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# EFFECT OF MATERNAL VITAMIN A AND IRON STATUS ON FETAL OUTCOME

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## ABSTRACT

Birth weight is an indicator of both neonatal morbidity and mortality, maternal health, nutrition and quality of antenatal services. The aim of study is determined of the Biochemistry nutritional marker [Vitamin A, Ferritin, iron, TIBC, Hb, total protein and Albumin] in maternal of preterm (n=31), term LBW infants (n=27), term NBW infants (30). Maternal vitamin A levels there is a significant decrease in preterm and Term – LBW as compared to Term-NBW. Maternal Hb and ferritin no significant difference between studied groups, while maternal iron, TIBC, Alb, total protein highly significant difference in studied groups. Also mean of cord ferritin increase significant in NBW-term compared with LBW of preterm and term. Therefore, it reinforces the fact that maternal factors important in fetal growth, There is a need to strengthen the existing maternal and child health services to reduce the incidence of low birth weight.

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# INTRODUCTION

Vitamin A is an important micronutrient, which has an important influence on the health of pregnant women and the fetus.Vitamin A deficiency is a major health problem, 25-50 million children suffer from Vitamin A deficiency, and VAD during pregnancy is associated with increased mortality and morbidity in mothers and infants. Interventions to prevent Vitamin A deficiency by diet, diversification, Supplementation and Food fortification.Vitamin A is essential for growth and differentiation of a number of cells and tissues. Notably, during pregnancy and throughout the breastfeeding period, vitamin A has an important role in the healthy development of the fetus and the newborn, with lung development and maturation being particularly important[1]. The American Pediatrics Association cites vitamin A as one of the most critical vitamins during pregnancy and the breastfeeding period, especially in terms of lung function and maturation. If the vitamin A supply of the mother is inadequate, her supply to the fetus will also be inadequate, as will later be her milk [2].In the fetus, vitamin A is important for cell differentiation and lung growth, regulation of lung alveolar septation, surfactant production and in maintaining the integrity and regeneration of respiratory epithelial cells [3]. Iron are essential micronutrients in fetusgrowth and development. maternal iron status has been a critical factor for pregnancy outcomes, because maternal anemia as well as iron deficiency increases the risk of adverse pregnancy outcomes such as preterm delivery and low birth weight [4] .Although iron supplementation is a common recommendation for pregnant women to prevent iron deficiency during pregnancy, maternal iron intake in mid-pregnancy is associated with reduced fetal growth [5]. Most fetal iron is transferred from mother to fetus during the third trimester of gestation [6]. This transfer is interrupted by preterm birth, resulting in iron stores at birth being proportional to birth weight despite low iron stores at birth, growth velocity of very Premature infants is maximal at 28–38 weeks postmenstrual age, reflecting a particularly high iron need during this period [7].Serum status of Hemoglobin during pregnancy is crucial for health of mothers, growth of fetus and optimal outcomes of the mother and fetus [8] low status of hemoglobin in pregnancy is associated with increased morbidity, infections, a substantial proportion of maternal deaths (due to ante-partum and post-partum hemorrhage), prematurebirths, lower birth weight and higher perinatal mortality in the babies [9] .Pregnant women are very susceptible to iron deficiency, particularly in the third trimester due to expanded blood volume, increased iron demands and poor bio-absorption or intake of this important micronutrient[10]. Also, the rate of prenatal care could have an impact on serum iron level. emerging evidence now indicates that the use of micronutrient-containing prenatal supplements pre-pregnancy is associated with reduced risk of congenital defects, preterm delivery, low infant birth weight, preeclampsia and improvement of serum micronutrients [11]. Iron deficiency during pregnancy could also result in hemoglobin deficiency.

### *OBJECTIVE*

- The present study was undertaken to investigate the serum levels of vitamin A, iron status and protein status in maternal of low birth weight.
- To study maternal nutrition parameters and to examine their associations with birth weight.

# MATERIALS & METHODS

The research was conducted at the Department of Obstetrics and Gynecology at Al-Yarmouk Teaching, Al Imamain kadhimain medical city (PBUH).and Fatima El Zahraa (PBUH) Hospitals and Biochemistry at AL-Nahrain University \ College of Medicine, Baghdad, Iraq. The study protocol was approved by the ethical committee of college of medicine\ AL-Nahrain University, and an informed signed consent was Obtained from the expectant mothers ,Patients studied were admitted between October 2013 toJune 2014 on 88 pregnant women admitted to the labor ward with gestational age from $25^{th}$ to $41^{th}$ weeks which is either calculated by the first day of last menstrual Period and/or by U/S scan obtained before 20 weeks of gestation, Pregnant women age range between (18-34) years, the subjects in this study were divided into three main groups:

- Term normal birth weight includes 30 neonates and their mothers.
- Term low birth weight includes 27 neonates and their mothers.
- Preterm includes 31 neonates and their mothers.

Women with an established medical risk factor for having reduced or excessive birth weight of the neonate such as, extremes of age (< 18 or >44 years), hypertension, toxemia of pregnancy, renal disease, heart disease, diabetes, urinary tract infection, metabolic disorder, tuberculosis, smoking, and alcohol or chronic drug intake were excluded from both the groups. Infants were excluded if they had history of difficult delivery, fetal distress, congenital malformations, birth injury or any complication requiring special care *e.g.* sepsis, seizure, respiratory distress, congenital heart disease, hypothermia, hypoglycemia and hyperbilirubinemia etc. Infants born to mothers who received sedatives /anesthesia within 4 hours prior to delivery were also excluded. All included newborns were delivered by vaginal route, with vertex presentation.Concentration of Vitamin A in serum was determined by Specific, ELISA Kit for Human (VA) of CUSABIO Chemical Company, China.Serum iron concentration was measured by iron kit BiolaboSA, France.(Ferene, 1984) .Total iron binding capacity was measured by T.I.B.C. kit Biolabo SA, France .Serum Ferritin concentration was measured byFerritin Mini-Vidas kit bio Mérieux, France.Hemoglobin by Automatic hematology analyzer, Germany.Serum Total Protein concentration was measured by Total Protein Kit Mindray, ChinaSerum Albumin concentration was measured by Albumin kit Mindray, China.

***Statistical Analysis***

Data were analyzed by statistical packages of SPSS 18 (statistical packages for social sciences-version 18). All data were presented as a mean ± Sd. Statistical differences among groups were carried out by one-wayanalysis of variance (ANOVA). Correlation between the variables was performed by spearman correlation coefficient. *P* values were significant if <0.05.

# RESULTS

During the period of the study a total sample of 88 pregnant women. In our study the cases were compared regarding the maternal age range 18-34 year, gestational age ranges 25-41 wks and parity ranges 1-3. In table (1) shows there was no significant among study groups in mean of maternal age and parity (*P*-value  0.05).while there was significant difference in mean gestational age (*P*-value  0.001). ).neonatal was significant difference in means of weight among study groups by using one-way ANOVA test.in table (2)revealed that there significant difference mean of maternal vitamin A inPreterm, Term-LBW and Term-NBW, *p* value 0.001 by doing one-way ANOVA, show thatthere is a significant decrease in the serum maternalvitamin A levels of preterm and Term – LBW as compared to Term-NBW.Maternal Hb and ferritin no significant difference between

studied groups, while maternal iron, TIBC, Alb, total protein highly significant difference in studied groups(*p*value□0.001).Also mean of cord ferritin increase significant in NBW-term compared with LBW of preterm and term (*p* value □ 0.001).Table (3) shows the Pertaining to the results of our study in low birth weight ;statistically significant correlations were observed between the levels of maternal ( Vitamin A ,iron ,ferritin , TIBC , Alb )and no statistical significant correlation with others parameters. Table (1): Anthropometric and Demographic characteristics of studied groups.

**Table 1**
***Anthropometric and Demographic characteristics of studied groups***

| Characteristic | Preterm (n=31) Mean±SD | Term–LBW (n=27) Mean±SD | Term -NBW (n=30) Mean±SD | *P* value |
|---|---|---|---|---|
| Gestational age (wks) | 30.86±3.5 | 38.93±1.32 | 39.49±1.5 | 0.001 |
| Birth weight (gm) | 1408±564.1 | 2146.7 ±152.53 | 3180 ±289.7 | 0.001 |
| Parity | 1.936±0.9 | 2.04±0.76 | 1.867±0.9 | 0.75 |
| Maternal age (years) | 24.38±4.43 | 25.43±4.45 | 25.1±3.82 | 0.627 |

**Table 2**
***Comparison of studied parameters between preterm, term-LBW and term- NBW.***

| **Parameters** | **Preterm (n=31) Mean±SD** | **Term - LBW (n=27) Mean±SD** | **Term – NBW (n=30) Mean±SD** | **P value** |
|---|---|---|---|---|
| Nutrient antioxidant | | | | |
| Maternal Vitamin A (ng\ml) | 396.45±61.14 | 429.63±67.23 | 471.67±34.65 | □0.001 |
| Iron status | | | | |
| Maternal Hb (g\dl) | 11.76±0.51 | 11.73±0.43 | 12.07±0.75 | 0.451 |
| Cord Ferritin (ng\ml) | 61.5 ± 56 | 72.77 ± 29.2 | 145.52±35.28 | 0.001 |
| Maternal ferritin (ng\ml) | 29.4±10.92 | 34.1±18.25 | 38.37±14.34 | 0. 062 |
| Maternal Iron (µg\dl) | 62.3±23.52 | 79.9±8.3 | 90.1±12.5 | 0.001 |
| Maternal TIBC (µg\dl) | 340.734±30.85 | 331.6±29.9 | 311.3±38.6 | 0.003 |
| Protein status | | | | |
| Maternal Alb (g\l) | 39.74±9.01 | 42.1±11.72 | 56.84±16.52 | 0.044 |
| Maternal total protein (g\l) | 62.92±6.08 | 63.51±3.92 | 66.43±5.12 | 0.022 |

**Figure 1**
***Box plot of maternal vitamin A of studied cases.***

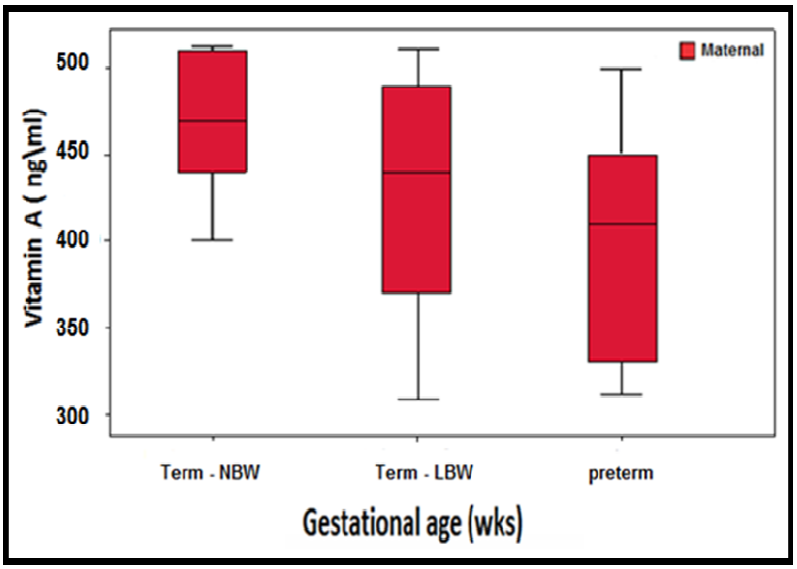


**Table 3**
***Correlation between levels of the studied parameters and fetal outcome.***

| Maternal nutritional marker | | Fetal outcome ( Birth weight) | |
|---|---|---|---|
| | | LBW N=58 | NBW N=30 |
| Vitamin A | r | 0.338 | 0.178 |
| | p | 0.028 | 0.081 |
| Maternal Hb | r | -0.204 | - 0.042 |
| | p | 0.351 | 0.791 |
| Maternal ferritin | r | 0.448 | 0.063 |
| | p | 0.022 | 0.841 |
| Maternal Iron | r | 0.578 | 0.137 |
| | p | 0.004 | 0.089 |
| Maternal TIBC | r | -0.357 | - 0.098 |
| | p | 0.036 | 0.423 |
| Maternal Alb | r | 0.452 | 0.137 |
| | p | 0.005 | 0.341 |
| Maternal total protein | r | 0.201 | 0.236 |
| | p | 0.358 | 0.159 |

## DISCUSSION

In the present study the nutrient antioxidant marker (vitamin A) level was found to be higher in NBW-term infants to preterm and LBW-term SGA infants at birth ($P$ □ 0.001). And a strongly positive significant correlation between maternal vitamin A with fetal outcome LBW infant, These data in accordance with the results reported by [12] .This decrement in antioxidants may be ascribed due to a transient imbalance between higher antioxidant requirement and intake [13], metabolic demand,hemodilution or a combination of these. It is known that vitamin A (retinol) plays an important role in cell proliferation and differentiation in embryonic development [14]. Through interactions with nuclear receptors, retinoic acid, the biologically active form of vitamin A, can alter gene transcription [15]. Additionally, vitamin A, possess antioxidant activity and protect tissues and cells by reacting with oxygen free radicals [16].Iron is an essential element for all cells, in the lack of iron the production of the hemoglobin in

erythroid cells will be interfered, thus the transfer of the oxygen to the cells decreases.The lowest normal hemoglobin in the healthy non-pregnant woman is defined as 12 g/dl .The World Health Organization recommends that hemoglobin ideally should be maintained at or above 11.0 g/dl, and should not be allowed to fall below 10.5 g/dl in the second trimester. During pregnancy Hb level in woman is naturally lower than non-pregnant; this is because the fluid (plasma) increases by about 50% during pregnancy(peaking at about 32 weeks), the increased plasma dilutes the red cells, making their level drop [17].The data of study indicates statistically significant differences in cord ferritin, maternal iron, maternal TIBC, maternal transferrin. Significantly lower maternal iron and cord ferritin and higher maternal TIBC and transferrin were observed in preterm and LBW-term than in NBW-term.In this study shown that cord serum ferritin concentrations increased with gestational age and were higher compared to maternal levels, low birth weight preterm infants had lower cord serum ferritin levels (mean: 61.5 ng\ml) compared normal birth weight term infants ( mean : 145.5 ng\ml ). Which agreed with the results reported by [18] and disagreed with study reported by [19] .While other study concluded thatserum ferritin level may be considered as an important parameter for detecting preterm labour [20].Serum ferritin usually falls markedly between 12 and 25 weeks of gestation, probably as a result of iron utilization for expansion of the maternal red blood cell mass [21]. In this study none of the maternal samples showed a serum ferritin in the range found in iron deficiency anemia (0-12, mg /l). Serum ferritin is a good measure of the iron storage of the body, particularly of iron in the reticuloendothelial system.Iron transfer from mother to fetus occurs against the concentration gradient. Most iron transfer to the fetus occurs after 30 weeks of gestation which correspond to the time of peak efficiency of maternal iron absorption. a study suggested that the incidence of preterm labor was much higher (65.6%) in the group of severe anemia than mild anemia and healthy pregnant [22]. In present study, maternal albumin was high in NBW-term comparable to LBW- term and preterm, serum albumin was found to be significant positive association with birth weight. That agreed with a study suggest that maternal albumin was observed to be directly proportional to birth weight of babies [23]. A study has showed that albumin attributed normal maternal albumin levels and normal birth weight of newborn to be good indicators not only of mother's health and nutritional status, but also of the outcome for survival, growth, long-term health and psychosocial development of babies [24].The importance variable was the mother's age, maternal age is one of the high risk factor that may face one or more problems during their reproductive period [25] . A study showed that mothers with age under 16 year were at high risk to get SGA babies. [26].Other study suggest that the older mothers (> 35 years) are at a higher risk of having low birth weight babies when compared with women of age 20 – 29 years, [27].Young or old maternal age is associated with LBW [28], In this study, maternal age ranges 18-34 year, the mean of maternal age was no significant difference among studied groups (P-value 0.05).In addition, various other factors have been observed to affect the birth weight of the infant, as follows: the gender of the infant, gestational age, smoking, obstetric history and genetic predisposition [29 ,30] .

## CONCLUSION

Maternal vitamin A in LBW infants was significantly lower than NBW infants. protein nutrition status (serum albumin) were significantly lower in mothers with preterm delivery compared to those with term delivery It is important to acknowledge the need to assess markers of iron status adequately in order to reach reliable conclusions regarding their relationship with fetal growth. Recommendation It was recommended to: Evidence of nutritional intervention effectiveness Iron supplementation ,Periconceptional folic acid intake, Iodine use ,Balanced energy/protein supplementation CalciumAntioxidant supplement may be more considered in babies with low birth weight.

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