International Journal of Preventive Medicine

Original Article Open Access

Vitamins A and E Deficiencies among Pregnant Women Attending Antenatal Care at General Hospital Dawakin Kudu, North-West Nigeria

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How to cite this article: Ugwa EA. Vitamins A and E deficiencies among pregnant women attending antenatal care at general hospital Dawakin Kudu, North-West Nigeria. Int J Prev Med 2015;6:66.

ABSTRACT

Background: Vitamins A and E deficiency is prevalent in developing countries, and plasma levels are low in pregnancy. This study was undertaken to determine the serum Vitamins A and E status among pregnant women attending antenatal care at a General Hospital in Dawakin Kudu, Kano and to provide the necessary information needed to suggest the supplementation of Vitamins A and E during pregnancy.

Methods: The study was done in General Hospital Dawakin Kudu Local Government Area. Dawakin Kudu, a rural community in Kano State is about 12 km from Kano metropolis which is the most populous city in Nigeria and commercial nerve center of Northern Nigeria. Most of the women are housewives, however, some engage in subsistent farming and petty trading. This was a prospective study of 200 pregnant women at various maternal ages, gestational ages, and parities. Informed consent was obtained from the participants. Research structured questionnaire was administered to 200 respondents which showed age and parity distributions. Determination of Serum Vitamins A and E was done using methods of Bessey, *et al*. and Tsen. Ethical approval for the research was obtained from General Hospital, Dawakin Kudu, Kano. Statistical Analysis Used: Data obtained were analyzed using SPSS version 17 statistical software (SPSS Inc., IL, Chicago, USA). Descriptive statistics was done. Mean serum Vitamins A and E concentration between trimesters were compared using two-way ANOVA and $P < 0.05$ was considered statistically significant.

Results: Majority of the women were aged 20–39 years with mean of 23.67 ± 6.11. Most were in the 1–4 parity range. Mean birth weight was 2.42 ± 0.74 kg. Above 65% were deficient while 34.5% had normal levels of Vitamin A and 51% were deficient of serum Vitamin E. Serum Vitamins A and E levels showed a marked reduction from first through third trimester. The differences were statistically significant ($P < 0.05$).

Conclusions: There is a significant reduction in the serum Vitamins A and E concentration throughout the period of pregnancy with the highest levels in the first trimester. Therefore, further studies should evaluate the value of Vitamins A and E supplementation during pregnancy especially for those whose fruit and vegetable consumption is inadequate.

Keywords: Antenatal clinic, E deficiencies, North-West Nigeria, pregnant women, Vitamin A

Access this article online

Quick Response Code:

Website: www.ijpvmjournal.net / www.ijpm.ir

DOI: 10.4103/2008-7802.161078

INTRODUCTION

Vitamins are organic substances, which are required by the body in small amounts to maintain life and health.[1] They act as catalysts in the formation of hormones, enzymes, blood cells, neurotransmitters, and genetic material. They are essential to complete the metabolism of carbohydrates, proteins, and fats. The body's need for vitamins is met by the diet. The fat soluble vitamins, A and E have antioxidant properties and as such either block the initiation of free radical formation or inactivate (scavenge) free radical.[2]

Vitamins A and E deficiency is prevalent in developing countries, and their levels are low in pregnancy.[3-6] Pregnant women are particularly vulnerable to deficiencies in micronutrients including Vitamins A and E because of the increased metabolic demands imposed by pregnancy.[6]

It has been suggested that Vitamin A supplementation, particularly in women with low or borderline serum retinol concentration, may improve mobilization of iron stores.[7] In one study, Vitamin A deficiency was the only micronutrient deficiency in 15% of all women possibly making this the second most frequent single micronutrient deficiency after the iron deficiency.[8] Subclinical Vitamin A deficiency is a problem during the third trimester of pregnancy.[9]

Vitamin E is the generic descriptor for two families of compounds, the tocopherols and tocotrienols. It acts as a lipid-soluble antioxidant in cell membranes, where many of its functions can be provided by synthetic antioxidants. Some studies suggest that the use of Vitamin E in women with preterm premature rupture of the membrane is associated with a longer latency period before delivery.[10,11]

This study was undertaken to determine the serum Vitamin A and Vitamin E status among pregnant women attending antenatal care at a General Hospital in Dawakin Kudu Local Government Area so as to be able to establish if there is any deficiency. This could possibly provide the necessary information needed to suggest the supplementation of Vitamins A and E during pregnancy especially in population where fruit and vegetable consumption is not adequate.

METHODS

This was a prospective study of 200 pregnant women at various maternal ages, gestational ages, and parities done between 31 November 2009 and 30 March 2011.

Dawakin Kudu, a rural community in Kano State, Nigeria and about 10 km from Kano, the commercial nerve center of northern Nigeria. Most of the women are housewives, however, some engage in subsistent farming and petty trading. They engage in farming during the rainy season, poultry, and livestock rearing. Their method of farming is not mechanized as they resorted to local tools and feeds for their livestock's and poultry. The major crops grown include maize, millet, groundnuts, cowpea, cassava, and vegetable.

The study population was all pregnant women attending antenatal care at Dawakin Kudu general hospital. Sample size was determined by confidence interval

Documented prevalence of 15% from the previous study was used.[8] This was rounded up to a sample size of 200 pregnant women. Random sampling of the study population was done, and it was ensured that every individual had an equal chance of being enrolled in the study. Participants with confounders such as hypertensive diseases and diabetes mellitus were excluded. Drop-outs were replaced. Research structured questionnaire was administered to 200 respondents which showed age and parity distributions.

Whole blood sample (10 ml) was collected from the 200 participants and drawn directly into a plain blood sample container. Blood was obtained from venipuncture after applying a tourniquet. The tourniquet was removed as soon as blood began to flow into the tube so as to minimize the risk of hemolysis. The blood samples were packed and transported carefully in the ice pack. Centrifugation at 2,500–3,000 rpm for 5 min was done to obtain plasma. They were labeled and covered with aluminum foils. Storage was in a deep freezer for 1-month.

Determination of Serum Vitamin A Level was according to Bessey, *et al*.[12] and normal value was 15–60 μg/dL. Deficiency level is <10.3 μg/dL, Suboptimal level is 19–40 μg/dL, and Optimal is >40 μg/dL. Determination of serum Vitamin E Level was according to Tsen,[13] and normal value was 5–20ug/dL. Vitamin E deficiency level is <3 μg/dL and toxicity occurs at >40 μg/dL. Please add the deficiency level and optimal and sub-optimal levels.

Data obtained were analyzed using SPSS version 17 statistical software (SPSS Inc., IL, Chicago, USA). Absolute numbers and simple percentages were used to describe categorical variables. Similarly, quantitative variables were described using measures of central tendency (mean, median) and measures of dispersion (range, standard deviation) as appropriate. Mean serum Vitamins A and E concentration between trimesters were compared using two-way ANOVA and $P < 0.05$ was considered statistically significant.

Ethical approval was obtained from general hospital Dawakin Kudu, Kano reference number: DKGH/SUB/1/8/44 dated 4/05/2005. Informed consent was obtained from the participants.

RESULTS

Results are shown in Tables 1-3. Majority of the women were aged 20–39 years with a mean of 23.67 ± 6.11. Most were in the 1–4 parity range. Mean birth weight was 2.42 ± 0.74 kg. Above 65% were deficient while 34.5% had normal levels of Vitamin A and 51% were deficient of serum Vitamin E. Serum Vitamins A and E levels showed a marked reduction from first through the third trimester. The differences were statistically significant ($P < 0.05$).

DISCUSSION

Report of the analysis of serum specimens for Vitamin A showed that 65.5% had levels below normal while 34.5% had normal levels. The present study has also shown that 51% of the participants had deficient level of serum Vitamin E. The report also shows that 70% of the pregnant women were aged 20–39 years and a mean of 23.67 ± 6.11 was reported. This compares with reports of the similar study.[14] The association between the status of Vitamins A and E and age has been reported earlier and has been related to factors such as dietary patterns and lifestyle that influence the nutritional status.[15-17]

Table 1: Age, parity, and birth weight distribution

Variables	Frequency	Percentage	Mean±SD	Coefficient of correlation (*r*)	*P*
Age					
<20	53	26.5	23.67±6.11	0.2	0.35
20-39	140	70			
≥40	7	3.5			
Parity					
0	56	28	2.47±2.50	0.1	0.41
1-4	109	54.5			
≥5	35	17.5			
Birth weight (kg)					
<2.5	80	40	2.42±0.74	0.75	0.01
2.5-3.99	120	60			
≥4	0	0			

SD=Standard deviation

Table 2: Report of biochemical analyses for serum Vitamins A and E

Variable (μg/dL)	Frequency	Percentage	Mean±SD
Vitamin A			
<15	131	65.5	13.39±9.44
15-60	69	34.5	
>60	0	0	
Vitamin E			
<5	102	51	5.99±3.95
5-20	98	49	
>20	0	0	

SD=Standard deviation

Table 3: Distribution of serum Vitamins A and E levels according to trimesters

Vitamin (μg/dL)	1st trimester	2nd trimester	3rd trimester	*P*
Vitamin A	19.54±9.97	11.94±9.80	8.71±8.55	0.001
Vitamin E	10.27±5.05	5.23±3.45	2.49±3.35	0.01

The majority of the women in this study were in the 1–4 parity range. There are differences in opinion as to whether parity influences serum Vitamins A and E levels. While some reported that the serum levels decrease with parity,[3] some others reported no difference.[18,19] It is believed that multiparous women in our environment may have depleted vitamin storage from frequent pregnancies at short intervals.[3]

This deficiency was higher than 28% in Northwest Ethiopia,[20] 31% in Nepal,[15] 2% in China, and 11.6% in Europe.[16] Maternal Vitamin A deficiency was also correlated to a reduced intra-uterine growth rate and low birth weight, and higher infant mortality.[21,22] The present study showed a mean birth weight of 2.42 kg among the babies of these women, although no correlation study was done. 25%[14] in Iran, Previous cohort studies have also reported low Vitamin E levels among pregnant women.[23,24] Vitamin is known to act as a lipid-soluble antioxidant in cell membranes, where many of its functions can be provided by synthetic antioxidants. Vitamin E requires bile for absorption, and 25% of it is absorbed orally. The vitamin is stored in adipose tissue, liver, and muscle. Conditions associated with Vitamin E deficiency include motor and sensory neuropathy and intestinal fat malabsorption. Some studies suggest that the use of Vitamin E in women with preterm premature rupture of membrane is associated with a longer latency period before delivery[10,11] and as a therapeutic agent in preeclampsia, which induces high maternal and fetal morbidity and mortality, has been discussed in numerous papers.[25,26]

The present study shows a significant reduction in the serum Vitamins A and E concentration throughout the period of pregnancy with lowest levels in the third trimester, and this has been supported by similar studies.[23-25] However, other studies in the contrary reported an increase in Vitamin E and decrease in Vitamin A from first to third trimester.[27-29] The authors stated that Vitamin A concentration declines gradually in pregnancy because of physiological hemodilution, while Vitamin E concentration is known to increase during gestation, probably because of the hyperlipidemic state associated with pregnancy. In the present study, physiological hemodilution of pregnancy, inadequate

intake, and increased oxidative stress among this population of pregnant women may have been responsible for the marked decrease in Vitamins A and E observed throughout the trimesters.[30]

Similar to the present study, there is no significant correlation among serum Vitamins A and E status with age and parity.[19,31] However, there is a significant correlation among maternal Vitamins A and E and birth weight as the mean weight of the newborn in this study was 2.42 ± 0.74 and coefficient of correlation being 0.75. This is consistent with reports from previous similar studies.[22-23]

CONCLUSIONS

This study has shown deficient Vitamins A and E status among pregnant women attending antenatal clinic at a General Hospital in Dawakin Kudu LGA, and there is a significant reduction from first to third trimesters. Therefore, further studies should evaluate the value of Vitamins A and E supplementation during pregnancy especially for those whose fruit and vegetable consumption is inadequate.

Received: 08 Jan 15 **Accepted:** 10 Apr 15
Published: 16 Jul 15

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Source of Support: Nil, **Conflict of Interest:** None declared.