

COMPARATIVE EVALUATION OF FOETAL WEIGHT ESTIMATION IN UTERO BY DAWN'S FORMULA AND JOHNSON'S FORMULA

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SUMMARY

Two hundred cases of full term pregnancy were studied for determination of foetal weight by Dawn's formula and Johnson's formula. With Dawn's formula the accuracy of foetal weight determination was 81% within ± 250 gms of birth weight while with Johnson's formula, it was 51.5% within ± 250 gms of birth weight. However, both the methods are found simple, safe, easy to perform, economical, without any side effects and can be used on mass scale with reasonable accuracy. But on comparative evaluation of the two. Dawn's formula was found to be more accurate than Johnson's formula in estimation of foetal weight.

Introduction

Foetal weight estimation has become increasingly important especially for the prevention of prematurity, evaluation of foetopelvic disproportion, decision for mode of delivery in breech presentation, induction of labour before term, in complications of pregnancy and detection of intrauterine growth retardation. A lot of work has been done to find out accurate methods for estimation of foetal size and weight in utero. These include clinical methods, X-ray of foetus in utero (Andreas, 1942; Donaldson and Cheney, 1948), external measurements of uterus (Poulas and Longstadt, 1955; McSweeney,

1958; Insler *et al*, 1967) and ultrasound techniques (Sabhagha and Turner, 1972; Campbell and Wilkin, 1975; Warsof *et al*, 1977).

The present study was aimed at estimation of foetal weight in utero by Dawn's formula (Dawn *et al*, 1983) as well as by Johnson's formula (Johnson, 1957) and to study a comparative evaluation of the two formulae.

Material and Methods

A total number of 200 patients were included in this study. All these patients were admitted in the Labour Ward of Medical College Hospital, Rohtak during the years 1983 and 1984, for delivery. The patients were divided into two groups. Group A was study group and patients in

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this group were multiparas, and having term gestation, vertex presentation and without any obstetrical complications. While group B was control group and patients were with full term pregnancy, irrespective of presentation, parity and antenatal complication. Only those patients were considered who delivered in the hospital.

A detailed history was taken and thorough examination was done of every patient. The foetal weight was calculated by both formulae.

Foetal weight estimation by Johnson's formula (Johnson, R. W., 1957):

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

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

Foetal Weight estimation by Dawn's formula (Dawn *et al*, 1983):

Following measurements of gravid uterus were taken with the help of pelvi-meter:

- Maximum vertical length of uterus (L)
- Maximum transverse diameter of uterus (T)
- Double abdominal wall thickness (DAWT)

If DAWT was more than 3 cms in any patient taken excess of DAWT was calculated and correction was applied because standard DAWT taken by the author is 3 cms for Indian women.

Excess of DAWT = Actual DAWT-3cms

Correction:

Corrected vertical length =
 $L - \frac{1}{2} \times \text{Excess DAWT}$
Corrected transverse diameter =
 $T - \text{Excess of DAWT}$

If DAWT was 3 cms or less, no correction was applied.

After correction foetal weight was calculated by Dawn's formula as follows:

Foetal weight in grams = $1.44 \times L \times (\frac{1}{2} T)^2$

The foetal weight estimated by both formulae was recorded and after delivery it was compared with birth weight.

Observations

The gestational period in both groups varied between 37 and 42 weeks, but most of them had 39-40 weeks pregnancy 78 per cent in group A and 56 per cent in group B.

As in group A all patients were primiparous but in group B 39% patients were multiparous. In group A patients were without any antenatal complications while in group B, 43% patients had varying degree of anaemia, 19% had pregnancy induced hypertension, 1% had placenta- praevia, 1% hyperemesis and 1% hydramnios.

In group A, all patients were with vertex presentation. But in group B, 87 per cent cases had vertex and rest 13 per cent had breech presentation.

The presenting part as felt per abdomen, was fixed in 81 per cent cases, engaged in 13 per cent and free in rest 6 per cent cases.

The bag of membranes was already ruptured in 4.5 per cent cases and in rest of the 95.5 per cent cases membranes were intact.

Foetal weight estimation by Dawn's formula: On comparing the foetal weight

estimated by Dawn's formula with birth weight it was found that in group A 81 per cent of the foetal weight estimates were within ± 250 gms of actual birth weight (Table I), while in group B, 60

TABLE I (Group A)

Difference between birth weight and estimated foetal weight	No. of cases	Percentage
± 700 gms	38	38
± 250 gms	81	81
± 500 gms	100	100

per cent of foetal weight estimates were within ± 250 gms (Table II). And irres-

TABLE II (Group B)

Difference between birth weight and estimated foetal weight	No. of cases	Percentage
± 100 gms	37	37
± 250 gms	60	60
± 500 gms	94	94

pective of group 70.5 per cent estimates were within ± 250 gms (Table III).

TABLE III

Difference between birth weight and estimated foetal weight	No. of cases	Percentage
± 100 gms	75	37.5
± 250 gms	141	70.5
± 500 gms	194	97.0

Foetal weight estimation by Johnson's formula: The foetal weight estimates by Johnson's formula were accurate within ± 250 gms of birth weight in 51.5 per cent cases in both group A and group B (Table IV).

TABLE IV

Difference between birth weight and estimated foetal weight	No. of cases	Percentage
± 100 gms	47	23.5
± 250 gms	103	51.5
± 500 gms	162	81.0

The comparative accuracy of foetal weight estimation by Dawn's formula and Johnson's formula is shown in Table V.

TABLE V

Name of formula	Percentage of cases within ± 250 gms	Percentage of cases within ± 500 gms
Dawn's formula	70.5	97
Johnson's formula	51.5	81

Discussion

Dawn *et al* (1983) reported 100 per cent results within 10 per cent of the actual birth weight. But in this study only in 81 per cent cases predicted foetal weight was within 10 per cent of the actual birth weight, even when the criteria for the selection of patients were similar to those of Dawn *et al* (1983).

In group B where patients were selected at random irrespective of parity, presentation and antenatal complications, the accuracy of birth weight prediction was further lowered. Only 60 per cent were within ± 250 gms.

The overall accuracy of foetal weight prediction at term by Dawn's formula came to the extent that 70.5 per cent estimates were within ± 250 gms and 97 per cent estimates were within ± 500 gms of actual birth weight.

Foetal weight prediction by Johnson's formula: The actual birth weight was accurate within ± 250 gms of predicted foetal weight in 51.5 per cent of cases. While 81 per cent of estimates were within ± 500 gms. Our results are similar to those of Johnson (1957) who reported birth weight to be within ± 240 gms of estimated weight in 50.5 per cent of cases. However, our results differ from those of Devi and Mokadam (1966) who reported Johnson (1957) simplified method to be correct in 75 per cent cases.

The accuracy of foetal weight prediction in low birth weight babies by Dawn's formula was 76.5 per cent within ± 250 gms and by Johnson's formula was 64.7 per cent within ± 250 gms. Dawn (1982), however, has reported accuracy of 90 per cent in detecting growth retardation in foetus, where calculated foetal weight showed 600 gms deficit as compared to average weight.

By ultrasonic cephalometry i.e. from B.P.D., only 50 per cent cases of intra-uterine growth retardation could be detected in studies conducted by Brenner *et al* and Cetrulo and Freeman (1977).

Accuracy of different formulae available for foetal weight prediction is given in Table VI.

Comparing the results in our series, we find that results of Johnson formula are consistent with the results of author (Johnson, 1957) while for Dawn's formula for results are 81 per cent as compared to

100 per cent results of the authors (Dawn *et al*, 1983).

This difference can be explained by the fact that the authors considered only those patients where vertex was sitting just at the brim, whereas in the present series, we have included all the patients where vertex was at -3, -2 or -1 station.

Comparative evaluation of Dawn's formula and Johnson's formula: In our study, the prediction of foetal weight in utero at term by Dawn's formula has been found definitely better than Johnson's formula because the total accuracy of foetal weight prediction by Dawn formula in patients selected according to the criteria given by the authors, exceeded than that of Johnson's formula i.e. 81.0 per cent within ± 250 gms as compared to 51.5 per cent within ± 250 gms. This can be explained to some extent by the facts that:

* In Dawn's formula, both vertical and transverse diameters of uterus are measured while in Johnson formula only vertical length of the uterus is taken into consideration.

* Double abdominal wall thickness is taken into consideration in Dawn formula, so that it helps in correcting the vertical and transverse diameters of the uterus because DAWT effects the measurement of these diameters of uterus. But in Johnson formula, DAWT is not taken into consideration so the vertical length of uterus which

TABLE VI

Author	Results
Poulas and Longstadt (1953)	68% within ± 250 gms
Johnson and Toshach (1954)	50.5% within ± 240 gms
Johnson, R. W. (1957)	50.5% within ± 240 gms
Dawn <i>et al</i> (1983)	100% within 10% of actual birth weight
<i>Present study</i>	
Dawn's formula (group A) 1984)	81% within ± 250 gms
Johnson's formula (1984)	51.5% within ± 250 gms

is measured per abdomen may not correspond with the exact vertical length of the uterus.

* Both these procedure are simple to perform. However in Dawn's formula determination of station by P/V examination is not required but for Johnson's formula this is needed.

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

Conclusion

Antenatal foetal weight at term 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 side effects and can be used on mass scale with reasonable accuracy.

— On comparative evaluation of the two, Dawn's formula was found to be more accurate (81 per cent within ± 250 gms) than Johnson's formula (51.5 per cent within ± 250 gms) in prediction of antenatal foetal weight.

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