

DETERMINANTS OF LOW BIRTH WEIGHT: FINDINGS FROM A COMMUNITY BASED STUDY IN A RURAL AREA OF VARANASI

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ABSTRACT:

Background : Low birth weight (LBW) remains an important public health problem and its extent and determinants have not been explored in rural setup of Varanasi in previous decades. With this background this study was contemplated in the rural setup of Varanasi.

Objective : To assess the extent of LBW and maternal factors influencing it.

Study Design : Community-based prospective study.

Methodology : A cohort of 311 pregnant women was followed till their deliveries. 298 subjects with prospective record were included in the study. Information pertaining to mothers was collected by interviewing them and anthropometric measurements were taken by standard technique and Hemoglobin (Hb) estimation was done by Sahli's method.

Statistical analysis : Chi square test, Fisher's exact test and Logistic regression.

Results : The LBW incidence was 27.9%. Maternal age (≥ 30 and < 19 years), nuclear family, illiteracy, lower socio-economic status (SES), maternal height (< 145 cm) & weight (< 45 kg), tobacco addiction, Hb % (< 11.0 gm %), number of antenatal visits (< 3), time of registration (< 16 weeks) and home delivery of newborn were significantly associated with LBW. However Multivariate Logistic regression analysis, identified lower SES, illiteracy, age (≥ 30 years), nuclear family, Hb % (< 11.0 gm %), and home delivery as risk factors for LBW.

Conclusions : Beside the various national plans to raise the maternal and child health status, government should have provision for microfinance to raise the SES and literacy of mother which are the strong determinants of LBW.

Key-words : Low birth weight, Maternal factors, Pregnancy, Logistic Regression.

Introduction:

Low Birth Weight (LBW) is defined by the World Health Organization (WHO) as a birth weight less than 2500 gram¹. WHO estimates that globally about 25 million LBW babies are born each year and nearly 95 per cent of them in developing countries. Almost 8 million LBW infants are born in India each year, an incidence of 30 per cent and nearly 40 per cent of global burden which is the highest of any country².

In spite of several programmes addressing preventable causes of LBW, it still remains an important public health problem. However extent of this problem as well as their determinants has not been explored in rural setup of Varanasi in previous decades. With this background this study was contemplated in the rural setup of Varanasi with the objective of assessing the extent of low birth weight and factors influencing it.

Subjects and Methods:

This Community-based prospective study was undertaken in the three randomly selected villages situated in the C.D. Chirgaon Block, Varanasi District. The study was conducted from 1st June 2006 to 30th May 2007. Study subjects comprised of women with confirmed pregnancy followed up till their deliveries during the study period. Sample size was calculated to be 233 taking the prevalence of LBW as 30 per cent obtained from the pilot study done prior to the study and

maximum permissible error as 20%.

Of 311 registered mothers who gave their consent to be included in the study, 298 pregnant women with prospective records were considered for the study. Those pregnant women were excluded from the study who resulted in abortion (5), stillborn (1), neonatal death without birth weight record (2) and whose baby's weight could not be taken (3). Non co-operative cases were also excluded from the study.

Socio-demographic characteristics and other relevant information related to maternal factors like age, religion, type of family, education, socioeconomic status (SES) and tobacco addiction were obtained from the study subjects by interviewing them with the help of predesigned and pretested interview schedule. They were subjected to anthropometric measurements. Weight of women was measured using a weighing machine having an accuracy of 0.1 kg and their height was measured with a steel anthropometric rod with parallel bar having accuracy of 0.1 cm adopting standard techniques³. Hemoglobin (Hb) estimation of the pregnant women was done by Sahli's method. Hb level in last trimester was considered for analysis. Socio economic status (SES) was assessed by Uday Pareek socio-economic classification⁴. All babies were weighed within one hour after birth in case of institutional delivery and within 48 hours in case of home delivery. WHO definition of LBW (< 2500 gram) was used in this study.

Statistical analysis:

The results were presented in form of frequency and proportion. Chi square test and Fisher's exact tests were used to study the significance of difference between proportions. Logistic regression analysis was carried out to control confounders.

Results:

Incidence of LBW in the study area was 27.9%. The overall mean birth weight of the study subjects was 2660.23 ± 231.67 grams. The mean birth weight of the Normal birth weight (NBW) and LBW of the babies were 2769.07 ± 166.13 and 2378.31 ± 104.23 grams respectively and the difference between two means was significant statistically ($t = 24.2$, $df = 235$, $p < 0.001$).

The incidence of LBW newborns in ≥ 30 years and < 19 years age group was 67.3% and 22.7% respectively as compared to 19.2% LBW in 20-29 years age group (Table-1). These differences were statistically significant ($p = 0.001$). Incidence of LBW was 27.8% and 28.6% in Hindu and Muslims respectively ($p = 1$). More than one third (34.4%) mothers from nuclear family and 27.8% from joint family delivered LBW newborns ($p = 0.03$). Compared to 6.1% LBW in subjects with education of high school and above, the incidence of LBW was 12.6% and 45.9% in primary or middle educated and illiterates group respectively and these differences were statistically significant ($p = 0.001$). The percentage of LBW was maximum (52.2%) in subjects with lower middle SES groups followed by 13.5% in middle and 8.6% in upper middle SES groups ($p = 0.001$). The proportion of the LBW in mothers of height < 145 cm was 46.5% in comparison to 25.6% in the subjects of height ≥ 145 cm and was statistically significant ($p = 0.01$). More than one third (35.3%) of the mothers less than 45 kg delivered LBW newborns, corresponding value for mothers with weight ≥ 45 kg was 21.6% ($p = 0.01$). There was higher incidence of 63.6% LBW in tobacco addicted mothers in comparison to 23.5% in non-addicted ($p = 0.01$). There was significant difference in incidence of LBW in anemic (32%) and non-anemic mothers (9.3%).

The proportion of LBW was maximum (32.0%) in mothers who received less than 3 antenatal visits in comparison to 20.6% in those who received ≥ 3 antenatal visits (Table-2) and was statistically significant ($p = 0.03$). There existed higher incidence (33.7%) of LBW in mothers with antenatal registration at more than 16 weeks as compared to 14.4% in those who had their registration within 16 weeks of conception ($p = 0.001$). Proportion of LBW was higher (34.6%) in home deliveries in comparison to 17.6% in institutional deliveries ($p = 0.001$).

The result of multivariate logistic regression (Table-3) shows that the risk of having LBW was about 3 times and 7 times higher in women of nuclear family and illiterate mothers as compared to joint family (OR=2.70; CI=1.31-5.55) and mothers educated up to high secondary and above (OR 7.42; CI=1.79-30.67) respectively. The women of lower SES and Hb level (< 11 gm%) had about 8 times and 4 times

higher risk of delivering a LBW newborn as compared to upper middle SES (OR=7.92; CI=1.70-36.88) and Hb % ≥ 11 gm% (OR=4.50; CI=1.17-17.24) respectively. The pregnant mother who were registered after 16 weeks of gestation and delivered babies at home were about 3 times and 2.5 times higher risk of giving low birth compared to women registered before 16 weeks (OR=2.60; CI=1.09-6.21) and institutional delivery (OR=2.46; CI=1.16-5.23) respectively. The risk of LBW was about 7 times higher in mother of 30 years and above as compared to 20-29 years age group (OR=6.80; CI=0.63-17.54). The influence of some factors like height, weight, smoking and number of antenatal visits got eliminated on applying multivariate logistic regression.

Discussion:

While describing population risk of LBW, this study confirms high burden of this problem. LBW is a sensitive indicator of health status of the population. It has its impact on infant and child morbidity and mortality. The mean birth weight observed was similar to the findings of earlier reports^{5,6}. Magnitude of LBW in the present study was higher than that of 22% in India (NFHS-3), but comparable to other study^{7,8}. Among different variables studied maternal age, family type, education, SES, height & weight, tobacco addiction, Hemoglobin percentage, number of antenatal visits, time of registration and place of delivery of newborn were significantly associated with LBW. In the present study the increase incidence of LBW in mothers of age group < 19 years and ≥ 30 years and was found which is in accordance with the study conducted by Joshi et al⁹. Higher burden of LBW in upper age group might be due to multiparity, inter-pregnancy interval, pregnancy/fertility planning and intention, and other nutritional factors. However these factors need to be further explored by research. Ghosh et al documented that there was no significant association between birth weight and religion of mothers but mothers who were less than 140 cm in height were more prone to have LBW and our findings are in conformity with their observations¹⁰. A high number of LBW newborns were seen in mothers whose pre delivery weight was less than 45 kg which is in accordance with study reported by Kiran Anand and B.S. Garg¹¹. The association of low SES and anemia with low birth weight observed in this study has also been reported from other studies in developing countries^{12,13,14,15,16}. Joshi et al also reported that 45.45% illiterate mothers delivered LBW babies which are in accordance with our study where 45.9% illiterate mothers delivered LBW babies⁹. These results also corroborated findings from earlier studies^{11,17}. The proportion of LBW babies decreased with increase in SES of the family. These findings are in accordance with other studies^{11,18}. Time of registration of mothers and place of delivery of newborns were two others significant factors associated with LBW. In the present study mothers who registered before 16 weeks had lower magnitude of LBW babies as compared to those who registered at later weeks of gestation. Incidence of LBW newborns were significantly lower in mothers who delivered in an institution and this finding is in accordance with the finding from the study of Biswas et al¹⁹. The above two

factors may be due to proper health education of mothers during subsequent contact of mothers with health care providers. However, the effect of height & weight, tobacco addiction and number of antenatal visits was nullified when multiple logistic regression analysis was done. Significant determinants in multiple logistic regressions were maternal age, type of family, education, SES, Hb%, time of

registration, and place of deliveries.

Conclusion :

To tackle the problem of low birth weight significant parameters mentioned above need to be addressed seriously. Beside the various national plans to raise the maternal and child health status, government should have provision for

Table 1
DISTRIBUTION OF LOW BIRTH WEIGHT (< 2.5KG) AND NORMAL BIRTH WEIGHT (≥ 2.5 KG)
NEWBORNS BY SELECTED CATEGORIES OF SOCIO-DEMOGRAPHIC CHARACTERISTICS
AND BIOLOGICAL CHARACTERISTICS OF THEIR MOTHERS (N=298)

Characteristics	Total	Birth weight of newborn				Statistical tests
		< 2.5 Kg		≥ 2.5 Kg		
	No.	No.	%	No.	%	
Characteristics						
≤ 19	22	5	22.7	17	77.3	$\chi^2 = 48.9$, df=2 p=0.001
20-29	224	43	19.2	181	80.8	
≥ 30	52	35	67.3	17	32.7	
Religion						Fisher's exact test P=1
Hindu	291	91	27.8	210	72.2	
Muslim	07	02	28.6	05	71.4	
Type of Family						$\chi^2 = 4.4$, df=1 p=0.03
Join	176	41	23.3	135	76.7	
Nuclear	122	42	34.4	80	65.6	
Education						$\chi^2 = 47$, df=2 p=0.001
Illiterate	146	67	45.9	79	54.1	
Primary & middle	103	13	12.6	90	87.4	
Secondary & above	49	03	6.1	46	93.9	
Socio-economic status						$\chi^2 = 55.4$, df=2 p=0.001
Lower middle	115	60	52.2	55	47.8	
Middle	148	20	13.5	128	86.5	
Upper middle	35	03	8.6	32	91.4	
Height in cm						$\chi^2 = 6.4$, df=1 p=0.01
< 145	32	15	46.9	17	53.1	
≥ 145	266	68	25.6	198	74.4	
Weight in kg						$\chi^2 = 6.9$, df=1 p=0.009
< 45	136	48	35.3	88	64.7	
≥ 45	162	35	21.6	127	78.4	
Eemoglobin gm %						$\chi^2 = 11.3$, df=1 p=0.001
< 11	244	78	32.0	166	68.0	
≥ 11	54	05	9.3	49	90.7	
Tobacco addiction						Fisher's exact test p=0.01
Yes	11	07	63.6	04	36.4	
No	287	76	26.5	211	73.5	

Table 2
DISTRIBUTION OF LOW BIRTH WEIGHT (<2.5KG) AND NORMAL BIRTH WEIGHT (≥2.5KG) NEWBORNS
BY SELECTED CATEGORIES OF ANTENATAL RECEIVED BY THEIR MOTHERS (N=298)

Characteristics	Total	Birth weight of newborns				Statistical tests
		< 2.5 Kg		≥ 2.5 Kg		
	No.	No.	%	No.	%	
No. of antenatal checkups						
<3	191	61	31.9	130	68.1	$\chi^2 = 4.4, df=1$ p=0.03
≥3	107	22	20.6	85	79.4	
Time of registration in week						
<16	90	13	14.4	77	85.6	$\chi^2 = 11.5, df=1$ p=0.001
≥16	208	70	33.7	138	66.3	
Place of delivery						
Home	179	62	34.6	117	65.4	$\chi^2 = 10.2, df=1$ p=0.001
Institutional	119	21	17.6	98	82.4	

Table 3
RESULTS OF MULTIVARIATE ANALYSIS USING LOGISTIC REGRESSION MODEL

Covariates	Odds ratio (OR)	p-value	95% confidence interval
Age (years)			
20-29	1	-	-
≤ 19	1.166	0.851	0.235-5.790
≥ 30	6.8	0.000	2.63-17.54
Family type			
Joint	1	-	-
Nuclear	2.7	0.007	1.31-5.55
Education			
Higher Secondary and above	1.0	-	-
Primary and Middle	1.242	0.782	0.267-5.773
Illiterate	7.421	0.006	1.795-30.676
Socio-economic status			
Upper middle	1	-	-
Middle	1.831	0.428	0.410-8.117
Lower Middle	7.925	0.008	1.703-36.885
Height in (cm)			
≥ 145	1	-	-
<145	2.5	0.09	0.84-7.46
Weight in (kg)			
≥ 45	1	-	-
<45	1.34	0.42	0.651-2.77
Tovacco addiction			
No	1	-	-
Yes	1.091	0.936	0.133-8.973
Hemoglobin in gm%			
≥ 11	1	-	-
<11	4.50	0.028	1.17-17.24

Table Contd.

Number of antenatal visits			
≥ 3	1	-	-
< 3	1.93	0.09	0.890-4.20
Time of registration (Weeks)			
< 16	1	-	-
≥ 16	2.60	0.31	1.090-6.210
Place of delivery			
Institutional	1	-	-
Home	2.46	0.018	1.160-5.230
Outcome (low birth weight = 1, normal birth weight = 0)			
Log-likelihood = -2.12.146, chi-square = 140.0, p value <0.0001 = Reference category			

References:

- World Health Organization, International Statistical Classification of Disease and Health Related Problems (Tenth Revision), Geneva, 1992, Vol.-1:772-773.
- Gupta P, Ghai OP. Textbook of Preventive & Social Medicine CBS Publishers and Distributors, New Delhi, Bangalore, 2007, p-383-384.
- Jilliffe DB. The Assessment of Nutritional Status of the Community. World Health Organization, Geneva, 1966;7-233.
- Lal S, Adarsh, Pankaj. Textbook of Community Medicine - CBS Publishers and Distributors, New Delhi, Bangalore, 2007, p-19.
- Prasad KN and Rao RSP. Study of low birth weight infants in the coastal areas of Udupi Taluk, Karnataka, South India. Bahrain Medical Bulletin 1994; 16 (3): 90-94.
- Kumar R, Kumar V. Effect of physical work during pregnancy on birth weight. Indian J Pediatr 1987; 54: 805-809.
- National Family Health Survey- 200506; International Institute for Population Sciences and Macro International, Mumbai, India 2007, Vol. - I: p-224.
- Siddhi S, Hirve Bela R, Ganatra. Determinants of low birth weight: a community based prospective cohort study. Indian J pediatr 1994; 31: 1221-1225.
- Joshi HS, Subba SH, Dabral SB, Dwivedi S, Kumar D, Singh S. Risk Factors Associated with Low Birth Weight in Newborns. Indian Journal of Community Medicine 2005; 30:142-143.
- Ghosh S, Hooja V, Mittal SK, Verma RK. Biosocial determinants of birth weight. Indian Pediatr 1977; 14:107-113.
- Kiran A, Garg BS. A study of factors affecting LBW. Indian Journal of Community Medicine 2000; 25: 57-61.
- Kramer MS. Determinants of low birth weight. Bull World Health Org 1987; 65:663-737.
- Dhar GM, Shah GN, Bhat LA, Butt N. Low birth weight- An outcome of poor socio obstetric interaction. Indian J Mat Child Hlth 1991; 2:10-13.
- Aurora S, Vishnu Bhat B, Srinivasan S, Habibullah S, Puri RK, Rajaram P. Maternal biosocial factors and birth weight. Indian J Mat Child Hlth 1994; 5: 65-67.
- Hirve SS, Ganatra BR. Determinants of low birth weight- A community based prospective study. Indian J Pediatr 1994; 31:1221-1225.
- Deshmukh JS, Motghare DD, Zodpey SP and. Wadhwa SK. low birth weight and associated maternal factors in an urban area Indian J Pediatr 1998; 35:33-36.
- Mavalankar DV, Gray RH, Trivedi CR. Risk factors for preterm and term LBW in Ahmadabad. International Journal of Epidemiology, 1992; 21: 263-72.
- Idris MZ, Gupta A, Mohan U, Srivastava AK, Das V. Maternal health and LBW among institutional deliveries. Indian Journal of Community Medicine 2000; 25: 156-60.
- Biswas R, Dasgupta A, Sinha RN, Chaudhari RN. An Epidemiological Study of Low Birth Weight Newborns in the District of Puruliya, West Bengal. Indian J Public Health, 2008; 52: 65-71.

