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Relationship among maternal height, pre-pregnancy nutritional status and birth weight of neonates in Dhaka city

Abstract

Low birth weight is a curse for child. Consequences of low birth weight are immense. The aim of this study was to find out the relationship among pre-pregnancy nutritional status, maternal height and birth weight of neonates in Dhaka City. Cross sectional analytical study was conducted for the survey and data were collected through questionnaire-based face-to-face interviews, for lactating mothers who had at least one baby. Nutritional status was determined by WHO cut off value. Statistical Package for Social Sciences was used for data analysis. Both descriptive and inferential statistics were used. Information of anthropometry, socioeconomic and birth weight were collected within January, 2014 to December, 2016. The current study found that 23.8% children born with LBW, 72.2% with NBW and 4.0% with HBW. On the other hand, 37.8% mother was tall, 47.85% was average and 14.4% was short. Besides 55.8% of the mothers had normal BMI whereas 13.5% were underweight before pregnancy. Half of the children were malnourished (MUAC). About 67.39% of NBW children were given birth by mothers having aged between 20 to 30years. Therefore, PPNS and maternal height was found to be associated with birth weight and MUAC of children. Moreover, birth weight of the children was related with nutritional status (MUAC) of children. Parents' education, maternal age, family income and dietary expenditure also had a relationship with birth weight in this study. It is concluded that maternal height is related with birth weight of neonates and may become a useful indicator for other countries.

Keywords: birth weight, PPNS, MUAC, maternal age and education

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Abbreviations: LBW, low birth weight; ELBW, extremely low birth weight; NBW, normal birth weight; VLBW, very low birth weight; ANC, antenatal care; BMI, body mass index

Introduction

Birth weight is the body weight of a baby at its birth. There have been numerous studies that have attempted, with varying degrees of success, to show links between birth weight and later-life conditions, including diabetes, obesity, tobacco smoking and intelligence. A baby born small or large for gestational age (either of the two extremes) is thought to have an increased risk of different complications in later life. Low birth weight (LBW) is a major public health problem. Globally, approximately 16% of infants are born weighing less than 2500 g, which represents more than 22 million LBW babies per year.[1] Over 95% of these infants are born in low-income and middle-income countries. In South Asia, about one quarter (28%) of all infants is born with LBW. In sub-Saharan Africa and in Latin America/Caribbean, the LBW rates are estimated to be 13% and 9%, respectively.[1] The WHO defines LBW as weight at birth less than 2500 g irrespective of the gestational age of the infant.[2] LBW includes very low birth weight (VLBW; less than 1500 g) and extremely low birth weight (ELBW; less than 1000 g) infants, who have the highest risk of adverse outcomes.[2,3] These LBW infants are at a higher risk of mortality, morbidity, poor growth, impaired psychomotor and cognitive development as immediate outcomes, and have a greater susceptibility to type 2 diabetes, hypertension and coronary heart disease in future. Maternal malnutrition prior to and during pregnancy manifested by low bodyweight, short stature, inadequate energy intake during pregnancy and coexisting micronutrient deficiency are considered major determinants in developing countries where the burden is too high. Studies have found that LBW babies are about 20 times more likely to die in infancy compared to normal birth weight (NBW) babies, and those who survive, share a greater burden of various physical and psychological complications, such as behavioral and cognitive disorders.[4] The resulting health-care expenditures are also higher for the surviving LBW babies.[5] Furthermore, with the demographic change of increased life expectancy at birth in developing countries, children born with LBW can cause an increased economic burden and an increased disease burden.[6,7] In addition, LBW is considered as a universal threat for developing countries that creates a barrier for child development.[8,9] Other studies have shown several factors to be determinants of LBW and have demonstrated that preventing those factors can help reduce early childhood morbidity and mortality.[10] The determinants of LBW are genetic, constitutional, obstetric, nutritional, related to maternal morbidities in the antenatal period, exposure toxins and drugs, and linked to antenatal care (ANC). Other factors including smoking, maternal age, birth spacing, ANC, anemia, genital infections, maternal

ill health, and stress have also been reported.[11] Another study found housing conditions as an independent variable affecting LBW. This was apart from the associated confounding factors like poor PNC, previous history of preterm birth, and low maternal body mass index.[12] Furthermore, one study reported several risk factors associated with the presence of LBW. However, socioeconomic status was associated with only extreme cases of LBW.[13,14] Several studies examining the relationship between maternal height and low birth weight showed that shorter maternal height was associated with reduced fetal growth and low birth weight (LBW)[15–18] and concluded that the primary reason for this association was undernutrition/malnutrition. The aim of the study was to find out the relationship among maternal height, pre-pregnancy nutritional status and birth weight of the children.

Methods and materials

The study was a cross sectional analytical study because study was carried out at a single point in a specified time period. Considering time period and resource availability, cross-sectional analytical (to show association and correlation among different variables) hospital based study design was most feasible for this study. Non-probability convenient sampling was used. Data were collected through questionnaire-based face-to-face interviews, for lactating mothers of age 14 to 45years and who have at least one child less than three years. Each respondent (mother) was asked to provide a detailed birth history and information about her under-three child. Available medical record was checked. Birth weight was recorded using the metric scale (in grams) and height (in centimeter) in all selected study locations. The study was conducted at different hospitals, MCH centers and clinics in Dhaka City, the most densely populated area of Bangladesh, which were selected purposively as the study objective fulfill and the place depending upon communication, availability to the sample and other relevant inclusions and exclusions factors. Study was conducted from January 2014 to December 2016 of the time scheduled and following this period was utilized for questionnaire development, data entry, and analysis. Data were collected from January 2014 to December 2016 in the different areas of Dhaka City. Lactating mother and those whom were agreed to fulfill the questionnaire willingly were included in the study. Respondents, who refused to participate in the study, did not have any child and mother's age of above 45years old been excluded. Data from children with a missing birth weight, mothers with twin and stillbirths were also excluded from the analysis. A total of 1155 (385 per year) were selected by convenient type of non-probability sampling. Rapport was built before initiation of the study. The permission was taken from the superior authority of specific community clinics and hospitals in Dhaka City.

A standard pretested questionnaire was used to obtain the relevant information regarding the socioeconomic information, and information about anthropometric status, vaccination status, disease presence and information about family planning, antenatal care, obstetric care, postnatal care, post abortion care. Questionnaires were checked each day after interviewing and again these were carefully checked after completion of all data collection to minimize the errors for entering the data set into the computer. The study variables were selected based on epidemiological information, prior studies; several review of the relevant published demographic studies. Different individual-level factors such as maternal age, the height of the mother, educational qualification, occupational status, ANC visit and nutritional status, as well as community-level factors, such as socioeconomic status and place of residence, were considered in the study. Education level was defined as less than secondary, secondary, higher education, graduate or above and current occupational status was classified as service, business, part time, and housewife. Height and body weight were measured during data collection, and body mass index (BMI) was calculated as the ratio of weight in kilograms to height in meters squared (kg/m^2). BMI was further categorized into four groups according to WHO cut off value: low ($\leq$18.5kg/m^2), normal or healthy weight (18.5-24.9kg/m^2) or overweight (BMI 25.0-29.99kg/m^2) and obese (>30kg/m^2). Income status was classified arbitrarily on the basis of the monthly income of the participants as less than 10000 BDT, 10000 to 20000 BDT, 20000 to 30000 BDT, 30000 to 40000 BDT, 40000 to 50000 BDT, 50000 to 60000 BDT and greater than 60000 BDT per month. Place of residence was classified as in building, tin shed building, slum. All the statistical analysis and all other data processing were done by using SPSS version 17.0 and Microsoft Excel 2010 windows program. Data were analyzed in term of frequency distribution and percentage. To reveal the association and correlation among different parameters Pearson Chi-square and Pearson correlation tests were used. For tabular, charts and graphical representation Microsoft word and Microsoft excel 2010 were used.

Results

Socioeconomic Characteristics Participants are given in Table 1A. About 23.5% family had more than five members, 23.8% had five members, 29.0% had four and 23.6% had three family members. Monthly income of 3.8% family had less than 10000 BDT followed by 26.1% family had 10000 to 20000 BDT, 24.2% had 20000 to 30000 BDT, 9.5% had 30000 to 40000 BDT, 11.3% had 40000 to 50000 BDT, 13.2% had 50000 to 60000 BDT and 11.9% family had more than 60000 BDT. About 25.3% families had monthly dietary expenditure less than five thousands followed by 32.6% had 5000 to 10000 BDT, 18.9% had 10000 to 15000 BDT, 14.3% had 15000 to 20000 BDT and 8.9% had above 20000 BDT per month.

Educational qualification of mother was 46.9% less than SSC followed by 15.2% SSC, 22.2% HSC and 15.8% graduate or higher. Educational qualification of father was 29.2% less than SSC followed by 14.8% SSC, 29.8% HSC and 26.2% graduate or higher (Table 1B). Among the participated mother 53.0% lived in building, 38.0% in tin shade building and 9.0% in slum area in Dhaka City. In this study, 66.0% of the mother was housewife followed by 10.4% part time worker, 23.0% full time worker and 0.6% business woman. On the other hand more than half of the father (53.9%) was service holder followed by 31.9% businessman, 6.3% rickshaw puller, 2.4% day labors and 5.5% other workers (Table 1B).

The Figure 1 indicates that in this study, most of the children had normal birth weight (72.2%) and 3.5%, 20.3%, and 4.0% had very low birth weight, low birth weight and overweight respectively.

Pre-pregnancy Nutritional Status of Mother was also estimated where 97.7% mothers were able to tell their pre-pregnancy condition and 20.3% mother did not tell their weight. About 55.8% of the mothers had normal BMI whereas 13.5% were underweight. On the other hand, 9.2% mothers were found overweight and 1.2% obese respectively. In our study, 14.4% mother was short in height followed by 47.8% average and 37.8% taller than average (Table 2) (Table 3).

Statistical significant association was found between birth weight of children and maternal height ($p=0.000<0.05$) (Table 4).

Statistical significant association was found between birth weight of children and pre-pregnancy nutritional status ($p=0.000<0.05$) (Table 5).

Table 1A Socioeconomic characteristics of mother (n=1155)

Number of Family Members	Frequency	Percent
Three	273	23.6
Four	335	29.0
Five	275	23.8
Above	272	23.5
Family Income (BDT Per Month)		
Less than 10000	44	3.8
10000 to 20000	302	26.1
20000 to 30000	279	24.2
30000 to 40000	110	9.5
40000 to 50000	131	11.3
50000 to 60000	152	13.2
Above 60000	137	11.9
Dietary Expenditure (BDT Per Month)		
Less than 5000	292	25.3
5000 to 10000	377	32.6
10000 to 15000	218	18.9
15000 to 20000	165	14.3
Above 20000	103	8.9

Table 1B Socioeconomic characteristics of mother (n=1155)

Maternal education	Frequency	Percent
Less than SSC	542	46.9
SSC	175	15.2
HSC	256	22.2
Graduate or Above	182	15.8
Father's education		
Less than SSC	337	29.2
SSC	171	14.8
HSC	344	29.8

Table continued...

Maternal education	Frequency	Percent
Graduate or Above	303	26.2
Household Structure		
Building	612	53.0
Tin shade Building	439	38.0
Slum	104	9.0
Occupation of Mother		
Service	266	23.0
Business	7	0.6
Part Time	120	10.4
House Wife	762	66.0
Occupation of Father		
Service	623	53.9
Business	368	31.9
Rickshaw Puller	73	6.3
Day Labor	28	2.4
Others	63	5.5

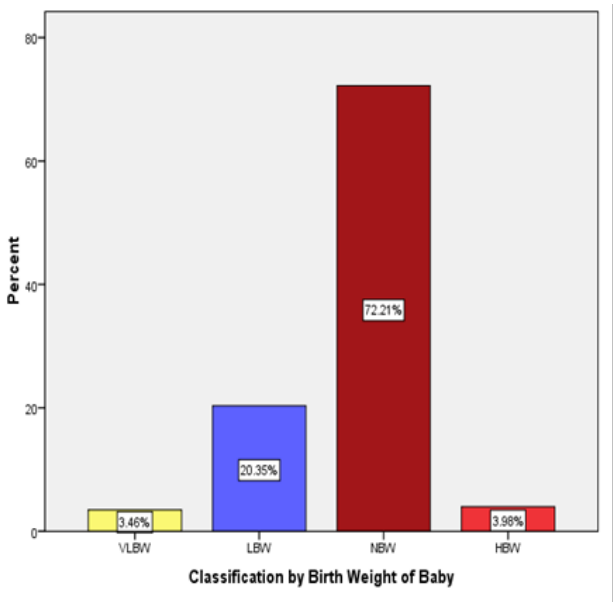

Figure 1 Distribution of birth weight of neonates (n=1155).

Citation: Howlader SU, Hossain S, Juliana FM, et al. Relationship among maternal height, pre-pregnancy nutritional status and birth weight of neonates in Dhaka city. *J Nutr Health Food Eng.* 2018;8(1):60–66. DOI: 10.15406/jnhfe.2018.08.00257

Table 2 Distribution of pre-pregnancy nutritional status and height (n=1155)

Pre-pregnancy nutritional status (BMI)	Frequency	Percent
Underweight	156	13.5
Normal	645	55.8
Overweight	106	9.2
Obese	14	1.2
Subtotal	921	79.7
Missing	234	20.3
Total	1155	100.00
Maternal Height		
Short	166	14.4
Average	552	47.8
Tall	437	37.8
Total	1155	100.0

Table 3 Association between birth weight of children and maternal height (n=1155)

Birth weight of children	Maternal height (Short, Medium and Tall)			Total	χ2 value	p-value
Classification by birth weight of baby	Short	Average	Tall			
VLBW	15	15	10	40		
LBW	46	111	78	235		
NBW	99	409	326	834	31.559	0
HBW	8	15	23	46		
Total	168	550	437	1155		

Table 4 Association between birth weight of children and pre-pregnancy nutritional status (n=1155)

Birth weight of children	Pre-pregnancy nutritional status (BMI)				Total	χ2	p-value
Classification by birth weight of baby	Underweight	Normal	Overweight	Obese			
VLBW	8	21	1	0	30		
LBW	42	111	16	4	173		
NBW	104	487	75	9	675	34.454	0
HBW	2	26	14	1	4		
Total	156	645	106	14	921		

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Table 5 Association between birth weight of children and children nutritional status (MUAC) (n=1155)

Birth weight of children	**Children nutritional status (MUAC)**			**Total**	X^2 **Value**	**P-Value**
Classification by birth weight of baby	**Severe Malnutrition**	**Moderate Malnutrition**	**Normal**			
VLBW	13	14	13	40		
LBW	80	66	89	235		
NBW	200	187	447	834	26.328	**0**
HBW	8	10	28	46		
Total	301	277	577	1155		

Statistical significant association was found between birth weight of children and children nutritional status (MUAC) ($p=0.000<0.05$) (Table 6).

Maternal education and father's education, pre-pregnancy nutritional status, and nutritional status of children had highly significant association with birth weight of children, ($p=0.000<0.05$) for all factors). Maternal profession ($p=0.009<0.05$) and height ($p=0.000<0.05$) also had highly significant association with birth weight of neonates. Family income and dietary expenditure had highly significant correlation with birth weight of neonates. Maternal age ($p=0.000<0.05$) also strongly associated and parity ($p=0.082<0.05$) was negatively correlated with birth weight of babies, but not at significant level.

Table 6 Association and Correlation of BWB with other factors (n=1155)

Variables	**r/ χ2 value**	**p-value**	**Comments**
Pre-pregnancy Nutritional Status	34.454	0.000	Highly Significant
Children Nutritional Status (MUAC)	26.328	0.000	Highly Significant
Family Income	0.192	0.000	Highly Significant
Dietary Expenditure	0.181	0.000	Highly Significant
Maternal Education	52.750	0.000	Highly Significant
Father's Education	41.767	0.000	Highly Significant
Profession of Mother	22.004	0.009	Significant
Profession of Father	20.665	0.056	Not Significant
Maternal Height	31.557	0.000	Highly Significant
Maternal Age	49.000	0.000	Highly Significant
Parity	-0.051	0.082	Not Significant
Frequency of Meal per Day	17.477	0.042	Significant

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Discussion

Birth weight is influenced by many factors including race, parity, maternal stature and weight and infant sex. Maternal height, weight and BMI are positively associated with larger birth weights. Tall mothers, heavy mothers and overweight mothers tend to have larger babies at birth than short, light and underweight mothers as shown in this study. There are various factors which causes low birth weight of neonates. These are complex and interdependent, and are known to influence the birth weight of neonates. Considering factors related to birth weight can be classified as demographical, physical, psychosocial, nutritional, behavioral, previous obstetric history, morbidity during pregnancy and antenatal care. Demographic factors pertain to the age, religion, and household structure, socio-economic status (income, education and occupation). The physical factors include the pre-pregnancy weight, maternal height and weight. Nutritional factors consist of food intake during pregnancy as well as weight gain during pregnancy. Psychosocial factors comprise of the psychological make-up of the mother during pregnancy e.g. mental stress, family support as well as the social factors having an effect on the mother. The current study found that 23.8% children born with LBW, 72.2% with NBW and 4.0% with HBW. On the other hand, 37.8% mother was tall, 47.85% was average and 14.4% was short and maternal height was strongly associated with birth weight. A relationship with maternal height and pre-pregnancy nutritional status was also found in this study.

Moreover, birth weight of the children was related with nutritional status (MUAC) of children. Therefore, LBW was involved in the relationship between maternal height, PPNS and MUAC. These relationships were very strong. This finding is similar to a study[19] reported that shorter women were more likely to have smaller newborns than taller women. Our study found that 55.8% of the mothers had normal BMI whereas 13.5% were underweight before pregnancy and 9.2% mothers were found overweight and 1.2% obese respectively, which was strongly associated with birth weight of children. Parents' education had great influence on birth weight of infants; indicate that educated parents have better opportunities of income, gathering nutritional knowledge and healthy dietary habits.

This is consistent with previous study.[19] Family income also had a relationship with birth weight in this study. Other studies reported similar findings.[20] Dietary expenditure had significant correlation. So mother in rich family usually gets proper nutrition and better care than mother in poor family. Occupation was somehow related with birth weight of baby, this may be due to an indirect effect of occupation on family income and dietary expenditure. In addition, maternal age was strongly associated with birth weight and 67.39% of NBW children were given birth by mothers having aged between 20 to 30years and parity was negatively correlated with birth weight of babies, but not at significant level. We collected information on parent's education and occupation. However, we did not obtain information on disease status. Education, income and occupational status were used as a measurement of SES. Additionally, information regarding frequency of meals per day was collected in this study, which was also associated with birth weight of baby.

This could affect individual nutrition status during pregnancy. There were also some limitations. First, this study was conducted in selected MCH and community clinics in Dhaka City. Second, there is chance of recall bias among participated mothers where they recalled past events (pre-pregnancy weight and birth weight in many cases). Third, education, income level were varied among them. Respondents were shy to provide real information in many cases.

Conclusion

Maternal height, weight and BMI were positively associated with larger birth weights. Tall mothers, heavy mothers and overweight mothers tend to have larger babies at birth than short, light and underweight mothers as shown in this study. A relationship with maternal height and pre-pregnancy nutritional status was found in this study. Moreover, birth weight of the children was related with nutritional status (MUAC) of children. Family income and dietary expenditure also had a relationship with birth weight in this study. Occupation was related with birth weight of baby. Moreover, frequency of meals per day was collected in this study and was associated with birth weight of baby. Therefore, we recommended that policy makers should make more emphasis on education as it imparts nutritional knowledge and thus modify dietary habits and quality of food consumed. This will lead to a better height and nutritional status in adolescent girls, the future mother resulting in lower rates of LBW and hence great reduction in infant morbidity and mortality. We can conclude that several maternal factors especially height and other socioeconomic factors are related with birth weight of neonates.

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Conflict of interest

Author declares that there is no conflict of interest.

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