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Use of Johnson's Formula in MCH Training

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Summary

This study was conducted over a period of one year on 110 patients who reported in the third trimester of pregnancy and delivered within one week of examination. The aim was to evaluate a simple method of foetal weight estimation clinically, which can be useful for training the health personnel at the PHC level. Foetal weight estimation was done clinically using Johnson's formula and these results were correlated with ultrasonographic foetal weight estimation. Results of foetal weight estimation by Johnson's formula were as good as ultrasonographic estimation. Thus, even though ultrasonography is a more accurate method for determining foetal weight, the results of Johnson's formula are comparable. Moreover, ultrasonography is not available in the rural areas, whereas Johnson's formula is easy and simple to calculate and thus it can be included in the MCH training programme of medical and paramedical staff and birth attendants.

Introduction

This study was conducted over a period of one year on 110 patients who reported in the third trimester of pregnancy and delivery within one week of examination. The aim was to evaluate a simple method of foetal weight estimation clinically, which can be useful for training the health personnel at the PHC level. Foetal weight estimation was done clinically using Johnson's formula and these results were correlated with ultrasonographic foetal weight estimation. The predicted error in estimation of foetal weight by Johnson's formula was 186.50+56 (mean+SD) as compared to 65.97+153.50 by USG. 46.36% of cases were within 500 gms error. Johnson's formula was as good as ultrasonographic estimation. Thus, even though ultrasound is a more accurate method for determining foetal weight, the results of Johnson's formula are comparable. Moreover, ultrasound is not available in the remote areas whereas Johnson's formula is easy and simple to calculate and thus it can be included in the MCH training programme of medical and paramedical staff and birth attendants.

A quick, easy and accurate method for estimating fetal weight in utero is an obvious benefit to the clinician practising modern obstetrics as the perinatal morbidity and mortality is affected not only by fetal age but also by weight. Fetal weight estimation has also become increasingly important under certain conditions like diagnosis and management of low birth weight babies (preterm and small for gestational age), decision for mode of delivery in breech presentation, induction of labour before term in complicated pregnancy, evaluation of fetopelvic disproportion and patient's mobility to remember dates, which is very common in our country. Assuming a crude birth rate of 25 per 10000, there are 23 million births in India every year, and approximately 17.5 million of them take place in the rural areas, of which majority are under domiciliary conditions. For these we have to search for a clinical method which can be applied at the PHC level and by the birth attendants. Thus the present study was undertaken in order to estimate the foetal weight by a simple and easy method which can be taught to the medical and paramedical staff and birth attendants under MCH teaching programme to improve

the perinatal morbidity and mortality.

Material & Methods

The study was conducted on 110 patients attending the antenatal clinic and/or maternity ward, whose last weight estimation was done within one week of delivery.

I. Foetal weight estimation by clinical methods :

1. Clinical palpation : Included facts, like the size of the foetal head, general contour of the abdomen and fundal height.
2. Johnson's formula (1957) : McDonald's measurement of the height of the fundus from the upper edge of symphysis pubis following the curvature of the abdomen were taken in a centimeter tape. The upper hand was placed firmly against the top of the fundus, with the measuring tape pressing between the index and middle fingers. Readings were taken from the perpendicular intersection of the tape with the fingers. (Fig. 1)

Station of the presenting part was assessed by abdominal examination and vaginally if necessary. Condition of the membranes were also noted (intact or ruptured).

Fig. 1

Foetal weight was estimated as follows :

Foetal wt. (gms)= (Mcdonald's measurement – 13) x 155
when the presenting part was at 'minus' station
= (McDonald's measurement – 12) x 155
and when it was at 'O' station
= (McDonald's measurement – 11) x 155
and when it was at 'plus' station or above

PP = Presenting Part

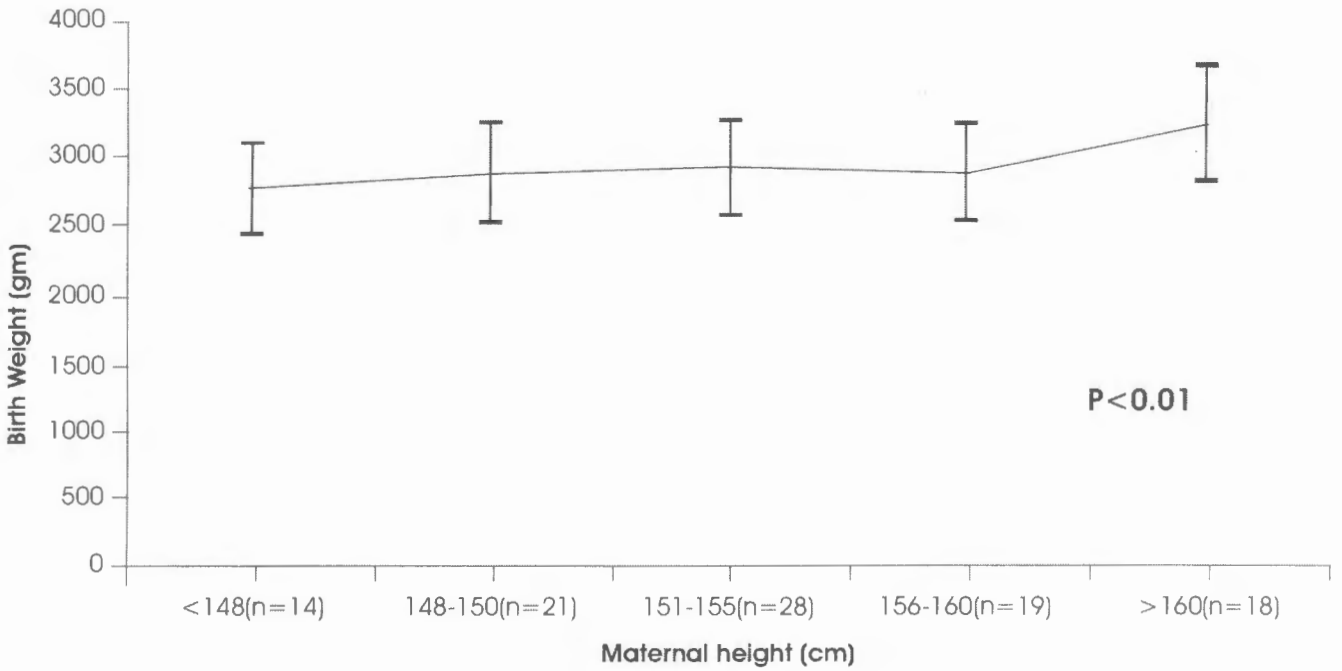

Table I: Birth weight of babies born according to maternal height (n=110)

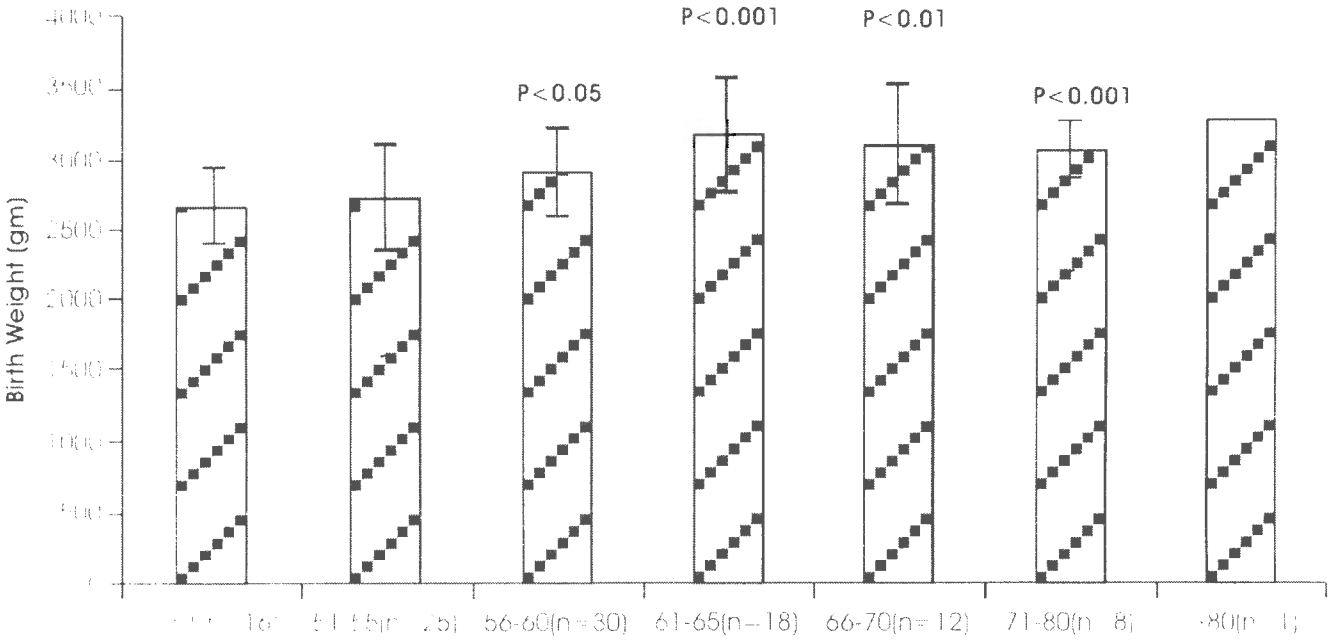

Fig. 1: Maternal and Fetal weights (kg)

II. Foetal weight estimation by Utrasonography :

FL and AC were measured and the foetal weight estimation was done using the Warsof et al formula (1986).

Observations

Of the 110 cases 89 were booked and 21 unbooked.

The maximum number of cases studied (49) were in the age group of 21-25 years and there was no statistical significance of birth weight with maternal age. Although mean birth weights were more in women with parity 2 and 3 (2955.45 gms and 2993.33 gms respectively), the differences were not statistically significant.

In the maternal height range of 148 – 160 cms., mean birth weight remained more or less same. When maternal height was greater than 160 cms., the mean birth weight was maximum (3202.22 gms.) which was statistically significant (Table I).

As the maternal weight increased, the mean birth weight also increased and this was also statistically highly significant in groups 61-65 kg and 71-80 kg (Fig. 1)

The mean birth weight (MBW) was the lowest in the illiterate mothers (2721.71 gms) and gradually increased as the level of literacy rose (3109.28 gms), a fact which was statistically significant .

On comparison of the predicted birth weight by different methods with the actual fetal birth weight, it was seen that the predicted birth weight by clinical methods was on the lower side and that by the sonographic method it was on the higher side of the actual birth weight (Fig. 2).

On comparison of the predicted error in birth weight by various methods, it was seen that overall Johnson's method and ultrasonogrphy were statistically better than clinical estimation. However, there was no statistically significant difference between Johnson's formula and ultrasonography (Fig. 3).

On estimation of over and underestimates in predicted birth weight, there was almost equal frequencies of under and over estimations in the 2001-2500 gms and 2501-3000 gms groups while in the 3001-3500 gms and > 3500 gms groups there was more of under estimations in the clinical method and Johnson's method. By ultrasonography, there were more of overestimations in first 2 groups and almost equal frequencies of over and under estimations in the second 2 groups (Table II).

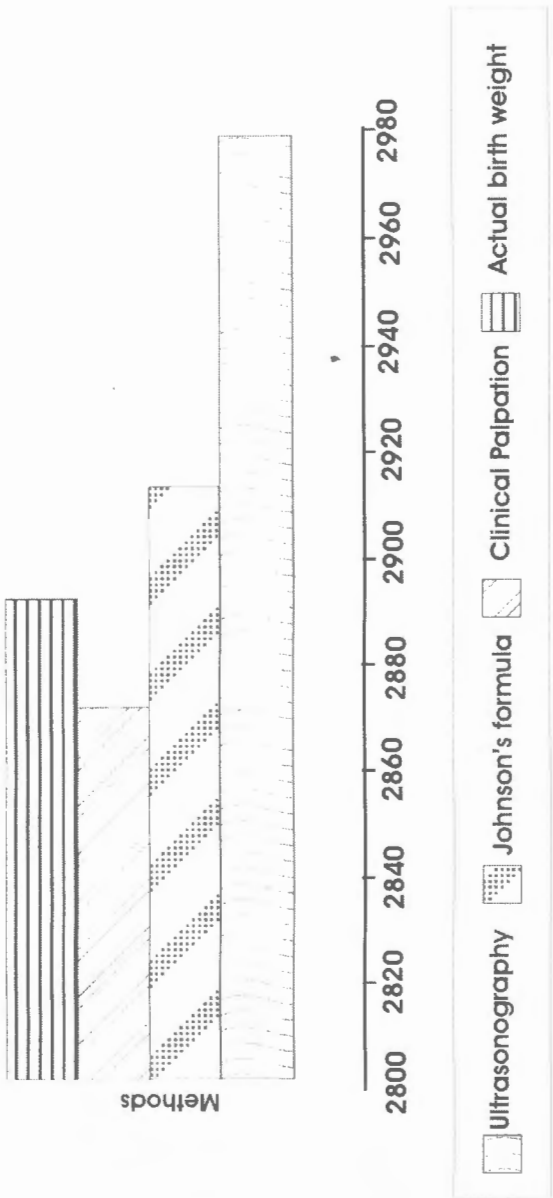

Table II: Comparison of actual birth weight with predicted birth weight (n=110)

Almost 80-90% of the predictions were within 10% of the birth weight by ultrasonography as compared to 76.36% and 75.45% by clinical and Johnson's methods respectively (Table III). The average error was least by ultrasonography method (63.29 gm), followed by Johnson's formula (66.90 gm), and then by clinical estimation (85.99 gm) (Table IV).

Discussion

The minimum age of mothers in our study was 18 and the maximum 40. There was no statistically significant increase in birth weight with age either in our study or in other studies (O'Sullivan et al., 1965). Seven was the highest parity in our study and changes in birth weight with parity were not found to be statistically significant, though some studies have found that birth weight increases with parity (Karn and Penrose 1965); 142-170 cms was the height range in our study and birth weight gradually increases with increase in height, which is a fact recorded by other authors too (Dougherty and Jones 1982). In our study maternal weight range was from 42 to100 kgs and it was seen that as the maternal weight increased, there was an increase in the birth weight also, but it would have been more satisfactory to have had data on maternal weight at the time of conception. It has been seen that maternal prepregnancy weight status is of greater significance in relation to birth weight than either age or parity (O'Sullivan et al., 1965).

Overall mean error per case for all cases (110) was least by ultrasonography (165.97 gms) compared to clinical (195.45 gms) and Johnson's (186.50 gms) methods. Tewari and Sood (1989) reported least predicted error by ultrasonography in all groups.

Clinical palpation and Johnson's formula had a tendency to over estimate in weight range <2500 gms and under estimate in weight range >3000 gms. Similar results have been reported by Niswander et al (1970) and Tewari and Sood (1989). In the present study, sonographic estimation had a tendency to over estimate in the weight range <3000 gms. On the contrary Tewari and Sood (1989) reported almost equal incidence of under and overestimation using Warsof et al's formula in ultrasonography.

In 80.9% cases, the percentage of error was restricted to 10% or less when ultrasound estimation was used as compared to clinical (76.36%) and Johnson's (75.45%). Dawn et al (1983) obtained predicted birth weight within 10% of actual birth weight by their formula, this was better than that found in our study.

Tewari and Sood (1989) obtained 59% cases by clinical and 55% by Johnson's method within an error of 10%. Shepard et al (1982) obtained 50.7% estimates within 10% error by using modified Warsof et al's formula and Ott (1981) obtained 71.3% of results within 10% and 87.4% within 15% error by using the same formula.

Predicted error in gm/kg of birth weight for all cases was found to be least by ultrasonography (63.24 gm/kg) as compared to clinical (85.99 gm / kg) and Johnson's (66.9 gm/kg) method (Table IV). The predicted

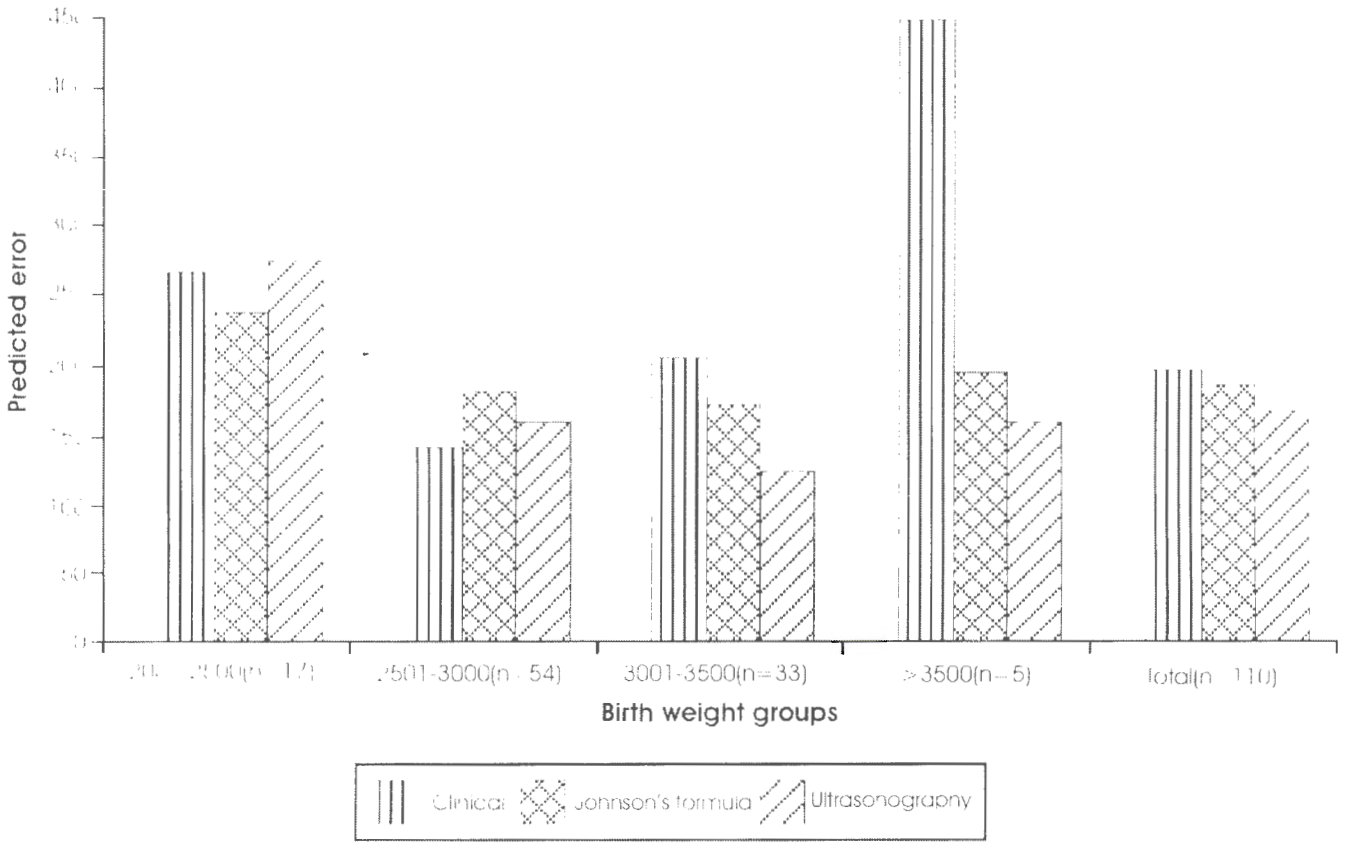

Fig 3: Comparison of predicted error of birth weight (n=110)

Table II: No. of under and over estimates (prediction) by various methods in different groups according to birth weight (n=109)*

Method	2001-2500 n = 17		2501 – 3000 n = 54		3001-3501 n = 33		>3500 n = 5		Total n = 1110	
	Over	Under	Over	Under	Over	Under	Over	Under	Over	Under
Clinical	10	6	29	21	7	24	0	5	46 (42.2%)	56 (51.3%)
Johnson's	10	7	28	24	11	17	0	5	49 (44.9%)	53 (48.6%)
USG	15	2	39	15	16	16	1	4	71 (65.1%)	37 (32.4%)

* One case was < 2000 gms

Table III: Percentage error by different method

Percentage Error	Percent age of cases		
	Clinical	Johnson's	USG
Upto 5%	46.36	48.18	53.63
Upto 10%	76.36	75.45	80.90
Upto 15%	90.00	94.54	90.00
Upto 20%	97.27	96.36	93.63
Upto 25%	99.09	99.09	99.09

Table IV: Predicted error per kg of birth weight by various methods in different fetal weight groups (n=109)*

Method	Error per kg birth weight (gms)				
	2001 – 2500	2501 – 3000	3001 – 35001	>3500	Total
Clinical	112.06	50.82	62.80	118.27	85.99
Johnson's	99.17	64.93	52.36	51.16	66.90
USG	115.90	57.07	37.90	42.08	63.24

* 1 case was < 2000 gms

error in gm/kg birth weight by any method in present study comprises well with other methods like McCullum and Brinkley (1979) – 130gm/kg and Warsof et al (1986) – 109 gm / kg.

Tewari and Sood (1989) obtained a predicted error of 142.69 gm/kg by clinical, 130.88 gm/kg by Johnson's method and 110.77 gm / kg by Dawn's method and 99.32 gm/kg by ultrasonographic formula.

Conclusion

Clinical estimation of foetal weight in utero by an experienced Obstertrician still has a role specially in 2500-3000 birth weight group. Majority of the deliveries take place in the rural areas in our country of which most are under domiciliary conditions. Under MCH teaching programme we can teach the medical and paramedical staff and birth attendants the foetal weight estimation by a simple and easy method to improve the maternal and perinatal mortality and morbidity Johnson's formula will thus be useful in the MCH training programme. A table has been formulated based on our experience to avoid even the simple calculation (Table V).

With the help of this Table, we suggest the use of a simple measuring tape in which different markings are made corresponding to the foetal weight estimation which may be made use of by the local birth attendants at a glance e.g. readings in red zone means patient should be referred to higher centre for delivery, those in the yellow zone should be dealt with caution and those in the green zone may safely be conducted at home (Fig. 4).

Though one cannot overlook the superiority of USG which not only estimates the foetal weight but also gestational age, foetal maturity and biophysical profile a simple method of foetal weight estimation should be included in the hospital teaching programme to train the undergraduates, postgraduates and paramedical staff.

Table V: Estimated Weight in Grams Based on Johnson's Formula

McDonald's Measurement (cm)	Station		
	Minus & Above	Zero	Plus
20	1085	1240	1395
21	1240	1395	1520
22	1395	1550	1705
23	1550	1705	1860
24	1705	1860	2015
25	1860	2015	2170
26	2015	2170	2325
27	2170	2325	2480
28	2325	2480	2635
29	2480	2635	2790
30	3635	2790	2945
31	2790	2945	3100
32	2945	3100	3255
33	3100	3255	3410
34	3255	3410	3565
35	3410	3565	3720
36	3565	3720	3875
37	3720	3875	4030
38	3875	4030	4185
39	4030	4085	4340
40	4185	4340	4495

If Weight is >91 kgs, McDonald's measurement will be 2 cm less.

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Fig. 4

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