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ASSOCIATION OF MATERNAL BODY MASS INDEX (BMI) AND MID UPPER ARM CIRCUMFERENCE (MUAC) AND BIRTH WEIGHT OF NEWBORN IN THE SOUTH-WEST REGION OF BANGLADESH

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ABSTRACT

Nutritional status and birth weight of newborns is probably the most important factor that affects the future, survival and quality of life and is considered as a major multifaceted public health concern. 343 pregnant women and their newborn babies were selected from three districts of Khulna division in Bangladesh. The mother and infant pair were selected from both hospitals and community. All data were obtained by the researcher with the help of health workers by a questionnaire and some anthropometric apparatus. LBW were found to be related with maternal Body Mass Index (BMI) and Mid Upper Arm Circumference (MUAC) and the lowest mean birth weight (2693.44g) and highest incidence of LBW (35.2%) was found among mothers with BMI 20-24.9 (before delivery) and mothers with BMI ≥30 (before delivery) was found to have highest mean birth weight (3100.00g) and with no LBW (0%) baby. Mothers with MUAC <22 cm were shown to have highest incidence of LBW (55.3%) and lowest mean birth weight (2486.84g). On the other hand, incidence of LBW was found null among mothers with MUAC >29 cm and highest mean birth weight (3050.00g) was also found in this groups.

Key words: LBW, MUAC, Newborn, Nutritional status, Maternal health.

INTRODUCTION

Nutritional status of newborn babies particularly in developing countries has received considerable attention because of its great impact on socioeconomic development of the country. The rate of infant mortality in Bangladesh is 88 deaths per 1000 live births (Bangladesh Bureau of Statistics, 1993). Poor nutritional status of pregnant women is a contributory factor of infant's poor nutritional status. Maternal nutritional status influences infant's birth weight (WHO, 1980, Villar J et al., 1984 and Bergman RE and Vaughan VCN, 1983). Anthropometry of newborn baby is probably the most important factor that affects the future, survival and quality of life (Habicht JP et al., 1974, Kaminski M *et.al.* 1973, Lechtig A *et.al.*, 1977 and Mc Cormick MC, 1986). In both developed and developing countries, birth weight is the important determinant of neonatal mortality and morbidity. For these reasons birth weight has long been a subject of clinical and epidemiological investigations and an area of public health interest. In particular, considerable attention has been focused on the casual determinants of anthropometry status, especially of low birth weight (LBW), for identifying the nutritional status of newborn babies.

Low birth weight is defined by WHO as a birth weight of less than 2500g, since below this value (2500g), birth weight specific infant mortality begins to rise rapidly (Chase HC, 1967, Puffer PR and Serrano CV, 1973 and Saugstad LF, 1981). Currently about 24 million low birth weight babies are born every year throughout the world which, is about 17 percent of all live births (UNICEF, 1998). Most of them are born in developing countries. LBW babies are not only at greater risk of dying than infants of average weight but, if they survive, they will also have more episodes of illness, their cognitive development may be impaired, and they are more likely to become malnourished. Evidence is also mounting that low birth weight predisposes children to a high risk of diabetes, heart diseases and other chronic conditions later in life (UNICEF, 1998 and Barker DJP, 1990). In Bangladesh, incidence of low birth weight is unacceptably high. In a study in 1989, 45% babies were found to born with low birth weight in Bangladesh (Canosa CA, 1989)]. Data cited in National Food and Nutrition Policy (1997) document shows that LBW babies ranges from 30-50 percent. From different other studies it has been seen that LBW prevalence rate is about 30 percent (Nahar N *et al.*, 1998 and Karim E and Taylor CGN, 1997). Among LBW

babies, who survive to adulthood are more likely to suffer from chronic diseases (diabetes, hypertension, heart disease etc) than adults who were at normal birth weights. It can be said that poor nutritional status is not only the tragedy for the newborns, infants and children but also for the adults who were of poor nutritional status. Poor nutritional status adversely affects mental and physical development, productivity and the span of working years all of which significantly influence the economic potential of man (Bergt A and Mescot J, 1973). The aim of this study is to investigate the association of Maternal BMI, MUAC and birth weight of infants in the South West region of Bangladesh.

MATERIALS AND METHODS

A cross sectional study was conducted during January 2008 to December 2008 in the three districts of Khulna division in Bangladesh to determine the effects of maternal BMI and MUAC on birth weight of newborn. The study was included 343 mothers and their 343 newborn babies including singleton infants, normal delivered babies. Caesarian babies were excluded from the study. Sample size was determined according to the Jaamess E. Baarttllettt *et al.* (2001). Mother-Infant pairs were selected from both hospital/clinics and community and with the help of health workers data were collected with a pre-tested questionnaire composed of structured and non- structured questions. The questions include clinical condition of mothers of newborn babies, anthropometry of newborns and their mothers. Mother's anthropometric parameters including height, weight, MUAC were recorded. All anthropometric measurements were carried out according to standardized techniques as described by Jelliffe and Jelliffe (1989). BMI was calculated using the height and weight recorded. Both before conception and delivery BMI was calculated for 343 mothers. Anthropometric parameters of the newborns were recorded by the investigator within 18 hours of birth by standard techniques (Jelliffe and Jelliffe, 1989). Finally data were statistically analyzed by using SPSS. Study objectives and procedure were orally described to each of the mother and a written consent to participate in the study was taken.

RESULTS

Table-1 shows the distribution of birth weight by maternal Body Mass Index (BMI) before conception. The incidence of LBW was 36.7% when BMI was between 18.5–19.9 and 0% with BMI 25 or more. Incidence of low birth weight was 40.3% when BMI was up to 18.4, while none of the babies were with low birth weight with maternal BMI ≥25 and lowest percent of infant (30.6%) with BMI up to 18.4 (X^2 = 9.927, P = 0.05). Difference in mean birth weight between the highest and the lowest BMI group of mothers was found to be 847.22g and the result is significant (F = 1.799, P =0.05).

Table-1: Relationship between Birth Weight and Maternal BMI before conception

Variable	Birth Weight (g)									
	<2500		2500-2999		3000+		X^2 (P)	Mean	SD	F (P)
	n	%	n	%	n	%				
BMI before conception										
Up to 18.4	21	29.2	29	40.3	22	30.6		2752.78	495.891	
18.5 - 19.9	40	36.7	36	33.0	33	30.3	9.927	2695.41	457.122	1.799
20 – 24.9	34	23.0	71	48.0	43	29.1	(0.5)	2772.97	433.086	(0.5)
25+	0	0	0	0	1	100.0		3600.00		
Total	95	28.8	136	41.2	99	30.0		2745.45	457.023	

Table-2: Relationship between Birth Weight and Maternal BMI before delivery

Variable	Birth Weight (g)									
	<2500		2500-2999		3000+		X^2 (P)	Mean	SD	F (P)
	n	%	n	%	n	%				
BMI before delivery										
20 - 24.9	86	35.2	91	37.3	67	27.5		2693.44	471.446	
25 - 29.9	10	10.9	43	46.7	39	42.4	22.559	2923.91	407.719	6.099
30+	0	0	1	50.0	1	50.0	(0.5)	3100.00	707.107	(0.5)
Total	96	28.3	136	40.1	107	31.6		2759.00	466.131	

Table-2 depicts birth weight distribution by body mass index (BMI). With BMI before delivery, 35.2% babies were of LBW when BMI was between 20-24.9 and only 0% when BMI ≥30 or more. Incidence of adequate birth weight babies was found to be 50% among mothers having BMI ≥30 or more and 27.5% when BMI was between 20-24.9. The result is highly significant (X^2 = 22.559, P =0.05). Difference in mean birth weight between the highest and lowest BMI group of mothers was found to be 506.56g (F = 6.099. P =0.05), which is not significant.

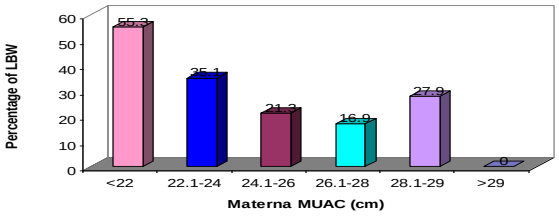

Figure-1: Percentage incidence of LBW by mother's MUAC

Table-3 shows the distribution of birth weight by maternal mid upper arm circumference (MUAC). The result shows that incidence of LBW was found to be highest (55.3%) when maternal MUAC was <22.0cm and lowest (16.9%) when it was between 26.1-28cm. Incidence of low birth weight was 50.0% when maternal MUAC was >29cm and 31.6% when it was <22.0cm. The incidence of adequate birth weight was highest (50.0%) when maternal MUAC was >29cm and lowest (13.2%) when MUAC was <22.0cm. The finding is statistically highly significant (X^2 = 32.437, P = 0.05). The difference in mean birth weight was found to be 563.16g between the highest and lowest MUAC group of mothers (F = 5.948, P = 0.05), which was also significant.

DISCUSSION

This study was conducted on 343 newborns and their mothers to assess the relationship among birth weight of newborns and different maternal factors. The birth weight status of newborn in the present study is better than that of the previous study (Canosa CA, 1989 and Tripathi AM *et.al.*, 1987). This difference could be due to the fact that the present study was conducted after 18 years of the previous study. In this time mothers are more conscious about their health status, antenatal care and nutrition. Body Mass Index (BMI) was calculated and its relationship was identified with birth weight of newborns (Table-1 & 2). BMI showed positive association with birth weight. Lowest mean birth weight (2693.44g) and highest incidence of LBW (35.2%) was found with BMI <20 before delivery and highest mean birth weight (3100.00g) and lowest incidence of LBW (0%) with BMI >30 before delivery. This finding is also in consistent with other findings (Karim E and Taylor CGN, 1997 and Naidu AN et al., 1991).

Relationship between birth weight and maternal mid upper arm circumference has been shown in the present study (Table-3). Arm circumference is a valuable index of mother's nutritional status. Significant association was observed between birth weights and maternal mid upper arm circumference. Mothers with MUAC <22 cm had highest incidence of LBW (55.3%) and lowest mean birth weight (2486.84g). On the other hand, mothers with MUAC >29 cm had the lowest incidence of LBW (0%) and highest mean birth weight (3050.00g). This finding is in agreement with many other studies (Canosa CA, 1989, Karim E and Taylor CGN, 1997, Lechtig A, 1988, Tripathi AM *et.al.*, 1987 and Tripathi AM *et.al.*, 1987). An anthropometric summary shows that as mean values for maternal anthropometric variables gradually increased, birth weight also gradually increased from <2500g to 2500-2999g to >3000g. Therefore, it can be reasonably concluded that maternal anthropometry reflects the nutritional status of mothers. Those mothers who are nutritionally sound (as measured by anthropometry) are most likely being able to give birth to normal weighing and nutritionally sound babies.

Table-3: Relationship between Birth Weight and Maternal MUAC

Variable	Birth Weight (g)									
	<2500		2500-2999		3000+		X^2 (P)	Mean	SD	F (P)
	n	%	n	%	n	%				
Maternal MUAC (kg)										
<22.0	21	55.3	12	31.6	5	13.2		2486.84	400.790	
22.1-24	34	35.1	42	43.3	21	21.6	32.43	2658.76	436.786	5.948
24.1-26	20	21.3	41	43.6	33	35.1	7	2802.13	424.765	(0.5)
26.1-28	11	16.9	28	43.1	26	40.0	(0.5)	2889.23	486.095	
28.1-29	12	27.9	12	27.9	19	44.2		2860.47	511.831	
>29	0	0	3	50.0	3	50.0		3050.00	437.035	

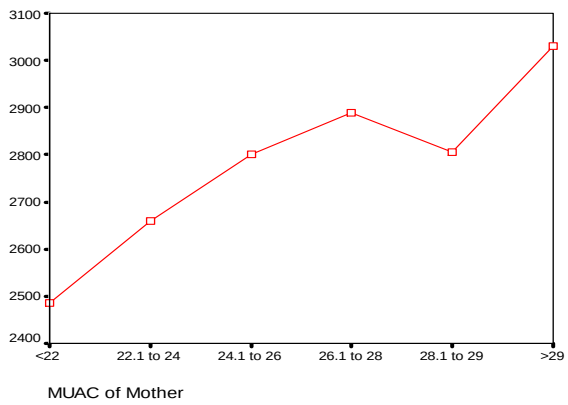

Figure-2: Relationship between Mean Birth Weight and Maternal MUAC

CONCLUSION

This study provided data on several maternal factors for nutritional status of newborn babies in Bangladesh. This cross sectional study reveals that there are significant relations between certain maternal anthropometric factors and birth weight of newborns. Maternal anthropometry height, weight, BMI, weight gain and MUAC have strong positive association with birth weight of newborns. These anthropometric parameters reflect the nutritional status of mothers. The use of anthropometric methods to assess materno-fetal malnutrition can be largely put to valuable practical use in maternity clinics. However, again here it can be cited that chronic effects of social deprivation can limit maternal weight, height and BMI and thus affect birth weight. Thus for long term permanent solution of the problem socio-economic development should be the key strategy.

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