Observational Study

Sociocultural factors influencing low birth weight in an urban hospital in India : a prospective case-control study

Kumkum Pahari[1], Rabindra Nath Mukherjee[2], Madhusha Mukhopadhyay[3]

Low birth weight (LBW) is an important cause of morbidity & mortality in the developing countries like India. 225 cases of newborns with low birth weight (LBW) were compared with 225 newborn controls with normal birth weight (NBW) matched by sex. Mean age was significantly higher for normal birth weight (NBW) babies compared to LBW babies (23.0 *versus* 22.1; p 0.027). Table 1 Analysis of socio-cultural maternal risk factors for low birth weight LBW was found to be higher at height <150cms (65% *versus* 43%; OR 2.5; CI=1.5-4.2), spacing <3 years (p = 0.002; OR 1.5; CI=1.1-2.0), hemoglobin <10.9g/dl (82% *versus* 59%; OR 1.9; CI=1.4-2.5), heavy workload during pregnancy (37% *versus* 18%; p<0.001), lower number of antenatal visits (mean 2.9 *versus* 4.2; p<0.001; OR 3.0; CI=2.1-3.6) and poorer personal hygiene (p=0.002; OR 2.0 CI=1.1-3.4). Drug exposure in the 1st trimester and literacy below primary education were also significantly associated with LBW (p <0.05). However, the influence of parity>2, low socio-economic status and social prejudices was not significant. Public health programs need to be enhanced to incorporate adequate nutrition, antenatal care and female literacy. The role of family and the health services are particularly important in reducing the risk of low birth weight by gradually diminishing the risk factors for this preventable burden.

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Low birth weight (LBW) is an important cause of morbidity &mortality in the developing countries like India. About 25 to 30% of babies in India are of low birth weight[1,2]. Low birth weight (LBW) is defined as a birth weight of a live born infant of less than 2,500g regardless of gestational age[3]. WHO estimates that LBW contributes to 60% to 80% of all neonatal deaths. The global prevalence of LBW is 15.5%, which amounts to about 20 million LBW infants born each year, 96.5% of them in developing countries. In India, immediate neonatal mortality of LBW babies is about 6 times more than the normal newborn and morbidity and mortality is very high[4].

By convention, Low birth weight babies are divided into two categories[5] :

- Preterm (those born before 37 completed weeks, less than 259 days)
- Small for gestational age (Birth weight below 10th percentile of the average)

LBW infants suffer more episodes of common childhood diseases like diarrhea, respiratory infections and the spell of illness is more prolonged and serious and often leads to hospital admission compared to normal birth weight (NBW) infants[2]. The causes of neonatal asphyxia in LBW babies include hypoglycemia, meconium aspiration pneumonia, disseminated intravascular coagulation, pulmonary hemorrhage and cerebral hemorrhage, pulmonary edema, heart failure, infection, jaundice, anemia, retrolental fibroplasia and idiopathic respiratory distress syndrome[6,7].

The known risk factors for LBW include low maternal age (<19 years), low maternal height (<150cm), increased parity (> than 2), shorter birth spacing (<3years), anemia, heavy maternal physical labor, lack of good antenatal care, poor maternal hygiene, literacy of mother, socio-economic status and addiction or drug consumption especially at 1st trimester[8,9]. In addition, 30-50% of cases of LBW have no identifiable risk factors and the epidemiology is not well-understood. In the developing countries adverse pre and post natal development of the child is associated with three interrelated conditions: malnutrition, infection & unregulated fertility[8]. These are often related to the socio-cultural factors mentioned above, including scarcity of health and social welfare services.

Hence, this study was undertaken considering the large size of the problems stated and will help to assess problem magnitude as well as means of interventions to reduce the incidence of such problems. We aimed to identify socio-cultural risk factors associated with low birth weight.

Department of Obstetrics & Gynaecology, Medica Superspecialty Hospital, Kolkata 700099
[1]MD, Consultant Gynaecologist and Corresponding Author
[2]MD, Consultant Gynaecologist
[3]DNB, Department of Family Medicine, The Calcutta Medical Research Institute, Kolkata 700027

Materials and Methods

This study is a prospective case-control longitudinal study performed between August 2012 and July 2014 (2 years). It was performed at Uttarpara State General Hospital, Hooghly district, India. This is an urban hospital catering primarily to semi urban areas, urban slums and industrial areas and to a much lesser extent from the elite group of the society.Sample size was calculated using statistical survey software. A total of 225 cases of newborns with low birth weight as per definition (less than 2500g) were compared with 225 newborn controls with birth weight more than 2500g. They were matched by sex. The cases and controls were selected randomly, and the results compared on the basis of socio-cultural and physical characteristics of mothers.

The results are expressed as mean (±SD). Means between two groups were compared using unpaired student t-test whereas categorical variables were evaluated with Chi-square test. More than two groups were evaluated using analysis of variance. Odd's ratio (OR) was calculated for significant findings with confidence interval of 95%. The analysis was done using SPSS 16.0 and p-value of less than 0.05 was considered as significant.

Results

The risk factors studied were maternal age, height, parity, birth spacing, hemoglobin, workload, antenatal care, personal hygiene, addiction or drug exposure and literacy levels. The overall demographic data have been presented in Table 1.

Mean age was significantly higher for normal birth weight (NBW) babies compared to LBW babies (23.0 *versus* 22.1; p 0.027). The incidence of LBW was highest when maternal age was less than 19 years {37% compared to 24% in NBW; OR 1.9 (1.2-2.8)}. Mean maternal height was also significantly lower in LBW group (p<0.001). On sub-analysis of age groups, the incidence of LBW was found to be maximum when the height was less than 150cms {65% *versus* 43%; OR 2.5 (1.5-4.2)}.

Table 1— *Analysis of socio-cultural maternal risk factors for low birth weight*

Maternal Risk Factors	LBW (n=225) [Mean±SD or n(%)]	Controls (n=225) [Mean±SD or n (%)]	p-value
Age (years)	22.1±4.3	23.0±4.2	0.027
Height (cm)	148.0±5.5	151.3±6.0	< 0.001
Parity > 2 (n)	43 (19%)	45 (20%)	0.81
Birth spacing (years)	3.0±0.9 [n=101]	3.4±0.0[n=123]	0.002
Hemoglobin (g/dl)	8.2±1.6	9.1±1.8	< 0.001
Heavy workload (n)	83 (37%)	41 (18%)	< 0.001
Antenatal visits (n)	2.9±1.4	4.2±1.5	< 0.001
Personal hygiene taken (n)	48 (21%)	78 (35%)	0.002
Drug intake (n)	44 (20%)	30 (13%)	0.08
Primary education or above(n)	72 (32%)	120 (53%)	< 0.001
Income >INR1000 (n)	92 (41%)	106 (47%)	0.07
Prejudice-yes (n)	198 (88%)	189 (84%)	0.22

Among the LBW mothers, 126 were primigravida while 104 mothers were primigravida among the NBW group. The incidence of multiparity in NBW group was slightly higher (54%) than the LBW group (44%). With parity >2, the difference between the LBW and NBW group was not statistically significant {19% *versus* 20%; OR 1.0 (0.08-1.2); p=0.81}. The multiparous mothers among both groups were assessed for birth spacing, and divided between <2 years, 2 to 3 years, 3 to 4 years and more than 4 years. The mean spacing was significantly higher in the control group than the LBW group (p = 0.002). On sub-analysis, it was found that spacing of 3 or more years had a lower incidence of LBW, with the difference rising with lower spacing (51% *versus* 48% in 2-3 years; 57% *versus* 43% in <2years). For spacing less than 3 years, OR was 1.5 (1.1-2.0).

The mean hemoglobin at delivery was significantly higher in the control group (9.1±1.8) than the LBW group (8.2±1.6; p<0.001). About 51% of LBW mothers had a hemoglobin less than 8g/dl. The incidence of LBW was highest at maternal hemoglobin less than 10.9g/dl {82% vs. 59%; OR 1.9 (1.4-2.5)}. This shows that the birth weight of the baby is directly proportional to the hemoglobin level of the mother. The maternal workload was divided into sedentary, low, moderate and heavy and the groups compared. The results are outlined in Table 2. Increased incidences of LBW babies were observed where there is heavy workload of mother during pregnancy (37% *versus* 18%; p<0.001).

Antenatal care was analyzed by the frequency of antenatal visits. This was divided into regular (>5 visits), irregular (3-5 visits), very irregular (<3 visits) and not at all (0 visits). The mothers with regular visits in the control group were far larger in number than the LBW group (32% vs. 14%) while most of the mothers in the LBW group had very irregular visits (64% *versus* 22% in NBW mothers). The overall mean number of visits was much higher in the control group than the LBW group {4.2 *versus* 2.9; p<0.001; OR 3.0 (2.1-3.6)}. Only 21% of LBW mothers took care of personal hygiene compared to 35% of NBW mothers {p=0.002; OR 2.0 (1.1-3.4)}.

There were only 3 smokers in the LBW group compared to none in the control group. Similarly, 3 mothers in the LBW group used alcohol compared to 1 in the control

Table 2 — *Distribution of babies by birth weight and mother's workload*

Maternal workload	Low birth weight (n=225)	Normal birth weight (n=225)	p-value
Low	30 (13%)	72 (32%)	<0.001
Moderate	108 (48%)	110 (49%)	0.85
Heavy	83 (37%)	41 (18%)	<0.001
Sedentary	4 (2%)	2 (1%)	0.41

group. They were not statistically significant. The use of other medications such as corticosteroids, paracetamol and antibiotics was also analyzed. Compared to 30 NBW mothers, 44 mothers from LBW group had used such medications. However, this was not statistically significant (p=0.08). When divided according to trimester, it was seen that NBW mothers had overall lower drug intake, but was not statistically significant (Table 3). In the first trimester, the difference in drug intake was statistically significant (p=0.005).

The mother's literacy levels were classified into illiterate, just literate, primary education, high school and graduate levels. On sub-analysis, it was found that nearly 53% on NBW mothers were at least primary educated compared to 32% in LBW group (Table 1). This was statistically significant {p<0.001; OR 2.4 (1.5-4)}. There was also a remarkable double increase in incidence of LBW by illiterate mothers compared to graduate mothers. According to socio-economic status, we found that there was a gradual decrease in LBW with increase in per capita income of the families. At more than INR 1000, LBW incidence was 41% compared to 47% in the control group {OR 1.2 (0.7-2.2)} but it was not statistically significant (Table 1). The proportion of difference between LBW group and NBW group in relation to practicing prejudices was also not statistically significant (p=0.22). However, it revealed a downward trend of birth weight in relation to mother's ignorance and prejudices.

Discussion

In literature, many maternal factors have been known to be associated with low birth weight. Some of these include history of premature delivery, hard physical workload, chronic medical illnesses, age, height, parity, nutritional intake, anemia, alcohol intake, smoking, drug exposure, regular antenatal care, personal hygiene, birth spacing, socio-economic status and literacy levels.[9] The consequences of preterm delivery include neonatal asphyxia, jaundice, disseminated intravascular coagulation and sepsis[12,13]. It may also lead to limitation of their growth potential in the first few years of life[14,15].

In our present study, we found that maternal age <19 years, height <150cms, birth spacing <3years, hemoglobin at delivery <10.9g/dl, heavy workload, <3 antenatal visits, poor maternal hygiene, drug exposure in the 1st trimester and literacy below primary education were all significantly associated with low birth weight babies (p <0.05).

Table 3 — *Drug consumption by mothers in different trimesters of pregnancy*

Drug Intake	Low Birth Weight	Normal Birth Weight	p-value
1st Trimester	36 (16%)	17 (8%)	0.005
2nd Trimester	6 (3%)	8 (4%)	0.59
3rd Trimester	2 (1%)	5 (2%)	0.25
No drug intake	181 (80%)	195 (86%)	0.08
Total	225	225	

Studies by Verma *et al*[17]. and Makhija *et al*[16]. evaluated the effect of teenage pregnancy in the Indian population and compared them to a control arm between 20 and 29 years. It also revealed that incidence of complications of pregnancy like anemia, pregnancy induced hypertension and preterm labours were significantly higher among teenage mothers.A recent study by Negandhi *et al*[11]. also found that maternal age below 20 years was a significant risk factor for LBW. However, in multivariate analysis, it did not appear significant. Bhargava *et al*. evaluated maternal height and weight as a cause for LBW and concluded that height less than 140cms and pregravid weight of less than 35kgs were significant factors for LBW[16]. In a study from Nepal urban community, they found no statistically significant effect of maternal height <146cms on birth weight (p=0.18; OR=1.65)[10]. In contrast, we found that maternal height <150cms was significantly associated with decreased birth weight.

Several studies have found no significant effect of parity on low birth weight[10,16]. We also came to the same conclusion. Short inter-pregnancy interval has also known to be associated with LBW[17]. Maternal hemoglobin below 11g/dl was not found to be significant in the study from Nepal.[10] However, hemoglobin levels, ferritin levels and low daily calorie intake have been implicated in several other studies[11,18-22]. Heavy physical workload during pregnancy has been associated with low birth weight babies[22-24]. Fourn *et al*. found that lifting heavy loads (OR=1.30; CI=1.1-1.6) was an independent risk factor for LBW[26]. This study also concluded that regular antenatal care was a protective factor (OR=0.85; CI=0.69-0.99).Similar findings have been reported from several other studies as well[11,19].

Maternal and family literacy has also been implicated as a risk factor for LBW[10,19]. The role of personal hygiene in LBW incidence is not very clear. In our study, poor maternal hygiene was found to be a significant risk factor for LBW. Many studies have examined the role of low socio-economic status on LBW. Sharma *et al* found a non-significant association, while multiple regression model by Hsieh *et al*. found that positive effect of higher parental income is significant in neonatal period but diminishes in later stages[10,18,25]. They concluded that primary care services uptake should be actively promoted, particularly in lower income groups, to prevent premature LBW mortality. This is in accordance with our study, which did not find a statistically significant association between low per-capita income and LBW.

There were several limitations of our study. The lack of blinding and the presence of several confounding vari-

ables may have affected our results. This was a single institution study, and community studies may be required to evaluate low birth weight further. Some factors like micronutrient deficiency, history of premature delivery, place of residence, type of family and diet were not evaluated as details of all patients were not available.

Conclusion

Low maternal age, low maternal height, decreased birth spacing, maternal anemia, heavy workload, poor antenatal care, poor maternal hygiene, drug exposure in the 1st trimester and literacy below primary education were all significantly associated with low birth weight. Public health programs need to be enhanced to incorporate adequate nutrition, antenatal care and female literacy. The role of family and the health services are particularly important in reducing the risk of low birth weight by gradually diminishing the risk factors for this preventable burden.

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