Original Research Article

Maternal factors as determinants of low birth weight deliveries

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Abstract

Background: Maternal factors are more influential in affecting neonatal birth weight through biological and non-biological means. Some of the bio-social factors like maternal age, parity, height, weight, gestation, etc., have been postulated to determine the birth weight of a newborn. **Aim:** To know the association between maternal factors and low birth weight babies. **Material and Methods:** In this hospital based cross sectional analytical study 326 mother with their neonates were included. Maternal factors such as age, parity, haemoglobin, height, weight and body mass index were studied for their association with low birth weight neonates. **Results:** The association of low birth weight with inter pregnancy interval of less than 2 years was significant (p value<0.05). However, the association of low birth weight with parity was not significant (p value>0.05). The association of low birth weight with maternal height of <150cm, weight of less than 55 kg and Hb less than 10 gm/dl was highly significant (p value<0.05). **Conclusion:** Many of the risks factors responsible for LBW can be identified prior to pregnancy. For reducing the prevalence of LBW there is a need of sustainable practices to improve women's nutritional status during childhood, adolescence and prior to pregnancy.
Key Word: Low birth weight, maternal factors, body mass index, haemoglobin

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INTRODUCTION

Low birth weight has long been used as a significant public health indicator. Low birth weight is directly linked with foetal, neonatal mortality and morbidity, inhibited growth, cognitive development and chronic diseases in advanced age.[1] There are several factors which directly or indirectly influence the period of gestation and intrauterine foetal growth, and thus, the birth weight. Maternal factors are more influential than other factors and affect birth weight through biological and non-biological (medical and non-medical) means.[2] It is little difficult to find out a particular single factor which influences the incidence of low birth weight. Some of the bio-social factors like maternal age, parity, height, weight, gestation, etc., besides others have been postulated to determine the birth weight of a newborn. It is generally observed that the low birth weight babies have more troublesome and disadvantages. It is generally recognized that being born with low birth weight is a disadvantage for the baby.[3]In view of above complications associated with increased prevalence of low birth weight in our country, the present study was carried out to know the association between maternal factors and low birth weight babies.

MATERIAL AND METHODS

In this hospital based cross sectional analytical study 326 mother with their neonates were studied with approval from Institutional Ethics Committee. Pregnant women willing to participate in the study were included after informed written consent. A neonate could be enrolled only once and written informed consent was obtained from the mother before their enrollment.

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Inclusion criteria

1. All live born neonates of mothers who are willing to take part in the study.

Exclusion criteria

1. Mother with multiple pregnancies,
2. Mother with last menstrual period not known,
3. Neonates with congenital malformations, chromosomal anomalies
4. Hemolytic disease of the newborn,
5. Sick newborn.

Measurements

Birth weight: For measuring birth weight electronic scales which provide reasonably valid and precise readings were used. Birth weight was recorded in Kilograms. Babies were weighed naked immediately after birth. The weighing machine checked periodically by known standard weights.

Height of mothers: Height was measured using an stadiometer after 24 hours of delivery. It was deferred till the mothers were able to stand erect. Accurate measurements taken using a calibrated stadiometer with a fixed footpiece and movable headpiece which is perpendicular to the ground.

Weight of mothers: For measuring Mother's weight, electronic scales which provide reasonably valid and precise readings were used. Weight was recorded in kilograms. Weight of the mother was assessed within 24 hours after delivery.

Body mass index (BMI): It is an indicator of nutrition among mothers. Weight and height of mothers taken according to the above mentioned criteria. The BMI was calculated following the internationally accepted standard equation of WHO156. BMI= Weight/ Height2, where weight is in kilogram and height in meters.

Hemoglobin Measurements: Maternal haemoglobin sampling was done under aseptic precautions, peripheral venipuncture blood samples of 2ml were collected in EDTA sample bottle from the pregnant women for the determination of Hemoglobin levels before delivery. Accordingly, 2 ml of cord blood was collected immediately in EDTA sample bottle after delivery of the baby for measuring neonate's cord blood haemoglobin levels. Hemoglobin was estimated using automated cell counter method using BECKMAN Automated hematology analyzer. Anemia in mother was considered as hemoglobin concentration of <10gm/dl.

Statistical analysis: The collected data was entered, tabulated, graphically displayed and analyzed using Microsoft office window excel 2013 and SPSS version 16 (SPSS 16.0 for Windows, release 16.0.0. Chicago: SPSS Inc). The data was analysed using a Chi- Square for quantitative data. Chi square test was used to calculate p value. We considered the association or difference to be significant when the p value was less than 0.05.

RESULTS

Total number of newborns enrolled in this study was 326, out of which 94 was low birth weight and 232 was normal weight babies. So, the incidence of low birth weight in this study was 28.8%. In low birth weight babies 49(52.1%) were females and 45(47.9%) are males. Although the percentage of females were more in low birth weight but the association of sex with low birth weight was found to be statistically insignificant($p>0.05$).Total number of newborns in 21-30 years maternal age groups were 162 (49.7%). Out of which normal birth weight babies constituted 131(56.5% of normal birth weight babies) and low birth weight babies were 31 (33% of low birth weight babies). Similarly, total number of newborns in <20 years maternal age groups were 145 (44.5%). Out of which normal birth weight babies constitute 88(37.9% of normal birth weight babies) and low birth weight babies were 57 (60.6% of low birth weight babies).On the other hand, total number of newborns in >30 years maternal age groups are 19 (5.8%) out of which normal birth weight babies constitute 13(5.6% of normal birth weight babies) and low birth weight babies were 6 (6.4% of low birth weight babies).Association of low birth weight with maternal age group was found to be highly significant as p value<0.001.

Table 1: Distribution of low birth weightand maternal age and parity

Maternal age and parity	Birth weight		Statistical significance
	Low	Normal	
Maternal age			
<20 years	31 (33%)	131 (56.5%)	χ^2=15.25; df=2; p<0.05 (Highly Significant)
21-30 years	57 (60.6%)	88 (37.9%)	
>30 years	06 (6.4%)	13 (5.6%)	
Spacing of birth			χ^2=6.27; df=1; p<0.05 (Significant)
<2 yrs	52 (86.6%)	35 (20.8%)	
>2 yrs	08 (13.4%)	133 (79.2%)	
Parity			χ^2=2.234; df=1; p>0.05 (Not Significant)
Primi	34 (36.2%)	64 (27.6%)	
Multi	60 (63.8%)	168 (72.4%)	

The incidence of newborns in mothers having inter pregnancy interval less than 2 years was 87(38.15%) and 141 (61.85%) in mothers who had the inter pregnancy interval of more than 2 years. In case of low birth weight newborns, incidence among mothers of pregnancy interval of less than 2 years was 52(86.6%) and of inter pregnancy interval of more than 2 years incidence decreased to 8(13.4%). Similarly, in case of normal birth weight newborns, incidence among mothers of pregnancy interval of less than 2 years were 35(20.83%) and of inter pregnancy interval of more than 2 years incidence increased to 133(79.17%). According to statistical analysis, the association of low birth weight with inter pregnancy interval of less than 2 years was significant (p value<0.05). The incidence of newborns in mothers who were primi were 98(30.1% of all newborns) and 228 (69.9%) in multiparous mothers. In case of low birth weight newborns, incidence among prmiparous mothers was 34(36.2% of low birth weight babies) and among multiparous mother incidence increased to 60(63.8% of low birth weight babies). Similarly, in case of normal birth weight newborns, incidence among primigravida mothers less was found to be 64(27.6% of normal birth weight babies) and in multigravida mother incidence increased to 166(72.4%). According to statistical analysis, the association of low birth weight with parity is not significant in this study (p value>0.05).

Table 2: Distribution of low birth weight according to maternal factors

Maternal factors	Birth weight		Statistical significance
	Low	Normal	
Height of mother			$\chi2=47.07$; df=1; p<0.05 (Highly Significant)
<150 cm	62 (66%)	59 (25.4%)	
>150 cm	32 (34%)	173 (74.6%)	
Weight of mother			$\chi2=73.02$; df=1; p<0.05 (Highly Significant)
<55 kg	90 (95.7%)	103 (44.4%)	
>55 kg	04 (4.3%)	129 (55.6%)	
BMI			$\chi2=10.36$; df=2; p<0.05 (Highly Significant)
<18.5	54 (57.4%)	93 (40.1%)	
18.9-24.9	39 (41.5%)	124 (53.4%)	
>24.9	01 (1.1%)	15 (6.5%)	
Hb of mother			$\chi2=130.79$; df=1; p<0.05 (Highly Significant)
<10 mg/dl	85 (47.9%)	50 (52.6%)	
>10 mg/dl	09 (9.6%)	182 (78.4%)	

Height of the mothers enrolled in the study was divided into two groups: of less than 150 cm and of >150 cm. The incidence of newborns in mothers of height <150 cm were 121(37.1% of all newborns) and 205 (62.9%) in mothers who had height of more than 150 cm. In case of low birth weight newborns, incidence among mothers of height <150 cm was 62 (66% of low birth weight babies) and incidence decreased to 32(34% of low birth weight babies) in mothers of height >150 cm. Similarly, in case of normal birth weight newborns, incidence among mothers of lesser height was found to be 59(25.4% of normal birth weight babies) and in mothers of height more than 150 cm incidence increased to 173(74.6%). According to statistical analysis, the association of low birth weight with maternal height of <150 cm was highly significant in this study(p value<0.05). Weight of the mothers enrolled in the study was divided into two groups: of less than 55 kg and of > 55 kg. The incidence of newborns in mothers of weight <55 kg was 193(59.2% of all newborns) and 133 (40.8%) in mothers who had weight of more than 55 kg. In case of low birth weight newborns, incidence among mothers of weight <55 kg was 90(95.7% of low birth weight babies) and incidence decreased to 4(4.3% of low birth weight babies) in mothers of weight >55 kg. Similarly, in case of normal birth weight newborns, incidence among mothers of lesser weight was found to be 103(44.4% of normal birth weight babies) and in mothers of weight more than 55 kg incidence increased to 129(55.6%). According to statistical analysis, the association of low birth weight with weight of the mother of less than 55 kg is highly significant in this study(p value<0.05). Hb levels of the mothers enrolled in the study was divided into two groups: of less than 10 gm and of >10 gm. The incidence of newborns in mothers of hb levels <10 gm was 135(41.4% of all newborns) and 191 (58.6%) in mothers who had Hb levels of more than 10 gm. In case of low birth weight newborns, incidence among mothers of Hb<10 gm was 85(90.4% of low birth weight babies) and incidence decreased to 9(9.6% of low birth weight babies) in mothers of Hb>10 gm. Similarly, in case of normal birth weight newborns, incidence among mothers of lesser hemoglobin levels were found to be 50(21.6% of normal birth weight babies) and in mothers of Hb levels more than 10gm incidence increased to 182(78.4%). According to statistical analysis, the association of low birth weight with Hb levels of the mother of less than 10gm is highly significant in this study(p value<0.05).

Maternal BMI ranged from <18.5 to > 24.9 and was divided into 3 groups-<18.5, 18.5-24.9 and > 24.9.The incidence of newborns in mothers of BMI <18.5 was found to be 147(45.1% of total newborns), in mothers who had BMI of 18.5-24.9 was 163 (50% of total newborn) and incidence was 15(6.15% of total newborn) in mother of BMI >24.9. In low birth weight babies, incidence was 54 (57.4%) in mothers of BMI <18.5, 39(41.5%) in mothers of BMI 18.5- 24.9 and 1(1.1%) in mothers of BMI >24.9. Similarly, in case of normal birth weight babies, incidence was 93 (40.1%) in mothers of BMI <18.5, 124(53.4%) in mothers of BMI 18.5-24.9 and 15 (6.5%) in mothers who had BMI > 24.9.As per the statistical analysis, the association of low birth weight with maternal BMI was significant in present study (p value<0.05).

DISCUSSION

Low birth weight has been associated with a lot of short term and long term complications. In the present study, maternal factors influencing low birth weight are studied. Due to diverse sequelae, low birth weight can be perceived as the greatest public health problem facing the globe. But as the etiology is diverse, though prevention is difficult still the incidence of LBW can be reduced by strong and applicable strategies. In the present study, 71.16% of the newborns were of normal birth weight and incidence of low birth weight was 28.83% which is very similar to the UNICEF data on low birth weight.[3] Incidence of low birth weight neonates was found to be 28.35% in a study done by Malik *et al*[4] which is almost comparable to the present study. In a study done by Roy *et al*,[5] the incidence of low birth weight babies was 33.6%, which is slightly higher as compared to the present study. In a study done by Bala *et al*[6] it was seen that 76.9% neonates had normal birth weight and 23.1% had low birth weight, which is lower than the present study. In a study done by Ram *et al*[7]the incidence of low birth weight was 33% which is slightly higher as compare to the present study. In a study done by Agrawal *et al*,[8] 32.3% were low birth weight neonates and 67.7% were non low birth weight which is slightly higher than the present study. In a study done by Paliwal *et al*[9] the incidence of low birth weight babies was 27.76%, which is almost comparable to the present study. In the present study, the association of low birth weight with inter pregnancy interval of less than 2 years is significant (p value<0.05). A study done by Deshpande JS *et al*[10] showed that spacing of <2 years was found to be significantly associated with low birth weight which is comparable to present study. Studies done by Roy *et al*[5] and Memon *et al*[11] showed the significant association between spacing of <12 months and low birth weight. Khan N *et al*[12] conducted a cross sectional study showed that close birth spacing was significantly associated with low birth weight. In the present study, in case of low birth weight newborns, incidence among primiparous mothers was 34(36.2% of low birth weight babies) and among multiparous mother incidence increased to 60(63.8% of low birth weight babies), the association of low birth weight with parity is not significant in this study(p value>0.05).A study done by Bala *et al*[6] and Agrawal *et al*[8] showed that the association was found to be significant with low birth weight and parity of mothers, the incidence was much higher in grand multipara. Similar results were also found in a study done by Chukwudi NK *et al.*[13] As this study is conducted in one of the metro city of India, the incidence of grand multiparity is supposed to be very less, this can explain the insignificant association between parity and low birth weight and association is insignificant could be due to improved ante natal practices in big cities as compared to smaller one. In present study, the association between maternal Height of <150 cm with low birth weight is found to be significant. A study done by Bala *et al*[6] in in urban slums of Jammu city 77.8% mothers with height <145cm delivered LBW newborns when compared to 18% of mothers with height >150cm who delivered LBW and the association was statistically significant which is comparable to present study. A study done by Bisai *et al*[14] showed that mternal height >155 cm had lower incidence of low birth weight baby and the association was significant which is comparable to our study. Malik *et al*[4] showed that maternal height of<145 cm was significantly associated with low birth weight which can be comparable to our study. Similar studies done by Roy S *et al*[5] and Deshpande *et al*[10] showed strong association of mother height of <145 cm with low birth weight which can be comparable to present study. The association of low birth weight with weight of the mother of less than 55kg is highly significant in this study(p value<0.05). A study done by Ezaeka VC *et al*[15] showed the significant association of low birth weight with maternal weight of <50 kg which is comparable to this study. Studies conducted by Boratne *et al*[16] and Deshpande *et al*[10] observed the significant association between maternal weight of <45kg and low birth weight. In an observation study conducted by Malik *et al*[4] showed the significant association of maternal weight of <42 kg and low birth weight. The association of low birth weight with Hb levels of the mother of less than 10 gm was highly significant in this study(p value<0.05).A study done by Deshmukh *et al*[17]showed a significant association with low birth weight and anemia which is comparable to present study. Prudhivi *et al*[18] conducted a prospective study showed a significant association between maternal

anemia and low birth weight which is comparable to present study. Kader *et al*[19] found a strong association with maternal anemia and low birth which is comparable to present study. Paliwal *et al*[9] showed the strong association of maternal anemia and low birth weight. In low birth weight babies, incidence was 54 (57.4%) in mothers of BMI <18.5,39(41.5%) in mothers of BMI 18.5-24.9 and the association of low birth weight with maternal BMI was significant in present study (p value<0.001). A study done by Kader *et al*[19] found that mothers having BMI<18.5 had a significant association with low birth weight which is comparable to our study. Bhaskar *et al*[20] conducted a study which showed that normal BMI of mother were found to be protective against LBW.

CONCLUSION

Many of the risks factors responsible for LBW can be identified prior to pregnancy. For reducing the prevalence of LBW in country like India public health strategy needs to pay attention on health education. There is a need of sustainable practices to improve women's nutritional status during childhood, adolescence and prior to pregnancy and to ensure their adequate weight gain during pregnancy, which require behavior change within households.

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