The accuracy of Ultrasound in Estimation of fetal weight

Mohamed Adam[1,2], Jumaa Yousif Tambul[3,4], Mohamed Yousef[3,4], Abdelmoneim Sulieman[4,5]

[1]Colleges of Applied Medical Sciences Radiological Science Department, King Khalid University Kingdom of Saudi Arabia P.O. Box 61481, Abha
[2]Alzaeim Alazhari University, Faculty of Radiological Sciences and Medical Imaging.P.O. Box 1432 Khartoum Bahri 13311-Sudan
[3]College of Applied Medical Sciences, Taibah University. P.O. Box 30001, Almadinah Almunawarah, KSA
[4]College of Medical Radiologic Science Sudan University of Science and Technology P. O. Box 1908, Khartoum, Sudan
[5]College of Applied Medical Sciences, Radiology and Medical Imaging Department, Salman Bin Abdulaziz University, Alkharj, Saudi Arabia
mohnajwan@gmail.com

Abstract: This study aimed to evaluate the accuracy of ultrasonography in estimating fetal weight among Sudanese as comparing the results with the International Standards. Abdominal Ultrasonography was performed with A real time system MEDISON Ultrasonic machine by using 3.5MHz convex transducer, using Hadlock formal. A total of 533 pregnant women over a 36 month were randomly selected from a group of antenatal patients ranged gestational age from (37-42 weeks). and the data analyzed by Statical package for social science (SPSS)., the study demonstrated that the Hadlock formula is valid in estimating fetal weight locally and it was found that the mean Birth Weight (BW) 3.139 kg, (87.4 %) with 472 g (± 15%) standard deviation, while the actual birth Ranges between 2000 to 4400g. The mean actual birth weight in Sudanese population ranges from 2.000 to 4.400 Kg, with mean of 3.139 Kg (87.4 %) and standard deviation of 472g (± 15%). It was found that there was significant correlation between birth weight (BW) and maternal weight, height and body mass index (BMI) and gestational age, while there was insignificant and week correlation between maternal age, and the mode of delivery.**.** It is concluded that predicting fetal weight using the formula witch derived by Hadlock *et al* is accurate and valid and will be useful in our environment.

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1. Introduction

Accurate prenatal estimation of fetal weight (EFW) in late pregnancy and labour is extremely useful in the management of labour and delivery, permitting obstetricians to make decisions about instrumental vaginal delivery, trial of labour after caesarean delivery and elective caesarean section for patients suspected of having a macrosomic fetus (Baum et al, 2002, Chauhan et al, 1998, Kurmanavicius et al, 2004, Ben-Haroush et al, 2004, McIntire et al., 1999).

An accurate diagnosis of macrosomia for patients with gestational diabetes can reduce perinatal morbidity as it may assist the physician and staff in deciding the appropriate route of delivery to prepare for shoulder dystocia or to prevent a traumatic injury Diase et al, 2002.

Correct EFW values are also important when intrauterine growth is restricted and in preterm labour (Ben-Aroya et al., 2002, Ott et al, 2006.).

EFW can be done by mothers (if they are parous), by clinicians using Leopold manoeuvres or by ultrasound. In the 1970s, the use of ultrasound to estimate fetal weight gained popularity because of the perceived ability to standardize and reproduce measurements Ratanasiri et al, 2002, although the technique can be challenging, depending on the mother's physique, uterine anomalies or amniotic fluid index Alsulyman et al,1997. Clinical EFW has been shown to accurately predict birth weight. For example, Baum et al. showed no significant difference between clinical and sonographic estimates of fetal weight; 64.0% versus 62.5% of the estimates respectively were within 10% of the actual birth weight. Maternal EFW is comparable to both clinical or ultrasound predictions in both term and postdate babies. (Chauhan et al, 1993. Chauhan et al, 1992)

Some researchers concluded that clinical EFW has higher accuracy than ultrasound EFW Chauhan et al, 1995), but other studies showed that ultrasound EFW is more accurate (Chauhan et al, 1993.and Baum et al, 2002); showed that the accuracies of both methods are the same.

Due to difficulties in accessing ultrasound equipment in rural areas of Sudan, this study aimed to evaluate the benefits of ultrasound in estimating fetal weight.

2. Material and Methods

Prospective study evaluated ultrasound measurements− on 533 women at the gestational age between '37 to 41' of gestation at Khartoum and Omdurman maternity hospitals at Khartoum State sudan The inclusion criteria were: singleton pregnancy and live-born infant without congenital malformations or hydrops fetalis. The mothers were instructed about the purpose of the study and gave informed consent for participation. Approval for the study was obtained from the research ethical committee of the University; Ultrasound EFW was obtained for all women by the same physician with a 3.5 MHz transducer (MEDISON Ultrasonic machine) using standard Hadlock reference tables that used biparietal diameter, abdominal circumference and femur length for calculating fetal weight Figure (1,2). Fetal weight, patient demographic data and actual birth weight were recorded on data sheets that were kept separate from the patients chart. Neonatal birth weight was considered as the gold standard. Correlations were made of the actual birth weight with the ultrasound.

Data were analyzed using statistical package for social science (SPSS) version 12.0 software.

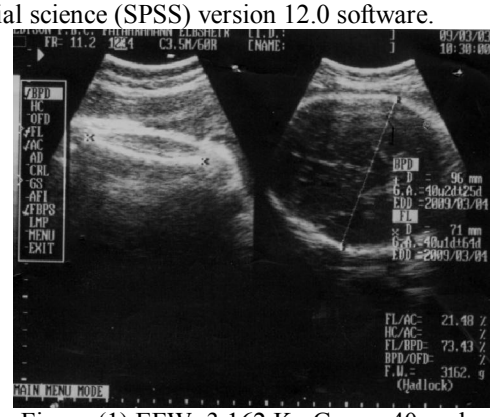

Figure (1) EFW=3.162 Kg G age=40weeks

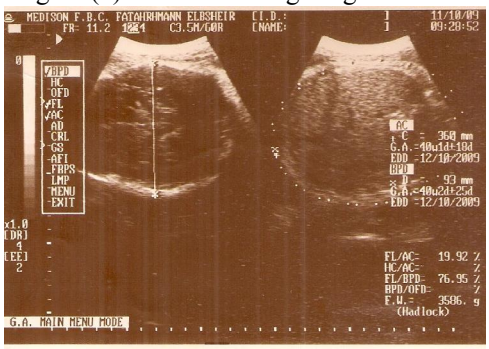

Figure (2) EFW=3.586 Kg G age=40weeks

3. Results

Total of 533 pregnant women were studied over a 36 month the range of maternal age from 15-45 years with a mean of 30.5 years, weight ranges was (61-70 Kg), height ranges was (161-170 cm) (Table (1)).

Table (1) maternal height &Birth weight correlation

	Mean	Std. Deviation	N	Correlation	Sig.
Mother's height	168.7	6.75	533	.334**	2.95e-016
Birth weight	3139.5	472.8	533		

** Correlation is significant at the 0.01 level (2-tailed).

The mean estimated birth weight is 3.139g, and standard deviation between mean EFW and actual birth weight was 472 g and the range of actual birth weight was from 2000 to 4400 gram.

Out of 533 cases included in this study, 458 were Multigravidae. (85.9%), and 50 were grand Multigravidae came from different regions of Khartoum state 108 fetuses at gestational age 37 weeks (20.26 %), 98 Fetuses gestational age 38 weeks, (18.39 %), 111 fetuses gestational age 39(20.28%), 183 fetuses gestational age 40 (34.33%), and 33(6.19%) their age greater than 40 weeks, concerning to the mode of delivery 317 (59%) infants was delivered vaginally and 216 (41%) was delivered by C/S, 307 and egarding gender 307 infant(57.6%) were female and 226(42.4%) were male 25 (4.69%).

It was found that there were insignificant correlation between mother age and birth weight, between actual birth weight maternal weight Pearson correlation =0.252,R^2=0.0739 and, and between Body mass index and birth weight P value < 0,05 and R^2 =0,002. The level of maternal obesity influences fetal weight such that the more a mother weighs, the larger her fetus is likely to be. But it was found that there was significant statical difference in weight between maternal height and actual Birth weight, though so it was week correlation (0.334)R^2 =(0.1148) Figure (1).

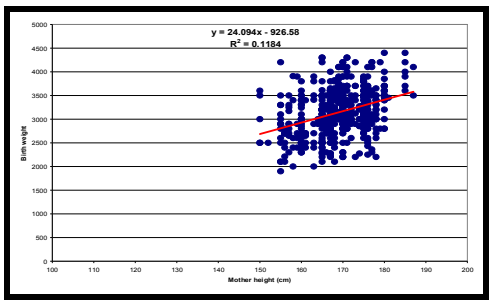

Figure (1) maternal Height& Birth weight correlation

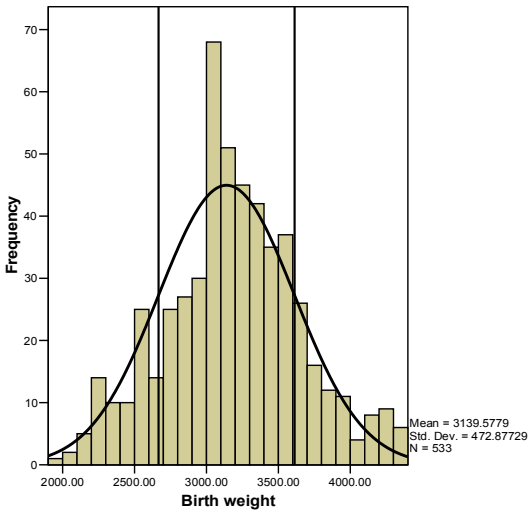

Figure (2) Mean actual birth weight and standard (SD)

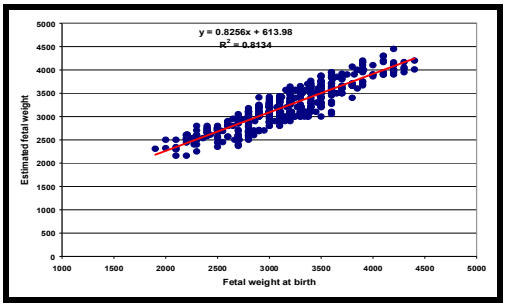

Figure (3) Estimated Fetal Weight& Birth weight

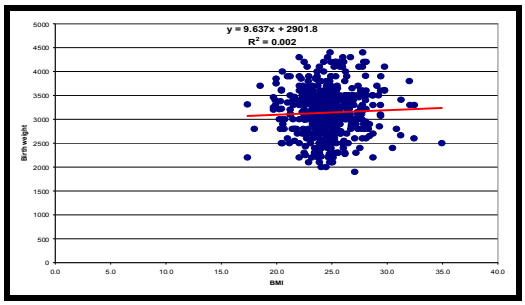

Figure (4) Body mass index & Birth weight

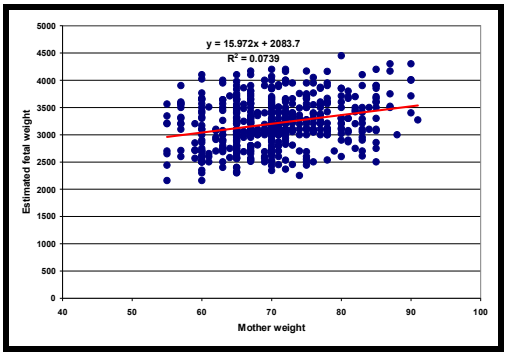

Figure (5) maternal weight& Birth weight correlation

4. Discussions

The estimated fetal weight by Hadlock formula is accurate and valid in Sudanese population. It is found that the Mean Estimate Fetal Weight (EFW) among Sudanese population by using Hadlock formula is 3,205g with 432g standard deviation (SD), Figure (2). The actual birth weight ranges from 2000 to 4400 g with mean of 3139g, and Standard deviation of 472 g, Pearson correlation =0.87, T.test=7.5, table (1), p value=0.07, and R^2=(0,8426). This agree with the findings of by Zozimo et al, 2004 and disagree with finding of abdallah(1997)

The accuracy of the fetal weight estimations were evaluated and compared with the actual birth weight (BW), it was found that the personal correlation coefficient showed strong and significant correlation at P value=0.001 with R^2 = 0.87, Systematic error =2.6 while in Melamed they found the systemic error was 2.0 random error about 8.1 while in this study equal 6.87, ant the absolute systematic error in this study equal 6.3 previous study by Yogev et al, 2009 showed overall accuracy in the range of 6.4% to 10.7%.

The correlation between estimated fetal weight versus actual birth weight for the fetal weight at G Age from (37-41 weeks) and the mean fetal weight has been correlated using *t*-test, which showed that of fetal growing before the delivery has showing effect on the weight throughout these weeks which confirm by *t*-test value (7.492), for the mean referring that is strong correlation between the Estimate fetal weigh and Birth weigh figure(3) In this study it was found that there is significant correlation between the body mass index and birth weight, R^2=0,002,and Pearson correlation=0.251 figure(4).

There was correlation between the maternal weights and height and, Pearson correlation =0,252 for maternal weight and actual birth weight figure(4). And the Pearson correlation, between birth weight and maternal height =0.33,figure (5) numerous studies have independently confirmed the direct relationship of maternal height to the birth weight of offspring. and agree with study used a population based sample of 4621 births., using multiple logistic regression analysis to estimate associations between paternal height and low birth weight, controlling for maternal age, other demographic factors and the child's gender, paternal age was identified as independent risk factor for LBW in US urban population, suggesting that more attention needs to be paid to paternal influences birth outcome. Reichman and Pagnini, 1997.

There is significant association or correlation was found in this study between birth weight and gestational age, Pearson correlation =0,744. while there insignificant association or correlation was found in this study between birth weight and maternal

age.Pearson correlation =0,079. thought research by Wasur has tested the effect of maternal age was in small study at Kenya at Nairobi hospital Comparison was made between adolescent mothers (aged below 20 years) and older mothers of low birth weight (birth weight less than 200gm) babies and concluded that other factors like being single parents having less formal education, being unemployed and having obstetric risks are more significant for poor pregnancy outcome. Likewise, paternal age was tested as a risk factor, but no significant association was found Nahum et al, 1999.

An in order to observe any possible effect of weight categories on estimating error and for comparison purpose. The EFW and the actual birth weight were divided into five groups, the five groups were, and 2000-2500 grams, 2501-3000 grams, 3001-3500 grams, 3501 – 4000 grams and Grater than 4000 grams. For comparison study the standard deviation errors for each group were compared with international records and it was found that it comprisable to the study done by Hadlock et al, 1984. Not attempt to measure social class in this study was done, in form of occupational class, house hold, income and wealth, and the level of maternal education. In Sudan there is lot of huge varieties in the habits and life style between different groups expect from nutritional and accessibility of health care on private bases, but almost of Sudanese women do not smoke, take alcohol or any toxic agents. Although many studies have highlighted the association between social factors and birth weight, there have been some theories to the possible reasons. It has been suggested that poverty could affect maternal health status at the time of pregnancy through lower physiological reserves. Also other causes could be variation in the quality and quantity of medical care, diet, housing conditions, lower social support, unemployment increased exposure to toxic agents, or differences in risk of infectious disease Battaglia et al,1996.. And Possible factors which can effect on birth weights (parity, education, antenatal care, anaemia and malaria). Indeed, we can not recommended use of these limits for fetuses whose ages have not been verified at US during early pregnancy, since minor errors in assignment of fetal age may lead to false diagnosis or alter fetal weight.

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Conclusion

The conclusion from this study is that the predicting fetal weight by ultrasonography with using the formula which derived by Hadlock *et al* is accurate and valid and will be useful in our environment. It recommended use of these for fetuses whose ages have been verified at US during early pregnancy, since minor errors in assignment of fetal age may lead to false diagnosis or alter fetal weight.

Corresponding Author:
Dr. Mohamed Yousef,
Department of Diagnostic Radiologic Technology, Taibah University College of Medical Radiologic Science, Tel: +96631028059, Fax: +9668475790,
E-mail: mohnajwan@gmail.com

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