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Original Article

Accuracy of Clinical and Ultrasound Foetal Weight Estimation in Predicting the Actual Birth Weight at Term at Federal Medical Centre, Keffi, Nasarawa State.

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ABSTRACT

Objective: The study set out to determine the accuracy of clinical and ultrasound fetal weight estimation in predicting the actual birth weight of pregnant women at term at the FMC, Keffi, North central Nigeria. **Methods:** It was a cross-sectional study that enrolled consecutive pregnant women. A total of 360 pregnant women at term, who met the inclusion criteria were recruited using interviewer-administered questionnaire. The clinical estimate was done using the Dare's formula while ultrasound fetal weight estimation was done using an ultrasound scan machine imputed with the Hadlock formula mode (BPD, HC, AC, and FL). The actual birth weight was measured in the labour room using the infant weighing scale. Quantitative variables were summarized using mean and standard deviation while categorical variables were summarized using frequencies and percentages. Accuracy was determined using percentage error, absolute percentage error, and proportion of accurate estimates within 10% of actual birth weight. **Result:** Analysis showed that the mean percentage error and mean absolute percentage error were -13.78 ±12.44; 14.89 ±12.54 and 4.38 ±11.42; 9.81 ± 7.29 for clinical and ultrasound foetal weight estimations respectively. The correct estimate, within 10% of actual birth weight were 41.5% and 55 % for clinical and ultrasound foetal weight estimations respectively. **Conclusion:** Ultrasound method of fetal weight estimation overestimates the actual birth weight with lower absolute percentage error while clinical method underestimates. The proportion of correct estimates, within 10% of ABW are 55% and 41.5% for Ultrasound and Clinical methods respectively.

KEY WORDS: Clinical, Actual birth weight, Ultrasound, fetal weight estimation, Keffi.

INTRODUCTION

The burden of extremes of fetal weight on maternal and neonatal health has necessitated research into accurate methods of fetal weight estimation especially when taking decision in the management of women in labour. Fetal weight assessment is a vital and universal part of antenatal care, not only in the management of labour and delivery, but often, during the management of high-risk pregnancies and growth monitoring.[1,2] Accurate pre-natal fetal weight estimation in late pregnancy and labour is important in the management of labour and delivery.[1] It helps the obstetrician decide and prepare for preterm deliveries, make decision about instrumental vaginal delivery, trial of labour after caesarean section, delivery of breech presenting fetuses and elective caesarean section for patients with suspected foetal macrosomia.[1,2,3]

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Birth weight of an infant is one of the important determinant of newborn survival.[2] The peri-natal morbidity and mortality rates are very high in our environment and this problem is largely related to prematurity and low birth weights.[4,6] Basically, group of birth weights that are important to the clinicians are the low birth weight (1.5-2.49kg), the normal birth weight (2.5 -3.99kg) and the macrosomic babies (≥ 4kg).[1] Infant mortality rates (peri-natal and post-natal) are more sensitive to fetal weights than their gestational ages. Delivery of macrosomic fetuses is a major challenge with any attempt at vaginal delivery often requiring considerable attention by an experienced Obstetrician and preparedness for operative delivery. Both low birth weight and excessive fetal weight are associated with an increased risk of newborn complication during labour and peuperium.[5-7] Peri-natal complications associated with low birth weight include birth trauma, intra-cranial and intraventicular haemorrage while complications associated with delivery of macrosomic fetuses include prolonged labour, shoulder dystocia, brachial plexus injury, bony injuries and intrapartum asphyxia. [8,9] Maternal risks associated with delivery of a very large fetus include birth canal and pelvic floor injuries, as well as postpartum haemorrhage. [7]

Foetal weight estimation can be predicted by two main methods which are: clinical and radiological methods. Radiological method of fetal weight estimation involves the use of magnetic resonance imaging and ultrasonography. In clinical obstetrics practice, there is a tendency to rely on available technology and ignore clinical judgment, which can lead to loss of the skill to estimate fetal weight clinically by clinicians .[12]

The aim of this study is to determine the accuracy of clinical method of fetal weight estimation and ultrasound method in predicting the actual birth weight at the Federal Medical Centre, Keffi.

MATERIALS AND METHODS

The sample size was calculated, using the Cochrane's formula[37] with the prevalence of 69.5% and an error margin of 5% at 95% confidence interval. A total of 360 pregnant women at term (37 weeks + 0day - 41weeks +6days), who met the inclusion criteria were consecutively recruited until the sample size was completed, at the Federal Medical Center, Keffi, North Central, Nigeria from 10th December 2018 to 25th July 2019. However, pregnant women with the following conditions were excluded: term pregnancy with maternal obesity (absolute weight > 90kg), confirmed fetal congenital anomaly / IUFD, preterm labour, multiple gestation, abdominal girth > 108cm, polyhydramnious/ oligohydramnious, participants who have ruptured their membranes, pregnant women presenting in advanced stage of labour, participants in critical or emergency condition such as antepartum haemorrage, severe cardiac disease, refusal to consent. Ethical clearance (FMC/KF/HREC/236/18) was obtained from the ethical committee of Federal Medical Centre Keffi. Informed consent was obtained from participants and a proforma was filled by the principal researcher and research assistants. The clinical estimate was done using the Dare's Formula (estimated foetal weight in kilogram= Symphysiofundal height x abdominal girth at the level of the umbilicus/1000 ±05kg)[19] in the lying-in ward and labour ward. The ultrasound fetal weight estimation was done using an ultrasound scan machine imputed with the Hadlock formula mode (BPD, HC, AC, and FL). The actual birth weight was measured in the labour room using the infant weighing scale which was corrected to zero prior to every use to ensure reliability of measurement. Accuracy was determined using percentage error, absolute error, and proportion of estimates within 10% of actual birth weight. The data collected was cleaned and analyzed using SPSS software version 25.0

RESULTS

Table 1B. Descriptive Statistics of Mothers

Variables	Min.	Max.	Mean (SD)	Median
Age (yrs.)	19	43	29.48 (4.83)	29.00
Estimated gestational age (wks.)	37	42	39.17 (1.35)	39.00
Parity	0	9	1.51 (1.60)	1.00
Weight of mothers (kg)	52	90	71.33 (9.74)	70.00

Table 1A. Socio-Demographic Characteristics of Mothers N=360

Variables	Frequency	Percentage
Age group (years)		
15-24	41	11.4
25-34	249	69.2
35-44	70	19.4
Highest Level of Education		
No formal education	18	5.0
Primary	20	5.5
Secondary	108	30.0
Tertiary	214	59.5
Occupational Status		
Artisan	31	8.5
Civil servant	99	27.5
Farming	11	3.0
Trading	31	8.5
Student	34	9.5
Unemployed	155	43.0
Religion		
Christianity	232	64.5
Islam	128	35.5
Traditional	0	0

Table 2: Obstetric Characteristics Of Mothers n=360

Variables	Frequency	Percentage
Parity		
0	117	32.5
1	99	27.5
2	65	18.1
3	43	11.9
4	14	3.9
5 & above	22	6.1
Estimated gestational age at delivery		
37 wks. - 37 wks. 6days	45	12.5
38 wks. - 38 wks. 6days	68	18.9
39 wks. – 39 wks. 6days	102	28.3
40 wks. – 40 wks. 6days	83	23.1
41 wks. – 41 wks. 6days	49	13.6
42 wks. – 42 wks. 6 days	13	3.6
Mode of delivery		
SVD	225	62.5
CS	135	37.5
Baby's gender		
Male	193	53.6
Female	167	46.4
Sex ratio at birth = 1.16: 1		

Table 3. Percentage Distribution of Birth Weight Of Babies (N=360)

Variables		**Frequency**	**Percentage**
CFWE (Dare's) (kg)			
2.5 – 2.99		7	2.0
3.0 – 3.49		95	26.5
3.5 – 3.99		211	58.5
4.0 – 4.49		40	11.0
4.5 – 4.99		7	2.0
Mean (SD)	**3.65 (0.34)**		
UFWE (kg)			
2.0 – 2.49		20	5.5
2.5 – 2.99		119	33.0
3.0 – 3.49		187	52.0
3.5 – 3.99		29	8.0
4.0 – 4.49		4	1.0
4.5 – 4.99		2	0.5
Mean (SD)	**3.07 (0.37)**		
ABW (kg)			
2.0 – 2.49		13	3.6
2.5 – 2.99		63	17.5
3.0 – 3.49		175	48.6
3.5 – 3.99		94	26.1
4.0 – 4.49		11	3.1
4.5 – 4.99		4	1.1
Mean (SD)	**3.24 (0.42)**		
Categorized ABW			
Low birth		13	3.6
Normal birth weight		333	92.5
Macrosomic birth		14	3.9

CFWE: Clinical Foetal Weight Estimation
UFWE: Ultrasound foetal weight estimation
ABW: Actual Birth Weight

Table 4: Assessment of accuracy of Clinical Fetal Weight estimation in predicting the Actual Birth Weight

Indices for accuracy	Values
Overall Actual Birth Weight	
Mean percentage error (SD)	-13.78 (12.33)
Mean absolute percentage error (SD)	14.89 (12.54)
Correct estimate within 10% of ABW	41.5%
Categories of birth Weight (kg)	
<2.5 kg	
Mean percentage error (SD)	-48.74 (17.01)
Mean absolute percentage error (SD)	48.74 (17.01)
Correct estimate within 10% of ABW	0.0%
2.5 <3.99 kg	
Mean percentage error	-13.29 (11.56)
Mean percentage absolute error	14.14 (10.50)
Correct estimate within 10% of ABW	71.5%
>/=4.0 kg	
Mean percentage error	2.44 (8.61)
Mean percentage absolute error	7.10 (5.08)
Correct estimate within 10% of ABW	52.9 %

Note: % absolute error was calculated as |{[(ABW-EBW)/ABW] X 100}|; Key: ≈ represents chi-square test

Table 5: Assessment of accuracy of Ultrasound Fetal Weight Estimations in predicting the Actual Birth Weight

Indices for accuracy	Values
Overall Weight (kg)	
Mean percentage error	4.38 (11.42)
Mean absolute percentage error	9.81 (7.29)
Correct estimate within 10% of ABW	55.0%
<2.5 kg	
Mean percentage error	-12.58 (4.86)
Mean absolute percentage error	12.58 (4.86)
Correct estimate within 10% of ABW	34.4%
2.5 c3.99 kg	
Mean percentage error	4.49 (11.02)
Mean percentage absolute error	9.47 (7.20)
Correct estimate within 10% of ABW	74.2%
>/=4.0 kg (Macrosomic)	
Mean percentage error	18.24 (5.78)
Mean percentage absolute error	18.24 (5.78)
Correct estimate within 10% of ABW	57.1%

Note: % absolute error was calculated as |{[(ABW- EBW)/ABW] X 100}|
☺ square test

DISCUSSION

The mean actual birth weight in this study was 3.24 ± 0.42kg. This is similar to the mean actual birth weight of 3.25 ± 0.62kg reported by Shittu et al in Ife, Nigeria [5] and 3.24 ± 0.50kg reported by Njoku et al in Calabar, Nigeria.[2] and slightly higher than 3.08 ± 0.61kg reported by Swende in Makurdi, Nigeria.[40] This is however significantly lower than value of 3.57 ± 0.60kg documented in the United Kingdom. The finding is in consonance with the report in literature which stated that birth weight of Caucasian babies is higher than that of Africans.[41] The reason for this difference was not investigated in this study, but it may be due to several factors such as observer error, regional and socioeconomic factors.[42]

The mean clinical fetal weight estimation in this study was 3.65 ± 0.34kg. It is clear from this study that the accuracy of ultrasound estimation is higher than clinical estimation (Dare) in predicting fetal weight. This finding is similar to that of Ugwu et al.[1] Who reported that ultrasound method of foetal weight estimation was significantly more accurate than the clinical method. This study showed that the overall mean % error for both clinical and ultrasound methods were -13.78± 12.33 and 4.38 ± 11.42, while the mean absolute % errors were 14.89 ± 12.54 and 9.81± 7.29 respectively. This means clinical methods overestimated actual birth weights while ultrasound underestimated actual birth weight. The overall mean % error and mean absolute % error for clinical method was higher than that for ultrasound method. This finding is similar to low values of mean % error of -6.6 ±381g and means absolute % error of 104 ± 89g/kg for ultrasound reported by Chaun et al.[13] Thus suggesting that ultrasound is more accurate than clinical method of fetal estimation.

The accuracy within 10% of actual birth weight in this study was 41.5% and 55.0% for both clinical fetal weight estimation and ultrasound fetal weight estimation respectively for all birth weight categories. This was comparatively similar to the findings of 35.0% and 67.5% for clinical and ultrasound fetal weight estimations reported by Ugwu et al in Enugu, Nigeria and 75% for ultrasound fetal weight estimation reported by Tawe et al in Jos, Nigeria.[1,43] However this result was at variance with the findings of 70% and 68% for clinical and ultrasound fetal estimations reported by Shittu et al in Ife, Nigeria and other reporters in Calabar,[2] Nigeria and in Kenyatta, Kenya.[39] The finding may be attributed to improvement in skills and knowledge of scanning in recent times.

CONCLUSION

The study clearly showed that, ultrasound method of fetal weight estimation overestimates the actual birth weight with lower absolute percentage error while clinical method underestimates. The proportion of correct estimates, within 10% of ABW are 55% and 41.5% for Ultrasound and Clinical methods respectively.

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