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Original Research Article

Predictors of low birth weight babies born in tribal tertiary health care setting: a cross sectional study

Thakre S. B.[1], Thakre S. S.[2]*, Kaware A. C.[3], Adikane H.[1]

Department of Community Medicine, [1]Government Medical College, Gondia, [2]Indira Gandhi Government Medical College, Nagpur, [3]Seth G.S. Medical College, Mumbai, Maharashtra, India

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***Correspondence:**
Dr. Thakre S. S.,
E-mail: sushamathakre@rediffmail.com

ABSTRACT

Background: A baby's weight at birth is a strong indicator of maternal and newborn health and nutrition. Strategies to reduce prevalence of LBW are important in order to achieve the third Sustainable Development Goals (SDG 3)-reduce child mortality. With this background the present study was undertaken to estimate proportion of LBW babies born at tribal tertiary health care institution and to find out predictors of the LBW among babies.
Methods: The present cross sectional study was undertaken at tertiary health care setting. We restricted analyses to singleton live births, and following an initial descriptive summary of the deliveries, logistic regression analysis was conducted to investigate the association of various factors.
Results: Our results show proportion of LBW was 17.84% in babies born at tribal tertiary health care setting. There is no significant difference of LBW in different socio-demographics of the mother. However; significant difference was observed in tribal and non-tribal women and women with low literacy lever; wherein significant predictors were related to utilization of antenatal care (ANC), ICDS services, etc. Statistical significance was ascertained based on a $p<0.05$.
Conclusions: In this study; significant predictors were low maternal education, <4 ANC visits, inadequate consumption iron and folic acid, low hemoglobin percent level, and no additional diet at ICDS during current pregnancy. It has also provided basic information pertinent to quality of ANC care and it influence on LBW. Findings of this study are useful for maternal and child health policy makers, practitioners and those who provide health care during pregnancy

Keywords: Rural, Urban, Naxalite, Low birth weight, ANC, ICDS, SDG-3

INTRODUCTION

A baby's weight at birth is a strong indicator of maternal and newborn nutrition. Being undernourished in the womb increases the risk of death in the early months and years of a child's life.[1] Those who survive tend to have impaired immune function and increased risk of disease; they are likely to remain undernourished, with reduced muscle strength, cognitive abilities and low intelligence quotient (IQ) throughout their lives.[2,3] Babies with a birth weight of less than 2500 grams, irrespective of the period of their gestation are termed as low birth weight (LBW) babies.[4] Evidence showed that in full-term fetuses' growth had been limited due to different factors.[5]

Despite consistent efforts to improve the quality of maternal and child health; more than twenty million LBW babies are born every year throughout the world. Low-income countries account for majority share of LBW. Half of the children with a LBW were born in

South Asia and among these countries India and Bangladesh has the highest prevalence of LBW (30%).[4] Since last 10 years institutional delivery have gain momentum in India.[6]

LBW is a multi-factorial origin. Factors includes maternal and obstetric factors, demographic, uncontrolled fertility, socio-economic status, nutritional status of mother, adequacy of micronutrients and macronutrient and adequate care during pregnancy (ANC).[7-17] Majority of these factors are interrelated, influencing each other and predispose a women to give birth to an infant with LBW.

There is a strong association between lack of ANC and adverse pregnancy outcomes.[12,17] Antenatal clinics are an essential element of the health services provided during pregnancy. These clinics provide services such as screening, prevention, and treatment of pregnancy-related complications. The World Health Organization (WHO) recommends at least four standard quality antenatal care visits.[18] Literature also reveals that more emphasis is given to those factors like socio-demographic and other factors. Either little can be done to modify these factors or may require longer period to modify it. There is a paucity of literature about determinants of LBW in women who deliver at tribal health care settings. Consequently, strategies to reduce prevalence of LBW are important in order to achieve the third Sustainable Development Goals (SDG 3)-reduce child mortality.[4] With this background a present cross sectional study was undertaken to estimate proportion of LBW babies born at tribal tertiary health care institution and to find out predictors of the LBW among babies.

METHODS

A hospital based cross-sectional study was undertaken during 1st April to 30th April 2017 in a Government Medical college and General hospital, Gondiya, state of Maharashtra, India. This district is declared as Naxalite affected district in Maharashtra. BGW hospital is a governmental hospital under the Government Medical College, Gondiya district of Maharashtra that provides medical services to a population of nearly 12, 00,000, spread across eight talukas and 952 villages.[19]

Sample size

A rotational sampling scheme was adopted; year was distributed in four quarters. By random method second quarter of 2017 and its first month (April 2017) was selected for the study. The estimated minimum sample size (n=287) was calculated using a formula to determine sample size for single population proportion, taking the prevalence (p) of LBW 23% in the same hospital and desired precision of 10% at the 95% confidence interval. All together 306 pregnant women were enrolled from obstetric ward. Those women were admitted for delivery. Those babies not suffering from any significant medical and surgical disorders at the time of enrollment were included. The mother and baby pairs were the study participants.

Ethical Committee of the Government Medical College (GMC), Gondiya, approved the study protocol. A written consent was obtained from each mother. Information on age, religion, years of formal schooling, maternal obstetric, family size and monthly income, etc were obtained using a questionnaire.

Birth weight was recorded for all live births immediately after birth under the direct supervision of a paramedical (nurse). Low birth weight was defined as a weight of a newborn less than 2500 grams. Birth weight was recorded immediately after birth.[4] Determination of gestational age was based on menstrual history, clinical examination and ultrasound investigation conducted and recorded by an obstetrician. Other investigation findings documented by obstetrician were also recorded in the present study.

Maternal data included were maternal age (years), parity (number), abortion (number), maternal and husbands education and occupation, education level (illiterate, primary school, secondary school, high school, university), maternity registration with public health system/ Integrated child development services (ICDS)/Private hospital (yes, no), place of living (urban, rural), utilization of Ante natal care (ANC) services, ICDS and other maternal characteristics like, height in centimeter (cm), weight in kilograms (kg), level of hemoglobin in gram per deciliter (g/dl). Assembled neonatal and delivery data collected were gender (female, male) and weight of baby in grams (g), gestational age (week), birth anomalies (yes, no), etc.

Analysis

We restricted analyses to singleton live births, and following an initial descriptive summary of the study participants, association of Socio-demographic factors, maternal factors and numbers/utilization of ANC services, etc. with having a LBW baby was carried out. Logistic regression analysis was conducted to model the relationship between independent variables-predictors and LBW. Results are reported as adjusted odds ratios (OR) with 95% confidence intervals (CI). Statistical significance was ascertained based on a $p<0.05$. All analyses used the licensed statistical software package SPSS (version 20).

RESULTS

Figure 1 shows that total of 306 enrolled; 297 pairs of mother and single ton infants were considered for final analysis. In the present study 53/297 (17.84%) were found to be low birth weight (LBW). Summary statistics of the study participants reveals that proportion of males 170 (57.0%) and females new born were 127 (42.0%).

Mean (±SD) birth weight and gestational age by USG were 2738.55 (±470.42) g and 38.24 (±2.34) weeks respectively. Mean (±SD) age of mother was 24.01 (±2.85) years. Mean (±SD) weight and height of mothers were 51.58 (±9.08) kg and 152.91 (±6.81) cm respectively. Mean (±SD) hemoglobin of mother was 9.76 (±1.44) g/dl. A total of 83% women were registered with ICDS and were taking supplementary meals. However; five percent of women were enrolled with private health care providers (doctors).

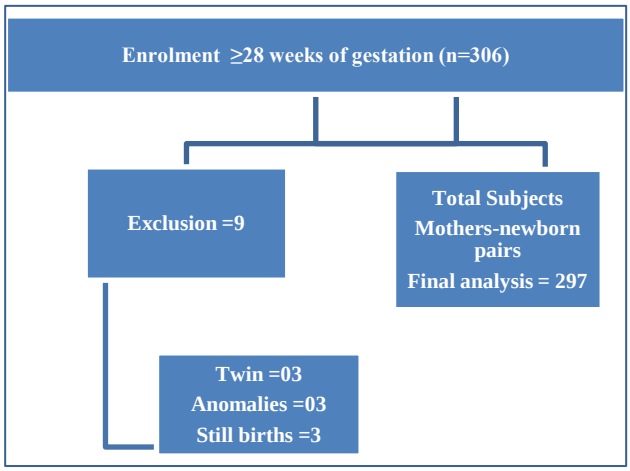

Figure 1: Enrolment and final analysis.

Analysis of maternal factors: Table 1 revealed that there is no significant difference in proportion of LBW in different socio-demographics to mother; like age of mother, education and occupation of father, type of family, geographical location and religion. However, proportion of LBW was significantly more (24.85%) in babies born to mothers whose education was less than middle school. It also reveals that babies born with LBW were significantly more (22.75%) in Tribes class women. There is no significant difference of LBW babies born of primi-para mothers. A higher proportion (18.00%) LBW was seen when inter-pregnancy interval was less than 24 months. LBW percentage was found to be higher among those women who had less than or equal to four antenatal care (ANC) visits (45.24%). Percentage of LBW was significantly more (43.24%) in mothers who had consumed less than 100 iron and folic acid tablets during pregnancy. Low birth weight proportion was significantly more (50.00%) in women who were not consuming additional diet from ICDS. The present study found maximum percentage of LBW babies (66.67%) among those women who had severe anemia. Among the mothers who had height of less than 145 cm, 26.67% had LBW babies. Those mothers who had previous history of abortions and stillbirth were also found to have low percentage of LBW babies (6.67%). Among the mothers who had BMI of less than 18.5 Kg/m^2, 25.00% had LBW babies.

Table 1: Association of socio-demographic determinants with birth weight.

Variables	Total	LBW No (%)	Normal No (%)	Significance
Age of mother				
≤19	3	0 (0.00)	3 (100)	X^2=0.704
20-29	279	52 (18.64)	227 (81.36)	P=0.704
≥30	15	1 (6.67)	14 (93.33)	P>0.05
Education-father				
≤Middle school	23	3(13.04)	20 (86.95)	X^2=0.392
Up to high school	144	28 (19.44)	116 (80.56)	P=0.531
Higher sec & above	130	22(16.93)	108 (83.07)	P>0.05
Education-mother				
≤Middle school	169	42(24.85)	127 (75.14)	X^2=19.148
Up to high school	88	3 (3.41)	75(96.59)	P=0.000
Higher sec and above	40	8 (20.00)	32(80.00)	
Occupation father				
Farmer	95	21 (22.11)	68 (71.58)	X^2=3.906
Labourer	149	26 (17.45)	113 (75.84)	P=0.278
Business/service	53	6 (11.32)	67 (88.68)	P>0.05
Type of family				
Nuclear	64	9 (14.06))	55 (85.94)	X^2=2.66
Joint	184	38 (20.65)	146 (79.35)	P=0.264
3rd generation	49	6 (12.24)	43 (87.76)	P>0.05
Geographical area				
Rural	235	44 (18.72)	191 (81.28)	X^2=0.592
Urban	62	9 (14.52)	53 (85.48)	P>0.05
Poverty				
BPL	178	31 (17.42)	154 (83.19)	X^2=0.592
APL	119	20 (16.81)	99 (81.46)	P>0.05

Variables	Total	LBW No (%)	Normal No (%)	Significance
Religion				
Hindu	243	45 (18.52)	198 (81.48)	X^2=2.842
Buddhist	45	8 (17.78)	37 (82.22)	P>0.05
Islam	9	0 (0.00)	9 (100.00)	
Caste				
Tribes (ST/NT)	145	33 (22.75)	112 (77.25)	X^2=5.621
OBC & Others	96	11 (11.45)	85 (88.89)	P=0.017
SC	56	9 (16.07)	47 (83.02)	P<0.05

Table 2: Association of maternal determinants with birth weight.

Maternal variables	Total	LBW No (%)	Normal No (%)	Significance
Parity				
1	198	39 (19.70)	159 (80.30)	$X^{2=}$3.21
2	82	10 (12.20)	72 (87.80)	P=0.143
≥3	17	4 (23.53)	13 (76.47)	
Inter pregnancy interval				
≤24 M	50	9 (18.00)	41 (82.00)	$X^{2=}$1.26
>24 M	51	6 (11.76)	43 (88.24)	P=0.532
Previous abortions				
Yes	30	2 (6.67)	28 (93.33)	$X^{2=}$3.47
No	267	51 (19.10)	216 (80.90)	P=0.172
ANC visits				
<4	42	19 (45.24)	22 (52.38)	X^2=26.34
≥4	255	34 (13.33)	222 (87.06)	P=0.000
Haematinics				
≥100 tab	260	37 (14.23)	223 (85.77)	X^2=16.57
<100 tab	37	16 (43.24)	21 (56.76)	P=0.002
ICDS Diet				
Yes	247	28 (11.34)	219 (88.66)	X^2=39.78
No	50	25 (50.00)	245 (50.00)	P=0.000
Additional diet home				
Yes (Regular)	230	26 (11.30)	204 (80.70)	X^2=30.87
No	67	27 (40.30)	40 (59.70)	P=0.000
Height in cm				
≤145	30	8 (26.67)	22 (73.33)	r=0.196
145-155	169	26 (15.38)	143 (84.62)	t=3.42
>155	98	19 (19.39)	79 (80.61)	P=0.000
Hemoglobin level (gm/dl)				
<7	6	4 (66.67)	2 (33.33)	r=0.2319
7-9.9	140	28 (20.00)	112 (80.00)	t=4.042
10-10.9	125	21 (16.80)	104 (83.20	P=0.000
≥11	26	0 (0.00)	25 (100.00)	
BMI (Kg/m^2)				
<18.5	44	11 (25.00)	33 (75.00)	r=0.1242
18.5-24.9	216	34 (15.74)	172 (79.63)	t=2.14
25.0-29.9	37	8 (21.62)	29 (78.38)	P=0.000

Table 3 reveals that on multiple logistic analysis of determinants of LBW babies, it was found that maternal education ≤middle school (odds ratio (OR) 1.64; CI 1.07-2.50), ANC visits ≤4 (odds ratio (OR) 2.18; CI 1.09-4.99), Not consuming additional diet from ICDS (odds ratio (OR) 8.56; CI 3.51-20.89), maternal hemoglobin <9.9 gm% [odds ratio (OR) 1.56; CI 1.73-3.31], and iron and folic acid <100 tablets (odds ratio (OR) 2.14; CI 1.08-5.46) were found to be significantly (p<0.05) associated with low birth weight (LBW).

Table 3: Logistic regression analysis of low birth weight and its predictors.

Variables	Adjusted Odds ratio	Std. error	Z value	P value	95% CI
Mothers education					
>Middle school	1	0.352	2.31	0.021	1.07-2.50
<Middle school	1.64				
ANC visits					
≥4	1	0.923	1.84	0.046	1.09-4.99
<4	2.179				
Additional diet :ICDS					
Yes	1				
No	8.568	3.898	4.72	0.001	3.51-20.89
Haemoglobin level (gm/dl)					
>9.9	1				
<9.9	1.56	0.6	2.16	0.024	1.73-3.31
Iron and folic acid tablets					
≥100 Tab	1				
<100 Tab	2.137	1.023	1.89	0.013	1.08-5.46

DISCUSSION

The proportion of LBW in the present study was found to be 17.84%, which was slightly less than the national average of rural India (23%).[1] However; a study by Borah et al reported 21.8% LBW in institutional births.[14] Present study was carried out at tertiary health care institution where women with optimum utilization of health care facilities like ANC, adequate use of iron and folic acid tablets and optimum utilization of ICDS services might have helped in declining LBW. In the present study no significant association was found between the birth weight and teenage pregnancy. It may be due to the fact that teenage mothers in the present study are lesser in number and also higher mean (±SD) age of the study participants is 24.01±2.85 years. No doubt that teen pregnant mothers are both physically and mentally less capable for bearing the burden of pregnancy. Banerjee et al also found that the incidence of LBW was significantly higher among the teenage mothers.[20]

A significant association was found between mother's education status and birth weight of babies in the present study. Similarly, Borah et al and Kader et al also reported that the percentage of LBW babies among illiterate mothers was high.[14,16] Our study found a statistically non significant association between birth weight of babies and the religion. However, Borah et al and, Kaushal et al found higher percentage of LBW babies among Muslim mothers.[14,21]

In the present study non significant association was observed with types of family, rural and urban difference, economic status of women. However; significantly high proportion of LBW was seen in women belonging to tribe's community. Majority of the women utilized social service benefits provided under maternal and child health care promotion like quality ANC care, special and general nutritional supplementation, etc. Therefore other social and demographic factors have not shown significant association with LBW. Most of the mothers of LBW babies were found to be anemic during the antenatal period. This finding is consistent with. Borah et al and Mumbare et al observed that maternal anemia is associated with delivery of a LBW infant.[14,22] This study also found higher percentage of LBW babies among mothers who did not have adequate ANC checkups. Similar findings were also observed by Kader et al.[14,16]

This study found that short inter pregnancy interval was not significantly associated with LBW of the baby. However; Borah et al and Metgud et al reported significant association with short inters pregnancy and LBW.[14,23] In the present study proportion of LBW was more in the short inter pregnancy interval (≤24 months); significant association could be due to less number of study subjects.

The study found that among those mothers, mothers with low hemoglobin level, low BMI and mothers of short stature, the percentage of LBW was significantly more. Study by Rao et al also found that maternal height and weight gain during pregnancy were associated with birth weight.[24] Universal registration of pregnant women and good-quality ante natal care are both vital. Similarly registration with ICDS and utilization of services like supplementary feeing was found to be more beneficial in terms of low proportion of LBW in optimally users. Similar finding have been reported by Borah et al.[14]

Risk factors identified in the study can be used taken up and addressed by policy makers. It is essential to provide proper diet and nutritional care of mothers during pregnancy. Increased general level of education of mothers is utmost important; so that she can understand principles of health promotion and protection

during antenatal period. It will have significant roles to play in reducing LBW in India.

There is a strong association between lack of ANC and adverse pregnancy outcomes.[12,17] Antenatal clinics are an essential element of the health services provided during pregnancy. These clinics provide services such as screening, prevention, and treatment of pregnancy-related complications. The World Health Organization (WHO) recommends at least four standard quality antenatal care visits comprising interventions such as tetanus toxoid vaccination, screening and treatment for infections, and identification of warning signs during pregnancy.[18]

Maternal education, BMI <18.5, short stature (height <145 cm) inadequate consumption of iron and folic acid tablets, non utilizing services provided by ICDS and lack of antenatal visits (<4 visits) are significant predictors of LBW. In agreement with previous studies, maternal education emerged as a strong determinant for LBW. Women with 'no education' had the greatest odds of giving birth to an infant with LBW followed by women with "primary education".[13,14,16,25] Agreeing with previous studies, birth weight of the baby is greatly influenced by mother's level of education and having some kind of maternal education (oppose to no education) have a protective effect against LBW.[13,16,25] It is likely that women with no or low level of education and/or knowledge may practice poor health habits (e.g. inadequate and poor quality of nutrition, hygiene, rest, and smoking, etc.).

Additionally they may be under utilization of adequate healthcare resources (e.g., antenatal care, iron supplements, nutritional supplement through ICDS, etc.) which consequently may influence fetal growth. Therefore, interventions to improve the utilization of ANC and interventions offered like macro and micronutrient supplement and its optimum use is utmost important. Health education at level of women of reproductive age, very special education during pregnancy and female children are important to reduce prevalence LBW in India. Targeted public health interventions to improve nutrition status of women in childbearing age as well as female children are imperative to reduce prevalence of LBW in India.

This study found a strong association between lack of antenatal care and low birth weight and the results are in agreement with previous studies.[16,17,25] Antenatal care provide routine monitoring of height and weight gain, identification of medical maternal or fetal problems, counseling against tobacco or substance use, provide psychosocial support, nutritional advice, and early intervention which may reduction adverse pregnancy outcomes including LBW.[18] Lack of access to ANC could be influenced by many factors including lower socio-economic status and poor knowledge. Therefore, utilization of ANC should be further investigated to understand obstacles and opportunities to improve services.

CONCLUSION

Our results shows higher likelihood of LBW babies born at tribal tertiary health care setting: where significant predictors were low maternal education, <4 ANC visits, inadequate consumption Iron and Folic acid, Low Hemoglobin percent level, and No additional diet at ICDS during current pregnancy. Findings of this study are useful for maternal and child health policy makers, practitioners and those who provide health care during pregnancy. It has provided basic information pertinent to quality of ANC care and it influence on LBW.

Strengths and limitations

This is the first study that uses data from a rural and urban area of the Naxalite region to investigate social, maternal characteristics and antenatal care components associated with LBW.

Some of the study participants were diagnosed with hypertension, diabetes or other systemic conditions prior or during pregnancy, thereby limiting the influence of these confounders on outcomes i.e. LBW.

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