

**THE RELATIONSHIP BETWEEN OXIDATIVE STRESS
AND ANTIOXIDANT LEVELS IN PATIENTS WITH
DIABETES MELLITUS**

Normurodov Xushid Tursunmurodovich

Angren Medical University, Angren City,
Tashkent Region Teacher of the Faculty of Medicine
khurshid3016966@gmail.com

Xodjimurodov Davron Ikramaliyevich

Angren Medical University, Angren City,
Tashkent Region Teacher of the Faculty of Medicine
Dr.khodjimuratov@gmail.com

Keywords: *Diabetes mellitus, oxidative stress, antioxidants, reactive oxygen species, glycemic control.*

Relevance. Diabetes mellitus (DM) is a chronic metabolic disorder characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. Chronic hyperglycemia promotes the generation of reactive oxygen species (ROS), leading to oxidative stress, which contributes to vascular complications, neuropathy, nephropathy, and retinopathy in diabetic patients. Antioxidants, including enzymatic (superoxide dismutase, catalase, glutathione peroxidase) and non-enzymatic (vitamins C and E, selenium) systems, play a critical role in neutralizing ROS and preventing cellular damage. Understanding the balance between oxidative stress and antioxidant defenses is crucial for developing targeted therapeutic strategies to reduce diabetic complications.

The Purpose of the Study. Diabetes mellitus (DM) is a chronic metabolic disorder characterized by hyperglycemia resulting from defects in

insulin secretion, insulin action, or both. Chronic hyperglycemia promotes the generation of reactive oxygen species (ROS), leading to oxidative stress, which contributes to vascular complications, neuropathy, nephropathy, and retinopathy in diabetic patients. Antioxidants, including enzymatic (superoxide dismutase, catalase, glutathione peroxidase) and non-enzymatic (vitamins C and E, selenium) systems, play a critical role in neutralizing ROS and preventing cellular damage. Understanding the balance between oxidative stress and antioxidant defenses is crucial for developing targeted therapeutic strategies to reduce diabetic complications.

Research Materials and Methods. A total of 60 participants were recruited: 40 patients diagnosed with type 2 diabetes mellitus and 20 age- and sex-matched healthy controls. Blood samples were collected after overnight fasting. Oxidative stress markers, including malondialdehyde (MDA) and protein carbonyls, were measured. Antioxidant levels, including superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPx), vitamin C, vitamin E, and selenium, were determined using standard biochemical assays. Fasting blood glucose and HbA1c levels were recorded to assess glycemic control. Statistical analysis was performed using Pearson correlation and ANOVA, with $p < 0.05$ considered significant.

Results and Discussion. Patients with diabetes mellitus exhibited significantly higher MDA and protein carbonyl levels compared with healthy controls ($p < 0.01$), indicating elevated oxidative stress. Antioxidant enzyme activities (SOD, CAT, GPx) and non-enzymatic antioxidants (vitamins C, E, selenium) were significantly lower in diabetic patients ($p < 0.05$). A negative correlation was observed between oxidative stress markers and antioxidant levels ($r = -0.65$, $p < 0.01$). Poor glycemic control, as reflected by elevated HbA1c, was associated with higher oxidative stress and lower antioxidant status. These findings confirm that chronic hyperglycemia in diabetes mellitus promotes oxidative stress, while antioxidant defenses are impaired,

highlighting the potential benefit of antioxidant supplementation in diabetic management.

Conclusion. The study demonstrates a clear relationship between oxidative stress and reduced antioxidant levels in patients with diabetes mellitus. Elevated oxidative stress is linked to poor glycemic control and may contribute to the development of diabetic complications. Interventions aimed at enhancing antioxidant capacity, combined with strict glycemic control, may reduce oxidative damage and improve clinical outcomes in diabetic patients.

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