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Original Research Article

Assessment of maternal risk factors associated with low birth weight neonates at a tertiary hospital, Nalgonda

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ABSTRACT

Background: Low birth weight continues to be the major cause of neonatal morbidity and mortality in developing countries. Birthweight and gestational age are important factors for survival, growth, and overall development of the child. In India, the prevalence of low birthweight has decreased from 20.4% to 16.5% in last decade.1 Although the prevalence of LBW neonates in India has declined over past decade, the extent of decline is only modest. Therefore, there is still need for the study of modifiable risk factors associated with low birth weight. The objective of the study was to identify the maternal risk factors associated with low birth weight in the babies admitted to Kamineni Institute of Medical Sciences, Narketpally.
Methods: A hospital based observational study was carried out in Kamineni Institute of Medical Sciences among 91 mother/newborn pairs using interviewer administered questionnaire.
Results: This study revealed that 29.67% infants were born low birth weight. The risk of LBW was higher among mothers of age<20 years (16.48%) and BMI<18.5 kg/m^2 (17.58%). Mothers who are anemic (21.98%) and suffering from chronic maternal illness (15.38%) were at high risk of giving birth to low birth weight baby. The likelihood of giving LBW baby was higher among multiparous (18.68%) than primiparous women.
Conclusions: The prevalence of low birth weight was found to be very high and it was associated with many risk factors related to maternal health. Hence it is recommended to improve maternal health through strengthening the existing maternal services at the basic level of community.

Keywords: Low birth weight, Socio economic factors, Gestational age, Maternal age, Maternal BMI, Parity, HB% level

INTRODUCTION

The World health organization (WHO) defined low birth weight (LBW) as weight at birth less than 2,500 grams. Low birth weight is more common in developing countries and contributes to a range of poor health outcomes in later life.[1] It contributes to 60% to 80% of all neonatal mortality and morbidity.[2]

Most of the low birth weight infants are born either preterm or have intrauterine growth retardation (IUGR). While most of the low birth weight newborns in developed countries are attributed to preterm delivery, in developing nations it is due term small for gestational age babies.[3] The prevalence of LBW in any population reflects its socio-economic development and it is a good proxy to gauge the developmental status of the country.[4]

The causes of SGA include socioeconomic factors such as residence (urban-rural difference), mother's age, mother's educational, nutritional and health status, parity, birth spacing, occupation, the family's income.[5-7]

More than 20 million infants worldwide, representing 15.5 percent of all births are born with low birth weight, 95.6 percent of them in developing countries. The level of low birth weight in developing countries 16.5 % is more than double the level in developed regions that is 7%.[1,6]

The significance and interpretation of low birth weight has recently come in to prominence because it indicates the chances of survival, growth and long term health and of impaired cognitive development, diabetes and coronary artery disease in later part of their lives.[8-10]

Aim and objectives

Aim was to assess the maternal risk factors associated with low birth weight.

Objectives were to identify maternal risk factors and to correlate them with the incidence of low birth weight and to identify a significant causal relationship between maternal risk factors and the incidence of low birth weight.

METHODS

Study design

The present study is a hospital based observational study consisting of singleton full term neonates with no gross congenital malformations.

Study area and period

They were evaluated at postnatal ward, Kamineni institute of medical sciences, Narketpally, Nalgonda between October 2018 to October 2019.

Inclusion criteria

Mothers who gave birth in the Kamineni Institute of Medical Sciences and delivered Live born, singleton, term neonates with gestational age between 37 to 42 weeks were included.

Exclusion criteria

Neonates with any congenital malformations, with gestational age<37 weeks or>42 weeks, babies requiring NICU admissions in less than 48hours of life were excluded.

Mothers suffering from severe medical or surgical condition, twin delivery were excluded from the study.

Study variables

The study variables included in the study are age of the mother, maternal BMI, maternal parity, maternal anaemia, chronic illness of the mother. Chronic medical illness that are included under the study are hypertension, diabetes mellitus, congestive heart failure, HIV, thyroid disorders during current pregnancy.

Data collection instruments

The data were collected using a structured pre-tested interviewer guided questionnaire which was prepared by reviewing similar literatures.

The following anthropometric measurements of the baby were specifically recorded.

Birth weight

Birth weight was measured on an electronic weighing scale. The naked babies were weighed on it. The electronic weighing machine had 1 gm accuracy.

Crown heel length

Length was measured on an infantometer. It was recorded to the nearest of 0.5 cm. Baby was kept supine, knees fully extended, and soles of feet held firmly against the foot board and head touching the fixed board.

All measurements were carried out between 24 and 48 hours of newborn age.

PI is calculated based on the following formula:[11]

PI=weight (g)×100/length (cm)3.

Term neonates with Ponderal index<2.2 is considered as an index of fetal malnutrition.12 In this study, both the anthropometric measurements, birth weight and ponderal index were studied in relation to maternal risk factors.

Data analysis

For statistical analysis data were entered into Microsoft excel spread sheet and analysed using social science statistics. Descriptive statistics were computed using simple frequency tables and charts. Spearman's Chi-square test or Fisher's exact test (FET) of significance was used to determine statistical significance. P value <0.05 was considered statistically significant.

Ethical consideration

Prior to start of the study, approval was taken from the Institutional ethics committee. A written informed consent was taken from either of the parent of the newborn satisfying inclusion and exclusion criteria prior to start of the study and those parents who are willing were included in the study.

RESULTS

The study included 91 mother/newborn pairs who delivered in Kamineni Institute of Medical Sciences, Narketpally, Nalgonda.

The mean age of the mothers was 23.8 years (SD±3.91). Concerning inter-pregnancy interval (spacing) (87%) were delivered more than or equal to two years ahead of the index pregnancy.

Table 1: Distribution of cases according to birth weight.

Baby weight in kgs	N (%)
<2.5	27 (29.67)
≥2.5	64 (70.33)
Total	91 (100)

Regarding the birth weight of the newborns 64 (70.33%) were above or equal to 2500 grams and less than 2500 grams were 27 (29.67%). Newborns with Ponderal index less than 2.2 were 24 (26.36%) and more than or equal to 2.2 were 67 (73.63%). The mean and standard deviations of the birth weights were 2580±432.1 grams (Table 1).

Maternal age

Twenty-four (26.37%) babies were born to mothers aged≤20 years and 15 (16.48%) babies had low birth weight, while 67 (73.63%) babies were born to mothers with age more than 20 years, out of which 12 (13.19%) babies had low birth weight. Mothers of younger age group had a greater number of low birth weight babies, with statistically significant association between maternal age and low birth weight ($\chi2$= 16.83, p<0.05) (Table 2).

Twenty-four (26.37%) babies were born to mothers aged≤20 years and 16 (17.58%) babies of them had ponderal index less than 2.2, while 67 (73.63%) babies were born to mothers with age more than 20 years, out of which 8 (8.79%) babies had ponderal index of less than or equal to 2.2. Mothers of younger age group had a greater number of malnourished babies, with statistically significant association between maternal age and low birth weight ($\chi2$=27.25, P<0.05) (Table 3).

Table 2: Relation between maternal age and birth weight of the newborn.

Maternal age in years	Birth weight (kg)		Total N (%)	$\chi2$	P value
	<2.5 N (%)	≥ 2.5 N (%)			
≤20	15 (16.48)	9 (9.89)	24 (26.37)		
>20	12 (13.19)	55 (60.44)	67 (73.63)	16.83	<0.05
Total	27 (29.67)	64 (70.33)	91 (100)		

Table 3: Relation between maternal age and ponderal index of the newborn.

Maternal age in years	Ponderal index		Total N (%)	$\chi2$	P value
	<2.2 N (%)	≥ 2.2 N (%)			
≤20	16 (17.58)	8 (8.79)	24 (26.37)	27.25	<0.05
>20	8 (8.79)	59 (64.84)	67 (73.63)		
Total	24 (26.37)	67 (73.63)	91 (100)		

Table 4: Relation between maternal BMI and birth weight of the newborn.

Maternal BMI	Birth weight (kg)		Total N (%)	$\chi2$	P value
	<2.5 N (%)	≥2.5 N (%)			
<18.5	16 (17.58)	7 (7.69)	23 (25.27)	23.47	< 0.05
≥18.5	11 (12.09)	57 (62.64)	68 (74.73)		
Total	27 (29.67)	64 (70.33)	91 (100)		

Maternal BMI

Twenty-three (25.27%) babies were born to mothers with BMI less than 18.5 kg/m2, of which 16 (17.58%) were low birth weight and 68 (74.73%) born to mothers with BMI more than 18.5 kg/m2, 11 (12.09%) were low birth weight.

Twenty-three (25.27%) babies were born to mothers with BMI less than 18.5 kg/m2, of which 13(14.28%) had

ponderal index less than 2.2 and 68 (74.73%) born to mothers with BMI more than 18.5 kg/m2, 11 (12.09%) had ponderal index of less than 2.2 which indicates fetal malnutrition (Table 4).

Therefore, this study shows a significant association between maternal BMI in relation to low birth weight and fetal malnutrition ($\chi2$=23.47, P<0.05) and fetal malnutrition ($\chi2$=14.04, P<0.05) (Table 5).

Table 5: Relation between maternal BMI and ponderal index of the newborn.

Maternal BMI	Ponderal index		Total N (%)	$\chi2$	P value
	<2.2 N (%)	≥2.2 N (%)			
<18.5	13 (14.28)	10 (10.99)	23 (25.27)	14.40	<0.05
≥18.5	11 (12.09)	57 (62.64)	68 (74.73)		
Total	24 (26.37)	67 (73.63)	91 (100)		

Table 6: Relation between parity of the mother and birth weight of the newborn.

Maternal parity	Birth weight (kg)		Total N (%)	$\chi2$	P value
	<2.5 N (%)	≥2.5 N (%)			
Primi	10 (10.99)	14 (15.38)	24 (26.37)	2.24	0.133
Multi	17 (18.68)	50 (54.95)	67 (73.63)		
Total	27 (29.67)	64 (70.33)	91 (100)		

Table 7: Relation between maternal anaemia and birth weight of the newborn.

Maternal Hb in G/dl	Birth weight (kg)		Total N (%)	$\chi2$	P value
	<2.5 N (%)	≥2.5 N (%)			
≤10	20 (21.98)	9 (9.89)	29 (31.87)	31.49	<0.05
>10	7 (7.69)	55 (60.44)	62 (68.13)		
Total	27 (29.67)	64 (70.33)	91 (100)		

Maternal parity

The relationship between parity birth weight and the nutritional status of the babies is shown in following tables. Low birth weight and Fetal malnutrition occurred most 17 (18.68%) and 13 (16.48%) in babies of multi parous mothers, but there was no significant relationship between parity, birth weight ($\chi2$=2.24, P=0.133). and nutritional status of the baby ($\chi2$=2.07, P=0.14) (Table 5).

Maternal hemoglobin

Twenty-nine babies (31.87%) out of 91 were born to mothers with hemoglobin less than or equal to 10. Of which 20 (21.98%) babies were low birth weight and out of 62 (68.13%) babies born to mothers with hemoglobin more than 10.7 (7.69%) babies were found to be low birth weight (Table 7).

Of twenty-nine babies (31.87%) born to mothers with hemoglobin less than or equal to 10, 16 (17.58%) had ponderal index of<2.2 and out of 62 (68.13%) babies born to mothers with hemoglobin more than 10, 8 (8.79%) had ponderal index of less than 2.2.

Hence this study shows a significant association between maternal anaemia and low birth weight ($\chi2$=31.49, p<0.05) and intra uterine growth retardation ($\chi2$=18.18, P<0.05) (Table 8).

Maternal chronic illness

In the present study, out of 91 babies, 21(23.08%) babies had maternal history of chronic illness, 14 (15.38%) of them were low birth weight. 70 (76.92%) babies had no history of maternal chronic illness, of which 13 (14.29%) had low birth weight ($\chi2$=17.90, P<0.05) (Table 9).

Twenty-one (23.08%) babies had maternal history of chronic illness, of them 14(15.38%) had ponderal index of less than 2.2. 70 (76.92%) babies had no history of maternal chronic illness, of which 10 (10.99%) had ponderal index of less than 2.2 which indicates intra uterine growth retardation ($\chi2$=22.8, P<0.05) (Table 10).

Hence this study shows a significant association between maternal chronic systemic illness, low birth weight and fetal malnutrition.

Table 8: Relation between maternal anaemia and ponderal index of the newborn.

Maternal Hb in g/dL	Ponderal index		Total N (%)	χ2	P value
	<2.2 N (%)	≥2.2 N (%)			
≤10	16 (17.58)	13 (14.29)	29 (31.87)	18.18	<0.05
>10	8 (8.79)	54 (59.34)	62 (68.13)		
Total	24 (26.37)	67 (73.63)	91 (100)		

Table 9: Relation between maternal chronic illness and birth weight of the newborn.

Maternal chronic illness	Birth weight (kg)		Total N (%)	χ2	P value
	<2.5 N (%)	≥2.5 N (%)			
Yes	14 (15.38)	7 (7.70)	21 (23.08)	17.90	<0.05
No	13 (14.29)	57 (62.63)	70 (76.92)		
Total	27 (29.67)	64 (70.33)	91 (100)		

Table 10: Relation between maternal chronic illness and ponderal index of the newborn.

Maternal chronic illness	Ponderal index		Total N (%)	χ2	P value
	<2.2 N (%)	≥2.2 N (%)			
Yes	14 (15.38)	7 (7.70)	21 (23.08)	22.8	<0.05
No	10 (10.99)	60 (65.93)	70 (76.92)		
Total	24 (26.37)	67 (73.63)	91 (100)		

DISCUSSION

In this study an attempt has been made to determine the modifiable maternal risk factors associated with low birth weight in the study area.

As most of the study participants belong to the local area (rural area), and educational status was mostly (88%) till secondary school, residence, educational and socio-economic status are not included under study variables.

However, the place of residence of the mothers was an important risk factor associated with the occurrence of low birth weight.

Mothers residing in rural area were at greater risk of delivering LBW babies when compared to those mothers who live in urban. This is shown in many studies done by Gagan et al. and others in India.[13,14] This could be due to the accessibility of medical services, health information, and nutritional awareness which are more prominent as the woman resides in urban area than rural area. In addition, rural residents do not appear to health institution, and are at greater risk of poor perinatal outcome than their urban counterparts.

Results of this study revealed that maternal age, weight, BMI, anaemia, and presence of chronic medical illness are significant predictors for low birth weight.

The prevalence of low birth weight was found to be 29.6% and IUGR 26.37%, which is high compared to incidence of low birth weight in developing countries (16.5%).[1,6] This difference might be due to the fact that the present study is being conducted in a rural area and in a tertiary care hospital where many of the pregnant women were referred from peripheral hospitals because of high risk pregnancy.

In our study incidence of low birth weight babies was higher among teenage pregnancies which is in line with many other studies- In a study conducted at peri-urban slum area of Mumbai, India, pregnancy at teenage was found to be a risk factor for lower birth weight as compared to women between the ages of 21 to 30 years.15 But this was against the other studies conducted done by Mavalankar et al and Kumar et al.[16,17]

Some of the explanations proposed for these adverse birth outcomes are biological- i.e. that a pregnant teenager who is still growing may be competing for nutrients with the fetus, or that pregnancy within two years after menarche increases the risk of preterm delivery.[18] In a cross-sectional observational study by Mukhopadhyay et al on teenage primigravida mothers in a tertiary care hospital in eastern India showed that the teenage mothers had a higher proportion (27.7%) of preterm deliveries compared to 13.1% in the adult mothers and had low-birthweight babies (38.9 vs. 30.4%, respectively).[19]

Hence maternal age less than 20years is considered as a significant risk factor for low birth weight.[20]

Our study revealed that maternal undernutrition (BMI<18 kg/m2) was significantly associated with LBW. This is consistent with earlier studies done in India by Mumbare et al, Nagargoje et al and Amitava et al and abroad.[21-24] This could be due the fact that maternal malnutrition during infancy and childhood periods that persist to affect the new offspring.

In our study multiparous women are at increased risk of delivering low birth weight babies when compared to primiparous but significant association was not proven. Studies have shown that risk of having an LBW baby was higher among multiparous women than those of primiparous. This may be due to short inter pregnancy interval.[22] But some studies were against this, with primiparous mothers being at high risk of having low birth weight babies than multiparous Kour et al and Nirmali gogai et al.[25,26]

Our study showed that anaemic mothers had higher risk of delivering LBW neonates. This finding was consistent with many studies done in India by Dubey et al and Dharmalingam et al and others.[3,27-32]

But was against the study conducted by Gogoi et al., who showed that the effect of birth weight of newborn was insignificant on Hb% level of mother during delivery.26 In other words, mother of low birth weight of newborn had same Hb% level of mothers with normal birth weight of newborn. It may be due to overall Hb% level of mothers both with low birth weight of newborn and with normal birth weight of newborn is very low in this study. A study by Kavitha et al. reported that about 35.28% of mothers with low birth weight HB% level was 10.9% and it was about two-third of the mothers were anaemic.[33]

Micronutrients deficiencies during pregnancy had been shown to have serious health implications on the developing fetus and hence, birth size.[34] Anaemia could impair oxygen delivery to the fetus and thus interfere with normal intrauterine growth which possibly leads to LBW. Iron supplementation during pregnancy protects women from becoming anaemic and subsequent increased risk of giving LBW babies, because the required amounts may not be supplied from dietary intake alone during this period. larger cohort study undertaken in China indicating maternal daily intake of 400 µg of folic acid alone significantly reduced the risks of LBW and SGA status of infants.[35]

In our study, presence of chronic medical illness during pregnancy was found to be significantly associated with LBW. This result is consistent with the studies conducted in India by Sachin et al, Meshram et al and others.[30-32] This could be due to inadequacy of the number and quality of antenatal check-ups that result in many undiagnosed chronic illnesses in the mother which may have detrimental effect on the fetus. A study conducted by Johnson et al. was against the result of our study which showed no relation between maternal diseases and low birth weight of the newborn.[36]

Limitations

In the present study, different predictors for LBW were studied, however, some important other potential risk factors for LBW including maternal psychological stress, domestic violence, family support, toxic exposures, and quality of antenatal care received by the pregnant women, which may have some effect on LBW were not studied. In the present study, the participants were selected from Narketpally, Nalgonda district, India. This being a rural area, the findings of this study cannot be extrapolated for all Indian participants.

CONCLUSION

This study showed that the prevalence of LBW is higher in our tertiary care setup as it is based in a rural area. The study also showed a significant association between LBW and maternal risk factors like maternal age, weight, hemoglobin and chronic illnesses.

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