A Study of Lipid Peroxidation and Antioxidant Enzymes in Normal Pregnancy

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Abstract

Pregnancy is a physiological state characterized by increased metabolic demand and an increased oxygen requirement. Augmented levels of oxidative stress would be expected because of the increased intake and utilization of oxygen. Evidence of increased oxidative stress in normal pregnancy in comparison with non-pregnant controls was estimated by measuring the levels of lipid peroxidation product Malondialdehyde, antioxidant enzymes like Superoxide dismutase, Glutathione peroxidase, Glutathione reductase and catalase. It was observed that pregnant women were more susceptible to oxidative damage than non-pregnants as indicated by increased Malondialdehyde and decreased antioxidants.

Key Words : Lipid peroxidation, Malondialdehyde, Thiobarbituric acid, Antioxidant enzymes.

Introduction :

Pregnancy though not a disease state, is a stressful condition with considerable alterations in physiological and metabolic functions. [1] Nowadays Measurement of Lipid peroxidation has become an acceptable trend in medicine to consider at oxidative stress at molecular level. Vascular endothelial dysfunction may be caused by uncontrolled lipid peroxidation. [2] Lipid peroxidation is an oxidative process which occurs at low levels in all cells and tissues. [3] Normally a variety of antioxidant mechanisms serve to control this process causing oxidative stress. [4] In recent years the role of decreasing antioxidant enzymes and increasing oxidative stress is gaining importance as they are threat for the normal pregnancy. Certain biochemical indices are useful in assessing the progression of pregnancy. Hence the present study was undertaken to assess the lipid peroxidation, superoxide generation in normal pregnancy and the role of antioxidant enzyme system. Free radical generation is a normal physiological process with a variety of effects. But increased production of these free radicals will render the lipids susceptible to lipid peroxidation. [5] A common reliable marker of lipid peroxidation is malondialdehyde (MDA) which is measured by Thiobarbiturate assay. Evolution has also provided the cells with a number of counter acting antioxidant defenses. These antioxidant defense mechanisms can be categorized in to two types- free radical scavenging and chain breaking antioxidants. The free radical scavenging mechanisms include antioxidant enzymes like Superoxide dismutase (SOD), Glutathione peroxidase (GSH-P), Glutathione reductase (GSH-R) and Catalase, which limit the cellular concentration of free radicals and prevent excessive oxidative damage. [1]

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The present study was undertaken with the aim to assess the lipid peroxidation and monitor antioxidant enzyme activities in the normal pregnant women during their 1st, 2nd and 3rd trimesters as compared to non-pregnant women.

Methodology

The present study took place between February 2009 to September 2009 comprised of 75 normal pregnant women (25 in each trimester) attending for antenatal checkup at Sri Aurobindo Institute of Medical Sciences, Indore and 25 healthy non-pregnant women as controls ranging in the reproductive age group from 20-40 years. The subjects were from low socio economic status as they had low-income. Exclusion criteria from study included subjects with severe anaemia (<6.0 gm% of Hb), Diabetes mellitus under medication and untreated diabetes, Alcoholic, and those suffering from any other systemic disorder.

Following venupuncture of antecubital vien, 10 ml of blood was drawn and collected in a heparinized tube (10 units/ml of blood). The following parameters were analyzed within 30 minutes of collecting blood sample. Malondialdehyde (MDA) as Thiobarbituric acid reactive substance, [6] Superoxide dismutase, [7] Glutathione peroxidase, Glutathione reductase and Catalase. [8] ANOVA-F with multiple comparison tests was used for statistical evaluation.

Results

In present study the MDA level was found to be significantly increased in pregnant women as compared to the control group. A gradual increase was observed with the progression of pregnancy from 1st to 3rd trimester, while antioxidants SOD, GSHP, GSHR and Catalase were found to be lowest in 3rd trimester of pregnancy. The p value calculated for the rise in MDA against the rise in the enzyme antioxidants level were all significant. (Table 1)

Discussion

Free radicals by their unstable and transient nature are difficult to measure directly. Their tendency to cause lipid peroxidation has been used as an indirect measure. Markers of lipid peroxidation (MDA) have been increased during the progression of normal pregnancy. [9] Ishihara [10] studied lipid peroxide levels in non-pregnant and normal pregnant (Ist, IInd

Table 1: Malondialdehyde and enzymatic antioxidant levels in the non-pregnant and normal pregnant women

	MDA Nmol/ml	SOD IU/gm Hb	GSH-P IU/gm Hb	GSH-R IU/gm Hb	CATALASE IU/gm Hb
Non-pregnant n=25	1.19±0.09	683.99±155.25	31.08±4.54	10.52+4.67	8.13±2.25
Pregnant n = 75					
1st Trimester n=25	1.42±0.13	617.10±134.35	28.29±5.06	10.17±3.49	7.82±2.84
2nd Trimester n=25	1.64±0.12	583.24±131.01	26.54±5.98	9.11±2.77	7.0±2.33
3rd Trimester n=25	1.77±0.14	542.64±142.86	23.45±4.89	7.78±3.47	6.20±1.73
	F-116.882	F-4.469	F-9.884	F-2.810	F-3.494
	p<0.000	p<0.006	p<0.000	p<0.044	p-0.019

and III[rd] trimesters) subjects and reported remarkable increased levels of lipid peroxidation products in 2[nd] and 3[rd] trimesters of pregnancy as compared to non-pregnant women. Kodliwadmath et al [11] have also reported increase in MDA and decrease of anti-oxidant enzymes level with progression of pregnancy. In the present study, it was found that there is significant increase of lipid peroxides in all the three trimesters. Since RBC do not contain nucleus, increased oxidative stress induces the activities of antioxidant enzyme and this increase suggests a role of superoxide dismutase in the protection of embryonic development against free radical damage, which was observed by Carone et al. [12] But, Stephen Wisdom et al [13] and Davidge et al [14] found that there is reduced superoxide dismutase activity in the third trimester of normal pregnancy as compared to non-pregnant women. Behne [15] and Pathak et al [16] have shown that there is a progressive fall in the activity of plasma Glutathione peroxidase and superoxide dismutase as pregnancy advanced. Our study reveals similar findings, and the decrease of both superoxide dismutase and Glutathione peroxidase were statistically significant. Yu [17] suggested that reduced glutathione is an effective reductant and plays an important role in a variety of detoxification processes. The enzyme Glutathione reductase plays a pivotal role in replenishing and maintaining optimum concentrations of reduced glutathione in biological systems. A gradual decrease in the activities of glutathione reductase and catalase throughout the three trimesters of pregnancy were observed in our study.

Conclusion

Pregnancy is a physiological condition of stress and hyperdynamic circulation. Oxidative stress increases as pregnancy progresses and is higher during the 2[nd] and 3[rd] trimester. Increased oxidative stress is manifested by increasing MDA levels and decreasing anti-oxidant enzymes like Glutathione peroxidase and Superoxide dismutase. Anti-oxidants can be initiated by identifying subjects showing signs of oxidative stress.

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