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Original Research Article

Association of Maternal Folic Acid and B12 Level with the Neoborn Birth Weight

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Abstract:

Background: Vitamin B12 and folic acid deficiency in pregnant women is an important health issue. Vitamin B12 and folate are micronutrients essential for foetal growth and development. Maternal folate and B12 concentrations have been positively associated with birth weight.

Aim: To find if any correlation exists between the level of serum B12 and folate in the mother and that of the neonate birth weight.

Material & Methods: This prospective study included 100 pregnant women (gestational age: 37-42 weeks). Vitamin B12 and folic acid levels were measured. Lower limit for vitamin B12 was 200pg/mL and the lower limit for folic acid was 5 ng/ml. Data regarding age of mothers, pre pregnancy weight, neonatal birth weight and relationship between the birth weight and vitamin B12 or folic acid was recorded in all mothers.

Results: The mean age of the mothers was 25.25 ± 3.62 years; mean pre pregnancy weight was 52.52 ± 6.28 kg. Mean neonatal birth weight was 2.46 ± 0.55. There was a positive correlation was observed between serum vitamin B12 and neonatal birth weight, found statistically significant ($P<0.05$) in 2nd trimester whereas not significant in 3rd trimester of pregnancy, also found significant correlation of folic acid level and neonatal birth weight

Conclusion: Maternal vitamin B12 and serum folate levels are significantly associated with birth weight of neonates, so during antenatal visit women should be screened for vitamin B12 and folate deficiency and vitamin supplementation should be continued throughout the pregnancy.

Keywords: Neonatal outcome, Vitamin B12, Folic acid, Birth weight.

Introduction

Food quality with adequate macro and micronutrient intake during pregnancy is crucial for the health status of the mother and newborn [1]. Vitamin B12 (cobalamine) is a red-colored water-soluble vitamin that is synthesized by microorganisms. Major sources of dietary vitamin B12 are foods of animal origin, including meat, milk, eggs, and fish, with plants and fungi contributing little vitamin B12 to the human diet [2].

The human body is not able to produce vitamin B12 and is therefore dependent on external supply [3].Folic acid, on the other hand, is a heat-labile, water-soluble vitamin, especially abundant in green leafy plants [4]. The most important function of vitamin B12 together with folic acid is to provide DNA synthesis, which is necessary for cell division and proliferation [5]. In addition to its role in the DNA synthesis, the vitamin B12 is a cofactor that plays role in methylation, neurotransmitter synthesis, homocys-tein/methionine cycle. It is an essential vitamin that exists as cobalamin in foods, particularly in those of animal origin. The vitamin B12 deficiency may be present in breastfed infants of mothers with vitamin B12 deficiency [4]. The children below 2 years of age with low socioeconomic level are at risk. The vitamin B12 deficiency can lead more severe consequences in neonatal period and infancy where growth is accelerated than symptoms seen in other periods [6].

While vitamin B12 deficiency in children may present with non-specific clinical findings such as fatigue, weakness, stomatitis, diarrhea or irritability, severe anemia with developmental delay, mental-motor retardation, ataxia, parest-hesia, hyporeflexia, clonus, muscle wasting, and acquired motor and mental functions (sitting), walking, talking, laughing, etc.), convulsions and coma in advanced stages [7]. Folic acid (FA) and Vitamin B12 (Vit B12) are mainly obtained through diet, and are important coenzymes for DNA synthesis [8, 9].

During pregnancy, low circulating levels of vitamin B12 or folic acid have been associated with complications such as neural tube defects, spontaneous abortion, premature birth, and possibly low birth weight. In women of child-bearing age and pregnant women, vitamin B12 deficiency is prevalent with frequencies between 10% and 50% across the world, with especially high rates in studies from the Indian subcontinent, Eastern Mediterranean, and South American regions [10, 11]. The fetus requires high levels of FA and Vit B12, especially during late pregnancy. Insufficient nutrients may lead to FA and Vit B12 deficiencies in the mothers, and thus affect the fetuses as well.

Aims & objectives: Objective of this study is to evaluate the effect of maternal vitamin B12 and folic acid level on neonatal birth weight.

Materials and Methods

A prospective comparative study was carried out in collaboration with the department of Obstetrics and pediatrics in government's medical hospitals and peripheral health care center, Rewa, M.P. Study duration was 01 years from April 2020 to March 2020. A total of 100 term pregnant women attending the Obstetrics Outpatient department provide consent were included.

Inclusion Criteria: Women between 18 and 40 years of age, with a single live intrauterine pregnancy of 37 to 41 weeks of gestation who had consented to be included in this study

Exclusion Criteria: Multiple pregnancies, preterm delivery, Patient with hypertension (PIH/Pre eclampsia/Eclampsia), women with any chronic illness and who not provide consent excluded for the study.

The subjects were taken from antenatal clinic after a detailed history and physical examination investigations, USG and were followed till delivery. The information was recorded on the basis of age, parity, education, urban/rural, status of subjects.

Pregnant women will be followed-up at the end of 2nd & 3rd trimester, blood samples for the mentioned serum nutrients i.e., serum Iron/folate/Vitamin B12, has taken and at the time of Newborn delivery to record their general status and birth weight.

Serum Iron at 2nd & 3rd trimester, Serum folic acid at 2nd & 3rd trimester, Serum Vitamin B12 level at 2nd & 3rd trimester were measured.

Plasma vitamin B12 concentrations were measured *via* electro chemiluminescence.

Primary analyses were based on continuous vitamin B12 biomarkers in pregnant women and neonates (i.e., cord blood). We also used conventional cut-offs from adult (non-pregnant) populations to describe categorical vitamin B12 variables. Vitamin B12 deficiency and insufficiency were defined as vitamin B12 concentrations <148 and <221 pmol/L, respectively.

Statistical analyses: Data were analysed by using Statistical Package for the Social Sciences "SPSS version 24. Mean, median, standard deviation and variance was calculated and following statistical significance tests were applied. P-values of <0.05 were considered significant

Results

A total of 100 full term pregnant women who want to deliver in our study hospital were enrolled and analysed**.** The mean age of the mothers was 25.25 ± 3.62 years; mean pre pregnancy weight was 52.52 ± 6.28 kg. Mean neonatal birth weight was 2.46 ± 0.55.

Table 1: Maternal and Neonatal Socio-demographic characteristics among study subjects:

Demographic Characteristics	**(Mean ±SD)**
Maternal parameters	
Age in years	25.25 ± 3.62 years
Pre-pregnancy weight	52.52 ± 6.28 kg
Neonatal Parameters	
Neonatal Birth Weight	2.46 ± 0.55

There was a positive correlation was observed between serum vitamin B12 and neonatal birth weight, found statistically significant (P<0.05) in 2nd trimester whereas not significant in 3rd trimester of pregnancy.

Table 2: Correlation between neonatal birth weights with Serum Vitamin B12

Parameters	**Birth weight (kg)**	**S. Vitamin B12 (ng/ml)**	**P value**	**Results**	**Correlation**
2nd trimester Mean ± S.D	2.46 ± 0.55	248.94 ± 52.29	<0.001	Significant	Positive correlation
3rd trimester Mean ± S.D	2.46 ± 0.55	211.73 ± 105.60	0.8404	Not Significant	Positive correlation

There was a positive correlation was observed between serum folic acid and neonatal birth weight, which was significant statistically (P<0.05)

Table 3: Correlation between neonatal birth weights with Serum Folic Acid

Parameters	Birth weight (kg)	S. Folic acid (ng/ml)	P value	Results	Correlation
2nd trimester Mean ± S.D	2.46 ± 0.55	9.56 ± 3.01	<0.001	Significant	Positive correlation
3rd trimester Mean ± S.D	2.46 ± 0.55	10.70 ± 3.36	<0.001	Significant	Positive correlation

Correlation of neonatal birth weight and different serum levels (folic acid & b12) was significant in 2nd trimester and not significant in third trimester.

Table 4: Correlation between neonatal birth weights with different Serum Levels in various trimesters

Different Serum level in 2nd Trimester				
Neonatal Birth weight (kg) (N=100)	**S.FA (ng/ml)**		**S. Vit B12 (pg/ml)**	
	Low (<0.8)	**Normal (0.8–24)**	**Low (<130)**	**Normal (130–656)**
LBW (1 – 2.49) (n=46)	0 (0%)	46 (46%)	0 (0%)	46 (46%)
Normal (2.5 –3.9) (n=53)	0 (0%)	53 (53%)	0 (0%)	53 (53%)
LGA (>3.9) (n=1)	0 (0%)	1 (1%)	0 (0%)	1 (1%)
Different Serum level in 3rd Trimester				
LBW (1 – 2.49) (n=46)	0 (0%)	46 (46%)	0 (0%)	46 (46%)
Normal (2.5 – 3.9) (n=53)	0 (0%)	53 (53%)	0 (0%)	53 (53%)
LGA (>3.9) (n=1)	0 (0%)	1 (1%)	0 (0%)	1 (1%)

Discussion

Folate and B12 levels were higher in cord than in the maternal blood, which agrees with known concentration gradients of these vitamins across the placenta (23).

Interestingly, the normal relation between maternal and cord blood folate levels disappeared in IUGR.

This finding supports the assumption of placental dysfunction and damage in folate deficiency, possibly mediated via hyperhomocysteinemia [12-13]. Mean age of the women in our study was 25.25 ± 3.62 years, comparable to the mean age observed by Muthayya et al [14] and Youssry et al [15].

In the present study mean serum vitamin B12 was 248.94 ± 52.29 in 2nd trimester and 211.73 ± 105.60 in 3rd trimester, our results were comparable with results of Takimoto et al [16] and Dayaldasani et al [17].

In our study there was a positive correlation between baby weight (kg) and S. vitamin B12, but not statistically significant in 3rd trimester of pregnancy, consistent finding also reported by Reischl-H et al [18] and Finkelstein, et al [19].

Current study observed positive and statistically significant correlation between baby weight (kg) and S. folate level, in agreement with the Jiang, et al [20] and C. L. Relton et al.

A study done by Dwarkanath P, et al [22], found that low vitamin B-12 and folic acid intakes in the first trimester were independently associated with a higher risk of SGA, in addition to vitamin B-12 and folic acid deficiencies alone, there may be adverse birth outcomes associated with unbalanced vitamin B-12 and folic acid intakes or levels during pregnancy.

Present study reported positive correlation between birth weight of neonates with 2nd and 3rd trimester serum B12/ Folic acid levels but their correlation was statistically not significant (p>0.05), similar results found by S Muthayya, et al [23] and Krishnaswamy PH, et al [24].

A study conducted by Chaudhary A, et al [25] observed a weak positive but statistically non-significant correlation between Apgar and S. vitamin B12 (rho=0.11, p=0.166) and S. folate

Conclusion

We have concluded that the maternal low vitamin B12 level and low S. folate levels are associated with low birth weight neonates.

This will recommend administration of vitamin B12 along with the administration of folate in pregnancy as a high percentage of women were found to be deficient in vitamin B12 with a direct correlation between maternal and neonatal B12 and folate levels**.**

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