

Johnsons Technique versus Hadlock – A Comparative Study to Estimate Foetus Weight

Aparna Chowdary Chaliki¹, Rajesh Nekkanti², Sunil Chowdary Chaliki³, T Jaya Chandra⁴

¹Assistant Professor, Department of Obstetrics and Gynaecology, GSL Medical College, Rajahmundry

²Assistant Professor, Department of Orthopedics, GSL Medical College, Rajahmundry

³Associate Professor, Department General Surgery, GSL Medical College, Rajahmundry

⁴Professor, Department of Microbiology, GSL Medical College

Received: 23-08-2022 / Revised: 26-09-2022 / Accepted: 10-10-2022

Corresponding author: Dr. Aparna Chowdary Chaliki

Conflict of interest: Nil

Abstract

Introduction: Birth weight is one of the most significant determinants of neonatal growth and development. The present study was conducted to find the accuracy clinical method to estimate foetal weight (FW) and comparison with ultrasound.

Materials and Methods: This was a prospective, comparative study conducted for 2 years. Study protocol was approved by the ethical committee of institution. Women those submitted informed consent, with singleton pregnancy, without any maternal complications, known gestational age, cephalic presentation were included in this research. Johnson's formula was used to estimate the FW. Then the participant was then sent to the Radio diagnostics for an obstetric ultrasound scan with the help of real time B mode scan equipment; biparietal diameter (BPD), femur length (FL), abdominal circumference (AC) were considered by Hadlock's reference table for FW. Baby was weighed within 2 hours of delivery using spring balance. The data was expressed in mean and standard deviation (SD) and association was estimated using one way ANOVA test, post hoc test; $P < 0.05$ was considered statistically significant.

Results: Total 100 antenatal women were included, majority were in 21 – 25 years (57%). The mean % error between Johnson and Hadlock techniques was not statistically significant. Statistically there was significant positive correlation between the actual birth weight with Johnsons ($r = 0.730$, $P < 0.05$) and Hadlock ($r = 0.891$, $p = 0.000 < 0.05$) techniques, respectively.

Conclusion: In low and middle income countries such as India, do not require modern technology. An efficient clinician in predicting birth weight by Johnson's formula is sufficient. This play an important role in labour management.

Keywords: Foetus, Weight, technique, significant

This is an Open Access article that uses a fund-ing model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Growth is the basic fundamental event of life. Birth weight is one of the most significant determinants of neonatal growth

and development. Due to the abnormalities of labour and neonatal complications due to the extreme birth weight, antenatal

estimation of foetal weight is important. The accurate estimation of foetal weight (FW) helpful in the management, counselling and optimal route of delivery. Hence the fetal weight estimation (FWE) is included as a routine parameter in the antepartum evaluation [1]. Objective techniques such as Johnson's formula using fundal height and maternal abdominal girth used for FEW [2,3]. Utility of clinical methods for FWE are limited, few studies only available [4,5]. The present study was conducted to find the accuracy clinical method to estimate FW and comparison with ultrasound.

Materials and Methods

This was a prospective, comparative study, carried in the department of Obstetrics and Gynecology, Navodaya Medical College Hospital & Research Centre. Study was conducted for 2 years, September 2015 to 2017. Study protocol was approved by the ethical committee of institution.

Women those submitted informed consent, with singleton pregnancy, without any maternal complications, known gestational age, cephalic presentation were included in this research. Obese women, polyhydramnios, ruptured membrane, abnormal position, antepartum haemorrhage, eclampsia, congenital abnormalities, with uterine or adnexal pathology and the noncooperative women were not considered in this research. Based on the birth weight, the new borns were divided into 4 groups; ≤ 2499 gms were

group 1, group 2 comprises 2500 – 2999 gms, 300 – 3499 gms in group 3 and those with >3500 gms were group 4.

Johnsons formula was used to estimate the FW [6]. Then the participant was then sent to the Radio diagnostics for an obstetric ultrasound scan with the help of real time B mode scan equipment, model logic & 100 and sonace – 6000 - C JDS medison. This equipment uses a convex 3.5MHz transducer for the sonographic measurement of the diameter of foetus head, biparietal diameter (BPD), femur length (FL), circumference of the abdomen (AC). BPD, AC, FL values were considered by Hadlock's reference table which gives an automatic value of FW using ultrasound [7-9].

Baby was weighed within 2 hours of delivery using spring balance. The participants were delivered within a week of ultrasound examination and clinical estimation of FW. Then the actual FW was compared with the weight estimated using Johnsons formula and ultra sound.

Statistical Analysis

The data were analysed using MS excel sheet and SPSS 21.0 version. Qualitative data was expressed in proportions; chi square and Fischers exact were used to find the association. The quantitative data was presented in mean and standard deviation (SD); ANOVA test, post hoc test (Tukeys HSD) were used to find the association; $P < 0.05$ was considered statistically significant.

Results

Table 1: Comparison of actual fetal birth weight with Johnsons and Hadlock techniques.

Technique used	Mean	SD
Actual weight	2980.25	241.19
Johnsons	3035.82	301.90
Hedlock	3023.36	271.51
Statistical analysis	F = 1.144; P>0.05	
	Statistically not significant	

Table 2: Average error in the foetal weight among the groups in two technique

Group	Johnsons			Hedlock		
	Mean	SD	SE	Mean	SD	SE
Group 2	2849.45	285.77	45.18	2810.48	220.26	34.83
Group 3	3143.78	231.71	30.43	3151.02	188.17	24.71
Group 4	3632.50	24.75	17.50	3579.00	111.72	79.00
Mean % error	1.86			1.44		
Mean absolute error	0.06			0.04		

Total 100 antenatal women were included in this research, the mean age of the participants was 22.25, the mean gestational age was 38.33±1.131 weeks. Majority of the participants were in 21 – 25 years (57%) and primigravidae (62%). Statistically didn't find significant difference with actual birth weight, clinical as well as USG readings (Table 1).

In Johns techniques, the standard error (SE) was 45.18, 30.43 and 17.50, respectively in the groups. Whereas it was 34.83, 24.71 and 79.00, respectively (Table 2). The mean % error between Johnson and Hadlock techniques was not statistically significant. Statistically there was significant positive correlation between the actual birth weight with Johnsons ($r = 0.730$, $P < 0.05$) and Hadlock ($r = 0.891$, $p = 0.000 < 0.05$) techniques, respectively.

Discussion

Accurate prediction of FW is very important for the specialist because it cannot be measured directly. As per Taylor and Ward [10] for the survival of the fetus, FW is the greatest as well as single factor. Mean age of the women in this study was 22.25 years and 31 members were ≤ 20 years. With this, it is clear that high prevalence of teenage pregnancy in this region. Whereas the mean was reported to be 24.7 years [11].

Ultrasound has revolutionized the knowledge of fetal medicine, utility had been increased in the past decade. In diagnostics, it helps in FW prediction with great degree of precision [12,13].

Measurement by using the linear or planar or both of fetal dimensions in utero is the greatest advantage of this technique. Whereas in high risk pregnancy, MRI is being practiced [14] Biparietal diameter (BPD) is also popularly discussed technique in this context [15]. In this research the mean±SD of actual FW was 2980.25±241.19 kgs. Whereas it was 3035.82±301.90 kgs in Johns techniques and 3023.36±271.51 kgs in hadlock technique; statistically there was no significant difference ($F = 1.144$; $P > 0.05$); (Table 1).

Similar findings were reported by Tiwari *et al* [16] So it is clear that the actual FW was almost similar with the techniques used in this research. As per the research findings, estimation of FW using clinical method was accurate as that ultrasonographic technique. However, the clinical method overestimated FW compared to the ultrasonic technique.

In this study, 3 measures of accuracy, actual foetus weight, the mean % of error and the mean absolute % error were used for the statistical analysis. But the mean % error can mislead because it is total of positive and negative deviations from actual foetus weight. Hence there was some reduction between the actual birth weight and estimated weight. When the mean error in the techniques were compared, in group 2 and 3, it was less in Johns technique, respectively.

Whereas in group 4, the mean error was more (Table 2); statistically there was no significant difference, respectively in groups. In a study by Shittu *et al.*, the mean

absolute % error was 9.7% and 9.9%, respectively; higher error was reported in ultrasonographic method but there was no significant difference [17]. Whereas, in another report, the mean absolute percentage error was reported to be lower in ultrasound method and the difference was not statistically significant. Improvement in skill and the quality of machine used for ultrasound were reported to be the reasons by the investigators [18].

Conclusion

In low and middle income countries such as India, do not require modern technology. An efficient clinician in predicting birth weight by Johnson's formula is sufficient. This play an important role in labour management.

References

- Shittu AS, Kuti O, Orji EO, *et al.* Clinical versus Sonographic Estimation of Foetal Weight in Southwest Nigeria. *Journal of Health, Population, and Nutrition.* 2007; 25(1): 14 – 23.
- Johnson RW, Toshach CE. Estimation of Fetal Weight Using Longitudinal Mensuration. *Am J Obstet Gynecol.* 1954; 68(3): 891 – 6.
- Dare FO, Ademowore AS, Ifatureti OO, Nganwuchu A. The Value of Symphysio-Fundal Height/Abdominal Girth Measurements in Predicting Fetal Weight. *Int J Gynaecol Obstet.* 1990; 31(3): 243 – 8.
3. Cury AF, Garcia SAL. Estimativa Do Peso Fetal: Comparação Entre Um Método Clínico E A Ultra-Sonografia. [Estimation of Fetal Weight: Comparison between a Clinical Method and Ultrasonography]. *Rev Bras Ginecol Obstet.* 1998; 20(10): 551 – 5.
4. Banerjee K, Mittal S, Kumar S. Clinical Vs. Ultrasound Evaluation of Fetal Weight. *Int J Gynaecol Obstet.* 2004; 86(1): 41 – 3.
- Yomibo-Sofolahan TA, Ariba AJ, Abiodun O, Egunjobi AO, Ojo OS. Reliability of a clinical method in estimating foetal weight and predicting route of delivery in term parturient monitored at a voluntary agency hospital in Southwest Nigeria. *Afr J Prim Health Care Fam Med.* 2021; 13(1): e1 – e6.
- Sovio U, Smith GCS. Comparison of estimated fetal weight percentiles near term for predicting extremes of birthweight percentile. *Am J Obstet Gynecol.* 2021; 224(3): 292.e1-292.e19.
- Hadlock F.P, Harrist R.B, Sharman R.S, Deter R.L, Park S.K. Estimation of fetal weight with the use of head, body, and femur measurements—a prospective study. *Am J Obstet Gynecol.* 1985; 151: 333 – 7
- Hadlock FP, Harrist RB, Martinez-Poyer J. In utero analysis of fetal growth: a sonographic weight standard. *Radiology.* 1991; 181: 129 – 33.
- Aruna S, Yalla S, Yellayi ASS, Bai KS. Estimation of Fetal Weight by Clinical Methods and Ultrasound and Correlating its Accuracy with Actual Birth Weight in Term Pregnancies. *Int J Sci Stud* 2017; 5(4): 265 – 9.
- Kumari A, Kumar K, Kumar Sinha A. The Pattern of Valvular Heart Diseases in India During Pregnancy and Its Outcomes. *Cureus.* 2021; 13(7): e16394.
- R. Sowjanya, S. Lavanya. Comparative Study Of Clinical Assessment Of Fetal Weight Estimation Using Johnson's Formula And Ultrasonographic Assessment Using Hadlock's Formula At Or Near Term. *IOSR Journal of Dental and Medical Sciences:* 14(4): 20 – 3.
- Wikstrom I, Bergstrom R, Bakketeig L, Jacobsen G, Lindmark G. Prediction of high birthweight from maternal characteristics, symphysis fundal height and ultrasound biometry. *Gynecol Obstet Invest.* 1993; 35(1): 27 – 33.
- Uotila J, Dastidar P, Hannone T, Ryymin R, Punonen R, Laasonan E. Magnetic Resonance Imaging Compared

- To Ultrasonography In Fetal Weight And Volume Estimation In Diabetic And Normal Pregnancy. *Acta Obstet Gynaecol Scand.* 2000; 79: 255 – 9.
15. Donald and T. G. Brown, —Demonstration of Tissue Interfaces within the Body by Ultrasonic Echo Sounding, *British journal of Radiology* 34 (1961): 539—45.
16. Tiwari R, Sood M. Comparative study of various methods of fetal weight estimation at term pregnancy. *J Obstet Gynecol India* 1989; 39: 279 – 86
17. A. S. Shittu, O. Kuti, E. O. Orji *et al.* Clinical versus sonographic estimation of fetal weight in southwest Nigeria. *J. Of Heal. Popul. and Nutriti.* 2007; 25 (1): 14 – 23.
18. Charles Njoku, Cajethan Emechebe, Patience Odusolu, Sylvestre Abeshi, Chinedu Chukwu, John Ekabua, "Determination of Accuracy of Fetal Weight Using Ultrasound and Clinical Fetal Weight Estimations in Calabar South, South Nigeria. *Int. Sch. Res. Notic.* 2014; 32: 82 – 8.