Original Article

Pregnancy-related Factors Responsible for Delivering Low Birth Weight Babies: An Institutional-based Cross-sectional Study, Jamnagar, Gujarat

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Abstract

Background: The WHO defines LBW as "Birth weight less than 2500 grams" regardless of gestational age. Being born with a low birth weight also incurs enormous economic costs, including higher medical expenditures and social service expenses, and decreased productivity in adulthood. **Objective:** To study distribution of newborns' according to pregnancy related factors and its association with newborns' birth weight. **Methods:** An institutional based cross-sectional study. New-borns delivered at study institute were considered as study participants. Estimated final sample size was 500. Guardians (mothers) were face-to-face interviewed and also recorded data were collected from the case file and Mother and Child Protection Card. **Results:** Prevalence of LBW newborns was higher in mothers with late ANC registration, <4 ANC visits, chronic medical conditions, infection during pregnancy, PIH, anemia, consuming tobacco, exposure to second hand smoke, LSCS/Assisted delivery, in female newborns', current pregnancy birth order number more than 2, in pre term newborns' and mothers with bad obstetric history. **Conclusion:** Create awareness and adoption of suitable family planning methods. Need to do early (within 12 weeks) ANC registration with minimum four ANC visits for better pregnancy outcome. Effective tracking and suitable intervention provided to improve current pregnancy outcome. Health care professional should pay special attention to high-risk pregnancy. Develop social culture in such a way that females are neither addicted nor exposed to any tobacco containing products in their life.

Keywords: Cross sectional study, low birth weight, newborn, pregnancy, tertiary care hospital

Introduction

The World Health Organization (WHO) defines low birth weight (LBW) as "Birth weight less than 2500 grams," regardless of gestational age, the measurement being taken preferably within the first hour of life.[1] It is estimated that the risk of neonatal mortality for LBW infants is 20 times more than for infants with birth weight exceeding 2500 grams, and it increases sharply as birth weight decreases.[2] Being born with a LBW also incurs enormous economic costs, including higher medical expenditures and social service expenses and decreased productivity in adulthood.[3]

Nearly 15 per cent of all infants worldwide are born with low birthweight. Southern Asia is the region with the highest incidence (27%). Progress in reducing low birthweight has been stagnant since the year 2000 – particularly during the most recent period from 2010 to 2015. The world is not on track to meet the WHA global target on low birthweight, and without accelerated action on prevention, we will not achieve the goal of a 30 per cent reduction in low birthweight by 2025. Important work lies ahead. The annual average rate of reduction (AARR) in low birthweight is 1.00 per cent per year in the most recent period from 2010 to 2015. But an AARR of 2.74 per cent per year between 2012 and 2025 is required to meet the global target of 10.5 per cent low birthweight prevalence.[4] According to the latest National Family Health Survey (NFHS-5, 2019-21), proportion of LBW was about 17.29%. The prevalence of newborns with LBW had a very

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small decline from 17.5% (17.19, 17.80) in NFHS-4 (2015-16) to 17.29% (17.01, 17.57) in NFHS-5 (2019-21).[5] India has made considerable progress in reducing the LBW of children during the past decade, and it remains a leading cause of child mortality in the country, especially among socio-economically disadvantaged groups. To achieve the target of the Sustainable Development Goal (SDG) in infant and under-5 mortality levels by 2030, an accelerated improvement is still required in reducing the occurrence of LBW.[6]

The problem of LBW, therefore, is a matter of public health concern worldwide and is more serious in India. Therefore, the objective of the study was the distribution of newborns' according to pregnancy-related factors and its association with newborns' birth weight.

Material and Methodology

This institutionally based cross-sectional study was carried out in three postnatal wards of Guru Govind Sinh Tertiary Care Hospital, Jamnagar, from December 2020 to November 2021. The study population consists of newborns of postnatal mothers. The estimated final sample size was 500, which was calculated by using equation $N = Z^2_{(1-\alpha/2)} pq/l^2$ where N = Desired sample size, $Z_{(1-\alpha/2)}$ at 95% CI = 1.96, P = prevalence of LBW in the studied institution in the previous year which was 27%, q = 73%, l = 15% of P and nonresponse rate as 5%.

Singleton live newborns of postnatal mothers, Newborns' mothers who were willing to participate, informants, and participants who must be free from any severe, debilitating, and mental illness were included. Newborns' mothers who were not willing to participate, twins, and stillbirths were excluded from the study.

For the sampling, all three postnatal wards of the gynecology department were considered. Mother and baby were put at least 48 hrs under observation after delivery. So, each unit considered visiting on a day following the emergency. Systematic random sampling methods were employed for selecting participants from the postnatal wards. Every third mother indoor in the postnatal ward after delivery was considered as our study participant. In case of nonrespondent, the next subject to the nonrespondent was selected.

For the data collection, a predesigned, pretested, and semi-structured questionnaire was prepared, which was adapted and modified from different works of literature and includes questions related to antenatal history, chronic medical conditions, and past obstetric history. A pretest was performed on 5% of the sample from the same source population before the actual data was collected to make sure the questions were precise and consistent. The questionnaire was modified as needed. The outcome variable of this study was birth weight. Data on the baby's birthweight were collected from recorded birthweight on the mother's case file or in the Mother and Child Protection (MCP) Card. The guardians (mothers) were interviewed through visiting PNC wards and explained the study in detail. Informed consent was taken before starting data collection. The data were collected through a face-to-face interview and also from the recorded data from the case file and MCP card. Collected data were compiled in a Microsoft Excel sheet; after that, data was analyzed in SPSS software version 26. The analysis made use of both descriptive and inferential statistics. Frequency and percentage were calculated in descriptive statistics, and a proportional bar diagram was utilized to display the findings. The proportion of LBW was determined first, and the LBW proportion associated with each factor was computed by Chi-square test. Statistical significance was set at the probability value ($P < 0.05$). This study was started after getting ethical clearance from the institutional ethics committee.

Result

The proportion of LBW in study institute was 29.2%. Table 1 shows the distribution of newborns' according to pregnancy-related factors. All 500 newborns' mothers had performed their ANC registration. Majority (91%) of newborns belonged to mothers who conducted it within 12 weeks. Only 6.1% of newborns belonged to mother who had taken less than 4 ANC visits. Most (97%) of the newborns belonged to mother without any chronic medical condition. For the infections during pregnancy, 5.4% of newborns belonged to mothers who were presented with it. Out of 500 newborns,' 1.8% belonged to gestational diabetic mothers. In case of pregnancy-induced hypertension, 491 newborns were considered and 9 were excluded because their mothers had already developed hypertension before the pregnancy. Newborns belonging to mother with PIH were 7.9%. Mothers' anemia status is determined based on the 1st Hb reading and last Hb reading from their MCP card or case file during the ANC period. Majority (82.8%) of newborns belonged to mothers who were anemic based on 1st Hb reading. So, out of 414 newborns, 36% newborns belonged to mothers who became nonanemic while 64% from who remained anemic based on the last Hb reading during pregnancy. Rightly 11.8% newborns belonged to mothers with tobacco chewing habits. For the second-hand smoking, 7% newborns belong to mothers who were exposed to it. LSCS/Assisted delivery was conducted in 37.4%. Female newborns were 46.2%. Current birth order number was more than second in 13.8% of newborns.' Precisely 13.8% were preterm babies.

Table 2 shows that the proportion of LBW newborns was 53.3% in mothers who had performed their ANC registration after 12 weeks, 51.6% in mothers who had less than 4 ANC visits, 66.7% in mothers with chronic medical conditions, 63% in mothers who presented with infection during pregnancy, 59% in mothers with PIH, 49.2% in mothers who were consuming tobacco, 48.6% in mothers who were exposed to second-hand smoke, 40.6% in mothers who delivered by LSCS/Assisted delivery, 33.8% in female newborns,' 42% in mothers with current pregnancy birth order number more than 2, 82.6% in preterm newborns.' All the above variables show statistically significant risk for delivering LBW newborns as compared to their respective contradictory parts. For the gestational diabetes,

Table 1: Distribution of newborns' according to pregnancy-related factors

Variables	Category	Frequency	%
Time of the registration	≤12 weeks	455	91
	>12 weeks	45	9
No. of ANC visits	<4	31	6.2
	≥4	469	93.8
Chronic medical conditions	Heart diseases	1	0.2
	Renal Diseases	0	0
	DM	0	0
	HT	9	1.8
	Epilepsy	5	1
	None	485	97
Infections during pregnancy	Present	27	5.4
	Absent	473	94.6
Gestational Diabetes	Present	9	1.8
	Absent	491	98.2
PIH (*n*=491)	Present	39	7.9
	Absent	452	92.1
Anemia (1st Hb reading)	Yes	414	82.8
	No	86	17.2
Anemia Corrected (Last Hb reading) (*n*=414)	Yes	149	36
	No	265	64
Tobacco	Yes	59	11.8
	No	441	88.2
Smoking	Yes	0	0
	No	500	100
Alcohol	Yes	0	0
	No	500	100
Second-hand smoking	Yes	35	7
	No	465	93
Delivery type	Normal	313	62.6
	LSCS/assisted	187	37.4
Newborn's sex	Male	269	53.8
	Female	232	46.2
Current birth order number	≤2	431	86.2
	>2	69	13.8
Gestational age (In weeks)	<37 (preterm)	69	13.8
	≥37 (term and above)	431	86.2

no mothers were presented with the LBW babies. The proportion of LBW was 31.6% in anemic mothers based on 1st Hb reading in pregnancy while 17.4% was nonanemic, and this difference was statistically significant. Out of total of 414 anemic mothers based on 1st Hb reading in pregnancy, 265 remain anemic based on the last Hb reading, in which the proportion of LBW was 36.2%, and anemia was corrected in 149 mothers from which it was 23.5%. This difference was statistically significant.

Chart 1 shows the distribution of newborns' according to past obstetric history of mothers in which out of 500 newborns, 255 were considered for past obstetric history based on the previous births given by the mother. History of preterm birth, history of LSCS/instrumental delivery, history of abortion/stillbirth/miscarriage, History of LBW child, inter-pregnancy interval <3 years were present in 18.8%, 22.4%, 12.2%, 30.2%, and 36.5%, respectively.

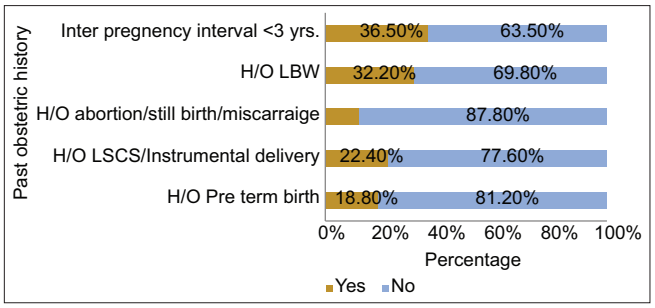

Chart 1: Distribution of newborns' according to past obstetric history of mother (N=255)

Table 3 shows that the proportion of LBW newborns was 45.8% in mothers with a history of previous preterm birth, 38.8% with a previous history of LSCS/Instrumental delivery, 51.6% with a history of abortion/stillbirth/miscarriage, 45% with a previous history of LBW child, 51.6% in with less than 3 years of interpregnancy interval for last two pregnancy. All the above variables were statistically significant for delivering LBW newborn babies as compared to their respective contradictory except in mothers with a history of previous LSCS/Instrumental delivery.

Discussion

India did not achieve the fourth Millennium Development Goal (MDG) to reduce infant and child mortality by two-thirds between 1990 and 2015. LBW is one of the major causes of infant and child mortality in India.[7] The 2025 target is to reduce the prevalence of LBW by 30%, from a baseline of 15% in 2012 (implying an AARR of 2.7%). When the SDG agenda was developed, with a 2030 horizon, Member States kept the reference to 2025 but set an aspirational target of "ending" all forms of malnutrition by six global targets (reducing stunting and wasting in children under 5, halting the epidemic of obesity, reducing anemia in women of reproductive age, reducing LBW and increasing the rate of exclusive breastfeeding) for 2030.[8]

Early ANC registration was seen in 91% of mothers which was higher than the study conducted by Metgud CS *et al*.[9] and Matthews Z *et al*.[10] where it was 65.4% and 56%, respectively. The fact that these studies were conducted in 2012 and 2001, respectively, may account for the larger disparity. The majority of mothers in our study received four antenatal care visits, which was similar to studies by Metgud CS *et al*. (81%),[9] Pal A *et al*. (77%),[7] and Kader M *et al*. (73%),[11] whereas only 60% of mothers in a study by Zaveri A *et al*.[12] had four ANC visits. The incidence of PIH in the general population is 5-15%[13], and it was matched to this study. In research conducted in East Delhi by Bhasin SK *et al*.,[14] 4% of participants had hypertension, and 1.4% had diabetes; while in our study, 1.8% had hypertension, and none had diabetes. In our study, 82.8% of mothers were anemic based on 1st Hb reading and 64% based on the last Hb reading, while in a Zaveri A *et al*.[12] study, over half (55.6%) of the mothers were anemic. In this study, tobacco chewing habit was reported in 11.8% of mothers while in the study by Gupta PC. *et al*.[15] 208 (17.1%) reported using tobacco regularly

Table 2: Association between pregnancy-related factors and newborns' birth weight

Variables	Category	Birth weight (in grams)				Total		χ^2	*P*
		<2500		≥2500					
		n	%	*n*	%	*n*	%		
Time of the registration	≤12 weeks	122	26.8	333	73.2	455	91	13.93	0.0001
	>12 weeks	24	53.3	21	46.7	45	9		
No. of ANC visits	<4	16	51.6	15	48.4	31	6.2	8.03	0.005
	≥4	130	27.7	339	72.3	469	93.8		
Chronic medical condition	Yes	10	66.7	5	33.3	15	3	10.50	0.001
	No	136	28	349	72	485	97		
Infections during pregnancy	Present	17	63	10	37	27	5.4	15.74	0.0001
	Absent	129	27.3	344	72.7	473	94.6		
PIH	Present	23	59	16	41	39	7.9	21.80	0.0001
	Absent	114	25.2	338	74.8	452	92.1		
Anemia (1st Hb reading)	Yes	131	31.6	283	68.4	414	82.8	6.95	0.008
	No	15	17.4	71	82.6	86	17.2		
Anemia corrected (Last Hb reading) (*n*=414)	Yes	35	23.5	114	76.5	149	36	7.15	0.007
	No	96	36.2	169	63.8	265	64		
Tobacco	Yes	29	49.2	30	50.8	59	11.8	12.88	0.0001
	No	117	26.5	324	73.5	441	88.2		
Second-hand smoking	Yes	17	48.6	18	51.4	35	7	6.83	0.009
	No	129	27.7	336	72.3	465	93		
Delivery type	Normal	70	22.4	243	77.6	313	62.6	18.92	0.0001
	LSCS/Assisted	76	40.6	111	59.4	187	37.4		
Newborn's sex	Male	68	25.3	201	74.7	269	53.8	4.33	0.04
	Female	78	33.8	153	66.2	232	46.2		
Current birth order number	≤2	117	27.2	314	72.8	431	86.2	6.37	0.01
	>2	29	42	40	58	69	13.8		
Gestational age (In weeks)	<37 (Pre term)	57	82.6	12	17.4	69	13.8	110.45	0.0001
	≥37 (Term and above)	89	20.6	342	79.4	431	86.2		

Table 3: Association between mothers past obstetric history and newborns' birth weight (*n*=255)

Past obstetric history	Birth weight (in grams)				Total		χ^2	*P*
	<2500		≥2500					
	n	%	*n*	%	*n*	%		
History of preterm birth								
Yes	22	45.8	26	54.2	48	18.8	7.68	0.006
No	53	25.6	154	74.4	207	81.2		
History of LSCS/Instrumental Delivery								
Yes	22	38.6	35	61.4	57	22.4	2.98	0.084
No	53	26.8	145	73.2	198	77.6		
History of abortion/stillbirth/miscarriage								
Yes	16	51.6	15	48.4	31	12.2	8.38	0.004
No	59	26.3	165	73.7	224	87.8		
History of LBW child								
Yes	45	58.4	32	41.6	77	30.2	44.78	0.0001
No	30	16.9	148	83.1	178	69.8		
Inter Pregnancy Interval <3 Years								
Yes	48	51.6	45	48.4	93	36.5	34.75	0.0001
No	27	16.7	135	83.3	162	63.5		

during pregnancy. In a retrospective cohort study conducted by Krishnamurthy AV *et al*.[16] among 1043 pregnant women reported that 30% of women were exposed to second-hand smoke, which was higher than this study's (7%) finding. The higher prevalence in Krishnamurthy AV *et al*.[16] study may be attributed to the fact that smoking is highly prevalent in

public places and in the workplace in the study area (JIPMER, Puducherry). A similar percentage of cesarean section was seen in the studies in Delhi by Bhasin SK *et al*.[14] and in Madras by Sreevidya S *et al*.[17] Newborn's sex distribution in a Bhue PK *et al*.[18] study (male child – 57.38%, female child – 42.62%) was similar to our study while in a study by Manna N *et al*.[19] male babies were 47.2%, while 52.8% were female. In a study by Domple VK *et al*.[20] 18.76% of the mothers were presented with >2 birth order numbers while in the present study, it was 13.8%. In this study, preterm birth was seen in 13.8% of newborns' while in a study conducted in East Delhi by Bhasin SK *et al*.[14] shown that 9.1% had preterm delivery.

In this study, late ANC registration showed a significant risk of delivering LBW babies. This finding was supported in a study by Metgud CS *et al*.[9] and L. Kercher *et al*.[21] Less than four ANC visits have a significant risk of delivering LBW babies.[7,12,20,22] The study by Kader M *et al*.[11] found a strong association between lack of antenatal care and LBW. Antenatal care provides routine monitoring of height and weight gain, identification of medical maternal or fetal problems, counseling against tobacco or substance use, psychosocial support, nutritional advice, and early intervention, which may reduce adverse pregnancy outcomes, including LBW. The presence of chronic medical conditions in mothers showed significant risk for delivering LBW babies, and a similar finding was also observed in a study by Pal A *et al*.[7] The proportion of LBW was significantly higher in mothers who presented with infections during pregnancy. A Similar finding was seen in a study by Idris MZ *et al*.[23] PIH is also an independent risk factor for LBW in our study. A significant risk of LBW was found among mothers with PIH in research by Marimuthu Y *et al*.[24] (AOR: 6.9; CI: 1.5-32.0) and Deshpande JD *et al*.[25] (OR: 4.09; CI: 1.49-11.19). In our study, the proportion of LBW was higher among the mothers who had PIH, and this is plausible due to the fact that toxemia of pregnancy impairs placental circulation, thereby reducing fetal weight gain. Mothers with anemia showed a significant risk of delivering LBW babies.[7,12,22] It is important to note that the birth weight of infants is determined by pre-pregnancy and during-pregnancy nutritional status. Anemia could impair oxygen delivery to the fetus and thus interfere with normal intrauterine growth. Both tobacco chewing and exposure to second-hand smoke shown significant risk for delivering LBW babies. A similar finding was seen in a study by Jayaraj N *et al*.[22] In a study by Gupta PC *et al*.[15] babies born to mothers using smokeless tobacco were, on average, 105 g lighter than those of non-users. In a study by Prince PM *et al*.[26] SHS exposure was significantly associated with LBW. In our study, the proportion of LBW was significantly higher in cesarean section deliveries, and this finding was supported by Momeni M *et al*.[27] and Sutan R *et al*.[28] The association between LSCS and LBW should be interpreted cautiously, as most mothers need LSCS due to complicated cases, such as pre-eclampsia, eclampsia, and bleeding placenta previa. Female newborns were at greater risk for LBW.[19,20,22] In a study by Pal A *et al*.,[7] it was shown that mothers with more than two birth orders had a prevalence of 25.79%, which was significantly higher than its counterpart ($P < 0.01$) and supported the findings of this study. The prevalence of LBW was significantly higher in preterm newborns.[7,20]

In this study, 12.20% of mothers had a history of abortion/stillbirth/miscarriage while the incidence of abortion in the general population noted is 10-15% (Mudaliar AL *et al*.).[29]

Past history of obstetric complications was found to be associated with an increased risk of LBW deliveries. These results are also similar to those made by Malvanker DV *et al*. (1992),[30] who reported that poor obstetric history was an independent risk factor for both term and preterm LBW infants, while Soltani MS *et al*. (1991)[31] observed that past history of adverse outcome was also found to be significantly associated with adverse outcome in the present pregnancy. A study by Lekea-Karanika V *et al*.[32] observed that the history of any prior pregnancy loss or even the threat of it in a previous pregnancy was much more statistically significant than any other factor concerning previous pregnancies. It is also apparent that the more fetuses the mother had lost, the greater the association with the delivery of a low birthweight baby in a subsequent pregnancy. In a study by Zaveri A *et al*.,[12] the occurrence of LBW was found to be significantly higher among women who had a history of pregnancy termination and any sign of pregnancy complications as compared to their counterparts. A study by Jayaraj N *et al*.[22] shows that mothers with lower birth intervals are directly proportional to the risk of LBW ($P = 0.005$). Short interpregnancy intervals may result in the depletion of maternal nutrient stores and lead to reduced birth weight. A possible explanation lies in the role of contraceptive use, where the interpregnancy interval is generally lower among those women who are not using contraceptives, which can eventually lead to a greater risk of LBW babies. Additionally, contraceptive use may increase knowledge and awareness about reproductive health care through interaction with professional health workers, and that could also have a positive influence on maternal healthcare-seeking.[12] All the above findings, along with their comparison, support that mothers with bad obstetric history had a greater risk of delivering LBW babies.

There are some limitations of the study, including that it was conducted only in a tertiary care hospital, and the sample size was small, so these findings cannot be truly representative of the entire population. The study was cross-sectional, so it is not possible to strongly demonstrate cause and effect relationships. There might be chances of a lot of missing information and misinformation given by the women at the time of the stressful moment of childbirth; therefore, the recall bias in the study could not be ruled out.

Conclusion

The current study found that delayed ANC registration, fewer than four ANC visits, chronic medical conditions, infections during pregnancy, PIH, anemia, tobacco chewing, second-hand smoke exposure, LSCS/Assisted delivery, female newborns, current pregnancy birth order number

greater than 2, preterm newborns and poor obstetric history are statistically significant risk factors for delivering LBW newborn babies.

So, the present study findings are likely to recommend creating awareness and adopting suitable family planning methods. Working with community leaders and other powerful influencers may be beneficial to ensure that the community understands the advantages of early (within 12 weeks) ANC registration with a minimum of four ANC visits. Implementation of efficient monitoring and targeted interventions to enhance present pregnancy outcomes. It is strongly recommended that healthcare professionals prioritize and devote special attention to pregnancies categorized as high-risk. This proactive approach ensures early detection, diligent monitoring, and timely interventions, ultimately leading to improved outcomes for both the mother and the baby. Promote a tobacco-free social culture for females through targeted awareness campaigns, education programs, and strong policy measures to prevent addiction and exposure to tobacco products.

Ethical clearance statement

Ethical clearance was taken from the institution ethical committee with Ref. No. IEC/Certi/85/03/2020.

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Conflicts of interest

There are no conflicts of interest.

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