



Original Research Article

Johnson's formula to compare fetal weight with actual birth weight

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ARTICLE INFO

Article history:

Received 18-02-2020

Accepted 19-03-2020

Available online 15-06-2020

Keywords:

Birth weight

Birth weight estimation

Johnson's formulae

Symphysis-fundal height

ABSTRACT

Introduction: Accurate fetal weight assessment is a problem which is associated where resources are subject to availability. Both low and high birth weight is connected with augmented prospect of complications of new born during labour and puerperium. Fetal weight assessment can reduce the risk of complications that are challenging in maternal and neonatal of Symphysis-fundal height measurement by adopting Johnson's Formula. For the fetal weight estimation a method that has now come to be prevalent. By adopting Johnson's formula along with its comparison to the actual birth weight. The present study thus aimed to determine fetal weight accuracy.

Materials and Methods: Present study of prospective analytical was accepted to in the Obstetrics and Gynaecology Department of a tertiary care hospital in Pune. Study included a total of 500 pregnant women attending the OPD with full term pregnancy till onset of labour, fulfilling the inclusion criteria. Adopting Johnson's formula birth weight estimation has been done along with the results were correlated with definite birth weight. Using SPSS ver. 21.0 the analysis of Data had been performed.

Results: As per the prediction of Mean birth weight by clinical (Johnson's formulae) and actual birth weight was 3.13 Kg and 2.89 Kg correspondingly. Johnson's formulae's co-relates well with actual birth weight ($r=0.86$; 95% CI: 0.84-0.88), though prediction of fetal weight was slightly on a higher side. In 60.8% cases the difference was within range of 10% and in 84.8% the difference was less than 15%. The mean difference in estimation was highest in babies those are in low birth weight i.e. <2.5 Kg.

Conclusion: Our observation indicates that as a diagnostic tool there is visibly a role for clinical birthweight estimation, in a pregnancy term suggesting that, to manage labour as well as delivery clinical estimation is sufficient.

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1. Introduction

Precise fetal weight assessment is a problem which is associated where resources are low or subject to availability, especially in developing country like ours where major population still resides in rural area. From a multifactorial perspective the analysis of birth weight must be recognised.¹ Antenatal care aims on identifying large and small gestational age fetuses, since they are always at the perinatal mortality or morbidity risk. By decreasing the complications linked to the birth or excessively large or small foetus that needs precise weight estimation of the foetus prior

to the delivery decision.² Restricted growth of both the intrauterine as well as macrosomia benefits the foetuses through evaluating the weight which could also diminish the risk of complications during maternal and neonatal.³ With small foetuses, foetal demise, birth asphyxia, neonatal hypothermia and hypoglycaemia and meconium aspiration all are increased not only due to the small size, the organs of the foetus but also functions sub-maturely.⁴ In childhood there is a subtle impairment in cognitive performance and educational performance reported in these children.⁵ Complications spanning up to long durations also includes high risk of stroke, dyslipidaemia, Type II diabetes mellitus, hypertension, or coronary heart diseases. Chronic lung disease or bronchopulmonary dysplasia is

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also more common in IUGR infants. IUGR also has direct effect on developing kidneys.⁶ Macrosomic fetuses suffer many complications linked to the delivery during birth that is comprised of intra-partum asphyxia, bony injuries, brachial plexus injuries, shoulder dystocia, and other maternal issues like postpartum haemorrhage, pelvic floor injuries, or birth canal injuries.⁷ The cephalopelvic disproportion occurrence is highly frequent due to the increasing foetus size and also is a contributing factor for caesarean delivery or operative vaginal when opposed to the normal weighing fetuses. Macrosomic or LGA foetus pose a complication for both mother as well as themselves. Mainly 2 usual methods of birth weight estimation are: clinical palpation and sonographic evaluation.⁸ By the abdominal palpation the fetal weight estimation (by means of Leopold's maneuvers) is personal and thus difficult for young physicians.⁹ Whereas, for the fetal weight estimation by clinical approach using fundal height are the easy objective along with.⁹

For the fetal weight estimation numerous clinical formulas like Johnson's formula and Dawns, Dare's, Risanto's formula have been used. Moreover, one of the approaches is there for the measurement of SFH which has now found to be prevalent for the fetal weight estimation by means of the Johnson's Formula since it is inexpensive and readily available with the help of nonelastic measuring tape. Though sonography is accurate, it is costly and entails to have special skill as used in terms of a screening tool for the detection of abnormal growth but since in our nation most of the population is rural oriented therefore women from poor resource settings lack access to reliable method of fetal weight estimation because of lack of sonography techniques. Pregnancies with lower risk a recommendation is made regarding the SFH: Symphysio-Fundal Height measurement which is a screening tool, used at initial levels and is not much expensive.¹⁰⁻¹²

Thus, Clinical efficacy in partaking a usual minimal cost, for the term birth weight prediction a non-invasive method in direction to recognize irregular growth along with to diminish the adverse perinatal outcome risk.

So, the present study aim was to regulate the fetal weight precision by means of Johnson's formula and comparing it as per the definite birth weight.

2. Materials and Methods

The study of present prospective analytical has been supported by "the Department of Obstetrics and Gynaecology of tertiary care hospital in Pune. Study included a total of 500 pregnant women attending the OPD with full term pregnancy till onset of labour, fulfilling the inclusion criteria.

2.1. Inclusion criteria

1. Pregnancy with singleton fetus
2. Vertex presentation

2.2. Exclusion criteria

1. Patients with sonographically diagnosed IUGR
2. Pregnancy with complicated chronic disease
3. Pregnancy with diagnosed oligohydramnios and polyhydramnios
4. Pregnancy with Intra uterine death
5. Pregnancy with uterine or abdominal mass
6. By the pre-eclampsia/eclampsia, HELLP syndrome no earlier pregnancy have been affected
7. Patients with LMP not known or unsure of LMP or patients with lactational conception

2.3. Methodology

In the following ways the data for the given study has been attained:

1. By detailed clinical history, abdominal and pelvic examination
2. By fundal height measurement and station identification
3. By fetal weight calculation using Johnson's clinical formula
4. By measuring outcome (weight of fetus)

2.4. Fundal height measurement

Firstly, patient need to empty their bladder also by means of non - elastic, a flexible, standard sewing measuring tape in centimetres symphysio fundal height has been measured. For the measurement's patient have to lie flat over her back by letting her legs extended. The measurement of the fundal height has been from center of the pubic symphysis upper border to the uterine fundus peak point.

2.5. Station Identification

A technique having "five-level is utilized for station designation. When doing a vaginal observation, probably the lowermost part of the" existing fetal component is actually over the ischial spines level. It's specified as actually set at 0 (zero) "station. Levels over the spines are actually specified in centimetre using stations of negative values, -2, -1, -3. Levels beneath the spines are actually specified in positive value, +1, +2, +3 facilities, right downcast to the pelvic floor.

2.6. Johnsons formula

Fetal weight in grams = (symphysio fundal height in cm – 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” +1¹³

2.7. Fetal Outcome (weight in grams)

In the delivery room the actual weight has been retrieved either delivered normally or if delivered by cesarean section, in operation theatre. As per the scale which was properly balanced the baby has been placed unclothed in the centre of it. In grams the weight has been verified.

3. Data analysis

In terms of mean (\pm SD), frequencies (in numeral cases) along with appropriate percentages of the data has been defined statistically. The Pearson correlation was used to test the level of correlation amid of the weight estimation by Johnson’s formulae and actual weight. For the efficacy evaluation the Linear Regression analysis has been carried out as per the Johnson’s formulae as a birth weight predictor. As per the statistically substantial probability value (p value) minimal to 0.05 has been measured. Using the computer programs all the statistical calculations has been done“ SPSS (Statistical Package for the Social Science; SPSS Inc., Chicago, IL, USA) version 21 and Microsoft Excel 2007” (Microsoft Corporation, NY, USA).

4. Results

Mean birth weight as prophesied through clinical (Johnson’s formulae) subsequently the actual birth weight was 3.13 Kg and 2.89 Kg correspondingly (Tables 1 and 2). Johnson’s formulae’s co-relates well with actual birth weight (r-0.86; 95% CI: 0.84-0.88), though prediction of fetal weight was slightly on a higher side. The least correlation was reported in cases with weight <2.5 kg (r-0.36; 95% CI: 0.14-0.55) (Table 3). Between the clinical as well as the actual birth weight the mean variance was an overestimation of 0.234 Kg i.e. an error of 8.1%. In 60.8% cases the difference was within range of 10% and in 84.8% the difference was less than 15%. In 94% of the cases the difference in weight estimation was less than 500 grams. The mean difference in estimation was highest in the babies having low birth weight i.e. <2.5 Kg. The mean difference in weight categories was 441 grams in <2.5 kg, 236 grams in 2.5-3 kg, 236 grams in 3-3.5 kg and 269 grams in > 3.5 Kg group (Tables 4 and 5).

Table 1: Mean weight by Johnson’s formulae and actual birth weight

Group	SD	Mean	Mean difference	% age diff
Birth Weight	500 0.38	2.895	0.23(0.19-0.28)	8.1%
Johnson Formulae	500 0.344	3.1		

Table 2: Birth weight distribution by actual birth weight and Johnson’s formulae

Actual Weight	Johnson’s Weight
BW	%
<2	0 0.0%
2-2.5	3 0.6%
2.5-3	224 44.8%
3-3.5	180 36.0%
> 3.5	93 18.6%
Total	500 100.0%

Table 3: Correlation between Johnson’s formulae and actual birth weight

Group	r- value	95% CI
2 - 2.5	0.36	0.14-0.55
2.5 - 3	0.56	0.46-0.64
3 - 3.5	0.66	0.56-0.73
> 3.5	0.36	-0.67
Total	0.86	0.84-0.88

Table 4: Absolute error in Johnson’s formulae for prediction of actual birth weight

Absolute error (gms)	
< 0.15	87
0.15 - 0.25	148
0.25 - 0.35	146
0.35 - 0.50	89
>0.50	30
Total	500

Table 5: Percentage error in Johnson’s formulae for prediction of actual birth weight

Percentage error categories	
< 5	97
5-10	207
10-15	120
15 - 20	42
20 - 25	19
25 - 30	5
30 - 40	10
Total	500

5. Discussion

To estimate weight of the fetal this is a routine obstetric practice through measuring the height of symphysio-fundal on every antenatal call along with to discuss on for a sonographic valuation if it fluctuates from the usual range to the evolution.

In the clinical practice the fetal weight estimation is rarely done by abdomen palpation. As we have derived to heavily depend on frequently readily accessible ultrasonography.¹⁴

As per the initial expectation of this method to provide standard for the objective to identify the abnormal size foetuses for evolutionary age that has been currently destabilized through the prospective studies. It represented that for predicting the foetal weight clinical palpation is better than that of the sonographic estimates.^{15–18}

In comparison to an assessed single examination the evaluation viewed that different biometric of obstetric sonographic foetal might be superior and has found to be helpful.^{15,19} Numerous well-known technical limitations are there for analysing foetal weight using sonographic technique. Amongst these given are as oligohydramnios, “maternal obesity, and anterior placentation. There are other drawbacks of ultrasonography that is equally complicated as well as labour intensive, being limited” as in potential manner by foetal structure’s suboptimal consideration. Expensive specially trained personnel along with the sonographic equipment is also required by this. Although in developed countries such costly imaging equipment is extensively available, is generally “this is not the terms in developing nations alike ours where the scarce of medical resources” exists.^{19,20}

As per the numerous approaches of the estimation of fetal weight, different results were noticed for the accuracy estimation. Humphries et al. presented the birth weight estimation accuracies, with both clinical as well as ultrasound, were still moderately low.²¹ Some studies of the EFW presented the ultrasound has been the finest EFW method, particularly in preterm fetuses,^{22–24} but further studies had not determined any difference amid of the given methods.^{25–28}

At term other studies have been conveyed imperfect precision of ultrasound EFW, mainly in macrosomic fetuses.^{23,29} Baum et al. at term determined that no benefit ultrasound offered over clinical approximations of fetal weight.²⁶ Equally validation is viewed for the Clinical estimation, especially for realistic in the light of the requirement, attainable standards. Differing outcomes have been seen about the precision of the numerous techniques of fetal bodyweight estimation. It was demonstrated that the birth weight judgement accuracies, mutually clinical as well as ultrasound, were so far impartially small Humphries et al.²¹

Specific tests presented the ultrasound was the best ways for EFW, especially in preterm fetuses^{22,24} although other scientific tests did not conclude a little difference between the possibilities.^{25,28} Especially in macrosomic fetuses numerous other researches has been renowned limited accuracy of ultrasound EFW in term.^{23,29} It was determined that over clinical estimates ultrasound provided absolutely zero benefit at phrase of fetal weight Baum et al.²⁶ For practical Clinical estimates should be perceived as likewise legitimate, specifically in the demand lighting, possible standards.

Clinically various calculations and formulae (Johnson’s, Dawn’s, Dare’s and Risanto’s formula) based on the measurement of uterine fundal height over symphysis pubis was been created. Moreover, SFH measurement came as from the different methods that now seem as popular for the fetal weight estimation using Johnson’s Formula since it is inexpensive and readily available with the help of non-elastic measuring tape.

In present study, we thus aimed at the comparison of expected fetal weight as per the actual birth weight by assessing symphysio-fundal height in antenatal women with >37weeks pregnancy by using Johnson’s formula. By clinical (Johnson’s formulae) “the mean birth weight is to be prophesied and actual birth weight” was 3.13 Kg and 2.89 Kg correspondingly.

Our study findings are as per the analysis of Shittu et al.,³⁰ where the mean of birth weight as prophesied through Clinical method was 3.29 while the mean actual birth weight remained 3.25 Kg. In a similar study Siddiqua S et al.,³¹ observed the weight by clinical method as 3.59 kg while the definite birth weight remained 3.22 Kg. Bhandary A et al.³² in their study also observed mean birth weight with clinical method as 3.11 and actual birth weight as 2.99 Kg. Pravin Z et al.³³ in a similar study in Bangladesh mean birth weight as prophesied by clinical (Johnson’s formulae) as well as the actual birth weight as 3.08 Kg and 2.99 Kg respectively.

In present study, on correlation analysis, Johnson’s formulae’s co-relates well with actual birth weight ($r=0.86$; 95% CI: 0.84-0.88), though prediction of fetal weight was slightly on a higher side. The least correlation was reported in cases with weight <2.5 kg ($r=0.36$; 95% CI: 0.14-0.55).

In a similar study by Shittu AS et al.,³⁰ also observed excellent correlation ($r=0.78$; $p<0.01$) with most accurate results in birthweight’s middle range (2,500-<4,000 gm). The correlation coefficient of clinical estimation in present study is also differentiable as that of Dare et al. ($r=0.74$; $p<0.01$) in an analogous population.³⁴ Correlation analysis amid “of the fetal weight and the actual birth weight” (Johnson’s Formula) by Pravin et al.,³³ knowingly discovered that the correlation of the “actual birth weight with fetal weight (found by Johnson’s Formula).” However, the correlation was weak for babies less than 2.5 Kg and more than 4.0 kg. Joshi et al.³⁵ in their study also observed

strong positive correlation “($p < 0.001$) between actual birth weight in comparison to the clinical” approach.

In addition, Stanislaw and Nahum discovered which the usage of ultrasonography had mostly no more precise compared to estimation that’s based exclusively on quantitative evaluation of maternal as well as the pregnancy certain qualities.²⁸ Chauhan et al.,³⁶ in the comparability of theirs of precision of the two techniques, observed absolutely no advantage in acquiring a sonographic estimation, since the accuracy of it is no superior to that of the clinical approach.

In present study, the mean variance between clinical as well as the actual birth weight remained an overestimation of 0.234 Kg i.e. an error of 8.1%. In 60.8% cases the difference was within range of 10% and in 84.8% the difference was less than 15%. In 94% of the cases the difference in weight estimation was less than 500 gms. The mean difference in estimation was highest in babies having “low birth weight i.e. <2.5 Kg.” The mean difference in weight categories was 441 grams in <2.5 kg, 236 grams in 2.5-3 kg, 236 grams in 3-3.5 kg and 269 grams in > 3.5 Kg group.

Shittu et al.³⁰ also observed that, in their study set, the actual birthweight is clinically overestimated systematically used method (+) 400 gm. Bhandary Amritha et al.³² found the average error of (+) 120 gm by clinical method. In a study by Siddiqua et al.,³¹ the average error of (+) 343 gm.³⁷ In the study, Tiwari and Sood³⁸ presented an average error of (+) 327.3 gm by clinical method.

Sherman et al. conveyed“ that the estimation rates of within 10% of birth weight as 72% by clinical method.²³ Shittu et al. stated that within 10% of birth weight rates of estimates as 70% by clinical method.³⁰ However, in <2.5 Kg weight category this estimate fell to only 41.7%. Regardless of the variations in review design, the results are actually in consonance with individuals described by others that the precision of clinical opinion of birthweight is great. The experiments “by Hendrix et al. as well as Raman et al. proved that clinical opinion was” much high precise compared to sonographic estimate.^{29,39} Sherman et al.²³ and Titapantet al.¹⁷ in their studies observed that ultrasonic estimate is much more precise only in terms of low birthweight. Amid of the two methods no substantial variance was observed even at extremes of birthweight at term Watson et al.⁴⁰ The primary issue associated to the computation of calculated fetal “weight by Johnson’s Formula was, it” wasn’t meaningfully precise babies having low birth weight. Furthermore, the end result suggested that calculated the weight of the fetal by adopting Johnson’s Formula had an inclination in the direction of birth weight estimation, particularly in low birth weight cases. However, the difference was less than 10% in majority of the cases.

6. Conclusion

The observation means there’s clearly a contribution for clinical of birthweight estimation as a device of analysis,

signifying that clinical estimation is actually adequate to handle delivery and labour for a phrase pregnancy. Even in macrosomic foetus weight estimation for decision making concerning towards labour trials, no benefit appears to be there for gaining a regular sonographic birthweight. The role of estimation in the ultrasonographic seems that, when clinically it was estimated as the proposes weight is less “than <2,500 g, right after sonographic estimation may deliver a much better prediction as well as would be” additionally essential to evaluate these kinds of fetuses for congenital malformation as well as to complete the biophysical profile to figure out as the foetus well-being. The above-mentioned observations have crucial inference for developing nations such as ours in which there’s absence “of technologically-advanced ultrasound devices capable of performing advanced capabilities such as for instance foetal weight but has a faced clinician” that might conduct the functionality likewise properly.

7. Source of Funding

None.

8. Conflict of Interest

None.

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Cite this article: Sehrawat K, Panchanadikar TM. Johnson's formula to compare fetal weight with actual birth weight. *Indian J Obstet Gynecol Res* 2020;7(2):147-152.