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Lipid peroxidation and Superoxide dismutase levels variation in Chronic Renal Failure

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ABSTRACT

Chronic Renal Failure (CRF) is a condition at which more than 50% functional loss to the renal system or kidneys. In this condition reabsorption process of nephrons will get damage which results in abnormal constituents in urine. This in terms leads to stress in the body, alters or affects different metabolisms. 40 subjects were selected from the outpatient department of Saveetha Dental College and Hospitals. They were divided into two groups. Group I (Control group) – Normal healthy individuals – 20 in numbers. Group II (Study group) – Chronic Renal failure patients (CRF) – 20 in numbers. 5ml of blood will be collected for the separation of serum. The serum was separated and analyzed for Melanaldehyde and Superoxide dismutase by TBARS method and Pyrogallol Autoxidation method using ERBA CHEM 5 plus analyzer. There is a significant increase in (MDA) lipid peroxidation ($p<0.005$) as well as there is a substantial decrease in (SOD) superoxide dismutase ($p<0.005$) in Hypothyroidism patients. Our study revealed that there is an imbalance of antioxidant status in Chronic Renal Failure (CRF) cause Cardio Vascular Diseases as well as other metabolic disorders. By estimating antioxidant status will be helpful to treat the condition before they were getting worse.

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INTRODUCTION

Chronic renal failure is stated to be an increasing and irreversible loss of renal function over time of months or years. In younger patients, CKD is related with loss of kidney function, but of patients o who are older than 65 years of age with CKD, 30% do not have a progressive disease with loss of kidney function over time.

Failure occurs through different stages and characterized by an abnormally low and decreasing in the rate of glomerular filtration chronic renal failure patients are exposed to Oxidative stress occurs when there is a free excessive radical production or low antioxidant defence and results in chemical alterations of biomolecules, which cause structural and functional modifications. Nowadays it is commonly classified as chronic kidney disease and it is classified based on the glomerular filtrate rate and the measure of the kidney's filtering capacity. Stage 1 means they have a filtering standard filtering capacity of the organ but deals with those patients that are at a possibility of progressive kidney disease, such as hematuria. Stage 2 is with a GFR of 60 to 90 mL per minute of the patient. Stage 3 is when a patient has a glomerular filtration rate of 30 to 60 mL per minute. Stage 4 is for a glomerular filtration rate of 15 to 30 mL per minute. Stage 5 patient is not in dialysis but has a glomerular filtration rate of less than 15 mL per minute. Stage 6 They need dialysis

as they have a filtration rate of less than 15 mL per minute and for their kidney failure. Chronic kidney failure shows loss of kidney function that occurs over a long course of time as opposed to acute renal failure. The loss of kidney function may be due to prolonged damage to the kidney.

Moreover, the prolonged deformation of the kidney may cause such as primary kidney diseases such as focal segmental glomerular sclerosis secondary disorders such as diabetes, nephropathy, lupus nephritis, or auto-immune disorders. The loss of kidney function may be increasing but with therapy of the prime cause the damage can be stopped and in some crises, the kidney function might improve. Unfortunately, many patients if they have reached the level of stage 5 and stage 6 they are said to progress to a state of dialysis. If the patient has started on dialysis, it can be confirmed with chronic kidney disease Stage 6. There are many types of research and work being put to slow the progress of chronic kidney disease. The ability to diagnose early chronic kidney disease is very useful in being able to prevent the progression of the patient's kidney from getting damaged. There is permanent kidney failure when there is an increase in the loss of kidney function over the period of years.

In response to oxidative stress lipid per-oxidation occurs and a great diversity of aldehydes are formed when lipid hydroperoxide disintegrate in biological systems. Superoxide dismutase is an enzyme that catalyzed the dismutation of the superoxide radicle into either ordinary molecular oxygen. (Wood NKet al.;2016)Superoxide is formed as a by-product of oxygen metabolism and if not regulated causes many types of cell damage so this place a significant effect in chronic renal failure and it is helpful to treat the condition before they get worse.

Patients with chronic renal failure, even those who have been receiving extended period hemodialysis, have an increased risk of premature cardiovascular disease. Oxidative stress which occurs when there is excessive free radical production or low antioxidant levels, has recently been implicated as a causative factor in atherogenesis (Sri Vasavikadiyala *et al.,*2015) Free radicals may cause lipid peroxidation and may damage macromolecules and the cellular structure of the organism, the endothelium and erythrocytes (Kohen R *et al.,* 1996). Few studies and researchers have shown that hemodialysis is related to increased free radical production (Loughrey CM *et al.,* 1994). Cardiovascular disease is one of the most significant cause of death in haemodialysed patients with chronic renal failure. Increased lipid peroxidation and the deterioration of antioxidants may commit to the increased risk of atherosclerosis (Bery E.M *et al.,*1995). This study was designed to actuate the difference in lipid peroxidation (level of lipid peroxidation.) and the superoxide dismutase.

METHOD AND MATERIALS

40 subjects were selected from the outpatient department of Saveetha Dental College and Hospitals. They were divided into two groups.

Group I (Control group) – Normal healthy individuals – 20 in numbers

Group II (Study group) – Chronic Renal failure patients (CRF) – 20 in numbers

Inclusion Criteria

1. A normal healthy individual with normal BMI (19.9-249)

2. Known Chronic Renal failure patients

Exclusion Criteria

1. Subjects with systemic diseases like Diabetes Mellitus, CVD, Hypertension and other endocrine disorders.

2. Immunocompromised persons

Sample collection and procedure

5 ml of venous blood was collected from the participants and blood was distributed in the plain collection tube and centrifuged in 2500 rpm for 10 minutes. The Serum was separated and analyzed for Melanaldehyde and Superoxide dismutase by TBARS method and Pyrogallol Autoxidation method using ERBA CHEM 5 plus analyzer.

RESULTS AND DISCUSSION

Table 1: Mean, SD and p-value of Control and Study groups

PARAMETERS	Control		CRF		p-value
	Mean	SD	Mean	SD	
MDA (nmol/ml)	1.1	0.49	2.7	0.83	<0.001
SOD (U/ml)	183.04	22.6	108.06	24.84	<0.001

Previous studies have illustrated that the increased oxidative stress and reduction of antioxidant defences in patients with CRF. (Avci E *et al.,* 2014) The current study assessed lipid peroxidation, and superoxide dismutase in CRF patients compared with healthy controls. (Drai J*et al.,* 2001)

SOD functions as a collector of superoxide radical in the body. SOD mean value is significantly decreased in chronic renal failure patients (p-value < 0.05) patients when compared to conservatively

controlled patients. This is in accordance with the study of A. Marjani (Marjani A Texas *et al.,* 2005), M Sasikala et al. (Weinstein T *et al.,* 2000) and M. Nouri (Nauri N*et al.,* 1999). Mechanisms which are involved in reducing serum SOD activity in CRF patients may be due to increased production of ROS like H2O2 which is known to suppress SOD activity. Increased lipid peroxidation causes consumption of antioxidant enzymes, especially in CRF patients, may be one of the cause for decreased SOD levels (Toborek M *et al.,* 1992).

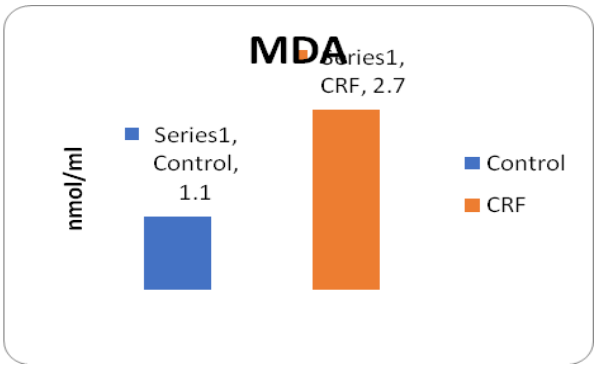

Figure1: Mean MDA levels in both groups

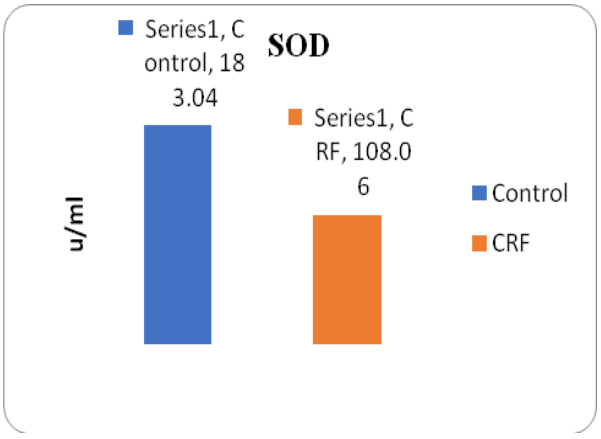

Figure2: Mean SOD levels in both groups

The antiradical enzyme activity is that of SOD, also diminished in CRF patients, while other studies have shown that erythrocyte SOD activity was the same as in the control group. (Ceballos-picot *et al.,*2014)The most probable explanation for decreased activity is a potential direct inactivation of the enzyme by its product hydrogen peroxide, or by the superoxide anion itself (Ceballos-picot I *et al.,* 1996). Pugalendhi (Pugalendhi Vet al.; 2012) demonstrated that the decreased GPx activity in erythrocytes leads to accumulation of hydrogen peroxide that may cause inhibition of SOD activity. SOD is an essential antioxidant enzyme having an antitoxic effect against superoxide anion. The overexpression of SOD might be an adaptive response, and it produces an increased dismutation of superoxide to hydrogen peroxide. (Taccone-Gallucci *et al.,* 1999; Surapeni KM *et al.,*2008)MDA, another indicator of oxidative stress, is a result of lipid peroxidation. A significant increase in mean plasma MDA level in the patient group was observed. The MDA increase may reflect the presence of increased oxidative stress as a result of membrane lipid peroxidation. The weakly negative correlation between plasma GPx, vitamins E and C levels and MDA suggests that duration and severity of the disease may parallel increased oxidative stress. (Diplock AT *et al.,*1998) Therefore, to decrease MDA level and prevent the occurrence of CRF complications, the CRF patients can be supplemented with antioxidant vitamins. In this study, it gives a similar result like the other studies in there is a rise in MDA level and a decrease in sod level in chronic renal failure patients. (Ratna P *et al.,* 2014) Recent medical and dental research is progressing towards the prevention of free radical-mediated diseases by using specific nutrient antioxidants (Monisha.K *et al.,* 2016).

CONCLUSION

Our study revealed that there is an imbalance of antioxidant status in Chronic Renal Failure (CRF) may lead to Cardio Vascular Diseases as well as other metabolic disorders. By estimating antioxidant status will be helpful to treat the condition before they were getting worse. It was found that with an increase in kidney deterioration the sod level decrease and the MDA level increases with the kidney deterioration. So, with this, we can assess the condition of chronic renal failure patients.

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