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Research Article

DETERMINATION OF SERUM LEVEL OF VITAMIN A AND E IN PREGNANT WOMEN IN JIAMUSI REGION

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ABSTRACT

Objective: To study and analyze serum levels of vitamin A and E in the first, second and third trimester of pregnancy.

Method: A total of 1263 serum samples from pregnant women during first, second and third trimester of pregnancy were collected ,from December 2015 to december 2016 in Jiamusi , then high performance liquid chromatograhy (HPLC) method was used to determine the concentration of serum vitamin A and E, and compared it with serum concentrations of vitamin A and E in normal people.

Results: In the first,second and third trimester of pregnancy, the serum concentration of vitamin A was (0.34±0.0) mg/L, (0.38±0.10) mg/L, (0.34±0.11) mg/L, respectively. The total abnormal rate was 18.13% with main performance of deficiency (17.35%). The rate of deficiency in the first trimester of pregnancy (36.20%) was higher than the rate of deficiency in the third trimester of pregnancy (9.40%). The serum concentration of vitamin E for the first,second and third trimester were (10.15±2.90)mg/L, (12.07±2.88) mg/L, (14.85±6.94) mg/L, respectively. The total abnormal rate was 9.38% with excess (8.59%) as the main performance.

Conclusion: The serum levels of vitamin A and E are different at different stages of pregnancy ,with vitamin A being deficient while vitamin E being in excess. Therefore attaching great importance to the monitoring of vitamin A, E levels in pregnancy.

Key words: Vitamin A, Vitamin E, Pregnancy.

INTRODUCTION

Vitamin A and E are essential micronutrients throughout life. Pregnant women represent the main population at risk of vitamin A deficiency ,there is also growing awareness that sub clinical and even clinical vitamin A deficiency also occurs in women of reproductive age and infants less than 6 months of age. During the period of early fetal development the supply of vitamin A must be carefully managed to ensure that the developing fetus is exposed to neither too little nor too much vitamin A because either condition can have teratogenic consequences. Towards the end of gestation, adequate maternal vitamin A status and dietary intakes are important to maximize the vitamin A transferred to the fetus in preparation for parturition and lactation[1].

Increased consumption of vitamin A-rich foods can meet increased needs during pregnancy and lactation. The first postpartum month is the only safe period during which to provide deficient lactating women with a single high-dose supplement to benefit the mother and breast-feeding infant for several months[2].

Alpha-tocopherol, the main component of a group of compounds known as vitamin E, is a powerful antioxidant and the main fat-soluble vitamin responsible for protecting cell membranes against peroxidation. As a lipophilic compound, it accumulates in circulating lipoproteins, cell membranes, and fatty deposits, reacting with free radicals and molecular oxygen, protecting polyunsaturated fatty acids (PUFAs) and lipoproteins from peroxidation[3,4].

China's research on pregnant women's vitamin A and E levels is based in Beijing area, similar studies have not been carried out in other regions. This study is designed to measure vitamin A, E levels of pregnant women in Jiamusi region, determine the gap between Jiamusi and Beijing, to facilitate early prevention of vitamin deficiency and further develop pregnant women nutritional care.

MATERIALS AND METHODS

1) Subjects: Between 2015.12.1- 2016.12.1 pregnant women visiting the outpatient and inpatient department of obstetrics and gynecology at the First Affiliated Hospital of Jiamusi University were enrolled for the study, excluding patients from outside Jiamusi region, patients with pregnancy complications and patients with existing medical diseases.

All subjects had not taken vitamin A or E containing medications two weeks prior to serum vitamin analysis.

During this period 2015.12.1 - 2016.12.1, 634 samples were collected for vitamin A analysis and 629 samples were collected for vitamin E analysis, see table 1.

	Vitamin A (n)	Vitamin E (n)
Early Pregnancy (≤12weeks)	149	150
Second trimester (14-28 weeks)	183	180
Third trimester(≥28 weeks)	302	299
Total	634	629

Table 1: Serum samples of Vitamin A and Vitamin E in pregnancy

2) An interviewer administered questionnaire was used to collect information about the nutritional status of the subjects. The subjects were asked about the daily consumption of food stuffs that contain vitamin A and E. They were then sent to the laboratory were peripheral blood samples were taken and analyzed for the levels of vitamin A and E using High Performance Liquid Chromatography (HPLC).The results were put into three categories according to the gestational age ,that is, first trimester, second trimester, third trimester, then analyzed

Vitamin Analysis: the concentration of serum vitamin A and E were determined by High Performance Liquid chromatography (HPLC).

High performance liquid chromatograph: Peripheral venous blood collection of 2 ml, no anticoagulant added, the blood was stored at 0 – 4degrees Celsius, protected from light, blood samples were centrifuged to obtain serum. The serum and the protein were precipitated with ethanol.Then n-hexane was added and shocked to extract Vitamin A and E. A certain amount of n-hexane layer evaporated by nitrogen-blow. The residue that dissolved by ethanol was analyzed by HPLC. The analytes were qualitated by retention time and quantitated by standard curve method. The analysis column of this method was C18 column(250mm×46mm,5 μm),the flow phase was methanol:CH3-OH+H2O(98+2) and detection wavelength was 325nm .The serum concentrations of vitamin A and E were then tabulated as shown in table 1.

3) Reference values: the normal reference value of serum vitamin A is 0.3 - 0.7 mg/L, vitamin E normal reference value of 5-20 mg/L, values lower than the reference value indicate the diagnosis of vitamin A, E deficiency, while values higher than the reference value indicate the diagnosis of vitamin A,E excess.

4) Statistical Analysis: Microsoft excel software was applied to establish a database, double check the entry times, then SPSS statistical software was used for data analysis.

5) Grouping criteria: First trimester pregnancy <14 weeks, Second trimester pregnancy between 14-27 weeks and third trimester pregnancy is ≥ 28 weeks.

RESULTS

Serum levels of vitamin A and E during pregnancy: During pregnancy, the serum level of vitamin A was (0.35 ± 0.07) mg/L, the first, second and third trimester values were (0.34 ± 0.01) mg/L, (0.38 ± 0.09), mg/L (0.34 ± 0.11) mg/L respectively, first and third trimester values were low ($P < 0.05$), see Fig. 1.During pregnancy serum vitamin E value was(12.4 ± 4.24) mg/L, the first, second and third trimester values were (10.15 ± 2.90) mg/L, (12.07 ± 2.88) mg/L, (14.85± 6.94) mg/L, the lowest level was recorded in first trimester while the highest level was recorded in the third trimester ($P < 0.05$), see Figure 2

The total abnormal rate of serum vitamin A during pregnancy was 18.13%, and the rate of deficiency of vitamin A was (17.35%). The abnormal rate was highest during first trimester (36.91%), of which the rate of deficiency was 36.20%, severe deficiency of (< 0.2 mg/L) 3.1%, the abnormal rate in third trimester (9.93%), of which the rate of deficiency was 9.4%, the rate of severe deficiency (< 0.2mg/L) 4.3%, the difference was statistically significant ($P < 0.05$) see table 2.

	Deficiency		Normal (0.3-0.7mg/L)	Excess>0.7mg/L	Abnormal rate (%)
	<0.2mg/L	0.2-0.3/L			
First trimester (n=149)	5(3.10)	49(33.10)	94(63.09)	1(0.71)	36.91
Second trimester (n=183)	2(1.20)	26(14.12)	152(83.06)	3(1.62)	16.94
Third trimester (n=302)	13(4.30)	15(5.10)	272(90.20)	2(0.40)	9.93
Total (n=634)	110(17.35)		519(81.87)	5(0.78)	18.13

Table 2: Abnormal rate of Vitamin A in pregnancy (n%)

3. The total abnormal rate of serum vitamin E during pregnancy was 9.38%, mainly in excess (8.59%). The lowest abnormal rate was recorded in first trimester (6.7%), of which the rate of deficiency was 2.0%, excess rate of 4.7%; the abnormal rate of vitamin E increased with the increase of gestational age, the highest abnormal rate recorded in third trimester (11.37%), vitamin E being in excess, the difference was statistically significant ($P < 0.05$), see Table 3.

	Deficiency <5mg/L	Normal 5-20 mg/L	Excess>20mg/L	Abnormal rate (%)
First trimester (n=150)	3(2.00)	140(93.30)	7(4.7)	6.7
Second Trimester (n=180)	2(1.11)	165(91.67)	13(7.22)	8.33
Third trimester (n=299)	0(0.00)	265(88.63)	34(11.37)	11.37
Total (n=629)	5(0.79)	570(90.62)	66(8.59)	9.38

Table 3: Abnormal rate of Vitamin E in pregnancy (n%)

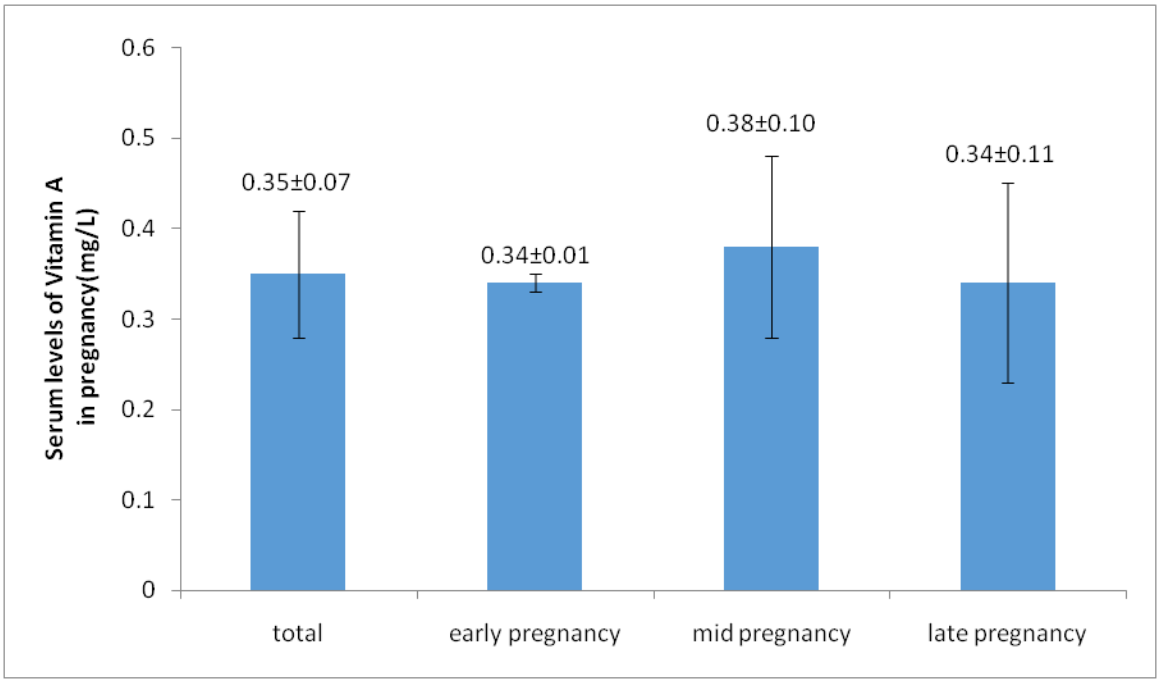

Figure 1: Serum levels of Vitamin A in pregnancy

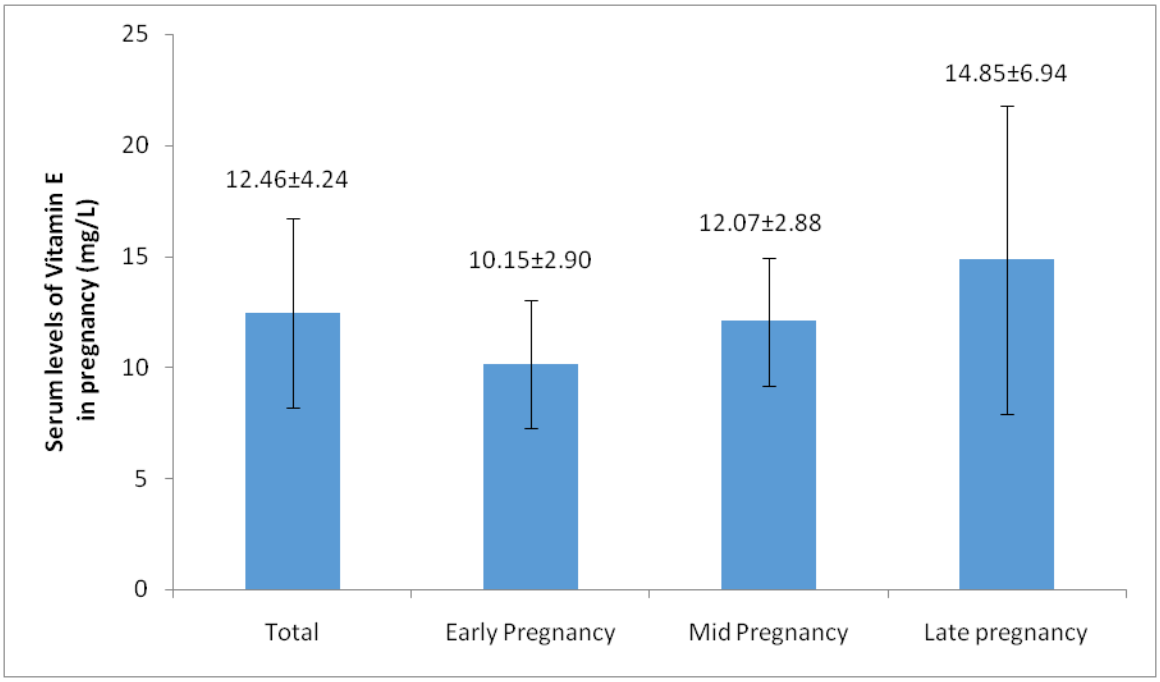

Figure 2: Serum levels of Vitamin E in pregnancy

DISCUSSION

Vitamin A is essential in maintain normal vision, maintaining the structural integrity of epithelial tissue, promoting epithelial cell glycoprotein synthesis, promoting growth, antioxidation, participates in the formation of cortical hormones, sex steroid hormone synthesis and bone tissue formation[5-7]. During the period of embryonic development, maternal vitamin A deficiency can lead to poor fetal growth and a series of congenital defects, such as microphthalmos(congenitally small eyes, usually associated with a small eye socket)and anophthalmos[8](congenital absence of eyes), heart malformation[9,10], pulmonary agenesis[11,12], retardation[13] and skeletal deformities[14]. The results of this study showed that the level of serum vitamin A was lower in the first and third trimesters of pregnancy, and the reasons may be related to the nutritional status of pregnant women, pregnancy response, hormone levels, regional differences and other factors. The level of progesterone increases gradually with the progression of pregnancy, and reaches the highest level at the end of pregnancy, progesterone can promote the release of vitamin A from the liver and adipose tissue.

The relatively low level of progesterone in the first trimester of pregnancy leads to decreased levels of serum vitamin A. vitamin A is a fat soluble vitamin, its absorption and utilization is closely related with the fat absorption and utilization, because of the pregnancy reaction, intake of vitamin A rich food is low and there is also reduced fat absorption, vitamin A storage in the liver and adipose tissue is relatively reduced, so release of vitamin A into the bloodstream is low. The concentration of vitamin A in the blood is also related to the retinol binding protein (RBP) concentration, RBP concentration in early pregnancy is low, so the serum

vitamin A level is decreased. Low vitamin A levels in late pregnancy may be associated with a rapid increase in fetal weight and an increase in demand.

In this study, there was vitamin A deficiency in pregnant women in Jiamusi region, mainly during the first trimester, the rate of first trimester vitamin A deficiency was 36.2%, and the rate of deficiency in third trimester accounted for 9.4%, of which third trimester severe deficiency (< 0.2 mg/L) accounted for 4.3%.

Therefore, we need to pay attention to the nutritional status of vitamin A in pregnant women, and it is necessary to monitor the stages of pregnancy, especially pay attention to the first and third trimester monitoring, and to develop personalized dietary guidance. For patients whose vitamin A intake is low, there should be emphasis on consumption of vitamin A rich animal foods such as drinking milk , eating eggs, fish, shrimps, meat ,animal liver; and at the same time eat green, red and yellow vegetables such as spinach, leek, peas, carrots, green peppers, sweet potatoes and pumpkin.

For those who have an adequate intake of vitamin A, they should continue with their current eating habits and teach them how to diversify their diet.

Those with high vitamin A intake should reduce their intake of animal food derived vitamin A, use a food composition table to explain to them how to achieve a reasonable diet.

The personalized dietary guidance to pregnant women and awareness of the importance of vitamin A on the growth and development of fetus ensures vitamin A intake to achieve a relatively suitable level. Reduced vitamin A intake or if not balanced can lead to a possibility of fetal abnormalities and congenital defects.

Vitamin E is essential in maintain normal metabolism with antioxidant, free radical scavenging functions.

During pregnancy ,a women's body metabolism increases , increasing the production of free radicals, also increasing lipid peroxidation, if the level of vitamin E in pregnant women is low, it will lead to excessive free radicals, causing aging of the placenta and vascular endothelial injury,this increases the occurrence of hypertensive disorders in pregnancy and the risk of adverse pregnancy outcomes, there is also damage to cell membranes, hence increased risk of premature rupture of membranes[15-18].

In addition, excessive vitamin E in pregnant women has antagonistic effects on other fat soluble vitamins ,it interferes with absorption of other fat soluble vitamins.

The results of this study show that the average level of vitamin E is lowest during the first trimester, and highest during the third trimester of pregnancy.

The overall abnormal rate in pregnancy accounted for 9.38% of the vitamin E, deficiency is rare, the lowest abnormal rate in first trimester accounted for 6.7%, increasing gradually with increase in gestational age, third trimester abnormality rate accounted for 11.37%, where the level of vitamin E was excess.

Apart from the hormonal factors, supplementary food stuffs and medicine taken during the third trimester of pregnancy might also cause the excess levels of vitamin E.

Therefore, we should pay attention to monitoring the level of vitamin E during pregnancy and offer

reasonable nutrition guidance.

In short, good nutrition condition during pregnancy can not only ensure maternal normal physiological function and maintain their health needs, but also ensures normal development of the fetus and smooth delivery.

During the first trimester of pregnancy maintaining reasonable supplements of vitamin A and E provides enough nutrition for the embryo and ensures the normal differentiation of embryonic cells and hyperplasia; while in the second and third trimesters of pregnancy maintaining reasonable supplements of vitamin A and E ensures adequate vitamin A and E reserves for the baby after birth, so as to ensure the healthy growth of the infant.

In clinical work, strengthening the prenatal education and prenatal nutrition guidance for pregnant women , as well as doing the necessary vitamin nutrition monitoring helps to develop early prevention and early intervention measures and hence reduce fetal abnormalities and congenital defects.

CONCLUSSION

The serum levels of vitamin A and E are different at different stages of pregnancy ,with vitamin A being deficient while vitamin E being in excess. Therefore attaching great importance to the monitoring of vitamin A and E levels in pregnancy.

The total mean serum levels of vitamin A in pregnant women in Jiamusi region is slightly lower than that in Beijing region.

Nutritional guidance and correct prenatal vitamin supplements have important significance to guarantee maternal and fetal safety.

The knowledge of factors that can influence vitamin A and E concentration in serum can provide important information for the prevention of their deficiency in pregnant women, as some of these variables (food) can be controlled.

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