Birth Weight and Late Neonatal Mortality & Morbidity in Bangladesh

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Cite this as:
BMCJ 2022; 8(1): 5-11

Received: 19 May 2021
Accepted: 20 October 2021

Abstract

Background: Low Birth Weight is probably the single most risk factor that contributes to a range of poor health outcomes. **Objective:** To evaluate the impacts of different grades of birth weight on late neonatal morbidity and mortality. **Methods:** This was a prospective cohort study conducted among the singleton full-term normal newborns delivered in Rajshahi Medical College Hospital, Rajshahi, Bangladesh. Initially seven hundred and seventy newborns were selected within 1 hour after birth for this study by stratified sampling from three birthweight strata (≤2, >2 to <2.5 and ≥ 2.5 kg) to ensure the proper representation of each stratum on the basis of their proportions[7] in Rajshahi district.Out of 770 neonates, 17 neonates were drop out and 7 neonates were died during their early neonatal period. So the sample size of the study was 746 of this follow up study during late neonatal period. Data were collected by a pretested structured questionnaire at the end of 1st and 4th week by hospital or domiciliary follow-up. One-way ANOVA test and multiple linear regression analyses were applied to find the association of different grades of birth weight with incidence of morbidities. **Results:** Out of 746 neonates, total 3 neonates were died during late neonatal period, all were due to respiratory infection. Total spells of morbidity during follow up period was 243. Incidence of acute respiratory tract infection (ARI) was the highest,177(72.84%) during that period.The mean episode of ARI of the neonates having birth weight ≤2 kg was statistically significant than that of the other groups of birth weight. But the mean episode of ARI of the neonates having birth weight > 2 to < 2.5 kg and ≤2.5 kg were not significantly different. **Conclusion:** Having birth weight ≤2 kg is a sensitive and effective predictor for identifying the high-risk baby in late neonatal period. Pediatricians in Bangladesh should take into special care nurseries, babies with a birth weight of 2kg or less.

Key words: lowbirth weight, late neonatal morbidity, respiratory tract infection

Introduction

Traditionally, birth weight is regarded as one simple measure of pregnancy outcome. It is a reliable indicator of foetal well being and maturity.[1] Birth weight is used as a yardstick of maturity.[2] The birth weight of a newborn baby is probably the single most important factor that affects its survival and quality of life. [3,4]

There is a lot of debate regarding the cut-off value of the birth weight, which is the risk for higher morbidity and mortality of newborns.[5] WHO fixed 2.5 kg as an universal cut-off point of birth weight for the risk i.e. LBW.[6] But it does not seem to be convenient for all the countries. As genetic and environmental factors are also important determinants of LBW, therefore birth weight may varies from region to region, country to country even within different areas of the same country. Some researchers also have questioned whether the criterion for LBW should be different for different populations and should be revised.[1,7] However, Individual countries often choose alternative cut-off values, which are convenient to them. Bangladeshi researchers evaluate the cut off value (<2.5 kg) of LBW and suggested ≤2 kg is the criterian of LBW. Indian scientists assessed it by maturity, respiratory distress and feeding problems that 2 kg or less should be taken as the criterion of Indian infants.[8] But most of the evaluative studies focused on early neonatal, neonatal and post neonatal period but not specifically on late neonatal (>7 - ≤28 days of their birth)morbidity and mortality.

In this study researchers are intendant to evaluate ≤2 kg as a risk factor of late neonatal morbidity and mortality.

Methods

This was a prospective cohort study conducted among the singleton full-term normal new borns delivered in Rajshahi Medical College Hospital, Rajshahi, Bangladesh. Seven hundred and seventy newborns were selected within 1 hour of their birth for this study by stratified sampling from three birth weight strata (≤2, >2 to <2.5 and ≥ 2.5 kg) to ensure the proper representation of each stratum on the basis of their proportions[9] in Rajshahi district. Data were collected weekly interval by a pretested structured questionnaire during their late neonatal period (>7 - ≤28 days of their birth) by hospital or domiciliary follow-up.

The Questionnaire was designed to record birth weight, maternal age, maternal occupation, maternal educational status, monthly family income, newborn' gender, birth order, neonate's feeding status, mortality and morbidity. If any one of them indicated the baby as preterm (gestational age <37 weeks), then he/she was excluded from the study. The gestational ages of the new borns were confirmed by clinical examination scoring on the conditions of their skin texture, skin colour, chest size and whether the ears were hard or soft when palpated.[10] Birth weight of the neonates were collected from the hospital records. The information regarding mother's age, occupation, educational status, monthly family income, newborn's gender and birth order were collected by interview of the mothers at any convenient time and place during the follow-up. The newborns' health and breast-feeding status were closely monitored by the data collectors and information regarding these was collected by examination of the babies, by interviewing the mothers and consulting the doctors concerned. The neonates, who were discharged before 28 days, were visited at home at the end of their late neonatal life (28 days). If a neonate died while in hospital, an immediate verbal autopsy was sought and the diagnosis confirmed with attending doctors. Death at home was assessed by the principal investigator, who conducted a verbal autopsy by parental interview. The verbal autopsy method used a format developed by a WHO advisory team and allowed for 15 causes of death, including a category for unknown causes.[11] Data analysis involved simple descriptive

as well as analytical techniques. One-way ANOVA test was applied to find the association of different grades of birth weight with incidence of morbidities. Multiple linear regression analyses was carried out to determine the independent effects of different grades of birth weight on late neonatal morbidity, taking account of some important factors such as maternal age, maternal educational level, maternal occupation, gender of the neonate, birth order of the neonate, family economic status and breast-feeding status.

Results

Table I. Mortality of the newborns during their late neonatal period (>7 - ≤28 days of their birth) among the different birth weight groups.

Level of Birth weight (Kg)	Living status		Total N (%)
	Alive N (%)	Dead N (%)	
≤ 2	133 (98.5)	2 (1.5)	135 (100.0)
> 2 to < 2.5	264 (99.6)	1 (0.4)	265 (100.0)
≥ 2.5	323 (100.0)	0(0.0)	323 (100.0)
Total	720 (99.6)	3 (0.4)	723 (100.0)

Out of 746 neonates, who were followed up during late neonatal period (>7 - ≤28 days of their birth), 23 neonates were dropped out due to leave the study area. Out of the rest 723 neonates, 3 were died due to acute respiratory tract infection during that period. Out of these 3 dead neonates, 2 were in the birth weight group of < 2 kg and 1 in the birth weight group of > 2 to < 2.5 kg (Table - I).

Table II. Causes of morbidity of the neonates during their late neonatal period.

Morbidity	Number	Percentage
Acute respiratory tract infection (ARI)	177	72.84
Diarrhea	50	20.57
Others	16	6.59
Total	243	100.00

Incidence of acute respiratory tract infection (ARI) among the neonates was the highest during their late neonatal period. Out of 243 spells of the total morbidity during that period, it was 177 (72.84%). Total spells of morbidity other than ARI and diarrhea was only 16. Out of these 16 spells of morbidity, 10 was due to skin problems, 4 due to conjunctivitis and 2 was due to jaundice (Table - II).

Table III. Incidence of morbidity among the neonates of different grades of birth Weight during their late neonatal period.

Level of birth weight (Kg)	Number n	Morbidity rate/100 neonates	Mean episodes of morbidity	F	significance between groups
≤ 2	133	61.00	.61[a]	14.968	.000
> 2 to < 2.5	264	28.00	.28[b]		
≥ 2.5	323	30.00	.30[b]		

Values in the same column not sharing common superscript letter were significantly ($p<0.05$) different.

During late neonatal period, morbidity rate (spells) was highest (61%) among the neonates having birth weight ≤2 kg. The mean episodes of morbidity among the birth weight group of ≤ 2 kg was significantly higher than the other two birth weight groups. But the mean episodes of morbidity of the two birth weight groups > 2 to < 2.5 kg and ≥ 2.5 kg were not differed significantly (Table III).

Multiple linear regression was run to assess the independent effects of birth weight on incidence of morbidity among the neonates having birth weight < 2.5 kg during late neonatal period considering 7 selected variables such as maternal age, Maternal education, maternal occupation, sex of the neonates, birth order, family income and breast

Table IV. Multiple linear regression: variables affecting the morbidity of the neonates having birth weight < 2.5 kg during late neonatal period. N = 397

Variables	Unstandarized coefficients		Standarized coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	.822	.273		3.005	.003
Maternal age	.178	.064	.155	2.767	.006
Maternal education	.03758	.095	.021	.396	.692
Maternal occupation	-.357	.201	-.090	-1.775	.077
Sex of neonates	-.042	.064	-.033	-.655	.513
Birth order	-.174	.057	-.169	-3.070	.002
Family income	-.113	.049	-.122	-2.304	.022
Breast feeding status	.373	.079	.238	4.728	.000
Level of birth weight 1=≤2 kg & 2 = >2 to < 2.5 kg	-.208	.066	-.157	-3.146	.002

R2 = .151

feeding status. All of these variables and their betas are shown in the above Table – IV. Breast feeding status (beta = .238) was the most important determinant of late neonatal morbidity. Birth weight (beta =-.157) also identified as an important determinant of late neonatal morbidity. Other significant determinants were birth order (beta = -.169), maternal age (beta = .155) and Family income (beta = -.122) (Table IV).

The independent effects of birth weight on incidence of morbidity among the neonates having birth weight ≤ 2 kg during late neonatal period considering 7 selected confounding variables. Of these variables, breast-feeding status (beta = .115) was the only determinant factor of late neonatal morbidity (Table - V).

Table V Multiple linear regression : variables affecting the morbidity of the neonates having birth weight > 2 kg during late neonatal period. N = 587

Variables	Unstandarized coefficients		Standarized coefficients	T	Sig.
	B	Std. Error	Beta		
Constant	.247	.191		1.291	.197
Maternal age	.009910	.052	.010	.190	.850
Maternal education	-.10	.064	-.069	-1.565	.118
Maternal occupation	-.046	.114	-.017	-.399	.690
Sex of neonates	.04764	.048	.041	.983	.326
Birth order	-.066	.044	-.073	-1.510	.131
Family income	-.009	.037	-.011	-.239	.811
Breast feeding status	.170	.062	.115	2.760	.006
Level of birth weight 1 = >2 to < 2.5 kg & 2 = ≥ 2.5 kg	.01751	.049	.015	.356	.722

R2 = .032

Table VI Incidence of acute respiratory tract infection (ARI) among the neonates of the different level of birth weight during their late neonatal life.

Level of birth weight (Kg)	Number n	Morbidity (due to ARI)rate/100 neonates	Mean episodes of morbidity due to ARI	F	significance between groups
≤ 2	133	40.00	.40[a]	8.999	.000
> 2 to < 2.5	264	21.00	.21[b]		
≥ 2.5	323	23.00	.23[b]		

Values in the same column not sharing common superscript letter are significantly ($p<0.05$) different.

The mean episodes of ARI in late neonatal period. It was highest (.40) among the birth weight group of < 2 kg and the lowest (.21) among the birth weight group of >2 to < 2.5 kg. The differences of mean episode of ARI between the groups of different level of birth weight were significant. The mean episode of ARI of the neonates having birth weight < 2 kg was statistically significant than that of the other groups of birth weight. But the mean episode of ARI of the neonates having birth weight > 2 to < 2.5 kg and > 2.5 kg were not significantly different (Table-VI)

Table VII: Incidence of diarrhea among the neonates of the different grades of birth Weight during their late neonatal life.

Level of birth weight (Kg)	Number n	Morbidity (due to diarrhea) rate/ 100 neonates	Mean episodes of morbidity due to diarrhea	F	significance between groups
≤ 2	133	18.00	.18[a]	13.628	.000
> 2 to < 2.5	264	4.55	.0455[b]		
≥ 2.5	323	4.95	.0495[b]		

Values in the same column not sharing common superscript letter are significantly ($p<0.05$) different.

The incidence rate of diarrhoea among the birth weight group of ≤ 2 kg was more than 3 times greater than that of other birth weight groups, > 2 to < 2.5 kg and ≥ 2.5 kg. The mean episode of diarrhoea of the neonates having birth weight ≤ 2 kg was statistically significant than that of the other groups of birth weight. But the mean episodes of diarrhoea of the neonates having birth weight > 2 to < 2.5 kg and ≥ 2.5 kg were not significantly different (Table -VII).

Table VIII: Incidence of others morbidity (other than ARI & diarrhea) among the neonates of the different grades of birth weight during their late neonatal life.

Level of birth weight (Kg)	Number n	Others morbidity (excluding ARI & diarrhea) rate/100 neonates	Mean episodes of morbidity due to other than ARI and diarrhea	F	significance between groups
≤ 2	133	3.01	.0301[a]	.306	.737
> 2 to < 2.5	264	3.79	.0379[a]		
≥ 2.5	323	2.48	.0248[a]		

Values in the same column sharing common superscript letter are not significantly different.

The mean episodes of others morbidity was highest (.0379) among the birth weight group of > 2 to < 2.5 kg and the lowest (.0248) among the birth weight group of ≥ 2.5 kg. There was no significant association of the birth weight with the incidence of others morbidity (Table VIII).

Discussion

The present study suggests that, birth weight ≤ 2 kg is independently associated with higher morbidity during late neonatal life. Birth weight>2kg has no individual effect on the occurrence of the morbidity. This report is also consistent with the findings of *Saha et al.*[12] *Saha et al.*[12] noticed an immune deficiency among the intrauterine growth retarded neonates (term babies having birth weight <2.5 kg). As these babies grew, the immunologic deficiency disappeared within short time in those who had birth weights of more than 2 kg (mild intrauterine growth retardation) and none of them gave history of infections. On the contrary, the babies with birth weight ≤ 2 kg (severe intrauterine growth retardation) continued to suffer from both humoral and cellmediated immune deficits. Thus they had repeated attacks of respiratory and intestinal infections and showed impaired growth.[13] Fortunately, in the Indian subcontinent more than 85% of LBW infants are term.[14] In Bangladesh it is more than 86%.[6,15] In India 90% of the deaths occurred in infants born with birth weight below 2 kg.[16] Unfortunately, there is insufficiency of such type of data in Bangladesh, yet similar type of trend also was observed in the studies of Hussain *et al.*[17] and Rahman *et al.*[15] In the study of Hussain *et al.*[17], it was reported that 80 % of the early neonatal death belong to the birth weight of < 2 kg in a rural community, Puthia. From the findingsof the different studies in Bangladesh and India, it is clear that having birth weight < 2 kg is a risk for newborns mortality and morbidity. The results of the present study also suggests that the infants of birth weight ≤ 2 kg has greater risk to develop morbidity and mortality than others birth groups >2 kg during late neonatal period. Furthermore, in this study, late neonatal

mortality and morbidity differences among the birth weight groups demonstrated were statistically tested. But mortality rate was too low due to study design. Much larger sample sizes would be required to apply statistical tests for mortality data in such type of study design.

However, It is no doubt LBW (<2500kg) is an important risk factor that determinate the mortality and morbidity during infancy, especially in the first months of birth. Hayati *et al.(2014)*[18] and Maryunani *et al. (2010)*[19] opined that it is due to the formation of incomplete anti-immune substances that leads to more susceptible of infections, especially pneumonia and diarrhea, and also incomplete growth and development of the lungs and weak respiratory muscles. The present study partially agrees with the theory; multiple linear regression analysis in this study suggests, this theory applicable for the term neonates having birth weight ≤ 2 kg, but not for the termed Border-line birthweight (> 2 to < 2.5 kg) neonates. Birthweight ≤ 2 kg is independently associated with higher morbidity during late neonatal life. Birth-weight have no individual effect on the morbidity among the term neonates with birth weight > 2 kg. The present study findings are also consistent with the observations of Saha *et al.*[12], who reported immune deficiencies among the term babies with birthweight< 2 kg, but not among those of > 2 kg. In a study Ullah *et al.* (2009)[5] opined the same opinion for the early neonatal neonates. The findings in this study regarding ARI and diarrhea could be explained in this way.

Having birth weight ≤2 kg is a sensitive and effective predictor for identifying the high-risk babies in late neonatal period. In India a birth weight of 2 kg or less has been recommended as the criteria for admitting infants into special neonatal care units and as well as the criterion of LBW.[8,20] The results of the present study are consistent with this and also recommends that neonates having birth weight 2 kg or less should be taken special care during their late neonatal period for the study population and other population same as them.

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