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Original Research Article

Estimation of maternal serum albumin at term to determine its correlation with birth weight of babies

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ABSTRACT

Background: Serum albumin is a vital laboratory indicator of nutrition status. Fetal weight depends upon the nutritional status of mothers. Indeed, the serum albumin status at term may help to assume the fetal weight. We do have not enough research-based data regarding this issue. The aim of this study was to estimate maternal serum albumin at term and to observe its correlation with the birth weight of babies.
Methods: This cross-sectional analytical study was done at department of gynaecology and obstetrics, Sir Salimullah medical college and Mitford hospital, Dhaka, Bangladesh from July 2019 to June 2020. A total of 96 mother-baby pairs were selected using purposive sampling method. Women with single full-term pregnancy based on fundal height on Naegele's rule irrespective of any mode of delivery was included in this study. Mothers with normal albumin levels (3.6-5.2 gm/dl) were defined as group A and mothers with low albumin levels (<3.6 gm/dl) in group B. Statistical analyses of the results were obtained by using window-based computer software devised with SPSS-22.
Results: In analyzing the maternal serum albumin level, we observed that majority of the participants were with normal albumin levels which were 81% and the rest 19% of patients were low albumin levels. In this study, it was observed that more than half (56.4%) of babies were male in group A and 9 (50.0%) in group B. The majority (94.9%) of babies' birth weights were ≥2.5 kg in group A and 4 (22.0%) in group B. The difference of birth weight was statistically significant ($p<0.05$) between the two groups. Maternal serum albumin was significantly associated with birth weight of babies in multivariate analysis. But negatively correlated with newborn birth weight which is statistically significant.
Conclusions: Maternal albumin was observed to be directly proportional to the birth weight of babies.

Keywords: Animal protein, Maternal albumin, Low birth weight, Antenatal care

INTRODUCTION

World health organization (WHO) has defined low birth weight (LBW) as weight at birth of less than 2500 gm. It is a major public health problem in most developing countries, being associated with a high incidence of neonatal mortality in these regions. Overall, it is estimated that 15.0% to 20.0% of all births worldwide are LBW, representing more than 20 million births a year.[1] There is significant variation in the incidence of LBW across regions. According to WHO report on LBW estimates the prevalence of LBW varied widely across regions from 7.2% in developed regions to 17.3% in Asia.[2] LBW also is an important cause in perinatal death.[3] In Bangladesh, at least 22.6% babies are born with a LBW according to a

national survey report of national LBW survey Bangladesh 2015. Different studies have revealed that significantly associated risk factors for the birth weight of a newborn vary according to the geographical location and the study population. There are many known risk factors associated with LBW and the most important of which are socio-economic factors, medical risks before or during gestation, and maternal lifestyles.[4] The common risk factors include maternal age, maternal education, time of antenatal registration, number of antenatal visits, physical work during pregnancy, and height and weight in pregnancy. A significant association between calorie and protein intake with birth weight of babies was also observed.[5] Another important factor influencing perinatal morbidity and mortality is birth weight of the baby. There is a high risk of death in fetuses or newborns who are born with LBW. Newborn may also carry risk of having problems physically and intellectually if it lives.[6] LBW renders individuals vulnerable to infectious disease morbidity and mortality during both infancy and childhood. Some of the interventions suggested to reduce LBW include delaying childbearing in adolescents, efforts to improve nutritional status of women, particularly anemia in pregnancy, access to antenatal care, advice on adequate rest during pregnancy, especially in undernourished women, efforts to stop smoking and reduce tobacco chewing in areas wherever it is common practice, improving female education, especially that of mothers.[7] Biological processes that affect fetus in utero are related to the mother's physiology, including her nutrition (mother's weight before pregnancy and history of having newborns with LBW), exercise, infections, and consumption of tobacco, alcohol, and other drugs.[8] Birth weight of babies correlated between half-siblings of the same mother but not of the same father because of the possible contribution of maternal albumin.[9] It has been argued that the likely effects of maternal albumin deficiency on the birth weight of babies depend on the stage of gestation. Reduced dietary protein during pregnancy causes decreased maternal albumin and LBW of babies. Nutritional reserves including protein and vitamins are low in these babies.[10] Increased dietary protein intake promotes the synthesis of more albumin and raises albumin levels in the blood. Albumin also has the free radical scavenging ability. Albumin attaches to and carries bilirubin, drugs, and thyroid hormone, it competitively binds with calcium, prevents photo degradation of folic acid, and helps maintain blood acidity in a narrow range.[11] Low albumin level in neonates is associated with various adverse clinical conditions, including necrotizing enterocolitis, and sepsis.[13] If a protein-rich diet is given to the mothers during pregnancy it will maintain the ideal serum albumin level and thus improve the weight of neonates.[14] This study was undertaken to determine the maternal serum albumin level at term and correlate it with the birth weight of the neonate.

METHODS

This cross-sectional analytical study was done at the department of gynaecology and obstetrics, Sir Salimullah medical college and Mitford hospital, Dhaka, Bangladesh from July 2019 to June 2020. A total of 96 mother-baby pairs were selected using purposive sampling method. Women with single full-term pregnancy based on the fundal height on Naegele's rule irrespective of any mode of delivery in the mentioned hospital were included in this study. The study was approved by the ethical committee of the mentioned hospital. Properly written consents were taken from all the participants before data collection. The whole intervention was conducted in accordance with the principles of human research specified in the Helsinki declaration and executed in compliance with currently applicable regulations and the provisions of the general data protection regulation (GDPR).[15,16] As per the inclusion criteria of this study patients with an uncomplicated singleton pregnancy, gestational age 37 completed weeks to 42 completed weeks were included as study subjects. On the other hand, as per the exclusion criteria, cases with preterm or multiple pregnancy, women with pregnancy complications including hypertensive disorder, gestational diabetes mellitus or having chronic diseases like (diabetes mellitus, thyroid disorder, renal diseases, heart diseases, SLE), mothers who disagree to be enrolled in the study and mothers delivering babies with obvious congenital anomalies were excluded. Details information on demographic profile, delivery outcome, birth weight was entered in the forms. To estimate serum albumin level, 2 ml maternal venous blood was collected using sterile disposable 5 ml syringe under aseptic technique. All sera collected were pooled in a refrigerator at -20°C until the time of maternal albumin assay. Mothers with normal albumin level (3.6-5.2 gm/dl) were defined as group A and mothers with low albumin level (<3.6 gm/dl) group B. The birth weight of babies in kilogram was determined immediately after delivery using the bassinet weighing scale which has a sensitivity of 50 gm. Babies weighing <2.5 kg was regarded as LBW and those weighing ≥ 2.5 kg was regarded as acceptable birth weight for this study. Independent variables were age, educational status, occupation, residence, socio economic status and maternal serum albumin. On other hand, dependent variables were birth weight of babies. Data were collected by developing structured questionnaire which included respondent personal information, demographic information, clinical examination and laboratory investigation. All data were processed, analyzed and disseminated by using MS excel as well as SPSS version 23 program as per the necessity.

RESULT

In this study, it was observed that, more than half (55.1%) of the patients belonged to age 18-23 years in group A and belonged that age among 12 (66.7%) in group B. Majority (87.2%) of the patients belonged to BMI 18.5-24.9 (kg/m^2) in group A and among 14 (72.2%) in group B. It was observed that, more than half (60.3%) of the patients were primi in group A and primi among 10 (55.5%) in group B. More than three fourth (76.9%) of patients had regular antenatal checkup in group A and among 8 (44.4%) in

group B. More than three fourth (79.5%) of patients underwent caesarean section in group A and underwent caesarean section 11 (61.1%) in group B. The difference of antenatal checkup was statistically significant (p<0.05) between two groups. In analyzing the maternal serum albumin level, we observed that, majority of participants were with normal albumin level which was 81% and the rest 19% patients were with low albumin level. In this study, it was observed that, more than half (56.4%) of the babies were male in group A and among 9 (50.0%) in group B. Majority (94.9%) of the babies' birth weight were ≥2.5 kg in group A and those weight was found among 4 (22.0%) in group B. The difference of birth weight was statistically significant (p<0.05) between two groups.

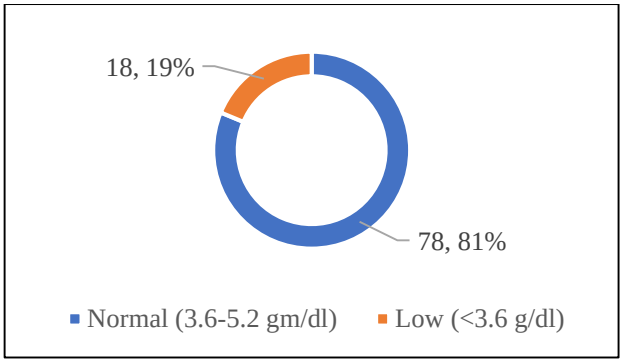

Figure 1: Maternal serum albumin level distribution, (n=96).

Table 1: Demographic status of participants, (n=96).

Variables	Group A, n=78		Group B, n=18		P value
	N	%	N	%	
Age (In years)					
18-23	43	55.1	12	66.7	0.371
24-30	28	35.9	6	33.3	
31-37	7	9.0	0	0.0	
BMI (kg/m^2)					
18.5-24.9	68	87.2	13	72.2	0.115
25-29.9	10	12.8	5	27.8	

Table 2: Distribution of mothers according to maternal parameter, (n=96).

Characteristics	Group A, n=78		Group B, n=18		P value
	N	%	N	%	
Parity					
Primi	47	60.3	10	55.6	0.714
Multi	31	39.7	8	44.4	
Antenatal checkup					
Regular (≥4 visits)	60	76.9	8	44.4	0.006
Irregular (<4 visits)	18	23.1	10	55.6	
Mode of delivery					
Vaginal delivery	16	20.5	7	38.9	0.1
Caesarean section	62	79.5	11	61.1	

Table 3: Distribution of newborns according to sex and birth weight, (n=96).

Parameters	Group A, n=78		Group B, n=18		P value
	N	%	N	%	
Sex					
Male	44	56.4	9	50.0	0.622
Female	34	43.6	9	50.0	
Birth weight (kg)					
<2.5	4	5.1	14	77.8	0.001
≥2.5	74	94.9	4	22.2	

Table 4: Association of maternal serum albumin with birth weight of babies, (n=96).

Birth weight (Kg)	Group A, n=78		Group B, n=18		P value
	N	%	N	%	
≥2.5	74	94.9	4	22.2	<0.01
<2.5	4	5.1	14	77.8	

DISCUSSION

The aim of this study was to estimate of maternal serum albumin at term and to observe its correlation with birth weight of babies. This cross-sectional analytical study was carried out with an aim to estimate the maternal serum albumin at term and determine birth weight of newborn. In this present study, it was observed that the maximum patients age was between 18 to 23 years. The mean (±SD) age of the patients was 23.53 (±4.54) years varied from 18 to 36 years. Yang et al found the mean maternal age were 26±5.33 years and 27.8±7.6 years respectively.[17] In Bangladesh Khan et al reported that the prevalence of LBW among infants from rural and urban areas did not differ significantly.[18] Their findings based on sub-sample suggest that both figures have now dropped to around 20.0%, perhaps indicating that rural-urban disparities in LBW prevalence have been improved in the Bangladesh MICS 2012-13. In this present study, it was observed that 93.6% of the patients' socio-economic status was lower middle class in group A and 94.4% in group B. Maternal parity is a well-recognized predictor of infant birth weight, with the lowest birth weights observed among infants born to nulliparous women.[19]

In this present study, it was observed that 56.4% babies were male in group A and 50.0% in group B were female and male to female ratio was 1.3:1 in group A and 1:1 in group B. Ahmadu et al found 53.1% were male babies and 46.9% female babies and male to female ratio was 1.1:1.[20] In this present study, it was observed that 94.9% babies were born as normal birth weight in group A and 22.2% in group B. Chaudhry et al study found 60.0% and 40.0% were normal birth weight and LBW respectively, which differ with the present study. Chaudhry et al showed majority of neonates and mothers had acceptable birth weight and maternal albumin respectively.[14] Similar observation was made by Baba et al who observed high percentage of mother-baby pair with acceptable maternal albumin levels and birth weight of babies.[21] In Chaudhry et al study it was seen that neonates in number had low weight and their mothers were having albumin level <3.5 gm/dl.[14] Saleem et al study reported that reduction in nutritional diet of mother causes intrauterine stress and disturbance of metabolic system leading to reduction in baby weight. Carlos and Marilia concluded that low baby weight and under-nutrition in utero causes adult diseases with fetal origin.[22] In Chaudhry et al neonates in number had acceptable weight and their mother was having albumin level in the acceptable range 3.5-5.0 gm/dl.[14] In the developing countries the relationship between maternal albumin and birth weight outcome of neonates is of major public health importance.[14] Malnutrition and LBW are alarmingly high.[23] Ahmadu et al found that, the risk of having LBW babies in mothers with presumably adequate albumin levels may be low.[20] This might not be unconnected to the fact that albumin is a protein and could be associated with high turnover of cells needed for tissue growth and repair in babies.

Limitation

The study population was selected from one selected hospital in Dhaka city, so that the results of the study may not be reflect the exact picture of the country. It was conducted at a very short period of time. Small sample size was also a limitation of the present study. The present study excludes pregnant women with co-morbidities thus such patient requires further research.

CONCLUSION

The study findings suggest that pregnant women with low serum albumin (<3.6 gm/dl) level carry higher risk of giving LBW newborns then women with normal serum albumin level (3.6-5.2). During antenatal checkup women should be screened for S. albumin deficiency, so that corrective measures could be taken to avert the burden of the LBW. Finally, this study concludes that maternal serum albumin level shows a strong relationship with birth weight of newborns.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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