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Comparative Evaluation between Two Clinical Methods of Fetal Weight Estimation with Actual Birth weight – A Prospective Study

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Abstract: ***Objective: Comparative evaluation of fetal weight using two clinical methods- Johnson's and Dare's formulae to the actual birth weight of the baby. Methods : Thefetal weight in utero was estimated in 150 antenatal women at term using two clinical formulae- Johnson's and Dare's and compared with actual birth weight of the baby - comparative analysis done. Results: Demographic data like age, gravidity analysed. Average error and maximum error of the two clinical methods in each group calculated. In 95% of cases, fetal weight was within 15% error with both clinical methods. Conclusion: 85.5% of total cases were in the group of fetal weight 2500-3500 grams most commonly seen in the routine practice and in this group both the clinical methods had reasonable accuracy in estimating fetal weight.***

Keywords: Estimated fetal weight, Symphysio - fundal height, Abdominal girth, Johnson's formula, Dare's formula

1. Introduction

Accurate estimation of fetal weight is very important in the ante partum and intrapartum management of pregnancy[1] along with gestational age and adequacy of maternal pelvis to decide management of labor and mode of delivery. Fetal weight estimation has been incorporated in the standard antepartum evaluation[2] .In the third trimester the estimated fetal weight is used to detect growth abnormalities like low birth weight babies or macrosomic babies. Low birth weight babies may be small for gestational age, intra uterine growth restriction or preterm babies, they are associated with increased perinatal morbidity and mortality[3]. Large babies are large for gestational age or macrosomic babies of diabetic mothers,who may land up with complications like brachial plexus injuries, facial palsies, birth canal injuries, post-partum haemorrhage.[4] Estimation of fetal weight is also important in breech deliveries and vaginal birth after caesarean section.

Identification of at risk fetus represents one of the main problems in the modern obstetrics, inspite of clinical, biochemical and ultrasonography techniques available .Once a clinically important deviation from normal fetal growth is defined, serial monitoring of the fetus to know its intrauterine environment helps to guide the obstetrician towards the appropriate timing and mode of delivery.

Fetal weight estimation by ultrasonogram is one of the most sensitive method for estimating fetal weight, Ultrasound determines fetal weight with error ranging from ±6-11% [5]. But it is not readily available as a screening method in many hospitals and low resource settings.Therefore it is essential to study the reliability of clinical estimation of fetal weight in assisting decision making. Simple and reliable clinical methods of fetal weight estimation are useful world-wide, particularly in developing countries, where high cost equipment, infrastructure and trained personnel are scarce. The objective of the study is comparative evaluation of the fetal weight using two clinical methods – Johnson's formula and Dare's formula to the actual birth weight of the baby.

2. Material &Methods

It is a prospective comparative study.

In this study 150 cases were analysed after taking required measurements by the residents posted in the labour room at JN Medical college Hospital, Belgaum.

Inclusion criteria :
1) Full term pregnancy
2) Singleton pregnancy
3) Cephalic presentation
4) Low risk pregnancy
5) Both spontaneous labour and induced labour.

Exclusion criteria :
1) Multiple gestation
2) Abnormal presentation
3) High risk pregnancy- pre eclampsia, Gestational diabetes mellitus, polyhydramnios, Intra uterine growth restriction
4) Premature rupture of membranes
5) Preterm labour

Patients who met the inclusion criteria were explained the procedure and verbal consent was taken. They were asked to void urine before taking measurements. Patient placed in dorsal position, Dextro rotation of uterus corrected with the palmar aspect of left hand. Person taking the measurements stood on the right side of the patient, Palpation was started from the xiphisternum downwards by the ulnar border of the hand, the first resistance felt was noted asa variable point i.e.,

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fundal point noted. Fixed point – the symphys is pubis was palpated next. With a flexible measuring tape the distance between two points measured keeping the inches on the top. Measurements were taken from the variable point to the fixed point. The tape was then turned to note the symphysiofundal height (SFH) in centimeters. Abdominalgirth (AG) taken next at the level of umbilicus keeping the inches on top and the same was noted in centimeters. Two clinical formulae used to calculate the estimated birth weight of the fetus.

a) Johnson's formula - (SFH-n)×155=Estimatedfetal weight (EFW) in grams,
n= 12 (station above the ischialspines), n= 11 (station below the ischial spines)

b) Dare's formula - SFH ×AG = EFW in grams
Both clinical formulae were used to calculate the fetal weight in grams and compared with the actual birth weight of the baby.

3. Statistical Analysis

Data obtained was tabulated and analysed using percentages, mean, averages to obtain the percentage errors, average errors of each clinical formula and the mean average error in all cases studied. Standard deviation was calculated using mean. Finally the correlation coefficient 'r' and 'p' values were calculated to know association between actual birth weight and the weights derived by the two clinical formulae and the significance of 'r' was tested by unpaired T test. Significant levelwas kept at 0.5(<0.5) for (p) and 0.7 for (r) value.

4. Results

Demographic data like age and gravida for 150 cases collected and mean calculated.

Table1: Age wise distribution.

Age (Years)	No. of cases (n= 150)
< 20	20
21-30	129
31-40	1

Age of the women ranges from 19 – 31 years, mean age – 23.45 years.

Table 2: Mean distribution of Gravidity

Gravida	No. of cases (n=150)
Primi	95
G2	35
G3	17
>G4	3

Mean gravidity – 1.5

Table 3: Distribution of cases according to actual birth weight of the baby

Birth weight (grams)	No. of cases (n=150)	%
2000-2500	20	13.3
2501-3000	92	61.4
3001-3500	36	24
>3500	02	1.3

Maximum number of cases were in the group with fetal weight 2501- 3000 grams. Only 1.3% of babies were greater than 3500 grams

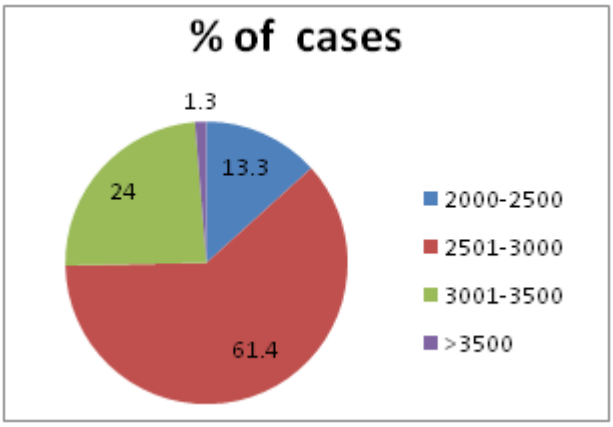


Figure 1: Percentage of cases according to actual birth weight of the baby

Table 4: Average error of the two clinical methods in each group

Birth weight distribution (grams)	Johnson's formula (grams)	Dare's formula (grams)
2000-2500	227	127.5
2501-3000	176.6	168.6
3001-3500	141.3	208.6
>3500	340	618

Average error is maximum in the group with birth weight > 3500 grams with both clinical formulae, 340 grams with Johnson's and 618 grams with Dare's. Overall average error – 177 grams with Johnson's and 178.7 grams with Dare'sformulae.

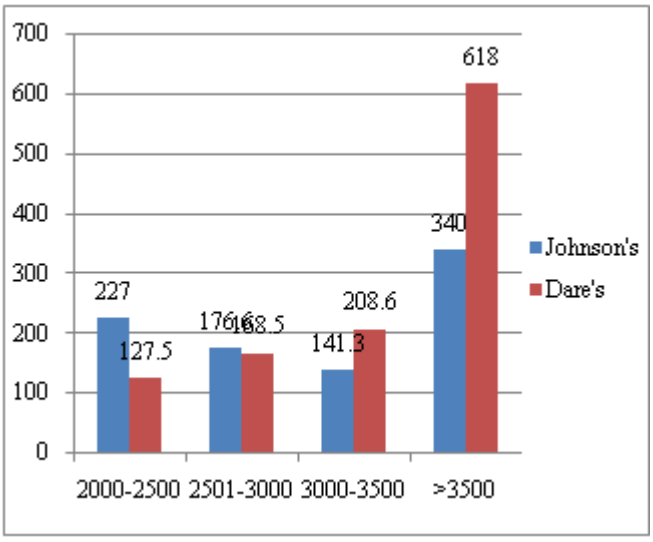


Figure 2: Graphical representation of average error of the two clinical methods in each group

Table 5: Maximum error in each group

Weight in grams	Johnson's formula	Dare's formula
2000-2500	450	294
2501-3000	756	645
3001-3500	365	420
>3500	340	648

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Table 6: Standard deviation of prediction errors Prediction error = X/Y
X=error in grams
Y= actual birth weight in grams

Formula	Standard deviation (grams)
Johnson's	140.44
Dare's	135.65

Standard deviation was calculated using the mean of the errors in each case and it was less with Dare's formula – 135.65 grams and the value with Johnson's formula was 140.44 grams

Table 7: Percentage Errors

% Errors	Johnson's formula	Dare's formula
Upto 5%	50%	46%
Upto 10%	76.7%	82.7%
Upto 15%	95.3%	96%
Upto 20%	99.3%	99.3%
Upto 25%	99.3%	100%

In 95% of all cases, fetal weight was within 15% error with clinical formulae, 95.3% and 96 % of cases with Johnson's and Dare's formula respectively. 75% of cases had percentage error of 10%.

Table 8: Correlation coefficient

Actual birth weight & Johnson's formula	r = 0.742 statistically significant	P= <0.001 statistically significant
Actual birth weight & Dare's formula	r = 0.726 statistically significant	P= <0.001 statistically significant

Statistical analysis with unpaired 'T' tests was carried out keeping standard [P] value of < 0.05 and [r] = 0.7 as significant.Both the clinical formulae correlated well with the birthweight, Dare's having a slightly closer correlation [r] value of 0.726 versus [r] = 0.742 for Johnson's formula. The [P] value < 0.001 was also found to be statistically significant.

5. Discussion

In the antepartum management of pregnancy at term exact estimation of fetal weight, gestational age and adequacy of maternal pelvis is very important to decide the mode of management of labour and delivery.From the beginning there are various methods of fetal weight estimation like mother's opinion, clinical estimation and ultrasound (USG) fetal weight estimation.

With the advent of USG,it has become a major role in assessing fetal weight, to rule out intra uterine growth retardation and macrosomia and plays a major role in deciding mode of delivery and time to induce labour. But in low resource settings , peripheral hospitals and midwifery units availability of USG , trained personnel to do and interpret it, is scarce .Even if USG is available, measurements are likely to be inaccurate if membranes ruptured and head engaged to get the correct planes.

In a study conducted by SP Chauhan etal concluded that a term parous woman in labor can estimate birth weight of fetus as accurate as clinicalestimation by physician or ultrasonography estimation of fetal weight.[6]A clinical estimation of birth weight by Leopold's manoeuvre requires experience.[7] There are various clinical formulae for calculation of fetal weight by measuring various parameters like symphysio-fundal height, abdominal circumference, eg., Johnson's formula [8] ,Dare's [9]and Dawn's [10]formulae, etc.

Clinical estimation of fetal weight by measuring SFH and AG using flexible measuring tape seems simple, cheap, readily available, non-invasive and acceptable to patients.If we are using Leopold's manoeuvre, it is tactile perception needs experience and inter observer variability is present.In clinical formula inter observer variability is small ranging from 0.52-1.72 cms.[11]

In the present study 150 term pregnant women included,61.4% cases actual birth weight is in the range 2501-3000grams.Only 1.3% i,e.,2 has birth weight greater than 3500 grams.The average error in both clinical groups is maximum in birth weight > 3500 grams. The average error in most common birth weight group i,e.,2501-3000grams is 176.6 and 168.6 grams by Johnson's and Dares formula respectively. The maximum error with Johnson's formula is maximum in group 2501-3000gms- 756 grams, whereas Dare's in the same group showed maximum error of 645 grams. In 95% of all 150 cases, fetal weight was within 15% error with both clinical formula – 95.3% in Johnson's and 96% in Dare's.

In our study both clinical methods of fetal weight estimation had overall correlation with actual birth weight r (correlation coefficient) was 0.742 with Johnson's and r = 0.726 with Dare's formula,which was statistically significant. The [p] value < 0.001 was also found statistically significant for each.The maximum error of 756 grams in 1 patient whose weight was more than 90 kgs, although our study did not consider BMI as exclusion criteria further studies towards this can be taken for modification of these formulae for better estimation.

In this study, if the fetal weight < 2500 grams in which Johnson's formula had a tendency to overestimate the fetal weight with average error of 227 grams. Dare's formula correlated better in this group with less error of 127.5 grams. Similarly in the group of fetal weight > 3500 grams the average error was maximum 340 grams with Johnson's and 618 grams with Dare's formula, but the limitation of this study ,only 2 cases fell in this category which itself explains the need for larger study.

In a clinical study conducted at Brazil where 100 patients studied, the mean error in calculatingfetal weight is less by palpation method than Johnson's formula.The estimation of actual birth weight±10% significantly higher in palpation method than Johnson's-65% Vs 38% [12] In study conducted by SP Chauhan etal error in estimation of birth weight is with in ±10% in 69.8%, 66.1%,42% cases by maternal estimation, clinical methods and sonogram respectively[6].In this study 76.7% and 82.7% cases had percentage error upto 10% in Johnson's and Dare's respectively.

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6. Conclusion

In group of 2000-2500 grams Johnson's and Dare's formula both had a tendency to overestimate. Both the formulae had maximum average error in fetal weight is >3500 grams.In this group there was a tendency to underestimate the birth weights.Fetal weight of 2500-3500 grams had the least average error. Hence both Johnson's and Dare's formulae correlated well with actual birth weight of the baby in this group.Fetal weight estimation needs to be ascertained by higher modalities like ultrasound for better accuracy in weight groups >3500 grams and < 2500 grams.

85.5% of total cases were in the group fetal weight 2500-3500 grams most commonly seen in routine practice and this group both clinical methods had a reasonable accuracy. These clinical methods are easy to learn, in expensive, simple, easy to apply, non-invasive,less inter observer variability therefore incorporated in routine clinical practice.

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