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Correlation between Maternal Factors and Risk of Low Birth Weight

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Abstract **Original Research Article**

This case control study on correlation between maternal factors and the risk of low birth weight were done at RPMCH, Rangpur from January 2010 to April 2010. This study was carried out on 100 LBW babies irrespective of their gestational age to identify the various risk factors related to LBW. Another 100 normal birth weight babies were studied as control. This study showed that 65% of LBW babies were preterm and 35% were term LBW and the mean weight, length and OFC of LBW babies were 1450 gm, 42cm and 29.05cm respectively. The mean gestational age of LBW babies in this study was 34 weeks. The incidence of male LBW babies were higher. Young mothers (less than 20 years) and primipara were responsible for 37% and 40% deliveries of LBW babies. Maternal body weight (below 40 kg) was responsible for 59% of LBW deliveries in contrast to only 28% in the control group of NBW babies. This difference was highly significant ($p<0.001$). Maternal height (140-150cm.) of LBW babies were 71%. On the other hand, in the control group maternal height in between 140-150cm. These difference was highly significant ($p<0.0001$). Therefore, this study also is in conformity with other studies that nutritional status of the mother has influence on birth weight of the babies. Other risk factors of LBW having significant associations with maternal characteristics in this study were upto primary level of education (72%). Housewives (84%), poor socio-economic status (55%), no and irregular antenatal checkup (76%). Impact of the adverse maternal conditions on LBW babies are seen as idiopathic (25%), premature rupture of the membrane (24%), twin gestation (14%), toxaemia of pregnancy (10%), hypertension and APH (12% and 3%) were responsible. This study on 100 LBW babies, has been able to detect the risk factors related to low birth weight in our country. Since this study was conducted on relatively small number of low birth weight babies, the findings in the study may not reflect the overall risk factors, prevailing in the community or the country as a whole. More work with greater sample size representing the whole population of the country should be initiated for proper identification of this serious problem.

Keywords: Maternal Factor, low birth weight (LBW), birth weight.

INTRODUCTION

Low birth weight has been defined by the world health Organization (WHO) as weight at birth of less than 2500grams (5.5 pounds) [1]. This practical cut off for international comparison is based on epidemiological observations that infants weighing less than 2500gm are approximately 20 times more likely to die than heavier babies [2]. More common in developing than developed countries, a birth weight below 2500gm contributes to a range of poor health outcomes.

The goal of reducing low birth weight incidence by at least one third between 2000 and 2010 is one of the major goals in a world fit for children, the declaration and plan of action adopted at the United Nations General Assembly special session on children in 2002. The reduction of low birth weight also forms an important contribution to the Millennium Development Goal (MDG) for reducing child mortality. Activities towards the achievement of the MDGs will need to ensure a healthy start in life for children by making certain that women commence pregnancy healthy and well nourished, and go through pregnancy and childbirth safely. Low birth weight is therefore an

important indicator for monitoring progress towards these internationally agreed-upon goals.

WHO and UNICEF published the first global, regional and country estimates of Low birth weight rates in 1992 [3]. At that time, the low birth weight rate for industrialized countries was around 7 percent, and in less developed countries it ranged between 5 and 33%, with an average of 17% [4]. The aim of this study is to evaluate the importance of maternal factors on the risk of low birth weight.

OBJECTIVE

- This study was be carried out to evaluate the risk factors of low birth weight babies.

METHODOLOGY

This was a hospital based observational case control study from January 2010 to April 2010 at Department of Pediatrics and Department of Obstetrics at Rangpur Medical College Hospital (RpMCH). During the study a total of 100 new born with LBW and 100 newborn with normal birth weight were included as sample size. After taking informed written consent thorough history taken and physical examination done in all these babies full obstetrical history birth history were collected from their mothers and height, weight of the mothers were recorded in the questionnaire. Weight was recorded on a standard spring balance machine and the babies were weighed naked. Length was recorded in infantometer. The dependent variable was birth weight. Independent variable were such as age, socio-economic factors, education, employment, etc. All variable were categorized. Statistics were calculated to describe the relationship between all independent variables and dependent variables. Two tailed probability (p) values of less than 0.05 will be considered to indicate statistical significant. Odds ratio (OR) to deliver low birth weight baby according to maternal factors and their corresponding 95% confidence intervals (Cl) were calculated. P-value were calculated by using Z test for proportion. The risk was estimated by calculating the Odds ratio (O.R) and calculating correlation-coefficient whenever appropriate.

RESULTS

Figure-1 shows birthweight of the babies in LBW group where In LBW group, in this study 8 babies (8%) were less than 1000gm. 53 babies (53%) had birth weight in range of 1000-1500gm. 33 babies (33%) in the range from 1500-2000gm, and 6 babies (6%) had birth weight in the range from 2000-2500gm. The lowest birth weight was recorded 900gm. The mean (+SD) birth weight among low birth weight group was 1450 (+397) gm. In the control group, on the other hand, birth weight of 100 neonates were above 2500gm. All were delivered term.

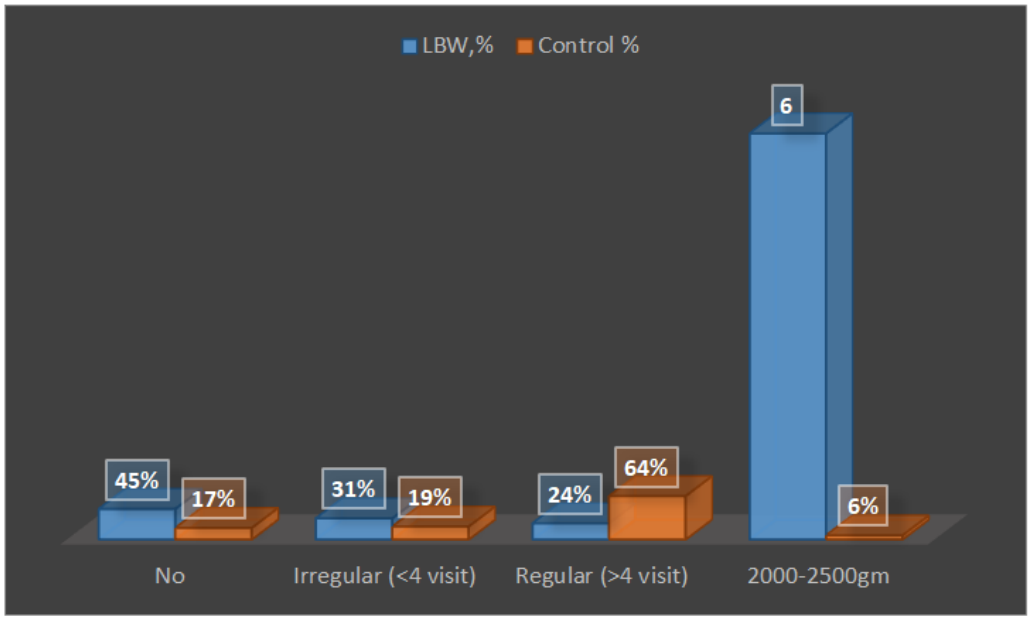

Figure-1: Birthweight of the babies in LBW group

Table-1 shows length of the babies were among 100 LBW babies, 68 babies (68%) had length in between 40-50cm. and that of 32 babies (32%) had length in between 30-40cm. The mean (+SD) length of LBW group were 42 (+5) cm. On the other hand in the control group, the length of all normal weight babies were in between 40-50cm.

Table-1: Length of the babies

Length (cm)	LBW (n=100)		Control (n=100)	
	Number	Percentage	Number	Percentage
40-50	68	68%	100	100%
30-40	32	32%	0	0%

Figure-2 shows Occipito frontal circumference (OFC) of the babies. Out of 100 LBW group, the Occipito frontal circumference (OFC) of 69 babies (69%) were in between 25-30cm. and 31 babies (31%) were in between 30-35cm. The mean (+SD) Occipito frontal circumference of LBW babies were 29.05cm. (SD+2.32cm)

In the control group, the OFC was 30-35cm. in 86% and above 35cm. in 14%.

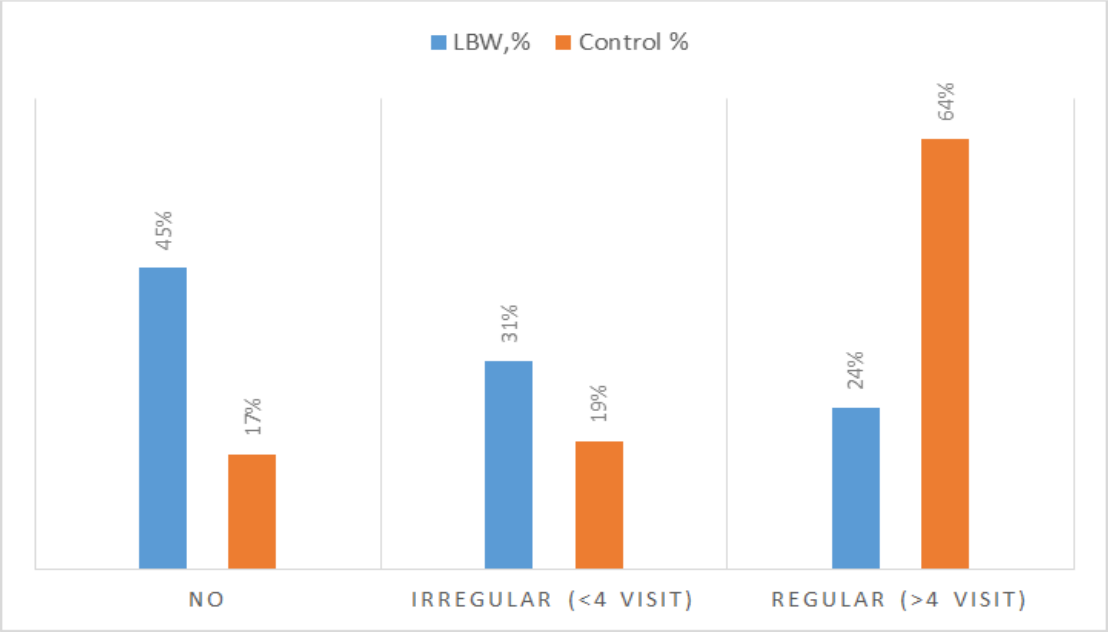

Figure-2: Occipito frontal circumference (OFC) of the babies

Table-2 shows gestational age of the babies. Among 100 LBW group, regarding relation of birth weight to gestational; period in terms of preterm and term. 10 babies (10%) had gestational period in between 24-28 weeks, 17 babies (17%) had gestational period in between 28-32 weeks, 38 babies (38%) had gestational period in between 32-36 weeks and 35 babies (35%) had gestational period 37-40 weeks. The mean gestational period among LBW group were 34 week (SD+3.90).

Table-2: Gestational age of the babies

Gestational age (Weeks)	LBW (n=100)		Control (n=100)	
	Number	Percentage	Number	Percentage
24-28	10	10%	0	0%
28-32	17	17%	0	0%
32-36	38	38%	0	0%
36-40	35	35%	83	83%
>40	0	0%	17	17%

Table-3 shows birth weight of the babies according to sex. Out of 100 LBW group, 59 babies (59%) were male and 41 babies (41%) were female. Out of 59 male babies 41 babies (69%) had birth weight less than 1500gm. and 18 babies (31%) had birth weight more than 1500gm. Out of 41 female LBW babies, 20 babies (48%) had birth weight less than 1500gm and 21 babies (52%) had birth weight above 1500gm. That is among 100 LBW babies. 61% babies were less than 1500gm and 39% babies were more than 1500gm. The male LBW babies significantly higher in this study ($p<0.05$). In the control group 63% babies were male and 37% were female.

Table-3: Birth weight of the babies according to sex

Sex	LBW (n=100)						Control (n=100)	
	No. of babies		No. of Babies					
	<1500gm	(%)	>1500gm	(%)	Total	(%)	No. of Babies	(%)
Male	41	69%	18	31%	59	59%	63	63%
Female	20	48%	21	52%	41	41%	37	37%
Total	**61**		**39**		**100**			

p<0.05 (Significant).

Table-4 shows maternal age and birth weight of the babies where among the LBW group, 37% of the babies were born to mothers below 20 years of age, 27% o the babies were born to mothers of age group in between 20-25 years, 29% of the babies were born to mothers of age group in between 30-35 years, 5% of the babies were born to mothers in between 30-35 years of age and 2% of the babies were born to mothers of age group above 35 years. In mothers less than 20 years of age the risk of LBW babies is 1.58 times higher than that in mothers >20 years age. Correlation coefficient (r) for mothers less than 20 years of age was 0.95. So, there was strong positive correlation to deliver LBW babies with this age group.

In the control group, 27 (27%) of the babies belonged to mothers age below 20 years, 30% of babies belonged to 20-25 years of mothers age group, 35% of babies belonged to mothers age group in between 25-30 years and 6% and 2% of babies belonged to 30-35 years and above 35 years of mothers age group respectively.

Table-4: Maternal age and birth weight of the babies

Maternal Age (years)	LBW (n=100)		Control (n=100)	
	Number	Percentage	Number	Percentage
<20	37	37%	27	27%
20-25	27	27%	30	30%
25-30	29	29%	35	35%
30-35	5	5%	6	6%
>35	2	2%	2	2%

Figure-3 shows maternal weight and birthweight of the babies where out of the 100 mothers having LBW babies. 59 babies (59%) were born to mothers weighing at or below 40 kg and 41 babies (41%) were born to mothers weighing above 40 kg. The proportion of low birth weight babies were found in maternal weight at or below 40 kg were significantly higher (p<0.001) compared to that of control group. The risk of LBW babies from mothers below 40 kg was higher than that of control (OR=3.7). Correlation coefficient (r) for maternal weight at or below 40kg was 0.95. So, there was strong positive correlation to deliver LBW babies with this weight group mother. In the control group more than 40 kg group mothers had the highest percentage (72%) of normal birth weight babies.

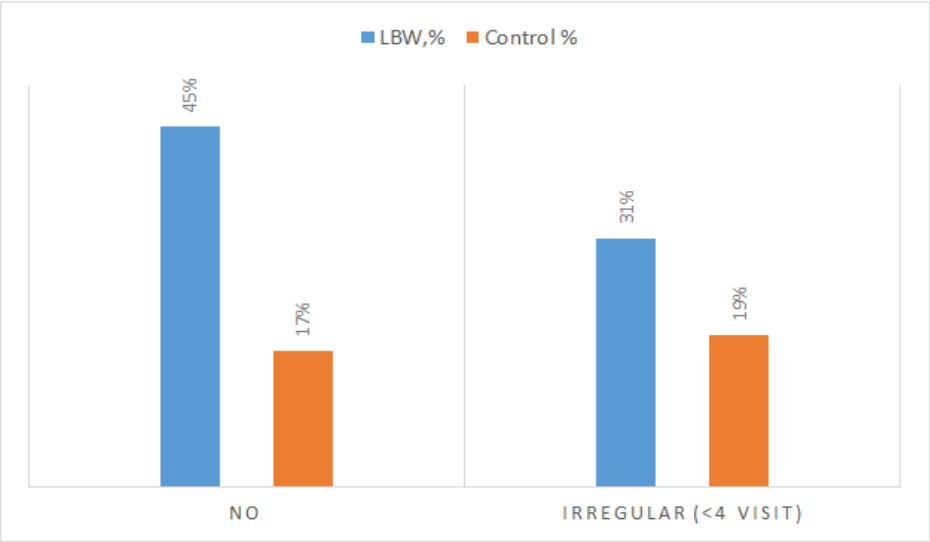

Figure-3: Maternal weight and birthweight of the babies

Figure-4 shows maternal weight and birth weight of the babies where out of 100 LBW babies, 71 babies (71%) were born to mothers of height in between 140-150cm and 29 babies (29%) were born to mothers who had height in between 150-160cm. The mean height of the mothers having LBW were 145cm (SD+4.5cm). Proportion of LBW babies was highest in the height group 140-150cm and it was highly significant (P<0.0001). The risk of LBW babies was higher in the maternal height group 140-150cm (OR 5.4) than that of control group. Correlation coefficient (r) for maternal height group 140-150cm was 0.95. So, there was strong positive correlation to deliver LBW babies with this height group mother.

In the control group on the other hand 69 babies (69%) were born to mothers who had height between 150-160cm. and rest 31 babies (31%) belonged to mothers height in between 140-150cm.

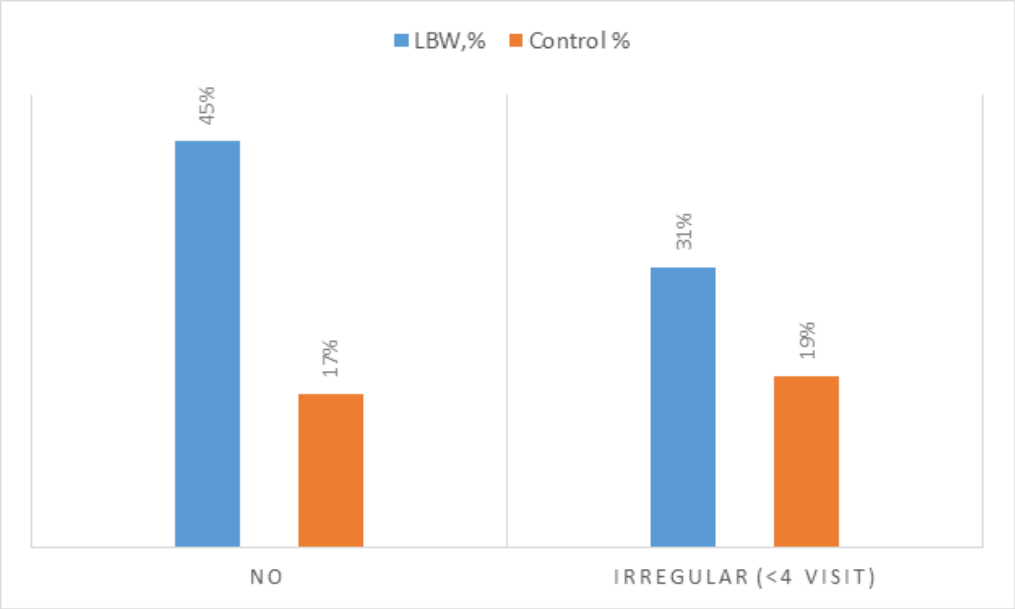

Figure-4: Maternal weight and birth weight of the babies

Table-5 shows sociodemographic status of the parents where Out of 100 mothers having LBW babies, 22 (22%) were illiterate, 50 (50%) were upto primary level of education and 28% were upto secondary and higher secondary group. Proportion of LBW group were significantly higher with maternal education upto primary level than that of control group (P<0.001). Out of 100 LBW group, 84 babies (84%) born to mothers who were house wives and the rest 16 babies (16%) born to mothers who were service holder. In mothers who were house wife, the risk of low birth weight babies were 1.6 times higher than that control group. Out of 100 cases of LBW, 98 babies (98%) were born to mothers were nonsmoker and only 2 babies (2%) were born to smoker mothers. On the other hand in the control group, 100 babies (100%) were born to mothers who were all nonsmoker. Among 100 LBW babies, 55 percent belonged to poor class. 34 percent belonged to average class and 11 percent belonged to rich group. The proportion of LBW were significantly higher in poor socioeconomic class (P<0.0001) compared with that of control group. Correlation coefficient (r) for mother of poor socioeconomic class was 0.95. So, there was strong positive correlation to deliver LBW babies with this class of mother.

Table-5: Sociodemographic status of the parents

Maternal education	**LBW**		**Control**	
	N	**%**	**N**	**%**
Illiterate	22	22%	17	17%
Primary	50	50%	30	30%
Secondary and Higher Secondary	28	28%	53	53%
Maternal occupation	**LBW**		**Control**	
	N	**%**	**N**	**%**
House wife	84	84%	76	76%
Service holder	16	16%	24	24%
Maternal Smoking status	**LBW**		**Control**	
	N	**%**	**N**	**%**

Maternal education	**LBW**		**Control**	
	N	**%**	**N**	**%**
Yes	2	2%	0	0%
No	98	98%	100	100%
Economic status	**LBW**		**Control**	
	N	**%**	**N**	**%**
Poor	55	55%	29	29%
Average	34	34%	52	52%
Rich	11	11%	19	19%

Figure-5 shows antenatal checkup and birth weight where out of 100 LBW babies, 45 babies (45%) were born to mothers having no antenatal checkup, 31 babies (31%) were born to mothers having irregular antenatal visit (<4 visit), 24 babies (24%) were born to mothers having regular antenatal visit (>4 visit). The proportion of LBW babies with mothers having irregular or no antenatal checkup were significantly higher (P<0.0001) than that of control group.

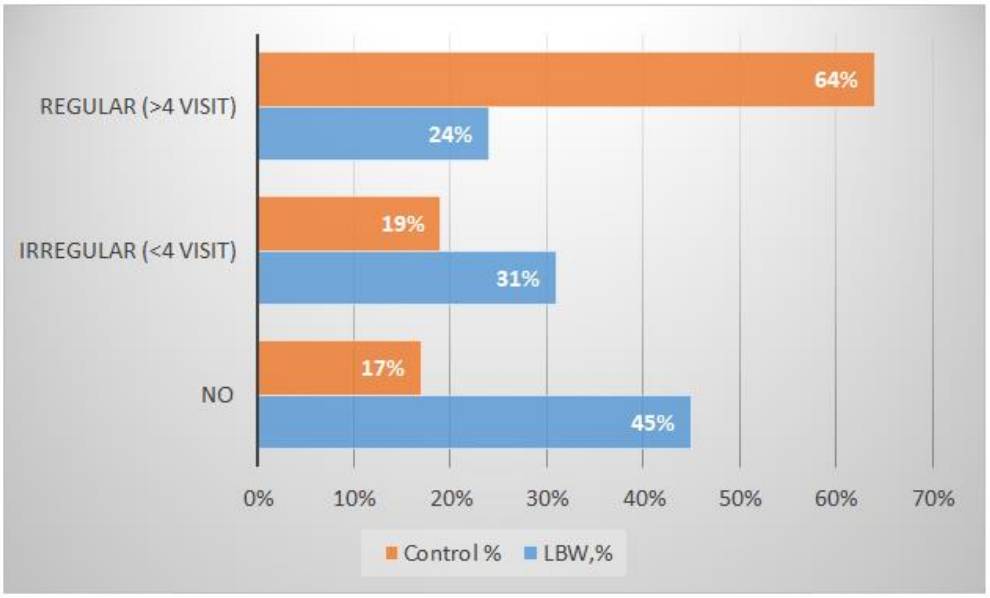

Figure-5: Antenatal checkup and birth weight

Table-6 shows antepartum problem and birth weight. Out of 100 LBW babies, 12 babies (12%) had history of maternal hypertension, 10 babies (10%) had history of maternal toxaemia, 24 babies (24%) had a history of premature rupture of the membrane of the mother, 2 babies (2%) had a history of maternal diabetes mellitus, 14 babies (14%) had a history of twin pregnancy, 25 babies (25%) with no cause identified in the mother, 10 babies (10%) had a maternal history of anaemia. 3 babies (3%) had history of maternal APH. On the other hand in the control group, 87 babies (87%) had no identifiable cause in the mother, 7 babies (7%) had a history of premature rupture of the membrane of the mother. 6 babies (6%) had a maternal history of anaemia.

Table-6: Antepartum problem and birth weight

Antepartum Problem	**LBW (n=100)**		**Control (n=100)**	
	Number	**Percentage**	**Number**	**Percentage**
Hypertension	12	12%	0	0%
Toxaemia	10	10%	0	0%
Premature rupture of membrane	24	24%	7	7%
Maternal DM	2	2%	0	0%
Twin gestation	14	14%	0	0%
APH	3	3%	0	0%
Anaemia	10	10%	6	6%
Idiopathic/ No cause	25	25%	87	87%

Table-7 shows maternal parity and birth weight. Out of 100 LBW babies, 40 babies (40%) were born to primipara mothers, 29 babies (29%) were born to mothers with second gravida, 16 babies (16%) were born to mothers of third gravida, 5 babies (5%) were born to mothers with fourth gravida and 10 babies (10%) were born to mothers with fifth gravida or more.

Table-7: Maternal parity and birth weight

Gravida	LBW (n=100)		Control (n=100)	
	Number	Percentage	Number	Percentage
1st	40	40%	25	25%
2nd	29	29%	38	38%
3rd	16	16%	23	23%
4th	5	5%	11	11%
> 5th	10	10%	3	3%

DISCUSSION

A strong positive correlation exists between LBW and low socioeconomic status.[5] Nutritional status of the mother may influence the fetal growth as well [6]. LBW is a negative health indicator affecting 21 million children in the world annually. Of these, probably 2 to 3 million are from Bangladesh [6]. So, LBW is an important cause of neonatal mortality, morbidity and disability in our country. The aim of this study is to recognise and identify the factors responsible for development of child health problem. So, that intervention strategies can be designed to reduce the incidence, mortality and morbidity of LBW babies by prompt recognition and effective management of high risk mother during pregnancy and high risk neonate at birth.

This study enrolled 100 LBW babies as study group and 100 normal weight babies as controls. The mean birth weight of LBW group in this study were found to be 1450gm. (SD = + 397gm) irrespective of gestational age. It is highly significant in this study that 61% of babies in the LBW group had weight less than 1500gm, that is very low birth weight. Birth weight in developed countries like England. USA and Sweden is much higher in comparison to that in this country [7]. The LBW in underdeveloped countries, perhaps can he attributed to maternal malnutrition, poor socioeconomic status, poor antenatal care [8]. J. N. Bhalla *et al*., [11] also found higher result with 68.4% of babies in the preterm weighing less than 1500gm. The babies weighing between 2000-2500gm showed a less incidence in this study. This is probably due to relatively less problem faced in this group, so relatively less hospital admission.

The length of the baby at birth has also been suggested as a useful criterion of maturity. Ellis and Lawley [10] suggested 45-47cm. of length at birth as the upper limit of prematurity. In this study it was shown that in 68% of the babies birth length were 40-50cm. and the rest were 30-40cm. The mean length of the babies were 42cm. (SD + 5cm) irrespective of Sex of these babies. From this study it was obvious that figures in the developed countries seem to be grater than those of developing countries. The another study [9] suggested that the combination of weight less than 2500gm and crown heel length less than 45cm had been used as a standard for prematurity. This study is also consistent with the studies mentioned above.

Many workers found head circumference to be an acceptable criterion of maturity Ellis and Lawly [10] evaluated its value and found that head circumference of less than 33cm. could be a sign for prematurity. Similar observations were made by Kalra *et al*., [11]. In the present series mean head circumference irrespective of sex is 29.05cm. (SD+2.32cm.) which is consistent with the above series. If anthropometric measurements are to be used in maturity assessment, head circumference is to be preferred to birth weight, crown heel length or skull diameters. The estimation of age from head circumference alone is better than from radiological measurements of epiphyseal centres [12].

In the present study at RPMCH, among LBW group 65% were preterm LBW i,e gestational age less than 37 completed weeks where as 35% of the babies were term LBW. Similar result was shown by Punja *et al*., [13] where in a study of 570 LBW babies found 65% preterm against 35% term LBW. Though prematurity rate is more in developed countries like USA and percentage of SGA is more in developing countries which is not consistent with this study because this study is not a reflection of the whole country. This study was done in one tertiary hospital.

Out of 100 LBW babies, 59% were male and 41% female, out of male LBW babies. 69% were less then 1500gm and 31% were more than 1500gm. On the other hand among female low birth weight group 48% were less than 1500gm and 52% were more than 1500gm. In control group 63% were male and 37% were female. The proportion of male LBW babies were significantly higher than that of female LBW babies ($p<0.05$) in this study. Similar findings have been reported by other authors [14]. This male preponderance in this study may be due to social custom existing in this country where the male infants are better cared for and often admitted in the hospital.

Also in the control group there is male preponderance which can be explained in the way as above.

The maternal factors and obstetric history should be taken into consideration while studying the risk factors of LBW babies. Common maternal risk factors are age, parity, nutritional status, levels of education, socio-economic status, chronic diseases, employment, smoking habit and antenatal care. The prevalence of smoker in women is less common in our country. So it may not be considered to be a significant risk factors of low birth weight. The relationship between the above risk factors and birth weight are well established in this study and these are discussed in the following.

The age of the mother also influences the birth weight of the newborn. In this study, 37 percent of LBW deliveries occurred in the mothers below 20 years of age. This result is consistent with other study [15]. The risk of LBW deliveries in the mothers below the age of 20 years are higher than that of control group (OR=1.58). The more occurrence of LBW babies in the teenage mothers is because they have not yet reached their own adult stature or organ size. So it is probable that mothers divert nutrients to meet their own needs, leading to LBW neonates. Proportion of LBW declined with the rise of maternal age upto 35 years, there after it rises again. Similar result was shown by other worker [16]. Women of over 35 years are grand multipara that may lead to shorter gestational duration or small for gestational age due to other associated factors, like more prevalence of malnutrition and anaemia among multipara mothers [15, 16].

The nutritional status of the mother should be considered since LBW have been associated with malnutrition of the mothers. Maternal weight, height have positive effect on birth weight. In this study 59% of the LBW babies had their mothers weighing at or below 40 lg. in contrast to only 28 percent in the control group. This difference is highly significant ($p<0.001$). The risk of LBW having mothers weight <40 kg were much higher (OR=3.7). In the control group, highest proportion (72%) of normal birth weight babies were found in the mothers weighing more than 40 kg. ($p<0.001$) These suggest that maternal body weight has got influence on fetal growth and birth weight. This findings is consistent with other studies [15, 16].

In this study, 71% of LBW babies were born to mothers who had height between 140-150cm and only 29% of the LBW babies were in mothers height between 150-160cm. In the control group 31 percent of the normal birth weight babies who had maternal height in between 140-150cm There was significant association of maternal height and birth weight ($p<0.0001$). The risk of LBW babies who had maternal height in between 140-150cm were 5.4 times higher than that of control group. So the maternal height is directly proportional to the birth weight of the babies. The finding in this series is consistent with other studies [7, 8].

Maternal education level in this study showed impact on birth weight of the babies. Seventy two percent of the mothers having LBW babies were either illiterate or educated upto primary levels in contrast to 47% in the control group. This difference was highly significant ($p<0.001$). The former group had a higher risk of LBW babies in comparison with controls (OR=2.8).

Proportion of LBW babies is highest in primary level educated group of mothers; this is probably not a reflection of real picture because illiterate mother from poor socioeconomic background have limited access to tertiary hospital.

Almost all LBW babies (84%) were born to mothers who were house wives. On the other hand, in the control group, the NBW babies (76%) were born to mothers who were house wives. The risk of LBW babies born to house wife mothers were higher (OR=1.6) than those of control group. This study is in conformity with the studies by PRITCHARD AND MFPHM [4].

CONCLUSION

The maternal risk factors like poor nutritional status of the mother, poor antenatal checkup, diseases during pregnancy, twin gestation, early conception and other factors, that give rise to mortality and morbidity of low birth weight babies.

Undoubtedly better perinatal care is largely responsible for steady decrease in perinatal mortality. Successful and adequate provision of high quality, prenatal and perinatal care requires competent health care professionals and coordination of services among physicians, attendants, untrained traditional birth attendant, obstetrician, paediatricians, clinics and hospitals.

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