

## Evaluation of Sialic acid Levels in Patients with Type 2 Diabetes Mellitus

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**Abstract:** Sialic acid-rich glycoprotein is found mainly in cell membranes, and elevated levels may indicate excessive cell membrane damage, but more specifically for cells of vascular tissue. Serum total Sialic acid is a marker of the acute phase response. Elevated levels have also been associated with cardiovascular disease especially in Type 2 diabetic subjects. The relation between type2 diabetes mellitus compared to the nondiabetics is not clear. The current study represents association between Sialic acid and cardiovascular disease is stronger in diabetics than in non-diabetic subjects.

**Key words:** Type2 diabetes mellitus, Sialic acid, cardiovascular diseases.

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### I. Introduction

Diabetes mellitus is a group of metabolic disorder, lifelong progressive disease, caused by an absolute or relative insulin deficiency, and is characterized by high circulating glucose. The International Diabetes Federation estimates that 366 million people had diabetes in 2011, and that by 2030, this figure will have risen to a staggering 552 million worldwide. One of the more debilitating aspects of diabetes is the numerous complications that can arise from the disease. The chronic hyperglycemia of diabetes is associated with significant long-term sequel, particularly damage, dysfunction, and failure of various organs especially the kidneys, eyes, nerves, heart, and blood vessels.. Complications of diabetes range from acute, life-threatening conditions [1]. Cardiovascular disease (CVD) is a major cause of mortality in diabetes. In addition to an increased incidence of CVD compared to the general population, people with CVD and diabetes fare more poorly compared to those without diabetes [2]. The prevalence of cardiovascular risk factors in young people with diabetes is of particular concern [3]. CVD is one of the complications of diabetes mellitus has been found to be partly due to low grade of systemic inflammation [4].

Elevation of serum or plasma sialic acid (N-acetyl neuraminic acid) concentration is a marker of the acute-phase response, since many of the acute-phase proteins (e.g.,  $\alpha$ 1-acid glycoprotein, fibrinogen, and haptoglobin) are glycoproteins [5]. Sialic acid can be used as a measurement of the acute phase response because many of these glycoproteins have sialic acid as the terminal sugar on their oligosaccharide chain [6]. Serum sialic acid is almost completely (99%) bound to glycoproteins and lipids [5]. some prospective studies that have investigated the relation between sialic acid and risk of cardiovascular disease. An elevated serum concentration of sialic acid (N-acetylneuraminic acid) is a strong predictor in the general population of cardiovascular death [8-11].

### II. Materials And Methods

Thirty individual Type 2 diabetic patients of both sexes aged 35-50 years of less than 5 years duration, attending on oral hypoglycemic drugs, diabetic out-patient department of Rajah Muthiah Medical College and Hospital, Annamalai University, Annamalai Nagar, Tamil Nadu, India, were selected for our study. Thirty healthy individuals both sex subjects were selected as control. Patients on insulin, Smokers, Alcoholics, Tobacco chewers, Hypertension, and other systemic illness were excluded from this study. This study was undertaken after approval by the institutional ethical committee overseeing human studies. Experiments were done in accordance with Helsinki declaration of 1975.

**Biochemical analysis:**

Fasting venous blood was collected immediately after enrolment in tubes containing EDTA. Blood samples were centrifuged at 2000×g for 10 min. Samples were analysed for Fasting Blood Glucose,Urea,Uric acid, Lipid Profile(Total Cholesterol, HDL, LDL, Triglycerides), by using Auto analyzer.

**Measurement of Sialic acid:**

Serum sialic acid was measured by a spectrophotometric assay [7]. Serum 0.15 ml was mixed with 3.60 ml of 5% TCA and the tubes were covered with marbles and kept in a boiling water bath for 15 minutes. The tubes were cooled and centrifuged for 10 minutes at 2000 g. The supernatant (1.0 ml) was mixed with 2.0 ml each of acid reagent and diphenylamine reagent. Standard and blank samples were treated in the same way. The contents were mixed using a vortex mixer, covered with marbles and placed in a boiling water bath for 30 minutes. Development of a purple color was measured on a spectrophotometer at 540 nm.

**III. Statistical Analysis**

All results were shown as mean±SD. Results were evaluated using Student’s t-test. P-value <0.05was considered statistically significant. Statistical analysis was performed using SPSS software.

**IV. Results**

*Table 1: Biochemical Data of control group and study group*

PARAMETERS (mg/dl)	Control group		Study group	
	Mean	Std.Dev	Mean	Std.Dev
Glucose	90.61	17.23	170.25	19.54
Urea	26.27	4.14	34.5	5.12
Uric acid	4.19	0.544	7.563	1.337
Total Cholesterol	182.2	12.87	251.8	37.94
Triglyceride	149.6	31.84	205.8	35.24
HDL	40.03	2.735	37.43	4.36
LDL	112.9	13.3	165.1	29.09
Serum Total Sialic acid	54.31	11.04	74.34	5.636

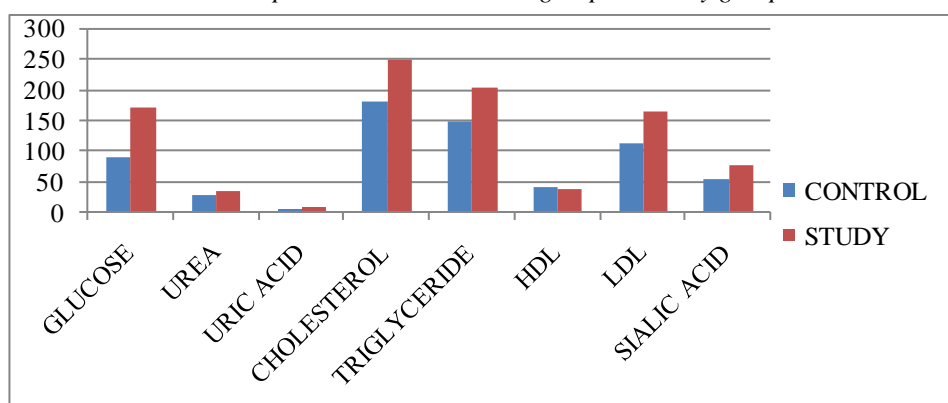
Data are expressed as mean±SD, P<0.05 was considered statistically significant. In normal individual (control group) glucose mean level was 90.61±17.23mg/dl. In Type 2 diabetic patients the glucose was significantly raised being 170.25 ± 19.54 mg/dl. Urea levels in control group were 26.27 ± 4.14mg /dl. In Type 2 diabetic patients the mean levels of urea was significantly raised, the value being 34.5 ± 5.12mg / dl. Uric acid levels in control group were 4.19± 0.544mg /dl. In Type 2 diabetic patients the mean levels of uric acid was significantly raised, the value being 7.563 ± 1.337mg / dl. Serum total Cholesterol was 182.2 ± 12.87mg /dl. In Type 2 diabetic patients the mean levels of serum total cholesterol was significantly raised, the value being 251.8 ± 37.94mg/ dl. The Triglycerides in control group is 149.6 ± 31.84 mg/dl, while inType2 diabetic patients the mean triglycerides levels have significantly raised to 205.8 ± 35.24 mg/dl. The mean HDL-Cholesterol in normal is 40.03± 2.735mg/dl, while the mean value of HDL-Cholesterol in Type 2 diabetic patients is 37.43 ± 4.36 mg/dl. The LDL-Cholesterol mean level in normal individuals was 112.9± 13.3 mg/dl. In Type 2 diabetic patients the LDL- Cholesterol was significantly raised being 165.1 ± 29.09 mg/dl. The total Sialic acid in control group is 54.31 ± 11.04 mg /dl, while in Type 2 diabetic patients the mean total sialic acid levels have significantly raised to 74.34 ± 5.636mg/dl. There is significant difference of glucose ,urea ,uric acid ,Cholesterol, triglycerides, HDL, LDL, sialic acid in control group & Type 2 diabetic group.

**V. Discussion**

We found a strong and independent association between elevated Serum Total sialic acid levels in Type 2 diabetic patients and risk for CVD events in our prospective study. Elevated levels of serum sialic acid are a risk factor for overall mortality in type 2 diabetic patients. There are several prospective studies that have investigated the relation between Sialic acid and risk of cardiovascular disease. serum sialic acid is a marker of the acute-phase response (5,12), acute-phase glycoproteins with sialic acid as a component of the oligosaccharide side chain being produced by the liver, stimulated by pro inflammatory cytokines such as interleukin-1, interleukin-6, and tumor necrosis factor (13,14).So the present finding explains that tissue injury caused by diabetic vascular complications and endothelial dysfunction. Previous studies in NIDDM and IDDM with incipient nephropathy demonstrated increased serum total Sialicacid levels [15, 16] which is claimed to be a strong predictor of cardiovascular mortality [11, 17, 18]. Serum total sialic acid was significantly increased in

patients undergoing cardiopulmonary bypass, which is known to induce an inflammatory response [19] and correlated with inflammatory, but not ischaemic markers, following cross-clamp removal [20]. And interestingly serum total sialic acid, total and LDL cholesterol were significantly decreased in growth hormone-deficient adults who were randomized to receive 3 months of growth hormone replacement therapy, compared to placebo therapy [21]. CVD and DM are inextricably linked. Serum Sialic acid is associated with incremental features of the metabolic syndrome. It should be highlighted that elevated serum sialic acid concentrations are not specific for CVD several malignancies compared to controls such as oral cancer [22], intraocular melanoma [23], laryngeal cancer [24], cholangio carcinoma [25] and is elevated in colorectal cancer [26]. Serum total sialic acid levels markedly elevated in alcoholism [27, 28] and is significantly elevated in inflammatory diseases such as liver cirrhosis [29]. So the current study clearly indicates that serum total sialic acid concentrations were elevated in type-2 diabetes because they are more prone to vascular complications.

**Bar diagram 1**  
Comparison between control group and study group



## VI. Conclusion

In summary, our study shows that serum total sialic acid level is an independent risk factor for future CVD; it is also elevated in patients with type 2 diabetes with or without known CVD.

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