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EVALUATION OF SERUM ANTIOXIDANT VITAMIN LEVELS IN TERM AND PRETERM NEONATES AND THEIR MOTHERS

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ABSTRACT

Background: Antioxidant vitamins such as vitamins A, C and E may play a role in fetal growth Objectives:to determine and correlate serum levels of antioxidant vitamins (A, C and E) in term and preterm newborns and their mothers.
Materials and methods: Thirty apparently healthy neonates were classified into 15 full term and 15 preterm neonates along with their mothers. Blood samples were collected from all neonates and their mothers for the estimation of serum antioxidant vitamins A, C and E.
Results: The mean levels of serum vitamins A& E were significantly lower in neonatal than in maternal sera while the level of vitamin C was significantly higher in neonatal than in maternal sera. At the same time the levels of these vitamins were significantly lower in preterm compared to term neonates. A significant positive correlations were found between neonatal and maternal serum vitamin A& E levels, whereas Vit c showed no significant correlations.
Conclusions: Antioxidant vitamins appear to accumulate during the third trimester, so preterm infants are more susceptible to oxidative stress.

KEYWORDS: antioxidant vitamins, pregnancy, oxidative stress, term and preterm neonates.

INTRODUCTION

The importance of antioxidant nutrient balance for pregnant women who are exposed to various oxidants through food, drinking water, or inhaled air is well documented. There are complex antioxidant defense systems, including both enzymatic and non-enzymatic components against the effects of oxygen free radicals on biological macromolecules,such as proteins, nucleic acids, carbohydrates, and lipids. Antioxidant vitamins such as vitamins A, C and E may play a role in fetal growth (Agustín et al; 2011).

Vitamin A has substantial singlet oxygen scavenging ability (Kumaretal; 2008).As vitamin C is a hydrophilic antioxidant, it counteracts several hydroxyl radicals and may contribute in protecting the fetus from oxygen free radical damage (Cederberg et al; 2001).Vitamin E is a lipophilic antioxidant and interferes with lipid peroxidation. On the other hand, it is known that vitamins C and E act synergistically against oxidative stress, because vitamin C is involved in the regeneration of oxidized vitamin E*(Surapaneni*; 2008).

Many reports have shown that serum contents of fat soluble nutrients in newborns to be much lower than those in mothers, but in contrast serum contents of hydrophilic nutrients in newborns have been higher than those in mothers.(Baydaset al; 2002).

Vitamin E (alpha tocopherol) appears to be the most important micronutrient involved in the protection of low density lipoprotein(LDL) from oxidation, it increases mean high density lipoprotein(HDL) level while decreasing LDL level. It is well documented that placental transfer of vitamin E is limited. Accordingly, newborn infants were reported to have low circulating levels of vitamin E (Wang et al; 2009). Study objectives:The aim of the present study was to determine and correlate serum levels of antioxidant vitamins (A, C and E) in term and preterm newborns and in their mothers respectively.

MATERIALS AND METHODS

The study was performed on thirty apparently healthy neonates admitted to neonatal unit and their mothers admitted to obstetrics department in Al Azhar Assiut university hospital - Egypt. They were classified into four groups. Group (I): 15 full term neonates, Group (II): 15 preterm (<37 weeks), Group (M_1): 15 mothers of group l and Group (M_2): 15 mothers of group ll. Detailed demographic and clinical characteristics of the studied neonates and their mothers were obtained. Gestational age was assessed by date of last menstrual period, ultrasonographic findings corresponding to the period of amenorrhea and by the method of scoring of Ballard (*Ballard et al; 1991*). Blood samples were collected from all neonates and their mothers in heparinized glass tubes for the estimation of serum antioxidant vitamins (A, C and E).Blood samples were centrifuged (3,000 rpm, 10 min), and sera were removed and stored at 20^0C until analysis. Levels of vitamins A and E were determined by the method of Catignani and Bieri; 1983 and Miller et al; 1984,using high performance liquid chromatography(HPLC) To determine serum vitamin C levels, proteins were precipitated according to Cerhata et al:1994 and vitamin C levels were determined by the method of Tavazzi et al; 1994. Recovery of vitamins A and E were 97.8 and 99.5%, respectively.

Statistical analysis

Data were collected, revised, coded, tabulated and introduced to a PC using Statistical Package for Social Science (SPSS 15.0.1 for windows MS Windows; SPSS Inc,

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Chicago, IL, 2001). Descriptive analysis was performed for demographic and clinical characteristics of the patients. Data were represented by Mean ± SD.Student *t* test was used for the assessment of mean differences between two groups. Chi- square (x^2) was used to compare between two groups

RESULTS

Table (1): Demographic and clinical characteristics of the studied neonates and their mothers

Variables	Group I (n=15) Term neonates	Group II (n=15) Preterm neonates
Maternal age (years) *	25.5±3.4	24.6±3.2
Pregnancy spacing (months) *	24±6	20±3
Gestational Age (Wks.) *	37.2±1.6	33.9±1.6
Sex (M/F)	5/10(33.3/66.7%)	6/9 (40/60%)
Birth Weight (Kg) *	3.1±1.1	2.1±0.1
Length (cm) *	47.4±3.2	41.8±2.2
Head circumference(cm)*	35.7±1.9	29.9±1.5
Fetal presentation ● Cephalic ● Breach ● Transverse	 12(80%) 2(13.3%) 1(6.7%)	 8(53.3%) 6 (40%) 1(6.7%)
Mode of delivery: ● CS ● NVD	 6 (40%) 9 (60%)	 8(53.3%) 7 (46.7%)
APGAR score*: ● 1 Min ● 5 Min	 7±1.5 8±1	 4.1±0.5 5.5±1.3

Key:
Values are given as no.(%) * Mean±SD
HC: head circumference CS: Cesarean section
NVD: Normal vaginal delivery M/F: male/female

Table (2): Mean ± SD levels of serum antioxidant vitamins in the studied preterms and their mothers

Vitamins(µ mol/ml) / Groups(n =15 for each)	Vitamin A	Vitamin B	Vitamin C
Group I(Term neonates)	0.69±0.016	101.2±38.9	15.9±11.8
Group II(preterm neonates)	0.49±0.09	85.6±32.8	6.6±3.7
Group M1(Mothers of group I)	1.13±0.37	81.9±32.6	25.4±10.4
Group M2(Mothers of group II)	1.1±0.35	79.1±33.5	23.5±11.2
Significance levels			
Group Ivs.Group II	***	***	***
Group M1 vs. Group M2	**NS**	**NS**	**NS**
Group Ivs. Group M1	***	***	***
Group IIvs. Group M2	***	***	***

NS: non-significant
****:** highly significant (p<0.01)*****:** very highly significant (p<0.001)

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Table (3): Correlation coefficient (r) of antioxidant vitamins (A, C&E) between the studied neonates and their mothers

Vitamins / Neonates	Vit. A	Vit. C	Vit. E
	Mothers of corresponding neonates		
Preterm (n=15)	0.725**(P < 0.01)	0.09 (P > 0.05)	0.775**(P< 0.01)
Term (n=15)	0.689** (P < 0.01)	0.04 (P > 0.05)	0.73**(P < 0.01)

N.B: Unites of the studied vitamins in μ mol/ml.

in a qualitative parameter, ***p***< 0.05 was considered significant.

DISCUSSION

Owing to the controversial findings regarding the assessment of antioxidant vitamins in neonates and their mothers, the present study was conducted to determine the serum levels of vitamins A, C and E in term and preterm neonates and their mothers.

In the present study the mean serum levels of antioxidant vitamins A &E were found to be significantly lower in term and preterm neonates versus their mothers. These findings were found to be in agreement with previous reports which clearly demonstrated that vitamin A&E levels in cord blood were lower than in maternal blood (Chen et al; 1999, Kiely et al; 1999, Baydaset al; 2002, and Wang et al; 2009). A positive correlation between neonatal and maternal serum vitamin A& E levels, as determined in the present study, has also been reported by other investigators (Chen et al; 1999, Baydaset al 2002). It is obvious that neonatal vitamin A& E concentration is dependent on maternal vitamin A&E levels. Viana et al; 1999 have shown in their study that treatment of pregnant rats with either vitamin A or alpha-tocopherol caused an increase in their concentrations in maternal and fetal plasma. The reason behind the low levels of serum vitamins A& E in neonates in the present study could be attributed to their limited transportation from placenta (Baydaset al 2002). Nonetheless, the mechanism of the transportation still must be clarified. However in contrary to our results Wang et al; 2009 found no correlation between maternal and cord plasma Vit. A& C concentrations and attribute their result to the different subject population.

This study demonstrated that the mean serum vitamin A& E concentrations of term neonates were significantly higher than that of preterms. Similar findings have been reported by other investigators(Shah et al; 1987 and Baydaset al; 2002). However, Chan et al; 1999, reported that there were no significant differences between term and preterm serum vitamin A& E levels. Nevertheless, these investigators reported that preterm neonates had a higher incidence of vitamin A& E deficiency compared to term babies. Baydaset al; 2002, have reported that serum vitamin A&E levels were lower in premature infants and low birth weight full term infants than full-term normal infants. These results are in agreement with the present findings. The low values of vitamin A& E seen in preterm infants may have consequential clinical importance. This may be potentiated by maternal vitamin A&E levels because there were a significant correlation between neonatal and maternal serum vitamin A& E levels.

In agreement with the results at hand, previous studies showed that maternal vitamin A&E levels correlated with neonatal vitamin A& E levels respectively(Chen et al; 1999 and Baydaset al; 2002). From the previous findings one can conclude that both vitamin A& E accumulate in the fetus throughout the third trimester. Therefore, preterm infants are predisposed to either vitamin A or E deficiency.

Although levels of vitamins A& E were lower in neonatal than in maternal serum, the level of vitamin C was significantly higher in neonatal than in maternal serum. These results were in agreement with other studies (Baydas et al 2002 and Wang et al 2009). Serum vitamin C levels in preterm neonates were lower than those of full-term neonates.

Guajardo et al; 1995and Baydas et al 2002, also reported that umbilical cord venous plasma ascorbic acid levels were significantly lower in the preterm group than in the term group. In contrast to these results,reduction in vitamin C levels was reportedly associated with an increase in gestational age (Das et al 1998). Placenta is permeable to dehydroascorbic acid but not to ascorbic acid, the fetus then converts dehydroascorbic acid to ascorbic acid and accumulates it (Baydas et al 2002).

Increased lipid peroxidation caused by oxygen free radicals is believed to be one of the common pathogenic mechanisms for so-called oxygen radical diseases of prematurity. Reactive oxygen species are generated endogenously underphysiologic and pathologic conditions. Vitamin E inhibits lipid peroxidation; hence, it prevents membrane damage and modification of low-density lipoproteins. It is regenerated by the water-soluble vitamin c. *In vitro*studies have shown that various forms of vitamin A can exert antioxidant effects more potent than those of vitamin E (Stahl et al; 1997 and Baydas et al; 2002). Hydroperoxide concentrations were found to be high, especially in premature infants. Erythrocyte membranes were also found to contain low levels and/or low activities of antioxidant defense mechanisms, which was more evident in premature newborns who demonstrated alphtocopherol levels significantly lower in comparison to full-term infant levels.(Huertas et al; 1998 and Baydas et al; 2002).

In conclusion, serum levels of lipid-soluble antioxidant vitamins (A and E) were lower in neonates than in their mothers with significant positive correlations between them,

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and term neonates had higher serum levels of these vitamins than did preterm neonates. These antioxidant vitamins appear to accumulate during the third trimester, so preterm infants are more susceptible to oxidative stress. In contrast, serum levels of vitamin C were found to be higher in neonates than in their mothers.

RECOMMENDATIONS

If antioxidant levels play a role in preventing adverse birth outcome, the risk will be reduced by the use of antioxidant-rich diet or supplementation, or by the avoidance of exposure to oxidative stress during pregnancy.

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