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Original Research Article.

Association Between Maternal Risk Factors and Low Birth Weight: A Hospital Based Cross-Sectional Study in Western Odisha, India

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ABSTRACT

Background: World Health Organization has defined low birth weight (LBW) as birth weight less than 2,500 grams. LBW is an important indicator of reproductive as well as general health status of a given population. The aetiology of LBW is multifactorial. The current study was conducted to find out the maternal risk factors associated with LBW delivered in V.S.S Medical College& Hospital, Burla.

Materials and Methods: It was hospital based cross -sectional study comprising of 1030 postnatal women and their newborns who delivered single live baby in V.S.S Medical College& Hospital, Burla. Selection of study participants done by systematic random sampling. The study was conducted from Oct 2012 to September 2014.Results obtained was expressed in simple number and percentages. Chi-square test was used to measure the association between LBW and various maternal risk factors.

Results: The proportion of LBW was found to be 27.76%. The proportion of LBW was found high and significant in Primi mothers (31.09%), birth spacing < 36 months (28.93%), gestational age < 37 weeks (62.94%), obstetric complications (31.12%), major medical illness (44.07%), Haemoglobin <11gms (34.32%), weight gain <10 kg during pregnancy (41.60%), late registration (33.62%), < 4 ANC visit (52.79%), <100 IFA tab. Consumption (44.70%) and without calcium supplementation (33.60%).

Conclusions: The finding of the present study indicates that LBW can be tackled by maternal education, socioeconomic development and providing adequate antenatal care to pregnant women in time.

Key words: Low Birth Weight, Maternal Risk Factors, Cross Sectional Study, Antenatal Check-Up.

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INTRODUCTION

World Health Organization has defined low birth weight (LBW) as birth weight less than 2500 grams irrespective of the duration of the gestational period.[1-3] Birth weight is the most important predictor of the neonatal and infant morbidity and mortality. LBW is a sensitive indicator of the socio-economic conditions as well as the health of the mother and the child.

Worldwide, LBW continues to remain as a major public health problem mostly in developing countries. The incidence of LBW is estimated to be 16% worldwide, 19% in the least developed and developing countries and 7% in the developed countries.[2,4,5] India accounts more than 40% of the global burden of LBW. The prevalence of LBW in India was found to be 28%.[6]

In Odisha, there is a wide variations in the prevalence of LBW in the entire 30 different district, with a minimum of 7 % in Puri district to a maximum of 26% in Kandhamal district. The prevalence of LBW in Sambalpur district which includes our study area is 20% but the less percentage could be due to under reporting.[7]

LBW is a result of preterm birth, intrauterine growth restriction, or a combination of both pathophysiologic conditions. There are numerous maternal and fetal factors contributing to LBW. Weight at birth is directly influenced by general health status of the mother. Maternal environment is the most important determinant of birth weight and factors that prevent normal circulation across the placenta cause poor nutrient and oxygen supply to the fetus, restricting growth.

The maternal risk factors are biologically and socially interrelated but most are modifiable. In a meta-analysis Krammer has identified 43 potential factors for LBW.[4] Most of these factors have been well studied i.e. age of the mother, parity, birth spacing, socioeconomic status, obstetric and medical complications during pregnancy, anaemia, tobacco consumption during pregnancy,

exposure to kitchen fuel, anthropometry of mother, physical activity, nutrition, antenatal care. It is not necessary that all the factors should be present in a given area. The factors vary from one area to another, depending upon geographic, socioeconomic and cultural factors. The LBW can be reduced if the modifiable maternal risk factors in a given area are identified. Thus it is necessary to find out factors prevailing in a particular area responsible for LBW.

With this background, the present study was conducted to find out the maternal risk factors associated with LBW delivered in V.S.S Medical College& Hospital, Burla.

MATERIALS AND METHODS

It was a hospital based cross-sectional study conducted in Obstetrics & Gynaecology department of V.S.S. Medical College & Hospital, Burla. The study was undertaken from Oct 2012 to September 2014 after due approval from Institutional Ethical Committee (IEC). A pilot study was carried out to test the questionnaire and to check the feasibility of the study before undertaking the actual study. The objective of the study was explained to the study participants and informed consent was obtained .Consent from the husband or head of the family was obtained in cases where mothers with age less than 18 years (minor). The study participants were recruited into the study just before delivery. All babies were weighed within one hour after the birth. The babies were weighed on calibrated baby weighing machine (max.weight10kgs) up to 10g accuracy (Docobel company). Birth weight below 2500gms were taken as LBW.

Taking prevalence of LBW babies in India as 28 % (UNICEF-2012)[6]and 10% allowable error with 95% confidence interval sample size calculated to be 1030, by using the formula: $n=4pq/l^2$

Outcome Variable: Low birth weight babies

Exposure Variables: Maternal age, residence, religion, education and occupation, type of family, socio economic status, parity, birth spacing, gestational age, bad obstetric history, major medical illness and obstetrics complications during pregnancy, weight at first trimester, body mass index (BMI), anaemia, time of registration of pregnancy, number of ANC visits, number of IFA tablets taken, calcium supplementation and sex of the baby.

Selection Criteria of Study Participants: Study participants comprised of 1030 pregnant mothers and their newborns satisfying following inclusions and exclusions criteria:

Inclusion Criteria: 1. Mothers who delivered Singleton live birth baby in Obstetrics and Gynecology Department, V.S.S Medical College and Hospital, Burla 2. Mothers who gave informed consent to participate at the time of study

Exclusion Criteria: Mothers with multiple pregnancies, severe complications and incomplete records, still births, neonates with congenital malformations, chromosomal anomalies and haemolytic disease of newborn.

Data Collection Method: 1030 mothers who delivered singleton live birth baby in the V.S.S Medical College and Hospital, Burla were selected by systematic random sampling method. The information regarding the exposure variables was collected in postnatal wards by mother's interview by using predesigned and pretested semi-structured questionnaires along with review of bed tickets and MCP card. Anthropometric measurements of all 1030 mothers were taken by principal investigator in the postnatal wards. The mother's height was measured using a height measuring stand up to the accuracy of 0.5 cm. and mother's weight was measured using a calibrated weighing machine up to the accuracy of 0.5 kg. Standardization of equipment was done to minimize error. The gestational age was calculated from the last menstrual period in completed weeks of gestation. Socioeconomic status as suggested by B.G. Prasad was adopted and modified as per all India consumer price index of 2013.[8]

After collection of data, all the variables were analysed by using descriptive statistics like frequency and percentages and comparison of group was done by chi-square test using SPSS version 20.0. P value less than 0.05 was considered as statistically significant.

RESULTS

Out of 1030 singleton live birth babies 286 were LBW. Thus the proportion of LBW was found to be 27.76%.

Table 1 shows out of 1030 mothers, majority 848 (82.33%) belonged to 20-29 years age group, whereas 139 (13.49%) were in≥30 years and 43 (4.18%) were ≤19 years. Most of the mothers 861 (83.59%) were from rural area and rest 169 (16.41%) were from urban area. Majority 989 (96.02%) of mothers were Hindus whereas 30 (2.91%) belonged to Christians and 11 (1.07%) were muslims. Majority 634 (61.5%) educated up to intermediate and above, whereas 175 (16.99%) were up to high school, 150 (14.56%) were up to primary and only 71 (6.9 %) were illiterate. Maximum number of women were house wives 944 (91.65%) followed by manual labourer (6.8%) and only 16 (1.55%) were service class and others. About 528 (51.26 %) belong to joint family, 268 (26.02 %) from three generation family and 234 (22.72 %) were from nuclear family. Majority 755 (73.3%) belonged to lower socioeconomic class (class IV and V), whereas 262 (25.43%) from middle class (Class II and III) and 13 (1.27 %) from upper class (I). Out of 1030 newborns 591 were male and 491 were female.

Table 2 shows majority 848 (82.33%) of mothers belonged to age group 20-29 years and the mean age of mother at time of admission was 24.32 years. The proportion of LBW babies was higher in below ≤19 years (44.19%) and ≥30 years (39.56%) mothers as compared to 20-29 years (25.0%) and the association between maternal age and LBW was found significant($p<0.05$).

Out of 1030 mothers, 653 (63.40%) were primipara. The proportion of LBW babies in primipara was 31.09 %. It decreased with increase in parity (20.13%, in para 2). It was again increased in para 3 or more (30.43%). Thus proportion of LBW was found high in primipara mother. A significant association was revealed between parity and birth weight of baby ($P<0.05$).

A total of 377 mothers were with para 2 or more. Out of which 159 (42.17%) had birth spacing <36 months. The proportion of LBW was high (28.93%) when birth spacing was less than 36months compared to birth spacing of 36 months or more (17.89%). A statistically significant association was found between birth spacing and birth weight of baby ($P<0.05$).

Out of 1030 delivery, 887(86.12%) were term and 143(13.88%) were preterm birth. The proportion of LBW among preterm was high (62.94%) compared to term baby (22.10%). The association between gestational age and birth weight of the baby was found to be significant ($p<0.05$).

210 (20.39%) mothers were having bad obstetric history. Of these 65 (30.95%) mothers delivered LBW babies as compared to 221

(26.95%) in mothers having no such history. The association between bad obstetric history and birth weight of the baby was found not significant (p>0.05). Out of 1030 mothers, 482(46.80%) had obstetric complication during present pregnancy. The proportion of LBW babies was higher (31.12%) in mothers with obstetric complications as compared to mothers having no such complications (24.82%).Presence of obstetric complication during pregnancy was significantly associated with birth weight of the baby (p<0.05). Only 118(11.46%) had major medical illness during present pregnancy. The proportion of LBW in mothers with major medical illness was 44.07% as compared to mothers with no such illness (25.66%). The association between major medical illness during pregnancy and birth weight of baby was found highly significant (p<0.05). Majority 804(78.05%) of mothers were anaemic (Hb<11gms).The proportion of LBW was found high 276(34.32%) and significant as compared to non-anaemic mothers 10(4.42%). Out of 563 mothers, 286(50.80%) had weight gain of <10kgs and 277(49.20%) had weight gain ≥10kgs during their pregnancy. The proportion of LBW was 41.60% in mothers with weight gain <10 kg during their pregnancy as compared to mothers with weight gain ≥10kgs during their pregnancy (3.61%). The association between weight gain during pregnancy and LBW was found to be highly significant (P<0.05).

Majority 409 (72.64%) of mothers had a 'normal' BMI between 18.5- 24 99.The proportion of LBW was more 6(37.5%) in mothers with BMI ≥25 as compared to mothers with BMI <18.5 (25.36%) and normal BMI (21.79%). The association observed between the BMI and birth weight of the baby was found statistically not significant (p>0.05).

Table 3 depicted that antenatal registration was 100% in the present pregnancy. Among all, 563 (54.66%) had done early registration and 467 (45.34%) late registration. The proportion of LBW was found high 157(33.61%) in late registration as compared to early registration 129(22.91%).The association between time of registration and birth weight of baby was found to be significant (p<0.05). Majority of mothers 797 (77.38%) had received 4 or more ANC visits ,however the proportion of LBW babies was high (52.79%) in mothers who received less than 4 ANC compared to mothers with 4 or more ANC visits (20.45%). A significant association was found between number of ANC visits and birth weight of baby (P<0.05). Most of mothers 728 (70.68%) had taken 100 or more IFA tablets during their pregnancy. The proportion of LBW baby was found high 139(46.02%) in mothers who had taken less than 100 tablets and 147(20.19%) in mothers who had taken 100 or more tablets. The association between IFA tablet supplementation during pregnancy and birth weight of the baby was found to be significant (P<0.05).

So far calcium supplementation is concerned out of 1030 mothers, 631(61.26%) had received calcium tablets during their pregnancy and 399(38.74%) had not received. The proportion of LBW was high 212 (33.60 %) in mothers who had not received calcium during pregnancy compared to mothers who had taken calcium 74 (18.55%).The association between calcium supplementation and birth weight of the baby was found highly significant (p<0.05).

Table 1: Socio-demographic variables of study participants (n=1030)

Socio-demographic Variables	No	%
Maternal age (years)		
≤19	43	4.18
20-29	848	**82.33**
≥30	139	13.49
Residence		
Rural	861	**83.59**
Urban	169	16.41
Religion		
Hindu	989	**96.02**
Muslims	11	1.07
Christian/others	30	2.91
Education		
Illiterate	71	6.90
Primary	150	14.56
High school	175	16.99
Intermediate& above	634	**61.55**
Occupation		
House wife	944	**91.65**
Manual labourer	70	6.80
Service	16	1.55
Type of family		
Nuclear	234	22.72
Joint	528	**51.26**
Three generation	268	26.02
Socioeconomic status(SES)		
I	13	1.27
II	95	9.22
III	167	16.21
IV	361	**35.04**
V	394	**38.26**
Sex of the baby		
Male	591	**57.38**
Female	439	42.62

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

Maternal risk factors	Low birth weight		Statistical significance
	Present	Absent	
Maternal age(years)			
≤19	19(**44.19**)	24(55.81)	
20-29	212 (25.0)	636(75.0)	χ^2=18.668
≥30	55(39.56)	84(60.44)	P-value<0.05
Parity			
1	203(**31.09**)	450(68.91)	χ^2=12.791
2	62(20.13)	246(79.87)	P-value<0.05
≥3	21(30.43)	48(69.57)	
Birth spacing(months)*			
<36	46 (**28.93**)	113 (71.07)	χ^2=6.418
≥36	39 (17.89)	179 (82.11)	P-value<0.05
Gestational age(weeks)			
<37	90(**62.94**)	53(37.06)	χ^2=102.407
≥37	196(22.10)	691(77.90)	P- value<0.05
Bad obstetric history			
Present	65(**30.95**)	145(69.05)	χ^2=0.311
Absent	221(26.95)	599(73.05)	P- value>0.05
Obstetric complications during pregnancy			
Yes	150(**31.12**)	332(68.88)	χ^2=5.079
No	136(24.82)	412(75.18)	P-value<0.05
Major medical illness during pregnancy			
Yes	52(**44.07**)	66(55.93)	χ^2=15.330
No	234(25.66)	678(74.34)	P-value<0.05
Anaemia			
Present (Hb<11gm)	276(**34.32**)	528(65.68)	χ^2=78.6519
Absent (Hb≥11gm)	10(4.42)	216(95.58)	P-value<0.05
Weight gain**			
<10kgs	119(**41.60**)	167(58.40)	χ^2=115.028
≥10kgs	10(3.61)	267(96.39)	P-value<0.05
Body mass index(kg/mt2)**			
<18.5	35(**25.36**)	103(74.64)	
18.5-24.99	88(21.51)	321(78.49)	χ^2=2.848
≥25	6(37.50)	10(62.50)	P value>0.05

*Out of 1030 participants only 377 mothers had para 2 or more and rest 623 were primi mothers.
**Weight at or before 12 weeks of pregnancy (pre-pregnancy weight) of only 563 participants was recorded from the MCP card. Out of 1030 mothers, only 563 mothers considered for weight gain as rest 467 mothers registered after 12 weeks of pregnancy.

Table 3: Distribution of low birth weight according to Utilisation of Antenatal care (n=1030)

Maternal risk factors	Low birth weight		Statistical significance
	Present (n=286)	Absent (n=744)	
Pregnancy registration		434 (77.09)	
Early	129(22.91)	310(66.39)	χ^2=14.5871
Late	157(**33.61**)		P value<0.05
ANC check-ups			
<4	123(**52.79**)	110 (47.21)	χ^2=94.002
≥4	163(20.45)	634 (79.55)	P value<0.05
IFA supplementation			
<100	139(**46.02**)	163(53.98)	χ^2=71.0274
≥100	147(20.19)	581(79.81)	P value<0.05
Calcium supplementation			
Yes	74(18.55)	325(81.45)	χ^2=27.608
No	212(**33.60**)	419(66.40)	P value<0.05

DISCUSSION

In the present study the proportion of LBW was found to be 27.76%. UNICEF statistical data of India and Archana Paliwal et al also reported similar finding .[6,9] However, it was higher than that of NFHS-3 data (21.5%).[10] The higher proportion of LBW could be due to the fact that high risk cases come for the delivery in the tertiary care setting.

Out of 1030 mothers, majority 848 (82.33%) belonged to 20-29 years age group. The mean age of mother at time of admission was 24.32 years. 861(83.60%) of mothers were from rural area which is as per the results of Agarwal et al.[11] Majority 989(96.02%) of mothers were Hindu. Rakesh K Nayak et al.[12] and Nagagorge et al.[13] also found Hindu as the major religion their

studies. Most of the mothers 634(61.55%) with education level intermediate and above. Similar finding was reported by Padda P et al.[14] and many other studies.[9,15,16] Maximum numbers of women were house wives 944 (91.65%). N. Swarnalatha et al.[15] and many others also reported similar findings.[10,18] 528 (51.26 %) mothers belongs to joint family. A Similar result was obtained by Agarwal et al in a Meerut based study.[11] The study observed 755(73.3%) mothers belonged to lower SES (class IV and V) and 262 (25.43%) belonged to middle class (Class II and III) and 13 (1.27 %) belonged to upper class. Agarwal et al.[11] and many others were in consistent with this study.[15,18-20] So far the sex of the newborn is concerned, 591 (57.38%) were found male and 439(46.62%) were female newborn. It is consistent with R.K. Nayak et al in a retrospective record based study in Belgaum; North Karnataka.[12]

The proportion of LBW babies was higher in below ≤19 years (44.19%) and ≥30 years (39.56%) mothers and the association between maternal age and LBW was found significant (p<0.05).The findings were in consistent with the studies done by Krammer, Rakesh K Nayak et al and Manna et al.[3,12,16] However some studies could not find a significant association between maternal age and LBW.[4,5,21] Young age of mother, inadequate development of the uterus and inadequate spacing due to marriage at an early age can cause LBW babies. Similarly higher proportion LBW in women over 30 years of age might be due to increased vascular changes and low nutritional status leading to exhibit impaired intrauterine growth or inadequate gestational duration. A significant proportion of LBW in Primi (31.09%) were having LBW babies which was in accordance with Velankar DH[18] and many other studies.[9,12,15] Parity has influence on birth weight. It was found that proportion of LBW increased with an increase in parity which may be due to inadequate spacing, leading to depletion in the woman's nutritional status and health, leaving incapable of producing a healthy baby.

The proportion of LBW was high (28.93%) and significant when birth spacing was less than 36months .Similar finding was revealed by Velankar DH[18] and various other studies.[9,17,20,22] This may be due to fact that, women cannot recover from the effect of last pregnancy and period of breastfeeding before conceiving again, her nutritional status deteriorates with subsequent pregnancies. So improved maternal health as a consequence of prolonged spacing could reflect in having higher birth weight.

The proportion of LBW among preterm (gestational age<37weeks) was found high (62.94%) and significant. Studies carried out by Nitin Solanki et al.[19] and many others also observed a significant inverse association of LBW with gestational age.[11,15,23,24]

Out of 210 (20.39%) mothers with bad obstetric history 30.95% delivered LBW babies. The association between bad obstetric history and LBW was found statistically not significant (p>0.05). This finding is in accordance with studies done by Kramer[3], M. Nazari et al.[26] but a number studies contradicting this study and found a significant association.[17,18,23, 26]

The proportions of LBW babies were found significantly higher (31.12%) in mothers with obstetric complications as compared to mothers having no such complications (24.82%) (p<0.05). Similar findings were reported by Archana Paliwal et al.[9] and Joshi et al in their study.[27]

The proportion of LBW in mothers with major medical illness was more (44.07%) as compared to mothers with no such illness (25.66%) and the association was found highly significant (p<0.001). Rafati S et al.[28], Kayastha and Tuladhar[29], Neelaiah PS and Begum K[30] and H. Hayat et al.[20] in their study observed similar findings.

Majority 804 (78.05%) of mothers were anaemic (Hb<11gms).The proportion of LBW was found high 276 (34.32%) and significant in anaemic mothers. The result was in accordance with Agarwal et al.[11] and several other studies.[16,20,21] Anemia is an established cause of LBW and again it depends on poor socio-economic status, lack of ante natal care and less birth spacing.

A significant proportions of mother having weight gain<10 kgs during the period of pregnancy had LBW 41.60% whereas the same for mothers having weight gain ≥10kg was 3.61% and the association was highly significant (P<0.001). Similar findings were revealed in many other studies.[15,25,31] Inadequate weight gain may be due to insufficient intake of calories and protein during pregnancy leading to LBW.

Majority 409 (72.84%) of mothers had a 'normal' BMI between 18.5- 24 99. Mothers having BMI≥25 had higher proportion (37.50%) of LBW in comparison to mothers having normal (21.79%) and low BMI (25.36%).The association was found statistically not significant (p>0.05). The cause behind this may be due to obesity increases the risk of hypertensive disease leading to LBW. The finding is consistent with studies of Bener et al.[32], Khatun S and Rahman M.[33] However other studies contradicting the result and found a significant association of BMI and birth weight.[13,18,25, 26, 34]

In the present study, antenatal registration was done by all the mothers. The proportion of LBW was found high 157 (33.61%) in late registration as compared to early registration 129 (22.91%).The association between time of registration and birth weight of baby was found to be statistically significant (p<0.05). Similar findings were observed by Agarwal et al.[11] Manna et al.[16] and Velankar DH.[18] Studies done by Kramer[3] and Nagagorge et al.[13] could not find a significant association between early registration and LBW.

Majority of mothers 797 (77.38%) had received 4 or more ANC visits. The proportion of LBW babies was significantly high (52.79%) in mothers who received less than 4 ANC compared to mothers with 4 or more ANC visits (20.45%). Similar finding were reported in various studies[16,18] but Nagagorge et al.[13] failed to establish a significant association between number of ANC check-up and LBW.

Most 728 (70.68%) mothers had taken 100 or more IFA tablets during present pregnancy. The proportion of LBW was high (80.0%) in mothers who had not taken IFA tablets in comparison to mother who had taken less than 100 tablets (45.45%) and 100 or more tablets (20.20%) respectively. The association was found to be highly significant (P<0.001).Similar finding was reported by N. Swarnalatha et al.[15] and many other studies.[9,16,20,23,35] In contradictory to this Nagagorge et al.[13] in a Maharashtra based study could not find any association between IFA supplementation and LBW. S Palma et al.[36] in a case control study showed that iron but not folic acid supplementation was associated with a lower risk of LBW in mothers without anaemia.

So far calcium supplementation is concerned, proportion of LBW was high (33.60 %) in mothers who had not received calcium during pregnancy compared to mothers who had received calcium (18.55%). The association was found to be highly significant

(p<0.001). H. Hayat et al.[20] also showed similar significant positive effect of calcium supplementation during pregnancy but in contradictory to the present study Nagagorge et al.[13] could not find a significant association with LBW. The cause behind this may be due to local variations in the dietary intake of food stuffs.

CONCLUSIONS

Birth weight remained as an important factor affecting the neonatal morbidity and mortality. The various risk factors associated with LBW was observed to be multiple, inter-related and acting simultaneously.

The proportion of LBW (27.76%) was found to be higher than national average (21.5%). As there are several factors interplaying leading to LBW babies, it is not feasible to single out any particular factor affecting LBW. Among the various maternal factors age at first pregnancy, education, SES, gestational age, parity, birth spacing, weight gain, major medical illness, obstetric complications, anaemia during pregnancy and utilization of antenatal care are found to influence the birth weight. Apart from maternal education and socioeconomic development it is the need of the hour to strengthen the existing maternal services at the door steps of the beneficiaries to reduce the morbidity and mortality due to LBW in the society.

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