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ASSESSMENT AND COMPARISON OF VARIOUS CLINICAL METHODS (DARE, JOHNSON, DAWN AND HADLOCK FORMULA) OF BIRTH WEIGHT ESTIMATION IN TERM PREGNANCY

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ABSTRACT

BACKGROUND: Knowledge of fetal weight in utero is vital for the obstetrician in deciding whether or not to deliver the fetus as well as in fixing the mode of delivery. Both low birth weight and excessive fetal weight at delivery are associated with increased risk of newborn complications during labor and the puerperium. Various clinical formulae are in use for fetal weight estimation.

AIM AND OBJECTIVE: To assess and compare the fetal weight with actual birth weight in term pregnancy by Dare's, Johnson's, Dawn's, and Hadlock's formula using Ultrasound.

MATERIALS AND METHODS: Two hundred and forty-six women between 37-42 weeks gestation were studied in the Department of Obstetrics & Gynaecology in our institution from March 2017 to August 2018. Detailed obstetrics and menstrual history were obtained along with the duration of gestation. Fetal weight was estimated using Dare's, Hadlock's, Johnson's, and Dawn's formula. The measurements were compared with actual birth weight after the birth of the baby.

RESULTS: Results vary in terms of accuracy with various methods employed for estimating fetal weight. Percentage error within 10% of actual birth weight by Dare's formula method was (68.2), followed by Hadlock's (46) Johnson's formula (30.6) and Dawn's formula. (20.8) respectively. The correlation coefficient of Dare's method was highest (r=0.82).

CONCLUSION: Of the three clinical methods studied Dare's formula has better predictability and accuracy in fetal weight estimation as compared to others.

KEYWORDS : Fetal weight, ultrasound, clinical methods, actual birth weight

INTRODUCTION

Knowledge of the weight of the fetus in-utero is important for the obstetrician to decide the mode of delivery so that maternal and perinatal complications can be anticipated and prevented.Clinical methods are simple and require no sophisticated instruments, but it has been criticized as less accurate owing to observer variation. The ultrasound method has the advantage of being accurate, simple and non-invasive and has gained much popularity. However in low resource setting sophisticated techniques may not available or may be costlier. Several studies have found clinical methods quite reliable and as good as the ultrasound method.

Various clinical methods of estimating fetal weight have been tried in different parts of the world. These are used extensively worldwide, being convenient and costless. however, it is subject to a wide range of predictive error and observer variation. Though controversies swarm as to which method is most useful and widely applicable for predicting fetal weight. There are several studies stating that ultrasonographic estimates of fetal weight are no better than clinical palpation in predicting fetal weight. Therefore, there is a need to devise a method to accurately predict fetal weight which is widely available as well as reliable. Hence the present study has been carried out to assess the fetal weight in term pregnancy by various methods and to do comparative evaluation of these methods with the actual birth weight of the baby after delivery.

MATERIALS AND METHODS

This prospective study was conducted on 246 women in the Department of Obstetrics & Gynaecology , NSCB Medical college and hospital, Jabalpur (M.P.)from March 2017 to August 2018 after obtaining approval from institutional ethical committee and an informed consent from the study subjects.

Inclusion Criteria-

confirmed singleton term pregnancy with vertex presentation

Exclusion Criteria-

preterm, multiple pregnancy, malpresentation, obesity, poly/ oligohydramnios, intrauterine fetal death, congenital malformation, and fibroid/ adnexal mass

Detailed history was taken, with special reference to obstetrics and menstrual history. Gestational age was calculated using Naegle's rule or by the first trimester scan followed by clinical and obstetrical examination. With empty bladder and after centralizing uterus, symphysio-fundal height (SFH) using MC Donald's method and abdominal girth (AG) were measured using standard measuring tape at the level of the umbilicus in centimetres.

Various formulas for calculating effective fetal weight (in gm)

Dare's formula = AG (cm) × SFH (cm)

Simplified Johnson's formula = (SFH-n) X 155

When the presenting part was at

- 'minus' station, n=13
- 'zero' station, n=12
- plus station, n=11

The DAWN'S formula = L x (T/2)2x1.44

The longitudinal (L) and transverse (T) diameters of the uterus were measured using a pelvimeter. Double abdominal wall thickness (DAWT) was recorded at the midpoint between umbilicus and symphysis pubis by pinching the abdominal wall with pelvimeter. If DAWT was more than 3 cms, the access was deducted from the transverse diameter and half the access was deducted from the longitudinal diameter.

Hadlock's formula using ultrasonographic measurement of biparietal diameter, abdominal circumference and femur length

The fetal weight estimated by the above methods were compared with the actual birth weight measured within half an hour of delivery.

The study population was divided into four groups :

Group	Birth weight (in gms)
Group A	2001-2500
Group B	2501-3000
Group C	3000-3500
Group D	>3500

All the data was analysed using IBM SPSS version 20 software.

RESULTS

The majority of the cases were in the age group 21 -25 years (47.96%) .The mean maternal age of the study population was 25.04±3.35 years. The majority of women were multigravida (57.96%) as compared to Primi-gravida (42.04%). Vaginal delivery (52.65%) followed by LSCS (42%), instrumental (4.08%), and VBAC (1.22%) respectively were the most common.

The mean birth weight was 2947.43±368.27. The estimated fetal weight by Dare's formula, Hadlock, Johnson's and Dawn's was 2854.69±186.89, 3058.29±343.49, 2879.00±176.47, and 2509.83±248.53 respectively. The closest estimation of birth weight was found by Johnson's and Dare's formula.

In fetal weight group 2001-2500 grams the mean value closest to mean actual birth weight was by Johnson's formula (2687), followed by Hadlock's formula (2649) and Dare's (2973). In fetal weight group 2501-3000 gm the closest mean value is by Hadlock's formula (2960) followed by Johnson's formula (2852) and Dare's (2973). In the group 3001-3500gm, the closest value is by Dare's formula (2973) followed by Johnson formula (2948). In more than 3500gm group the closest value was by Dawn's formula (3021) followed by Johnson's formula (2852).

The average error was least with the Hadlock's formula (-110) in all the weight categories followed by Dare's formula (92). It was maximum with Dawn's formula (437.6). Percent error was least with the Hadlock's formula followed by Dare's formula and maximum with Dawn's formula.

Tables

Table 1: Percent error in different categories from actual birth weight and estimated fetal weight by different methods

Percentage error (%)	Dare's	Hadlock's	Johnson's	Dawn's
Up to 5	26 (10.6)	79 (32.2)	27 (11)	4 (1.6)
5.1-10	167 (68.2)	113 (46.1)	77 (30.6)	51 (20.8)
10.1-15	45 (18.4)	40 (16.3)	127 (51.8)	75 (30.6)
15.1-20	5 (2)	9 (3.7)	14 (5.7)	77 (31.4)
20.1-25	0 (0)	0 (0)	0 (0)	22 (9)
>25	2 (0.8)	4 (1.6)	2 (0.8)	16 (6.5)

Table 2: Showing correlation of birth weight and fetal weight estimated by different methods

Methods	Pearson's Correlation coefficient (r)	P-value
Dare's formula	0.82	<0.001
Hadlock's formula	0.76	<0.001
Johnson's formula	0.74	<0.001
Dawn's formula	0.54	<0.001

The number of underestimated and overestimated birth weights in all the fetal weight groups for all the methods was calculated. Dare's formula (62.4%), Johnson's formula(59.2%), and Dawn's formula (99.2%) had a tendency to overestimate the fetal weight whereas Hadlock's formula(66.9%) under-estimated the birth weight.

Table 3: Univariate linear regression analysis of actual birth weight (dependent) and estimated fetal weight by different methods

Methods	Adjusted R Square	Constant	Beta Coefficient	Standardized Beta Coefficient	t	test P-value
Dare's formula	0.68	-1332.94	1.5	0.76	18.28	<0.001
Hadlock's formula	0.58	507.28	0.8	0.74	17.37	<0.001
Johnson's formula	0.55	-276.25	1.12	0.54	9.91	<0.001
Dawn's formula	0.29	-113.66	1.22	0.82	22.59	<0.001

DISCUSSION

Accurate prediction of fetal weight is of vital significance in deciding the management of labour and delivery. Clinicians frequently estimate fetal weight while examining women in the antenatal period and during labour. Fetal macrosomia and intrauterine growth restriction have to be detected prenatally to reduce perinatal mortality and morbidity particularly in terms of long term neurological and developmental disorders50. As fetal weight cannot be measured directly, it must be estimated from fetal and maternal anatomical characteristics.

In the present study majority of women were between the age group 21- 25 years (47.96%). Findings of Bajaj et al (Bajaj P 2017) and Parvathavarthini et al (Parvathavarthini K 2018) are in line with the present study.

In the present study majority of women were multigravida (57.96%) as compared to primigravida (42.04%). In agreement to present study Bhandary et al reported 45% as primigravida and 55% as multigravida. (Bhandary A 2004) Anupama K et al reported both as equal (50%). (Kumari A 2013).

Out of 246 women, 129 (52.65%) underwent vaginal delivery, 103 (42.04%) had lower segment cesarian section while 10 (4.08%) subjected to instrumental delivery. Bhandari et al (Bhandary A 2004) and Anupama K et al (Kumari A 2013) reported 70% and 86% vaginal births respectively.

We found mean actual birth weight as 2947.43±368.27 in the present study. Mean birth weight by AG×SFH (Dare's) as 2854.69±186.89, 3058.29±343.49 by Hadlock's formula, 2879±176.47 by Johnson's and 2509.83±248.53 by Dawn's formula. Mean fetal weight by Johnson's and Dare's formulae was closest to the mean actual birth weight. Mean actual birth weight in the study conducted by Parvathavarthini K et al was 2984.21±490.3 gm which is in .ine with the present study. Mean birth weight by Dare's formula reported by Parvathavarthini K et al was 3363.2±487.8 gm, by Johnson's formula as 3462.7±485.8 gm and by Hadlock's formula 3175.1±483.3 gm. (Parvathavarthini K 2018).

In the fetal weight group 2001-2500 grams, the mean value closest to mean actual birth weight was by Johnson's formula (2687) followed Hadlock's formula (2795) In fetal weight group 2501-3000 gm the closest mean value was by Hadlock's formula (2795) followed by Johnson's formula (2852) and Dare's formula (2634). In the group 3001-3500gm, the closest value was by Dare's formula followed by Johnson formula. In more than 3500gm group the closest value was by Dawn's formula. The average error in our study was least with Hadlock's formula (- 110) followed by Dare's formula (92.74) in all the various categories of birth weight. Bhandary et al found the average error in various fetal weight groups by AG x SFH as 224.37gm which was least when compared to Johnson's and Hadlock's methods. (Bhandary A 2004) Tiwari and Sood in their study showed an average error of 364.96 gram, 327.28gm, and 198.6gm by AG x SFH, Johnson's, and Hadlock's method respectively. (Tewari R 1989) The average error reported by Bajaj et al was least with Dare's formula followed by Hadlock's in all the categories. (Bajaj P 2017)

In our study, the percentage error was least with Hadlock's formula (7.9) followed by Dare's formula (8.31). Dawn method showed maximum error (14.72). In various categories, the percent error restricted up to10% was by AG x SFH/Dare's formula (68.2) followed by (46.1), (30.6), and (20.8) by Hadlock's, Johnson's and Dawn's formula respectively. Bhandari et al and Bajaj et al found a percent error up to 10% as (67) and (68) respectively. (Bhandary A 2004, Bajaj P 2017) Tiwari and Sood found 92% of cases within 15% of error by ultrasound method and 74%, 68%, and 78% by clinical, Dawn's, and Johnson's methods respectively. (Tewari R 1989).

Sherman et al reported that rates of estimates within 10% of birth weights were not statistically significant in clinical and USG methods (72% and 69% respectively). (Sherman DJ 1998) Bhandary et al reported that rates of estimates within 10% of birth weight were not statistically significant in the AG X SFH method and USG method (67% and 62% respectively). (Bhandary A 2004) In line with that in the present study the clinical estimation by Dare's formula and USG method i.e. Hadlock's formula found to be equally good for estimation of birth weight within 10%.

In our study, we found Dare's formula (62.4%), Johnson's formula (59.2%), and Dawn's formula (99.2%) tended to overestimate the fetal weight whereas Hadlock's formula (66.9%) underestimated the birth weight. While in the study done by Chauhan et al Johnson's formula

(73%) and Hadlock's formula (58%) tended to overestimate the fetal weight whereas Dare's formula (70%) and Dawn's formula (66%) underestimated the birth weight. (Chauhan KP 2013).

The correlation coefficient for various methods in the present study was highest by Dare's formula (r=0.82), followed by Hadlock's (r=0.76) and Johnson's (r=0.74) which correlated positively with the actual birth weight. Linear regression analysis showed a strong positive association with Dare's formula (r2=.68), moderate association with Hadlock's (r2=0.58), and Johnson's (r2=0.55) and least with Dawn's formula (r2=.0.29). In line with this Darshit, et al showed that the correlation coefficient for Dare's formula and Johnson's formula compared to actual birth weight were +0.9026 and +0.8182 respectively, showing positive correlation with ABW. So the strongest positive correlation with ABW was observed for Dare's formula. (Darshit GP 201

Fetal weight estimated by different clinical methods when compared with actual birth weights were found to have a good association and statistically significant. This study indicates that clinical estimation of birth weight has a role in the management of labor and delivery in a term pregnancy.

CONCLUSION

Clinical estimation of birth weight has a role in the management of labour and delivery in a term pregnancy. Of the three clinical methods studied Dare's formula (AG x SFH) has better predictability and accuracy in fetal weight estimation as compared to others. Ultrasonography has its advantages and limitations in estimating fetal weight. Despite its superiority, the conclusion from this study may provide further evidence that simple cost-effective clinical methods are equally reliable, accurate, and easy to apply, thus aiding in the betterment of fetomaternal outcome.

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