

Study of Oxidative Stress Markers in Relation to Birthweight in Newborn

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Abstract— The purpose of this study to measure birth weight of new born babies as well as determining cord blood total antioxidant status and malondialdehyde (product of oxidant injury). Oxidative stress injury has been linked with some clinical conditions in newborn. This cannot be readily measured. Measuring placenta and birth weight along with other features may help in predicting likelihood of oxidative stress injury babies have suffered. Serum extracted from cord blood of subjects was used for the laboratory determination of Antioxidant activity, malondialdehyde and Uric acid. There were positive correlations between birth weight and AOA($r=0.761, p<.0001$), between birth weight and Uric acid($r=0.184; p=0.157$). There were significant negative correlations between placenta weight and MDA($r=-0.739; p<.0001$)

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and Gynecology, Mahila Chikitsalya, S.M.S. medical college Jaipur. 60 healthy normal newborn (at term) and their mothers were recruited for the study. Women with prolong labor and those with fetal congenital malformation, hypertensive, diabetic, pre-eclampsia, eclampsia and smokers were excluded from the study. Cord blood sample was collected from new born babies immediately after delivery and centrifuged at 3000rpm for 10minutes and supernatant was extracted into plain screw cap specimen bottle. The serum was therefore kept frozen until laboratory analysis. Baby were also weighed in kilogram. For mother blood sample were collected from anticubital vein of pregnant women. Biochemical Analysis Total antioxidant status was measured using method of (Koracevic et al., 2001)⁶. Malondialdehyde was estimated by thiobarbituric acid (TBA) assay method of Buege & Aust, 1978 on spectrophotometer⁷. Uric Acid was estimated by Uricase-POD method, Searcy, R.L.1969); kit supplied by Transasia Bio-Medicals Ltd⁸.

I. INTRODUCTION

Pregnancy is a stressful physiological condition and has been associated with oxidative stress. Oxidative stress results from imbalance in Oxidant/free radical-antioxidant equilibrium. Oxidative stress caused by reactive oxygen species (free radical) adversely affect newborn growth and cause physiological changes in mother. Oxidative stress is normally high during pregnancy due to increased oxygen consumption and energy needs. Newborn are more susceptible to oxidative stress due to increase production of free radical at birth and incompletely developed antioxidant mechanism. Attack of free radical on lipid membrane initiate a cascade of reaction resulting lipid peroxidation, damage to protein and DNA ultimately causing cell death and necrosis¹. Nutrients and antioxidant deficiencies along with increased oxidative stress are factors that affect neonatal outcome and influence intrauterine growth and development². Pregnant women are regularly exposed to various condition that may invoke oxidative stress such as chemicals in drinking water and diet, tobacco smoke or air pollution. In pregnant women, oxidative stress may derive from excessive production of reactive oxygen species along with dietary deficiency of antioxidant³. Further, oxidative stress in various studies has emerged as a likely promoter of several pregnancies related disorders like spontaneous abortion, pre-term labor and low birth weight⁴. Free radicals originate from normal physiological process and also from environmental exposure. Free radical levels are held in check by antioxidants. Lipid peroxide are formed enzymatically in the course of arachidonic acid metabolism. Malondialdehyde (MDA) is a marker of oxidative stress, has been growing interest in studying the role played by lipid peroxidation in disease progression⁵.

II. MATERIAL AND METHODS

The Study was conducted in the Department of Biochemistry, S.M.S. Medical College and Hospital Jaipur. Subjects were selected among those attending the Department of Obstetrics

III. RESULTS

Table 1 shows comparison of AOA, MDA and Uric Acid in newborn and their mother according to newborn birth weight. A significant increase in cord blood antioxidant activity with birth weight of Newborn seen. Antioxidant activity in group 1 (Birth weight < 2.25Kg) was 1.16 ± 0.43 mmol/l followed by 1.91 ± 0.57 mmol/l in group 2, (birth weight 2.25-3.5Kg) and 2.82 ± 0.44 mmol/l group 3 (birth weight >3.5 Kg) (Table 1). Similarly serum antioxidant activity was found to be significantly low in low birth weight babies' mother. Positive correlation was seen between newborn antioxidant activity level and Birth Weight ($r=0.761, p <0.0001$) of newborn. (Table 2). In our study, MDA level of Newborn and Mother was found to decrease progressively with Birth Weight as can be seen in (Table 1) Malondialdehyde (MDA) level in newborn, in group 1 was 2.54 ± 0.82 μ mol/l, group 2 were found to be 1.85 ± 0.425 μ mol/l and in group 3 was 1.07 ± 0.25 μ mol/l. As evidence from the observation, low birth weight suffer with greater oxidative stress as compared with normal birth weight newborn and they were found to be relatively deficient in their antioxidant status. In case of mother it was observed that Serum Uric Acid was slightly raised in high birth weight babies' as compare to low birth weight babies' (Table 1).

Group	Newborn AOA (mmol/l)	Mother AOA (mmol/l)	Newborn MDA (µmol/l)	Mother MDA (µmol/l)	Newborn UricAcid (mg/dl)	Mother UricAcid (mg/dl)
Group1(20) <2.25Kg	1.16±0.43 0.60-2.3	1.41±0.56 0.46-3.0	2.54± 0.82 1.6-3.84	3.01± 0.50 2.08-4.0	4.12± 0.97 2.2-6.0	4.18± 1.23 1.5-6.0
Group2(30) 2.25-3.5Kg	1.91±0.57 1.0-3.0	2.17±0.55 1.2-3.5	1.85± 0.42 1.28-3.04	2.64± 0.60 1.76-4.8	4.29± 1.30 1.7-8.2	4.44± 1.16 2.65-8.2
Group3(10) >3.5Kg	2.82±0.44 2.0-3.5	3.03±0.75 1.53-3.73	1.07± 0.25 0.64-1.44	1.98± 0.61 1.12-3.2	4.71± 0.91 3.45-6.1	4.74± 0.91 3.67-6.85

Table 1:

S. No.	Parameters	Correlation coefficient (r)	P – Value
1.	Antioxidant activity (mmol/l)	0.761	<0.0001*
2.	Malondialdehyde(MDA) (µmol/l)	-0.739	<0.0001*
3.	Uric Acid(mg/dl)	0.184	0.157

Table 2: Correlation between birth weight and with various parameters of Newborn

*The mean difference is significant at P <0.001

Correlation Coefficient depicted in Table3. All oxidative stress parameters of Mother and their newborn were found to be associated. Hence any influence in maternal antioxidant status will bring similar change in newborn. A Strong and positive correlation was found between maternal and newborn Antioxidant Activity (AOA), Malondialdehyde (MDA), Uric Acid. Significantly negative correlation was found between maternal and newborn MDA and Antioxidant Activity (Table 3). It Indicate that enhanced antioxidant activity will always be associated with decrease MDA which shows if antioxidant given to mother would help to improve newborn antioxidant status and decrease oxidative stress and this in term could improve their birth weight and increased chances of survival and reduced mortality.

Newborn Parameter	Maternal parameters		
	AOA Correlation Coefficient (r)	MDA Correlation Coefficient (r)	UA Correlation Coefficient (r)
AOA	0.686	-0.506	0.032
MDA	-0.527	0.677	-0.234
UA	0.197	0.054	0.764

Table 3: Correlation among various parameters of Mother and Newborn

AOA: Antioxidant Activity, MDA: malondialdehyde, U.A.: Uric Acid

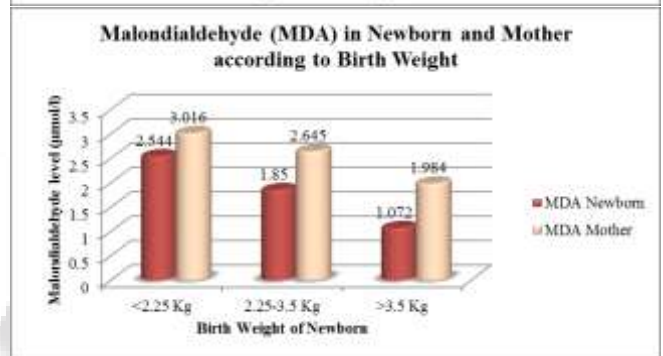
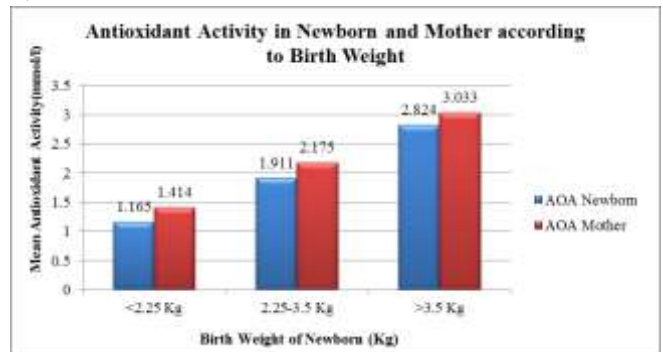


Fig. 1: Malondialdehyde (MDA) in Newborn and Mother according to Birth Weight

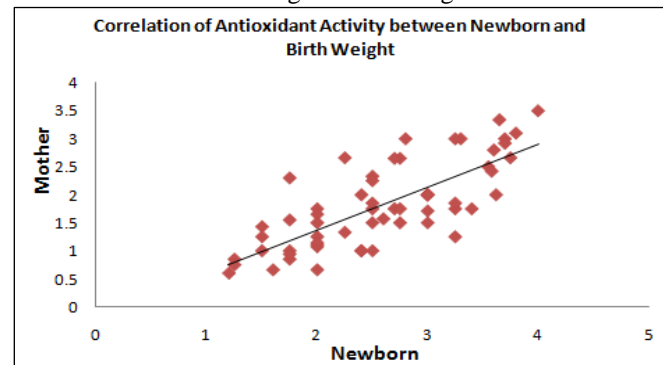


Fig. 2: Correlation of Antioxidant Activity between Newborn and Birth Weight

IV. DISCUSSION

The present study showed association between oxidative stress and birth weight using specific biomarkers of lipid peroxidation and protein oxidation. Low birth weight newborn exhibited low level of Antioxidant Activity. Oxidative stress results from the imbalance in the pro-oxidant–antioxidant equilibrium. Significantly higher level of malondialdehyde (MDA) along with decreased level of antioxidant activity was seen in low birth weight newborns.

Similar pattern was seen in various other studies as well. This study involves measurement of plasma malondialdehyde to access the extent of free radical injury (lipid peroxidation). Plasma uric acid and total antioxidant status were also measured. All of the above parameters were correlated to birth weight

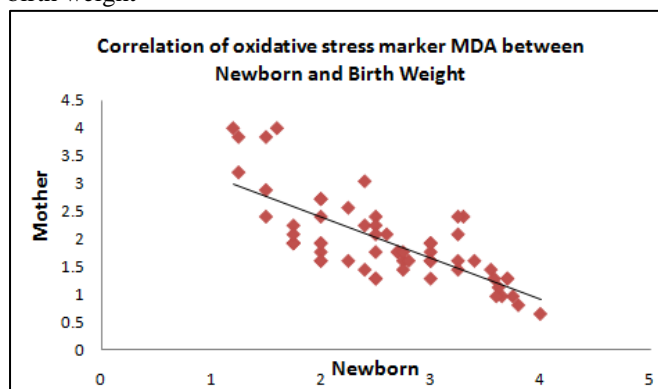


Fig. 3: Correlation of MDA (oxidative stress marker) between Newborn and Birth Weight

The positive correlation of newborn birth weight to AOA and UA as well as negative correlation with MDA observed in our study shows enhanced oxidative stress in low birth weight infants as compare to normal Birth Weight infant. Increase dietary resources' of antioxidant like β -Carotene should be supplemented during pregnancy. Plasma MDA was negatively correlated to AOA and UA. This indicate that the free radicals so generated overwhelm the available antioxidants capacity. Further, dietary deficiency of antioxidant in mother's diet related to low socio-economic status and poor awareness to habits during pregnancies affected antioxidant status in newborn. Further, it was seen that Antioxidant Activity in mother increases with increase in newborn antioxidant activity. Such positive correlation between mother's and newborn antioxidant activity indicates that the nutritional status of mother does influence nutritional status of newborn. Thus the improvement in dietary antioxidant to mother would be beneficial for growth of fetus and their Birth Weight thereafter. This shall enhance survival rate and health benefits to both mother and children

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