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2

Serum Ascorbic Acid Levels During Pregnancy in Enugu, Nigeria.

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Background: Pregnancy, though a physiological process promotes oxidative stress. Ascorbic acid and other antioxidants are used as defense mechanisms against this stress leading to low levels in pregnancy. The degree of reduction in plasma levels has been implicated in the aetiology and severity of many obstetric complications.

Objective: To determine the level or degree of reduction in serum ascorbic acid during pregnancy and recommend supplementation strategies.

Subjects and Methods: Sixty five (65) pregnant and 65 non pregnant women with age range 20-38 years were recruited. The pregnant women were in their second and third trimesters, attending antenatal clinic at University of Nigeria Teaching

Hospital Enugu. Serum levels of ascorbic acid were determined for all the subjects.

Results: The serum ascorbic acid levels were significantly lower in pregnant women than in controls. ($P < 0.05$). There was also a steady decline in the serum levels of ascorbic acid with increasing gestational age.

Conclusion: Serum levels of ascorbic acid were reduced in our pregnant women despite our supplementations. Thus increase in the dose during pregnancy and lactation is strongly advocated. The amount to be given is subject to further research.

Key words : Ascorbic acid, Pregnancy, Increased dosage

INTRODUCTION

Ascorbic acid is an essential water soluble vitamin. It is required for proline hydroxylation in collagen synthesis. It also maintains prosthetic metal ions in their reduced form, thus preventing them from producing free radicals¹. It is also important in scavenging already produced free radicals². Thus, it is classified as a non enzymic antioxidant with the protection of biomembranes and low density lipoproteins (LDL) from peroxidative damage³. It also plays a key role in the recycling of another important antioxidant, Vitamin E.

The normal daily requirements of ascorbic acid are debatable and variable. Previously it had been recommended that a daily requirement of 10mg will prevent scurvy while 200mg per day will saturate the tissues⁴. In pregnancy, a daily requirement was given as 70 mg per day and 50 – 60mg per day for non pregnant women⁵. These values were recommended when the role of ascorbic acid was mainly to prevent scurvy. Presently the role has gone beyond this, with a lot of emphasis world wide by both orthodox and alternative practitioners on its antioxidant properties. There is therefore the need to review these recommendations especially in our poor socioeconomic environment.

Pregnancy although a physiological process involves a great number of physical and biochemical changes, with increased requirements for minerals and vitamins⁶. There are marked changes in circulatory steroids⁷ which tend to precipitate increase in cholesterol, phospholipids, free fatty acids and decrease in albumin^{8,9,10}. All these contribute to the generation of free radicals which tends to induce oxidative stress. Ascorbic acid and other anti-

are utilized to mop up these radicals to prevent cellular damage and pregnancy complications, thus leading to low levels. The increased requirement by the fetus and the physiological haemodilution of pregnancy further contribute to the reduced levels in pregnancy.

The study aims to determine the serum concentration of ascorbic acid in uncomplicated pregnancies in Enugu to enable us have a baseline to advocate and implement intervention strategies.

SUBJECTS AND METHODS

Sixty five (65) pregnant women with uncomplicated singleton pregnancies, attending antenatal clinic at the University of Nigeria Teaching Hospital (UNTH) Enugu were recruited. Their pregnancies were judged normal based on history, physical examination, routine laboratory investigations and Ultrasonography. They were in their second and third trimesters within the age range 20 – 38 years. 65 non-pregnant control subjects were selected from students and staff of UNTH Enugu. Early pregnancy was ruled out by checking their last normal menstrual period and samples were taken on the 7th day of their normal cycle. They were in the same age range (20-38 years) and social class (class 3 upper middle using occupational characteristics) with the test subjects.

Both groups were selected by simple random selection of lucky dip of yes or no, after informed consent. For all the cases, fasting venous blood was collected from the ante-cubital vein into sterile plain bottles. Samples were allowed to stand for about 30 minutes to clot and then centrifuged at 3, 500 rpm for

ten minutes. The serum was collected and kept frozen in the refrigerator. Analysis was done within two weeks of sample collection and ascorbic acid determination was done by Roe and Kether method¹¹. Analysis of results was done using SPSS version 11 computer soft ware and were presented as mean and standard deviation. Test for significance was done using the T- test.

RESULTS

The results obtained show that in the second trimester the mean serum ascorbic acid level was $19.0 \pm 2.95 \mu\text{mol/L}$. This was significantly lower than the control $35.3 \pm 8.94 \mu\text{mol/L}$ ($P < 0.05$). The value of ascorbic acid further reduced to $18.5 \pm 2.32 \mu\text{mol/L}$ in the third trimester and was also significantly lower when compared to control ($P < 0.05$) see tables 1 & 2. The bar graphs also illustrate the differences as shown in figures 1 and 11 respectively.

Table:1. Mean ascorbic acid levels in the second trimester (test and control):

	No of patients	Mean age (years)	Ascorbic acid ($\mu\text{mol/L}$)
2nd Trimester	29	29.0 ± 4.19	19.0 ± 2.95
control	65	28.40 ± 5.32	35.3 ± 8.94
P - value			$P < 0.05$

Table2: Mean ascorbic acid levels in the third trimester (test and control):

	No of patients	Mean age in years	Ascorbic acid $\mu\text{mol/L}$
Third trimester	36	29.0 ± 4.19	18.5 ± 2.32
Control	65	28.40 ± 5.32	35.3 ± 8.94
P - value			$P < 0.05$

Values are mean \pm SD

DISCUSSION

In this study, it was noted that the serum level of ascorbic acid was significantly lower in pregnant women than in control subjects. There was also a progressive fall in the concentration as pregnancy progressed to the third trimester. This corresponds to findings in earlier studies done in different parts of the world^{1,12,13,14}. Some studies however found no significant reduction in the levels of ascorbic acid^{15,16}. The researchers attributed this finding to adequate use of the vitamin supplements during pregnancy. The question now is whether we adequately use vitamin supplements in our

factor that militates against adequate vitamin supplementation in pregnancy. In a study in western Nigeria it was found that dietary intake of mothers in terms of energy, protein, riboflavin and ascorbic acid was inadequate¹. Even when dietary intake is adequate, pregnancy induced increased requirement, haemodilution and oxidative stress adversely affect serum levels. Heavy smoking has also been identified to adversely affect serum ascorbic acid levels¹⁸.

There is no doubt that vitamins are essential to maintain normal metabolic processes and homeostasis within the body, however, the amount required by an individual varies considerably and may be influenced by such factors as body size, growth rate, physical activity and pregnancy¹⁹. The need for Vitamin c supplementation during pregnancy can thus not be over emphasized. This is particularly important in our environment where much emphasis is on iron replacement. This we do blindly without knowing the level of serum iron in our pregnant women and may predispose to iron overload. Iron overload may stimulate the generation of free radicals and result in deleterious cellular damage¹ but vitamin c, if adequately supplemented will be on duty to mop up the excess radicals.

In UNTH Enugu, 300mg of Vitamin C is given as part of routine antenatal drug supplementation. Despite this, we still recorded in this study a significant reduction in the level of ascorbic acid on our pregnant women. There is thus no doubt that the daily supplementation of 300mg of Vitamin C for pregnant women in our environment is not sufficient and should be increased. Further studies are needed to adequately determine the dose that will be appropriate.

The enormous benefits of adequate serum levels of ascorbic acid during pregnancy can not be overemphasized. Very recent studies have implicated low vitamin C levels in the aetiology or worsening severity in gestational Diabetes,^{20,21} Preeclampsia,^{22,23} recurrent abortion,²⁴ preterm premature rupture of membrane,^{25,26} and intrauterine growth retardation(IUGR).²⁷ It has also been shown that levels of ascorbic acid is further reduced during normal labour²⁸ and may influence perinatal and neonatal morbidity.

Having ascertained that serum levels of ascorbic acid are significantly lowered in pregnancy and as pregnancy progresses, efforts should be made to encourage our women to consume diet rich in Vitamin c (citrus fruits and green leafy vegetables, raw cabbage etc). In addition, a higher dose of ascorbic acid and if possible other antioxidants like Vitamin E should be supplemented. This will go a long way in reducing maternal and perinatal mortality and morbidity.

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