International Journal of Reproduction, Contraception, Obstetrics and Gynecology
Radhika M. Int J Reprod Contracept Obstet Gynecol. 2024 Mar;13(3):594-598
www.ijrcog.org
pISSN 2320-1770 | eISSN 2320-1789

DOI: https://dx.doi.org/10.18203/2320-1770.ijrcog20240461

Original Research Article

Comparative study of clinical assessment of fetal weight estimation using Johnson's formula and ultrasonographic assessment using Handlock's formula at or near term and its correlation with its actual birth weight

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Received: 01 August 2023
Revised: 24 January 2024
Accepted: 25 January 2024

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ABSTRACT

Background: Fetal growth assessment is an important part of antenatal care. Accurate estimation of fetal weight is one of the important aspects in management of labour. Estimation of birth weight by Johnson's formula based on symphysiofundal height has advantage of speed, economy and general applicability. Obstetric ultrasound can predict fetal weight with a great degree of precision.
Methods: The prospective study was conducted at the Department of Obstetrics and Gyenecology, Yenepoya Medical College and Hospital, Mangalore on 100 pregnant women at or near term. Detailed history was taken, general, obstetric and systemic examination was done. Pelvic examination also done. Estimated fetal weight calculated using Johnson's formula clinically and ultrasound was done to calculate estimated fetal weight using Handlock's formula and correlated the birth weight calculated by two methods with its actual birth weight. Then the statistical analysis done to estimate the accuracy of two methods in estimated fetal weight.
Results: In this study, out of 100 pregnant women, mean actual birth weight was 3041.6gms. Actual birth weight divided into 3 groups 14% birth weight <2.5kg, 73% had 2.5-3.5kg and 13% had >3.5kg. Accuracy of both methods evaluated, ultrasonographic measurement more accurate than clinical estimation but the error with Johnson's formula was with low birth babies.
Conclusions: Estimated fetal weight using Ultrasonographic Handlock's formula was more accurate than Johnson's formula. However, the results of Johnson's formula were comparable to Handlock's.

Keywords: Birth weight, Handlock's formula, Johnson's formula, Ultrasonography

INTRODUCTION

Present day obstetrics has in fact rightly been to focus on the concept of fetal medicine as distinct and significant entity in view of rapid decline in maternal morbidity and mortality. Growth is a basic fundamental of life[1].Assessment of fetal weight in utero leads to an improved prospective management of high risk pregnancies and considerable reduction in perinatal morbidity and mortality.[1] Accurate estimation of fetal weight is of paramount importance in management of labour and delivery. Fetal weight in conjuction with gestational age is an important indicator of pregnancy outcome.[2]

Two main methods for predicting birth-weight in current obstetrics were used: (a) Clinical techniques based on abdominal palpation fetal parts and calculations based on fundal height and (b) Sonographic measures of skeletal fetal parts, which are then inserted into regression equations to derive estimated fetal weight.[3] Evaluation of uterine size externally with use of a physician's hand is characterized by being simple, easy and cheap. In addition, it is characterized by being a standard clinical method as an alternative to ultrasound (USG) which is expensive and not always easy to access, especially in countries with limited financial resources for health.[4]

Knowledge of the weight of the fetus in utero is important for the obstetrician to decide whether to deliver or not to deliver the fetus and also to decide on the mode of delivery. Estimation of fetal weight is being done clinically, which has been criticized as less accurate because of observer variations.

This study aimed to estimate fetal weight antenatally at or near term clinically by Johnson's formula and ultrasonographically using Handlock's formula and comparing the two methods after knowing the actual birth weight of these babies after delivery and their accuracy is compared.

METHODS

This was prospective observational study conducted at Yenepoya Medical College and Hospital, Mangalore. Total 100 pregnant women selected by simple random sampling, who attended antenatal clinic or were admitted in the antenatal ward at Yenepoya Medical College and Hospital, Mangalore. The duration of study was from May 2017 to September 2017.

Inclusion criteria

Full term pregnancy (37-42 weeks gestation), vertex presentation, singleton pregnancy, primigravida, multigravida and grandmulti, reliable dates, ultrasonogram done one week prior to delivery were included.

Exclusion criteria

Patients with multiple gestation, pregnancy with fibroid or ovarian tumour or cyst, polyhydramnios or oligohydramnios, ruptured membrane, intrauterine death, abnormal presentation, congenital anomalies were excluded.

Detailed history of pregnant women including LMP (regular cycles), abdominal examination and pelvic examination done to know the station of the head.

The symphysiofundal height is measured with non-elastic tape after emptying the bladder in cm. Estimated fetal weight is calculated using Johnson's formula.

Estimated Fetal Weight (EFW) in grams= (symphysiofundal height in cm – X) x 155

Where, X= 13, when presenting part is not engaged; X=12, when presenting part is at station 0; X=11, when presenting part is at station +1.

Ultrasound was done to estimate the fetal weight in grams by using fetal parameters such as abdominal circumference (AC), femur length (FL), bi-parital diameter (BPD) and head circumference (HC) in cm using Handlock's formula.

Handlock's formula= log 10 (1.335-(0.0034*AC*FL)+(0.0316*BPD)+(0.0457*AC)+(0.1623 *FL)

The patients were followed until delivery. The date of delivery was noted within one week ultrasound examination. Baby was weighed within 2 hours of the delivery using weighing machine. Finally, comparative analysis of fetal weight was made and accuracy of both the methods was evaluated using the actual birth weight of baby after delivery.

RESULTS

The sample comprised of 100 pregnant women at or near term. Mean maternal age of the sample 25.94years ranged 18-38years. Mean gestational age of the sample 39.13weeks ranged 37-42weeks. All of them delivered within one week of examination. 71% delivered normally and 29% LSCS. 34% Primigravida, 61% Multigravida and 5% Grandmultigravida.

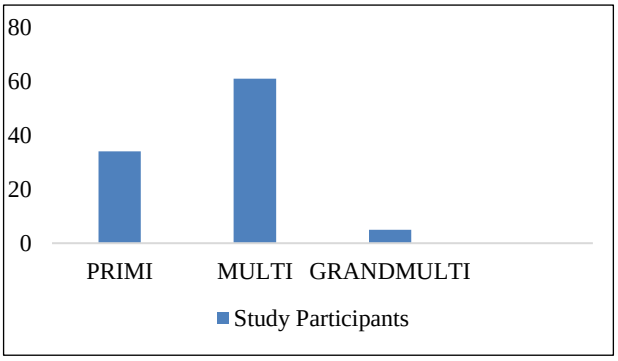

Figure 1: Distribution of Gravida.

Table 1: Distribution of birthweight.

Groups	Weight of babies in grams	No. of cases
I	1000-2500	14
II	2500-3500	73
III	>3500	13

Total 100 cases were categorized into 3 groups with mean birth weight of the babies being 2978.5gms.

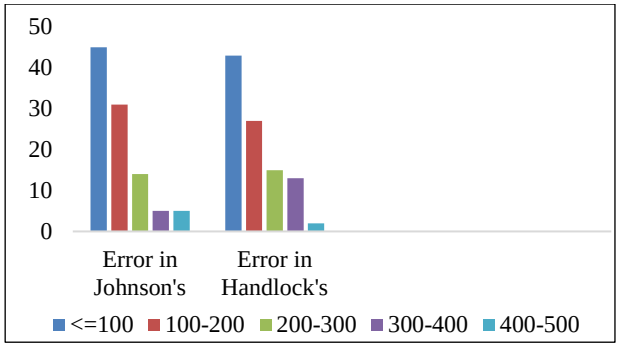

Figure 2: Comparison of error in estimation of fetal weight by Johnson's and Handlock's method.

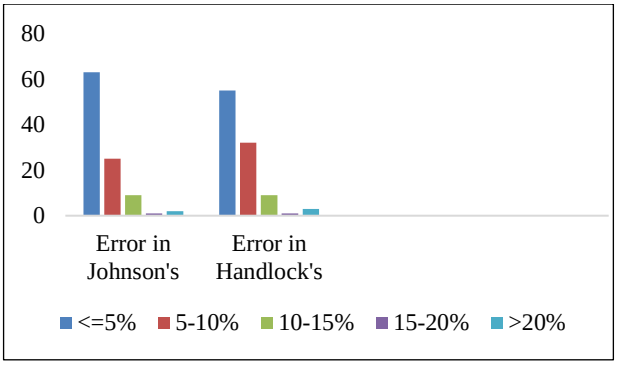

Figure 3: Comparison of error in estimation of fetal weight in percentage by Johnson's and Handlock's method.

Table 2: Calculation of P value.

		N	Group						Chi square	P value
			Group 1 (1000-2500grams)		Group 2 (2500-3500grams)		Group 3 (>3500grams)			
			Count	Column N %	Count	Column N %	Count	Column N %		
Error in Johnson's	<=100	45	4	28.60	38	52.10	3	23.10	15.615	0.048
	100-200	31	3	21.40	22	30.10	6	46.20		
	200-300	14	3	21.40	8	11.00	3	23.1		
	300-400	5	1	7.10	3	4.10	1	7.70		
	400-500	5	3	21.40	2	2.70	0	0.00		
	>500	0	0	0.00	0	0.00	0	0.00		
Error in Handlock's	<=100	43	6	42.90	32	43.80	5	38.50	5.584	0.694
	100-200	27	2	14.30	21	28.80	4	30.80		
	200-300	15	2	14.30	10	13.70	3	23.10		
	300-400	13	4	28.60	8	11.00	1	7.70		
	400-500	2	0	0.00	2	2.70	0	0.00		
	>500	0	0	0.00	0	0.00	0	0.00		
Johnsons formula estimation	Overest-imation	35	4	28.60	26	35.60	5	38.50	0.732	0.947
	Accurate	1	0	0.00	1	1.40	0	0.00		
	Underes-timation	64	10	71.40	46	63.00	8	61.50		
Handlock's formula estimation	Overest-imation	73	11	78.60	52	71.20	10	76.90	1.536	0.82
	Accurate	4	1	7.10	3	4.10	0	0.00		
	Underes-timation	23	2	14.30	18	24.70	3	23.10		
Errors in Johnson's method	<=5 %	63	4	28.60	50	68.50	9	69.20	25.445	0.001
	5-10%	25	4	28.60	17	23.30	4	30.80		
	10-15%	9	3	21.40	6	8.20	0	0.00		
	15-20%	1	1	7.10	0	0.00	0	0.00		
	>20%	2	2	14.30	0	0.00	0	0.00		
Errors in Handlock's method	<=5 %	55	6	42.90	41	56.20	8	61.50	12.143	0.145
	5-10%	32	3	21.40	24	32.90	5	38.50		
	10-15%	9	3	21.40	6	8.20	0	0.00		
	15-20%	1	1	7.10	0	0.00	0	0.00		
	>20%	3	1	7.10	2	2.70	0	0.00		

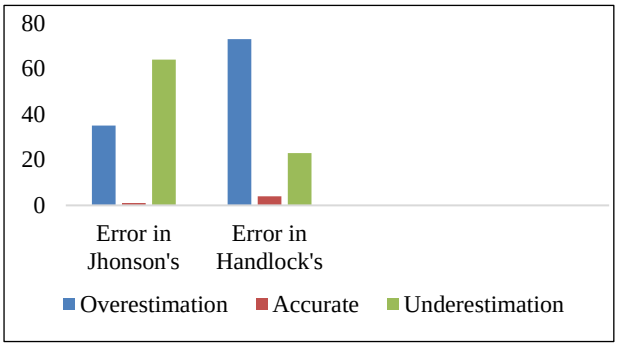

Figure 4: Comparison of accuracy of estimation of fetal weight by Johnson's and Handlock's method.

DISCUSSION

Antenatal fetal weight can be estimated with reasonable accuracy by clinically using Johnson's formula and ultrasonographically using Handlock's formula.

In the present study, among 100 pregnancy women, 34% were primigravida, 61% were multigravida and 5% grandmultigravida as shown in Figure 1, whereas Bajaj et al in their study found that out of 200 women 34.5% were primigravida and 65.5% were muligravida in which they compared the accuracy of clinical and ultrasonographic estimation of fetal weight at term with actual birth weight.[5]

Among 100 pregnant women, divided into 3 groups, 14 cases belongs to Group 1 (1000-2500grams), 73 cases belongs to Group 2 (2500-3500 grams) and 13 cases belongs to Group 3 (>3500grams) as shown in Table 1.

In Figure 2, comparison of error in estimation of fetal weight by both Johnsons and Handlocks method, it is found that Handlocks method is better and has less error in estimation of fetal weight as compared to Johnson's formula in all the groups.

Error in estimated fetal weight with Johnson's formula more compared to Handlock's formula but error was within 5% of actual birth weight in both methods. Error of estimation using Johnson's formula less in group II and more in group I and III and vice versa with Handlock's formula as shown in Figure 3.

Estimation of fetal weight using Johnson's formula underestimates whereas Handlock's formula overestimates the actual birth weight in all groups as shown in Figure 4.

Accuracy is compared between 2 methods using p value, error of estimation with Johnson's formula has P value <0.001 which is significant. Handlock's formula is more accurate when compared to Johnson's formula in this study. Whereas, as the study conducted by Dare et al, Roy et al, clinical estimation of fetal weight appears to be as accurate as ultrasonographic estimation.[6]

In the study conducted by Peru Pradhan et al, the Johnson's method of fetal weight estimation was more accurate than Handlock's method.[7]

Dare et al found percentage of error between actual and estimated weight to be 20% by AG X SFH method.[8]

Nijoku et al reported similar findings with ultrasound estimating that estimating birth weight had the lowest average inaccuracy.[9]

According to study by Parvathavarthini et al, Johnsons approach had the greatest percentage of inaccuracy followed by Dare's and then ultrasound which supports the present study.[10]

This study has some limitations. Ultrasound formula is not a representative of genetic background. As fetal weight by ultrasound is operator dependent, there can be some limitations on accuracy of weight. The most frequently used Bi-parietal diameter, Abdomen circumference, Femur length for estimating fetal weight is cummulative error. This requires expertise. Lack of necessary skills might lead to measurement errors. Head circumference not taken as method of Hand-lock's calculations, so there can be some variations in weight of fetus.

CONCLUSION

Antenatal fetal weight can be estimated with reasonable accuracy,clinically using Johnson's formula and ultrasound with Handlock's formula. Handlock's formula is more accurate than Johnson's formula. The clinical method is also a quick, effective and inexpensive technique in calculating the fetal weight even by less experienced person especially in areas of low resource setting.The present study suggests that the Handlock method should be the preferred method for ultrasound estimation of fetal weight.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Radhika M. Comparative study of clinical assessment of fetal weight estimation using Johnson's formula and ultrasonographic assessment using Handlock's formula at or near term and its correlation with its actual birth weight. Int J Reprod Contracept Obstet Gynecol 2024;13:594-8.