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Original Article

Determinants of low birth weight in a Block of Hooghly, West Bengal: A multivariate analysis

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ABSTRACT

Low Birth Weight (birth weight < 2.5kg) has been a problem of constant worry in the world, especially in developing countries like India. The causes are multifactorial. Most of the causes can be prevented with simple measures. But in India adequate statistical modeling for multivariate data has often not been done to elicit the most important factors. Thus this study has been undertaken in Singur Block of West in order to find out the distribution and determinants of LBW in the study area. Cluster sampling was done, to sample the mothers of Under-5 children in the villages of the said block. Necessary data was obtained after consulting the records and interviewing the mothers. Final analysis was done using a multiple logistic regression model. Results showed, out of 253 samples, 28.8% were found to be having low birth weight. The model showed that poor socio-economic condition, low gestational age, anemia, non-consumption/irregular consumption of IFA tablets, inadequate food intake during ANC to be the factors significantly associated with low birth weight.

1. Introduction

In 1976, the 29th World Health Assembly agreed on the following definition: "Low birth weight is a weight at birth of less than 2,500 g (up to and including 2,499 g) irrespective of gestational age." [1]. The cut-off has been set like this to make international comparison based on epidemiological observations, which states that infants weighing less than 2,500 g are approximately 20 times more likely to die than heavier babies [2, 3].

The following statistics can summarize how much of a public health burden Low birth weight poses. It has been estimated that more than 20 million infants worldwide, amounting to a monstrous 15.5 per cent of all births, are born with low birth weight [4]. The number of low birth weight babies is concentrated in two regions of the developing world namely, Asia and Africa. Another point to be noted is that is, in industrialized countries the epidemiology of low birth weight has been extensively studied, while in less developed countries reliable data on low birth weight still remain limited. The primary reason is that more than 40 per cent of babies are born at home and without a skilled attendant [5, 6]. As for the burden in India, NFHS 3 mentions that among children for whose birth weight was reported, 22 percent had a low birth weight, it being slightly higher in rural areas (23 percent) than in urban areas (19 percent) with regional disparities like as low as 8 percent in Mizoram to 33 percent in Haryana. In West Bengal this percentage is reported to be 22.9 [15] .

Coming to the causes and consequences of low birth weight, a baby's low weight at birth is either the result of preterm birth (before 37 weeks of gestation) or of restricted fetal (intrauterine) growth [2]. The determinants identified for low birth weight reflect to factors related to the mother and her environment[7]. Kramer in his systematic review listed as many as 43 factors broadly classifiable as genetic, constitutional, socio-demographic, obstetric, nutritional, maternal morbidities in Antenatal period, toxic exposures and antenatal care[2]. This is further corroborated with other studies also [11-32]. The influence of some factors are proved beyond doubt, and for others, it is still a matter of controversy. As for the consequences, low birth weight is closely

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associated with fetal and neonatal mortality and morbidity, inhibited growth and cognitive development, and chronic diseases later in life [8]. In fact, a low birth weight baby has a bad start in life, vulnerable to low immunity, infection and malnutrition. So, it can be emphatically stated that both infant morbidity and mortality rates can be drastically reduced with the reduction of LBW rates. Therefore it is necessary to pinpoint the factors affecting low birth weight, especially the preventable ones, because recognizing them may facilitate better recommendations for actually making and implementing sustainable reforms to stop this menace of low birth weight.

Many studies have been done regarding this, but not so much in West Bengal in recent times. So the current study aims at finding the magnitude and the determinants of low birth weight in a rural area of West Bengal.

2. Materials and Method

The data presented are the results of a 6 month cross-sectional, community based retrospective study of birth weights of children over the last 5 years. Low birth Weight was defined as a birth weight below 2.5 kg. The diagnosis of low birth weight was accepted when it was recorded by trained personnel. The universe was all under 5 children. The study population was the Under-5 children of the Singur Block.

2.1.Sampling Design

Sample population was collected by cluster sampling design from Singur block of Hoogly District of West Bengal having 66 villages and a total population of 1,03,652. The prevalence of LBW in India was taken to be 22% (NFHS 3 data). A sample size of about 250 was obtained by taking a precision of 5%, Design-effect of 1.2. Less than 10 samples per cluster could lead to unstable variance estimates, while more than 40 per cluster would result in little improvement in precision [9].So with this trade-off, 25 clusters were chosen including 20 villages by probability proportionate to size technique, with 10 subjects in each cluster. The inclusion criteria was mothers who had institutional deliveries, antenatal records document and who could provide the birth certificate of their children. A pre-designed, pre tested schedule in the local language (Bengali) which was translated and back-translated to verify content, criteria and semantic equivalence by bilingual and monolingual experts was prepared and used on the mothers of the under 5 children after obtaining informed consent from them. Relevant risk factors of Low birth weight were obtained with the help of the schedule and antenatal records and birth certificate. SPSS 17 was used for analysis. Firstly, a univariate analysis was done to ascertain the relationship of birth weight with other variables. Only those found to be significant were entered into a multiple logistic model LINK FUNCTION=LOGISTIC). Diagnostic tests were done after modeling to asses goodness-of-fit and assumptions pertaining to logistic regression. Further exploratory analyses were done where it was thought to be necessary.

3.Results

The proportion of institutional delivery in the block was found to be 82.68%.As per inclusion criteria 253 (54% males, 46% females) under-5 children were considered for the study among whom 73 (28.8%) were low birth weight children, the proportion being significantly more among females than the males (61.6%vs 38.4%)

Table 1 shows the association and its strength of different socio-demographic and antenatal care related determinants with low birth weight. Univariate analysis shows that the significant determinants of LBW are poor housing, people living below the poverty level, non-use of sanitary latrine, low gestational age of new born baby. Again, mothers with short stature, anemia, improper consumption of IFA tablets, inadequate rest and food were significantly more likely to give birth to LBW babies. Again, the proportion of LBW was more, but not significantly so, among mothers less than 20 years, living in joint families and registering late (after 20 weeks) in pregnancy. Further exploration as variables were not considered for the following i.e Addiction to tobacco (only 4 mothers smoked), Antenatal care (all had 3 or more visits) and gestational diabetes (none suffered from GDM)

Table 1 also shows the variables already found significant being being entered into a Multiple Logistic model (binary logistic: link function=logit), by “Enter” method. When controlling for the other variables, variable “taking inadequate rest” lost its significance, although the Adjusted OR of them actually changed from 1.97 to 1.64. The other variables, namely housing, poverty level, gestational age, anemia, adequacy of food, adequacy of IFA tablets and height of mother, which were found significant in the univariate analysis, stayed significant in the multivariate analysis, with the Odd's Ratio of all of them increasing. However, for illiterate mothers the OR was found to be 0.049 (CI=0.006-0.387). Though Sex of the child cannot be called as a risk factor for Low birth weight in the truest sense, the data was again modelled keeping sex as a variable, and it was found that the same variables are emerging as significant, as was without keeping sex of the child in the model. Females were found 1.35 (CI=0.39-4.54) times more prone to be low birth weight than males.

4. Discussion

In the present study we have found that the number of institutional deliveries in the block comes to be around 82.68%, well ahead of the NFHS 3 data, which mentions that total percentage of institutional deliveries stand at 40.8% with 31.1% in the rural areas.

Dowding has shown socio economic class of the mother to influence birth weight [14]. NFHS 3 also confirms that the proportion of births with a low birth weight is lesser among children born to older women (age at birth >=20 years) as also families with higher wealth quintiles. This, in fact, is further corroborated by this study. However, contradictory to NFHS 3 report and other reports [19], in this study, maternal education turned out to be not a risk factor of low birth weight in the multivariate model, in spite of its significance as a risk factor in the univariate analysis. But as reported by Molly from Kerala [20], and Deswal et al from Meerut, mother's education has got no relationship with low birth weight. The results also indicate that the mothers aged below 20 years had significantly greater chance to deliver LBW baby than the age group of above 20 years in the univariate analysis. It corresponds with the findings of Ahmed et al (1994)[16] and Eisner et al (1979)[17]. This fact reflects both

Table 1: Showing the distribution of different socio demographic and antenatal care related variables and its relationship with birth weight

Socio-demographic Factors						
House						
Kutcha	68	26 (38.2)	32 (61.8)	P<0.05	1.82 (0.97-3.42)*	5.37 (1.43-2.01)**
Pucca	185	47 (25.4)	138 (74.6)			
Poverty						
BPL	94	35 (37.2)	59 (62.8)	P<0.05	1.89(1.05-3.42)*	15.99 (2.17-117.8)**
APL	159	38 (23.9)	121 (76.1)			
Sanitary Latrine						
No	101	44 (43.6)	57 (56.4)	P<0.05	3.27 (1.79-5.99)*	3.99 (1.01-15.75)**
Yes	152	29 (19.1)	123(80.9)			
Family						
Joint	102	38 (37.3)	64 (62.7)	P=0.988	1.09 (0.59-2.01)	
Nuclear	151	35 (23.2)	64 (76.8)			
Mother's Education*						
Illiterate	196	63 (32.1)	133 (67.9)	P<0.05	2.23 (1.01-5.04)*	0.049 (0.006-0.38)**
Literate	57	10 (17.5)	47 (82.5)			
Mother's Age						
<20 years	130	43 (24.4)	87 (75.6)	P=0.127	1.53 (0.85-2.76)	
>=20 years	123	30 (33.1)	93 (66.9)			
Antenatal Care Related factors						
Gestational Age*						
Pre term	97	65 (67)	32 (33)	P<0.05	37.58 (15.5-94.5)*	59.75 (12.24-291.73)**
Term	156	8 (5.1)	148 (94.9)			
Height*						
<152 cm	127	56 (44.09)	71 (55.91)	P<0.05	5.52 (2.86-10.75)*	4.64 (1.16-18.58)**
>=152 cm	126	17 (13.49)	119 (86.51)			
Registration						
After time	237	69 (29.1)	168 (70.9)	P=0.725	1.23 (0.35-4.71)	
On time	16	4 (25)	12 (75)			
Rest*						
Inadequate	102	38 (23.2)	64 (76.8)	P<0.05	1.97 (1.09-3.55)*	1.64 (0.4-6.66)
Adequate	151	35 (37.3)	116 (62.7)			
Food*						
Inadequate	74	54 (73)	20 (27)	P<0.05	22.74 (10.72-48.95)*	62.16 (10.51-367.7)**
Adequate	179	19 (10.6)	160 (89.4)			
IFA tablets*						
Inadequate	181	59 (32.6)	122 (67.4)	P<0.05	2 (1.01-4.00)*	9.11 (1.36-61.01)**
Adequate	72	14 (19.4)	58 (80.6)			
Anemia*						
Yes	210	73 (34.8)	137 (65.2)	P<0.05	Ω**	μ*
No	43	0 (0)	43 (100)			
Parity						
Primipara	512	19 (37.3)	32 (62.7)			
Multipara	02	54 (26.7)	148 (73.3)			

*Significant at p=0.05 in univariate analysis

** Significant in multivariate analysis

- Only those values significant with the chi-square test were included for the multivariate analysis
- Gravid was not included in multivariayr analysis as the number of mothers who gave birth for a second time was small
- For the model, the Hosmer-Lemeshow test gave a Chi-square value of 3.764 (p=0.878, not significant), showing that the predicted model is not significantly different from the actual data, indicating good model fit.
- On plotting the predicted probability with the square of deviance the assumption of independence of observation was found to be valid.
- Cox-Snell R2 was 0.582 that showed that the variables included in the model predicted 58.2% of low-birth weights, though this parameter has got its own limitations in a logistic regression.
- Ω, μ huge odd's ratio cannot be displayed

consequences of aging in elderly women may be due to decline hormonal activities[18]. Also sanitary latrine usage seemed to have decreased the occurrence of LBW, This can be explained by the fact that anaemia (an important determinant of LBW) in the sample population was significantly associated with lack of usage of sanitary latrine, probably due to the prevailing problem of hookworm infestation among persons practicing open air defecation.

Coming to the Antenatal-care related factors, Preterm birth (<37 weeks gestation) was found to be significantly associated with low birth weight in the study. It should be mentioned that though in developed countries, intra uterine growth retardation (IUGR) comprises one third of all LBW cases and pre-term accounts for the remainder two thirds, the reverse is true for less developed countries like India. So the focus in less developed countries remains almost exclusively on LBW as it is considered to be one of the leading causes of stillbirths and perinatal mortality[2, 22-24].

Here, short statured mothers (Height<152cm) mothers in our study were found to be at more risk of giving birth to a low birth weight baby. This is another controversial risk factor of low birth weight. Some authors [31] opine that it was an important risk factor of LBW but on the other hand some [32] opines that it was not. But according to Kramer's meta analysis, here, mothers less than 152 cm, a cut off for developing countries, posed a greater risk of having low birth weight baby. Based on our findings it was clear that provision of antenatal care, like good counseling to take adequate food, rest and primary health care clinics is necessary, and it may be of relevance in reducing the burden of LBW, also agreed upon by previous investigators [24].

We also found that lack of proper consumption of IFA tablets increase low birth weight. In a study in the United States, pregnant women randomly received either ferrous sulfate (case) or placebo (control) until 28 weeks of gestation. The rates of LBW infants in case and control groups were 4% and 17% respectively (P = 0.003) [27]. it has always been highlighted that programs directed at girls and women much before pregnancy are needed [25]. In our study, anaemia in pregnancy was significantly associated with LBW, that agrees with various other studies [28, 29,26]. But this finding was in contrast with Kramer's meta-analysis and studies conducted in various other developing countries.

Conclusion

Thus all in all, it should be stated that low birth weight still poses a fair problem in our perspective, and when we cannot control ethnic factors like height, or do a drastic socio-economic upliftment, some basic factors, like good ANC care, provision of IFA tablets, correcting anemia, promotion of use of sanitary latrine and above all motivating the mother to follow some habits in the ANC period like adequate consumption of food and adequate rest, institutional deliveries shall take a long way forward in addressing the problem.

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