



Comparison of the Antioxidant Nutrient Profile among Normal Pregnant Women and Women having Pregnancy Induced Hypertension

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Abstract

Background: Preeclampsia is a multifactorial disorder comprising many organs. Oxidative stress (OS) has been intensely linked to its occurrence. Vitamin E, a lipophilic chain breaking antioxidant has been proved to suppress the OS. Present study was designed to investigate antioxidant nutrient profile in patients with different grades of pregnancy induced hypertension (PIH) and to compare them with normal pregnant controls.

Methods: The study group comprised 110 patients divided in three groups as Group A (n=40) Normotensive patients, Group B (n=40) Mild hypertensive, Group C (n=30) Severe hypertensive. Vitamin A, B-Carotene, serum alpha tocopherol (vitamin E) and vitamin C levels were analysed.

Results: Serum alpha tocopherol (vitamin E) was significantly low in severe and mild cases (0.32 ± 0.00 mg/dl, 0.74 ± 0.03 mg/dl respectively), when compared with normal pregnant women levels (0.78 ± 0.040). All other nutrients were also found to be in reduced quantity for Group C when compared to control group (P value <0.001).

Conclusion: It was therefore concluded that in patients with risk of preeclampsia (PE) adequate antioxidant nutrients may have a role in cessation of free radical-mediated cell disturbances, and thereby protecting against endothelial cell damage, which is the key factor in PE development.

Keywords: Preeclampsia, Pregnancy induced hypertension, oxidative stress, antioxidants, Vitamin E

Introduction

P re-eclampsia (PE) affects approximately 7-10% of all pregnancies. It is concomitant with improved perinatal health and mortality associated to intrauterine growth impedence, premature delivery and perinatal asphyxia. Furthermore, the pregnant women stand at increased risk for abruption placentae, intracerebral hemorrhage and hepatic and renal shut down (1). Vascular endothelial hurt is recognized to show a part in the

pathophysiologic etiology of PE (2).

Endothelial cell damage is believed to decrease prostacyclin formation ensuing in an increase peripheral vascular resistance and platelet aggregation (3). The pathogenesis of such endothelial cell harm however rests unclear. It has been advocated that free radical mediated lipid peroxidation might be complicated in the endothelial impairment perceived in PE (4). Several justifications support this notion, together with a proliferation in lipid peroxidation

products and a drop in antioxidant activity in PE as matched with normal gestation (5).

Antioxidant nutrients neutralize free radical instabilities and therapy protect cell membranes from free radical mediated lipid peroxidation (6). Additional free radical instabilities are classically complemented by improved consumption of antioxidants (7).

Gathering confirmation from clinical and epidemiologic studies, proposes that diffuse endothelial dysfunction occasioning from oxidative stress (OS), shows a central part in the pathophysiological basis of PE (8). Human plasma comprises an assortment of low molecular weight, non-enzymatic antioxidants that assist to look after the vasculature from oxidative damage (2) and nitrogen species (3). In addition, ascorbic acid can spare or recover glutathione and vitamin E (α -tocopherol) which are two other vital physiologic antioxidants. In the red to these important characteristics of antioxidants, investigators have theorized that ascorbic acid influence prevents or ameliorate OS prompted endothelial dysfunction and PE (4).

Women with EP have a little concentration of antioxidant vitamins. They reinforce the concept of increased OS. The early provision of antioxidants such as vitamins C and E to women at high risk of developing PE is a marked clinical benefit. The use of vitamins has been related with better endothelial function and less placental dysfunction. Tocopherols can act as scavengers of free radicals and alpha-tocopherol, particularly in vivo, in this regard (9). There is also substantiation for abridged antioxidant status and improved free radical production (OS) in PE, a number of antioxidants have been reported to be reduced in PE, including this, vitamin E, ascorbate and carotenoids (10).

Peroxidic lipids (resulting from lipid oxidation), plasma concentrations of antioxidants and plasma concentrations of vitamins E and C (antioxidants) equivalent to those of pregnant women are normal in women with EP (11). Women with PE had clearly reduced antioxidant activity, which supports the idea that lipid peroxidation by free radicals and associated antioxidant consumption may play a role in the pathophysiological mechanism of PE. Free radicals can diffuse into the cell membranes that cause lipid peroxidation, the propagation of which can be suppressed by alpha-tocopherol (5). Vitamin E and C supplementation in pregnant women at high risk of

PE was helpful for PE inhibition. This study was the basis for the use of vitamins E and C and the likely clarification of the observed beneficial effect was to reduce OS (12).

Methodology

A cross-sectional study with 110 pregnant women who fulfill the inclusion criteria attending Obstetric OPD or admitted in the department of gynecology and obstetrics of Jinnah Postgraduate Medical Centre (JPMC), Karachi, was carried, after informed paper consent. The study procedure was sanctioned by Institutional Review panel. The identification of PE was established in accordance with the delineations of "The American College of Obstetricians and Gynecologists (ACOG)". PE remained categorized mild least one or more of the subsequent signs or indications were present wherein situation the PE was ordered as severe:

1. Systolic blood pressure ≥ 160 mmHg or 110 mmHg diastolic taking place two occasion 6 hours apart.
2. Oliguria in 24 hours (urinary output < 400 to 500 ml).
3. Cerebral or optical instabilities.
4. Pulmonary edema or cyanosis.
5. Epigastric or right upper quadrant pain.
6. Impaired liver function of uncertain source or
7. Thrombocytopenia

They were divided in three groups as:

Group A:	n=40	Normotensive patients (control group)
Group B:	n=40	Mild hypertensive > 140/90 mmHg
Group C:	n=30	Severe hypertensive > 160/110 mmHg

Inclusion Criteria:

Age 18-38 years, gestational age 20-42 weeks and single pregnancy female were included in the study. A small epidemiologic form was completed by each partaker related to personal history, maternal age, weight, height, systolic and diastolic blood pressure readings, parity, gestational age, any underlying illness, drug abuse history, family history of PIH or any complication occurred in previous pregnancies etc. Recent dietary intake was also recorded.

Women having a history of vitamin supplementation before pregnancy, having prolonged hypertension

Comparison of the Antioxidant Nutrient Profile among Normal Pregnant Women and Women having Pregnancy Induced Hypertension

(either essential or next to renal disease, endocrine disease, anemia, malnutrition, malabsorption or other diseases), multiple pregnancies and abnormal levels of serum creatinine (i.e. 1.5 mg/dl) were omitted from the study.

Fasting venous blood test samples were collected in heparin coated tubes. Plasma was parted by centrifugation and initially kept at -80°C to be analysed later but within 1 week. α -tocopherol level was tested using means of HPLC (high pressure liquid chromatography). Vitamin A and B-Carotene and vitamin C were analysed by Micro techniques of clinical chemistry by (13) Samuel Natelson (1961). Platelet count was done by fractional centrifugation after citric acid blood coagulation. A 24 hour urine sample was collected for proteinuria estimation by urine dipstick method. All the parameters were statistically evaluated by Chi-square test at the completion of study period.

Results

Levels of vitamin E were assessed in blood samples of mild, severe cases of PIH and normal pregnant controls.

Table 1 displays the mean maternal age, weight, height, gestational age and birth weight of normal pregnant and pregnancy induced hypertensive women. Maternal Age and birth weight of group B was found to be significantly reduced when compared with control group and group A ($P < 0.001$).

Table 2 compares the blood pressure and proteinuria among three groups. The increase in systolic (144.5 \pm 1.11 mmHg) and diastolic (93.0 \pm 0.8 mmHg) blood pressure of mild cases and systolic (172.6 \pm 3.31 mmHg) and diastolic (127.5 \pm 2.07 mmHg) of severe cases were extremely noteworthy ($P < 0.001$) when associated to controls: systolic (121 \pm 1.69 mmHg) and (77.7 \pm 1.11 mmHg). The rise in the systolic and diastolic blood pressure values for severe cases (group C) were again very important ($P < 0.001$) when compared with the mild cases of PIH. Proteinuria was detected in 3 (7.5%) cases of normal pregnant women, 21 (52.5%) cases of mild PIH and 30 (100%) cases of severe PIH women.

Table 3 compares the antioxidant nutrient profile among the three groups. Serum alpha tocopherol (vitamin E) was significantly low in severe and mild cases (0.32 \pm 0.00 mg/dl, 0.74 \pm 0.03 mg/dl respectively), when compared with normal pregnant women levels (0.78 \pm 0.040).

Table 4 compares the antioxidant nutrient profile among the three groups A, B and C respectively. Except for vitamin A levels, all the nutrients were found to be in reduced quantity for Group C when compared to control group and Group B (P value < 0.001). Vitamin A levels were also significantly decreased in group C when compared with Group A (P value < 0.001).

Table 1. Maternal Age, Weight, Height, Gestational Age and Birth Weight of Normal Pregnant and Pregnancy Induced Hypertensive Women

Parameters	Control (n=40)	Group A Mild cases(n=40)	Group B Severe cases(n=30)
Maternal age (Years)	25.00 \pm 0.60	23.37 \pm 0.78	20.30 \pm 0.5036* α
Weight(Kg)	60.40 \pm 0.50	58.05 \pm 0.50	56.60 \pm 0.36
Height(cm)	154.00 \pm 0.90	154.00 \pm 0.60	151.70 \pm 0.80
Gestational age (weeks)	36.60 \pm 0.37	33.63 \pm 0.23	31.16 \pm 0.50
Birth weight (Kg)	3.10 \pm 0.024	2.924 \pm 0.019	2.391 \pm 0.067* α

* P value < 0.001 (significantly low when compared to control group).

α P value < 0.001 (significantly low when compared to group A).

Table 2. Blood Pressure Values and Proteinuria of Normal Pregnant and Pregnancy Induced Hypertensive Women

Parameters	Control (n=40)	Mild cases Group A (n=40)	Severe cases Group B (n=30)
Systolic BP(mm Hg)	121.00 \pm 1.69	144.50 \pm 1.11	172.60 \pm 3.31* α
Diastolic BP (mm Hg)	77.70 \pm 1.11	93.00 \pm 0.80	127.83 \pm 2.07* α
Proteinuria	7.5 (3)	52.50 (21)	100.0 (30)

* P value < 0.001 (significantly high when compared to control group).

α P value < 0.001 (significantly high when compared to group A).

Table 3. Detection of alpha tocopherol vitamin e (mg/dl) in normal pregnant and pregnancy induced hypertensive women

Parameters	Control (n=40)	Mild cases (n=40)	Severe cases (n=30)
Alpha tocopherol Vitamin E (mg/dl)	0.78±0.040	0.74±0.03	0.32±0.001* α

* P value <0.001 (significantly low when compared to control group).

α P value <0.001 (significantly low when compared to group A).

Table 4. Comparison of The Antioxidant Nutrient Profile Among Normal Pregnant and Pregnancy Induced Hypertensive Women

Groups	Ascorbic acid vitamin C (mg/dl)	Alpha tocopherol vitamin E (mg/dl)	Beta carotene (mg/dl)	Vitamin A (mg/dl)
Group A (n = 40) Control Group	0.49 ±0.028	0.78 ±0.040	0.131 ±0.004	0.02 ±0.01
Group B (n = 40) Mild cases of PIH	0.36* ±0.001	0.74 ±0.03	0.129 ±0.01	0.019 ±0.01
Group C (n = 30) Severe cases of PIH	0.30* ±0.02	0.32* α ±0.001	0.04*α ±0.002	0.019* ±0.004

Number of cases are given as 'n'.

* P value <0.001 (significantly low when compared to control group).

α P value <0.001 (significantly low when compared to group B).

Discussion

PE is the main contributor to maternal and fetal mortality and morbidity (14). OS has been associated in the pathophysiology of PE. Physiologic irregularities of PE have been attributed to abnormalities in endothelial cells of maternal vessels due to emergence of free radicals from defective placenta (15, 16). The role of nourishment in usual and unusual gestations has long been discussed (17). This study focused on plasma / serum concentration and the possible role of antioxidant in pregnancy-induced hypertension (PIH). Our results determine that plasma levels of ascorbic acid were expressively reduced in mild and severe patients of PIH, while alpha-

tocopherol and beta-carotene levels were meaningfully reduced only in patients with severe cases of PIH. These discoveries are comparable to those distinguished by Al-Gubory (18).

The mean maternal age and parity of the severe cases of pregnancy induced hypertension were significantly low as compared to normal pregnancy. Primigravida and teenage, were at a higher risk of developing the disease. There is a sharp rise in incidence above the age of 35 years (19, 20). The present outcomes remain in settlement through a current finding of decreased antioxidant action in females having pregnancy induced hypertension. In normal gestation there is an alteration in the percentage of vitamin E to lipid peroxides in maternal blood that gradually favours vitamin E through progressing pregnancy (21).

Sarwar et al. 21 in his study also proved that vitamin E levels were unchanged in mild cases of pregnancy induced hypertension but were significantly decreased in the severe cases. The proportion of lipid peroxides to alpha tocopherol was improved in mild cases, besides significantly improved in severe cases of pregnancy induced hypertension. Alpha tocopherol is a free radical scavenger and thus applies antioxidant action. On the other hand, alpha tocopherol is used up in applying its usage, so unusual upsurges in lipid peroxides in pregnancy induced hypertension would increase consumption resulting in the increased alpha tocopherol levels (22).

Concentrated ascorbic acid is a bioavailable type of ascorbic acid. This works as per the antioxidant is transformed from the reduced to the oxidized pattern. It has been reported that ascorbic acid is a hydrophilic antioxidant acts as a first-line antioxidant against oxygen particles, which appear mainly in plasma. Unlikely, alpha-tocopherol and beta-carotene are the hydrophobic antioxidants that can quench oxygen free radicals, which are mainly present in the membrane of lipid cells (23).

Ascorbic acid and free radicals, that entraps the major part of the water present in the plasma. Since ascorbic acid exceeded capability of free radicals in the cell membrane through extensive lipid peroxidation, which can be inhibited by the disclosure of alpha tocopherol and beta-carotene (24) antioxidants i.e. ascorbic acids and beta carotene make alpha tocopherol an efficient antioxidant (25).

The right levels of vitamin C maintain and strengthen the powerful antioxidant, namely vitamin E. We restrained the concentrations of three powerful

Comparison of the Antioxidant Nutrient Profile among Normal Pregnant Women and Women having Pregnancy Induced Hypertension

antioxidants, ascorbic acids, alpha-tocopherol and plasma / serum beta-carotene together with vitamin A. Decreasing the antioxidant nutrients levels witnessed in this study indirectly sustenance an idea that hyperoxidation of free radicals mediated lipid peroxidation and the relative utilization of antioxidants may be involved in the pathophysiological mechanism PIH (26).

Our findings that vitamin C levels stayed reduced in patients with mild and severe PIH however alpha-tocopherol and beta carotene concentrations merely decreased while the disease existed severe suggest that antioxidant radical interactions in PIH might be introduced in the water-soluble part of plasma. We estimate that the progression can then be transmitted to the endothelial cell membrane as the disease developments.

Conclusion

In Pakistan, severe PE due to PIH is very common as a result of low socioeconomic status and lack of prenatal care. An improved understanding of PIH and its management is the main outcome of the study with good control PIH and safe prolongation of pregnancy till term. PIH treatment includes routine antihypertensive drugs along with antioxidants to prevent PE. Vitamin E is powerful antioxidant circulating in blood and detoxifying free radicals which prevents damage to the cell membrane, thereby reducing the risk of cardiac disease and malignancies.

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