Original Article

EFFECTS OF SOCIO DEMOGRAPHIC FACTORS ON PLASMA ASCORBIC ACID AND ALPHA TOCOPHEROL ANTI OXIDANTS DURING PREGNANCY

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ABSTRACT

Objectives: To assess the plasma levels of vitamins C and E at the various stages of pregnancy and to correlate their plasma levels with the socio-demographic factors of pregnant Nigerians.

Methodology: The pregnant cases (n=180) were randomly selected according to gestational ages. And the controls (n=20) were non-pregnant women of the same age. Plasma levels of both vitamins were assayed with well established laboratory methods.

Results: The mean plasma vitamins C and E in the pregnant cases was lower (by 17-23%) than controls across the three trimesters, $p<0.0001$. The correlation of vitamin C versus maternal age was significant; $r = - 0.59$, $p<0.05$; the mean plasma level of vitamin C declined by 57% as the maternal age increases from 22-37 years.

Conclusion: The mean plasma Ascorbic acid and Alpha-tocopherol are reduced during pregnancy and socio-demographic factors have mild effects on the plasma levels of these vitamins.

KEY WORDS: Antioxidants, Vitamins C and E, Pregnancy, Socio-demographic factors.

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INTRODUCTION

Pregnancy is the state of carrying a developing embryo or fetus within the female body. It is a physiological process that alters the physiology of the female body with changes ranging from increased hormonal secretions to elevated basal metabolic rate and increased muscular activity.[1] During pregnancy, mostly because of the mitochondria-rich placenta, it favors oxidative stress. Oxidative stress occurs as a consequence of imbalance between the formation of oxygen free radicals and inactivation of these species by antioxidant defense system.[2] Many diseases occur for the first time during pregnancy probably as a result of oxidative stress. Total anti oxidant capacity represents the balance between oxidative stress (oxidants) and the neutralizing systems such as Ascorbic acid (vitamin C), Alpha tocopherol (vitamin E), Catalase, ceruloplasmin, betacarotene, super oxide dismutase, glutathione peroxidase and transferin.[3]

Ascorbic acid is regarded as the major aqueous phase antioxidant.[4] By reacting with activated oxygen more readily than other aqueous

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component, ascorbic acid protect critical macromolecules from oxidative damage thus it act as an effective stabilizer of free radical minimizing the damage caused by oxidative stress.

Alpha tocopherol (vitamin E) is a membrane bound antioxidant employed by cells.[5] Research has shown it to be a membrane stabilizer and a multifaceted antioxidant that scavenges oxygen free radicals and lipid peroxy radicals and singlet oxygen.[5] Ascorbic acid and alpha tocopherol may function together in a cycle type of reaction.[5]

It has been reported that antioxidants such as vitamin C may be reduced during pregnancy but in Nigeria there is dearth of literature about the stage of pregnancy that these antioxidants begin to decline. The objective of this study was to assess the plasma levels of vitamins C and E at the various stages of pregnancy as well as correlate the plasma levels with some socio-demographic factors of pregnant Nigerians.

METHODOLOGY

The cases were selected from the antenatal clinic attendees, according to the gestational period calculated from their last menstrual periods (LMP) and confirmed by uterine ultrasound investigation. Sixty cases each were recruited from first, second and third trimester (total=180).The controls were non-pregnant women of the same age range attending the gynecology clinic for routine medical check-ups. The inclusion criteria were age 18-40 years, confirmed pregnancy either in the first, second, or third trimester without any pregnancy complication. Excluded from the study were pregnant women with medical complications such as diabetes mellitus, hypertension, eclampsia, heart failure or ischemic heart diseases as well as those on vitamins C and E supplements.

Ethical Consideration: Ethical approval was obtained from the hospital research ethical committee. All the participants gave approval after due explanation by the researchers.

Sample Collection: Ten milliliters of venous blood was obtained from each of the participant into heparinized specimen bottles; they were separated after centrifugation at 3000rpm for ten minutes and the plasma stored frozen and the analysis of the vitamins done within 12 hours after blood collection to prevent vitamin C deterioration.

Laboratory assay: Ascorbic acid assay was analyzed using the 2,4 Dinitrophenyl hydrazine methodology[6] and Alpa tocopherol assay was done using the Hexane extraction method.[7] All samples were assayed in duplicate and the interassay and intraassay CVs were less than 5% for all procedures.

Statistics: Statistical analysis was performed using Instat graph pad soft ware version 3.0. Means and standard deviations were determined for quantitative data and frequency determined for categorical variables. Student-t test was used to test for significant association and analysis of variance was used to compare multiple means. P value < 0.05 was considered statistically significant.

RESULTS

A total of 180 pregnant cases (1st trimester n=60, 2nd trimester n=60 and 3rd trimester n=60) were studied, the controls were twenty (n=20).Among the cases; the civil servants were 56 (31.1%), traders 80 (44.4%), full time housewives were 28 (15.6%) and farmers 16 (8.9%), primiparous women (para 0) were 56(25.6%), para one, 71 (39.4%), para two, 49 (27.2%), para three, 13(7.2%) and para four , one(0.6%).

The mean plasma vitamins C and E at the three trimesters are shown in Table 1. The mean plasma vitamin C in controls 2.1±0.41µg/ml is significantly different from the pregnant cases (1.75±0.36, 1.76±0.38, 1.67±0.37µg/ml for 1st, 2nd and 3rd trimester respectively), p=0.001. Also the mean plasma vitamin C is significantly different across the three trimesters. The mean plasma vitamin E is significantly higher in the controls when compared with pregnant cases $p<0.0001$. The mean plasma levels of the vitamins and parity, occupation and age are shown in Table-II. The mean plasma level of vitamin C is highest 1.660±0.461µg/ml, in the farmers and lowest 1.396 ±0.524µ/ml in the house wives, it is highest 1.973±0.252µg/ml, in the age group

Table-I: Mean plasma vitamins C and E in the pregnant cases and controls

	Pregnant women			*Non pregnant women(controls)*	
Parameter	*1st A*	*2nd B*	*3rd C*	*D*	*p*
Vitamin C (microg/ml)	1.75±0.36	1.76±0.38	1.6±0.37	2.10±0.41	0.001
Vitamin E(mg/ml)	0.90±0.39	1.87±0.57	0.88±0.36	2.31±0.42	0.001

All averages are means ± SD
A: women in first trimester of pregnancy, B: women in second trimester of pregnancy
C: women in third trimester of pregnancy, D: non pregnant women

22-25 years and lowest 1.418±0.375µg/ml, in the age group 34-37 years. Also mean plasma vitamin E levels are highest 1.317±0.780mg/ml in age group 22-25 years and lowest 1.307±0.780mg/ml in the age group 30-33 years. The correlation of parity and plasma levels of vitamins C and E showed positive correlations but not statistically significant, r=0.0134, P>05; r=0.05, P>0.05, for vitamins C and E respectively. The correlation of vitamin C versus the maternal age showed a negative significant relationship; r = -0.59, p<0.05, (the plasma level decreases with increase in maternal age) but that of vitamin E was not significant r = 0.08, P>0.05.

DISCUSSION

We found low (17-23% reduction) in plasma vitamin C level which was significant across the three trimesters. Uchenna etal similarly found significant reduction in serum vitamin C in pregnant Nigerians.[8] Plasma vitamin C decline during pregnancy have been shown elsewhere to follow a linear trend with time [9]. Our findings are similar as the decline was gradual and became more significant in the last trimester. It has been found that this decline of vitamin C during pregnancy is progressive even with vitamin C supplementation.[9] This decrease most likely reflects the effects of hemodilution and of active transport of the vitamin to the fetus, which increases throughout pregnancy.[10] We found significantly reduced level of vitamin E through the three trimester of pregnancy. This is contrary to the findings of Roes etal, who reported a linear increase of vitamin E during pregnancy.[11] The differences in finding may have been due to differences in socioeconomic and nutritional factors of the studied populations.

At the beginning of this study, we hypothesized that occupation which determine to a large extent the social status of people, may impact significantly on the plasma levels of vitamins C and E during pregnancy, since humans and primates lack L-gulonolactone oxidase, rendering them incapable of synthesizing

Table-II: Socio-demographic factors versus plasma levels of vitamins C and E

Socio-demographic factor	*Plasma level of vitamin C (µg/ml)*	*Plasma level of vitamin E (mg/ml)*
Parity of the cases		
Para 0(n=56)	1.539±0.498	1.050±0.582
Para 1(n=71)	1.408±0.465	1.301±0.649
Para 2(n=49)	1.542±0.475	1.267±0.623
Para 3&4(n=14)	1.500±0.640	1.115±06.49
P-value	0.41 (NS)	0.16 (NS)
Occupation		
Civil servants(56)	1.56±0.450	0.494±0.073
Traders(n=80)	1.476±0.512	0.490±0.075
House wives(n=28)	1.396±0.524	0.4900±0.074
Farmers(n=16)	1.660±0.461	0.460±0.065
P-value	0.37 (NS)	0.42 (NS)
Age groups(years)		
22-25(n=32)	1.973±0.252	1.317±0.780
26-29(n=60)	1.515±0.356	1.307±0.790
30-33(n=50)	1.517±0.376	1.306±0.790
34-37(n=38)	1.418±0.375	1.307±0.780
P-value	0.0001 (S)	0.99 (NS)

All averages are mean±SD
NS: not significant
S: significant

ascorbate and thus make them completely dependent on dietary sources of the vitamin.[12] But curiously, we found plasma vitamin C to be higher in the farmers than even the civil servants probably because the farmers in our community have more access to green vegetables and different kind of fruits that are rich in vitamin C than the civil servants. On the other hand, occupation had no effect on plasma level of Vitamin E, probably because vitamin E unlike vitamin C can be stored to a reasonable extent in the liver and other storage depot of the body.

Another revelation from this study is the inverse relationship between plasma level of vitamin C and the maternal age, the vitamin level decreases with increase in maternal age. We are unable to explain this relationship but we hypothesized that it may have been due to environmental stress which is likely to be more on older women in our community than on the younger women. This hypothesis will require further investigation.

The low antioxidant vitamin C and E reported in this study may appear to support the use of these vitamins supplementation during pregnancy but there are conflicting reports on the benefits of these vitamins' supplementation on the outcome of pregnancy. Whereas, many studies have shown that low antioxidants status in pregnancy may lead to pregnancy complications such as preeclampsia, threatened abortion, placenta calcification.[13-15] Some interventional studies have shown that the use of vitamins C and E supplementations during pregnancy did not yield better pregnancy outcome,[16-18] other studies contradict this, by reporting that the use of vitamin C and E supplementation during pregnancy are beneficial.[19-21] Even in the face of conflicting reports on the benefits of antioxidant supplementations during pregnancy, it is generally agreed that although pregnancy is a physiological process, it promotes oxidative stress and antioxidants are used as defense mechanism against oxidative stress.[22,23]

CONCLUSIONS

Plasma levels of vitamins C and E decline during pregnancy. The plasma level of vitamin C decreases with increase in the maternal age. These findings are important when considering supplementation with these vitamins during pregnancy.

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