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RESEARCH PAPER

Association of Maternal Risk Factors with Birth Weight of Newborn in a Tertiary Level Hospital in Dhaka City

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Abstract

Background: Lowbirthweight(LBW)contributes substantially to neonatal, infant, and childhood mortality and morbidity. Several maternal factors contribute to the incidence of LBW, majority of which are biologically and socially interrelated, are modifiable; making LBW a potentially preventable condition.

Objective: To evaluate the association of maternal risk factors with birth weight of newborn.

Methods: This hospital-based cross-sectional comparative study was conducted in Mugda medical college, Dhaka, a government health center of Bangladesh, from January 2019 to 30 June 2019. A total of 180 recently delivered pregnant mother were included in this study and categorized into two groups: Group A- 90 mother who had given birth of low birth weight baby, and Group B- another 90 mother who delivered normal birth weight baby.Face-to-face interviews using a structured questionnaire and a review of medical records were carried out. Statistical analyses of the results were obtained by using window-based computer software devised with SPSS version 23.

Results: Highest percentage of patients from both group A and B were belonged to 20 - 34 years of age (62.2% and 81.1% respectively) and para ≤3 (76.7% and 88.8% respectively) with significant odds ratio for delivering low birth weight baby at advanced maternal age (≥35 years) (OR=2.14, p value 0.037) and high parity (para >3) (OR=2.44, p value 0.03).Majority mothers from group A had hypertension (58.9%) whereas 90% mothers from group B were normotensive with significant odds ratio (OR= 12.89, p value <0.001) as risk factor for predicting low birth weight baby. Multivariate logistic regression analysis revealed that gestational hypertension was the most powerful independent risk factor (OR= 12.72, p value <0.001) for delivering LBW baby compared to age ≥35 years (OR= 0.757, *p* value .717) and parity >3 (OR= 2.66, *p* value 0.257).

Conclusion: Gestational hypertension, advanced maternal age and high parity are the significant risk factors for delivering LBW baby. However, further larger multicenter study is recommended.

Keywords: Pregnancy induced hypertension, PIH, Gestational hypertension, Low birth weight

Introduction

Maternal and child mortality and morbidity are unacceptably high in our country. Low birth weight is one of the most important risk factors for neonatal & childhood mortality and morbidity. It has got negative impact in future development also. Children born with weight less than 2.5 kilograms are considered vulnerable to early childhood death.[1]

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LBW is a multifaceted problem that may result in a wide range of diseases in later life such as ischemic heart disease, stroke, hypertension, diabetes, metabolic syndrome, malignancies, dementia and osteoarthritis.[2]

Globally, It is estimated that LBW constitutes about 15% to 20% of all the births worldwide, leading to a total of more than 20 million birth per year.[3] Considerable variation exists between different regions and countries regarding LBW, and the majority of LBW births are in low and middle income countries especially in most vulnerable populations.[4] In Bangladesh, the incidence of LBW is 30%. Thus, reducing LBW is an important public health concern

and a major determinant in the achievement of Millennium Development Goals or MDG.[5]

Several factors contribute to the incidence of LBW, which are both maternal and fetal. The majority of the maternal factors, which are biologically and socially interrelated, are modifiable; making LBW a potentially preventable condition.[6,7] Among maternal risk factors, gestational hypertension has been found to be a risk factor for low birth weight.[8] It is estimated that hypertensive disorders in pregnancy complicate approximately 10–16% of pregnancies and are leading causes of maternal, fetal and neonatal morbidity and mortality worldwide.[9,10] It is also estimated that gestational hypertension affects about 5 – 8 % of all pregnant women worldwide.[11] Rahman et al found PIH to be an independent risk factor for low birth weight. Women who delivered low birth weight babies were 5 times more likely to have had pregnancy-induced hypertension.[12] Various other factors have well-established association with LBW including gestational age, maternal age, low hemoglobin, non-pregnant weight, pregnancy interval, parity, and educational status, violence during pregnancy, tobacco use and very low socioeconomic status.[13,14]

However, there is limited study in Bangladesh on maternal risk factors responsible for delivering low birth weight. For better understanding in our country perspective, we conducted this study with an aim to identify the maternal risk factors associated with low birth weight of newborn.

Materials and Methods

Study area and period: This study was carried out in gynecology and obstetrics ward of Mugda Medical College, Dhaka, over a period of six months (January, 2019 to June, 2019).

Study design, source of population and data collection: This was a hospital-based cross-sectional comparative study. Total 180 recently delivered pregnant mother in Mugda Medical College were included in this study and divided into two groups: group A- 90 mother who had given birth of low birth weight baby and Group B- 90 mothers who delivered normal birth weight baby. Following informed written consent, detailed history, physical examination and necessary investigations were performed. All patients were interviewed at hospital using a semi structured questionnaire, which was pre-tested at Dhaka Medical College Hospital. Necessary modification was done before the finalization of the questionnaire. It contained socio-demographic variables including age, religion, educational status, occupation and monthly family income. It also contained obstetric history including parity, ANC visit, gestational hypertension, drug & family history of HTN, mode of delivery, sex and weight of baby.

Low birth weight was defined as a birth weight of below 2.5 kg[8]. Pregnancy-induced hypertension was defined as blood pressure of e”140/90 mm Hg or a rise of systolic blood pressure of 30 mm Hg and a diastolic rise of 15 mm Hg on more than 2 occasions after the 20th week of gestation[8]. Gestational hypertension was confirmed by physicians measuring blood pressure by sphygmomanometer. Weight measurement was done by Electronic and Balance Beam Infants Scale/ Spring Scale.

Ethical clearance: Prior to the commencement of this study, ethical clearance was obtained from the Ethical Committee of Mugda Medical College, Mugda, and Dhaka. Written permission was taken from hospital authority before taking interviews. Study population who fulfilled the selection criteria were enrolled purposively. Perspectives of the study were explained to the respondents in easily understandable local language then informed written consent was taken from each respondent.

Data quality assurance: Data was collected using a pre-tested standard questionnaire. It was ensured that the study participants will be able to understand the questionnaire and answer accordingly. To reduce recall bias, we reviewed medical records to verify information on the patients' obstetric history. All collected data from the interview were recorded in a separate case record form. Strict confidentiality was maintained and data was kept locked under principal investigator. After collection of all the required information, data was checked and verified by investigators.

Statistical analysis: The statistical analyses were carried out by using the Statistical Package for Social Sciences version 24.0 for Windows (SPSS Inc., Chicago, Illinois, USA). Frequency and percentage were used to express categorical variables. Mean and standard deviation were used to express continuous variables. Chi square test and independent sample t test was performed in categorical and continuous comparison, respectively. Box-plot distribution of newborn birth weight according

gestational hypertension was performed (figure 3). Point-Biserial correlation analysis was performed to see the correlation of birth weight with maternal blood pressure status. A *p* value of <0.05 was considered significant.

Results

The highest percentage of patients from both group A and B belonged to 20 – 34 years (62.2% and 81.1% respectively) with significant differences in age distribution between groups (*p* value 0.015) (figure 1).

There were no significant differences between the two groups of patients regarding socio-demographic profile (*p* value >0.05) (table I).

Majority mothers from both group A and B had para ≤3 (76.67% and 88.89% respectively) whereas high parity (para >3) was significantly higher among group A compared to group B (23.33% vs 11.11%, p value 0.03). Average ANC visit, distribution of mode of delivery and sex of baby was statistically similar between groups (*p* value >0.05). Mean birth weight of group A and B were 2.18±0.23 and 2.93±0.33 kg respectively (*p*<0.001) (table II).

Majority mothers from group A had hypertension (58.89%) whereas 90% mothers from group B were normotensive (*p*<0.05) (figure 2).

The median (range) birth weight were higher in normotensive patients than hypertensive patients [2.65(1.2 to 3.7) and 2.30 (1.7 to 3.5) respectively,

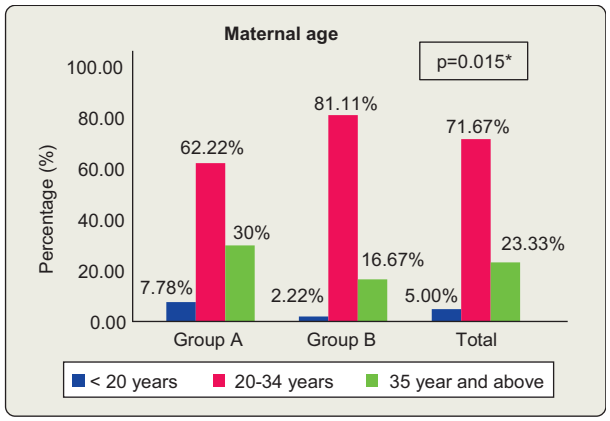

Figure 1: Age group distribution of study mother (n=180).
Group A= mothers who delivered low birth weight baby
Group B= mothers who delivered normal birth weight baby
* Pearson Chi-squared Test (c^2) was performed.

Table-I: Distribution of socio-demographic between two groups (n=180)

Socio-demographic profile	Group A (n=90) No. (%)	Group B (n=90) No. (%)	Total (n=180) No. (%)	p value*
Education status				0.263
Illiterate	11 (12.22%)	11 (12.22%)	22 (12.22%)	
Primary	24 (26.67%)	33 (36.67%)	57 (31.67%)	
Secondary	52 (57.78%)	40 (44.44%)	92 (51.11%)	
Informal education	3 (3.33%)	6 (6.67%)	9 (5%)	
Occupation				0.717
Service holder	12 (13.33%)	15 (16.67%)	27 (15%)	
Business	15 (16.67%)	12 (13.33%)	27 (15%)	
Housewife	63 (70%)	63 (70%)	126 (70%)	
Socio-economic status				0.168
Lower	11 (12.22%)	4 (4.44%)	15 (8.33%)	
Middle	77 (85.56%)	84 (93.33%)	161 (89.44%)	
Higher	2 (2.22%)	2 (2.22%)	4 (2.22%)	

Values are expressed within parenthesis percentage (%) over column in total.
Group A= mothers who delivered low birth weight baby
Group B= mothers who delivered normal birth weight baby
* Pearson Chi-squared Test (c^2) was performed.

Table-II: Distribution of obstetric history between two groups (n=180)

Variables	Group A (n=90) No. (%)	Group B (n=90) No. (%)	Total (n=180) No. (%)	*p* value
Parity				0.03*
Low (para ≤3)	69 (76.67%)	80 (88.89%)	149 (82.78%)	
High (para >3)	21 (23.33%)	10 (11.11%)	31 (17.22%)	
ANC visit	4.11±0.827	3.86±0.931	3.98±0.887	0.053*
Mode of delivery				0.271*
NVD	18 (20%)	25 (27.78%)	43 (23.89%)	
Assisted vaginal delivery	0 (0%)	1 (1.11%)	1 (0.56%)	
LUCS	72 (80%)	64 (71.11%)	136 (75.56%)	
Birth weight (kg)	2.18±0.23	2.93±0.33	2.56±0.47	<0.001**

Values are expressed within parenthesis percentage (%) over column in total.
Group A= mothers who delivered low birth weight baby
Group B= mothers who delivered normal birth weight baby
* Pearsons Chi-squared Test (χ^2) was performed
** Independent sample t test was performed

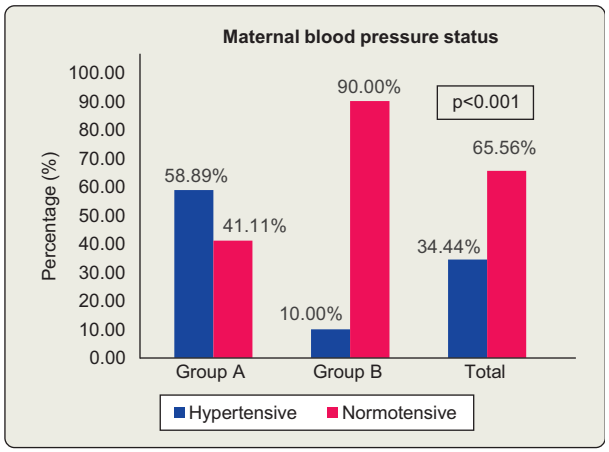

Figure 2: Gestational blood pressure status of study mother (n=180).
Group A= mothers who delivered low birth weight baby
Group B= mothers who delivered normal birth weight baby
* Pearson Chi-squared Test (χ^2) was performed.

p value <0.001 determined by Independent sample median test.]. Independent sample T test found the mean birth weight was significantly lower among hypertensive patients (2.32±0.35) compared to normotensive group (2.68±0.48) (p value <0.001). Besides, the diagram showed a negative slope toward hypertensive group and Point-Biserial correlation analysis found a negative relationship between birth weight and developing hypertension (r= -0.373, *p* <0.001) (figure 3).

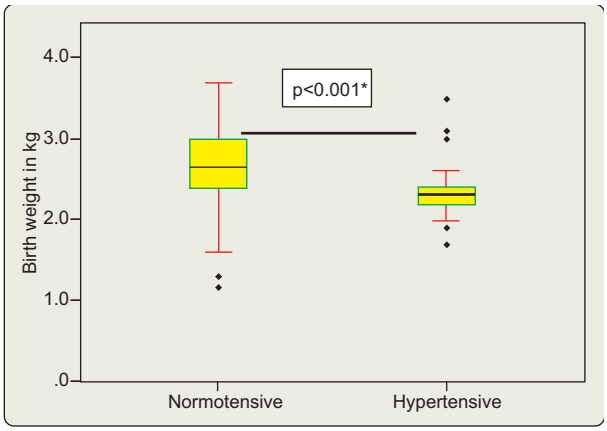

Figure 3: Birth weight distribution according to blood pressure status (n=180)
* Independent sample T Test was performed.

Univariate logistic regression analysis shows that gestational hypertension had more significant odds ratio (OR= 12.89, *p*<0.001) as risk factor for predicting low birth weight baby than age ≥35 years (OR= 2.14, p value 0.037) and parity >3 (OR= 2.44, *p* value 0.033) (table III).

Table-III: Univariate logistic regression to determine risk factor for delivering low birth weight baby (n=180)

Variables	B	OR	p value	95% CI	
				Lower	Upper
Age ≥35 years	0.762	2.14	0.037	1.049	4.378
Para > 3	0.890	2.44	0.033	1.073	5.523
Gestational hypertension	2.557	12.892	<0.001	5.755	28.881

OR=odds ratio

Table-IV: Multivariate logistic regression to determine independent risk factor for delivering low birth weight baby (n=180)

Variables	B	AOR	p value	95% CI	
				Lower	Upper
Age ≥35 years	-0.278	.757	0.717	0.168	3.409
Para >3	0.976	2.66	0.257	0.490	14.385
Gestational hypertension	2.54	12.718	<0.001	5.589	28.940

AOR=Adjusted odds ratio

Multivariate logistic regression analysis to determine the independent risk factor of delivering low birth weight baby showed that gestational hypertension was the most powerful independent risk factor (OR= 12.72, *p* value <0.001) for delivering LBW baby compared to age ≥35 years (OR= 0.757, p value 717) and parity >3 (OR= 2.66, *p*=0.257) (table IV).

Discussion

This hospital-based cross-sectional comparative study was conducted to identify the risk factor to deliver a low birth weight baby with a hypothesis that gestational hypertension is more strongly associated with delivering low birth weight baby compared to advanced age and high parity. Total 180 recently delivered pregnant mother were included in this study and categorized into two groups: 90 mothers who had given birth of low birth weight baby were assigned in group A, and another 90 mother who delivered normal birth weight baby were in group B.

Highest percentage of patients from both group A and B were belonged to 20 – 34 years of age (62.2% and 81.11% respectively) with significant odds ratio (OR=2.14, *p* value 0.037) for delivering low birth weight baby at advanced maternal age (≥35 years). In agreement with this findings, Bekele et al found a maternal age of 40 and above were associated with higher risk of delivering an LBW newborns (AOR 1.96, 95% CI = 1.22, 3.20) compared to a maternal age of 30-34.[15] A retrospective study of 2,551 mothers conducted in Japan in 2017 also suggested that pregnant women aged ≥40 were at a 1.97 times higher risk of delivering an LBW babies compared to the reference group (30-34 years).[16] Similarly, several other studies also confirmed that birth weight decreases as maternal age increases.[17,18] However, in contrast to the current study on the effect of maternal age on birth weight, study done in Nepal found that the relationship between birth weight and maternal age was insignificant.[19] Moreover, several showed that young mothers had greater risk of delivering an LBW baby compared to other age groups.[20-22] This difference in effect of maternal age on delivering LBW babies between studies may be due to variation in other maternal factors responsible for LBW baby, such as nutritional status, hemoglobin level, adverse psychosocial factors and violence/abuse during pregnancy. Several studies demonstrated that these factors were associated with LBW.[20,23–26]

In our study, majority mothers from both group A and B had para ≤3 (76.67% and 88.89% respectively) whereas high parity (para >3) was significantly higher among group A compared to group B (23.3% vs 11.1%, OR=2.44, *p*=0.03). Previous research also found that the risk of LBW events was more significant in mothers with high parity.[20,27,28] Rahfiluddin et al found an increase in LBW after fourth parity (51.28%) [28].

Makhija et al documented 39.7% LBW after 4th parity.[29] This negative effect on birth weight is likely due to the deterioration of endometrial and corpus uterine functions due to too many giving birth, thus affecting circulatory nutrition and consequently susceptible to LBW.[20]

We found, majority mother of group A had hypertension (58.89%) whereas 90% mothers from group B were normotensive with significant odds ratio (OR= 12.89, p<0.001) as risk factor for predicting low birth weight baby. Besides, our study revealed that gestational hypertension was the most powerful independent risk factor (OR= 12.72, p<0.001) for delivering LBW baby compared to age more than 35 years (OR= 0.757, p value 717) and parity more than 3 (OR= 2.66, p value 0.257). Like us, a population-based case control study conducted by Rahman et al, found pregnancy-induced hypertension as an independent risk factor (adjusted odds ratio = 5.06; 95% confidence interval: 2.63, 9.71) for low birth weight.[12] A secondary analysis on the role of aspirin for the prevention of eclampsia demonstrated that women with severe pregnancy-induced hypertension without proteinuria had a higher rate of low birth weight than normotensive mothers and those with mild hypertension (p<0.003).[30] A study of Bindu et al. found that the incidence of low birth weight was 70% among PIH group compared to only 16.7% in normotensive group and this difference was statistically significant (p value <0.001) [31].Afrin et al found gestational hypertension as a strongly significant risk factor for LBW (p value 0.02).[22] Where hypertension is a strongly significant risk factor for LBW (p value 0.02). Matin et al also found the same contributing factor on LBW.[32] The same was documented by several other studies.[4,7,14,17,27] Though, Aleem et al found no significant effect of pregnancy induced hypertension on birth weight of newborn [11]. A Canadian study also showed that infant birth weights were similar between pre-eclamptic and normotensive pregnancy delivered at term.[33]

Howbeit, biological mechanisms have been suggested to explain the relation between pregnancy induced hypertension and low birth weight.[12] In a normal pregnancy, the trophoblast cells invade the decidualized endothelium and the inner third of the myometrium. This invasion serves to anchor and connect the placenta with the maternal vascular system. In pregnancy induced hypertension or preeclampsia, it is postulated that the trophoblast invasion into the spiral arteries that supply the placenta is incomplete.[34] Because of the decreased uretro-placental blood perfusion, this leads to intrauterine growth retardation and low birth weight. This "hypoperfusion" model has been supported by many studies.[12,35]

There are some limitations in this study as it was done in one hospital so it cannot be true representative of the whole country scenario. As there are several factors interacting in this phenomenon so it is not feasible to single out any particular factor affecting low birth weight. Hence, it is the need of the hour to strengthen the existing maternal services at the community level to prevent and reduce LBW.

Finally, the result will be important to be used by national health policy makers to take early possible measures to reduce rate of LBW and to bring ideas supporting. Early detection of women at high risk of having pregnancy-induced hypertension coupled with more intensive antenatal care may reduce the occurrence of low birth weight.[12] Different components of the disorders of hypertension in pregnancy should also be explored.

Conclusion

This hospital-based case-control study revealed that gestational hypertension, advanced maternal age and high parity are the significant risk factors for delivering LBW baby. Of these, the relationship between gestational hypertension and low birth weight is more strongly associated with low birth weight compared to advanced maternal age and high parity confirming associations in the published literature. Early diagnosis and proper management of gestational hypertension along with appropriate counseling and monitoring in the ante-natal care is recommended to reduce delivery of LBW baby.

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