

**Original article:**

**Low level of serum Hemoglobulin concentration associated with neonatal birth weight**

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**Abstract:**

**Background:** Lower level of maternal serum hemoglobin (Hb) concentration may cause adverse pregnancy outcome (LBW, Preterm delivery) have been inconsistent. Many studies have been shown the impact of Hb concentration and protein status on pregnancy outcome in GA<37 weeks of pregnant mother. **Objectives:** The study was carried out to measure serum Hb concentration correlated with TP level on birth outcomes in GA <37 weeks of delivery mother. **Method:** This observational study was carried out in the Department of Physiology Sir Salimullah Medical College Mitford Hospital, Dhaka. A total number of 108 subjects were included in this study. They were divided into two groups among them 27 full term delivery mother gestational age (>37 wks) with their respective neonates (control group). The study group consisted of 27 Preterm delivery mothers gestational age (<37 wks) with their respective neonates (study group). Age ranged of both (control & study) pregnant mother were from 20-40 yrs. The serum Hb and TP level of all participants were estimated by usual lab technique (Autoanalyser) in laboratory of department of Physiology, SSMC to observe the availability of binding protein. Independent samples t test, and Pearson's correlation were done by as a test of significance. p value <0.05 was considered as significant. Statistical analysis was done by using SPSS Programme, Version-15. **Result:** Mean serum Hb level were significantly higher (p<0.01) and serum total protein level were significantly lower in gestational age <37 weeks pregnant mother (study) in comparison to gestational age >37 weeks of pregnant mother (control). Again, cord serum TP concentration of neonates were significantly (p<0.001) lower in gestational age <37 weeks of neonates compared with gestational age >37 weeks neonates of their respective mother. On the other hand, mean birth weight ( $\geq 2.5\text{kg}$ ) and APGUR score both at 1<sup>st</sup> and 5<sup>th</sup> minute ( $\geq 8$ ) were significantly (p<0.001) lower in neonates of gestational age <37 weeks than that of, gestational age >37 weeks neonates of their respective mothers. **Conclusions:** The present study revealed significantly reduced hemoglobin & lower cord blood protein concentration in neonates and & TP level of their respective mothers whose are gestational age <37 weeks. Abnormal hemoglobin concentrations causes increase the risk of adverse birth outcomes LBW, poor APGUR score; these may be due to poor maternal protein status.

**Keywords:** Hb; TP; birth weight; gestational age

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**Introduction**

Adequate supply of nutrients is essential for the normal progression of healthy fetal growth and development. Maternal Hb is one of the important factors that

influence birth weight. Low Hb concentration may have some adverse effect.<sup>1,2</sup> & also predisposing factors for low birth weight & abnormal outcome<sup>3</sup>. The relation of Hb concentration to birth outcome

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will probably depend on when the Hb is measured. Pregnant women with Hb levels below 11g/dl are at higher risk of LBW<sup>4</sup>. The normal Hb concentration in the body is between 12-14 gm%. During pregnancy, plasma volume increases by 50%, there is a consequent fall in Hb concentration, hematocrit and red cell count because of haemodilution called physiological anemia of pregnancy<sup>5,6</sup> but, low concentration of Hb which causes anemia in pregnancy,<sup>7</sup> because haemodilution is a main factor to aggravate anemia<sup>8</sup> is a significant cause of morbidity and mortality, both for pregnant mother and her fetus<sup>9,10</sup> and about 16% to 40% of maternal deaths occur due to anemia<sup>11</sup>. Some studies showed a significant association between abnormal level of maternal Hb concentration and adverse pregnancy outcomes in the form of low birth weight (LBW) babies, preterm delivery, perinatal death, intrauterine growth restriction and the fact is at a higher risk of early childbearing<sup>12,13,14</sup>. This supports the fact that poor placental and neonatal development is due to inadequate oxygen supply to fetus across the placenta.<sup>15</sup> Pregnancy is associated with increased demand of all the nutrients like protein, iron, copper, zinc, etc<sup>16</sup> Trace elements is needed in minute quantities are essential for development and normal function of the body as well as for healthy fetal outcome<sup>17</sup>. A deficiency of one micronutrient is often associated with deficiencies of others, which may lead to reduced concentration of hemoglobin during pregnancy<sup>18</sup>. Deficiency of these may cause various reproductive health problem<sup>17</sup>, as a consequence of LBW & increased risk of infant mortalities may occur<sup>19</sup>.

Major nutrients like protein is a host of micronutrients play a significant role in vital process of growth<sup>20</sup>. Protein are vital to every part of the human body are found in bones, muscles, skin, and nearly every vital organ or tissue. Protein must be consumed through food, for proper functioning and survival to the body<sup>21</sup>. So, deficiency of these may affect pregnancies, delivery, outcome and strongly affect fetal growth as well as length of gestation<sup>22</sup>. Hypoproteinaemia during pregnancy have shown to have serious implications on the developing foetus.<sup>21</sup> Birth weight is a strong indicator not only of the mothers health and nutritional status but also of the newborn's baby for survival, growth and development<sup>6,23</sup>. Neonates are presence with fetal growth retardation is major cause of infant mortality and is considered as a sensitive index of nation health and development<sup>2</sup>. The low birth weight neonates have a number of neonatal problems like

hypothermia, inability to suckle the breast, asphyxia, sepsis, infection, hypoglycemia etc<sup>5,24</sup>.

The prevalence of LBW is higher in Asia than elsewhere. In India, prevalence of low birth weight babies is 21.5%.<sup>2</sup> In Bangladesh, LBW the causes of preterm related neonatal mortality is 30%<sup>11</sup> is recognized to be contributory to under nutrition of the fetus.<sup>10</sup>

### **Materials and methods**

The present cross sectional study was carried out in the Department of Physiology, Sir Salimullah Medical College, Mitford Hospital, Dhaka. A total number of 108 subjects were included in this study. Among them 27 were neonates (<37wks) (study group) and another 27 were neonates (>37wks) (control group) of their respective mother. Pregnant mother were selected on the basis of defined selection criteria. All the participants were belonged to lower and lower middle socio-economic status. All the neonates were collected from emergency labor ward in Sir Salimullah Medical College, Mitford Hospital. Detail personal, dietary, medical, family, socio economic, occupational histories were taken of those mother and a thorough clinical examination were done and all information's were recorded in a standard prefixed questionnaire. Five (5) ml of neonatal blood were collected from placental end of cord immediately after delivery. Blood was centrifuged at 3000 rpm for 20 minutes. The statistical analysis was done by Independent-samples t test and by using SPSS, Version-15.

**Ethical clearance:** Prior the submission, this research study was approved by the Ethics committee of Sir Salimullah Medical College, Mitford, Dhaka.

### **Results**

The anthropometric data of the subjects are presented in Table-I

This table shows that mean serum hemoglobin levels were significantly ( $p<0.01$ ) higher in gestational age <37weeks (preterm mother) in comparison to gestational age >37weeks (full term mother). On the other hand, mean serum total protein level were significantly ( $p<0.001$ ) lower in gestational age <37weeks (preterm mother) than those of gestational age >37weeks (full term mother). Again, these values were significantly ( $p<0.001$ ) lower in neonates of gestational age<37wks in comparison to those of, gestational age>37wks neonates of their respective mothers. Furthermore, table shows that APGUR

score both at 1<sup>st</sup> and 5<sup>th</sup> minute ( $\geq 8$ ) and birth weight ( $\geq 2.5$ kg) were significantly ( $p < 0.001$ ) lower in neonates of gestational age  $< 37$  weeks than that of, gestational age  $> 37$  weeks neonates of their respective mothers.

**Table I: Hemoglobin (Hb) Serum total protein, in different groups (n=108)**

Groups	Hb (g/dl)	Total Protein (g/dl)	APGAR Score		Baby weight (kg)
			At 1 <sup>st</sup> minute	At 5 <sup>th</sup> minute	
Group A <sub>1</sub>	8.89 ± 0.65	7.40 ± 1.52			-
Group A <sub>2</sub>	-	6.02 ± 1.50	8.04 ± 1.02	8.70 ± 0.67	3.03 ± 0.31
Group B <sub>1</sub>	9.36 ± 0.34	5.35 ± 1.21			-
Group B <sub>2</sub>	-	3.76 ± 0.62	6.59 ± 1.12	7.63 ± 1.21	2.22 ± 0.25
<b>p value</b>					
A <sub>1</sub> vs B <sub>1</sub>	0.002 <sup>s</sup>	<0.001 <sup>s</sup>			-
A <sub>1</sub> vs A <sub>2</sub>	-	0.002 <sup>s</sup>			-
B <sub>1</sub> vs B <sub>2</sub>	-	<0.001 <sup>s</sup>			-
A <sub>2</sub> vs B <sub>2</sub>	-	<0.001 <sup>s</sup>	<0.001 <sup>s</sup>	<0.001 <sup>s</sup>	<0.001 <sup>s</sup>

Data are expressed as Mean ± SD. p value was done by unpaired “t” test. n = Total number of subjects.

s = Significant

**Group A<sub>1</sub> = Gestational age >37 weeks of pregnant mother**

**Group A<sub>2</sub> = neonates of the respective delivery mother**

**Group B<sub>1</sub> = Gestational age <37 weeks of pregnant mother**

**Group B<sub>2</sub> = neonates of the respective delivery mother**

**Control**

**Study**

**Graph-I** showed, no linear correlation between maternal hemoglobin concentration with birth weight of their respective neonates in both study and control group separately.

**Graph-II, III** showed, maternal serum total protein concentration were positively correlated with birth weight of their respective neonates in control group (GA > 37 weeks), and maternal serum total protein concentration were negatively correlation with that of birth weight of their respective neonates in

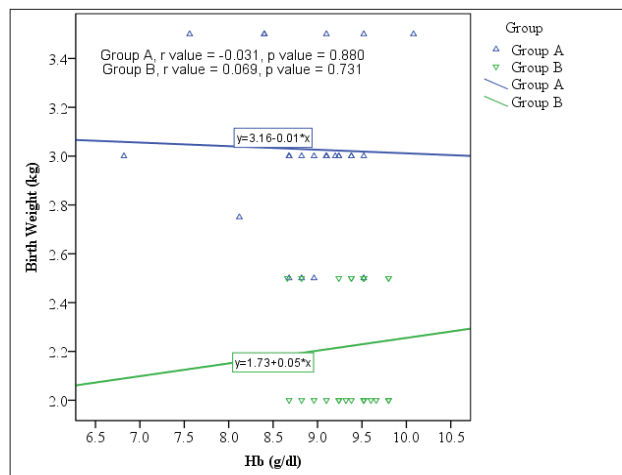


Figure-I: Correlation & regression of hemoglobin of mother with birth weight of respective neonates

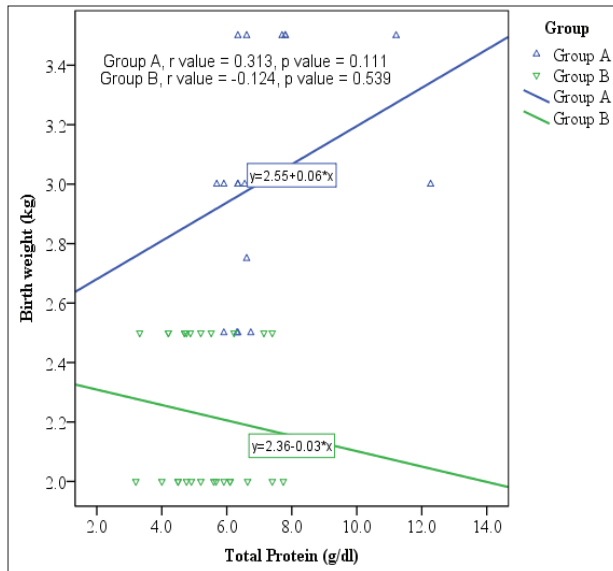


Figure-II: Correlation & regression of total protein of mother with birth weight of respective neonates study group (GA < 37 weeks). Though the relationship were not statistically significant.

**Discussion**

In this study, lower level of Hb and TP have been observed in study group. Again, Low birth weights (LBW) have been documented in this group of neonates. These findings are consistent with those

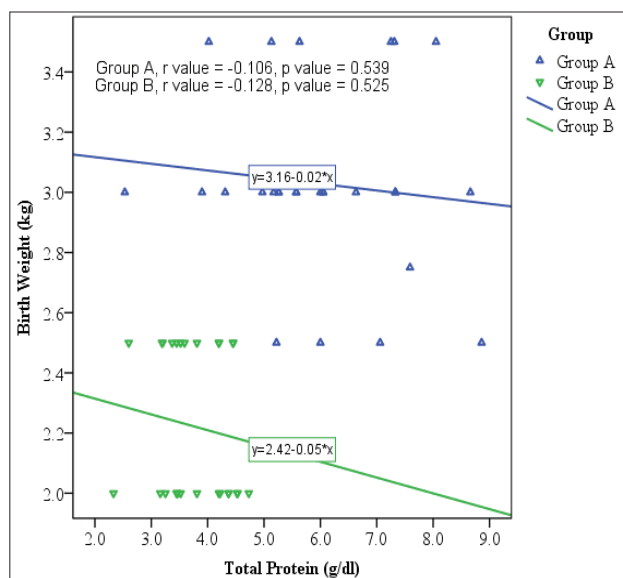


Figure-III: Correlation & regression of total protein of neonates with their birth weight

of some other researchers. Pregnant women in developing countries consume diet with lower quantity of protein, minerals and vitamins. This inadequate dietary intake may be responsible for lower concentration of Hb, and total protein as a consequence of LBW of neonates and poor outcome. It has been suggested that, reduced level of Hb during pregnancy in control women were within normal range due to physiological anemia during pregnancy. Decrease maternal Hb causes decreased availability of oxygen transport to the fetus as a consequence, of intrauterine foetal growth restriction as well as LBW & preterm delivery<sup>4</sup>. Furthermore, low APGUR score causes increased risk of neonatal mortality because of very poor survival rate, also found by different researcher in different studies.<sup>25</sup> Again, some other investigators suggested that, during pregnancy plasma volume increases by 50% & there is a consequent fall in Hb concentration, hematocrit value and red cell count due to hemodilution.<sup>6,26</sup> On the other hand, poor socio-economical status indicates increase intake of especially grain product containing dietary fiber, phytate are known to decrease the availability of binding protein and decrease absorption<sup>27</sup>. Again, increased urinary excretion may causes decreased availability of binding protein is an important contributory factor<sup>28</sup>. This study shows mean(+\_SD) serum Hb were significantly ( $p < 0.01$ ) lower in group A<sub>1</sub> (control mother) in comparison to group B<sub>1</sub> (study mother). And mean TP concentration was significantly ( $p < 0.001$ ) lower in group B<sub>1</sub> (study mother), than group A<sub>1</sub> (control mother). On the other

hand, mean serum TP concentration was significantly lower ( $p < 0.001$ ) in group B<sub>1</sub>, & B<sub>2</sub> (study mother & their neonates) than group A<sub>1</sub>, A<sub>2</sub> (control mother & their neonates). Study shows, Hb concentration comparatively increase in study mother (<37 weeks) than control (>37 weeks) mother. it may be due to inadequate plasma volume expansion, may increase blood viscosity, which lead to poor placental blood flow and poor nutrient delivery to fetus, thus limiting the fetal growth. However, In the present study, lower concentration of Hb and TP level in this study group is due to- decrease availability of binding protein due to inadequate dietary intake. Poor fetal outcome as evidence by, LBW-birth weight <2.5kg, poor APGUR score <7 at 1<sup>st</sup> & 5<sup>th</sup> minute. Again, LBW of neonates (GA <37 wks) in this study may be due to, reduced level of maternal Hb and low plasma protein status in neonates as evidence by their measured values in cord blood. This reduced level of Hb is due to low maternal consumed diet as evidenced by the negative correlation of maternal serum Hb, total protein, with that of neonatal blood. However, the exact mechanism involved for the LBW of neonates & poor outcome due to reduced level of these in the blood. Again, poor socio background of the study subjects indicates that the observed hypoproteinaemia is most likely due to its low dietary intake which is evident from their dietary history. Increased metabolic demand during pregnancy also likely to be an additional factor is responsible for this hypoproteinemia in the subjects of the present series. In addition, increase dietary intake of grain may be attributed to reduced Hb level as all the subjects of the present study had history of high dietary intake of cereals.

Therefore, this study revealed that lower concentration of maternal Hb and low plasma concentration in cord blood may have higher risk of early childbirth (<37wks) and LBW.

### Conclusion

Inadequate dietary intake and increased metabolic demand both for mother and the fetus are mainly responsible for low level of Hb in relation with TP concentration in pregnant mother and thereby causing development of low birth weight and malnourished fetus. From the present study it may be suggested that, improve dietary intake (protein containing diet) with supplementation of some micronutrients during pregnancy can be given to maintain normal maternal Hb concentration & increase protein binding availability should be regarded as optimal for fetal

growth and well-being associated with the lowest risk of low birth weight.

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**Conflict of interest:** None declared

### **Authors' contribution:**

Data gathering and idea owner of this study: Sultana M, Jahan N, Sultana N

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Data gathering: Sultana M, Jahan N, Sultana N

Writing and submitting manuscript: Sultana M, Jahan N, Sultana N

Editing and approval of final draft: Sultana M, Jahan N, Sultana N, Doha M

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