# Correlation of Glycemic Status and Serum Selenium Level in Patients with Type 2 Diabetes Mellitus

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#### ABSTRACT

**Background:** Diabetes related complication and higher glycemic status are the causes of death in Bangladesh. Low level of selenium (Se) one of the principal contributors higher glycemic status and accelerated the chance of diabetes related complications in type 2 diabetic patients. The objective of this study was to observe serum selenium level and its correlation to glycemic status in type 2 diabetic patients.

**Materials and methods:** A cross-sectional study was done at the Department of Physiology at Dhaka Medical College in Dhaka during the period July 2014 to June 2015. The study group consisted of fifty type 2 diabetes patients ranging in age from 40 to 55 years old, while the control group consisted of fifty healthy subjects of similar ages and BMI. Patients were chosen from the Bangladesh Institute of Research for Diabetic Endocrine and Metabolic Disorders (BIRDEM) General Hospital in Dhaka. HbA<sub>1c</sub> and FSG levels were measured in the Department of Biochemistry at BIRDEM General Hospital in Dhaka. Serum Se level was estimated in the laboratory of the Department of Soil, Water and Environment, University of Dhaka, Dhaka by flame atomic absorption spectrophotometer with hydride vapor generation. The unpaired Student's 't' test was used for statistical analysis.

**Results:** In this investigation, patients with diabetes mellitus had significantly reduced serum selenium (p 0.001) levels. Mean FSG (p 0.001) and  $HbA_{1C}$  (p 0.001) levels were considerably higher in patients with type 2 diabetes mellitus. Serum selenium level showed negative correlation with FSG level, which showed statistically significant. Again serum selenium level showed negative correlation with HbA<sub>1C</sub> level (Glycated hemoglobin) which was statistically significant.

**Conclusion:** The result of this study concluded that lower selenium may be associated with type 2 diabetes mellitus and higher glycemic status of this disease may have inverse relationship to serum Se.

# **KEY WORDS**

Fasting serum glucose; Glycated hemoglobin; Serum selenium; Type 2 diabetic patients.

#### INTRODUCTION

Diabetes Mellitus (DM) is a major global health problem. Incidence of diabetes and its related complications are gradually increasing day by day throughout the world and also in Bangladesh.<sup>1</sup>

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According to International Diabetes Federation (IDF) about 10 million new cases of diabetes occur in each year in the world. In the year 2017, diabetes caused about 4 million deaths and in every 8 seconds a person dies from diabetes.<sup>2</sup>

Researchers investigated the link between glycaemic status and trace elements such as selenium (Se). Se is a trace element that plays a role in the complex system of oxidative stress defense via selenium-dependent glutathione peroxidases and other selenoproteins.<sup>3</sup> Se acts as a cofactor with glutathione peroxidase, an active antioxidant enzyme that reduces formation of free radicals and peroxides of lipoproteins.<sup>4</sup> Lower serum Se levels are seen in diabetes together with increased oxidative stress.<sup>5</sup> Many studies have observed lower serum Se levels in diabetes than population.<sup>6</sup> In type 2 diabetes with lower serum Se level increases the risk of hypertension and coronary heart disease.<sup>7</sup>

It is obvious that lower serum Se level increase the risk of diabetes related complications in type 2 diabetes patients.<sup>6,7</sup> This study aimed to investigate Se status and its correlation with glycemic status in patients with type 2 diabetes.

#### MATERIALS AND METHODS

A cross-sectional study was done at the Department of Physiology, Dhaka Medical College in Bangladesh during the period July 2014 to June 2015. The protocol for this study was approved by Ethical Review Committee of Dhaka Medical College and Diabetic Association of Bangladesh. For this study, 50 type 2 diabetes patients both male and female (28 male and 22 female) with age ranging from 40 to 55 years with FSG level  $\geq 7.0$  mmol/l and HbA<sub>1c</sub>  $\geq 6.5\%$  were enrolled from the Outpatient Department of BIRDEM General Hospital in Dhaka and 50 age and BMI matched healthy volunteers (26 male and 24 female) served as controls. Following subject selection, the nature, goal and usefulness of the study were thoroughly explained to each subject and informed written consent was obtained. Before drawing blood, detailed medical and family history were collected. The individuals' anthropometric measurements and blood pressure were taken. A data schedule was used to keep track of everything. A disposable plastic syringe was used to collect 5 mL of venous blood from each subject's antecubital vein for estimate of biochemical assays. HbA1c and FSG levels were measured in the Department of Biochemistry at the BIRDEM General Hospital in Dhaka. Serum selenium level was estimated in the laboratory of the University of Dhaka's Department of Soil, Water and Environment in Dhaka. The unpaired Student's't' test and the Chi square test were used for statistical analysis. The level of significance was set at a p value of less than 0.05. The statistical analyses were carried out using the SPSS Version 20 computer-based statistical tool.

# RESULTS

Table I lists the general characteristics. In this investigation, patients with diabetes mellitus had significantly reduced serum selenium (p 0.001) levels (Table II). In DM patients, mean FSG (p 0.001) and HbA<sub>1C</sub> (p 0.001) levels were considerably higher (Table II). Serum selenium level showed negative correlation with FSG level, which showed statistically significant (Table III). Again serum selenium level showed negative correlation with HbA<sub>1C</sub> level, which was statistically significant (Table III).

**Table I** General characteristics of the subjects in both groups (n=100)

Parameter	Control	Diabetes	p value
		patients	(A vs B)
	(n=50)	(n=50)	
Age (Years)	47.58±3.59	48.00±3.49	0.554
	(40.00-52.00)	(42.00-53.00)	

Parameter	Control	Diabetes	p value
		patients	(A vs B)
	(n=50)	(n=50)	
Sex			
Male	26 (52.0)	28 (56.0)	
Female	24 (48.0)	22 (44.0)	
Height (cm)	159.54±5.20	158.32±8.17	
	(150.00-168.00)	(140.00-178.00)	
Weight (Kg)	64.62±5.51	64.54±8.21	
	(50.00-78.00)	(50.00-80.00)	
Body mass index			
$(Kg/m^2)$	25.44±2.06	25.80±3.06	0.487
	(20.58-30.86)	(20.14-33.78)	
Systolic blood pressure			
(mmHg)	121.70±5.31	123.40±7.45	0.799
	(110.00-130.00)	(110.00-140.00)	
Diastolic blood pressure			
(mmHg)	76.30±5.70	79.70±5.19	0.498
	(70.00-85.00)	(70.00-90.00)	

Sex distribution has been shown in number and percentage. All other results are expressed as mean±SD. Figures in parentheses indicate range. Unpaired Student's "t" test was performed to compare between groups.

**Table II** Study parameters of the subjects in both groups (n=100)

Parameter	Control	Diabetes	p value
		patients	(A vs B)
	(n=50)	(n=50)	
Fasting serum glucose			
(mmol/L)	5.18±0.30	$10.06 \pm 2.18$	< 0.001***
	(4.30-5.80)	(6.90-14.00)	
HbA <sub>1</sub> c (%)	5.17±0.28	9.04±1.60	< 0.001**
1 ( )	(4.80-6.00)	(6.80-13.70)	
Serum selenium (g/L)	94.22±16.67	78.72±21.85	<0.001***
	(72.00-135.00)	(49.00-133.00)	

Results are expressed as mean $\pm$ SD. Unpaired Student's 't' test was performed to compare between groups. \*\*\*p< 0.001. n = Number of subjects.

**Table III** Correlation of Fasting Serum Glucose (FSG) and Glycated Hemoglobin (HbA1c) levels with serum selenium level in study group (n=50)

Parameter	FSG		HbA <sub>1c</sub>		
	Group B		Group B		
	Diabetes patients		Diabetes patients		
	(n=50)	(n=50)			
1	r		р	r	р
Serum selenium	-0.355	< 0.05*	-0.35	4	< 0.05*

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Pearson's correlation-coefficient (r) test was performed to compare relationship between parameter. The test of significance was calculated and p value <0.05 was accepted as level of significance. n = Number of subjects. \* = Significant.

# DISCUSSION

In this study, serum selenium level was found significantly lower and statistically significant changes in type 2 diabetes patients. FSG and  $HbA_{1C}$  levels showed strong negative correlations with serum selenium level which were statistically significant in patients with type 2 diabetes mellitus. Similar types of observations were reported by different researchers of different countries.<sup>8-11</sup> But some study did not find difference in serum selenium level in between type 2 diabetic patients and healthy control.<sup>12</sup>

In type 2 diabetes mellitus, hyperglycemia is the diagnostic hallmark finding of this disease. This prolonged hyperglycemia raises the osmotic pressure in renal tubules, which prevents the kidney from reabsorbing water, leading in polyuria. Due to this polyuria increased excretion of selenium occur in type 2 diabetic patients.<sup>13-16</sup> As a result lower serum selenium level increase the risk of diabetic complications like hypertension, atherosclerosis and coronary heart disease in type 2 diabetes mellitus.<sup>7, 17</sup>

## LIMITATION

This study had its limitation of being a cross sectional study one. Data from single centre does not reflect the true picture.

# CONCLUSION

The result of this study concluded that decreased selenium may be associated with type 2 diabetes mellitus and higher glycemic status of this disease may have inverse relationship to serum Se.

#### RECOMMENDATION

Further multicentre study are recommended with the inclusion of adequate of sample size for true picture.

#### DISCLOSURE

All the authors declared no competing interest.

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