

THE RATIO, BIRTH WEIGHT TO MATERNAL WEIGHT, AS AN INDEX OF MATURITY OF NEONATE

by

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SUMMARY. The suitability of the ratio, birth weight to maternal weight as an indicator of an infant at risk, has been investigated. The ratio correlates significantly with weight gain during pregnancy and the socio-economic status of the mother. The ratio is a more adequate indicator of a neonate at risk than birth weight alone. It is suggested that a birth weight of less than 5.5% of the weight of the mother during the first trimester be used by a birth-attendant as an indicator for referral to a more qualified person, when the mother is of low body weight and of poor nutritional status.

INTRODUCTION

The ability of a neonate to survive is closely related to its size at birth,^{1,11} and the term "low-birth-weight infant" for all neonates of 2.5 kg or less has been recommended¹². Birth attendants in rural maternity wards use this birth weight as an index of viability of the neonate. However, birth weight is dependent on a number of factors other than gestational age, such as the genetic potential⁷, maternal nutrition^{5,4} parity⁹, intrauterine infection^{5,8} and maternal age^{9,14}, so that birth weight alone would be an inadequate indicator of a neonate at risk.

For comparison of the performance of pregnant women of different ethnic groups Kerr (1943) has suggested expressing both weight gain by the mother during pregnancy and birth weight as a percentage of maternal weight⁷. In his study of 500 deliveries at a Lying-in Hospital in Boston, the weight of the neonate was found to be 5.8% of the weight of the mother in the third month of pregnancy. In a study of 53 births in the non-paying delivery rooms of the General Hospital, Kandy, the weight of the neonate was

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found to be 5.58% of the weight of the mother at term¹⁴. For 37 neonates appropriate for gestational age (according to the classification of Battaglia and Lubchenco¹) the figure, expressed as a percentage, was 5.96 ± 0.592 , whereas for marginally small babies it was 4.55 ± 0.62 , the difference being highly significant. In a subsequent study of 294 neonates at the same hospital, de Silva *et al.*³ found the ratio, birth weight to maternal weight, to be 0.053 ± 0.008 . Although a significant reduction in birth weight was not observed in subjects with evidence of intrauterine infection, the ratio was significantly lower in the group with cord Ig M greater than 10 IU/ml.

In both studies in Kandy cited above the weight of the mother just before admission to the delivery room was used in calculating the ratio. As the pre-delivery weight varies with the amount of water retained, the influence on the ratio of the weight of the mother at the end of the first trimester was studied by following the progress during pregnancy and delivery of 131 mothers attending the ante-natal clinic in the General Hospital, Kandy.

METHODS

The population studied is the same as that used in a study of weight gain during pregnancy¹³. The weights of the mothers were measured on a beam balance (UNICEF-Avery), and of the neonates on a Homs platform scale to the nearest 50g. The age, parity and height of the mother were recorded as well as her socio-economic level (indicated by the per capita income of the family).¹³ Only singleton, uncomplicated, term (38 to 42 weeks of gestation from the last menstrual period) deliveries have been included in the study. The mothers were healthy by medical and obstetric criteria and the neonates were free from congenital malformations.

Statistical differences were assessed by analysis of variance and the students 't' test,

RESULTS

Tables 1 to 6 show the relationship between the ratio birth weight to maternal weight (BW/MW) and the height of the mother, her age, parity, weight gain during pregnancy and her the socio-economic status and the gestational age of the neonate. In calculating this ratio, the weight of the mother at the end of the first trimester (MW 1) and her weight before partus (MW 2) have been used. Those in socio-economic group 1 had a per capita income more than Rs. 600, those in group 2 an income between Rs. 300 and 600, while mothers in group 3 had a per capita income less than Rs. 300 per month.

TABLE 1. The relationship between the height of the mother and the ratio, birth weight to maternal weight (BW/MW)

Maternal height cm	n	BW/MW1 mean	X 100 S.D.	BW/MW2 mean	X 100 S.D.
≤ 150	53	6.61+	1.08	5.62*	0.81
≥ 150	78	6.35+	0.88	5.44*	0.67
All mothers	131	6.46	0.96	5.51	0.74

+ 0.02 < p < 0.05

* 0.05 < p < 0.1

MW 1 mother's weight at end of first trimester

MW 2 mother's weight before partus

TABLE 2. The relationship between the age of the mother and the ratio, birth weight to maternal weight (BW/MW)

Mother's age yr.	n	BW/MW1 mean	X 100 S.D.	BW/MW2 mean	X 100 S.D.
≤ 20	17	6.47*	1.02	5.52	0.77
21-27	63	6.55*	0.95	5.56	0.71
≥ 28	51	6.32*	0.95	5.43	0.75

* 0.05 p < 0.1

MW 1 Mother's weight at end of first trimester

MW 2 Mother's weight before partus

TABLE 3. The relationship between parity and the ratio, birth weight to maternal weight (BW/MW)

Parity	n	BW/MW1 mean	X 100 S.D.	BW/MW2 mean	X 100 S.D.
P ₁	66	6.65*	1.02	5.56+	0.79
P ₂₊₃	40	6.55*	0.94	5.54+	0.74
p ≥ 4	25	6.14*	0.75	5.32+	0.58

* 0.1 < p < 0.5

+ not significant

MW1 mother's weight at end of first trimester

MW2 mother's weight before partus

The shorter mothers have a higher BW/MW ratio (Table 1). The ratio also varies with the age of the mother, being highest in the age group 21 to 27 years (Table 2). Parity did not have the same influence on the ratio as maternal height and age (Table 3). Weight gain during pregnancy has a highly significant influence on the ratio, whether the mother's pre-delivery weight or her weight at the end of the first trimester is considered (Table 4). Gestational age had no significant effect on the ratio, provided the period of gestation was more than 38 weeks (Table 5). Weight gain during pregnancy and the socio-economic status of the mother (Table 6) appear to have a greater influence on the

ratio than the other factors studied. Weight gain shows a positive correlation with the nutritional status of the mother, and the nutritional status depends on her socio-economic status¹³.

TABLE 4. The relationship between weight gain during pregnancy, and the ratio, birth weight to maternal weight (BW/MW)

Weight gain kg	n	BW/MW1 X 100		BW/MW2' X 100	
		mean	S.D.	mean	S.D.
<7.50	59	5.89*	0.61	5.14*	0.47
≥7.50	72	6.91*	1.00	5.81*	0.76

* $p < 0.001$

MW 1 Mother's weight at end of first trimester

MW 2 Mother's weight before partus

TABLE 5. The relationship of gestational age to the ratio birth weight to maternal weight (BW/MW)

Gestational age weeks	n	BW/MW1 X 100		BW/MW2 X 100	
		mean	S.D.	mean	S.D.
38	2	4.64+	0.68	3.86*	0.69
39	39	6.40+	0.91	5.56*	0.70
40	69	6.56+	1.02	5.59*	0.80
41	21	6.34+	0.71	5.44*	0.51

+ $0.1 < p < 0.5$ * $0.02 < p < 0.05$

MW1 mother's weight at end of first trimester

MW2 mother's weight before partus

TABLE 6. The relationship between socio-economic status and the ratio, birth weight to mother's weight (BW/MW)

Socio-economic status	n	BW/MW1 X 100		BW/MW2 X 100	
		mean	S.D.	mean	S.D.
3	32	5.57*	0.45	4.89*	0.40
2	40	6.36*	0.85	5.40*	0.64
1	59	7.00*	0.91	5.92*	0.68

* $p < 0.001$

MW1 mother's weight at end of first trimester

MW2 mother's weight before partus

TABLE 7. Birth weight to maternal weight ratio (from Bricnd²)

Maternal weight at mid-pregnancy kg	Mean birth weight kg	Ratio BW/MW
35	2.91	0.083
40	3.03	0.076
45	3.145	0.070
50	3.255	0.065
55	3.36	0.061
60	3.46	0.057
65	3.555	0.054
70	3.645	0.052
75	3.73	0.049
80	3.815	0.047

DISCUSSION

The results in Tables 1 to 6 are in agreement with the results of earlier studies.^{3,14} The ratio correlates significantly with weight gain during pregnancy and is therefore dependent on the nutritional status of the mother. The weight of the mother early in pregnancy gives a higher value for the ratio, which is more significantly affected by weight gain, socio-economic status and age of the mother, than the ratio obtained with the pre-delivery weight. Therefore, the weight during the first trimester is to be preferred when computing the ratio. There is little or no weight gain during the first 6 weeks and weight during first trimester is approximately equal to pre-pregnant weight.⁶

However, the ratio is not constant for babies born to mothers who are adequately nourished and of large size. Table 1 shows that the ratio falls with increase in the height of the mother. This is supported by data in Table 7, which shows the mean birth weight of term neonates for different maternal body weights measured at mid-pregnancy, calculated from the Aberdeen standards.¹⁰

This table indicates that, although birth-weight is greater when the mother is heavier, the ratio BW/MW decreases with maternal weight in well-nourished communities. Therefore, the ratio can be of use in assessing the maturity of neonates only when the mother is of low body-weight and of poor nutritional status. The results of the present study as well as of those reported earlier^{3,14} indicate that, for small babies and those in whom there is evidence of intrauterine infection, the ratio BW/MW is below 0.05, and the ratio may be used by the birth-attendant as an indicator for referral to a more qualified person. When the pre-pregnant weight of the mother is not known, her weight during the first trimester could be used in computing the ratio. An arbitrary cut-off point could be a birth-weight of 5.5% of the maternal weight.

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