Low birth weight and its determinants in a tertiary care teaching hospital in Central Karnataka, India.

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Abstract

Introduction: Childhood mortality and morbidity has become a significant public health concern in India. One of the most crucial factors that determines the survival and development of a newborn is their birth weight. This is because most low-birth-weight babies do not make it through the first year of life.

Objectives: 1). To assess the proportion of low birth weight. 2). To determine the factors associated with low birth weight.

Methodology: For a period of four months, a hospital-based, cross-sectional study was conducted at a tertiary care center in Davanagere. The study includes postnatal mothers and their newborn babies at J.J.M. Medical College and Hospital in central Karnataka. A pretested questionnaire was used to determine the factors associated with low birth weight (LBW).

Results: Our study involved 270 postnatal mothers, of which 93 (34.44%) delivered babies with Low Birth Weight (LBW). We found that maternal education, with 15 out of 28 (53.57%) illiterate mothers delivering LBW babies, was significantly associated with LBW. Other factors that showed a significant association with LBW include first pregnancy 53 out of 129 primiparous mothers (41.1%), gestational age at birth preterm delivery 26 out of 36 births (72.22%), and pregnancy-induced hypertension (PIH) 23 out of 45 mothers (51.11%).

Conclusions: Low birth weight is a health indicator of maternal health, nutrition, healthcare delivery and poverty. Newborns with low birth weight have a greater than 20-fold risk of death within the first month of life.

Keywords: low birth weight, gestational age, parity, birth interval.

Introduction:

The World Health Organization (WHO) defines Low birth weight (LBW) as a birth weight of up to and including 2499 gm, which is considered one of the significant global health crisis [1]. Low birth weight is an important indicator of public health as it reflects the health status, nutrition, healthcare and poverty. Newborn with low birth weight is at significantly higher risk of mortality compared to babies born with a birth weight of more than 2500 gm [2,3].

Low birth weight babies are at risk of developing long-term neurological disabilities, impaired language milestones, poor academics and risk of developing chronic diseases, including cardiovascular disease and diabetes which are shown to be linked to low birth weight [4].

Addressing the causes of low birth weight is crucial not only for the health of the baby immediately after birth but also for its long-term impacts. Cost-benefit analyses in low-income families have shown, reducing the prevalence of low birth weight would significantly reduce the financial burden for the families and the healthcare system [5]. The impact of this is extensive on the well-being of the general public, affecting healthcare strategies, initiatives and community education. For instance, a comprehensive understanding of the factors involved can guide efforts aimed at improving maternal nutrition and accessibility to healthcare [6,7]. This research adds to a larger framework for prevention of low birth weight particularly for at-risk groups.

The objective of this research is to evaluate the percentage of babies born with low birth weight and identify the factors that contribute to it. The

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need for this study is to gain a thorough knowledge about the factors involved and to implement precise interventions and regulations that aim to reduce the occurrence of low birth weight.

This study aims to expand on existing literature on low birth weight by examining specific determinants under a tertiary care teaching hospital located in central Karnataka, providing a more nuanced understanding of this critical issue. The study focuses on the interplay between maternal behaviors, social factors and medical conditions which helps to bridge gaps in current knowledge and offers practical insights for healthcare practitioners, policy makers, and researchers.

Objectives: 1). To assess the proportion of low birth weight. 2). To determine the factors associated with low birth weight.

Materials and Methods:

Study setting: This cross-sectional study was carried out at a tertiary care teaching hospital located in central Karnataka, Davanagere. **Study design and target population:** This study was a hospital-based cross-sectional study carried out in a tertiary care teaching hospital, in central Karnataka, Davanagere. The study populations were the post-natal mothers and their newborn babies. The inclusion criteria were all mothers who delivered singleton live babies in the study setting. Stillbirths, multiple gestation, and newborns with congenital malformations were excluded from the study. **Sample size determination:** The sample size was calculated with an expected frequency of 20.1% [8], allowable error at 5% and confidence level at 95% with a 10% non-response rate. The sample size was 270. The sample for study were all mothers who delivered singleton live babies at the study place. Institutional ethical clearance was obtained. A pretested questionnaire was prepared by the investigator before undertaking the study. All babies were weighed within 24 hours of birth. A birth weight of < 2500g was considered as low birth weight (up to and including 2499g), 1500-1000g very low birth weight (VLBW) and < 1000 extremely low birth weight (ELBW). **Study period:** The study duration was from July 2023 to October 2023. **Study tool:** A pretested questionnaire was prepared by the investigator which includes socio demographic profile, name, mother age, education and occupation, husband's education, socioeconomic status which was calculated using B.G. Prasad classification, residence, weight, number of antenatal visits (minimum of at least 4 antenatal visits), T D injection, oral supplements (iron and folic acid tablets for 6 months, calcium tablets for 6 months), parity, gestational age at birth, the time

interval between pregnancies, weight gain during pregnancy (minimum 10 kgs weight gain during pregnancy), illness during pregnancy, birth weight of the baby, sex of baby, and neonatal complications. **Data collection:** After obtaining institutional ethical committee approval (Ref No: JJMMC/IEC-48-2023) postnatal mothers were selected based on inclusion and exclusion criteria. Informed consent was obtained from all mothers, the questionnaire was explained and the responses were filled out by using the interview method. **Statistical analysis:** The responses were coded and the data tabulated on a Microsoft Excel sheet and analysis was done by using IBM SPSS Version 25. The chi-square test was used to analyze the association between the LBW and various factors. P value less than 0.05 was considered statistically significant.

Results:

Table 1: Sociodemographic details of the mother

Variables	N (270)	Percentage
Age		
18-23	125	(46.29)
24-29	101	(37.4)
30-35	40	(14.81)
> 35	4	(1.48)
Education		
Illiterate	28	(10.4)
Till 7th	56	(20)
Till 10th	91	(33.7)
Till 12th/diploma	62	(23)
Till degree and above	33	(12.2)
Occupation		
Daily laborer	23	(8.5)
Govt employee	2	(0.7)
Homemaker	241	(89.3)
Non- gov employee	4	(1.48)
Residence		
Rural	198	(73.3)
Urban	72	(26.7)
Marital status		
Divorced/ Separated	2	(0.74)
Married	268	(99.26)
Husband's education		
Illiterate	32	(11.9)
Till 7th	58	(28.5)
Till 12th/diploma	52	(19.3)
Till 10th	91	(33.7)
Till degree and above	37	(13.7)

Religion		
Hindu	216	(80)
Muslim	50	(18.5)
Christian	3	(1.1)
Other	1	(0.4)

The study included a total of 270 mothers who delivered newborn babies and were observed for a duration of 4 months. Of the 270 participants, 125 (46.29%) were between the ages of 18 and 23 years and only 4 (1.48%) were above the age of 35. The average age of the participants was 25 ± 4.41 years. 72 (26.7%) participants were from urban areas and the remaining 198 (73.3%) were from rural areas. In terms of educational status, 28 (10.4%) were illiterate, while 91 (33.7%) had completed high school. The majority of the participants were homemakers, accounting for 241 (89.3%) of the total, with only 23 (8.5%) working as daily wage workers. In our study, 268 (99.26%) participants were married, with only 2 (0.74%) separated and divorced. Majority of the participants, 216 (80%) were Hindus. Among husbands' education, 32 (11.9%) were illiterate, and rest were educated (Table 1).

Table 2: Details of neonate

Variables	N (270)	Percentage
Sex		
Male	140	(51.9)
Female	130	(48.1)
Birth weight		
LBW	93	(34.44)
Normal	177	(65.56)

Of the total number of 270 babies in our study, 140 (51.9%) were male while the remaining 130 (48.1%) were female. Out of 270 babies, 34.44% of babies had low birth weight, which was measured within 24 hours of their birth (Table 2).

Table 3: Classification of birth weight of newborn babies

Classification	N (270)	Percentage
Normal	177	65.5
LBW	89	32.96
VLBW	3	1.12
ELBOW	1	0.36

Of 270 babies included in our research, 32.96% (89 babies) had low birth weight, 1.12% (3 babies) had very low birth weight, and 0.36% (1 baby) had extremely low birth weight (Table 3).

Table 4: Antenatal details of mother

Variables	N (270)	Percentage
ANC follow up		
Yes	264	(97.8)
No	6	(2.2)
No. of ANC visits		
4 visits	42	(15.6)
4 visits	228	(84.4)
TD injections		
2 doses	198	(73.3)
1 dose	65	(24.1)
None	7	(2.6)
Iron and folic acid tablets		
Yes	261	(96.7)
No	9	(3.3)
Calcium tablets		
Yes	257	(95.2)
No	13	(4.8)
Pregnancy status		
Unwanted & Unplanned	2	(0.7)
Wanted and planned	219	(81.1)
Wanted but unplanned	49	(18.1)
Parity		
Multiparous	141	(52.2)
Primiparous	129	(47.8)
Gestational age		
Term	225	(83.3)
Preterm	36	(13.3)
Post-term	9	(3.3)
Birth interval		
3yrs	85	(31.48)
< 3 yrs	185	(68.51)
PIH		
Yes	45	(16.7)
No	225	(83.3)
Meal frequency per day		
4 times	177	(65.6)
4 times	93	(34.4)
H/o Still births		
Yes	11	(4.1)
No	259	(95.5)
H/o Previous abortions		
Yes	56	(20.7)
No	214	(79.3)
Mode of delivery		
C- Section	138	(51.1)
Vaginal	132	(48.9)

Weight gain during pregnancy		
10	141	(52.22)
> 10	129	(47.78)
Liquor		
Normal	262	(97)
Oligohydramnios	7	(2.6)
Polyhydramnios	1	(0.4)

In our study, 228 (84.4%) participants had 4 ANC visits, 198 (73.3%) participants had taken 2 doses of TD injection, 261 (96.7%) participants had taken iron and folic acid tablets, 257 (95.2%) participants had taken calcium tablets. 141 (52.2%) participants were multiparous and 129 (47.8%) were primiparous.

Gestational age at delivery, 225(83.4%) deliveries were at term, 36 (13.3%) were pre-term and 9(3.3%) were post term. 85 (31.48%) participants had birth interval of 3years and 185 (68.51%) had birth interval of < 3years. 45 (16.7%) mothers had pregnancy-induced hypertension, and 177 (65.6%) of them had less than 4 meal frequency per day. 11 (4.1%) participants had still births, 56 (20.7%) participants had previous abortions. 132 (48.9%) participants had vaginal delivery and 138 (51.1%) had C-section. In our study 7 (2.6%) participants had oligohydramnios, 1 (0.4%) had polyhydramnios and 262 (97%) had normal liquor. 141 (52.22%) participants gained weight more than 10 kgs with a mean weight gain of 11.16 kgs with a standard deviation of +/-9.9 (Table 4).

Table 5: Association of low birth weight and characteristics of mother

Variables	Total	LBW	Normal	p - value	Crude Odds Ratio	95% CI
Birth interval						
3yrs	85	27(31.76)	58(68.24)	0.530	0.84	0.48-1.45
3 yrs.	185	66(35.67)	119(64.32)			
PIH						
Yes	45	23(51.11)	22(48.89)	0.010*	2.31	1.2-4.43
No	225	70(31.11)	155(51.11)			
Parity						
Multiparous	141	40(28.3)	101(71.63)	0.028*	0.57	0.34-0.94
Primiparous	129	53(41.1)	76(58.9)			
H/o Previous abortions						
Yes	56	21(37.5)	34(0.71)	0.392	1.24	0.67-2.29
No	214	71(33.18)	143(66.82)			
Age of mother						
18-23	125	45(36)	80(64)		1	1
24-29	101	34(33.66)	67(66.37)	0.943	1.11	0.64-1.92
30-35	40	13(32.5)	27(67.5)		1.17	0.54-2.49
> 35	4	1(25)	3(75)		1.69	1.17-16.7
Gestational age at birth						
Term	225	65(28.89)	160(71.11)		1	1
Preterm	36	26(72.22)	10(27.78)	0.0001*	0.16	0.07-0.34
Post-term	9	2(22.22)	7(77.78)		1.42	0.29-7.02
TD Injection						
2 doses	198	72(36.36)	126(63.64)		1	1
1 dose	65	18(27.69)	47(72.3)	0.396	1.49	0.841-2.76
None	7	3	4		0.76	0.16-3.5
Education						
Illiterate	28	15(53.57)	13(46.42)		1	1
Till 7th	56	16(28.57)	40(71.42)		2.88	1.12-7.4
Till 10th	91	37(40.65)	54(59.34)	0.017*	1.68	0.72-3.95
Till 12th/diploma	62	13(20.96)	49(79.03)		4.34	1.66-11.38
Degree and above	33	12(36.36)	21(63.63)		2.01	0.72-5.63
Residence						
Rural	198	70(35.35)	128(64.65)	0.602	1.16	0.65-2.07
Urban	72	23(31.94)	49(68.05)			

H/o Still birth						
Yes	11(4.1)	5(45.45)	6(54.54)	0.433	1.62	0.48-5.45
No	259(95.5)	88(33.97)	171(66)			
Iron and folic acid taken						
Yes	261(96.7)	90(34.48)	171(65.51)	0.943	1.05	0.26-4.31
No	9(3.3)	3(33.33)	6(66.67)			
Calcium tablets taken						
Yes	257(95.2)	89(34.63)	168(65.36)	0.775	1.19	0.36-3.97
No	13(4.8)	4(30.77)	9(69.23)			
Mode of delivery						
C- Section	138(51.1)	50 (36.23)	88 (63.76)	0.527	1.18	0.71-1.94
Vaginal	132(48.9)	43 (32.58)	89 (67.42)			
Sex of neonate						
Male	140(51.9)	40 (28.57)	100(71.42)	0.035*	0.58	0.35-0.96
Female	130(48.1)	53 (40.76)	77 (59.23)			
Husband's education						
Illiterate	32(11.9)	15(46.88)	17 (53.12)	0.083	1	1
Till 7th	58(28.5)	19(32.75)	39 (67.24)		1.81	0.75-4.39
Till 10th	91(33.7)	37(40.66)	54 (59.34)		1.29	0.57-2.89
Till 12th/diploma	52(19.3)	11(21.15)	41 (78.84)		3.29	1.26-8.6
Degree and above	37(13.7)	11(29.72)	26 (70.27)		2.08	0.77-5.61
Pregnancy status						
Unwanted and Unplanned	2(0.7)	0 (0)	2 (100)	0.358	1	1
Wanted and planned	219(81.1)	79(36.07)	140(63.92)		0.35	0.02-7.45
Wanted but unplanned	49(18.1)	14(28.57)	35 (71.42)		0.49	0.02-10.83

*p < 0.05 statistically significant

In our study, subjects who delivered LBW babies, 34 (33.66%) were between the ages of 24-29. A total of 66 (35.67%) low-birth-weight babies were born to mothers who had a birth interval of less than three years and 27 (31.76%) low-birth-weight babies were born to mothers who had a birth interval of more than or equal to three years. Statistically significant (p < 0.05), 23 (51.11%) low birth weight babies were born to mothers with PIH. Statistically significant (p < 0.05), LBW were born to primiparous women in 53 cases (41.1%). 21 (37.5%) of the LBW children whose mothers had previous abortions. Of the LBW babies, 26 (72.22%) were preterm (p < 0.05) which is significant. Of the LBW babies, 40 (28.57%) and 53 (40.76%) were male and female, respectively (Table 5).

Discussion

This study included 270 participants and their newborns at a tertiary care hospital, in central Karnataka, to assess the various factors associated with LBW.

The proportion of LBW in this study was 34.44% which is slightly higher than the study conducted by Kotabal Rajashree et al. [9], where the prevalence was 31.3%. Most of the hospital-based studies [10-12] showed the prevalence rate to be more than 30%. NFHS data from the year 2019-2021, the prevalence was found to be 64% [13]. The reason for the high prevalence rate can be due to tertiary care centers handling high-risk and complicated pregnancies. In study conducted by K. Agarwal et al., the prevalence of LBW was 40% [10].

In our study, the majority of LBW babies were born to mothers in the age group of 18-23years (36%), followed by 24-29 years (33.66%), whereas the studies done by Nararyanamurthy MR et al. [8], LBW was more frequent in the age group of 21-25 years (44.4%).

This study showed that the incidence of LBW was more (53.57%) among illiterate mothers, which is similar to the study done by Kotabal Rajashree et al. [9] and Joshi et al. [14]. This can be due to increased awareness and utilization of healthcare services among educated mothers.

The proportion of LBW was 28.3% among multiparous women, and 41.1% among primiparous women as in studies done by Kotabal Rajashree et al. [9], found to be 32% and 30.9% among multiparous and primiparous women respectively.

In our study, the proportion of LBW was more 72.22% among preterm compared to 22.22% in post-term babies which is comparable to the study done by Kiran Agarwal et al. [10] where it was found to be 76.5% and 31.4% among preterm and post-term babies

respectively. This might be due to various factors like anemia during pregnancy, pregnancy-induced hypertension, infections during pregnancy, oligo or polyhydramnios, and maternal nutrition.

In our study, 36.36% of LBW babies were born to mothers who had taken 2 doses of TT injection whereas in a study done by Ajith Kumar Kannaujiya et al., it was 16.6% of mothers had taken 2doses of TT injection [15].

As it was observed from the present study the proportion of LBW was higher among the mothers with a birth interval of less than 3 years and this was supported by other studies [10,14]. Hence it is recommended to adopt birth spacing for at least 3 years.

Conclusions

The study draws conclusions about important factors that influence low birth weight (LBW) which includes maternal age, mother's education, gestational age, birth interval, high risk pregnancy and parity. Nonetheless, there are several facets to the LBW issue. Therefore, we need comprehensive and integrated approaches, which include interventions to enhance the overall strategies most likely to be successful in lowering low birth weight in India.

Recommendations

Adolescents should be educated about nutrition and the appropriate age for marriage and pregnancy. Married women should be educated about nutrition and appropriate age for pregnancy. Pregnant women should be educated about the importance of nutrition, regular antenatal checkups, taking supplement medications (iron, folic acid and calcium tablets), birth spacing (at least 3 years), family planning, and adequate rest and sleep.

Limitations:

Purposive selection of the study area and sampling are some of the limitations of this study. Maternal psychological stress that may have some influence on birth weight is not assessed in this study.

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