

Correlation Between Non-insulin Dependant Diabetes Mellitus and Serum Sialic Acid

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Abstract: Sialic Acid (SA) is a class of important glyceic derivatives that contain 9 carbon atoms.¹ N-acetyl neuraminic acid (NANA) is the principal SA found in human tissues.² SA is a generic term for a family of acetylated derivatives of neuraminic acid and is an essential component of glycoproteins and glycolipids.³ In this study, the relationship between Serum Sialic Acid (SSA) and Non-Insulin Dependant Diabetes Mellitus (NIDDM) patients was investigated. One hundred (100) subjects, 32 males and 68 females, were included in the study. They were divided into two groups according to presence or absence of Non-Insulin Dependant Diabetes Mellitus (NIDDM). Group-A was having 24 subjects without Diabetes Mellitus (DM) as a control; whereas, Group-B comprised of 76 patients with NIDDM. Sialic Acid (SA), Glucose, Lipids (Triacylglycerols and Total Cholesterol) levels were measured in serum. While, Glycated Hemoglobin (HbA_{1c}) level was assayed in whole blood. Here we found a highly significant correlation between NIDDM patients and SSA as, NIDDM Patients had higher levels of SSA 2.37 ± 0.42 mmol/L as compared to the control group i.e. 1.48 ± 0.27 mmol/L where $p < 0.05$ as well as Triacylglycerols and Total Cholesterol had highly significant correlation with NIDDM.

Introduction

Sialic Acid (SA) is either N- or O-acyl derivative of neural-minic acid² – an aldol condensation product of mannosamine and pyruvic acid.³ Whereas Neuraminic acid it self is not found naturally.⁴ They act as cofactors of many cell surface receptors e.g. insulin receptors,⁵ and are positively associated with most of the serum acute phase reactants.^{6,7} The levels of SSA are increased in several pathologic conditions such as inflammation and malignancy.⁷ Sialic Acids (SAs) have been found to be significantly associated with the development of DM⁸ and are especially increased in patients with NIDDM.⁹ In this study, SSA levels in normal subjects were compared specifically with NIDDM patients only. Whereas in our other study before, an extra increase in TSSA levels were observed in diabetic patients in general (having no specification of whether Insulin Dependent or Non Insulin Dependent Diabetes Mellitus) with retinopathy as compared to those without retinopathy,¹⁰ and in another study elevated SSA levels were also correlated with blood pressure as well as with retinopathy in NIDDM patients.¹¹

Research Design and Methods

This study included 100 subjects, 32 males and 68 females. Diabetic patients were defined as those who had known diabetes (onset of DM after 40 years of age), and those with fasting blood glucose value exceeding 7.8 mmol/L on two different occasions – according to World Health Organization (WHO) criteria.¹² The subjects were divided into two groups: Group-A was having 24 normal subjects (10 males and 14 females) without diabetes as a control; whereas, Group-B comprised of 76 patients (22 males and 54 females) with NIDDM. According to WHO 1985 recommendations following standardized protocols;¹² all Group-A subjects underwent oral glucose tolerance test (OGTT) to ex-

clude the presence of impaired glucose tolerance (IGT). After over night fasting, a venous blood sample for glucose, lipids and serum sialic acid estimations were made in plain tube; and another aliquot of whole blood sample for HbA_{1c} was collected in lithium heparin tube by venipuncture of anticubital vein from every individual. Serum was obtained by centrifugation of plain tubes. Glucose, Triacylglycerol (TAG) and Total Cholesterol were determined in serum using kits of Randox Laboratories Ltd., by following methods and procedures of the manufacturer;³ SSA was estimated using Ehrlich's method as given by Shamberger;¹⁴ and HbA_{1c} was measured in whole blood by using an enzyme immunoassay.¹⁵

Results

Characteristics of the subjects (number, sex, age and duration of NIDDM) in Groups A (Normal subjects) and B (NIDDM patients) are shown in Table-1. These groups were comparable according to mean age in years \pm SD (57.5 ± 15.5 vs. 56.5 ± 13.5) where, p value – non significant and mean duration in years of NIDDM \pm SD 13.5 ± 6.5 (p value – non significant). Thus the results showed that, SSA has insignificant relationship with age as well as duration of NIDDM.

In group-B (NIDDM patients) serum levels of Triacylglycerols and Total Cholesterol were higher as compared to control subjects ($p < 0.05$); also, the NIDDM patients whether males or females had higher levels of SSA (2.37 ± 0.42 mmol/L) in comparison with controls (1.48 ± 0.27 mmol/L) with $p < 0.05$ (p value – highly significant), as shown in Table 2.

Discussion

Our experimental data show, the increase of SSA concentration in NIDDM patients as compared to normal control

Table 1: Comparison between control subjects (Group-A) and NIDDM patients (Group-B) on the basis of sex, age and duration of diabetes is given where $p > 0.05$.

Characteristic	Group-A (Control)	Group-B (NIDDM patients)
Number of Subjects	24	76
Sex:		
Male	10	22
Female	14	54
Age in years (mean \pm SD)	57.5 \pm 15.5	56.5 \pm 13.5
Duration of NIDDM in years (mean \pm SD)		13.5 \pm 6.5

Table 2: Comparison between control subjects (Group-A) and NIDDM patients (Group-B). Mean \pm SD is given ($p < 0.05$).

Parameter	Group-A (Normal / Control)	Group-B (NIDDM patients)
Fasting Blood Glucose (mmol/L)	5.31 \pm 0.86	8.98 \pm 1.15
Serum Sialic acid (mmol/L)	1.48 \pm 0.27	2.37 \pm 0.42
Triacylglycerols (mmol/L)	1.94 \pm 0.53	2.46 \pm 0.74
Total Cholesterol (mmol/L)	5.49 \pm 0.45	6.57 \pm 0.96
Glycated Hemoglobin (%)	5.14 \pm 1.09	9.06 \pm 1.33

subjects; where, p value < 0.05 is highly significant. This finding had also been shown partly in our other study; where more increase in Total Serum Sialic Acid (TSSA) in diabetic patients with retinopathy than those without retinopathy, i.e., 2.59 ± 0.47 mmol/L (0.81 ± 0.15 G/L) vs. 2.02 ± 0.29 mmol/L (0.63 ± 0.09 G/L) was observed.¹⁰ Furthermore, the SSA levels were independent of the duration of diabetes and degree of glycemic control (as estimated by HbA_{1c}). There was also a strong positive correlation observed between SSA and important risk factors for diabetes mellitus such as triacylglycerols and total cholesterol. It has also been reported before that, SSA is elevated in subjects with NIDDM without late complications, a finding which has not been recorded in Insulin Dependant Diabetes Mellitus (IDDM) patients.^{16,17} Besides this, SSA levels are increased in IDDM patients with albuminuria.¹⁸ SA is also increased in non-diabetic patients with end stage renal disease.^{19,20} The possible explanation of our findings, con-

firming the results of other studies²¹⁻²⁴ is that, this must be associated with the role of SSA in maintaining the negative charge of renal glomerular basement membrane, one of the main regulators of glomerular permeability.^{24,25} It may be speculated that vascular permeability is regulated by SA moieties, with increased vascular permeability resulting from the shedding of vascular endothelial SA into circulation.^{9,11} As the majority of SSA is a component of glycoprotein such as acute phase proteins¹⁶ and is also raised even in acute hyperglycemia.²⁶

Conclusion

Thus our study established that, Serum Sialic Acid (SSA), Triacylglycerols and Total Cholesterol have got highly significant correlation with Non-Insulin Dependent Diabetes Mellitus (NIDDM). While, there was a non-significant relationship of SSA with age as well as duration of the Diabetes.

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