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Research Article

## Estimation of fetal weight in utero by Dawn's formula and Johnson's formula: a comparative study

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### ABSTRACT

**Background:** Survival of the premature infant has been shown to be related more to fetal weight than to any other consideration. A lot of work has been done to find out accurate methods for estimation of fetal size and weight in utero.

**Methods:** This study consists of total 200 case studies included patient of different parity all delivered in these hospitals either vaginally or by caesarian section. Two methods of estimation of birth weight were assessed and compared.

**Results:** 33.5% of cases were within  $\pm 100$ gms by Johnson's formula, whereas in Dawn's formula 51.5% cases were within +100 gm of actual birth weight. 73% of cases by Johnson's formula were within  $\pm 250$  gms and 88.5% of cases by Dawn's formula were within  $\pm 250$  gms of actual birth weight. 91% of cases by Johnson's formula and 99% of cases by Dawn's formula were within  $\pm 500$  gms of actual birth weight.

**Conclusions:** Dawn's formula was found to be more accurate (88.5% within  $\pm 250$  gms) than Johnson's formula (53.5% within  $\pm 250$  gms) in prediction of antenatal fetal weight.

**Keywords:** Birth weight, Johnson formula, Dawn formula

### INTRODUCTION

Estimation of fetal weight in utero has become increasing important in regard to the prevention of prematurity and in evaluation of fetopelvic disproportion where a large baby is suspected, induction of labour before term, in complications of pregnancy and detection of intrauterine growth retardation.

Survival of the premature infant has been shown to be related more too fetal weight than to any other consideration. Obstetrician is faced with estimation of the fetal weight when interruption of pregnancy is considered at a relatively elective time. These occasions arise with conservative management of placenta praevia, repeat

caesarean section, interruption of pregnancy in the treatment of toxemia and diabetes.

A lot of work has been done to find out accurate methods for estimation of fetal size and weight in utero. These include clinical methods, x-ray of foetus in utero, external measurement of uterus and ultrasound techniques.<sup>1-7</sup>

The present study was aimed at estimation of fetal weight in utero by Dawn's formula as well as by Johnson's formula and to study a comparative evaluation of the two formulas.<sup>8,9</sup>

## METHODS

A total number of 200 patients were included in this study. All these patients were admitted in the labour ward of Govt. General Hospital, Sangameswar Teaching & General Hospital attached to M. R. Medical College, Gulbarga.

### *Selection of cases*

This study consists of total 200 case study included patient of different parity all delivered in these hospitals either vaginally or by caesarian section.

### *Inclusion criteria*

1. Single fetus with vertex presentation
2. Gestational age more than 28 week

### *Exclusion criteria*

1. Congenital malformation
2. Multiple pregnancy
3. Malpresentation

### *Examination method*

All the patients studied were selected randomly after thorough clinical examination.

### *History*

A detailed history of present pregnancy in terms of parity, period of amenorrhea, regularity of cycles, history regarding illness or pregnancy associated complications was asked. An account of menstrual, obstetrical and medical history is noted.

### *Clinical examination*

A general and systemic examination is conducted. Obstetrical examination included SFH, Maximal vertical length of uterus, maximal for diameter of uterus, double abdominal wall thickness, fetal lie, attitude, presentation, position and station.

### *Routine investigation*

1. H6%
2. Blood grouping and typing
3. VDRL
4. Urine routine

### *Instruments used*

1. Pelvimeter
2. Non-elastic measuring tape

### *Method of measurement: Johnson's formula*

Measurements were made during uterine relaxation of the patient were in labour. Measurement was made from the upper edge of the symphysis pubis following the curvature of the abdomen with a tape; the upper hand was placed firmly against the top of the fundus with the measuring tape passing between the index and middle fingers. Readings were taken from the perpendicular intersection of the tape with the fingers.

The station of the head was assured by pelvic examination.

### *Procedure*

Fetal weight estimation by Johnson's formulae.

Fetal weight in grams  
= (Fundal height in cms - 11 or 12 or 13) According to station x 155

When station presenting part at the level of Ischial spines (zero station) 12 was subtracted from fundal height in cms, when above the level of ischial spine (minus station) 13 and when below the level of ischial spines (plus station) 11 was subtracted from fundal height.

If women weight more than 200 patients (90 kg), 1 is subtracted from the fundal height.

Fetal weight estimation by Dawn's formula.

With pelvimeter, vertical length of gravid uterus is measured from superior border of symphysis pubis to fundus-L in cm that of transverse diameter at uterine cornu-(T) in cm.

Double abdominal wall thickness (DAWT) is measured by pelvimeter for correction of h. & T, finally measures of L & T are fed in formula  $L \times (\frac{1}{2} T)^2 \times 1.44$ . Fetal weight in gm is calculated.

### *Procedure*

The measurements are taken from 28 weeks onwards till 42 weeks when vertex lies on the pelvic brim.

Standing on the right of pregnant women, superior border of symphysis pubis and summit of uterine fundus are palpated by two fingers. Abdominal skin at uterine fundus is marked with pen. One limb end of pelvimeter is pressed against superior border of symphysis pubis while the other limb end is pressed against uterine fundus. The measure read on pelvimeter is vertical length (L) is cure.

## RESULTS

In this study 200 patients admitted to labour room were selected as study group. Patients were selected randomly.

Patient with single lives fetus, of more than 28 were gestation, with vertex patient without obstetric complicative were included. Also cases of multiple pregnancies, malpresentation were excluded.

Results were evaluated and analysed with respect to age, parity, gravide, gestational weeks. A comparative analysis of fetal weights assessed by Johnson's and Dawn's methods was made.

Accuracy of the Johnson's and Dawn's method was evaluated using the actual birth weight of baby after delivery as the standard.

In the present study of 200 cases 38% of cases were booked and 62% of cases were unbooked.

In the present study, most of the patients were from middle socio-economic status i.e. 56% followed by low 40% and 4% were high socioeconomic status.

Out of 200 cases, 30% of cases were less than 20 years of age, 67% were between 21 to 30 years. 3% of cases were of above 30 years of age (Table-1).

**Table 1: Age distribution.**

Age group	Frequency	Percentage
≤20 years	60	30.0
21 – 25 years	83	41.5
26 – 30 years	51	25.5
31 – 35 years	06	03.0
Total	200	100

Out of 200 cases, 13% of cases were of less than 37 weeks of gestation, 86% were of 37 — 40 weeks and 1% were of > than 40 weeks (Table 2).

**Table 2: Period of gestation.**

Gestation	Frequency	Percentage
<37 weeks	26	13
37 – 40 weeks	172	26
>40 weeks	02	01
Total	200	100

Out of 200 cases, 42.5% were of primi gravida, 50% were multi gravida and 7.5% were of cases were of grand multiparas (Table-3).

**Table 3: Parity of patients.**

Parity	Frequency	Percentage
Primi	85	42.5
G2	44	22
G3	56	28
≥G4	15	07.5
Total	200	100

Upon delivery, actual birth weight of the baby was recorded. The birth weight of the babies fell into 6 categories (Table-4). The largest group of patients delivered babies between 2500-2999 gms.

**Table 4: Actual birth weight.**

Birth weight	Frequency
< 2000 gms	05
2001 to 2499 gms	35
2500 to 2999 gms	102
3000 to 3499 gms	42
3500 to 3999 gms	14
4000 gms and above	02
Total	200

**Table 5: Fetal weight estimation by Johnson's formula.**

Parity	±100	%	±250	%	±500	%
Primi	26	30.5	49	57.6	78	91.7
G2	15	34	21	47.7	39	88.6
G3	20	35.7	26	46.4	50	89.2
≥G4	06	40	11	73.5	15	100

On comparing the fetal weight estimated by Johnson's formulae with the actual birth weight, the following observations were made.

*Primi: total number of patients 85*

Out of 85 primi, in 26 cases i.e., 30.5% the fetal weight estimated were within ±100 gms of actual birth weight.

In, 49 cases i.e., 57.6% the fetal weight estimated were within ±250gm of actual birth weight. In 78 cases i.e., 91.76%, the fetal weight estimated were within ±500 gms of actual birth weight.

*G2: total number of capes 44*

In 15 cases i.e., 34% the fetal weight estimated were within ±100 gms of actual birth weight.

In 21 cases i.e., 47.7%, the fetal weight estimated were within ±250 gms of actual birth weight.

In 39 cases i.e., 88.6% the fetal weight estimated were within ±500 gms of actual birth weight.

*G3: total number of cases 56*

In 20 cases i.e., 35.7% the fetal weight estimated were within ±100 gms of actual birth weight.

In 26 cases i.e., 46.4% the fetal weight estimated were within ±250 gms of actual birth weight.

In 50 cases i.e., 89.2% the fetal weight estimated were within  $\pm 500$  gms of actual birth weight.

$\geq G4$ : total number of cases 15

In 6 cases i.e., 40%, the fetal weight estimated were within  $\pm 100$  gms of actual birth weight.

In 11 cases i.e., 73.3% the fetal weight estimated were within  $\pm 250$  gms of actual birth weight.

In 15 cases i.e., 100% the fetal weight estimated were within  $\pm 500$  gms of actual birth weight.

In 67 cases out of 200 cases studied i.e., 33.5%, the fetal weight estimated by Johnson's formula were within  $\pm 100$  gms if actual birth weight.

In 107 cases, i.e., 53.5% the fetal weight estimated by Johnson's formula were within  $\pm 250$  gms of actual birth weight.

In 182 cases i.e., 91% the fetal weight estimated were within  $\pm 500$  gms of actual birth weight.

**Table 6: Difference between actual birth weight and estimated birth weight.**

Difference B/w Actual and estimated	Frequency	Percentage
$\pm 100$	67	33.5
$\pm 250$	107	53.5
$\pm 500$	182	91

**Table 7: Fetal weight estimations by Dawn's formula.**

Parity	$\pm 100$	%	$\pm 250$	%	$\pm 500$	%
Primi	46	54.1	80	94.1	85	100
G2	24	54.5	39	88.6	43	97.7
G3	24	42.8	43	76.7	55	98.2
$\geq G4$	09	60	15	100	15	100

On comparing the fetal weight estimated 'by Dawn's formula with the actual <sup>1</sup> birth weight, the following observations were made.

*Primi*: total number of cases 85

Out of 85 primi in 46 cases i.e., 54.1% the fetal weight estimated were within  $\pm 100$  gms of actual birth weight.

In 80 cases i.e., 94.1%, the fetal weight estimated were within  $\pm 250$  gm of actual birth weight.

In 85 cases i.e., 100%, the fetal weight estimated by Johnson's formula were within  $\pm 500$  gm of actual birth weight.

*G2*: total number of cases 44

In 24 cases i.e., 54.5% the fetal weight estimated were within  $\pm 100$  gm of actual birth weight.

In 39 cases i.e., 88.6% the fetal weight estimated were within  $\pm 250$  gm of actual birth weight.

In 43 cases i.e., 97.7% the fetal weight estimated were within  $\pm 500$  gm of actual birth weight.

*G3*: total number of cases 56

In 24 cases i.e., 42.8% the fetal weight estimated were within  $\pm 100$  gm of actual birth weight.

In 43 cases i.e., 76.7% the fetal weight estimated were within  $\pm 250$  gm of actual birth weight.

In 55 cases i.e., 98.2% the fetal weight estimated were within  $\pm 500$  gm of actual birth weight.

$> G4$ : total number of cases 15

In 9 cases i.e., 60% the fetal weight estimated were within  $\pm 100$  gm of actual birth weight.

In 15 cases i.e., 100% the fetal weight estimated were within  $\pm 250$  gm of actual birth weight.

In 15 cases i.e., 100% the fetal weight estimated were within  $\pm 500$  gm of actual birth weight.

**Table 8: Difference between actual birth weight and estimated birth weight by Dawn's formula.**

Difference B/w Actual and estimated	Frequency	Percentage
$\pm 100$	103	51.5
$\pm 250$	177	88.5
$\pm 500$	198	99

In 103 cases out of 260 cases studied i.e., 1.5%, the fetal weight estimated by Dawn's formula were within  $\pm 100$  gms if actual birth weight.

In 177 cases, i.e., 88.5% the fetal weight estimated by Dawn's formula were within  $\pm 250$  gms of actual birth weight.

In 198 cases i.e., 99% the fetal weight estimated by Dawn's formula were within  $\pm 500$  gms of actual birth weight.

33.5% of cases were within  $\pm 100$  gms by Johnson's formula, whereas in Dawn's formula 51.5% cases were within  $\pm 100$  gm of actual birth weight.

73% of cases by Johnson's formula were within  $\pm 250$  gms and 88.5% of cases by Dawn's formula were within  $\pm 250$  gms of actual birth weight.

91% of cases by Johnson's formula and 99% of cases by Dawn's formula were within  $\pm 500$  gms of actual birth weight.

As can be observed from table-13, it is found that, mean actual birth weight of 2777.57, Johnson's has a mean of 2851.4 and the standard deviation of 350.70 gms standard error of 38.98 gms.

For Dawn's formula, the mean weight is 2744.48 for the actual birth weight of 2777.57. The standard deviation is 392.39 gm and the standard error is 40.9.

Probability value (p) is not statistically significant in case of both Johnson's and Dawn's formula of compared to actual birth weight.

**Table 9: Comparing the estimated fetal weight by Dawn's formula and Johnson's formula.**

Formulae	% of cases within $\pm 100$	% of cases within $\pm 250$	% of cases within $\pm 500$
Johnson's formula	51.5%	88.5%	99%
Dawn's formula	38.5%	53.5%	91%

## DISCUSSION

By Johnson's formula the actual birth weight was accurate within  $\pm 250$  gms of predicted portal weight in 53.5%. Present study results are similar to those of Johnson's and Tostach<sup>9</sup> and Vimila and Sushila studies.<sup>10</sup>

By Dawn's formula present study had 88.5% within  $\pm 250$  gms of actual birth weight which is similar to that of Vimila and Sushila who reported 81% of cases within  $\pm 250$  gms of actual birth weight whereas Dawn et al reported 100% within 10% of actual birth weight.<sup>10</sup>

Comparing the results in present study, the results of Johnson's formula are consistent with the results of author, while for Dawn's formula the results are 58.5% as compared to 100% results of the authors<sup>8</sup> (Dawn et al, 1983).<sup>9</sup>

Comparative evaluation of Dawn's formula and Johnson's formula:

In present study, the prediction of fetal weight in utero by Dawn's formula has been found definitely better than Johnson's formula because the total accuracy of fetal weight prediction by Dawn's formula exceeded that of Johnson's formula at all level of differences. i.e., at  $\pm 100$

gms accuracy by Dawn's formula was 51.5% as compared to Johnson's formula of 38.5%, at  $\pm 250$  gms it was 88.5% by Dawn's formula and 53.5% by Johnson's formula and at  $\pm 500$  gms. 99% by Dawn's formula and 91% by Johnson's formula.

This can be explained by the facts that

1. In Dawn's formula, both vertical and transverse diameters of uterus are measured while in Johnson's formula only vertical length of the uterus is taken into consideration.
2. D'arble abdominal wall thickness is taken into consideration in Dawn's formula, so that it helps in correcting the vertical and transverse diameter of the uterus because DAWT affects the measurements of these diameters of uterus. But in Johnson formula DAWT is not taken into, consideration. So the vertical length of uterus which is measured per abdomen may not correspond with the exact vertical length of the uterus.
3. Both these procedures are simple to perform. However in Dawn's formula determination of station by Per Vaginal (P/V) examination is not required but for Johnson's formula this is needed.

Johnson's formula can be applied irrespective of station of presenting part but Dawn's formula should be applied as recommended by the author, only in those cases where vertex sits just at the brim i.e., neither free floating nor deeply engaged.

## CONCLUSIONS

Antenatal fetal weight can be estimated with reasonable accuracy by Dawn's formula and Johnson's formula. Both the methods are simple, safe easy to perform, economical, without any on comparative evaluation of the two, Dawn's formula was found to be more accurate (88.5% within  $\pm 250$  gms) than Johnson's formula (53.5% within  $\pm 250$  gms) in prediction of antenatal fetal weight.

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