

## Research Article

# Study of neonatal outcome in relation to maternal nutrition and anthropometry

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### ABSTRACT

**Background:** Neonatal mortality contributes to over 64% of the infants deaths and most of these deaths occur during first week of life. Of the various causes of infant mortality, birth weight is one of the important factors for the survival, normal growth and development of child.

**Methods:** This one year hospital based case control study was undertaken to find out the proportion of low birth weight babies in institutional deliveries and to find out the association between various socio-demographic and maternal factors with low birth weight deliveries in study population. Data analysis was done using SPSS version 15.0. One way Anova and Chi square test was used.

**Results:** Out of total 100 live new-borns, 46 were low birth weight babies. Significant associations were found between maternal height < 150 cm, maternal weight gain and maternal pre partum body weight with low birth weight babies. Significant correlation was also seen between the age <20 yrs and >30 yrs of age, parity and socioeconomic status with low birth weight.

**Conclusions:** This study provides baseline information from the tertiary care hospital in this region. Strengthening of the maternal health program focusing on maternal nutrition and iron and folic acid supplementation during antenatal period and nutrition education to facilitate better weight gain during adolescent period is required.

**Keywords:** Neonatal mortality, Low birth weight

### INTRODUCTION

The survival and wellbeing of mothers and children are important to self as a right and also central to solving much broader economic, social and developmental challenges. Improving the survival and wellbeing of mothers and children will not only increase the health of societies but also decrease inequity and poverty.<sup>1</sup>

The essential source of concern lies in the implications of birth weight, and particularly of low birth weight (LBW) i.e. birth weight less than 2500 g.<sup>2</sup> Birth weight is an important parameter, which could be indicative of the immediate viability of the neonate and the state of maternal health and nutrition during pregnancy.<sup>3</sup> The

survival of infants and their postnatal growth and development largely depend on birth weight.<sup>2,4-6</sup> WHO in 1995 estimated that 142 million babies were born in the world in 1990; out of them 25 million were of low birth weight and 19 million of these LBW babies were born in the developing countries.<sup>7</sup> The present proportion of LBW babies in India is estimated to be 30 percent as compared to 4-5 percent found in economically developed countries.<sup>8,9</sup>

In India, over half of perinatal and two-thirds of all infant deaths are due to low birth weight.<sup>10</sup> LBW is a consequence of either preterm (<37 weeks of gestation) delivery or intrauterine growth retardation (IUGR) or of both.<sup>2</sup> In addition to short-term consequences, such as

high infant morbidity, mortality and childhood growth failure among survivors, growth retardation is a major public health problem worldwide.<sup>11</sup> Fetuses which suffer from growth retardation have higher perinatal morbidity and mortality, and are at an increased risk of sudden infant death syndrome.<sup>12-15</sup> During childhood they are more likely to have poor cognitive development and neurological impairment.<sup>16-20</sup> Moreover, IUGR contributes to the intergenerational cycle of poverty, disease and malnutrition. The cycle of poor nutrition continues across generations. Young girls who grow poorly become stunted women, and are more likely to give birth to low birth weight infants. If those infants are girls, they are likely to continue the cycle by being stunted in adulthood, and so on, if something is not done to break the cycle. Adolescent pregnancy heightens the risk of low birth weight and the difficulty of breaking the cycle. Support is needed for good nutrition at all these stages – infancy, childhood, adolescence and adulthood- especially for girls and women.

The causes of low birth weight are multi-factorial, associated with environmental, demographic, social and cultural characteristics.<sup>9,22</sup> Medical complications in pregnancy, adverse maternal practices, genetic factors and nutritional variables and especially maternal anthropometry also cause low birth weight. Malnourished women are more prone to deliver low birth weight babies and to have pregnancy complications.<sup>22,23</sup> Perinatal mortality and prematurity rates are found to be high among short-stature women.<sup>24</sup> Women among developing countries like India are undernourished, and their dietary energy intake is not adequate to compensate their heavy physical workload.<sup>25</sup> Most women weigh below the 55 kg norm used by WHO. The data of family health survey, (NFHS-3) reveals that about 70 in 1000 live births in Madhya Pradesh did not see their first birthday.

Improving female education, nutrition and increased the use of health services during pregnancy and delivery are important for reducing childhood mortality rates. With our clinical experience and observation we analysed that there may be a direct impact of physical health of antenatal mothers on their new born babies. This view motivated us to conduct a study on the impact of health and anthropometry of antenatal mothers on their neonates in Madhya Pradesh with the following aim and objectives, to find out the proportion of low birth weight babies in institutional deliveries, to identify the socio-demographic and maternal determinants of low birth weight and to explore association between various socio-demographic and maternal determinant with low birth weight delivery in study population.

## METHODS

This one year hospital based, case control study was carried out at Sri Aurobindo Medical College and PG Institute, Indore, Madhya Pradesh. The study included 100 antenatal mothers and their neonates enrolled from

March 2013-March 2014 in the obstetrics ward. Consent was obtained from mother in writing after explaining the study and its value in local language.

### *Inclusion criteria*

- Pregnant women with first visit in less than 13 weeks
- Term pregnancy i.e. between 37 weeks to 40 weeks
- Singleton pregnancy
- Maternal age between 18-35 yrs

### *Exclusion criteria*

- Mothers having first visit after 13 weeks of gestation
- Not having clear data of gestational week at registration
- Preterm or post term pregnancy
- Twin pregnancy

Maternal anthropometric measurements such as post pregnancy weight, height, mid-arm circumference and triceps skin fold thickness were recorded at the time of enrolment following stabilization (within 24 hours of delivery) at hospital using standard technique. Maternal mid-arm circumference was measured using non-stretchable fibre tape. Mother's triceps skin fold thickness was measured using Lange skin fold calliper and body mass index was calculated using the formula, weight in kg divided by the square of height in meters.

### *Height*

Maternal height was measured using wall-mounted wooden height measuring board. The measuring board was 185 cm high and capable of measuring to an accuracy of 0.1cm.

### *Weight*

A Salter digital weighing balance was placed on a hard flat surface and checked for zero balance before each measurement. The body weight was recorded to the nearest 100 g as soon as the indicator on the scale was stabilized. The balance was calibrated with a set of standard weights regularly.

### *Mid-arm circumference*

MAC measurement was made using a flexible, non-stretch tape. The tape was wrapped gently but firmly around the arm at the midpoint. Measurement was taken to the nearest 0.1 cm.

### *New-born anthropometry*

New-born anthropometric (birth weight, length at birth, foot length and circumference of mid arm, chest, head) measurements were made and recorded within 24 hours of birth at and gestational age was assessed by Ballard's

physical and neurological maturity scoring method of newborn and then matched with gestational age as calculated from history of maternal last menstrual period (LMP). In case of unavailability of LMP, the gestational age by Ballard's score was used for classification of maturity and weight-for-gestational age. All new-born anthropometry was measured by standard techniques.

### Birth weight

Birth weight is taken in a digital weighing machine without clothing under radiant warmer. Weight was recorded to the nearest 1 gm.

### Length at birth

Newborn length was measured by neonatometer with accuracy to 0.1 cm.

### Foot length

Foot length was measured by the setsquare triangle with markings in millimetre by holding one foot of the neonate vertically on a hard surface and measuring the length to great toe from the heel with the longer side of the instrument.

### Circumference

Head, chest and mid arm circumferences were measured by a non-stretchable fibre tape with markings in millimetre division. The accuracy of the measurement was 0.1 cm.

### Statistical analysis

Data analysis was done using SPSS version 15.0. One way ANOVA was carried out to find impact of maternal factors. Chi square test was used for finding significance between two parameters.

## RESULTS

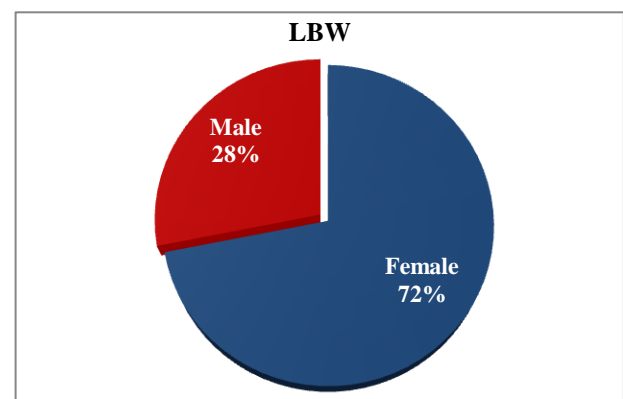
The mean age of mother was 26.19 years $\pm$ 3.999 years in study group and 24.57 years $\pm$ 3.304 years in control group. The mean parity was 4 in study group and 2 in control group. The mean weight gain was 7.222 kg $\pm$ 0.776 kg in study group and 8.820 kg $\pm$ 1.100 in control. The mean height was 150.57 cm $\pm$ 3.812 in study group and 156.15cm $\pm$ 6.509 in control. Table 1 shows mean height, weight, and weight gain of low birth weight mothers was lower than those who had normal birth weight babies. Of these, the difference in mother's weight, height and weight gain was statistically significant. The mean age of low birth weight mother was higher than that of normal birth weight babies, the difference being statistically significant. The MUAC was similar in two groups of mother (P value- 0.178) and it was not statistically significant.

**Table 1: Mean anthropometric values of the study and control groups.**

Anthropometry of mother	Study group	Control group	P-value
Age	26.19 $\pm$ 3.999	24.57 $\pm$ 3.304	0.030
Height	150.57 $\pm$ 3.812	156.15 $\pm$ 6.509	0.000
Weight	58.76 $\pm$ 4.252	58.66 $\pm$ 5.904	0.000
MUAC	25.89 $\pm$ 2.470	25.26 $\pm$ 2.065	0.178
Weight gain	7.222 $\pm$ 0.776	8.820 $\pm$ 1.100	0.000

Out of 100 singleton live born babies, 48% were boys and 52% were girls. The mean and (SD) birth weight for boys was 2.438 kg. Out of which 18% of boys were LBW. The mean birth weight for girls was 2.335 kg with 29% of them being LBW. As expected, anthropometric indicators favoured boys. In our study boys were 103gm heavier than girls.

The total number of LBW babies in the study group were 38 (38%) of which 9 (28%) were males and 29 (72%) were females (Figure 1).



**Figure 1: The total number of LBW babies in the study group.**

In our study 37% of mother's had a height below 150 cm out of which 55% delivered LBW babies and 53% mothers had a height between 150-160 cm out of which 32% delivered LBW babies.

Out of 100 mothers, 2% were below 20 years of age and all of them (100%) delivered LBW babies. 23% mothers were between 21-25 years and out of them 31% delivered LBW babies. In 26-30 years age group the incidence of LBW was 58%. And 25% females were above 30 years of age out of which 56% delivered LBW babies. Out of 100 mothers, 16% had weight gain less than 7 kg and out of them 14 (88%) delivered LBW babies. 64% women gained weight between 7-9 kg and out of them only 23 (35%) delivered LBW babies.

A significant association was found between maternal prepartum body weight and parity with low birth weight of baby (Table 2).

**Table 2: Percentage of low birth weight babies in association of maternal characteristics.**

Variables	Study group	Control group	P- value
Height (cms)			
140-150 (37%)	20 (55%)	17 (45%)	0.000
150-160 (53%)	17 (32%)	36 (68%)	
160-170 (10%)	00 (0%)	10 (100%)	
Age (Years)			
<20 (2%)	2 (100%)	00 (0%)	0.030
21-25 (23%)	7 (31%)	16 (69%)	
26-30 (50%)	21(42%)	29 (58%)	
31 and above (25%)	14 (56%)	11 (44%)	
Weight (kg)			
<40 (20%)	18 (90%)	2 (10%)	0.000
40-60 (60%)	20 (33%)	40 (64%)	
>60 (20%)	00(0%)	20(100%)	
Parity			
First	47.8% (11)	52.5% (12)	0.003
Second	20.0% (8)	80.0% (32)	
Third	50.0% (13)	50.0% (13)	
Fourth	40.0% (2)	60.0% (3)	
Fifth	66.7% (2)	33.3% (1)	
Sixth	100% (1)	0.0% (0)	

**Table 3: Percentage of LBW babies in association to socioeconomic status and parent's education.**

Education	Study group	Control group	P-value
Socioeconomic status			
Lower (70%)	46.4%(32)	53.6% (37)	0.020
Middle (27%)	19.2% (5)	80.8% (21)	
Upper (3%)	0.0% (0)	100% (3)	
Mothers education			
Up to 8 <sup>th</sup> (26%)	34.6% (9)	65.4% (12)	0.627
High school (20%)	36.7%(11)	63.3% (19)	
Intermediate (25.5%)	48.0% (12)	52.0% (13)	
Graduate and above (17.5%)	29.4% (5)	29.4% (12)	
Fathers education			
Up to 8 <sup>th</sup> (23.5%)	45.5%(10)	56.5% (13)	0.053
Intermediate (35.7%)	48.0% (14)	52.0% (21)	
High school (25.5%)	40.0% (12)	60.0% (13)	
Graduate and above (15.3%)	6.7% (1)	93.3% (14)	

Out of the 100 mothers, 70% were of lower socioeconomic status and 46.4% of them delivered LBW babies. Significant correlation was seen between the socioeconomic statuses with low birth weight.

There was no significant correlation seen between parent's education and LBW babies (Table 3).

## DISCUSSION

This study was done to estimate the proportion of low birth weight and to identify the maternal risk factors associated with these low birth weight babies. In present study, out of total 100 live new born, 38 were LBW (38%), which is more than the prevalence of LBW (21.5%) observed in National Family Health survey (NFHS-3).<sup>26</sup>

This could be because present study was carried out in a tertiary care hospital where many of the pregnant women are referred from the peripheral centres because of high risk pregnancy.

Munesh et al carried out a hospital based study in government medical college; Chandigarh in a setting similar to present study.<sup>27</sup> The overall proportion of LBW was found to be 23.8% which is lower than that found in our study.

Idris et al, Joshi and Pai, Dasgupta et al also found higher percentage (>30%) of LBW as was observed in our study.<sup>28-30</sup>

A significant association was found between maternal height and maternal weight gain with birth weight of baby in this study.

Maternal weight gain was used as a measure of nutritional status rather than more complex measures of weight and height, because it is routinely recorded and easy to understand.

Our findings are consistent with the studies done by Chhabral et al and Khatun et al.<sup>31,32</sup> In our study significant correlation was noted between the parity and birth weight. Our findings were consistent with Chhabral et al, Khatun et al.<sup>31,32</sup> In the present study a significant association was found between socioeconomic status and birth weight of baby.

Mothers with lower per capita income were at increased risk of delivering low birth weight babies compared to mothers with higher per capita income. Similar findings have been reported by NFHS-3 survey.<sup>26</sup>

Khatun et al, Biswas et al and More, et al also found significant association between socioeconomic status of mother and birth weight of baby.<sup>32-34</sup>

Optimal weight gain during pregnancy and a desirable foetal outcome may be a result of synergistic effects of improved food intake, food supplementation, improved micronutrient intake, education and the environment of the pregnant woman and her family.<sup>35</sup> This study emphasises the need for improving the quality and



utilization of antenatal care, nutritional education to improve the pre delivery body weight, height, reduce parity along with improving socioeconomic and educational status of mothers. The variation in this present study and other studies could be due to the differences in the population based and hospital-based studies.

## CONCLUSION

The low birth weight was found to be high (46%). A number of factors like maternal age height, weight, weight gain during pregnancy, parity and socioeconomic status were found to be significantly associated with LBW. Since most of the factors can be tackled easily by providing adequate antenatal care the low birth weight problem can be tackled effectively. Cost effective alternative would be to enhance female literacy, as illiteracy is directly related to low socioeconomic condition and non-utilization of services. Although proper health education was given at the time of interview, repeated health education should be given at individual, family and community level in order to bring appreciable change in the knowledge, attitude and practice before and during delivery. Thus this study provides baseline information from the tertiary care hospital in this region, which could help in interventions regarding maternal and newborn health in the future. Strengthening of the maternal health program focusing on maternal nutrition and iron and folic acid supplementation during antenatal period and nutrition education to facilitate better weight gain during adolescent period is required.

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