Original Article

Prevalence and Determinants of Low Birth Weight among the Newborns in Dadra and Nagar Haveli: A Community-based Study

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Abstract

Background: The world is not on track to meet the World Health Assembly (WHA) global target on Low Birth Weight (LBW). To estimate the prevalence and to identify the associated determinants of LBW among the newborns. **Material and Methods:** We conducted a cross-sectional study among the 364 mothers registered under the all government health facilities of Dadra & Nagar Haveli (DNH) during November 2021 to January 2022. **Results:** The prevalence of LBW was found to be 39%. On uni-variable logistic regression, live in relationship, caste, weight of mother, Body Mass Index (BMI), weight gain <5 kg in 2nd and 3rd trimester, high-risk pregnancy, complication present in previous pregnancy and preterm delivery, while on multi-variable logistic regression, weight gain <5 kg in 2nd and 3rd trimester (AOR 2, 95% CI 1.007-4.2) and having high-risk pregnancy (AOR 2, 95% CI 1.1-3.0) were found to be the significant predictors of LBW among the newborns. **Conclusions:** We conclude from the study that the prevalence of low birth weight among the newborn was high. There is a need to address maternal and child health issues like low birth weight, malnutrition and high-risk pregnancy under the RMNCAH+N program through various effective interventions. Future research should evaluate the feasibility of collaborative activities between RMNCAH+N program and the UNICEF in India.

Keywords: India, logistic models, low birth weight, mother, newborn, surveys and questionnaires

Introduction

Low birth weight (LBW) is a major public health problem, which is characterized by the weight of a newborn at birth being less than 2,500 g regardless of the gestational age.[1] The United Nations Children's Fund (UNICEF) and World Health Organization (WHO) indicate that one in seven live births (20.5 million babies) globally suffered from LBW in 2015, almost half of them in Southern Asia.[1]

The prevalence of LBW varied widely across the regions from 7.2% in more developed regions to 17.3% in Asia.[1] In Southern Asia, the prevalence of LBW was 26.4% in 2015, which is more than five times higher than the 5.1% prevalence in Eastern Asia.[1] In India, the prevalence of LBW among the newborns ranges from 14.6% to 34.1%.[2-10]

The progress in reducing LBW has been stagnant since the year 2000, particularly during the period from 2010 to 2015.[1] In that duration, the annual average rate of reduction (AARR) in LBW is 1.00%. The world is not on track to meet the World Health Assembly (WHA) global target on LBW, and without accelerated action on prevention the goal of a 30% reduction in LBW by 2025 will not be achieved.

A newborn's weight at birth is an important marker of maternal and fetal health and nutrition. LBW newborns have a higher risk of dying in the first 28 days of life. Those who survive are more likely to suffer from stunted growth and lower intelligence quotient (IQ).[1] The consequences of LBW continue into adulthood, increasing the risk of adult-onset chronic conditions such as obesity and diabetes.

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However, there is paucity of evidence estimating the prevalence and risk factors of LBW in Dadra and Nagar Haveli (DNH). The finding of this study would be helpful to stakeholders in planning and implementing effective maternal and child health interventions for reducing LBW. This study was conducted in DNH to estimate prevalence and risk factors of LBW among newborns.

Methods

Study design, period, and setting

It was a cross-sectional study conducted in the district of DNH from November 2021 to January 2022. DNH is a district of the Union Territory, wedged between Gujarat and Maharashtra. As per census 2011, the DNH has a population of 3,43,709; among them 1,93,760 were male and 1,49,949 were female. The literacy rate of DNH is 76.24%.[11]

Study participants

The mothers who were registered and delivered at Government Health Facilities of DNH within last 30 days from the start of study and willing to participate were included in the study.

Sample size

A sample size of 359 was calculated using the statistical formula $4pq/E^2$ (where, P = hypothesized % frequency of outcome factor in the population, q = 1-p, E = allowable error) taking prevalence of LBW from the Health Management Information System (HMIS) in year 2019–2020 of DNH as 34%,[10] confidence interval as 95%, and allowable error as 5%.

Sampling, recruitment, and data collection

Permission was obtained from Directorate Medical Health Services (DMHS) of DNH & DD to conduct this study. Mothers who were registered under various PHCs/UPHCs/CHCs of DNH constituted the sampling frame for the present study. In DNH, there are total 13 government health facilities (which include 9 Primary Health Centres, 2 Urban Primary Health Centres and 2 Community Health Centres) that are functioning and all of them were included in the study. The 28 recently delivered mothers from each government health facility were selected. Flowchart defining the sampling methods can be found in Figure 1.

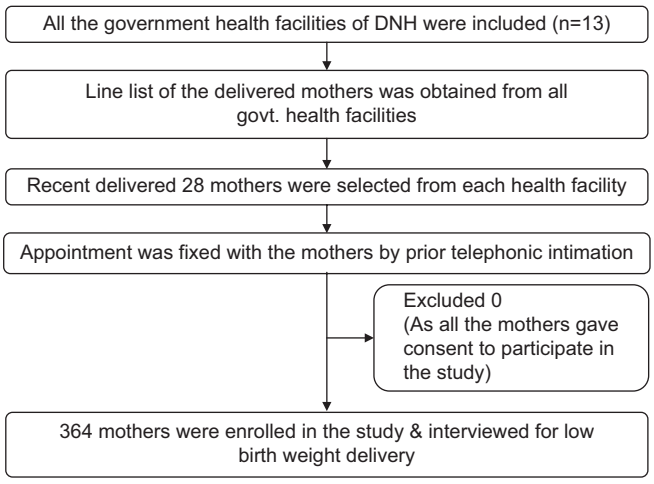

Figure 1: Flow Chart Describing Sampling Methods of Mothers of DNH District, UT of DNH and DD

After the selection of recently delivered mothers, telephonic calls were made to mothers to arrange visits with them. If a mother was not available on the date of survey, then next recently delivered mother was selected for the survey purpose. All interviews were conducted in a local language and at a place and time convenient to the participant.

Data collection tool

Pre-designed, pre-tested, semi-structured proforma was used to collect the information of mothers.

Variables and definition

The outcome variable was a dichotomous variable (LBW or normal birth weight). The predictors were the individual items such as caste, education of mothers, per capita income, socio-economic status, high-risk pregnancy, birth order, birth space, anemia, addiction, etc., For socioeconomic status, Modified Prasad's classification was used taking All India Consumer Price Index for Industrial Workers value of 124.9 for India in the month of October 2021[12].

Statistical analysis

Data entry was performed by Epi Info software version 7, (Bangalore, India) with appropriate data checks to avoid errors in data entry. The association between LBW and other categorical variables was tested using the Pearson Chi-square test and was expressed in odds ratio with 95% CI. Uni-variable regression analysis was performed for those variables with *P* value <0.05 on the Pearson Chi-square. The variables with <0.05 on uni-variable analysis were further included in multivariable analysis. The significant predictors were expressed as adjusted odds ratio (AOR) with 95% CI. The data were analyzed using Statistical Package for Social Sciences (SPSS) version 25 (Bangalore, India). The difference was said to be significant when *P* value was <0.05.

Ethical considerations

Approval was obtained from the Ethics Committee of NAMO Medical Education and Research Institute, Silvassa. Informed written consent was taken from the participants and they were counseled for post natal care, referral services, and alarming symptoms.

Institute Ethics Committee Clearance Certificate Number: DMHS/IEC/2016/214/6327

Results

Socio-demographic profile of the mothers

Among the 364 mothers, 16 mothers (4.4%) were between the age group of 15 and 18 years and 13 mothers (3.6%) were in the age group of 35–38 years. Around 94% of the mothers were Hindu, 69.0% belonged to schedule tribe/schedule caste, 22.2% had live-in relationship, 18.0% had no formal education, and 69.8 were home makers [Table 1].

Characteristics of the participants

Among the selected mothers, 41.5% were primipara, 5.2% had less than four antenatal care (ANC) visit during their pregnancy, 45.3% were underweight at the time of ANC registration, 85.4% had weight gain less than 5 kg in second and third trimesters, and 33.8% of the mothers had high-risk pregnancy; out of the all high-risk pregnancy, 43.1% were identified as a high-risk pregnancy by healthcare workers and registered under healthcare facility; 38.5% had anemia, 83.0% were counseled for diet by healthcare workers, 26.6% had food taboos related to the pregnancy, and 70.9% had sedentary work pattern during pregnancy [Table 2].

Vaccination against coronavirus disease 2019 (COVID-19) was not taken by 89.3% of the mothers, while Td vaccine was taken by all the mothers. Consumption of less than 30 folic acid, less than 180 IFA, and less than 360 calcium tablets were seen in 14.3%, 18.1%, and 74.2% of the mothers, respectively, while all the mothers had taken albendazole. Around 28.3% of the mothers had on an average less than 8 hrs of sleep, while 34.6% of the mothers had on an average less than 2 hrs of day rest.

Out of all the multi-para mothers, 33.8% of the mothers had complication in previous pregnancy, 10.4% deliveries were pre-term, 88.7% deliveries were conducted in government health facility, 39.0% were LBW deliveries, and 51.4% newborns were male [Table 3].

Association of various predictors and low birth weight outcome

On uni-variable logistic regression, live-in relationship, caste, weight of mother, body mass index (BMI), weight gain <5 kg in second and third trimesters, high-risk pregnancy, complication present in previous pregnancy, preterm delivery, and newborns requiring hospitalization after delivery had a *P* value <0.005 and were included in multi-variable logistic regression [Table 4].

On multi-variable logistic regression, weight gain <5 kg in second and third trimesters, high-risk pregnancy, and newborns requiring hospitalization were significantly predicting LBW among newborns. Weight gain <5 kg in second and third trimesters was associated with a two (95% confidence interval, CI 1.007–4.2) times higher odds, having high-risk pregnancy was associated with a 1.9 (95% CI 1.1–3.0) times higher odds and newborns requiring hospitalization after delivery were associated with a 3.4 (95% CI 1.9–6.0) times higher odds of having LBW than their counterparts.

Table 1: Socio-demographic Profile of the Selected Mothers during November 2021-January 2022 in DNH District (*n*=364)

Socio-demographic profile	Number (%)
Age	
15-22 years	140 (38.5)
23-30 years	192 (52.7)
31-38 years	32 (8.8)
Hindu (vs others)	342 (94.0)
Schedule tribe/schedule caste (vs others)	251 (69.0)
Married (vs live in relationship)	283 (77.8)
Education of mothers	
Illiterate	66 (18.0)
Schooling	262 (72.0)
Graduation and above	36 (10.0)
Working mother (vs homemaker)	110 (30.2)
Education of fathers	
Illiterate	25 (6.9)
Schooling	284 (78.0)
Graduation and above	55 (15.1)
Occupation of father	
Agriculture/labour	221 (60.7)
Job	135 (37.1)
Unemployed	8 (2.2)
Modified Prasad socioeconomic class IV (vs others)	110 (30.2)
Joint family (vs nuclear/three generation)	221 (60.7)

Table 2: ANC Component of the Selected Mothers during November 2021-January 2022 in DNH District (*n*=364)

Antenatal care (ANC) component	Number (%)
Primi-para (vs multi-para)	151 (41.5)
Less than 4 ANC visits (vs 4 visits and more)	19 (5.2)
≤ 140 cm height of the mother (vs >140 cm height)	8 (2.2)
≤ 40 kg pre-conception weight of the mother (vs >40 kg weight)	134 (36.8)
BMI-underweight (vs normal/overweight)	165 (45.3)
< 11 kg weight gain during pregnancy (vs >11 kg weight)	317 (87.1)
< 5 kg weight gain during 2nd & 3rd trimester (vs >5 kg weight)	311 (85.4)
High-risk pregnancy (vs non-high-risk pregnancy)	123 (33.8)
High-risk pregnancy identified as a high-risk in healthcare facility (*n*=123)	53 (43.1)
H/o no addiction during pregnancy (vs addiction)	362 (99.5)
H/o major disease* present during pregnancy (vs no major disease)	19 (5.2)
H/o illness developed** during pregnancy (vs no illness)	151 (41.5)
Anaemic mother (vs non-anaemic)	140 (38.5)
Counselled for diet by Health care worker (vs not counselled)	302 (83.0)
≥3 meals per day during pregnancy (vs <3 meals)	334 (91.8)
Taken extra diet*** during pregnancy (vs regular diet)	246 (67.6)
Food taboos/restriction during pregnancy (vs no taboos)	97 (26.6)
Sedentary work intensity (vs moderate intensity)	258 (70.9)
Continuation of work during pregnancy (*n*=110)	
Left work after detection of pregnancy	14 (12.7)
1st trimester	57 (51.8)
2nd trimester	09 (8.2)
3rd trimester	30 (27.3)
Stress**** felt by mothers during pregnancy (vs no feeling of stress)	48 (13.2)
Victim of physical violence during pregnancy (vs no physical violence)	11 (3.0)

*Major disease- hypertension, diabetes mellitus, tuberculosis, thyroid, HIV/AIDS, heart/kidney disease, sickle cell anemia, thalassemia, etc. **Illness developed- anemia, malaria, syphilis, urinary tract infection, thyroid, tuberculosis, pregnancy induced hypertension, etc. ***Extra diet- fruits, milk, etc. ****Stress- mode of delivery of the current pregnancy, history of previous abortion or death of the previous child, conceived this pregnancy after taking the treatment of infertility, COVID pandemic, etc.

Discussion

The prevalence of LBW among the newborns in this study was 39.0% (95% CI 34%–44%). Study from Bangalore (South India) [2] reported the lowest prevalence (14.6%) of LBW among the newborns. The study from Haryana (North India)[3] and secondary analysis from NFHS-4[4] reported the prevalence of LBW as, 17% and 17.5%, respectively, while the other two secondary analysis from NFHS-4[5,6] observed the prevalence of LBW as about 18.2%. The studies from Kolkata (East India)[7] and Karnataka (South India)[13] reported the prevalence of LBW as, 21.4% and 22.9%, respectively. The study from South India[9] and HMIS report of government of DNH observed the prevalence of LBW as, 31.3% and 34.1%, respectively, which was very close to the present study. Majority of the studies observed the lower prevalence than the present study. The discrepancies of the findings with the present study might be because the present study was conducted in the district which has major tribal population.

Table 3: Characteristics of the Selected Mothers during November 2021-January 2022 in DNH District (*n*=364)

Characteristics of the selected mothers	Number (%)
Details of previous pregnancy (*n*=213)	
Complication in previous pregnancy	
Low birth weight	13 (6.2)
LSCS	23 (10.8)
Pre term delivery	5 (2.3)
Severe anaemia	5 (2.3)
Abortion	17 (8.0)
Combination of above mentioned complication	9 (4.2)
Outcome of previous pregnancy	
Live birth	192 (90.1)
Still birth	4 (1.9)
Abortion	17 (8.0)
Intra natal care component	
Pre-term delivery (vs term/post term)	38 (10.4)
Delivery in government health facility (vs private/home delivery)	323 (88.7)
Normal delivery (vs assisted/LSCS)	263 (72.2)
Live birth outcome (vs still birth)	364 (100)
Low birth weight (vs normal birth weight)	142 (39.0)
Male gender of newborn (vs female)	187 (51.4)
Newborn required hospitalization after delivery	84 (23.1)
Reasons for newborn hospitalization (*n*=84)	
LBW	32 (38.1)
LBW with pre term delivery	17 (20.2)
Jaundice	24 (28.6)
Meconium aspiration	11 (13.1)
≤ 7 days of days of newborn hospitalization (vs >7 days) (*n*=84)	74 (88.1)
Details of family planning	
Birth order >2 (vs ≤2)	82 (22.5)
Birth interval ≤3 years (vs >3 years) (*n*=213)	121 (56.8)

The present study found a statistically significant difference between the mothers of schedule tribe caste, who had live-in relationship and LBW among the newborns. Our finding was supported by the secondary analysis from NFHS-4.[6] In this study, the major participants were from schedule tribe caste and as a custom of tribal culture, the young female tends to live with her male partner's family and once she delivered the baby, they used to get married. The societal ritual to prove female's fertility by giving birth at younger age to get married might be the reason for increase in the LBW among the tribal mothers who had live-in relationship.

In this study, a statistically significant association was found between BMI, weight of the mother at the time of pregnancy detection ≤40 kg, weight gain of mother in second and third trimesters <5 kg, and LBW. The study from the Kolkata[7] and secondary analysis from NFHS-4[5] found the same finding as the present study that the mothers with underweight had higher prevalence of LBW. The study from the East India[7] observed that the prevalence of low birth was higher among the mothers who had weight less than 45 kg at the time of pregnancy detection. The study from the Nepal[14] reported that the prevalence of LBW was higher among the mothers who had weight gain less than 6.53 kg in second and third trimesters. The study from Karnataka,[2] observed that the mothers who had weight gain less than 9 kg during the pregnancy had delivered LBW babies. The other studies from Hyderabad[8] and Karnataka[9] also reported that the mothers who had weight

Table 4: Uni-variable and Multi-variable Logistic Regression for Variables Predicting Low Birth Weight among Newborns during November-January 2021-2022 in DNH (*n*=364)

Variables	Uni-variable logistic regression		Multi-variable logistic regression	
	Crude OR (95%CI)	*P*	Adjusted OR (95% CI)	*P*
Live in relationship	1.9 (1.2-3.2)	0.008	1.4 (0.8-2.6)	0.247
ST/SC	1.6 (1.03-2.6)	0.036	1.1 (0.6-2.0)	0.715
Weight of mother ≤40 kg	2.6 (1.7-4.1)	<0.001	1.3 (0.6-2.8)	0.475
Underweight (BMI)	2.6 (1.7-4.0)	<0.001	1.9 (0.9-4.0)	0.081
Weight gain <5 kg in 2nd and 3rd trimester	1.9 (1.0-3.7)	0.045	2.0 (1.007-4.2)	0.048
High-risk pregnancy	1.9 (1.2-3.0)	0.003	1.9 (1.1-3.0)	0.014
Previous pregnancy complication	2.1 (1.2-3.8)	0.013	1.0 (0.9-1.0)	0.997
Preterm delivery	3.4 (1.7-7.0)	0.001	2.0 (0.9-4.3)	0.094
Newborn required hospitalization	3.9 (2.4-6.6)	<0.001	3.4 (1.9-6.0)	<0.001

gain less than 6 kg and 6.5 kg, respectively, had delivered LBW babies. Similarly, the study from South India[13] observed that the mothers who had weight gain ≤4 kg delivered LBW babies. Thus, encouraging the women to attain a healthy weight before conception and keep adequate weight gain during pregnancy is important to prevent LBW among the newborns.

In this study, the association between high-risk pregnancy and LBW was found statistically significant. The finding of the present study was supported by the several studies conducted in Hyderabad,[8] Karnataka,[13] Nepal,[14] Ethiopia,[15] and Jordan.[16] All these studies have also reported that the mothers with high-risk pregnancy (e.g., pregnancy-induced hypertension, twin birth, oligo-hydramnios, multi-gravida, and pregnancy with co-morbidity) were the significant risk factors for LBW.

The present study found the statistically significant association between the previous pregnancy complication and LBW among the newborns. The study from Karnataka[13] also reported significant association with the history of previous LBW delivery.

In this study, the association between the preterm delivery and LBW was found statistically significant. The finding was consistent with two studies conducted in Kolkata[7] and Nepal.[14] Thus the elevated risk of preterm birth demands increased attention to maternal health including the antenatal diagnosis and management of the other co-morbidities to prevent LBW among the newborns.

On multi-variable logistic regression, the present study predicted that variables such as weight gain of mother <5 kg in second and third trimesters, high-risk pregnancy, and newborns requiring hospitalization after delivery were significantly associated with LBW among the newborns. This finding of the study was supported by the following studies. Multivariate analysis from the Karnataka[2] showed significant association of birth weight with maternal pregnancy weight gain. The study from the Nepal[14] observed that maternal weight gain during second and third trimesters less than 6.53 kg (AOR 2.6, CI: 1.5–4.7) and co-morbidity during pregnancy (AOR 2.4, CI: 1.3–4.5) were the risk factors associated with LBW. The other study from the Ethiopia[15] also reported that pregnancy-induced hypertension [AOR 6.955; 95% (2.386–20.275)] was the predictor for LBW.

Conclusion

We conclude from the study that the prevalence of LBW among the newborns was high. The finding of the study indicates that several maternal factors such as marital status, caste, weight of the mother at the time of pregnancy, BMI, weight gain during pregnancy, high-risk pregnancy, preterm delivery, etc., were significantly associated with LBW among the newborns. There is a need to address maternal and child health issues like LBW, malnutrition, and high-risk pregnancy under the RMNCHA + N program through various effective interventions. Future research should evaluate the feasibility of collaborative activities between RMNCHA + N program and the UNICEF in India.

Limitations

Information bias and recall bias might have affected the result as response of mothers might not be completely reliable. However, to minimize the chances of recall bias, recently delivered mothers were interviewed and interviews were conducted in vernacular language at their convenient time and place providing enough time to retrieve all the information required. The information provided by the participants was also verified with the records available in mother and child protection card, whenever available.

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Conflicts of interest

There are no conflicts of interest.

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