

## VITAMIN A CONCENTRATION IN CORD AND MATERNAL SERUM AND ITS RELATION TO BIRTH WEIGHT

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### Abstract

Low birth weight (LBW) is a common problem in Bangladesh associated with poor survival, growth and development. Among many factors, Vitamin A deficiency is thought to be associated with LBW. To investigate this relation a study was conducted at Maternity and Child Health Training Institute at Azimpur, Dhaka during January 2000 – July 2002. One hundred pregnant women (38-40 wks of gestation) with their newborns were included. Weights of the newborns were recorded within 20 – 30 minutes of delivery. Vitamin A level was estimated in maternal and cord serum. The newborns having weight < 2500gm showed Vitamin A level of  $49.40 \pm 3.04 \mu\text{g/dl}$  in their maternal serum while those weighing  $\geq 2500\text{gm}$  had a Vitamin A level of  $60.18 \pm 2.03 \mu\text{g/dl}$  in their maternal serum. A trend of increased maternal serum Vitamin A level was observed with increasing birth weight. Thus neonates with higher birth weights were found to be associated with higher values of maternal serum Vitamin A, though not being statistically significant.

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**Key words:** LBW, Vitamin A, cord blood, neonates

### Introduction

Birth weight is a reliable index of intrauterine growth and a major factor in determining child survival, future physiological growth and mental development. 70% of all neonatal mortality occurs in low birth weight infants.<sup>1</sup> Neonates born with low birth weight have poorer chances of survival and healthy growth and development than neonates born with normal weight.<sup>2</sup> Average birth weight of Bangladeshi neonates is 2480 – 2530 gm.<sup>3</sup> About 50% of newborn in Bangladesh are of low birth weight while in developed countries it is only 4-5%. The estimated neonatal mortality in Bangladesh is 85 per 1000 live births,<sup>3</sup> most of which being related to LBW.<sup>4</sup>

Kramer<sup>5</sup> pointed out that among the many maternal and environmental factors influencing fetal growth and development, diet and nutritional status play important roles. A number of studies have reported both lower maternal serum Vitamin A and cord serum Vitamin A

levels of neonates to be associated with low birth weight or prematurity.<sup>6-9</sup> However, others have shown no significant improvement in birth weight following supplementation of Vitamin A during third trimester of pregnancy.<sup>10-11</sup>

In the Indian sub-continent, Vitamin A deficiency has been known to exist among adults, especially in women of reproductive age.<sup>12,13</sup> An early national survey in Bangladesh reported that only 10% of the families meet the recommended daily allowance (RDA) of Vitamin A.<sup>14</sup> The average intake of Vitamin A by the rural households was between 19 -28% of the RDA. Some studies have reported lower maternal serum Vitamin A levels of lower birth weight of premature neonates.<sup>7,8</sup> The aim of this study was to determine the relationship, if any, between birth weight and Vitamin A level in cord and maternal serum at delivery.

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## Materials and Methods

This prospective randomized study was carried out in Maternity and Child Health Training Institute (MCHTI), Azimpur, Dhaka. The period of study was from January 2000 - July 2002. The study was conducted on 100 pregnant women (gestational age 38 – 40 wks) who visited the hospital for the purpose of delivery. The study included all 100 newborns of those mothers. Only those with single term pregnancy and having a normal delivery and with known gestational age were included in the study. Not included were those with medical diseases, obstetrical complications, and congenital malformations of infants.

Mixed venous-arterial cord blood (about 3 ml) from the clamped umbilical cord (placental line), just after delivery (prior to expulsion of placenta) was collected directly into a glass tube. Serum was separated and immediately stored at  $-20^{\circ}\text{C}$  until Vitamin A level estimation was done. Maternal venous blood was drawn just before delivery and was processed similar to the cord serum. Estimation of Vitamin A was measured by using high performance liquid chromatography (HPLC). Neonate's weight was taken within 20-30 minutes of delivery.

## Results

It was found that 18% of the neonates had birth weights below 2500 gm and 82% were either 2500 gm or above.

**Table-1:** Mean cord and maternal serum Vit A level of study population ( $n=100$ ).

Measures	Mean $\pm$ SE	Range
Cord serum Vit A ( $\mu\text{g}/\text{dl}$ )	58.2702 $\pm$ 1.7291	4.93 – 102.04
Maternal serum Vit A ( $\mu\text{g}/\text{dl}$ )	53.5167 $\pm$ 1.4899	17.19 – 89.17

**Table-2:** Cord serum Vit A level of newborn neonates by sex ( $n=100$ )

Measures	Sex	N	Cord serum Vit A level		Level of Significance
			Mean $\pm$ SE	95% confidence for mean	
Cord serum Vit A	Male	48	59.05 $\pm$ 2.46	4.09–64.02	Not Significant
Cord serum Vit A	Female	52	57.64 $\pm$ 2.43	52.64–62.43	

**Table-3:** Birth weight in relation to the concentration of cord and maternal serum Vit A ( $n=100$ )

Measures	Birth weight (gm)		Level of Significance
	<2500(low)	$\geq$ 2500(Normal)	
Maternal serum Vit. A( $\mu\text{g}/\text{dl}$ )	49.40 $\pm$ 3.04	54.49 $\pm$ 1.6	NS
Cord serum Vit. A( $\mu\text{g}/\text{dl}$ )	60.18 $\pm$ 2.03	57.84 $\pm$ 2.06	NS

Thus majority of the neonates were within the normal range. Table 1 shows the mean ( $\pm$ SE) concentration of Vit A in cord and maternal serum. Cord serum Vit A level was found to be  $58.27 \pm 1.7 \mu\text{g}/\text{dl}$  with a range of 4.93 -  $102.04 \mu\text{g}/\text{dl}$ , while maternal serum Vit A level was found to be ( $53.51 \pm 1.48$ )  $\mu\text{g}/\text{dl}$  with a range of 17.19 –  $89.17 \mu\text{g}/\text{dl}$ .

Table 2 shows the mean ( $\pm$ SE) concentration of serum Vitamin A level in cord serum by sex. Level of cord serum Vit A was found to be  $59.05 \pm 2.46 \mu\text{g}/\text{dl}$  and  $57.54 \pm 2.43 \mu\text{g}/\text{dl}$  for male and female neonates respectively. No significant sex difference was found in the concentration of cord serum A level. Table 3 shows that neonates having birth weight 2500 gm and above had cord Vitamin A level  $57.84 \pm 2.06 \mu\text{g}/\text{dl}$  and those with low birth weight i.e. below 2500 gm had  $60.18 \pm 2.03 \mu\text{g}/\text{dl}$ . No difference in relationship was found between birth weight and the level of Vit A in cord serum. Table 3 also shows that maternal serum Vit A level is  $49.40 \pm 3.04 \mu\text{g}/\text{dl}$  in neonates weighing <2500gm and  $54.49 \pm 1.6 \mu\text{g}/\text{dl}$  in case of neonates weighing 2500 gm or above having no significant difference.

Table 3 shows the birth weight of newborns in relationship with the levels of cord and maternal serum Vitamin A. No difference was found between birth weight and the level of Vit A in cord serum. A trend of higher level of maternal serum Vitamin A with increasing birth weight was observed. Thus neonates with higher values of birth weight were found to be associated with higher values of maternal serum Vitamin A, although not statistically significant.

## Discussion

In this study, the mean birth weight of neonates was found to be 2804 gm with a range from 1600 to 3900 gm. Mean birth weight of neonates is lower than some

cited western values i.e., 3046 to 3385 gm studies<sup>1,15-17</sup> and is closer to Indian values i.e. 2494 to 2850 gm,<sup>18</sup> but higher than some Bangladesh studies. Canosa<sup>19</sup> reported the mean birth weight of Bangladeshi infants to be 2593 gm while Chowdhury<sup>20</sup> reported the mean to be 2506 gm. This may be attributed to the fact that our study population were mostly from well to do urban families with comparatively good socioeconomic background.

In this study, the cord and maternal serum Vitamin A levels were found to be 58.27 $\mu$ g/dl and 53.51 $\mu$ g/dl respectively (Table1). Only 5% of cord serum Vitamin A was found to be low (<20 $\mu$ g/dl). Cord serum Vitamin A level was reported to be in a range of 13.8 – 33.7 $\mu$ g in some previous studies.<sup>9,21</sup> Our mean is distinctly higher than those reported in these studies. The mean for maternal serum Vitamin A is also distinctly higher than the Indian value cited at 25.55 $\mu$ g/dl<sup>8</sup> but lower than the Western value of 108.40 $\mu$ g/dl.<sup>21</sup> However, this variation may be attributed to the variations in mother's dietary Vitamin A. Maternal and cord serum Vitamin A did not differ significantly between the low and normal birth weights (Table 3). It is to be noted that, though not significantly, maternal serum Vitamin A tended to be higher for normal birth weights, compared to that for lower birth weights.

One of the limitations, in the present study, appears to be a relatively small number for low birth weight neonates. This might have masked the effect of maternal serum Vitamin A that was expected to be present in neonate's birth weight, especially when maternal serum Vitamin A was compared between low and normal birth weight. However, the trend of higher maternal serum Vitamin A, as was observed for neonate's normal birth weight, apparently appears to be in line with the observation that maternal serum Vitamin A status influences the intrauterine growth of fetus positively.<sup>22</sup> Vitamin A is known to have specific role in cellular growth and differentiation.<sup>23</sup> Influence of retinoic acid on growth hormone production through regulation of gene expression<sup>24</sup> stresses the importance of retinoid for normal growth and development. Thus, inadequate supply of Vitamin A to growing fetus may be partially responsible for intrauterine growth retardation, or in other words, for low birth weight. In view of wide spread Vitamin A deficiency that prevails in Bangladesh, Vitamin A intake of pregnant mothers should be improved through dietary approach. An increased inclusion of locally available pro-Vitamin

A rich foods such as leafy vegetables and colored fruits in the diet of pregnant and lactating women is strongly recommended.

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