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# TO ESTIMATE SERUM SUPEROXIDE DISMUTASE (SOD) LEVEL IN DIABETES MELLITUS

Biochemistry

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## ABSTRACT

**Background:** The purpose of this study was to determine the SOD in the patient with diabetes and to look over the relation to the development of micro and macrovascular diabetes complications associated with SOD. **Material & Method:** Serum SOD concentrations were determined in 150 patients which is divided into 3 groups. Group 1 is diabetes with microalbuminuria, Group 2 is diabetes without microalbuminuria whereas Group 3 is health control and the correlation among them was correlated. **Result:** The mean value for SOD estimation of group 1 was 31.50 with SD of 1.31 which is higher when compared to group 2 which was 31.15 with SD of 10.89 whereas in group 3 the mean value was 36.13 with SD of 15.15. The p-value among groups was significant ($p<0.005$). **Conclusion:** The serum concentration of SOD may act as a marker of vascular injury which is going to reflect diabetes and its complication of both micro and microvascular.

## KEYWORDS

## INTRODUCTION:

Diabetes mellitus is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion and action or both. Chronic hyperglycemia is associated with long-term damage, dysfunction, and failure of normal functioning of various organs, especially the eyes, kidneys, nerves, heart, and blood vessels [1,2].

Diabetes-specific microvascular disease is a leading cause of blindness, renal failure, and nerve damage [3]. The prevalence of diabetes is rising all over the world due to population growth, aging, urbanization, and the increase in obesity due to physical inactivity. Unlike the West, where the older are most affected, diabetes in Asian countries is comparatively high in young to middle-aged people. All these complications have long-lasting adverse effects on a nation's health and economy, especially for developing countries. As per the estimate of the International Diabetes Federation (IDF), the total number of people in India with diabetes, in 1,000s was around 74,194.7 in 2021 would be 92,973.7 by 2030 and 124,874.7 by 2045 [4]. Hyperglycemia generates reactive oxygen species (ROS), which in turn cause damage to the cells in many ways. Damage to the cells ultimately results in secondary complications in diabetes mellitus [5,6]. In this research article, we estimated serum superoxide dismutase (SOD), microalbuminuria, Glycosylated Hemoglobin, and fasting Blood Glucose levels in diabetes patients and also check the correlation among the parameters.

## MATERIAL & METHODS:

The subject included in the study was categorized into 3 groups:

- GROUP 1: 50 Patients with Diabetes mellitus with microalbuminuria.
- GROUP 2: 50 Patients with Diabetes mellitus without microalbuminuria.
- GROUP 3: 50 age-matched healthy controls.

### Criteria For Diabetes Mellitus:

- Fasting blood glucose level ≥ 126mg/dl
- Post prandial plasma glucose level >200mg/dl
- Glycosylated hemoglobin (HbA1c) 6.5% to 7%

### Sample Collection:

5ml of blood was aseptically collected from the antecubital vein of patients and healthy controls. About 3 ml of blood was poured into the plain vial for the separation of serum and 2 ml was poured into the EDTA (Ethyene Diamine Tetraacetic acid) for the separation of plasma. A vial containing serum was preceded for the estimation of blood glucose, SOD, microalbuminuria, and plasma for glycosylated hemoglobin (HbA1c).

### Biochemical Analysis:

Blood Glucose was estimated by enzymatic method – Glucose Oxidase Peroxides Method, Glycosylated Hemoglobin (HbA1c) was estimated by ion exchange resin method, and Microalbuminuria was estimated by endpoint – Pyrogallol Red Method. The activity of SOD was assayed by the method of Kakkar et al.[7] based on the formation of nicotinamide adenine dinucleotide (NADH) – phenazine methosulfate – nitro blue tetrazolium.

## RESULT:

TABLE 1: The mean value and standard deviation (SD) of Age, FBG, HbA1c, SOD, Microalbuminuria, and duration between the healthy control, type II diabetics with microalbuminuria and without microalbuminuria cases.

| Variable | Group | Number of Participants | Mean | Std. Deviation | p-value |
|---|---|---|---|---|---|
| Age | Type II diabetics with microalbuminuria | 50 | 50.98 | 10.83 | 0.026 |
| | Type II diabetics without microalbuminuria | 50 | 52.42 | 10.60 | |
| | Healthy control | 50 | 46.42 | 12.82 | |
| | Total | 150 | 49.94 | 11.67 | |
| Fasting Blood Glucose | Type II diabetics with microalbuminuria | 50 | 242.68 | 114.27 | 0.000 |
| | Type II diabetics without microalbuminuria | 50 | 220.89 | 90.60 | |
| | Healthy control | 50 | 80.31 | 8.06 | |
| | Total | 150 | 181.29 | 110.58 | |
| HbA1c | Type II diabetics with microalbuminuria | 50 | 8.12 | 1.26 | 0.000 |
| | Type II diabetics without microalbuminuria | 50 | 8.12 | 3.26 | |
| | Healthy control | 50 | 4.66 | 0.47 | |
| | Total | 150 | 6.95 | 2.90 | |
| SOD | Type II diabetics with microalbuminuria | 50 | 31.50 | 1.31 | 0.000 |
| | Type II diabetics without microalbuminuria | 50 | 31.15 | 10.89 | |
| | Healthy control | 50 | 36.13 | 15.15 | |
| | Total | 150 | 21.50 | 12.34 | |
| Microalbuminuria | Type II diabetics with microalbuminuria | 50 | 108.57 | 5.46 | 0.000 |
| | Type II diabetics without microalbuminuria | 50 | 29.60 | 94.13 | |
| | Total | 150 | 63.96 | 80.13 | |

A total of 150 subjects were selected in three different groups with

equal distribution based on the criteria of the groups. The mean value for fasting blood glucose estimation of group 1 was 242.68 with SD of 114.27 which is higher when compared to group 2 which was 220.89 with SD of 90.60 whereas in group 3 which is the control group in then the mean value was 80.31 with SD of 8.06. The p-value among groups was significant ($p<0.005$).

The mean value for HbA1c estimation of group 1 and group 2 was equal which is 8.12 with SD of 1.26 in group 1which is lower when compared to group 2 which was 3.26 whereas, in the control group, the mean value was 4.66 with SD of 0.47. The p-value among groups was significant ($p<0.005$).

The mean value for SOD estimation of group 1 was 31.50 with SD of 1.31 which is higher when compared to group 2 which was 31.15 with SD of 10.89 whereas in group 3 the mean value was 36.13 with SD of 15.15. The p-value among groups was significant ($p<0.005$).

In microalbuminuria, the estimation mean value of group 1 was 108.57 with SD of 5.46 which is higher when compared to group 2 which was 29.60 with SD of 94.13 whereas in group 3 which is the control group which is not estimated for microalbuminuria. The p-value among groups was significant ($p<0.005$).

## DISCUSSION:

Free radicals are reactive radicals, these reactive radicals and oxidants may injure cells and tissue directly with oxidative degeneration of essential cellular components and also indirectly injure the cells. [8] In this study results show lower SOD levels in groups A and B when compared with group C which indicated that in the case of diabetes mellitus, there is ROS production, but the body doesn't adapt for the required antioxidant formation. Thus, due to enzymatic use, the level of SOD is decreased.

Kimura et al [9] in their study observed a strong relationship between the serum concentration of SOD and the severity of both micro- and macrovascular diabetic complications. Their findings suggest that serum SOD concentration levels may be a marker of vascular injury, possibly reflecting hyperglycemia-induced oxidative injury to the vascular endothelium and decreased binding of SOD to the vascular wall.

Whereas in some studies also found that hyperglycemia induces superoxide formation, and overproduction of superoxide also appears to be the central mechanism underlying all the major molecular mechanisms implicated in glucose-mediated vascular damages induced in the target cells of diabetic complication. [10]

## CONCLUSION:

There is a strong relationship between the serum concentration of SOD and the severity of diabetic complications which suggests that the serum concentration of SOD may act as a marker of vascular injury which is going to reflect diabetes and its complication of both micro and microvascular.

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