



A Study on Oxidative stress and antioxidant status in diabetic nephropathy

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ABSTRACT

Diabetes mellitus is the most common metabolic disorder in the world. The metabolic dysregulation of diabetes mellitus affects multiple organs like Kidney, nerves, eyes and heart. Worldwide Among all diabetics, 20-40% of the people are suffering from Diabetic Nephropathy. Oxidative stress is increased by hyperglycemia in which Reactive Oxygen Species has been implicated in the pathology of these complications. The aim of our present study is one such attempt to find the role of oxidative stress by estimating the levels of oxidants and antioxidant levels in diabetic nephropathy in the ethnic south Indian population. Thirty diagnosed cases of diabetic Nephropathy were taken as cases and 30 age and sex-matched Type 2 Diabetes mellitus patients were included as controls in the study. For oxidant levels, Malondialdehyde (MDA) was estimated and for antioxidant levels, Superoxide Dismutase (SOD), Glutathione Peroxidase (GPx), Glutathione Reductase (GR) were measured. Statistically, a significant increase is observed in the levels of Malondialdehyde in cases when compared to controls. There is no statistically significant difference in the levels of Superoxide dismutase and Glutathione peroxidase between cases and controls. Whereas significant statistical difference is observed in the levels of Glutathione reductase in Diabetic Nephropathy cases when compared with controls.



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INTRODUCTION

Diabetic Nephropathy is one of the major microvascular complications of diabetes mellitus (Bosma *et al.*, 2019). It is the single leading reason for the development of End-stage renal disease (Rossing and Frimodt-Møller, 2019). Diabetic nephropathy is associated with the development of characteristic

renal lesions, diffuse, or nodular diabetic glomerulosclerosis, as described by Kimmelsteir & Wilson (Alsaad and Herzenberg, 2007). These lesions are associated with a) Clinical syndrome of proteinuria b) Hypertension c) Progressive renal failure. In India, the prevalence of diabetic nephropathy is 2.2% (Chawla *et al.*, 2016). As per the International Diabetes Federation (IDF), the total number of people with diabetes is about 69.2 million and it may raise to 123.5million by 2040 (Tavafi, 2013).

Oxidative stress has been implicated in the pathogenesis of various disorders (Beck and Levander, 1998). Oxidative stress is the result of the imbalance between the levels of various oxidants produced in the body and antioxidant levels, which leads to an overload of oxidants and depletion of antioxidants (Calabrese *et al.*, 2012). Oxidative damage occurs to biomolecules like proteins, carbohydrates, lipids and nucleic acids and other extracellular components like collagen, Hyaluronic acid, which are

Table 1: Comparison of oxidative stress levels and antioxidant enzymes in Controls (Group I) and Cases (Group II)

	Parameters	Group I Mean \pm SD (n=30)	Group II Mean \pm SD (n=30)	pvalue
1	MDA	3.71 \pm 2.3	8.06 \pm 6.19	0.0006
2	Superoxide dismutase	60 \pm 13.5	58 \pm 11	0.5318
3	Glutathione peroxidase	49 \pm 13.4	45 \pm 18.2	0.3364
4	Glutathione reductase	12 \pm 2.60	10 \pm 2.54	0.0038

very deleterious (Frei, 1994). The aim of our present study is to find the relation between oxidative stress in diabetic nephropathy patients when compared with type -2 diabetes mellitus patients.

MATERIALS AND METHODS

The present study is conducted in the Department of Biochemistry and the Department of Nephrology of Saveetha medical college. Thirty diagnosed patients of Diabetic nephropathy patients were taken as cases. 30 age and sex-matched Type -2 Diabetes mellitus were taken as controls. Patients having hypertension, cardiovascular disorders, liver diseases, thyroid disorders and other renal disorders were excluded from the study. Informed consent was obtained from all cases and controls. Approval for this study is obtained from the Institutional Ethical committee.

5 ml of blood is collected from both cases and controls. Malondialdehyde (MDA), Superoxide Dismutase (SOD), Glutathione peroxidase (GPx), Glutathione Reductase (GR) levels were estimated by ELISA. Statistical significance is measured by unpaired t-test using SPSS package.

RESULTS AND DISCUSSION

Evaluation of oxidative stress is measured by estimating the levels of MDA and a statistically significant increase in the values was observed between cases and controls (Table 1). There is no statistically significant decrease in the levels of antioxidants like Superoxide Dismutase (SOD) and Glutathione peroxidase (GPx) between cases and controls. Statistically, a significant decrease was observed in the levels of Glutathione Reductase (GR) between cases and controls.

Diabetes mellitus is the most common endocrine, metabolic disorder, affecting about 170 million peo-

ple worldwide (Wild *et al.*, 2004). An early stage of Diabetic nephropathy is commenced by hyperfiltration, which is followed by microalbuminuria and then macro-albuminuria, which progressively leads to a decline in renal function resulting in End-Stage Renal Disease(ESRD). In the present study, a statistically significant increase was observed in the levels of Malondialdehyde (MDA) in diabetic nephropathy patients when compared to Type-2 diabetes mellitus patients. This statistically significant increase suggests that Diabetic nephropathy cases have increased production of Reactive oxygen species and free radicals when compared with controls. Several other studies also show similar findings (Köksal *et al.*, 2000).

Superoxide Dismutase, a superoxide scavenging enzyme which is considered the first line of defense against the deleterious effect of oxygen radicals in the cells, which is decreased in diabetic nephropathy when compared to type 2 diabetes and it is not statistically significant. Selenium containing enzyme Glutathione Peroxidase, is also decreased in diabetic nephropathy when compared to type 2 diabetes and it is not statistically significant. GR levels in diabetic nephropathy are decreased when compared with Type 2 Diabetes mellitus and it is statistically significant.

CONCLUSION

Lipid peroxidation increases and Antioxidant status may decrease in diabetic nephropathy. Oxidative stress is implicated in the development of diabetic nephropathy in cases of Type-2 Diabetes mellitus. Antioxidants can be used as potential drugs in the treatment of diabetic nephropathy cases in the future, which requires further studies.

REFERENCES

- Alsaad, K. O., Herzenberg, A. M. 2007. Distinguishing diabetic nephropathy from other causes of glomerulosclerosis: an update. *Journal of Clinical Pathology*, 60(1):18–26.
- Beck, M. A., Levander, O. A. 1998. Dietary Oxidative Stress And The Potentiation Of Viral Infection. *Annual Review of Nutrition*, 18(1):93–116.
- Bosma, E. K., Noorden, C. J. V., Klaassen, I., Schlingemann, R. O. 2019. Microvascular Complications in the Eye: Diabetic Retinopathy. *Diabetic Nephropathy*, pages 305–321.
- Calabrese, V., Cornelius, C., Leso, V., Trovato-Salinaro, A., Ventimiglia, B., Cavallaro, M., Scuto, M., Rizza, S., Zanolli, L., Neri, S., Castellino, P. 2012. Oxidative stress, glutathione status, sirtuin and cellular stress response in type 2 diabetes. *Biochimica et Biophysica Acta (BBA) - Molecular Basis of Disease*, 1822:729–736.
- Chawla, R., Chawla, A., Jaggi, S. 2016. Microvascular and macrovascular complications in diabetes mellitus: Distinct or continuum? *Indian Journal of Endocrinology and Metabolism*, 20(4):546–546.
- Frei, B. 1994. Reactive oxygen species and antioxidant vitamins: Mechanisms of action. *The American Journal of Medicine*, 97(3):5–13.
- Köksal, I. T., Tefekli, A., Usta, M., Erol, H., Abbasoglu, S., Kadioglu, A. 2000. The role of reactive oxygen species in testicular dysfunction associated with varicocele. *BJU International*, 86(4):549–552.
- Rossing, P., Frimodt-Møller, M. 2019. Clinical Features and Natural Course of Diabetic Nephropathy. *Diabetic Nephropathy*, pages 21–32.
- Tavafi, M. 2013. Diabetic nephropathy and antioxidants. *Journal of Nephropathology*, 2(1):20–27.
- Wild, S. H., Roglic, G., Green, A., Sicree, R., King, H. 2004. Global Prevalence of Diabetes: Estimates for the Year 2000 and Projections for 2030: Response to Rathman and Giani. *Diabetes Care*, 27(10):2569–2570.