

Epidemiological determinants of low birth weight: A prospective study

Wahida Kouser¹, Kiran Bala², Bhavna Sahni², Najma Akhtar²

¹Jammu and Kashmir Health Services, ²P.G. Department of Community Medicine, Government Medical College Jammu, Jammu and Kashmir, India

ABSTRACT

Context: Infant and child survival is recognized as an essential ingredient for the overall health of a society. **Aims:** To study the magnitude and epidemiological determinants of LBW. **Settings and Design:** Community-based longitudinal study. **Subjects and Methods:** A prospective study was conducted for a period of 1 year in Block R.S Pura, Jammu where 364 pregnant women registered at four randomly selected PHCs were followed to assess the magnitude of LBW and to study its association with various determinants. **Statistical Analysis Used:** Data was analyzed using MS Excel and Open epi version 3.01. **Results:** Severe anemia, heavy physical activity, low socioeconomic status, illiteracy, extreme ages, and short stature of women were found to be significantly associated with a higher incidence of LBW babies. **Conclusion:** There is a need to focus on the sensitization of grass-root level health workers as well as pregnant females and their families on the importance of antenatal care, good dietary practices, etc., Thus, strengthening the primary health care system is vital in ensuring optimum health of both mothers and newborns.

Keywords: Anemia, low birth weight, physical activity, prospective study, socioeconomic status

Introduction

The major concern of every nation is to improve the health status of its populace and the best and the most effective way to achieve it is by focusing on the health issues of women. With an improvement in health services, though there has been significant reduction in infant mortality in India by about 50% during the past century, the reported incidence of low birth weight (LBW) has not changed much.^[1] This should follow a life course approach that is starting from the birth of a girl child into her adulthood and beyond. Nations quantify their achievements with the help of indicators such as low birth weight (LBW) which is defined as weight at birth of less than 2500 g (lbs 5.5) regardless of gestational age.^[2]

Address for correspondence: Dr. Najma Akhtar,
R/o Upper Thathar, Near Shemrock School,
P.O Bantalab - 181 123, Jammu and Kashmir, India.
E-mail: najmaakhtar907@gmail.com

Received: 19-03-2020

Revised: 25-04-2020

Accepted: 19-05-2020

Published: 30-07-2020

The World Health Organization and United Nations Children's Fund (UNICEF) published the first global, regional, and country estimates for LBW in 1992.^[3] Since then, the World Health Organization has set several goals to improve the health of mothers and children. Good nutrition in every stage of life of women is undoubtedly the most important step in reducing the incidence of LBW, especially in developing countries. The WHO global nutrition targets 2025 and diet-related global NCD targets for 2025, endorsed by the World Health Assembly in 2012 and 2013, are an effort to end malnutrition.^[4]

According to UNICEF and WHO, it is estimated that nearly 15% of babies worldwide are LBW and more than half of them are born in Asia. Much needs to be done as the figures show the minimal reduction of 0.4% from the 2012 baseline 15% to 14.6% in 2015, whereas the target is to reduce the levels to 10.5% by the year 2025.^[5]

To establish the multifactorial interrelationship that exists between the environments in which pregnant mothers live

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

How to cite this article: Kouser W, Bala K, Sahni B, Akhtar N. Epidemiological determinants of low birth weight: A prospective study. J Family Med Prim Care 2020;9:3438-43.

Access this article online

Quick Response Code:



Website:
www.jfmpc.com

DOI:
10.4103/jfmpc.jfmpc_414_20

and the growth of the fetus, the data on LBW babies needs to be accurate but it often remains under-reported because of unregistered births and unrecorded birth weights in our country. The prevalence in India is about 18% as reported by NFHS 4.^[1]

Most of the times, girls suffer in the area of health and nutrition. In rural areas, the female literacy rate is generally low; girl child is made to marry in adolescence, she starts reproducing when she is physically and mentally unprepared which results in newborns being LBW, deterioration of mother's health, and the vicious cycle thus continues. Consequently, there is a dire need to ameliorate all factors that will boost the mother's health status to lessen the incidence of LBW babies.

It has been observed that a strong correlation exists between birth weight and anthropometric measurements of mothers like height, weight, and BMI at the start of pregnancy, and with conditions like hemorrhage, anemia, poor obstetric history, and noncommunicable diseases like diabetes and chronic hypertension. Thus, emphasis should be laid on maternal biosocial factors, which are amenable to improvement to reduce the incidence of LBW babies.

Many studies have been conducted for identification of various factors responsible for LBW but so far, no longitudinal study has been conducted in community settings in our area.

Aims

To study the magnitude and epidemiological determinants of LBW.

Subjects and Methods

The present study was carried out for a period of 1 year in Block RS Pura, the field practice area of post graduate department of Community Medicine, Government Medical College (GMC) Jammu. The study participants belonged to four primary health centers (PHC) which were chosen by convenience sampling. The sampling frame and the number of women studied are depicted in Figure 1. The study was initiated after receiving the approval of Institutional Ethic Committee, GMC Jammu. The Block Medical Officer, Medical Officers, and Multipurpose Health Workers in RS Pura Block were sensitized about the purpose of study.

The participants were explained about the study and the women who gave their consent were included. Pregnant women with any chronic medical illness were excluded from the study. A total of 364 pregnant females were included in the study. The women were interviewed in a separate room ensuring their confidentiality. The women were reexamined at an interval of 4 weeks, 3 weeks, and fortnightly in first, second, and third trimester, respectively, at PHCs where they were registered. The women were asked to plan their visit on scheduled time by telephonically reminding them. The study participants, family members, and health workers were asked to inform the investigator at the time of delivery. The investigator reached the home/facility where delivery was conducted and recorded the birth weight of baby within 24 h. In cases where it was not possible, the weight of the baby was recorded within a week. The weight was recorded using calibrated weighing scale (Pan Type). The required information was recorded on a predesigned and pretested Performa with the help of interview. The women were subject to physical measurements by employing standardized methodology and equipment.

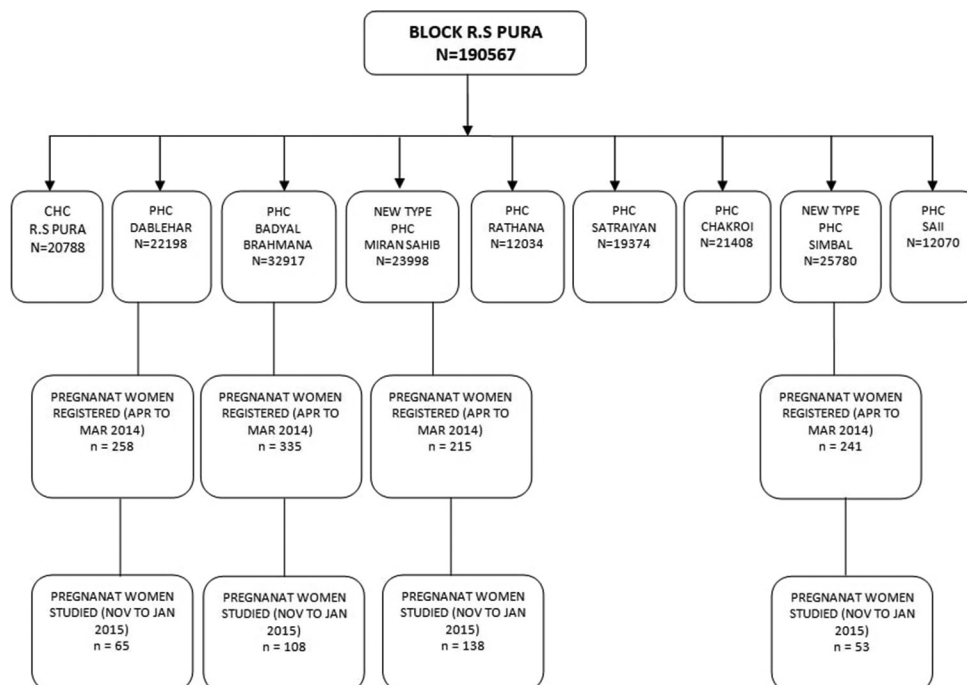


Figure 1: Sampling frame

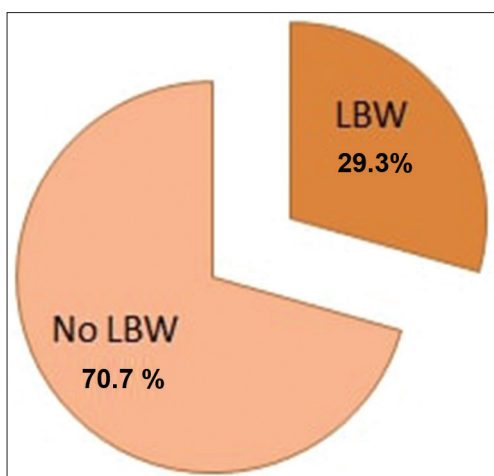


Figure 2: Incidence of LBW

Registered pregnant women	Number of babies with >2.5 kg	Number of babies with <2.5 kg	Incidence of LBW babies
Total 364	257	107	29.3%

The data so collected was entered into MS Excel and analyzed in excel and web-based software open epi version 3.01. Chi-square test was applied to analyze the associations of LBW with selected epidemiological determinants.

Results

Incidence of low birth weight babies was 29.3% in our study [Figure 2]. The mean age (years), weight (kg), and height (cm) of registered pregnant women was 25 ± 3.93 , 47.18 ± 7.41 , and 146.8 ± 9.99 , respectively. Nearly one-fourth of pregnant women were illiterate and an equal percentage belonged to lower socioeconomic strata according to Modified Uday Pareek Scale. Most of the women were engaged in moderate physical activity during pregnancy. 8.2% women had a weight of <40 kg [Table 1].

Of all the variables studied and analyzed to find the association with LBW, low socioeconomic status (SES) ($P=0.04$), short stature ($P=0.01$), multiple pregnancy ($P=0.01$), and anemia ($P=0.002$) were found to have a statistically significant association with LBW [Table 2].

A higher incidence of LBW babies was observed among moderately and severely anemic women [Figure 3].

Discussion

LBW is an important indicator for monitoring progress toward internationally agreed-upon goals and thus is given high priority by national governments and the international community. Impact of various socioeconomic determinants on LBW has been studied extensively. The finding of our study revealed that 29.3% of babies were born with LBW. These findings are in accordance with the studies conducted in different parts of India wherein 27.4% and 28.6% babies were LBW as studied

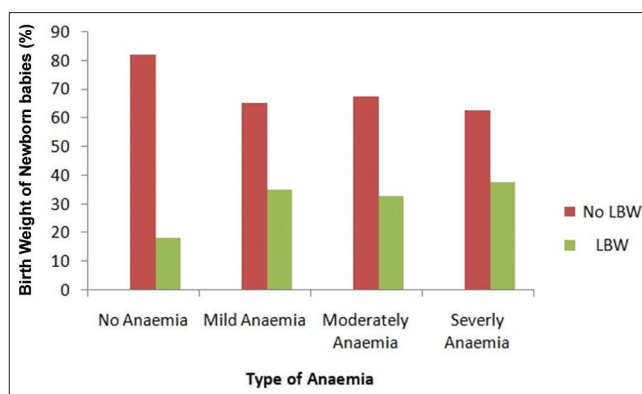


Figure 3: Anemia vs. LBW

Type of Anemia	Birth weight of Newborn (kg)		Total
	<2.5 n (%)	>2.5 n (%)	
No Anemia	20 (18.3)	89 (81.7)	109
Mild	20 (35.1)	37 (64.9)	57
Moderate	49 (32.6)	101 (67.4)	150
Severe	18 (37.5)	30 (62.5)	48

Table 1: Sociodemographic characteristics of pregnant women

Sociodemographic Variable	Category	Number n=364	Percentage (%)
Age (years)	15-24	186	51.1
	25-34	168	46.1
	>35	10	2.8
Religion	Hindu	263	72.3
	Muslim	60	10.9
	Sikh	41	16.8
Literacy	Illiterate	95	26.2
	Up to Secondary	185	50.8
	Higher secondary	48	13.2
Socioeconomic status	Graduate	36	9.8
	Upper	42	11.5
	Middle	222	60.1
Physical activity	Lower and BPL	100	27.4
	Sedentary	4	1.1
	Moderate	348	95.6
Height (cm)	Heavy	12	3.3
	<140	38	10.4
	140-149	200	54.9
Weight (kg)	150-159	116	31.8
	>160	10	2.9
	<40	30	8.2
Risk factors	40-49	216	59.3
	50-59	91	25.1
	>60	27	7.4
Sex of baby	Smoking	03	0.8
	Multiple Pregnancies	05	1.3
	X-ray exposure	03	0.8
BOH	BOH	06	1.6
	Male	201	55.2
	Female	163	44.8

BOH: Bad Obstetric History; H/O Intrauterine death, Abortions, Still birth, Early neonatal death

by Kumar et al. and by Sahu et al.^[6,7] Interestingly there is a wide range of variation in the prevalence of LBW from 11%–33%

Table 2: Association of sociodemographic characteristics with LBW

Variables	LBW n (%)		Normal Birth weight n (%)		Odds ratio (95% CI)	Chi-Sq. (P)
Age (years)						
19-30	82	27.4	218	72.6	1.69	3.49 (0.06) NS
<19 and >30	25	39.1	39	60.9	(0.96-2.97)	
literacy						
Illiterate	32	33.7	63	66.3	1.31	1.13 (0.28) NS
Literate	75	27.9	194	72.1	(0.79-2.17)	
Socioeconomic status						
Low SES	47	35.6	85	64.4	1.58	3.84 (0.040)S
High SES	60	25.8	172	74.2	(0.99-2.51)	
Physical activity						
Heavy	5	41.7	7	58.3	1.75	0.90 (0.34) NS
Sedentary and moderate	102	28.9	250	71.1	(0.54-5.64)	
Maternal height (cm)						
<145	45	38.1	73	61.9	1.82 (1.14-2.92)	6.42 (0.01) S
>145	62	25.2	184	74.8		
Maternal weight (kg)						
<40	11	36.6	19	63.4	1.43	0.83 (0.36) NS
>40	96	28.7	238	71.2	(0.65-3.12)	
Smoking Smoker	2	66.7	1	33.3	4.8	*0.20 NS
Nonsmoker	105	29.1	256	0.9	(0.43-54.3)	
Multiple pregnancy Present						
Absent	4	80	1	20	9.94	6.25 (0.01) S
	103	28.6	256	71.4	(1.09-90)	
Anemia						
Yes	87	34.1	168	65.9	2.3	9.1 (0.002)S
No	20	18.3	89	81.7	(1.34-4.06)	

*Fischer's exact test

as reported in other studies and 18% according to NFHS 4.^[1,8,9] There are country wise variations also; from 10.0% in Northern Ethiopia, 10.6% in Pakistan to 21% in Nepal.^[10-12]

There is unequivocal evidence that very young mothers and elderly Primigravida have more chances of delivering LBW babies.^[13,14] We also observed a higher incidence of LBW in these two subsets of pregnant women indicating that efforts aimed at delaying first pregnancies and the resultant benefits might have been negated by delayed marriages and first childbirth owing to the adoption of urban lifestyle. In our study, mothers with height less than 145 cm have 82% more chances of delivering LBW babies and similar findings were observed by a study conducted in Ethiopia.^[15] Education is known to influence people's perceptions and dispositions toward health activities and behavior such as maternal feeding practices and utilization of health services. This is more so with respect to maternal education as the incidence of LBW babies has been found to be higher among illiterate mothers and mother belonging to lower SES. Many studies have reported that mothers who are illiterate were at a higher risk of delivering LBW babies.^[16-19] Significant association of SES with LBW is hardly surprising as most socioeconomic scales are composite scales with education as one of the important elements.^[17,18] This is despite the fact that most women studied by us were from middle class indicating that education has dominant influence on LBW regardless of SES. Therefore, more opportunities for maternal education are likely to yield rich dividends.

Monitoring hemoglobin levels in pregnant women can identify undernourished mothers whose fetus may suffer from ill effects of malnutrition. Emphasis on identification, prevention, and amelioration of anemia has a significant impact on the incidence of LBW.^[20-22] In the present study, the prevalence of anemia among pregnant women was 70.1% which is higher than that reported by NFHS 4 (50%).^[1] Various studies have reported anemia prevalence in India ranging from 23.0%–89.0%.^[23-25]

Women undertaking heavy physical activity during pregnancy have been reported to have a higher incidence of LBW babies.^[26,27] This is hardly surprising as pregnant women often end up consuming lesser proteins and calories during pregnancy thus putting the unborn child at a disadvantage. Coupled with this, large proportions of Indian women are reportedly are of low stature and low weight and it has already been documented by some authors that such women were more prone to have LBW and our findings are in conformity with their observations.^[17,28]

Among other risk factors, tobacco chewing and alcohol consumption have been reported to lead to a higher incidence of LBW.^[29,30] Smoking causes fetal hypoxia by increasing carboxyhemoglobin levels and attenuates blood oxygen unloading to fetal tissues and reducing maternal blood supply to the placenta. Since only less than 1% women in our study were either smokers or were consuming alcohol, we are limited by our numbers to comment about the relationship.

Conclusion

It is clearly evident that the incidence of LBW and the factors associated with it are widely prevalent across population groups in India. Numbers of strategies put forth by NRHM and Government of India directly or indirectly influence the nutrition of girl right from the conception to old age. We need to identify the bottlenecks and barriers in the implementation of these strategies and ensure that these are addressed at various level of health care.

Finally, it must be kept in mind that the study is not without limitations. The sample size was small for evaluating associations with risk factors. However, the complete follow-up of registered women adds to the strength of the study.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

- International Institute for Population Sciences (IIPS) and ICF. National Family Health Survey (NFHS-4), 2015-16: India. Mumbai: IIPS; 2017.
- World Health Organization, International statistical classification of diseases and related health problems, tenth revision. Geneva: World Health Organization; 1992.
- United Nations Children's Fund & World Health Organisation, Low Birth Weight: Country, Regional and Global Estimates. New York, UNICEF; 2004.
- WHO. WHA Global Nutrition Targets 2025: Low Birth Weight Policy Brief. WHO; 2014.
- United Nations Children's Fund (UNICEF), World Health Organization (WHO). UNICEF WHO Low birth weight estimates: Levels and trends 2000-2015. Geneva: World Health Organization; 2019 Licence: CC BY-NC-SA 3.0 IGO.
- Kumar S, Kumar R, Tewari A, Richa, Chakraborty S, Som KT. Prevalence and determinants of low birth weight: An experience from a secondary referral unit of Burdwan District West Bengal (India). IOSR J Dent Med Sci 2018;17:54-9.
- Sahu KK, Agarwal M, Ahmed N, Singh SK, Khanna A. Incidence of low birth weight and effect of maternal factors on birth weight of neonates in rural areas of Uttar Pradesh. Int J Multidisc Res Dev 2015;2:707-15.
- Kumar V, Deshmukh PR, Taywade M, Gupta SS. Magnitude and Correlates of Low Birth Weight at Term in Rural Wardha, Central India. Online J Health Allied Scs 2016;15:2.
- Ashtekar SV, Kulkarni MB, Sadavarte VS, Ashtekar RS. Analysis of birth weights of a rural hospital. Indian J Community Med 2010;35:252-5.
- Talie A, Taddele M, Alemayehu M. Magnitude of low birth weight and associated factors among newborns delivered in Dangla primary hospital, Amhara Regional State, Northwest Ethiopia 2017. J Pregnancy 2019;2019:3587239. doi: 10.1155/2019/3587239.
- Khan A, Nasrullah FD, Jaleel R. Frequency and risk factors of low birth weight in term pregnancy. Pak J Med Sci 2016;32;1:138-42.
- Bhaskar RK, Deo KK, Neupane U, Chaudhary Bhaskar S, Yadav BK, Pokharel HP, *et al.* A case control study on risk factors associated with low birth weight babies in eastern Nepal. Int J Pediatr 2015;2015:807373. doi: 10.1155/2015/807373.
- Mondal N, Dey S, Sen J. Association of maternal age, pregnancy order and seasonal variation in low birth weight (LBW) in West Bengal India. J Life Sci 2018;10:1-9.
- Som S, Pal M, Adak DK, Gharami AK, Bharati S, Bharati P. Effect of socio-economic and biological variables on birth weight in Madhya Pradesh, India. Mal J Nutr 2004;10:159-71.
- Baye Mulu G, Gebremichael B, Wondwossen Desta K, Adimasu Kebede M, Asmare Aynalem Y, Bimirew Getahun M. Determinants of low birth weight among newborns delivered in public hospitals in Addis Ababa, Ethiopia: Case-control study. Pediatric Health Med Ther 2020;11:119-26.
- Agarwal G, Ahmad S, Goel K, Kumar V, Goel P, Garg M, *et al.* Maternal risk factors associated with low birth weight neonates in a tertiary care hospital, Northern India. J Community Med Health Educ 2012;2:1000177.
- Dhankar M, Rawat AK, Varun. Etiological factors associated with low birth weight newborns. Int J Basic Appl Med Sci 2013;3:44-8.
- Johnson AR, Surekha A, Dias A, William NC, Agrawal T. Low birth weight and its risk factors in a rural area of South India. Int J Community Med Public Health 2015;2:339-44.
- Shreshta S, Shreshta S, Shreshta SU, Gyawali K. Predictors of low birth weight at Lumbini provincial hospital, Nepal: A hospital-based unmatched case control study. Adv Prev Med 2020;26:2020:8459694. doi: 10.1155/2020/8459694.
- Shah N, Upadhyay C, Sahota R. Neonatal outcome in anemic mothers: A prospective study. J Evol Med Dent Sci 2013;2:8324-28.
- Yakout SM, Taha N, Badawy AS, Al-Salooly HA. Effect of iron supplementation and nutritional education among a group of anemic pregnant women on their perinatal outcome in Riyadh. J Curr Res Sci 2014;2:41-7.
- Patil SV, Durgawale PM, Kakade SV, Dighe S. An assessment of interventional strategies for control of anemia among adolescent girls in an urban slum of Karad, Dist. Satara, Maharashtra. Al Ameen J Med Sci 2014;7:195-200.
- Madhu Priya N, Bijesh Y, Ruby J. Prevalence of anemia in pregnant women at booking visit in India. Indian J Obstet Gynecol Res 2017;4:244-8.
- Toteja GS, Singh P, Dhillon BS, Saxena BN, Ahmed FU, Singh RP, *et al.* Prevalence of anemia among pregnant women and adolescent girls in 16 districts of India. Food Nutr Bull 2006;27:311-5.
- Vindhya J, Nath A, Murthy GVS, Metgud C, Sheeba B, Shubhashree V, *et al.* Prevalence and risk factors of anaemia among pregnant women attending a public sector hospital in Bangalore, South India. J Family Med Prim Care 2019;8:37-43.
- Idris MZ, Gupta A, Uday M, Srivastava Kumar A, Das V. Maternal health and low birth weight among institutional deliveries. Indian J Comm Med 2000;25:156-60.
- Dwarkanath P, Muthayya S, Vaz M, Thomas T, Mhaskar A, Mhaskar R, *et al.* The relationship between maternal physical activity during pregnancy and birth weight. Asia

- Pac J Clin Nutr 2007;16:704-10.
28. Devaki G, Shobha R. Maternal anthropometry and Low birth weight: A review. Biomed Pharmacol J 2018;2:815-20.
 29. Zheng W, Suzuki K, Tanaka T, Kohama M, Yamagata Z; The Okinawa Child Health Study Group. Association between maternal smoking during pregnancy and low birth weight. Effects by maternal age. PLoS One 2016;11:1-9.
 30. Agrawal Rashmi, Kejriwal Mohan, Singh Alka. Study of factors concomitant with low birth weight babies. Int J Med Health Res 2017;3:151-4.