ASCORBIC ACID STATUS IN THIRD TRIMESTER OF PREGNANCY, AT DELIVERY AND IN CORD BLOOD

C.O. Awoyelu*, J.C. Agharanya* and O.O. Oguntibeju**

**Department of Medical Laboratory Sciences, Faculty of Health Sciences & Technology, College of Medicine, University of Nigeria, Enugu, Nigeria. ** School of Health Technology, Technikon Free State, Bloemfontein 9300, South Africa*

ABSTRACT

Ascorbic acid levels in 30 subjects in their third trimester of pregnancy were estimated. Their haematological parameters (packed cell volume, haemoglobin and mean cell haemoglobin concentration) were also determined. The values were compared with that of 30 non-pregnant women (control group). The ascorbic acid status of newly born babies using cord blood were determined along with that of their mothers at delivery. The ascorbic acid level of 0.92 ± 0.37 mg/dl was reported in third trimester. This value was not significantly ($P > 0.05$) lower than in the control group (1.04 ± 0.4 mg/dl). The result showed that the ascorbic acid level at delivery was significantly ($P < 0.05$) higher than that of the control group. The ascorbic acid levels in the cord blood of the newly born babies were significantly ($P < 0.01$) higher than the maternal level. There was insignificant difference in the haematological parameters between the pregnant and non-pregnant women.

INTRODUCTION

Pregnant women have been known to have high demand for nutrients during different stages of their reproductive cycles. This increase in demand cuts across all types of nutrients, however, the most significant ones are those that can easily be lacking in their daily food, either due to lack of knowledge about these nutrients, poverty or through the preparation, processing and storage of food stuff (1, 2). Additionally, the nine months of pregnancy, although physiologically normal is seen as a period of stress during which the nutritional need of the developing foetus is dependent on that of the mother (3, 4). There is evidence from experimental animal studies that the requirements of certain vitamins are increased by pregnancy. Vitamin C is one of these important vitamins and few studies have linked various obstetric problems with its deficiency during pregnancy (3). The plasma ascorbic acid level is believed to fall steadily as pregnancy progresses. The level in the third trimester of pregnancy has been shown to be significantly lower than the first and second trimester. There are divergent views as to whether the difference in ascorbic level is due to an increased demand for vitamin C, changes in blood volume, hormonal changes or decreased dietary intake (1-3). According to Nino and Shaw (5), decreased maternal ascorbic acid has been associated with premature/low birth, pre-eclampsia, anaemia and premature rupture of the foetal membrane. Nelson and Tagfer (6) suggested that deficiency of ascorbic acid

might have teratogenic effect. This study was aimed at determining the serum ascorbic acid status in pregnant women 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 vitamin C during pregnancy in general and in the third trimester in particular especially in populations where fruit consumption is not adequate.

MATERIALS AND METHODS

Subjects

Pregnant women between the ages of 19 and 35 against non-pregnant women (aged 17-35) were studied at the University of Nigeria Teaching Hospital, Enugu. Thirty non-pregnant women serve as the control group. Thirty out of these women were at their third trimester of pregnancy while 20 at delivery. They were assessed on their dietary intake, stage of pregnancy, state of health and current medications with the aid of questionnaire designed for the purpose. The nutritional status was graded as "very good", "good", "moderate", "poor" and "very poor". By an ordinary ranking all the subjects were graded as good and moderate, none was graded as poor or very poor as observed. Blood samples were taken from the subjects by veni puncture from the ante-cubital vein and from the end of the umbilical cord of the babies into plain tubes for ascorbic acid determination while 2.5 ml of blood into EDTA tubes for haematological parameters determination. The samples in the plain tubes were allowed to clot, then spun at 3000 rpm for 5 minutes. The sera were separated and analysed the same day.

Methods

The modified chemical method as described by Nino

Author for Correspondence:

Dr. O.O. Oguntibeju

School of Health Technology,
Technikon Free State, P/Bag X20539,
Bloemfontein 9300, South Africa.

and Shaw (5) was applied in the determination of ascorbic acid. Haemoglobin was determined colorimetrically using Drabkin's solution while the packed cell volume was done by the means of haematocrit centrifuge. The value of the mean cell haemoglobin concentration (MCHC) was calculated from the values of the haemoglobin and packed cell volume (PCV).

RESULTS

Table 1 shows the mean ascorbic levels of pregnant women (third trimester), at delivery, that of babies (cord blood), and the control group. There is no significant ($P>0.05$) difference in the ascorbic level of the pregnant women and the non-pregnant women. The ascorbic acid level at delivery was significantly ($P<0.05$) higher than in the above-mentioned groups while the ascorbic acid level of babies from the cord blood was significantly

Table 1: Ascorbic acid levels (mg/dl) among different subject groups.

Subject	Mean $\pm$ S.D.
Pregnant women (30)*	0.92 $\pm$ 0.37**
Non-pregnant women (30)	1.04 $\pm$ 0.4**
Post-partum women (20)	1.16 $\pm$ 0.42***
Cord blood (20)	2.29 $\pm$ 0.81****
Female baby (14)	2.35 $\pm$ 0.45*****
Male baby (6)	2.16 $\pm$ 0.56*****

* Figure in parenthesis denotes number of subjects.

** $P>0.05$ No significant difference in ascorbic acid level of pregnant and non-pregnant women.

*** $P<0.05$ Significant difference at delivery.

**** $P<0.01$ Significant difference in cord blood ascorbic level.

***** $P>0.05$ No significant difference in relation to sex of babies.

($P<0.01$) higher than that of the maternal serum and the two groups as well. Table 2 shows the weight of babies and their corresponding ascorbic acid level as determined from the cord blood. The result however,

Table 2: Ascorbic acid levels in new born babies and their corresponding weight.

Weight	Mean $\pm$ S.D.
1.2-2.5 (8)*	2.31 $\pm$ 0.41**
3.26-4.0 (12)	2.28 $\pm$ 0.54**

* Figure in parenthesis denotes number of subjects.

** $P>0.05$ No significant difference in ascorbic acid level in new born babies in relation to their corresponding body weight

did not indicate evidence of any relationship between body weight and ascorbic acid status.

Table 3 shows the mean value of haematological parameters of both pregnant and non-pregnant women. There was no significance ($P>0.05$) observed.

DISCUSSION

In this study, the mean plasma ascorbic acid level in third trimester of pregnancy was found to be 0.92 mg/dl while that of non-pregnant women was 1.04 mg/dl. Although, there was no significant difference, however, the slight decrease observed in the pregnant women may probably be associated with volume expansion or hormonal changes. It has also been suggested that stress secondary to pregnancy combined with foetal nutritional demand may be contributing factors to this slight but insignificant decrease in the ascorbic acid level recorded in pregnant women especially in the third trimester (1-3). From our observation, all the pregnant women seem to be within the reference range indicating to some extent a normal level as compared with the standard used for this study. This however, cannot be applied in general terms bearing in mind differences in methodology and experimental design. According to Nino and Shaw (5), values below 0.6 mg/dl are said to be low or marginally low while values greater than 0.6 mg/dl is considered to be within the reference range. By applying Nino and shaw principle to the values obtained in this study, 67% of the pregnant women have values > 0.6 mg/dl, 23% within the reference range while 10% could be said to have marginally low level of ascorbic acid. Applying same

Table 3: Mean values of haematological parameters in pregnant and non-pregnant women (control group).

Subject	PCV (%)	Hb (g/dl)	MCHC (%)
Pregnant women (30)*	36.5 $\pm$ 3.3**	11.4 $\pm$ 0.8**	31.1 $\pm$ 2.3**
Non-pregnant women (30)	29.8 $\pm$ 4.2**	10.5 $\pm$ 1.4**	35.6 $\pm$ 3.1**

* Figure in parenthesis denotes number of subjects.

** $P>0.05$ No significant difference between the two groups in haematological values.

rule to the control group, 10% can be grouped as having marginally low level of ascorbic acid. The value reported for the control group is similar to the finding of Oguntibeju and Fafunso (7). Both authors reported marginally low level of ascorbic acid among the control subjects. This result thus agrees with the reported inadequate intake of fruits by an average Nigerian and can be said to reflect a sub-optimal level of vitamin C of the general population to a certain extent. Our result showed significant value of ascorbic acid at delivery and this agrees with the work of Therieko and Ettes (3). The ascorbic acid level in cord blood and maternal serum reported here agree with the findings of previous research work.

There was slight but insignificant decrease in the values of Packed cell volume, haemoglobin as observed in the pregnant women and may be associated with haemodilution. The result of the present study indicate the need to regularly monitor the ascorbic acid status in pregnant women and the general public so as to determine when supplementation is necessary especially in areas where fruit consumption and dietary intake is poor in order to prevent likely complications that may result from vitamin C deficiency. This study then is a step in the right direction as it furnishes information on the current vitamin C status of pregnant women and equally gives a reflection of the vitamin C status of an average adult as shown by the control group.

REFERENCES

1. Yoshioka, T. (1999). Vitamins in pregnancy. *Nippon Rinsho* 57, 2381-2384.
2. Rogers, I. and Emmett, P. (1998). Diet during pregnancy in a population of pregnant in South West England. ALSPAC Study Team. *Eur. J. Clin. Nutr.* 52, 246-250.
3. Therieko, P.A. and Ettes, S.X. (1981). Plasma ascorbic acid levels in Nigerian mothers and new born. *J. Trop. Ped.* 27, 263-266.
4. Bodzek, P., Wielkoszynski, T., Zamlynski, J. *et al* (1999). The estimation of L-ascorbic acid serum concentration and selected parameters of metabolism of serum lipids in pregnant women. *Ginekol. Pol.* 70 (10), 667-671.
5. Nino, B.V. and Shaw, N. (1987). Vitamins. In: *Fundamental of clinical chemistry*, 3rd Ed, ed Teitz; Philadelphia, London.
6. Nelson, N. and Tagfer, J. (1971). Association between drugs administered during pregnancy and congenital abnormalities of the foetus. *Br. Med. J.* 1, 523-535.
7. Oguntibeju, O.O. and Fafunso, M.A. (2002). Serum ascorbate, cholesterol and total protein levels in newly diagnosed non-insulin dependent diabetes mellitus among Nigerians. *Med. Tech. S.A.* 16, 358-360.