

Maternal Risk Factors Determining Birth Weight of Newborns: A Tertiary Care Hospital Based Study

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Research Article

Abstract: Introduction: Globally, more than 20 million infants are born with low birth weight. The number of low birth weight babies is concentrated in two regions of the developing world: Asia and Africa. 72% of low birth weight infants in developing countries are born in Asia where most births also take place, and 22% are born in Africa. India alone accounts for 40% of low birth weight births in Asia. . The reduction of low birth weight also forms an important contribution to the Millennium Development Goal (MDG) for reducing child mortality. The factors associated with intrauterine growth retardation are multiple and interrelated to mother, placenta and foetus. **Objectives:** 1) To study the 'Birth weight' pattern among study group. 2) To identify the maternal factors associated with low birth weight of newborns. **Material and Methods:** The present cross sectional study was carried out in Government Medical College & Hospital, Miraj amongst all the mothers and newborns delivered at institution during the period of one calendar year from January 2007 to December 2007. The data was collected with the help of interview technique using predesigned and pretested questionnaires followed by the thorough clinical examination and anthropometric measurements of mother and newborn. Interview was followed by thorough clinical examination and necessary investigations. **Results & Conclusion:** Low birth weight was found to be present in 92 (18.1%) newborns. The internal comparison was made among the study subjects with normal birth weight babies and those with low birth weight babies using the bivariate analysis and multiple logistic regressions. The factor found significantly associated were gestational age at delivery, number of antenatal visits, anemia, gestational age at 1st ANC visit, bad obstetric history, mothers weight, socio-economic status, birth interval, type of work, iron and folic acid supplementation, religion, sex of new born and gravida.

Key Words: Low birth weight, maternal risk factors, antenatal care, newborns.

Introduction

Growth of the fetus is affected by maternal, environmental and genetic factors. Intrauterine growth and development is one of the most vulnerable processes in human life cycle and its aberrations can result in lasting profound influence in later life. In the context of developing countries, intrauterine growth has been invariably assessed by birth weight.¹ The birth weight of an infant is the single most significant

determinant of its chances of survival, healthy growth and development.²

Low birth weight is one of the most serious challenges in maternal and child health in both developed and developing countries. Its public health significance may be ascribed to numerous factors – its high incidence, its association with mental retardation and a high risk of peri natal and infant mortality (half of all peri natal and one third of all infant deaths are due to low birth weight); human wastage and suffering, the very high cost of special care and intensive care unit and its association with socioeconomic underdevelopment.² Low birth weight is considered as a sensitive index of Nation's health and development.³

Early marriages, high work burden, small birth intervals and discriminatory food customs combine to place the pregnant women at the risk of becoming, or remaining, malnourished.

Globally, more than 20 million infants are born with low birth weight. The number of low birth weight babies is concentrated in two regions of the developing world: Asia and Africa. 72% of low birth weight infants in developing countries are born in Asia where most births also take place, and 22% are born in Africa. India alone accounts for 40% of low birth weight births in Asia.

The goal of reducing low birth weight incidence by at least one third between 2000 and 2010 is one of the major goals in "A world Fit for Children", the Declaration and Plan of Action adopted at the United Nations General Assembly Special Session on Children in 2002. The reduction of low birth weight also forms an important contribution to the Millennium Development Goal (MDG) for reducing child mortality. Activities towards the achievement of the MDGs will need to ensure a healthy start in life for children by making certain that women commence pregnancy healthy and well nourished, and go through pregnancy and childbirth safely. Low birth weight is therefore an

important indicator for monitoring progress towards this internationally agreed-upon goals.⁴

The factors associated with intrauterine growth retardation are multiple and interrelated to mother, placenta and foetus. Maternal factors include malnutrition, severe anemia, heavy physical work, malaria, toxemia, smoking; low socioeconomic status, short maternal stature, very young age, high parity, close birth spacing and low educational status etc. placental causes include placental insufficiency and placental abnormalities. The foetal causes include foetal abnormalities, intrauterine infections, chromosomal abnormalities, multiple gestations

Thus in view of all this the study was designed with the following objectives 1) To study the 'Birth weight' pattern among study group. 2) To identify the maternal factors associated with low birth weight of newborns.

Material and Methods

This hospital based cross sectional study was conducted in Government Medical College & Hospital, Miraj amongst all the mothers and newborns delivered at institution during the period of one calendar year from January 2007 to December 2007.

A pilot study was carried out to test the proforma and check the feasibility of the study. After the pilot study necessary revisions were made in the proforma. Study variables included were birth weight of baby, maternal age, religion, occupation and education, socio-economic status, type of residence, type of family, mother's height and weight, parity, inter-pregnancy interval, gestational age, number of ANC visits, iron and folic acid supplementation received, hemoglobin status, nature of work during pregnancy, nutritional intake, bad obstetric history and sex of baby.

Low birth Weight (LBW) babies were defined as babies having birth weight less than 2.5 kg.⁵ The birth weight of newborn was recorded within 1 hours of delivery on electronic weighing machine. Before taking weight clothes were taken off and zero was confirmed. Machine was standardized from time to time.

Data Collection:

Ethical clearance was obtained from the institutional Ethics Committee. The objective of the study was explained to participants and informed consent was taken. The data was collected with the help of interview technique using predesigned and pretested questionnaires followed by the thorough clinical

examination and anthropometric measurements of mother and newborn. Necessary investigations were carried out like hemoglobin estimation, urine sugar and albumin, VDRL and blood group estimation. Interview was taken on the next day of delivery. The available health records were also reviewed.

Statistical analysis:

For analysis descriptive statistics used were percentage, mean and standard deviation (SD). Bivariate analysis was done using crude odds ratio, 95% confidence interval (CI) and chi-square test. Multiple logistic regressions were used to calculate adjusted odds ratio.

All the analysis was carried out using SPSS 16.0 and EPI Info 3.5.1.

Results

Out of total 524 deliveries only 509 (97%) could be covered / interviewed and examined and were included in the analysis. The remaining 15 (3%) could not be included in the study, due to immediate transfer of patient, non – response of the patients, non co-operation for examination and incomplete information. Table 1 shows the birth weight pattern of total 509 births, 417 (81.9%) newborns were having normal birth weight while 92 (18.1%) newborns were having low birth weight.

Table 1: Birth weight pattern of the newborns

Birth weight	Total	%	Mean birth wt. ± S.D.
Normal birth weight	417	81.9	2.87 ± 0.31
Low birth weight	92	18.1	2.14 ± 0.25
Total	509	100	

The internal comparison was made among the study subjects with normal birth weight babies and those with low birth weight babies using the bivariate analysis. The Odds ratios were calculated for the attributes. Table 2 shows the bivariate analysis of the socio demographic factors amongst the study subjects with normal and low birth weight babies. The factors which were found to be significantly associated with low birth weight of the newborns were age of the mother at the time of conception, type of the mother's work and socioeconomic status. However religion, mother's education, type of the residence and the type of family were found insignificant in the present study. Highest odds was observed for socioeconomic status i.e 5.26 followed by type of work (4.37).

Table 2: Bivariate analysis of the socio- demographic factors amongst the study subjects with normal and low birth weight babies

Attributes	NBW		LBW		Total	p value	OR (95% CI)
	No.	%	No.	%			
Age of Mother in years							
< 19	32	69.57	14	30.43	46	0.022*	0.46 (0.23 - 0.96)
≥ 19	385	83.15	78	16.85	463		
Religion							
Hindu	299	81.92	66	18.08	365	0.99	1.00

other religions	118	81.94	26	18.06	144		(0.59 - 1.69)
Mother's Education							
Illiterate	56	80.00	14	20.00	70	0.86	0.86 (0.44 - 1.72)
Literate	361	82.23	78	17.77	439		
Type of Work							
Light or Moderate Work	342	87.92	47	12.08	389	< 0.001*	4.37 (2.63 - 7.25)
Heavy Work	75	62.50	45	37.50	120		
Socioeconomic Status							
Upper (U + UM+ LM)	112	94.92	6	5.08	118	< 0.001*	5.26 (2.14 - 13.76)
Lower (UL +L)	305	78.01	86	21.99	391		
Residence							
Urban	153	83.7	34	16.3	187	0.96	0.99 (0.60 - 1.62)
Rural	264	82	58	18	322		
Type of Family							
Nuclear Family	104	80.6	25	19.4	129	0.58	
Joint Family	206	83.7	40	16.3	246		
Three Generation Family	107	79.9	27	20.1	134		
Total	417	81.9	92	18.1	509		

* - significant

Table 3: Bivariate analysis of the maternal constitutional and reproductive factors amongst the study subjects with normal and low birth weight babies

Attributes	NBW		LBW		Total	p value	OR (95% CI)
	No.	%	No.	%			
Mother's Height							
< 140 cm	14	93.3	1	6.7	15	0.49* Fisher Exact	3.16 (0.43 - 65.24)
> 140 cm	403	81.6	91	18.4	494		
Mother's Weight							
< 40 kg	16	45.7	19	54.3	35	< 0.001*	0.15 (0.07 - 0.33)
> 40 kg	401	84.6	73	15.4	474		
Sex of newborn							
Male	240	85.7	40	14.3	280	0.014*	1.76 (1.09 - 2.85)
Female	177	77.3	52	22.7	229		
Gravida							
1,	172	78.5	47	21.5	219	0.072	0.66 (0.41 - 1.07)
> 1	249	84.5	45	15.5	290		
Gestational age at delivery							
< 37	66	45.5	79	54.5	145	< 0.001*	0.03 (0.02 - 0.06)
≥ 37	351	96.3	13	3.6	364		
Inter pregnancy Interval							
< 3	332	79.2	87	20.8	419	< 0.001*	0.22 (0.08 - 0.60)
≥ 3	85	94.4	5	5.6	90		
Bad Obstetrics history							
Absent	381	88.2	51	11.8	432	< 0.001*	8.51 (4.82 - 15.05)
Present	36	46.8	41	53.2	77		
Iron and folic acid supplementation							
Not Received	12	44.5	10	45.5	22	0.002* Fisher Exact	0.24 (0.09 - 0.63)
Received	405	83.3	82	16.7	487		
Anaemia							
< 11 gm	110	60.8	71	39.2	181	< 0.001*	0.11 (0.06 - 0.19)
> 11 gm	307	93.6	21	6.4	328		
Gestational age at 1st ANC visit							
I st Trimester	324	87.6	46	12.4	370	< 0.001* (df=2)	-----
II nd Trimester	68	72.3	26	27.7	94		
III rd Trimester	14	60.1	9	39.1	23		
Not registered	11	50	11	50	22		
Total number of ANC Visits							
< 3	13	39.4	20	60.6	33	< 0.001*	0.12 (0.05 - 0.26)
> 3	404	84.9	72	15.1	476		
Total	417	81.9	92	18.1	509		

* - significant

Table 3 shows the bivariate analysis of the maternal constitutional and reproductive factors amongst the study subjects with normal and low birth weight babies. Mother's weight, gestational age at delivery, gestational age at 1st ANC visit, inter pregnancy interval, anemia in mother, bad obstetrics history, and total number of ANC visits, Iron and folic acid supplementation, sex of newborn were found to be significantly associated with low birth weight of the

newborns. Comparison was also made between the mothers with gravida =1 and gravida >1 but it was found insignificant in the present study. Also mother's height was found to be insignificant. Bad obstetrics history had the highest odds ratio (8.51).

Multiple logistic regression analysis (Table 4) was done to eliminate the confounders as well identifying the individual effects of the factors.

Table No. 4: Multiple logistic regressions analysis of maternal factors associated with low birth weight

Sr. No.	Variables tested	Adjusted Odds Ratio	95% CI.	Level of significance
1	Gestational age at delivery	32.47	17.06 – 61.81	HS
2	Total no. of ANC visits	10.91	4.95 – 24.02	HS
3	Anaemia	9.43	5.45 – 15.86	HS
4	Gestational age at 1 st ANC visit	8.7	3.66 – 20.74	HS
5	Bad obstetrics history	8.5	4.92 – 14.66	HS
6	Mother's weight	7.05	3.41 – 14.59	HS
7	Socio-economic status	5.20	2.21 – 12.2	HS
8	inter pregnancy interval	5.11	1.97 – 13.27	HS
9	Type of work	4.57	2.80 – 7.54	HS
10	Iron & Folic acid supplementation	4.50	1.79 – 11.30	HS
11	Religion	3.34	1.67 – 6.69	Sig
12	Sex of newborn	1.77	1.12 – 2.80	Sig
13	Gravida	1.70	1.02 - 2.84	Sig
14	Residence	1.18	0.70 - 199	NS
15	Mothers education	1.14	0.59 - 2.21	NS
16	Type of family	0.89	0.53 – 1.51	NS
17	Mother's height	0.31	0.04 – 2.45	NS

HS- Highly significant, Sig- significant, NS- non significant

Table No. 4 shows that OR is very high for gestational age at delivery, number of antenatal visits, anemia, gestational age at 1st ANC visit, bad obstetric history, mothers weight, socio-economic status, birth interval, type of work, iron and folic acid supplementation. These factors were found to be highly significantly associated with the low birth weight. Religion, sex of new born and gravida were found to be significantly associated. While Mother's education, type of family and mother's height, and residence were found to be insignificant.

Discussions

The present study was carried out to assess the birth weight pattern in study group and to identify and to assess the impact of certain vulnerable factors influencing the birth weight.

In the present study prevalence of low birth weight was found to be 18.1 %. These findings were similar to that studied by Kamaladoss T et al (1990)⁶.

Prevalence of low birth weight babies was low as compared to that observed in NFHS -3 (21.5%)⁷. Deshmukh et al (1994)⁸, Idris MZ et al (2000)³, Joshi SM et al(2000)⁹ found very high prevalence of low birth weight babies in their studies i.e. 30.3% , 32.2% and 32.5% respectively.

Low prevalence of low birth weight babies in present study might be due to the fact that majority women were registered during pregnancy and they were availing the antenatal services from Govt. Medical College hospital and also receiving medicinal supplement and nutritional education.

In present study factors found to be significantly related with low birth weight of babies were gestation age at delivery, number of antenatal visits, anemia, gestational age at 1st ANC visit, bad obstetric history, mothers weight, socio-economic status, birth interval, type of work, iron and folic acid supplementation religion, sex of new born and gravida.

Anand K et al (2000)¹⁰ observed that lower socioeconomic status, higher parity, bad obstetrics history, presence of anaemia and antenatal care were risk factors for the low birth weight of babies. Similar findings were also observed by Mann LI et al (1974)¹¹, Sharma MK et al (2009)¹² and Joshi SM et al (2000)⁹ found that lower socioeconomic status was significantly associated with LBW. Low socio-economic strata were usually overburdened with work, poor nutritional status and lack of education which could contribute to large number of LBW.

Studies conducted by Mavalankar DV et al (1992)¹³, Acharya D et al (2004)¹⁴ and Deswal BS et al (1999)¹⁵ found that maternal constitutional factors like

maternal height and weight were significantly associated with low birth weight of babies. In present study no association was found between maternal height and birth weight of baby which might be due to less number of women having height less than 140 cm in the study.

Prevalence of low birth weight babies was high in mothers whose age was more than 35 years as well as less than 19 years as compared to 20 to 34 years age group. Similar findings were observed by Mukherji DK et al (1970)¹⁶, Fedric J et al (1976)¹⁷, Anand K et al (2000)¹⁰.

While Kramer MS (1984)¹⁸ in contrary to our observations reported two studies with no association between maternal age and birth weight of baby.

High prevalence among < 19 years age groups could be due to teenage pregnancies, when the growth is not fully completed. Also marriages at an early age would lead large no of pregnancy with inadequate spacing contributing for low birth weight.

Similarly women over 35 years of age might exhibit impaired intrauterine growth or inadequate gestational duration delivering low birth weight babies.

Present study also revealed that the percentage of low birth weight decreases with increasing inter pregnancy interval. Similar finding were also observed by Ghosh et al (1969)¹⁹ Das et al (1977)²⁰ and Deswal BS et al (1999)¹⁵ in their study. Vijaykumar (1992)²¹ revealed that birth interval had a direct relation to birth weight. In contradictory to above finding Ghate et al (1993)²² in their study found no association between inter-pregnancy interval and low birth weight of baby.

Improved maternal health as a consequence of prolonged spacing could reflect in having higher birth weight. On multiple logistic regression it was observed that gravida >1 and bad obstetrics history was significantly associated with low birth weight, which was also confirmed by the findings observed by Anand K et al (2000)¹⁰ in their studies.

In present study it was found that prevalence of LBW babies in mothers whose hemoglobin was less than 11 gm, was higher as compared to mothers whose hemoglobin level was more than 11 gm, which was consistent with the findings observed by Ghosh et al (1969)¹⁹ Tyagi et al (1985)²³, Swain et al (1988)²⁴, Steer et al (1991)²⁵, Ghate et al (1993)²², Grover et al (1998)²⁶ and Anand K et al (2000)¹⁰.

Thus the study finding suggests improving the utilization of ANC services, and improving educational status of women. Also activities to increase awareness regarding birth spacing and early ANC registration should be carried out. Health education should be given to mothers regarding nutrition and iron and folic acid supplementation. Early diagnosis and proper management of anemia should be done.

Limitations

1. Present study was hospital based study. Not all sections of the community use hospital facilities. Again government facilities delivered at free are not used by all sections of the community. So due precaution should be taken while projecting the study results into the community.
2. Precise information regarding pre pregnant weight of the women could not be obtained as majority women are illiterate coming from rural area and not aware about the significance of weight records.

References

1. Sachdev HPS. Low birth weight in South Asia. *Int J Diab Dev Countries* 2001; 21(1):13-33.
2. Park K. Text book of Preventive and Social Medicine. 19th edition. Jabalpur Banarsidas Bhanot Publishers, 2007. p. 426-428.
3. Idris MZ, Gupta A, Mohan U, Srivastava AK, Das V. Maternal health and low birth weight among institutional deliveries. *Indian Journal of Community Medicine*.2000; 25(4):156-160.
4. United Nations Children's Fund, World Health Organization. Low Birthweight: Country, Regional and Global Estimates. New York, NY UNICEF 2004:1- 27.
5. World Health Organization. International Statistical classification of diseases and health problems. 10th revision, 2nd edition, World Health Organization, Geneva, 2004; 2:136-137.
6. Kamaladoss T, Abel R, Sampathkumar V. Epidemiological co-relates of low birth weight in Rural Tamilnadu. *Indian Journal of Pediatrics* 1992; 59:299-304.
7. International Institute of Population Sciences, National Family Health Survey, India. 2005-06 (NFHS-3, Vol. 1) 2007:225.
8. Deshmukh JS, Motghare DD, Zodpe SP, Wadhva SK. Low birth weight and associated maternal factors in an urban Area. *Indian Paediatrics* 1998; 35:33-35.
9. Joshi SM, Pai NP. Effect of the maternal Bio-Social Determinant on Birth Weight in A Slum Area of Greater Mumbai. *Indian Journal of Community Medicine* 2000; 25(3):121-23.
10. Anand K, Garg BS. A study of Factors affecting LBW. *Indian Journal of Community Medicine* 2000; 25(2):57-61.
11. Mann LI, Tejani NA, Weiss RR. Antenatal diagnosis and management of small for gestational age fetus. *Am J Obstet Gynecol* 1974;120:995-1004.
12. Sharma MK, Kumar D, Huria A, Gupta P. Maternal risk factors of low birth weight in Chandigarh India. *Internet J Health* 2009: 9.
13. Mavalankar DV, Gray RH, Trivedi CR. Risk factors for preterm and term low birth weight in Ahmedabad, India. *Int J Epidemiol* 1992;21:263-72.
14. Acharya D, Nagraj K, Nair NS, Bhat HV. Maternal determinants of intrauterine growth retardation: a case control study in Udupi District, Karnataka. *Indian J Community Med* 2004;29:181-83.
15. Deswal BS, Singh JV, Kumar D. A study of risk factors for low birth weight. *Indian Journal Community Medicine* 1999; 24 (3): 127-131.

16. Mukherjee DK, Sethna NJ. Birth weight and its relation with certain maternal factors. *Indian J Pediat* 1970; 37:460-464.
17. Fedrick J, Adelstein P. Factors associated with low birth weight of infants delivered at term. *British Journal of obstetrics and Gynaecology* 1987; 85(1): 1-7.
18. Kramer MS. Determinants of low birth weight: Methodological assessment and meta-analysis. *WHO Bull* 1987;65(5):663-737.
19. Ghosh S, Hooja V, Mittal SK, Verma RK. Bio-Social Determinant of Birth Weight. *Indian Pediatrics* 1977;14(2):107-114.
20. Das K, Ganguly SS, Saha R, Ghosh BN. Interrelation of birth weight with certain biological and Socio-economic factors. *Indian Journal of Public Health* 1981;25 (1): 11-19.
21. Vijayakumar K. Birth Spacing and its Bearing on Birth weight. *Indian Journal of Community Medicine* 1992; 17 (1): 15-20.
22. Ghate MM, Pratinidhi AB, Gupte AM. Effect of maternal nutritional status on birth weight of the baby. *The Journal of obstetrics and Gynaecology of India* 2001; 51(1): 38-41.
23. Tyagi NK, Bhatiya BD, Sur AM. Low birth weight babies in relation to nutritional status in primipara. *Indian Pediatrics* 1985; 22: 507-514.
24. Swain S, Singh S, Bhatia BD, Pandey S, Krisna M. Maternal hemoglobin and serum albumin and foetal growth. *Indian Paediatrics* 1994: 31;778-782.
25. Steer P, Alam MA, Wordsworth J, Wekh A. Relation between maternal haemoglobin concentration and birth weight in different ethnic groups. *British Medical Journal* 1995; 30: 489-491.
26. Grover V, Agarwal OP, Gupta A, Kumar P, Tiwari RS. Effect of daily and alternate day iron and folic acid supplementation to pregnant females on the weight of newborn. *Indian Journal of Community Medicine* 1998;23 (4): 165-168.