Original Article

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Prevalence and Socio-demographic Determinants of Low Birth Weight Newborns: A Prospective Observational Study

Obstetrics and Gynaecology Section

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ABSTRACT

Introduction: Birth weight is not only strongly associated with foetal and neonatal mortality but also with stunted growth. Low Intelligence Quotient (IQ) in childhood, obesity and diabetes in adulthood. Despite all measures taken, the prevalence of Low Birth Weight (LBW) is not significantly decreasing in Southeast Asia {from 33% in 2000 to 27% in 2015 according to United Nations Children's Fund (UNICEF) 2019 data}. Added to the surprise in UNICEF data from countries for LBW, from A-Z data, (A-Z data is data of LBW countries whose name starts from letter A to letter Z in alphabetical order) India was not included, because data from India was partial.

Aim: to assess the prevalence and socio-demographic determinants of LBW in newborns.

Materials and Methods: A prospective hospital-based observational study was carried out in the Obstetrics and Gynaecology Department of Mahatma Gandhi Institute of Medical sciences, Sewagram, Wardha, Maharashtra India, among 500 consecutive, consenting pregnant women from December 2017 to November 2019. Socio-demographic parameters and neonate birth weight was recorded. Statistical analysis was done by inferential statistics using Chi-square test and z-test with significance value considered at <0.05.

Results: Among the total 500 subjects 162 (32.4%) had LBW and 338 (67.6%) Normal Birth Weight (NBW). By using Chi-square test, statistically significant difference was found in parity, socio-economic condition, mother's education, area of residence of both the LBW and NBW groups (χ^2=6.49, p=0.039; χ^2=51.32, p=0.0004; χ^2=12.95, p=0.012; χ^2=5.66, p=0.017), respectively.

Conclusion: The prevalence of LBW babies was 32.4%. Rural areas, low socio-economic condition, education, were significant determinants of LBW. As the parity increases birth weight increases.

Keywords: Neonatal, Predictors, Pregnancy, United nations children's fund

INTRODUCTION

The birth weight of an infant is the first weight recorded after birth, ideally measured within the first hours after birth, before significant postnatal weight loss has occurred. LBW is defined as a birth weight of less than 2500 g (upto and including 2499 g), as per the International Classification of Disease (ICD)-10 [1]. It is universally acknowledged that size at birth is an important indicator of foetal and neonatal health in the context of both individuals and populations [2].

Birth weight in particular is not only strongly associated with foetal and neonatal mortality but also with stunted growth, low IQ in childhood and obesity, diabetes in adulthood [3-5]. Despite all measures taken, the prevalence of LBW was not significantly decreasing in Southeast Asia from 33% in 2000 to 27% in 2015 according to UNICEF 2019 data [6]. Added to the surprise in UNICEF data from countries with LBW, from A to Z data, India was not included, because data from India was partial [6].

Periods of foetal and infant growth are vital predictors of a child's health status which are largely determined by maternal characteristics. Hence, socio-demographic factors are crucial prognosticators of pregnancy outcomes as they reflect genetic aspects, skeletal maturity and give an account of nutritional conditions [7].

This institute is placed in a rural area. Thus, the knowledge about determinants of LBW could potentially be used to plan simple public health interventions to improve pregnancy outcomes in resource-poor settings and contribute to improving maternal and child health. The study aimed to assess the prevalence and socio-demographic determinants of LBW in newborns.

MATERIALS AND METHODS

This hospital-based prospective observational study was conducted in Department of Obstetrics and Gynaecology at Mahatma Gandhi Institute of Medical Sciences, Sewagram, Wardha, Maharashtra, India after Institutional Ethical Committee approval over 24 months from 1st December 2017 to 30th November 2019.

Inclusion criteria: All pregnant women who visited the obstetric Outpatient Department in the first trimester and were amenable for follow-up were enrolled. All pregnant women who gave consent, regardless of age and parity, having singleton pregnancy and who wished to deliver in the concerned hospital, were recruited in the study.

Exclusion criteria: Women who are lost to follow-up, congenital anomalies foetus, intrauterine demise during subsequent follow-ups were excluded from the study.

Sample size calculation: According to a recent UNICEF global database (2019), prevalence of LBW was highest in South Asia i.e., 27% [6]. Considering this value, sample size was calculated by using the following formula: considering the minimal allowable error of 15%.

$n=4pq/L^2$

$n=4\times27\times73/4.05\times4.05$

Minimum sample was calculated as 480

So, a total of 500 pregnant women were considered for the study.

A total of 574 women were recruited in the study over a period of six months and were followed over the next 8-9 months with an estimated follow-up of 80% [8,9].

Study Procedure

A redesigned and pretested proforma was used as a study tool to collect information. 'Booked' patients were those who carried documented evidence of more than or equal to three antenatal visits, with the last visit in the preceding month in the concerned hospital, and whose pregnancy care was planned.

i) **Socio-demographic factors:** Age of mother, mother's education expressed as years of schooling, type of family, an income of the family, and socio-economic status according to Kuppuswamy's classification [10].

ii) **Obstetric factors:** Gravidity, Parity, birth order, prior abortions.

iii) **Neonatal birth weight:** The naked baby was placed on an electronic weighing machine immediately after birth and measured to the nearest 10 grams.

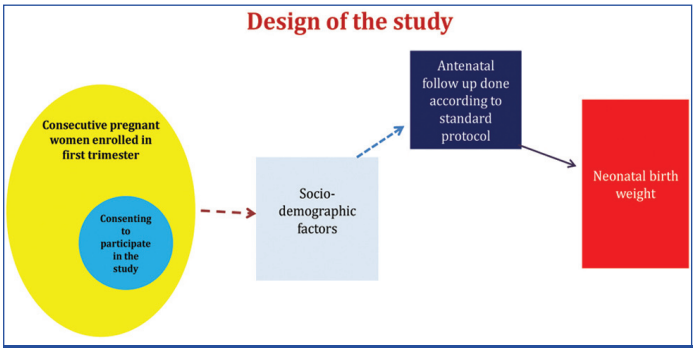
Study participants were grouped into those giving birth to LBW babies (below 2500 g) and NBW babies (above 2500 g) for inferential statistics, as coded by National Family Health Survey-4 (NHFS-4) [11].

STATISTICAL ANALYSIS

The data was entered in a Microsoft Excel spreadsheet. Statistical analysis was done by inferential statistics using the Chi-square test and z-test. The softwares used in the analysis were the Statistical Package for Social Sciences (SPSS) 17.0 version and Graph Pad Prism 5.0. A two-level p-value <0.05 was considered statistically significant.

RESULTS

A total of 574 singleton pregnant women in the first trimester, after fulfilment of inclusion and exclusion criteria, were enrolled. A total of 481 (83.8%) women came for follow-up on their own, 19 (3.3%) women turned for final follow-up after personal phone calls and home visits by auxiliary nurse midwifes. Thus, the data of 500 study participants were analysed [Table/Fig-1].



[Table/Fig-1]: Study design: Socio-demographic characters were asked to consecutive pregnant women in first trimester who had given consent to participate in study. They are followed and neonatal birth record was recorded.

Out of 500 women, the mean weight of babies was 2636.09 g, 162 (32.4%) delivered LBW babies, and 338 (67.6%) were NBW.

Socio-demographic Determinants

Age: Mean age of the mother in LBW group was 23.46±3.51 years and in NBW group it was 23.55±2.78 years; by using the z-test, statistically no difference was found in the age of the mother in both the groups (z=0.09, p=0.760) [Table/Fig-2].

Gravida: By using the Chi-square test, statistically no difference was found in both the groups. (χ^2=4.09, p=0.25) [Table/Fig-2].

Parity: In LBW, 116 (71.6%) were nulliparous, 43 (26.54%) were primipara and 3 (1.85%) were the second para compared with NBW which had 205 (60.65%), 119 (35.21%), and 14 (4.14%) women in para 0, 1 and 2 groups, respectively. The difference was statistically significant (χ^2=6.49, p=0.039). It shows that as the parity increases birth weight increases [Table/Fig-2].

Booking status: In LBW, 65 (40.12%) women were booked with the hospital and 97 (59.88%) were unbooked, compared to 149 (44.08%) and 189 (55.92%) in NBW, respectively. Although in LBW number of unbooked cases are more, but it was not statistically significant by using the Chi-square test (χ^2=0.70, p=0.40) [Table/Fig-2].

Residential area and type of family: Out of a total of 162 LBW, 97 (59.88%) women resided in the rural area and 65 (40.12%) in an urban area, and NBW, 164 (48.52%) in rural and 174 (51.48%) in urban area respectively. Statistical difference was found between the two (χ^2=5.66, p=0.017). But joint/nuclear status difference was not statistically significant (χ^2=0.16, p=0.68) [Table/Fig-2].

Mother's education: The difference was statistically significant (χ^2=12.95, p=0.012). Thus, education does play a major role in the amelioration of LBW [Table/Fig-2].

Determinants	LBW group (n=162)	NBW (n=338)	Test result	p-value
Age of the mother	23.46±3.51 (18-35 years)	23.55±2.78 (19-35 years)	0.09	0.76
Gravida status of mother				
One	106 (65.43%)	194 (57.40%)	4.09	0.25
Two	44 (27.16%)	104 (30.77%)		
Three	12 (7.41%)	37 (10.94%)		
Four	0 (0)	3 (0.89%)		
Parity of mother				
Parity 0	116 (71.60%)	205 (60.65%)	6.49	**0.039**
Parity 1	43 (26.54%)	119 (35.21%)		
Parity 2	3 (1.85%)	14 (4.14%)		
Booking status				
Booked	65 (40.12%)	149 (44.08%)	0.70	0.40
Unbooked	97 (59.88%)	189 (55.92%)		
Area of residence				
Rural	97 (59.88%)	164 (48.52%)	5.66	**0.017**
Urban	65 (40.12%)	174 (51.48%)		
Type of family				
Nuclear	62 (38.27%)	123 (36.39%)	0.16	0.68
Joint	100 (61.73%)	215 (63.61%)		
Father's education				
Illiterate	0 (0)	0 (0)	0.13	0.98
Primary	3 (1.85%)	6 (1.78%)		
Secondary	40 (24.69%)	86 (25.44%)		
Graduate	49 (30.25%)	97 (28.70%)		
Postgraduate	70 (43.21%)	149 (44.08%)		
Mother's education				
Illiterate	5 (3.09%)	13 (3.85%)	12.95	**0.012**
Primary	16 (9.88%)	66 (19.53%)		
Secondary	71 (43.83%)	140 (41.42%)		
Graduate	70 (43.21%)	112 (33.14%)		
Postgraduate	0 (0)	7 (2.07%)		
Socio-economic status				
Lower	27 (16.67%)	12 (3.55%)	51.32	**0.0004**
Upper lower	13 (8.02%)	9 (2.66%)		
Lower middle	42 (25.93%)	174 (51.48%)		
Upper Middle	23 (14.20%)	55 (16.27%)		
Upper	57 (35.19%)	88 (26.04%)		

[Table/Fig-2]: Comparison of demographic determinants in Low Birth Weight (LBW) group and Normal Birth Weight (NBW) group.
z-test is used for age and for rest chi-square test.
% in LBW group calculated from n=162 and in Normal Birth Weight (NBW) from n=338.
p-value <0.05 was considered significant

Determinants	Present study	NFHS-4 [11], 2015-16 India, sample size-249967	Kader M and Perera NKP [13] 2014, India, sample size-20946	Mumbare SS et al., [19] 2012. Maharashtra India, sample size-274 case 274 control	Deshpande Jayant D et al., [14] 2011, Maharashtra, sample size-200 case 200 control	Kumar SG et al., [16] 2010, Karnataka, India, sample size-150 cases 300 control	Khatun S and Rahman M [15] 2008, Bangladesh, sample size-108 LBW, 357 NBW	Dharmalingam A et al., [17] 2010, India, sample size-10042	Rafati S et al., [20], 2005, Tehran, Iran, sample size-160 LBW, 300 NBW	Bisai S et al., [18], 2006 Kolkata, India, sample size-331
Maternal age	×	×	✓	×	✓	✓	✓	✓	×	✓
Maternal education	✓	✓	✓	×	✓		✓		✓	
Father education	×			×						
Rural/urban	✓	×	✓		✓		×			
Religion/caste		×	✓							
Socio-economic status	✓	✓	×	✓	✓		✓			
Nuclear/joint	×			×	×					
Parity	✓	×	✓	×			×	✓		✓

[Table/Fig-3]: Shows the determinants of LBW reported by various studies.
✓-means significant association; ×- no association, blank space- parameter not studied

Socio-economic status (Modified Kuppuswamy scale 2019): Most women, 51.48% (174 of 338) with NBW babies belonged to lower middle class as compared to 25.93% (42 of 162) in LBW. A 16.27% (55 of 338) in NBW and 14.20% (23 of 162) in LBW belonged to the upper-middle class, respectively while 9 (2.66%) and 12 (3.55%) in NBW and 13 (8.02%) and 27 (16.67%) in LBW belonged to upper lower and lower class, respectively. The difference was found to be statistically significant. (χ^2=51.32, p=0.0004) [Table/Fig-2].

DISCUSSION

In the present study, the proportion of LBW babies was 32.4%. In 2015, nearly 20.5 million newborns, an estimated 14.6% of all babies born globally that year, had LBW, (UNICEF 2019) with more than half from Asia [6]. According to NFHS-4 (2015-16) prevalence of LBW in India was 18% [11].

Kramer MS in his meta-analysis on determinants of LBW had observed low maternal age as an important risk factor and its causal effect was established [12]. Similar findings have been observed by various studies [13-18]. But some studies support that age was not a significant determinant consistent with the present study [11,13-20]. In NFHS-4, 20.6% of women had LBW at age <20 years and 18.2% had LBW if age was 35-49 years which was not statistically significant [11] [Table/Fig-3].

Studies done by many including NFHS-4 has not identified parity as a significant risk factor for LBW babies [11,15,19,21]. However, studies were done by Kader M and Perera NKP, Dharmalingam A et al., and Bisai S et al., showed that parity was a significant risk factor of LBW which was consistent with our study [13,17,18]. In the present study, a higher proportion of LBW belonged to joint families (61.73%) than nuclear families (38.27%). Vijayalaxmi KG and Urooj A conducted a study in Bangalore and concluded that most women who delivered LBW babies lived in joint families (54.0%) [22]. But the difference between LBW and NBW was not significant in the present study, as consistent with other studies [14,19].

In the present study, the difference in the mother's education status was statistically significant between LBW and NBW (χ^2=12.95, p=0.012). The level of mother's education influences birth weight of the baby. Thus, having some amount of maternal education has a protective effect against LBW [13,15,23]. Low socio-economic status is one of the strongest predictors of LBW in low-income countries, consistent with the present study [19,23]. But Kader M and Perera NKP also reported that perhaps despite poor socio-economic status if a woman could maintain a good nutritional status and avoid potential medical complications during pregnancy, giving birth to an NBW baby might be a possibility [13].

Limitation(s)

The present study had a few limitations. Most important was that it was a hospital-based study, thus the chances of getting referred cases were high. The majority of women included in the study lived in the surrounding area. The result of this study, therefore, may not be completely applicable to women living and delivering their babies in more remote areas of the district.

CONCLUSION(S)

The prevalence of LBW in a tertiary hospital of rural central India was 32.4%. Rural areas, low socio-economic conditions, mother's education are significant determinants of LBW. According to this study, if women were residing in rural area, having low socio-economic status and mother's education was low then they will have more number of LBW babies. But other parameters like age, gravida, booking status, family type, father's education was not statistically significant. Further Systemic review and meta-analysis are required to add to the data needed for UNICEF.

REFERENCES

[1] ICD-10 Version: 2016 [Internet]. [cited 2021 May 26]. Available from: https://icd.who.int/browse10/2016/en#!/P05.9. Last accessed 13/12/2021.
[2] National, regional, and worldwide estimates of low birthweight in 2015, with trends from 2000: A systematic analysis- ScienceDirect [Internet]. [cited 2021 Dec 11]. Available from: https://www.sciencedirect.com/science/article/pii/S2214109X18305655. Last accessed 13/12/2021.
[3] Christian P, Lee SE, Donahue Angel M, Adair LS, Arifeen SE, Ashorn P, et al. Risk of childhood undernutrition related to small-for-gestational age and preterm birth in low-and middle-income countries. International Journal of Epidemiology. 2013;42(5):1340–55.
[4] Gu H, Wang L, Liu L, Luo X, Wang J, Hou F, et al. A gradient relationship between low birth weight and IQ: A meta-analysis. Scientific reports. 2017;7(1):01-13.
[5] Jornayvaz FR, Vollenweider P, Bochud M, Mooser V, Waeber G, Marques-Vidal P. Low birth weight leads to obesity, diabetes and increased leptin levels in adults: the CoLaus study. Cardiovascular Diabetology. 2016;15(1):01-10.
[6] Low birth weight [Internet]. UNICEF DATA. [cited 2021 May 26]. Available from: https://data.unicef.org/topic/nutrition/low-birthweight/ Last accessed 13/12/2021.
[7] Kapoor S, Bhasin P, Dhall M, Verma D, Gupta S, Tungdim MG. Maternal predictors of newborn somatometrics. Journal of Anthropology. 2012;2012:639345.
[8] Mahajan BK, (2006). Methods in Biostatistics for Medical Students and Research Workers, 6th Edn., New Delhi, Jaypee Brothers Medical Publishers (P) Ltd., pp. 92-94. 09.
[9] Rao NSN, Murthy NS, (2008). Applied Statistics in Health Sciences, 1st Edn., New Delhi, Jaypee Brothers Medical Publishers (P) Ltd., pp. 105-107.
[10] Wani R. Socio-economic status scales-modified Kuppuswamy and Udai Pareekh's scale updated for 2019. J Family Med Prim Care. 2019;8(6):1846.
[11] International Institute for Population Sciences- IIPS/India, ICF. India National Family Health Survey NFHS-4 2015-16 [Internet]. Mumbai, India: IIPS and ICF; 2017. Available from: http://dhsprogram.com/pubs/pdf/FR339/FR339.pdf Last accessed 13/12/2021.
[12] Kramer MS. Determinants of low birth weight: Methodological assessment and meta-analysis. Bulletin of the World Health Organization. 1987;65(5):663.
[13] Kader M, Perera NKP. Socio-economic and nutritional determinants of low birth weight in India. North American Journal of Medical Sciences. 2014;6(7):302.

[14] Deshpande Jayant D, Phalke DB, Bangal VB, D Peeyuusha BS. Maternal risk factors for low birth weight neonates: A hospital based casecontrol study in rural area of western maharashtra, India. National Journal of Community Medicine. 2011;2(3):394-98.
[15] Khatun S, Rahman M. Socio-economic determinants of low birth weight in Bangladesh: A multivariate approach. Bangladesh Medical Research Council Bulletin. 2008;34(3):81-86.
[16] Kumar SG, Kumar HH, Jayaram S, Kotian MS. Determinants of low birth weight: A case control study in a district hospital in Karnataka. The Indian Journal of Pediatrics. 2010;77(1):87-89.
[17] Dharmalingam A, Navaneetham K, Krishnakumar CS. Nutritional status of mothers and low birth weight in India. Maternal and Child Health Journal. 2010;14(2):290-98.
[18] Bisai S, Sen A, Mahalanabis D, Datta N, Bose K. The effect of maternal age and parity on birth weight among Bengalees of Kolkata, India. Human Ecology. 2006;14:139-43.
[19] Mumbare SS, Maindarkar G, Darade R, Yenge S, Tolani MK, Patole K. Maternal risk factors associated with term low birth weight neonates: A matched-pair case control study. Indian Pediatr. 2012;49(1):25-28.
[20] Rafati S, Borna H, Akhavirad MB, Falah N. Maternal determinants of giving birth to low-birth-weight neonates. Archives of Iranian Medicine. 2005;8(4):277-81.
[21] 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(4):10-12.
[22] Vijayalaxmi KG, Urooj A. Influence of maternal factors on mode of delivery and birth weight in urban pregnant women. Journal of Human Ecology. 2009;25(2):133-36.
[23] Elshibly EM, Schmalisch G. The effect of maternal anthropometric characteristics and social factors on gestational age and birth weight in Sudanese newborn infants. BMC Public Health. 2008;8(1):01-07.

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