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Insulino Mimetic Selenium in Type II Diabetes: Correlation with Blood Glucose

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Abstract

Background: Selenium has been reported to be insulinomimetic and to reduce blood glucose level in type 2 diabetes. **Material & Methods:** This study describes an inverse correlation of serum selenium with blood glucose level. This is a case control study conducted among 30 low BMI and 70 normal BMI diabetes and 50 low BMI non-diabetic controls. Serum selenium concentration was determined by atomic absorption graphite spectrophotometry. **Results:** Serum selenium concentration was estimated to be 44±16µg/L, 48±15µg/L and 59±33µg/L respectively in low BMI (<18.5) and normal BMI (18.5-24.9) diabetics and low BMI non-diabetics controls. A trend of inverse correlation was found between serum selenium and blood glucose levels. Serum selenium level at > 40 (41-60) µg/L was found to be inversely correlated ($p<0.05$) with blood glucose level. **Conclusions:** Lower serum selenium was observed in the diabetic patients and it was inversely correlated with blood glucose level.

Keywords:- Insulino, Mimetic, Selenium, Blood Glucose.

INTRODUCTION

Selenium has been reported to be insulinomimetic, and it reduces blood glucose level in type 2 diabetes.[1,2,3] Selenium stimulates glucose uptake, regulates metabolic process and directs specific β-cell target genes to promote islet function for the purpose of enhancing insulin synthesis and secretion.[1] In contrast, high selenium load has been reported to be diabetogenic increasing the risk of type 2 diabetes and insulin resistance.[4] Some studies reported its inverse correlation with fasting blood glucose or prevalence of diabetes, someone obtained no correlation,[5] while others identified a positive association.[3,7] Meta-analysis reported a U-shaped non-linear dose-response relationship between selenium and diabetes.[8]

Diabetes is a stress-induced metabolic disorder. The oxidative stress reduces insulin secretion, increases insulin resistance and develops glucose intolerance.[9,10,11,12] Diabetes or hyperglycemia itself increases oxidative stress by generating excess reactive oxygen species.[13] Oxidative insult of beta-cells has now been focused or addressed as the key aetiology of diabetes and insulin resistance.[14] Pancreatic beta-cells have low antioxidant

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capacity and are sensitive to oxidative stress.[14] Selenium is first line of antioxidant defense; in human its deficiency causes decreased glutathione peroxidases activity, and reduces insulin secretory reserve and makes glucose intolerance.[15] Selenium, through glutathione peroxidases (GPx), protects against oxidative stress, and thus, provides defense against diabetes.[1,2,6,10,11,12] The present article reports an inverse correlation of serum selenium with type 2 diabetes.

MATERIAL AND METHODS

Selection and Description of Participants: The present study is a case control research conducted among 30 low BMI (<18.5) and 70 normal BMI (18.5-24.9) diabetes and 50 low BMI (<18.5) non-diabetic controls. The diabetic patients were recruited with defined criteria of BMI, blood glucose level and newly diagnosed, who were free from renal, heart and other complications. Technical Information. Estimation of blood glucose. A 3 ml fasting blood sample was collected aseptically from anticubital vein of each of the diabetic and non-diabetic subjects and blood was processed to obtain serum. Serum glucose level was estimated by glucose-oxidase method using a glucose oxidase ELISA kit (Human, Germany). Serum selenium was analysed with atomic absorption graphite spectrometer (AA-680 Series, Shimadzu Corporation, Kyota, Japan).SPSS software package (Version 12.0, SPSS/PC Inc., Chicago, USA) was used to analyze the data. Descriptive statistics were used to calculate all variables. Values were expressed as mean, standard deviation and median. One way analysis of variance, independent t-test, and correlation analysis were performed.

RESULTS

Serum selenium was estimated to be 44±16µg/L, 48±15µg/L and 59±33µg/L respectively in low BMI diabetics, normal BMI diabetics and low BMI non-diabetic control [Table 1]. It was indicated that diabetic subjects had significantly ($p<0.007$) lower serum selenium concentration as compared to the non-diabetic control. However, the difference in serum selenium between low and normal BMI diabetes was found to be insignificant (<0.7). When the serum selenium concentrations were categorised into the ranges- <30µg/L, 31-40µg/L and >40 (41-60) µg/L (respectively marked as x, y and z) with their corresponding blood glucose levels [Table 2], there was observed a trend of decreasing glucose level with increasing serum selenium value. It was observed that low and normal BMI diabetics having serum selenium value >40 (41-60) µg/L had significantly low blood glucose level. It is to be noted that in controls, serum selenium did not show any influence on the glucose level.Correlation analysis revealed that serum glucose level was inversely correlated with serum selenium level of the diabetic patients [Table 2, Figure 1,2].

Table 1: Serum selenium concentration of diabetics and non-diabetic control subjects

Parameter	Low BMI diabetics[a]	Normal BMI diabetics[b]	Low BMI non-diabetic [c] control
Selenium (µg/L)	44±16 46 (20-75)	48±15 45 (26-120)	59±33 49 (23-155)

Results are expressed as mean and standard (sd) and median (range) as appropriate. [abc]p= 0.007; [ab]p=0.700

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Table 2: The correlation between the levels of serum selenium and blood glucose among different study groups

Diabetes and control	Selenium range (µg/L)	Glucose level[1] mmol/L	Correlation
Low BMI diabetic[a]	<30[x]	11.1±0.6	r=-0.33, p=0.42
	31-40[y]	10.5±3.1	r=-0.97, p=0.14
	>40 (41-60)[z]	9.4±4.0	r=-0.53, p=0.01
Normal BMI Diabetic[b]	<30[x]	14.21±9.6	r=-0.10, p=0.89
	31-40[y]	10.17±6.0	r=-0.30, p=0.24
	>40 (41-60)[z]	9.20±4.0	r=-0.31, p=0.03
Low BMI non-diabetic[c]	<30[x]	3.62±0.4	r=-0.06, p=0.85
	31-40[y]	3.67±0.5	r=-0.20, p=0.60
	>40 (41-60)[z]	3.62±0.5	r=-0.04, p=0.82

Results are expressed as mean and standard deviation (SD).
x: selenium level <30µg/L, y: selenium 31-40µg/L and y: selenium >40 (41-60) µg/L.
ANOVA (Bonferroni) was performed to find out the significance among the glucose value.
[1a] F(2,27) = 0.14, [1xy] p=0.81, [1yz] p=1.0,[1xz] p=0.39, [1b]F(2,67) =1.18, [1xy] p=0.11,[1yz] p=1.0,[1xz] p=0.04, [1c]F(2,47) = 0.30,[1xy] p=1.0,[1yz] p=1.0,[1xz] p=1.0
Correlation was performed using Pearson correlation and Spearman's where appropriate. P<0.05 was taken minimum level of significance.

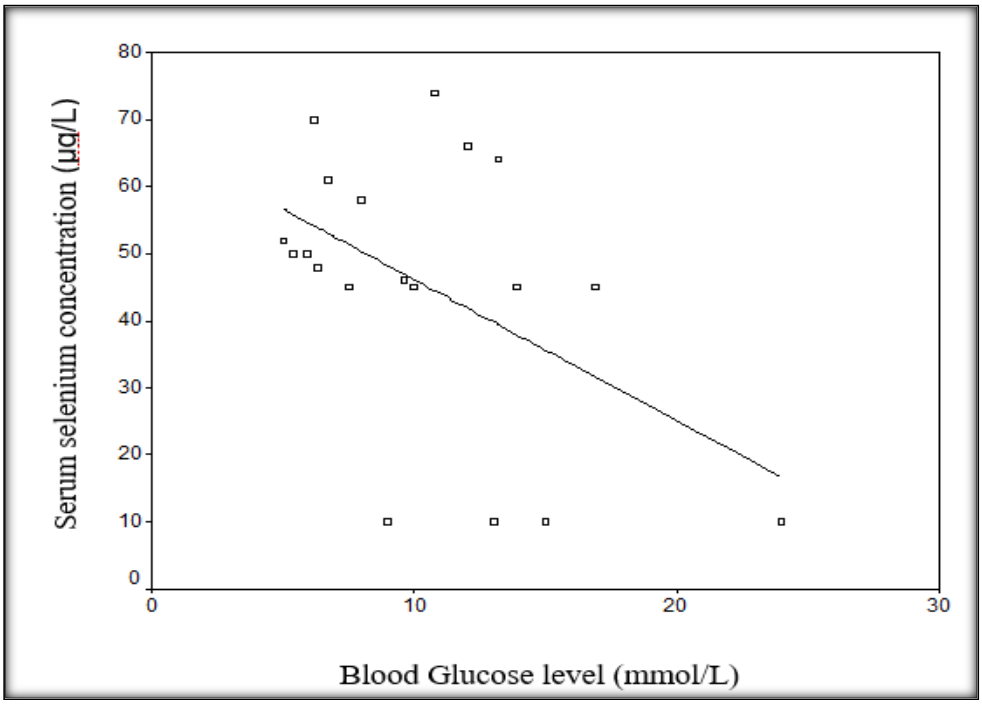

Figure 1: Correlation between serum selenium concentration andblood glucose levels in low BMI diabetic subjects

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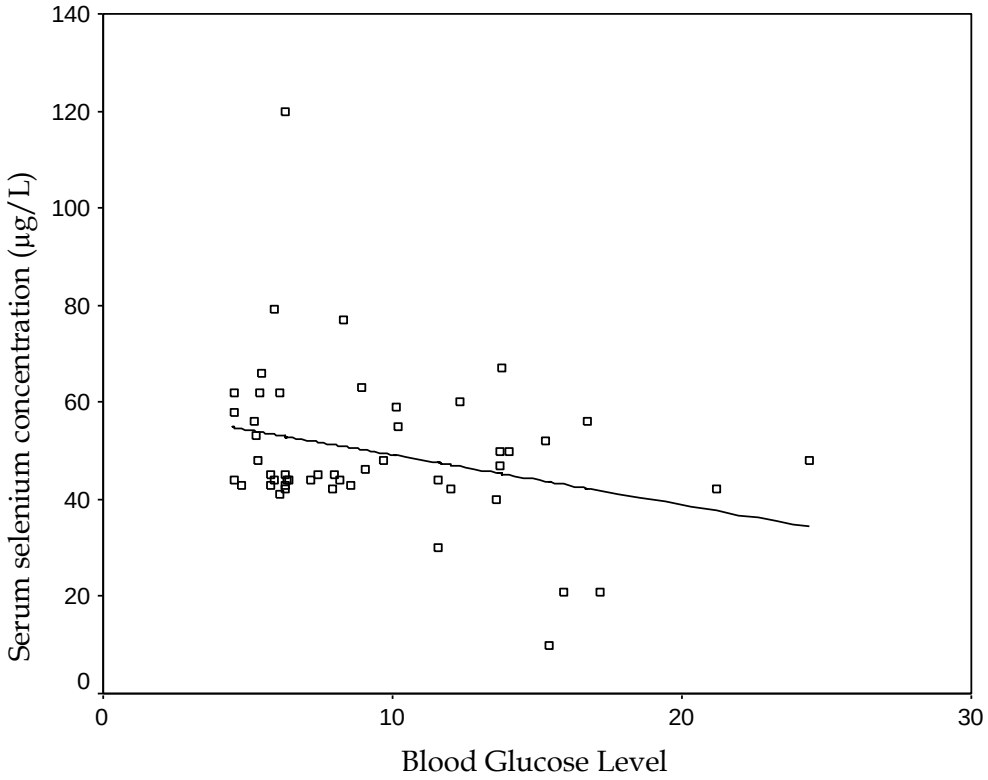

Figure 2: Correlation between serum selenium concentration and blood glucose level of normal BMI diabetic subjects.

DISCUSSION

In the present study, lower serum selenium concentration was observed in low BMI diabetic patient as compared to normal BMI diabetic patient and non-diabetic controls. This was in line with some previous findings.[16,17] It has been documented that the oxidative stress has an inverse correlation with nutritional status,[18] therefore, the lower BMI diabetes might have higher oxidative stress and lower serum selenium. The inverse correlation between serum selenium and blood glucose levels as observed in present study has also been reported elsewhere.[2,6] The low serum selenium in low BMI diabetes might be due to an increased oxidative stress,[8,9,10] which in turn might have caused an increased loss of selenium.[1,2] This increased loss of selenium decreases antioxidant defense, and thus, results in hyperglycemia or diabetes.

CONCLUSIONS

Selenium has a trend of inverse correlation with blood glucose in type 2 diabetes. At a concentration of >40 (41-60) µg/L, serum selenium has significantly inverse correlation with blood glucose level in type 2 diabetes.

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