

# Vitamin A Concentration in Cord and Maternal Serum and its Effects on Birth Weight

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## Abstract

*Introduction: Birth weight is a reliable index of intra-uterine growth and a major factor determining child survival, future physical growth and mental development.*

*Objectives: The present study was designed to explore the association of maternal serum as well as cord serum vitamin A level with birth weight.*

*Materials and Methods: This prospective randomized study was carried out in Maternity and Child Health Training Institute (MCHTI), Azimpur, Dhaka during the period from January to July, 2002 on 100 healthy pregnant mothers of 38-40 weeks of gestation and on 100 new born babies born to these mothers.*

*Results: Mean birth weight was 2804 gm ( $\pm 43.1$ ) with a range of 1600-3900 gm. Cord serum vitamin A level was 583 ( $\pm 1.73$ )  $\mu\text{g/dl}$  with a range of 4.9-102.04  $\mu\text{g/dl}$ , while maternal serum vitamin A level was 53.5  $\mu\text{g/dl}$  ( $\pm 1.5$ ) with a range of 17.2-89.2  $\mu\text{g/dl}$ . Newborn having birth weight  $\geq 2500\text{gm}$  was found to have higher level of maternal serum vitamin A than the newborn having weight  $< 2500\text{gm}$ , ( $54.5 \pm 1.6 \mu\text{g/dl}$  vs  $49.4 \pm 3.04 \mu\text{g/dl}$ ,  $p = .06$ ) but the difference was not statistically significant. There was no significant difference in cord serum vitamin A level between two groups of newborn ( $57.8 \pm 2.06 \mu\text{g/dl}$  vs.  $60.2 \pm 2.03 \mu\text{g/dl}$ ,  $p = .2$ ).*

**Key words:** Vitamin A concentration, birth weight.

## Introduction

Birth weight is a reliable index of intra-uterine growth and a major factor determining child survival, future physical growth and mental development<sup>1</sup>. Babies born with low birth weight (LBW) have poorer chance of survival and healthy growth and development than babies born with normal weight<sup>2</sup>. These babies experience greater mental, physical and neurological handicaps later in life<sup>3</sup>. The birth weight of baby is dependant to a large extent on mothers' nutritional status. Over the last few decades a large number of investigations have been done to explore the causes of LBW. Several studies have shown that an

inadequate supply of nutrients during pregnancy may lead to impaired growth and development of foetus<sup>4-8</sup>. In the recent years affect of vitamin A deficiency on pregnancy out-come aroused much interest. A large number of studies have reported lower maternal serum vitamin A and cord serum vitamin A of babies to be associated with low birth weight<sup>9-11</sup>. However, others have shown no significant improvement in birth weight following supplementation of vitamin A during third trimester of pregnancy<sup>12-13</sup>. In Bangladesh there is little information regarding maternal serum vitamin A in pregnancy and its relationship with birth weight. The present study was designed to explore the association of maternal serum as well as cord serum vitamin A level with birth weight.

## Materials and Methods

This prospective randomized study was carried out in Maternity and Child Health Training Institute (MCHTI), Azimpur, Dhaka during the period from January to July, 2002. A total 100 healthy pregnant women of 38-40 weeks of gestation who visited the hospital for the purpose of delivery were included in this study. Women having any medical disorders, obstetrical

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complications or babies with congenital malformation were excluded from the study. Study was also conducted on 100 newborn babies of these mothers. Written informed consent was taken from each patient to be included in this study. Gestational age was calculated from LMP (last menstrual period), with the help of a calendar or using local events, if necessary.

Neonate's birth weight was measured by a balance (YAMATO-Japan) to the nearest 20 gm, within 20-30 minutes of delivery in most cases.

Mixed venous cord blood (about 3 ml) from clamped umbilical cord (placental line), just after delivery (prior to expulsion of placenta) was collected directly into acid rinsed glass tube. Maternal venous blood sample (3 ml) was also drawn by disposable syringe. All blood samples were protected from direct light exposure. Serum was separated by centrifugation and preserved at 18° C until further analysis.

Vitamin A in maternal serum and cord blood was measured by high performance liquid chromatography (HPLC) according to Bieri et al<sup>14</sup> with slight modification. 100µl serum sample was mixed with equal amount of internal standard solution (retinol acetate 50µg/ml), then the contents were mixed in a vortex mixture for 15 seconds. For extraction of lipid along with retinol 300µl hexane was added and mixed for 45 seconds in a vortex mixture. The sample was centrifuged at 10,000 rpm for 10 minutes and top hexane layer was separated. Finally the hexane was evaporated under a stream of nitrogen gas. The extracted vitamin A was redissolved in 100µl of absolute alcohol. The solution was then injected into HPLC machine. A solvent flow of 1.5 ml/min was used and elution was monitored at 325 nm. The concentration of vitamin A was obtained from the integrator based on the peak area ratio retinol to retinol acetate.

Data were analyzed using SPSS window version 10 (Chicago, Illinois USA). Mean, range and standard error for all parameter were measured by one way analysis. Unpaired Student's 't' test was used to compare the difference of mean between the two groups.

## Results

The anthropometric indices of the mothers under study including weight, height, mid upper arm circumference (MUAC) and BMI were mean±sd, 59.3±8.32 Kg, 148.8±5.7cm, 23.6±2.8cm and 26.7±3.1 Kg/M<sup>2</sup>

respectively (Table-I). In this study, mean birth weight was 2804±43.1gm, cord serum vitamin A level was found to be 58.3±1.7 µg/dl, while maternal serum vitamin A level was 53.5±1.49µg/dl.

**Table-I**  
*Anthropometric indices of mothers*

Measures	Mean±SD	Range
Height (cm)	148.8±5.7	135-163
Weight (Kg)	59.3±8.3	39-89
BMI (Kg/m <sup>2</sup> )	26.7±3.1	19.9-36.7
MUAC (cm)	23.6±2.8	20-32

Birth weight and cord serum vitamin A level did not differ significantly for variation of sex (Table-III). Newborns having birth weight ≥ 2500 gm have been found to have higher level of maternal serum vitamin A than the newborn having birth weight <2500gm but the difference was not statistically significant (54.5±1.6 µg/dl vs 49.4±3.04 µg/dl, p= .06). There was no significant difference in cord serum vitamin A level between two groups of newborn (57.8±2.1µg/dl vs. 60.2±2.03 µg/dl, p=.2)

**Table-II**  
*Mean birth weight and concentration of vitamin A in cord and maternal serum*

Measures	Mean±SE	Range
Birth weight (gm)	2804±43.1	1600-3900
Cord serum Vit A (µg/dl)	58.3±1.7	4.9-102.04
Maternal serum Vit A (µg/dl)	53.5±1.5	17.2-89.2

**Table-III**  
*Birth weight and cord serum vitamin A level of newborn babies according to sex*

Measures	Sex		P value*
	Male (n=48)	Female (n=52)	
Birth weight (gm)	2812.5±63.6	2796.2±59.2	.4
Cord serum Vit A (µg/dl)	59.1±2.5	57.6±2.4	.3

\* Independent t test

**Table-IV**  
*Birth weight in relation to the level of cord and maternal serum Vitamin A*

Vitamin A level	Birth weight		P value*
	<2500 gm (n=18)	≥2500 gm (n=82)	
Maternal serum (µg/dl)	49.4±3.04	54.5±1.6	.06
Cord serum (µg/dl)	60.2±2.03	57.8±2.1	.2

\* Independent t test

**Discussion**

In the present study, mean birth weight was lower than Western values (3006-3385gm) but very similar to Indian values (2700-2870gm)<sup>15-17</sup>. It is, however higher than Bangladeshi means (2506-2593 gm) reported in previous studies<sup>18,19</sup>. In our study 18% babies were low birth weight (LBW), previous studies in Bangladesh reported 23-45 percent of the new born to be LBW<sup>19,20</sup>.

In this study mean cord and maternal serum vitamin A level were found to be 58.3µgm/dl and 53.5µgm/dl respectively. Only 5% cord serum vitamin A was found to be low (<20µgm/dl). In previous studies cord serum vitamin A level was reported to be in a range of 13.8-33.7 µgm/dl<sup>17,21</sup>. In our study the mean level of cord serum vitamin A was distinctly higher than those reported in the previous studies. In this study the mean maternal serum vitamin A level was higher than that reported from India (25.55 µgm/dl) but lower than that of western value (108.4µgm/dl)<sup>17-21</sup>. A number of studies have reported both lower maternal serum vitamin A and cord serum vitamin A level of babies with low birth weight or prematurity<sup>9,10,16</sup>. In this study maternal and cord serum vitamin A level did not differ significantly between normal and low birth weight newborn. Maternal serum vitamin A level was found to be higher in normal birth weight babies compared to low birth weight (54.5±1.6 vs 49.4±3.04; p=.06) but the difference was not statistically significant. Nance and Alveraz<sup>22</sup> observed in their study a trend of increasing birth weight with increasing cord vitamin A level. Wright et al<sup>23</sup> demonstrated that infant born to mother with low serum vitamin A also had low serum vitamin A level. Maryam et al<sup>24</sup> in their study observed that serum retinol values increasing gradually with birth weight and mean serum vitamin A for premature neonates was significantly lower than term neonates. Girish et al<sup>25</sup> demonstrated that neonates born to clinically vitamin A deficient mothers had significantly lower serum vitamin A level as compared to the control,

while serum retinol binding protein level was maintained at normal level. Agarwal K et al<sup>26</sup> observed in their study significantly higher cord vitamin A level with increasing birth weight of newborn as well as its maturity and gestational age.

**Conclusion**

Maternal serum Vitamin A has positive role to play in intra-uterine growth and development of foetus.

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