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Low Birth Weight of Newborns and Its Association with Demographic and Socio-economic Determinants: Findings from Multiple Indicator Cluster Survey (MICS) Bangladesh 2019

Md. Nure Alam Siddiqi[1*], Abdul Muyeed[2], Md. Nuruzzaman Haque[3], Md. Abdul Goni[3], Supti Chakrabarty Shadhana[4]

[1] Lecturer, Department of Population Science, Jatiya Kabi Kazi Nazrul Islam University, Trishal, Mymensingh-2224, Bangladesh.
[2]Lecturer, Department of Statistics, Jatiya Kabi Kazi Nazrul Islam University, Trishal, Mymensingh-2224, Bangladesh.
[3]Professor, Department of Population Science and Human Resource Development, University of Rajshahi, Rajshahi, Bangladesh.
[4]M Sc. Student, Department of Statistics, Islamic University, Kushtia-7003, Bangladesh.

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Abstract

Background: *Low birth weight (LBW) is considered as one of the major public health problems which is an important determinant of morbidity and mortality among newborn babies in Bangladesh. This study aimed to examine the current prevalence of LBW and its association with different socio-economic and demographic determinants in the context of Bangladesh.*

Methods: *The cross-sectional data for this study were extracted from the multiple indicator cluster survey (MICS) Bangladesh 2019, which was carried out in 2019 by the Bangladesh bureau of statistics (BBS) in collaboration with UNICEF Bangladesh, as part of the global MICS program. To examine the association of LBW with other selected determinants, Chi-square ($\chi 2$) test was performed and a logistic regression model was used to explore the net effect of determinants on LBW using odds ratio (OR).*

Results: *Using the sub-sample of nationally representative data, the study reveals that the prevalence of LBW in Bangladesh was 13.6%. The highest prevalence of LBW was found among mothers whose ages were less than 20 years, who did not receive prenatal care, who were not educated, who were from poor socio-economic conditions. LBW was also severe among infants with the highest birth order and multiple births. This study also identified the mother's age at the time of childbirth, the status of receiving prenatal care, type of birth (single or multiple), birth order, educational status of the mother, wealth index, and place of residence are the most important determinants that are significantly associated with LBW status of newborns.*

Conclusions: *This study suggests that the Government should take necessary initiatives to address the risk factors which are responsible for the high prevalence of LBW in Bangladesh. This study will also deliver the degree of success in public health policy in Bangladesh and aims to help outline future tactics to lessen the prevalence of LBW.*

Keywords: Low birth weights, Multiple indicator cluster survey (MICS), Bangladesh.
***Corresponding to:** Md. Nure Alam Siddiqi, **Email:** nurealam_rasel@yahoo.com
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Introduction

One of the important and most studied variables in the field of public health is birth-weight all over the world which is an influential determinant of a child's survival. There is a reverse relationship between birth-weight and infant mortality and the mean birth-weight is related to child mortality.[1] If a child's weight at birth is below 2500g then it is regarded as low birth weight (LBW).[2] Approximately, 15% to 20% of infants are born globally with below 2500g (5.5lb) weights, above 95% of these babies are born in low and middle-income countries.[3] Beyond 20 million babies are born worldwide each year with LBW which represents 15.5% of births and 95.6% of them are born in developing countries.[4] The LBW fluctuates significantly around the world such as 28% of the LBW in south Asia which is the highest prevalence followed by 13% in sub-Saharan African countries, 9% in the Caribbean and Latin America, and 6% in the Pacific and Eastern Asia.[5] The goal has set on sixty-fifth world health assembly to reduce 30% of the infants globally born with a weight below 2500g by the year 2025.[6] The assembly targeted a roughly 3% relative decrease of LBW each year between 2012 and 2025 and decrease to 14 million with low weight at birth globally.[5] The LBW is a vital determinant of prenatal mortality and morbidity, and also found the risk of increasing fetal mortality, poor cognitive development, non-communicable diseases like diabetes mellitus type 2, and cardiovascular diseases in adulthood.[7,8] Many important research works have been directed to evaluate and recognize the determinants of LBW. Multiple factors affect LBW such as genetics, early induction of cesarean birth, multiple pregnancies, drug abuse, maternal age, height, overweight, and obesity along with different socioeconomic factors, infections, and chronic conditions such as diabetes mellitus and hypertension.[9] Few more determinants have also been reported as birth spacing, antenatal care (ANC), anemia, genital infections, and stress.[10] The children with LBW have higher probabilities of dying within the first month of born or face sunned growth later.[11] It is very essential to figure out the populations and determinants that are at the greatest risk of LBW for preventing these situations. Widespread global policy is indispensable to lessen the rates of LBW in the early interventions which comprise improving maternal nutritional status, threatening preeclampsia, providing adequate maternal care, perinatal clinical services, and social support, affordable and accessible health care.[5] As life expectancy at birth is being increased with demographic change in developing countries, an increased economic and disease burden can be caused by the children born with LBW.[12,13] Thus LBW has treated a global warning for developing countries which hampers child development.[14,15] Early pregnancy associated with early marriage is often identified as a significant determinant in the birth of a child with LBW in most of the developing countries.[16-19]

The LBW is a global concern here and now especially in low and middle-income countries like Bangladesh. Early marriage women are an important determinant of child LBW and according to the United Nations children's fund (UNICEF, 2017), about 59% of women in Bangladesh get married before 18 years of age. Many of the early married girls get conceived in their teens. Approximately 19.9% of babies are born with LBW in Bangladesh and 20.8% in rural Bangladesh.[20] More than one million babies are born with LBW in Bangladesh annually, which is a great alarm since child mortality and LBW are associated.[21] Although there was extensive progress in health sectors, the state of LBW was almost the same in Bangladesh over time. According to the national low birth weight survey (NLBWS) of Bangladesh conducted in 2003-2004, about 36% of total babies were estimated born with LBW where 29% found in urban areas and the LBW decreased to 22.6% in 2015 in Bangladesh.[22]

The reduction of LBW for a country is indispensable to attain sustainable development goals (SDGs) and which determinants that influence LBW are essential to identify to reduce the prevalence of LBW. The determinants that have a significant impact on LBW can be split into demographic and socioeconomic in the Bangladesh context. Identifying influential determinants of LBW is also a crucial step for designing national management strategies to minimize infant mortality. Preventing the determinants that influence the LBW can reduce infant morbidity and mortality[23] but the individual influence of each of the determinants on LBW is quite arguable. There are a few research have been conducted to identify the associated determinants of LBW in the perspective of Bangladesh using nationally representative Bangladesh demographic and health survey (BDHS) data. But no study has been conducted to identify socioeconomic and socio-demographic determinants of LBW in the context of Bangladesh using multiple indicator cluster survey 2019 (MICS 2019) data. We designed this study to explore the current prevalence of LBW and to identify the most influential determinants of LBW in the population of Bangladesh using nationally representative MICS-2019 data. So this study aimed to examine the current prevalence of LBW and its association with different socio-economic and demographic determinants in the context of Bangladesh. This study will deliver the degree of success in public health policy in Bangladesh and aims to help outline future tactics to lessen the prevalence of LBW.

Materials and Methods

The cross-sectional data for this study were extracted from the multiple indicator cluster survey (MICS) Bangladesh 2019, which was carried out in 2019 by the Bangladesh bureau of statistics (BBS) in collaboration with the United Nations children's fund (UNICEF) Bangladesh, as part of the global MICS Programme. Technical support for this survey was provided by UNICEF and UNFPA Bangladesh and has also provided the financial resource to undertake quality assurance visits during data collection. The nationally representative data were collected from January to June 2019. The population sample for this survey was designed to provide estimates for various health indicators on the situation of children and women at the national level. Following a two-stage stratified cluster sampling method, data for this survey were collected from the household level and the sampled household was 64,400. A sub-sample of 4,493 women between ages15 to 49 years (excluding missing values concerning dependent and explanatory variables) were selected for this study, who had a live birth in the last two years preceding the survey whose most recent live-born child has a recorded or recalled birth weight. In this study, low birth weight (LBW) is defined as a birth weight less than 2,500 grams (g) regardless of gestational age, carries a range of grave health and developmental risks for children.

The ethical protocol of this survey was approved by the technical committee of the government of Bangladesh lead by the Bangladesh bureau of statistics (BBS). Verbal consent about the interview and questionnaire was obtained for each respondent who participated in the survey. Details about the sampling design, standard questionnaire, and data collection procedure are available in the final report of 2019 MICS.[24]

All newborns with birth weight less than 2,500 gm were categorized as low birth weight (LBW) and newborns with birth weight 2,500 gm or more were categorized as non-low birth weight (n-LBW) or normal birth weight which is considered as the dependent or outcome variable for this study. In this study, several socio-economic and demographic determinants are assessed as independent or explanatory variables which are mother's age at birth, mother' age at first marriage, Educational qualification of the mother, place of delivery, place of residence, received prenatal care, type of birth, birth order, wealth index, educational qualification of household head and place of administrative division.

All data and statistical analyses in this study were performed using the IBM SPSS for Windows ver. 23.0 (IBM Corp., Armonk, NY, USA). Descriptive statistical analysis was performed to characterize the study population in relation to explanatory variables. To examine the association of low birth weight (LBW) with other selected determinants, the bivariate statistical technique, Chi-square ($\chi 2$) test was performed. The Chi-square test is an important test to measure whether the determinant is significantly associated or not with the target variable. To assess the net effect of various factors on low birth weight, multivariate binary logistic regression analysis was conducted. For convenient understanding and easy interpretation, the result of logistic regression has been presented by odds ratio (OR) with 95% confidence interval (CI).

Results

Table 1 represents an overview of the birth weight status of newborns according to different demographic and socio-economic characteristics of the study population. The overall prevalence of low birth weight (LBW) in Bangladesh was found 13.6%. The highest prevalence of LBW at birth was found among young mothers (16.5%) whose ages were below 20 years, among early married mothers (14.8%) who were married before the age of 18, and mothers whose place of delivery was at home (18.4%). In this study, the prevalence of LBW was found high among mothers who did not experience prenatal visits (13.4%), having multiple births (48.9%) and mothers with birth order 7 or higher (60%). Female children (14.3%) were more likely to be LBW than their male counterparts are observed in the present study. The study findings explore that, mothers with higher secondary or higher education (10.6%), the household headed by a person with secondary or higher education (11.8%) experienced a lower prevalence of LBW of their babies at the time of birth. It is also evident from the study that, LBW was more prevalent among

children from households with the poorest wealth index (17.5%) and mothers living in urban areas (16.5%). LBW was found to vary greatly by the geographic division of the country and Chattogram division (17.8%) shows the highest prevalence of LBW babies whereas lowest prevalence was reported in Khulna division (9.8%).

Table 1. Birth weight status of newborns according to demographic and socio-economic characteristics

Socio-economic and demographic variables	Birth weight status		Chi-square value
	Normal birth weight (%)	Low birth weight (%)	
Mother's age at birth			
–<20	954(83.5)	188(16.5)	
–20-34	2727(87.3)	395(12.3)	10.718 ***
–35 or above	201(87.8)	28(12.2)	
Mother' age at first marriage			
–<18	2164(85.2)	377(14.8)	7.626***
–18 or above	1718(88.0)	234(12.0)	
Received prenatal care			
–Yes	3673(86.6)	567(13.4)	3.282*
–No	209(82.6)	44(17.4)	
Place of delivery			
–Delivery at home	271(81.6)	61(18.4)	
–Delivery at govt. institution	985(85.1)	172(14.9)	11.056***
–Delivery at private clinic, NGO or others	2622(87.5)	375(12.5)	
Type of birth			
–Single	3858(86.8)	588(13.2)	50.478***
–Multiple	24(51.1)	23(48.9)	
Sex of child			
–Male	2037(87.0)	304(13.0)	1.563
–Female	1845(85.7)	307(14.3)	
Previous birth interval			
–First Birth	2039(86.1)	330(13.9)	
–<2 years	60(81.1)	14(18.9)	3.316
–2-3 years	170(85.0)	30(15.0)	
–4 or 4+ years	1613(87.2)	237(12.8)	
Birth order			
–1	2039(86.1)	330(13.9)	
–2-3	1663(87.3)	242(12.7)	12.576**
–4-6	178(83.2)	36(16.8)	
–7 or 7+	2(40.0)	3(60.0)	
Educational status of mother			
–Pre-primary or no education	137(84.0)	26(16.0)	
–Primary	514(81.3)	118(18.7)	23.660***
–Secondary	2140(86.4)	337(13.6)	
–Higher secondary or higher	1091(89.4)	130(10.6)	
Educational status of household head			
–Pre-primary or no education	834(83.7)	163(16.3)	
–Primary	1011(85.2)	176(14.8)	14.444***
–Secondary or higher	2037(88.2)	272(11.8)	
Number of house hold member			
–4 or less	1512 (86.7)	232(13.3)	
–5-9	2173(86.2)	347(13.8)	0.220
–10 0r more	197(86.0)	32(14.0)	
Wealth index			
–Poorest	453(82.5)	96(17.5)	
–Second	662(86.2)	106(13.8)	
–Middle	793(87.7)	111(12.3)	9.250*
–Fourth	952(87.3)	138(12.7)	
–Richest	1022(86.5)	160(13.5)	
Place of residence			
–Urban	914(83.5)	180(16.5)	10.028***
–Rural	2968(87.3)	431(12.7)	
Division			
–Barishal	256(86.8)	39(13.2)	
–Chattogram	629(82.2)	136(17.8)	
–Dhaka	868(84.4)	160(15.6)	
–Khulna	788(90.2)	86(9.8)	31.101***
–Mymensingh	157(86.7)	24(13.3)	
–Rajshahi	455(89.7)	52(10.3)	
–Rangpur	504(85.7)	84(14.3)	
–Sylhet	225(88.2)	30(11.8)	
Total	**3882(86.4)**	**611(13.6)**	

Note. *** Significant at P<0.01. ** Significant at P<0.05. * Significant at P<0.10

Table 1 also shows the association of different socioeconomic and demographic determinants with LBW (applying Pearson's chi-square test) and we observed a statistically significant association between LBW of babies and mother's age at birth, mother's age at first marriage, the status of receiving prenatal care, place of delivery, type of birth, birth order, educational qualification of mother and household head, wealth index, type of place of residence and place of the administrative division of the country. Out of all the explanatory variables, three variables show statistically insignificant association with LBW of newborns, they are sex of the child, previous birth interval, and the number of household members. All the explanatory variables which showed statistically significant association with LBW of babies from Pearson's chi-square test were further analyzed in Logistic regression models to establish associations between all independent variables and dependent variable (LBW) and to obtain odds ratio (OR). The results of logistic regression analysis are shown in table 2.

Table 2. Regression model for low birth weight

Explanatory variables	Coefficient (β)	Odds ratio (OR)	P.Value	95% CI of OR
Mother's age at birth				
–<20	0.559	1.749	0.044*	1.014-3.016
–20-34	0.311	1.365	0.196	0.852-2.186
–35 or above (RC)	-	1.00	-	-
Mother' age at first marriage				
–<18	0.20	1.127	0.270	0.911-1.395
–18 or above (RC)	-	1.00	-	-
Received prenatal care				
–Yes (RC)	-	1.00	-	-
–No	0.190	1.209	0.292	0.849-1.722
Place of delivery				
–Delivery at home	0.356	1.428	0.027**	1.041-1.958
–Delivery at govt. institution	0.106	1.112	0.308	0.907-1.365
–Delivery at private clinic, NGO or others (RC)	-	1.00	-	-
Type of birth				
–Single (RC)	-	1.00	-	-
–Multiple	1.983	7.261	0.000***	4.013-13.138
Birth order				
–1	-2.602	0.074	0.006***	0.012-0.477
–2-3	-2.639	0.071	0.005***	0.011-0.454
–4-6	-2.468	0.085	0.010***	0.013-0.548
–7 or 7+ (RC)	-	1.00	-	-
Educational status of mother				
–Pre-primary or no education	0.083	1.087	0.754	0.646-1.827
–Primary	0.462	1.587	0.005***	1.152-2.184
–Secondary	0.166	1.180	0.182	0.925-1.505
–Higher secondary or higher (RC)	-	1.00	-	-
Educational status of household head				
–Pre-primary or no education	0.273	1.314	0.023**	1.038-1.662
–Primary	0.166	1.180	0.146	0.944-1.476
–Secondary or higher (RC)	-	1.00	-	-
Wealth index				
–Poorest (RC)	-	1.00	-	-
–Second	-0.225	0.799	0.156	0.586-1.089
–Middle	-0.342	0.710	0.033**	0.518-0.973
–Fourth	-0.266	0.766	0.095	0.560-1.048
–Richest	-0.274	0.761	0.122	0.537-1.076
Place of residence				
–Urban	0.415	1.514	0.000***	1.216-1.884
–Rural (RC)	-	1.00	-	
Division				
–Barishal	0.160	1.173	0.555	0.690-1.996
–Chattogram	0.516	1.675	0.020**	1.083-2.589
–Dhaka	0.315	1.371	0.150	0.892-2.106
–Khulna	-0.180	0.835	0.447	0.525-1.328
–Mymensingh	0.019	1.019	0.951	0.561-1.852
–Rajshahi	-0.166	0.847	0.512	0.515-1.391
–Rangpur	0.120	1.127	0.618	0.704-1.805
–Sylhet (RC)	-	1.00	-	-

Note. *** Significant at P<0.01. ** Significant at P<0.05, RC- Reference Category

Discussion

LBW is considered as one of the major public health problems which is an important determinant of morbidity and mortality among newborn babies in Bangladesh.[25] Findings of the study showed that almost one out of every eight babies born in Bangladesh experienced LBW. Although the prevalence of LBW is declining in Bangladesh, it remains high. According to our study, the risk of having LBW newborns is high among mothers whose age at birth is below 20 years and over 35 years. Table 2 reveals that the odds of experiencing LBW among young mothers (<20 years) is 1.749 times and among mothers of age group 20-24 is 1.365 times higher than those mothers whose ages were 35 or over. Similar results have been found in previous such national and international studies.[16,26-28] This study also found a significant association between LBW and mother's age at first marriage. it is observed that the odds of giving birth to LBW babies among mothers whose first age at first marriage were 18 or above is 1.127 times higher than those mothers whose first age at marriage were less than 18 years. These findings are consistent with those of another study conducted in Bangladesh.[29] The early married young mothers are facing a variety of problems during pregnancy including nutritional deficiency which results in delivering to a baby with LBW.

Prenatal care is an effective way by which the prevalence of LBW can be reduced efficiently.[30] There is a positive association was found between the birth weight of infants and receiving prenatal care in this study. The result of the regression model shows that the risk of having LBW babies among mothers who did not receive prenatal care is 1.209 times higher than those mothers who received prenatal care and such a result is in line with other several studies.[10,31,32] In this study, an increased risk of having LBW babies was observed among mothers whose places of delivery were at home as compared to mothers whose places of delivery were at the different public hospital, private clinic, or other institution. A recent study conducted by Ahammed B et al. (2020)[33] on newborn babies of Nepal reported that twin children as an important predictor of LBW and our study also identified multiple births as the most important determinant of LBW. The result of logistic regression analysis shows that multiple births experienced LBW 7.261 times higher than single births. Higher birth order is also found as a risk factor of LBW in this study. Children with lower birth order had a significantly lower likelihood of LBW than children with birth order 7 or higher.

A mother's educational qualification has a great influence on a newborn's health status. Educated mothers are very much conscious about their upcoming baby and also about their health during pregnancy. As a result LBW babies are less common among educated mothers. From table 2, it is observed that pre-primary or no educated mothers have 1.087 times, primarily educated mothers have 1.587 times and secondary educated women have 1.180 times higher odds of having LBW newborns than mothers with higher secondary or higher education. A similar result was found for the educational qualification of household head and the findings are consistent with those of similar several other studies.[22,26]

The current study found that a household with better economic conditions was less likely to experience LBW babies as compared to a household with a poor economic condition. Findings of this study show that a household with wealth index category second, middle, rich and richest have 20%, 29%, 23%, and 24% respectively lower risk of having LBW babies than a household with poorest wealth index and such result is in contrast with several other studies.[33-35] The present study observes a higher prevalence of LBW among children from urban areas than children from rural areas. A study was done by Khan JR (2018)[22] observed that LBW was varied greatly by geographic division and the findings of the present study are also confirming these results, shows a regional variation in the LBW prevalence among the administrative divisions of the country.

This study identified significant demographic and socio-economic determinants that are associated with the LBW of newborns in Bangladesh. Using the nationally representative data, the present study confirms that mother's age at birth, the status of receiving prenatal care type of birth (single or multiple), birth order, and educational status of the mother, wealth index, and place of residence are the most important determinants that significantly influence the birth status of newborns. This study suggests that the Government should take necessary initiatives to address the risk factors which are responsible for the high prevalence of LBW in Bangladesh. Besides, this study also recommends, the Government along with Non-Government organizations should implement a community-based national intervention program aimed at improving maternal and child health with special attention given to prenatal care, safe motherhood, and safe delivery. In addition to health promotion programs, ongoing national policies and programs should be strengthened to improve the educational status and other socio-economic and demographic conditions of women.

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Conflict of Interest

The authors declare that they have no conflict of interest.

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