	69.650	(55.2-88.8)
Parity	2.52 ± 2.127	2.00	(0-8)

The sample size was 60 pregnant women; all the women participated in the study (100%). Their mean age was (28.3 ± 6.48), and their median age (27.5). The mean weight (kg) was (69.79 ± 6.98), with a median (69.65 kg). The mean number of birth (parity) was (2.52 ± 2.13) child birth with a median of (2.0).

Table [3]: The mean actual weight and ultra sound estimated fetal weight

Variable	Mean ± SD	Median	Range
Actual weight (g)	3,069.00 ± 508.093	3,105.00	(2,230-4,240)
Ultrasound weight (g)	3,121.83 ± 555.452	3,000.00	(2,210-4,140)

In this study, the mean actual weight after delivery was (3,069.00 ± 508.093) ranging between (2,230-4,240) grams. The mean ultra sound estimated fetal weight was (3,121.83 ± 555.452) ranging between (2,210-4,140) grams. As observed from the table there is no much difference comparing the two means.

Table [4]: Comparison between mean ultra sound fetal weight and actual fetal weight (Paired t-test)

Variable	N	Mean ± S.D	Range	t-test	P-value
Ultrasound weight	60	3,121.83 ± 555.452 g	2,210-4,140 g	0.903	0.370
Actual weight	60	3,069.00 ± 508.093 g	2,230-4,240 g		

This table illustrates the comparison between the mean actual weight and ultra sound estimated weight. Using paired t-test on mean ultrasonically calculated weight taken before birth of fetus and actual birth weight revealed no significant difference (t = 0.903, P = 0.370).

Table [5]: Correlation between ultra sound fetal weight and actual fetal weight

Variable	N	Mean ± S.D	r
Ultra sound	60	3,121.83 ± 555.452	0.64
Actual weight	60	3,069.00 ± 508.093	

This table shows there is an intermediate to strong linear relationship between actual fetal weight and ultra sound estimated fetal weight (r= 0.64).

Table [6]: Association between actual fetal weight and no. of birth (parity)

No. of birth (I)	No. of birth (J)	Mean difference (I-J)	Significance P value
Nulliparous	Primiparous	145.00	0.562
	Multiparous	121.03	0.462
	Grand multiparous	102.00	0.629
Primiparous	Multiparous	266.03	0.253
	Grand multiparous	247.00	0.356
Multiparous	Grand multiparous	19.03	0.920
Total	**59**		

In this table we used ANOVA test to describe the association between actual fetal weight and no. of birth (parity). The results showed no significant association between variables. P value > 0.05.

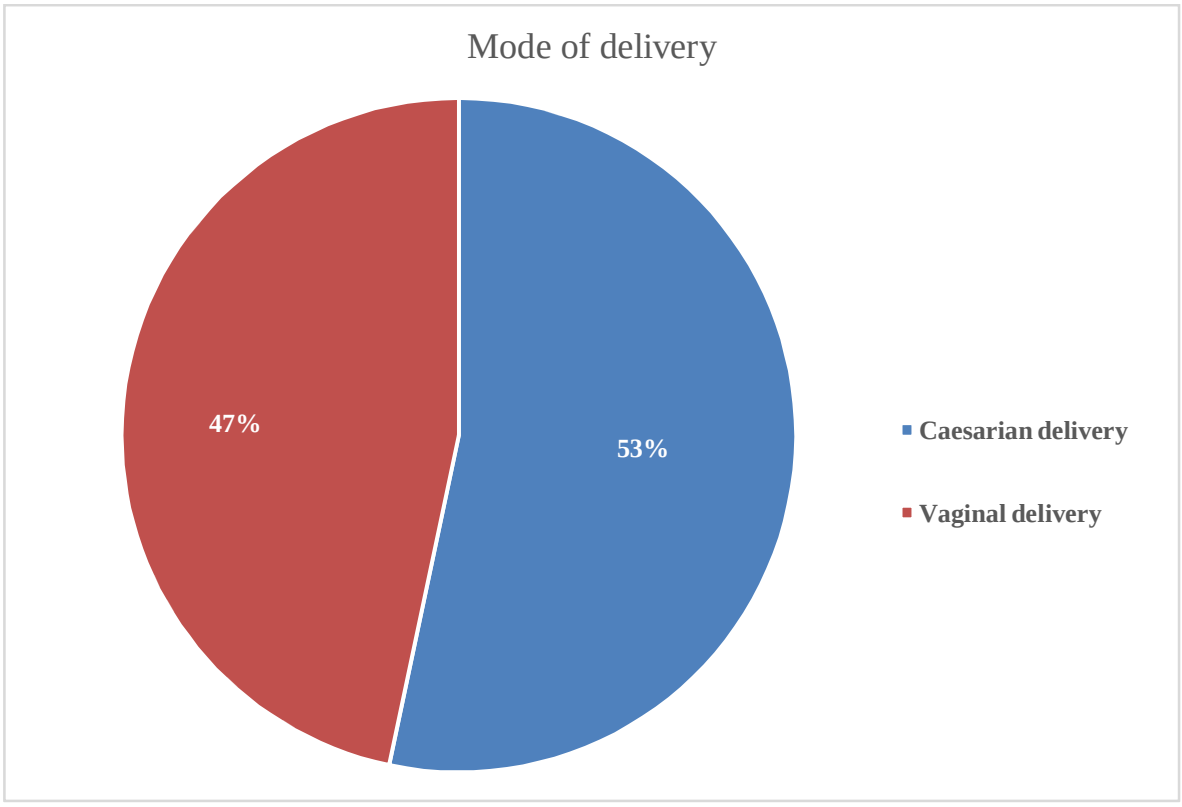

Figure [1]: distribution of study sample according to mode of delivery (caesarian, vaginal delivery)

More than half (53.3%) of the participants given birth by caesarian delivery, while (46.7%) given birth by normal vaginal delivery.

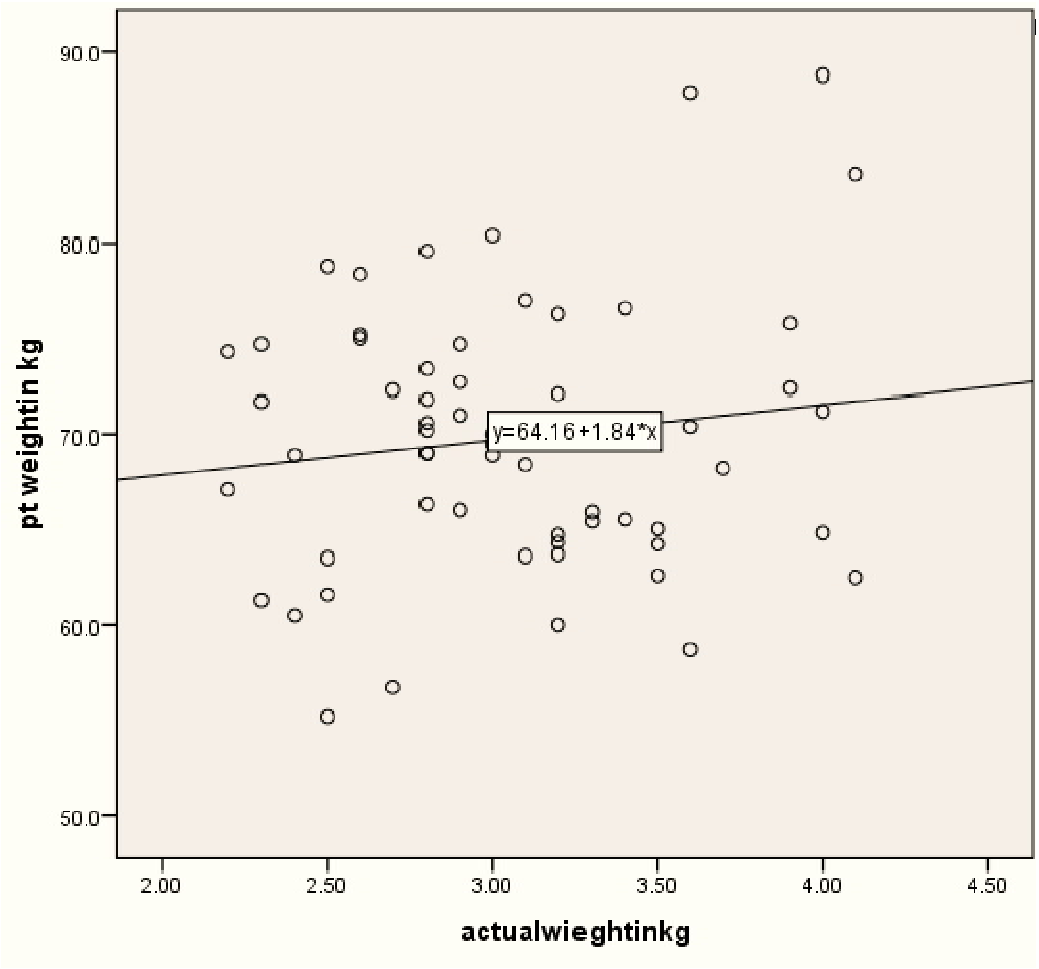

Figure [2]: The relationship between maternal weight at delivery and the actual birth weight

The scatter diagram showing the relationship between maternal weight at delivery and actual birth weight. There is a weak positive relationship between maternal and fetal weight (r= 0.135).

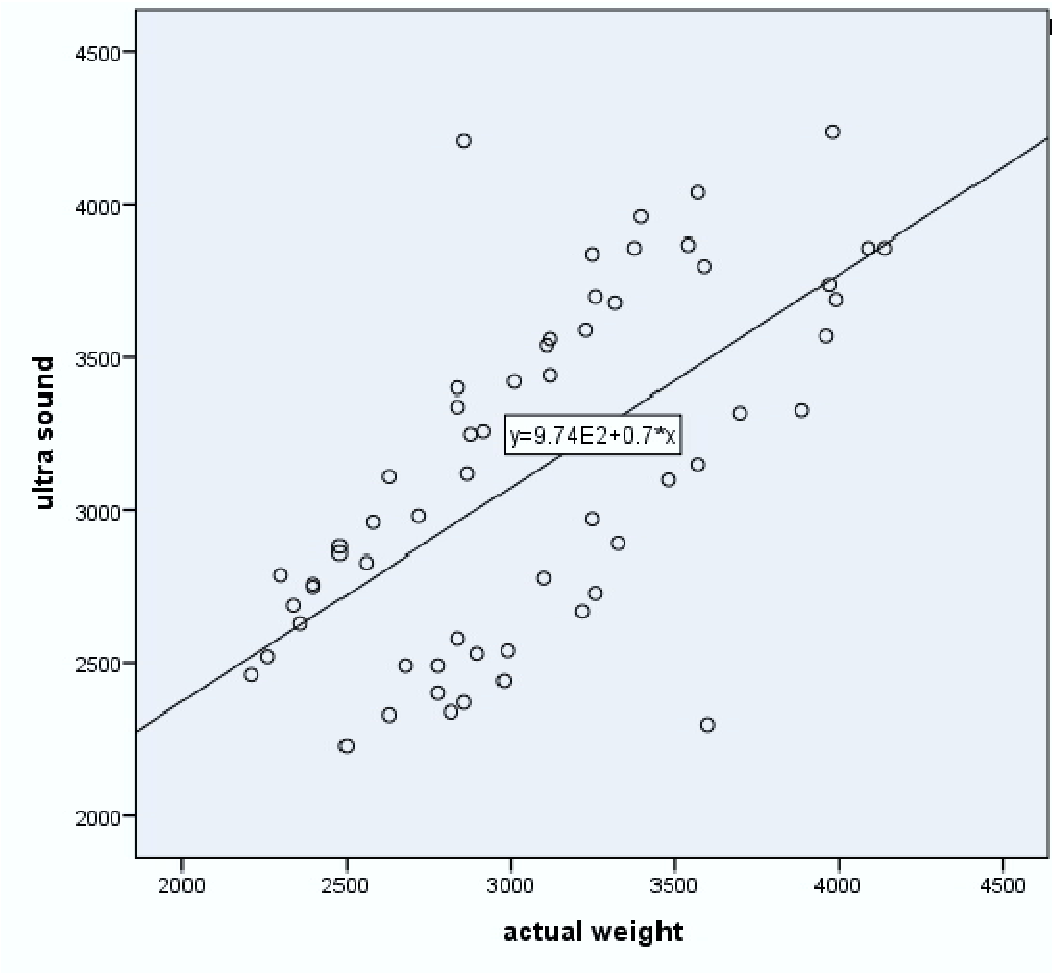

Figure [3]: The scatter diagram of clinical fetal weight estimation and actual birth weight. Clinical fetal weight estimation showed positive correlation with the actual birth weight

The scatter diagram showing the relationship between ultra sound fetal weight estimation and actual birth weight. Ultra sound method of fetal weight estimation showed a positive correlation (r= 0.64) with the actual birth weight of the fetus after delivery. There is a linear positive relationship between ultra sound fetal weight estimation and actual birth weight.

Chapter Five

Chapter Five

5.1 Discussion:

Birth weight is an important indicator and prognostic factor for the health of newborns, as it reflects the nutritional and metabolic conditions of the mother, as well as fetal development during pregnancy. The World Health Organization (WHO. 2020) defines birth weight as the first measurement obtained from the newborn and that defines the classification of weight strata. Globally 2.4 million children died in the first month of life in 2019. There are approximately 7 000 newborn deaths every day, amounting to 47% of all child deaths under the age of 5-years, up from 40% in 1990 (UNICEF. 1990).

Accurate prediction of fetal weight has been of great interest in obstetrics. As fetal weight cannot be measured directly, it must be estimated from fetal and maternal anatomical characteristics. Of the various methods, the most commonly used are the clinical and ultra-sonographic methods, as in this study we used ultra-sonographic method. Both fetal macrosomia and intrauterine growth restriction increase the risk of perinatal morbidity and mortality and of long-term neurologic and developmental disorders. Identification of intrauterine growth restriction and macrosomia will reduce the chance of fetal morbidity and mortality (Ekele, et al. 2006), (Westerway. 2012).

The mean actual weight in this study was 3,069.00 ± 508.093g; this was slightly lower than 3,254 ± 622g reported by (Shittu, et al. 2007). in Ife, Nigeria. However, it is lower than 3,568 ± 496g documented in United Kingdom (Richards, et al. 2001). The reason may be due to several factors affecting birth weight such as regional and socio economic factors.

There was a weak positive relationship between maternal weight at delivery and mean birth weight of the babies in this study, contradicting the findings in a study in Ile-Ife (Shittu, et al. 2007) in their study there was a strong positive linear relationship between maternal weight at delivery and fetal weight; as the mother weight increases the fetal weight increases too. This contradiction is probably due to the false weight estimates from the mothers as many factors can affect their answers about their weight, many Sudanese women are shy and feel uncomfortable telling the truth.

The mean of ultrasonic weight estimation was 3,121.83 ± 555.452g. When the result was compared with actual birth weight 3,069.00 ± 508.093g, it was found that actual birth weight was not significantly different from ultrasonic estimated weight. So it is clear from this finding that the ultrasound is comparable to clinical weight in predicting actual birth weight. The finding was in sharp contrast to the study by (Ugwa, et al. 2015). where ultrasound estimation was significantly more accurate than clinical prediction. However, it is similar to the finding obtained in some earlier studies (Shittu, et al. 2007).

The correlation coefficient for the ultrasonic method in this study, compared to the actual birth weight was (+0.64), it correlated positively with the actual birth weight. The correlation coefficient for ultrasound estimation is comparable with slight difference (+0.74) with (Shittu, et al. 2007) in their comparison of ultrasonic estimation.

Nulliparity is associated with lower birth weight, but few studies have examined how within mother changes in risk-factors impact this association. In a cohort study by (Hinkle, et al. 2014) found out the association between parity and birthweight was non-linear with the greatest increase observed between first and

second-born infants of the same mother. Adjustment for changes in weight or chronic diseases did not change the relationship between parity and birthweight. In our study the association between actual fetal weight and no. of birth (parity) showed no statistically significant results. P value > 0.05.

The observations imply that there is clearly a role for ultrasonic estimation of birth weight as a diagnostic tool, suggesting that ultrasonic estimation is sufficient to manage labor and delivery in a term pregnancy.

5.2 Conclusion:

The above findings have important implication for developing countries like ours where there is paucity of technologically advanced ultrasound machines capable of doing sophisticated functions such as fetal weight but can be cost effective. Estimation of fetal weight by ultrasound when compared to the actual weight after delivery there was no statistically significant difference, so can be reliable way of assessment and judgment for the health of the baby and determining the mode of delivery in some cases.

5.3 Recommendations:

- Estimation of fetal weight by ultrasound is a reliable way of assessment and judgment, since there was no statistically significant difference when compared to the actual weight after delivery, yes it is sophisticated,cost effective job for the ultrasound machine, and need experienced personnel, training also for this function can be looked out.
- More studies need to be worked out in this field, especially using different formulas not used in the current study.

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Appendices

Sudan University of Science and Technology

College of Post Graduate Studies

Questionnaire about: ***Assessment of Accuracy of Ultrasound in Estimation of Baby Weight***

Prepared by: Abdalla Mohamed Abdalla Albasha

Participant name (optional): **Residence:**

Occupation:

Age: Less than 20year 20-30year 31-39 more than 40

Weight: **Parity:**

Mode of delivery:

Diabetis: **Hypertention:**

Mode of delivery: vaginal delivery: caesarean section:

Estimated fetal weight using ultrasound: ……..

Baby weight after delivery: ……