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SONOGRAPHIC COMPARISON OF ESTIMATED FETAL WEIGHT BY DIFFERENT METHODS AT TERM AND AFTER BIRTH

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ABSTRACT

Background: The fetus is thought to have an inherent growth potential that under normal circumstances, yields a healthy newborn of appropriate size. Knowledge of weight of fetus in intrauterine life is important for the obstetrician to decide the management plan for delivery whether it would be vaginal or cesarean section and also to decide the place of delivery in order to optimize the fetomaternal outcome. **Objective:** The study was conducted to evaluate sonographically different methods of estimating of fetal weight at term and to determine their relative accuracy in predicting the actual weight after birth. **Methodology:** Cross-sectional study was performed and the duration of the study was 3 months. The setting where the study was performed in Mansoorah hospital and Gilani ultrasound centre Lahore Pakistan. Convenient sampling technique was applied to perform the test and the sample size was 116. Four formulae were used for the estimation of exact fetal birth weight which were hadlock's formula, shepard's formula, shinozuka formula and warsof's formula. **Results:** It was found from the study that these four equations are most widely used in all over the world for the estimation of birth weight. Further study confirmed that warsof's formula is the most useful and better method the estimation of weight. Indetpendent T-test was applied to determine the means of each formulae comparing them with the mean of actual birth weight. The results showed that warsof's formula stated clear estimates confirming it to be the best methods for estimations of fetal weights. After warof's, shepard's formula was better and can evaluate specific results. Hadlock's formula overestimated fetal weight so was not identified as a better method for birth weight estimation. The study showed that different formula can be used for birth weight evaluation according to country. Each country use different formula according to their requirements and environment. It was concluded that all four methods were showing good results and can be used for the estimation of birth weight. **Conclusion:** The study described the sensitivity and accuracy of different formulae in the pregnant women for the detection of fetal birth weight. The results determined the accurate and ideal formula for the detection of birth weight. The mean of each formula was compared with the mean of actual birth weight. Thus, results showed that warsof's formula is one of the best method for the detection of actual birth weight. When t test was applied to the formulae it was determined that mean of warsof's formula was 3.2065kgs that showed much resemblance with the mean of actual birth weight that was 3.2727kgs. Hadlock's method is mostly used formula in Pakistan, but the difference between mean of hadlock's formula and actual birth weight is more therefore is not considered as ideal method. Furthermore, Shepard's formula was also used to find birth weight. Mean of that formula was 3.3641kgs, mean of Shinozuki formula was 3.3763kgs and in last the mean of hadlock's formula was 3.4106kgs.

KEYWORDS: Shepard's, shinozuka, warsof's, hadlock's.

INTRODUCTION

Low birth weight is a complication in which weight of the newborn is less than 5 pounds and the average weight of a baby is almost 8 pounds.[1] There are many chances of serious health problems in microsomic babies. Most of the weight is gained in the last week of pregnancy, there are many other causes due to which weight of the fetus decreases such as intrauterine growth restriction, scanty amniotic fluid etc.[2]

There are also some possibilities of increasing of the weight at the time of birth. These all complications can be treated by finding the weight of baby before pregnancy. Knowledge of fetal weight in intrauterine life is important for the obstetrician to decide the management plan for delivery whether it would be vaginal or cesarean section and also to decide the place of delivery in order to optimize the fetomaternal outcome.[3]

The two main methods of estimation of birth-weight in current obstetrics are: clinical techniques based on abdominal palpation of fetal parts and calculations done by Johnson's formula (fundal height x n(155) where n stands for 11 or 12 n is 11 if vertex is below the ischial spine and 12 if above the ischial spine) and Dare's formula (fundal height multiplied by the abdominal girth in centimeters) and sonographic measures of skeletal fetal parts which are then inserted into regression equations (Hadlocks 1-5, Shinozuka, Shepard, Woo's, Warsof's with Shepard modifications, Jordaan, Waseem1 and many more) to derive fetal weight.[4]

Ultrasound is being used to estimate fetal weight for more than 30 years. Ultrasonography is the most widely used method for fetal weight estimation and many studies have highlighted the practicality of this method in monitoring normal fetal growth an in detecting IUGR, macrosomia and isoimmunization. Sonographic estimation of fetal weight has been presumed to be more accurate than clinical methods that is why clinicians are becoming progressively reliant on imaging and also as a consequence of advances that have been made in ultrasound technology.[5] The advantage of this technique is that it relies on linear and planar measurement of fetal dimensions that are definable and provide sufficient information to allow for accurate algorithmic reconstruction of the three-dimensional fetal volume of varying tissue density.[6] Sonographic predictions are based on algorithms of fetal body measurements, such as abdominal circumference (AC), femur length (FL), biparital diameter (BPD), head circumference (HC) both singly or in combination where combination of three parameters was found to be preferable over one or two parameters in the prediction of fetal weight.[7] The popular formulae used have the following equations Hadlock II formula (Log10 EFW= 1.335- 0.0034x AC x FL + 0.0316BPD+ 0.0457 AC +0.1623x FL), Shepard formula (Log10 EFW= − 1.7492 + 0.166 BPD+ 0.046 AC − 2.646 (AC × BPD)/1 000), Warsof's formula (Log10 EFW= − 1.599 + 0.144 BPD+ 0.032 AC − 0.111 (BPD2×AC)/1000), Shinozuka formula (EFW= 0.23966+ AC2 FL+ 1.6230xBPD3) respectively.[8]

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. This study aimed in finding the most appropriate sonographic formula for birth weight estimation among the management of the pregnant women. The primary goal of this study was to then evaluate the various methods of estimating fetal weight at term and to determine their accuracy in contrast to the actual birth weight.

METHODOLOGY

Study Design
Cross Sectional study.

Setting
Mansoorah Hospital, Gillani ultrasound center, University of Lahore teaching Hospital.

Study Duration
3 Months.

Sampling Technique
Convenient Sampling technique.

Sample Size: 116.

Inclusion Criteria
- Women of all ages with pregnancy week of above 37.
- Women having normal delivery before this pregnancy
- Pregnancies with certain LMP less than 1 week difference with gestational age calculated from biometric parameters were included.
- Women with gestational age of at least 37 to 40 weeks.

Exclusion Criteria
- Women with pregnancy with fetal abnormalities
- Women with an uterine abnormality
- Pregnant women with any placental abnormalities

Equipment
Xario Ultrasound Toshiba.
Nemio 35 Ultrasound Unit Toshiba.
Nemio 17 Ultrasound Unit Toshiba.

Formulae
- Hadlock II formula (Log10 EFW= 1.335- 0.0034x AC x FL + 0.0316BPD+ 0.0457 AC +0.1623x FL)
- Shepard formula (Log10 EFW= − 1.7492 + 0.166 BPD+ 0.046 AC − 2.646 (AC × BPD)/1 000)
- Warsof's formula (Log10 EFW= − 1.599 + 0.144 BPD+ 0.032 AC − 0.111 (BPD^2×AC)/1000)
- Shinozuka formula (EFW= 0.23966+ AC^{2}x FL+ 1.6230xBPD^3)

RESULTS

Table 4.1: Gender of babies.

Gender	Frequency	Percent
Male	66	56.9
Female	50	43.1

Table 4.1 shows the frequency as well as percentage of the gender of baby sample. The participant of this research were 116 pregnant women. From total 116 babies 66 were male and 50 female which means frequency of male was 56.9% male and female was 43.1%.

Table 4.2: Gestational age.

Gestational age	Frequency	Percent
37-38 wk	75	64.7
39-41 wk	41	35.3

Table 4.3: One sample t test.

One-Sample Statistics				
N	**Mean**	**Std. Deviation**	**Std. Error**	**Mean**
Hadlock's formula	116	3.4106	0.33600	0.03120
Shepard's formula	116	3.3641	0.35711	0.03316
Shinozuka formula	116	3.3763	0.32570	0.03024
Warsof's formula	116	3.2065	0.34873	0.03238
Actual birth weight	116	3.2727	0.40550	0.03765

Table 4.3 described the gestational age when transabdominal ultrasound was performed. The gestational age of 75 patients was ranging between 37-38 weeks while gestational age of only 41 patients was 39-41 weeks.

Table 4.3 compared the accuracy of different sonographic formulae for the detection of fetal weight in the pregnant women. The results determined the most accurate and ideal formula for the detection of birth weight. The mean of each formula was compared with the mean of actual birth weight. Thus, results showed that warsof's formula is one of the best method for the detection of birth weight. When t test was applied to the compiled data it was determined that mean of warsof's formula was 3.2065kgs that showed resemblance with the mean of actual birth weight that was 3.2727kgs. Furthermore, mean of Shepard's formula was 3.3641kgs, mean of Shinozuki formula was 3.3763kgs and the mean hadlock's formula was 3.4106kgs.

DISCUSSION

The study was conducted to find the accuracy of four equations of ultrasound for the estimation of fetal birth weight comparing them to the actual birth weight. Four equations of ultrasound hadlock's formula, shepard's formula, shinozuka's formula and warsof's formula were used for the study. From the study it was concluded that the most accurate method for birth weight estimation is warsof's formula. Mean of warsof's formula concided with the mean of actual birth weight recorded. Hadlock's formula despite being widely used in Pakistan, overestimated fetal weight which could be clrealy seen in the results of the study conducted. It was also found that few formulae have been produced for assessing fetal load in the late second and the third trimester. These formulae include an assortment of sonographically acquired biometric estimations. The sonographic estimation which depends on estimation of different fetal measurements, especially BPD, AC and FL has been better than clinical estimation yet at the same time needs instruments and very much prepared physicians are needed.

The results were similar to a study conducted by Nir Melamed et al. whose aim of the study was to find the choice of formula for estimation of fetal weight in the fetuses. The use of particular equation for fetal weight estimation is the decision of the user. There is no any specific equation that is considered as most applicable and accurate method and can lead to misleading of the situation.[9]

The present study indicated that the warsof's formula is one of the best method for estimation of actual birth weight because mean birth weight calculated by this formula closely resembles with actual mean weight. The results are similar to the study conducted by J. Siemer et al. at the Perinatal center Germany. The study suggested that Shepard and Osaka are also better techniques and can applicable for the estimation of birth weight but the most accurate method is hadlock's formula and is mostly used in developed countries for birth weight estimation[10]. Where as according to the present study hadlock's formula overestimated fetal weight, concluding warsof's formula to be the most accurate.
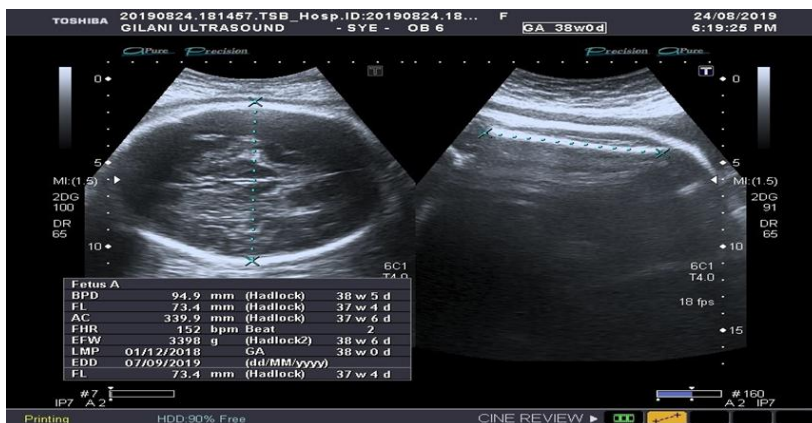
CONCLUSION

The study was performed to determine the different methods to find the accurate fetal birth weight. Four methods were used and their mean were compared with mean of actual birth weight in the study. The methods include hadlock's formula, shepard's formula, shinozuka formula and warsof's formula. The results revealed that warsof's method is the most specific, sensitive and accurate method for the detection of fetal birth weight. Other formulaae were also considered as better estimates of fetal weight rather than the hadlock's formula which overestimated fetal weight.

The results described the sensitivity and accuracy of different formulae in the pregnant women for the detection of abdominal birth weight. The results determined the accurate and ideal formula for the detection of birth weight. The mean of each formula was compared with the mean of actual birth weight. Thus, results showed that warsof's formula is one of the best method for the detection of fetal birth weight. When t test was applied to the formulae it was determined that mean of warsof's formula was 3.2065 that was much resemble with actual birth weight that was 3.2727. It was found that hadlock method is mostly used formula in Pakistan, but the difference between mean of both hadlock and actual birth weight is more therefore is not

considered as ideal method. Furthermore, Shepard's formula was also used to find birth weight. Mean of that formula was 3.3641, mean of Shinozuki formula was 3.3763 and in last the mean of hadlock's formula was 3.4106.
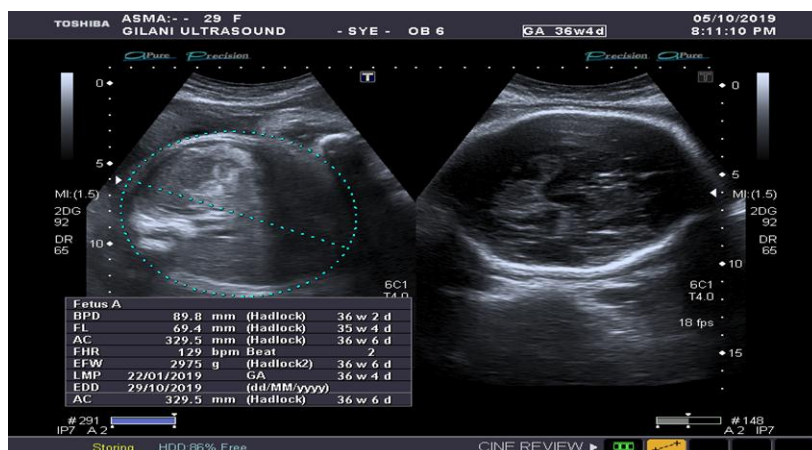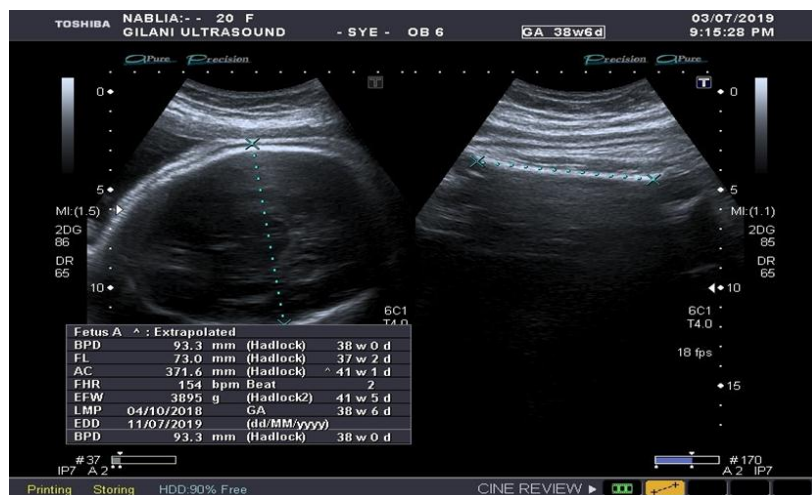
CASE NO 1

Ultrasound was done at 38 weeks with BPD measuring 9.4cm, FL 7.3cm and AC 33.9cm with the estimated fetal weight being 3.398 kgs.

CASE NO 2

Mrs Asma ultrasound done at almost 37 weeks with BPD measuring 8.9cm, FL 6.9cm and AC 32.9cm with the estimated fetal weight being 2.975 kgs.

CASE NO 3

Mrs Nabila ultrasound done at almost 39 weeks with BPD measuring 9.3cm FL 7.3cm and AC 37.1cm with the estimated fetal weight being 3.895 kgs.

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