

Original Article

Relationship of Maternal Folic Acid and Vitamin B₁₂ with birth weight and body proportion of newborn

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Abstract

Vitamin B₁₂ and folate are two important B vitamins that are related to normal fetal development and fetal growth because they act as co-enzyme for the synthesis of nucleic acid and take part in DNA replication and cell division. Reduced level of serum folate and vitamin B₁₂ also results in hyperhomocysteinemia which causes IUGR. A cross sectional study was made in which 150 pregnant women were included according to set inclusion and exclusion criteria of the study. On the basis of anthropometric measurements (birth weight, birth length, OFC) of the newborn, study subjects were grouped into group-I those who delivered low birth weight babies and group-II those who delivered normal birth weight babies. Serum folate and vitamin B₁₂ level were measured in all the study subjects after delivery. Maternal serum folate & vitamin B₁₂ of group-I were significantly lower than that of group-II. Birth weight, length & OFC of newborns showed significant positive correlation with maternal serum folate & vitamin B₁₂. The risk of lower serum folate was significant for lower weight (OR 11.00, 95% CI 4.81-25.15), lower length (OR 3.67, 95% CI 1.42-9.47), lower OFC (OR 6.96, 95% CI 2.47-17.87). The risks of lower serum vitamin B₁₂ were significant for lower weight (OR 4.09, 95% CI 1.67-10.00), lower length (OR 4.83, 95% CI 2.28-10.22), lower OFC (OR 4.11, 95% CI 1.97- 8.54).

Keyword: *Folate, Vit-B₁₂, Low Birth Weight, Birth Length, OFC.*

Introduction

Low birth weight is a big challenging problem in developing countries like Bangladesh. It is an important public health problem because of its marked adverse effect on child survival, growth & development¹. Low birth weight is considered as weight less than 2.5 kg at birth. Low birth weight is of two categories: One is preterm birth or premature births which occur before the end of 37 weeks of pregnancy. Another category is small for date babies or small for gestational age or growth restriction. Intrauterine growth restriction (IUGR) is the term applied to infants who are at or below the 10th percentile for their expected birth weight at a given gestational age.² In the developed world most low birth infant born preterm & in developing world most low birth weights

are growth restricted.³ According to the report of UNICEF/ WHO (2004); in the developing

countries, the incidence of low birth is more than 58%. This is highest in South Asia (74%).

Pregnancy is a period of increased metabolic demand when nutritional status directly influences the infant size and also the main determinant factor for the growth and development of the offspring.⁴ During this period, inadequate store or intake of nutrients can have adverse effects on pregnancy and even death of the mother.⁵ Furthermore; the fetus can be affected resulting in still birth, preterm delivery, IUGR, congenital malformation, reduced immunocompetence and abnormal organ development.⁶

So nutritional status during pregnancy has a direct influence upon birth weight of newborn and adequate supply of micronutrient is known to be very important in pregnancy.⁷

Vitamin B₁₂ and folic acid are the two important B vitamins which act as a cofactor for the

synthesis of DNA and RNA and in numerous methylation reactions. So that they take part in DNA replication and cell division.⁸ A lack of folic acid in pregnancy impair the growth of the placenta and fetus leading to lower birth weight, length & OFC.⁹ Vitamin B₁₂ plays an integral role in folate dependent homocysteine metabolism as a rate limiting cofactor in the conversion of homocysteine to methionine. So limited supply of vitamin B₁₂ during pregnancy causes hyperhomocysteinemia which may have very important consequences for fetal growth.^{7,9} Thus hyperhomocysteinemia following folate & vitamin B₁₂ deficiency associated with IUGR.¹⁰ & maternal folic acid and vitamin B₁₂ status are proved to be associated with birth weight & body proportions of their newborn. So it could be possible to bring health benefit for our pregnant women and to get rid of low birth weight by folic acid and vitamin B₁₂ supplementation. With this view the present study was designed to evaluate maternal folate & vitamin B₁₂ status with respect to birth weight & body proportions of their newborn.

Material and Method

The present cross sectional study was conducted in the Dept. of Biochemistry, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh during the period from January 2008 to December 2008. A total of 150 pregnant women in the 3rd trimester (age between 18 to 35 years) were included in the study as subjects. 50 were included as group -I who delivered low birth weight babies. 100 study subjects were included as group- II who delivered normal birth weight babies. The pregnant women suffering from diabetes, hypertension, malnutrition, hepatic disorder, hypothyroidism, chronic renal disease, preeclampsia, eclampsia, were excluded from the study. At 3rd trimester maternal serum & vitamin B₁₂ were estimated by ion capture technology & Microparticle Enzyme Immunoassay (MEIA) method by Abott AxSYM system auto analyzer respectively. At delivery anthropometric measurements (Birth weight, length, OFC) were taken from newborn.

Statistical analyses

The data was analyzed by using SPSS. Mann - Whitney U test was done to see significance between two groups (group-I, group-II). Pearson correlation coefficient test was done to see the correlation of serum folate & serum vitamin B₁₂ with anthropometric measurements (weight, length, OFC) of newborns at birth. Odds Ratio (95% CI) was calculated to see the association of maternal serum folate & vitamin B₁₂ concentration with birth weight, length & OFC of newborns. Regression analysis was done to find out the impact of folate & vitamin B₁₂ deficiency on birth weight, length & OFC of newborn.

Results

The comparison of serum folate & vitamin B₁₂ between Group- I & Group- II are shown in Table 1. Folate & vitamin B₁₂ were significantly lower in Group- I.

Table-2 shows the comparison of weight, length & OFC between the babies born to Group-I & Group-II. All these three anthropometric characteristics were found significantly lower in the babies in Group- I.

Table-1: Comparison of serum folate & vitamin B₁₂ between group-I & group-II.

Parameter	Group-I	Group-II	p- value
Folate(ng/ml)	5.19	10.91	0.000
Vitamin(pg/ml)	182.20	217.50	0.001

Table-2: Comparison of weight, length & OFC at birth between babies born to Group-I & Group-II.

Variable	Babies born to Group-I Mean±SD	Babies born to Group-II Mean±SD	p- value
Weight(kg)	2.11±0.15	2.88±0.33	0.000
Length(cm)	45.35±1.28	47.75±1.83	0.000
OFC(cm)	31.98±1.28	35.20±1.37	0.000

Table-3. Correlations of maternal serum folate with birth weight, length & OFC of newborn.

Dependent Variable / Independent Variable	r- value	p- value
Birth weight/Folate	.665	0.000
Length/Folate	.524	0.000
OFC/ Folate	.501	0.000

r- Correlation coefficient.

Table-4. Correlation of maternal serum vitamin B₁₂ with birth weight, length & OFC of newborn.

Dependent Variable / Independent Variable	r- value	p-value
Birth weight/vitamin B ₁₂	.512	0.000
Length/ vitamin B ₁₂	.500	0.000
OFC/vitamin B ₁₂	.379	0.000

r- Correlation coefficient.

Additionally, gestational serum folate & vitamin B₁₂ were found to have a significant positive correlation with fetal variable (weight, length & OFC of the newborn).

Table-5: Odds ratio (OR) of maternal serum folate & vitamin B₁₂ for the same anthropometric variables.

Risk factor	OR (95% CI)		
	Low Birth Weight	Decreased Length	Decreased OFC
Low Folate	11(4.81-25.15)	3.67(1.42-9.47)	6.96(2.47-17.87)
Low Vitamin B ₁₂	4.09(1.67-10.00)	4.83(2.28-10.22)	4.11(1.97-8.54)

The risks of lower serum folate were significant for lower weight (OR 11.00, 95% CI 4.81-25.15), lower length (OR 3.67, 95% CI 1.42-9.47), lower OFC (OR 6.96, 95% CI 2.47-17.87). The risks of lower serum vitamin B₁₂ were significant for lower weight (OR 4.09, 95% CI 1.67-10.00), lower length (OR 4.83, 95% CI 2.28-10.22), lower OFC (OR 4.11, 95% CI 1.97-8.54).

Discussion

In this cross sectional study an attempt was made to evaluate the association of maternal folic acid and vitamin B₁₂ with birth weight, birth length and OFC. We have compared the serum folic acid and vitamin B₁₂ of pregnant women who delivered low birth weight babies, with that of pregnant women who delivered normal birth weight babies. Maternal folic acid and vitamin B₁₂ found to be significantly low in women who delivered low birth weight babies compared to those who delivered normal birth weight babies. This finding found consistent with other similar studies done by Scholl et al. (1996), Tamura et al. (1997), Rolschau et al. (1999), Rao et al. (2001), Lindblad et al. (2005).^{9,11-14}

In comparison to our study several studies showed discrepant views; Ronnenberg et al. (2002) made a case control study & found no association of low plasma folate with low birth weight in study subjects. This could be due to inappropriate timing of measurement of plasma folate. They measured plasma folate before pregnancy which failed to reflect folate status at last trimester of pregnancy.¹⁵ On the other hand Guerra-Shinohara et al. (2002), Christian et al. (2003), Takimoto et al. (2007) could not find any significant correlation between maternal folate and birth weight.¹⁶⁻¹⁸ This disparity in contrast to our study may be due to small sample size of their study which failed to show significant correlation between serum folate and birth weight.¹⁶

Our study showed the strong positive correlation between maternal serum folate and birth weight, length, OFC of their fetus which is supported by other studies.¹⁹⁻²² We also found strong positive correlation between vitamin B₁₂ with birth weight which is similar to other studies.^{23, 24}

Maternal low serum vitamin B₁₂ found to be a significant risk for low birth weight, decreased length & low OFC newborn which simulate several other studies.²³

Several other studies observed both the effect of folate & vitamin B₁₂ with birth weight. Yajnik et al. (2005) showed the effect of folate & vitamin B₁₂ concentration on offspring's size & found that red cell folate is directly related to

offspring's size but vitamin B₁₂ concentration is unrelated to offspring's size.²⁵

Conclusion

This study suggests that maternal low serum folate & vitamin B₁₂ might be risk factors for low birth weight as well as reduced body proportion of newborn. So during antenatal check up women should be screened for folate & vitamin B₁₂ deficiency as well as vitamin supplementation should be continued throughout the pregnancy rather than to stop at the end of Ist trimester as in traditional practice. Hopefully these measures will rescue us from this unacceptable burden of low birth weight and other health hazards which produce adverse effect on child survival, growth and development. Since the estimation of folic acid and vitamin B₁₂ in the pregnant woman as a routine antenatal check up is very much costly & difficult to bear by our general population, so government support is needed to allow our general population to overcome this problem.

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