

Erythrocyte CAT, GPx and GR levels in pregnant anemic woman

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Abstract

Pregnancy is characterized by a high-energy demand and an increased oxygen requirement. This is a condition exhibiting increased susceptibility to oxidative stress. Hydrogen peroxide is a harmful by-product of many normal metabolic reactions. Catalase and Glutathione peroxidase are the antioxidant enzymes produced naturally within the body. These enzymes help the body to convert hydrogen peroxide into water. Glutathione reductase catalyzes the reduction of glutathione disulfide (GSSG) to the sulfhydryl form Glutathione (GSH), which is a critical molecule in resisting oxidative stress and maintaining the reducing environment of the cell. We have estimated the catalase and glutathione peroxidase and glutathione reductase activity in the erythrocytes of pregnant anemic patients and these levels were significantly low as compared to control. Our results suggest that oxidative stress in pregnant anemic women causes the deficiency in antioxidant enzymes, which is a result of enormous production of ROS in the system. These findings may also indicate a possible link between decreased antioxidants and increased levels of cells alterations due to oxidative damage, supporting the idea that there is a persistent oxidative stress in pregnant anemic women.

Key Words: Catalase, Glutathione peroxidase, Glutathione reductase.

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INTRODUCTION

Pregnancy is characterized by a high-energy demand and an increased oxygen requirement¹. This is a condition exhibiting increased susceptibility to oxidative stress². Normally, there is balance between pro-oxidants and antioxidant. When this balance shifted toward pro-oxidants is called as oxidative stress³. Hydrogen peroxide is a harmful by-product of many normal metabolic reactions. Catalase (CAT) and Glutathione peroxidase (GPx) are the antioxidant enzymes produced naturally within the body. These enzymes help the body to convert

hydrogen peroxide into water. Catalase (CAT) is haem-containing protein which can convert millions of molecules of hydrogen peroxide to water and oxygen per second. Glutathione peroxidase (GPx) is element selenium containing enzyme also removes H₂O₂ by using reduced glutathione (GSH)⁴. Glutathione reductase (GR) catalyzes the reduction of glutathione disulfide (GSSG) to the sulfhydryl form Glutathione (GSH), which is a critical molecule in resisting oxidative stress and maintaining the reducing environment of the cell. Glutathione reductase is a dimeric disulfide oxidoreductase enzyme utilizes coenzyme FAD and NADPH to reduce one molar equivalent of GSSG to two molar equivalents of GSH⁵. The aim of the present study was to estimate the antioxidant enzymes CAT, GPx and GR activities in pregnant anemic women.

MATERIALS AND METHODS

The present study was conducted in the Department of Biochemistry, Government Medical College and Hospital, Miraj and P.V.P. Government Hospital, Sangli (Maharashtra). Study protocol was approved by ethical committee of Government Medical College. Miraj.

Sample size: The study included total 90 subjects. This includes patients as well as control.

Control: Consists of 30 normal healthy pregnant woman selected from staff members and normal healthy pregnant woman attaining the OPD of Government Medical College and Hospital, Miraj and P.V.P. G. H. Sangli.

Patients: This included 60 patients with pregnant anemic women hospitalized or attaining Gynecology OPD at Government Medical College and Hospital. The diagnosis of the patient was done on the basis of the patient's condition, clinical history, personal history and physical examination by clinician.

Inclusion Criteria: The females between age 18 to 40 years with no other complications were selected for the study.

Exclusion Criteria: The subjects having history of other hematological disorders, DM which alter antioxidant enzyme were excluded from study.

Collection of blood samples: Informed consent was obtained from the participants. 1ml venous blood was collected in bulb having anticoagulant (heparin) from the patients and control under aseptic condition by venipuncture using 2 ml sterile disposable syringe and needle. Blood samples from heparin bulb were centrifuged and plasma was removed. Erythrocytes were washed with normal saline for three times and used for estimation of catalase, GPx and GR levels. Catalase level was estimated by method described by L. Goth (6) and levels were expressed as u/ml whereas GPx and GR levels were measured by Randox (Ransel) kit method (7, 8) and levels were expressed in u/gmHb. The data were evaluated statistically by using student 't'.

RESULTS

Table No 1 shows the erythrocyte CAT, GPx and GR levels in pregnant anemic women and controls. We found significant decrease in CAT, GPx and GR in patients as compared to control.

Table 1: Erythrocyte CAT, GPx and GR levels in pregnant anemic patients and controls

	Patients (n=60) (Mean \pm SD)	Control (n=30) (Mean \pm SD)	T value	P value
Catalase (u/ml)	6.07 \pm 0.37	7.20 \pm 0.19	16.69	0.001
Glutathione peroxidase (u/gmHb)	23.07 \pm 0.58	30.21 \pm 0.43	59.86	0.001
Glutathione reductase (u/gmHb)	7.07 \pm 0.43	11.00 \pm 0.42	41.4	0.001

DISCUSSION

We found lower activities of erythrocyte CAT, GPx and GR in pregnant anemic women as compared to control. This may be due to over production of reactive oxygen species (ROS)¹. Antioxidant enzymes are the major defense system of cells in normal aerobic reactions. Although, erythrocytes possess highly efficient antioxidant enzymes, such as CuZn-SOD and GPx compared to other cell types. CAT has been suggested to provide important pathway for H₂O₂ decomposition into H₂O and O₂¹. The enzymes involved is oxidative metabolism requires iron. Ferrous iron used for oral iron treatment in pregnancy may acts as a potent pro-oxidant. Several studies have suggested that iron deficient women were further susceptible to this iron therapy induced oxidative stress. This may be due to increased production of ROS because of increased oxygen demand during pregnancy decrease in the activities of antioxidant enzymes such as superoxide dismutase and glutathione peroxidase⁹. During metabolism, superoxide anion is converted to H₂O₂ by ubiquitous enzyme SOD. Normally H₂O₂ is converted to harmless compounds by the action of catalase and peroxidase. But if free iron is available, it reacts with H₂O₂ to form hydroxyl radicals which are extremely reactive species leading to lipid peroxidation, DNA strand breakage and inactivation of functional proteins¹⁰. Similar findings of depletion in antioxidant enzyme levels have also been reported earlier in pregnant anemic women^{1,9}. Our results suggest that oxidative stress in pregnant anemic women causes the deficiency in antioxidant enzymes, which is a result of enormous production of ROS in the system. These findings may also indicate a possible link between decreased antioxidants and increased levels of cells alterations due to oxidative damage, supporting the idea that there is a persistent oxidative stress in pregnant anemic women.

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