

ORIGINAL ARTICLE

Serum Sialic Acid and Lipid Levels in the Offsprings of Type 2 Diabetic Parents*Bikas Kumar Pandey^{1*}, Vanishree B. Jabannavar¹, Smita S. Sonoli¹, Manjunath S. Somannavar¹**¹Department of Biochemistry, JN Medical College, Belagavi-590001(Karnataka) India***Abstract:**

Background: Diabetes mellitus is a major healthcare problem worldwide. Sialic Acid (SA) is a generic term for a family of acetylated derivatives of neuraminic acid, which is an essential component of glycoprotein and glycolipids. In patients with Type 2 Diabetes Mellitus (T2DM), the levels of SA are increased. The first degree offsprings of T2DM patients are at increased risk of getting T2DM and coronary heart disease, hence the present study is undertaken to evaluate the levels of SA in the first degree relatives of T2DM and establish its relationship. **Objectives:** The study was aimed to compare the levels of serum SA in the first degree offspring of T2DM with control subjects and also to compare the levels of lipid profile in the first degree offspring of T2DM with control subjects. **Material and Methods:** Serum SA, Serum lipid profile were determined in 30 control subjects of age group ranging from 20-60 years, 30 individuals who were offspring of one parent having T2DM and 30 individuals who were off springs of both the parents having T2DM. **Results:** Total SA concentration was significantly higher ($p < 0.05$) in the first degree relatives of one parent having T2DM as well as in the first degree relatives of both the parents having T2DM when compared to the control subjects. Our study showed that the desialylation of the vascular endothelium could be an early event that precedes the expression of impaired glucose tolerance or any lipid changes in asymptomatic offspring of one parent having diabetes and both the parents having diabetes. **Conclusion:** Sialic acid was significantly elevated in the off springs of type T2DM, however further studies are required to establish the validity of sialic acid as a marker.

Keywords: Sialic Acid, Type 2 Diabetes Mellitus, Offsprings

Introduction:

Diabetes mellitus is the major healthcare problem worldwide. According to International Diabetes

Federation (2013), 8.3% of total world population is diabetic and India is the home to nearly 65 million diabetes cases-second only to China which has over 98 million diabetes cases. It is the leading cause for mortality and morbidity [1-2]. Cardiovascular diseases are also currently the leading cause of death globally. Type 2 Diabetes Mellitus (T2DM) has a distinctive association with coronary heart disease. Those with diabetes have two to four fold higher risk of developing coronary heart disease than people without diabetes [3].

It is widely accepted that T2DM is preceded by a long pre-diabetic stage [4]. Family studies have confirmed that the incidence of T2DM in the first degree offspring (relatives) of T2DM patients is higher when compared with control subjects [5-6]. So accelerated atherosclerosis and microvascular disease will be occurring in the first degree relatives of T2DM.

The step by which T2DM causes atherosclerotic vascular disease is not clear. Emphasis is shifting from elucidation of risk factors such as insulin resistance to an understanding of the process occurring at the vasculature [7-8]. Increase in the concentration of serum Sialic Acid (SA) has been shown to be a possible cardiovascular risk factor in patients with non-insulin- dependent diabetes [9]. The earliest event associated with atherosclerosis is the accumulation of low density lipoprotein (LDL) cholesterol and fibrinogen /fibrin in the affected arterial wall [10]. It is, therefore, important to understand the mechanisms, which govern the endothelial

binding, uptake and transport of these macromolecules across the vessel wall as a prerequisite to the prevention of atherogenesis. The luminal surface of the endothelium is rich in sialoproteins and thus provides an anionic barrier for the receptor mediated uptake of LDL. It has been shown that the removal of the sialic acid as well as the glycosaminoglycans increases the internalization of LDL by 20 folds [11]. Therefore, desialylation of the endothelium could be an early event in the atherosclerotic process in cardiovascular disease and in T2DM. SA is a component of cell membranes and vascular permeability is regulated by SA moieties. The vascular endothelium carries a high concentration of SA, hence extensive microvascular damage accounts for its shedding into the circulation, leading to increased vascular permeability and overall increased SA concentration. Thus, shedding of SA from the endothelium can be the beginning process of atherosclerotic event in cardiovascular disease and T2DM, so it can be an early marker in the development of diabetes in the offsprings. On doing literature search, it was found that very few studies have been done to see the levels of SA in the offsprings of diabetics, so the present study was undertaken to evaluate the levels of SA in the first degree relatives of T2DM and establish its relationship.

Material and Methods:

The present study comprised of the healthy individuals of age ranging from 20-60 years, attending medicine outpatient Department (OPD) at KLE's Dr. Prabhakar Kore Hospital and Medical Research Centre, Belagavi who were the first degree offsprings of T2DM parents. Subjects with history of diabetes, cardiac diseases, smoking habit, alcohol intake, pregnancy, malignancy or any inflammatory disorders were excluded from the study. The study was conducted

on 90 individuals during the year 2014-2015. The study group consisted of 30 individuals who were off springs of one parent having T2DM, 30 individuals who were offsprings of both the parents having T2DM and 30 control subjects having non-diabetic parents. Written informed consent was obtained. With aseptic precautions 3 ml of blood was collected from antecubital vein after 8-12 hours of fasting. Serum SA was determined by the modification of the periodate resorcinol method [12]. Total cholesterol, triglycerides and high density lipoprotein were measured by Autoanalyzer using commercially available Erba kit and low density lipoprotein was determined by Friedewald equation [13].

Statistical analysis:

Data was expressed as mean \pm standard deviation. Continuous variables were analysed using one way ANOVA. Two tailed *p* value of less than 0.05 was considered significant.

Results:

Total SA concentration was significantly higher ($p < 0.05$) in the first degree relatives of one parent having diabetes as well as in the first degree relatives of both the parents having diabetes when compared to the control subjects (Table 1). LDL Cholesterol concentration was also significantly higher ($p < 0.05$) only in the first degree relatives of one parent having diabetes as when compared to the control subjects. But there was no difference in total cholesterol, triglycerides and HDL Cholesterol concentration between the groups has been shown in (Table 2).

Discussion:

The present study showed that the total SA concentration was elevated significantly in the first degree relatives of one parent having diabetes as well as in the first degree relatives of both the parents having diabetes. The findings of the study

Table 1: Serum SA Levels in Different Groups

Parameters	Control (N=30)	Offsprings of one parent having T2DM (N=30)	Offsprings of both of parents having T2DM (N=30)
Total SA (m.mol/l)	2.61 ± 1.01	3.71 ± 1.56*	3.76 ± 0.66*

p* < 0.05, T2DM: Type 2 Diabetes MellitusTable 2: Lipid Profile in Different Groups**

Parameters	Control (N=30)	Offsprings of one parent having T2DM (N=30)	Offsprings of both of parents having T2DM (N=30)
Total Cholesterol (m.mol/l)	5.09 ± 1.14	5.78 ± 1.83	5.46 ± 0.97
Triglycerides (m.mol/l)	1.33 ± 0.82	0.99 ± 0.38	0.98 ± 0.29
LDL Cholesterol (m.mol/l)	2.13 ± 1.06	3.17 ± 1.96*	2.61 ± 0.95
HDL Cholesterol (m.mol/l)	2.32 ± 0.92	2.21 ± 0.61	2.37 ± 0.76

**p* < 0.05, T2DM: Type 2 Diabetes Mellitus

are in accordance with Rajesh Qvist *et al* [14] who showed that the plasma lipid status and plasma sialic acid levels were elevated in individuals who are genetically at risk for developing diabetes but presently are not diabetic clinically. The significant finding noted in their study was total sialic acid concentration was significantly higher in the offspring with Normal Glucose Tolerance than in the offspring with Impaired Glucose Tolerance. LDL in diabetic patients are desialylated to a larger extent than in normal individuals, which accumulate in the endothelium and can cause premature development of atherosclerosis in diabetic patients.

The present study also agrees with another study done by Blau Mahendran *et al* [15] which states that individuals with elevated levels of serum sialic acid are at risk factor overall mortality in type 2 diabetic patients. According to their study sialic acid is a marker of the acute phase response [16-17], glycoproteins with sialic acid as a

component of the oligosaccharide side chain produced by the liver in response to proinflammatory cytokines like interleukin-1, interleukin-6 and tumor necrosis factor [18-19]. This explains the findings of the above study that tissue injury is caused by diabetic vascular complications and endothelial dysfunction. The raised concentration of proinflammatory cytokines and the resultant acute phase response may underlie much of the metabolic clustering including glucose tolerance[20]. Therefore an increase in the acute phase proteins explains the elevation of SA in T2DM. So our study shows that the desialylation of the vascular endothelium could be an early event that precedes the expression of impaired glucose tolerance or any lipid changes in asymptomatic offspring of one parent having diabetes and both the parents having T2DM.

Limitation:

The major limitation of the study was that offsprings were not evaluated for their glycemic status. Hence further studies are needed to establish the validity of sialic acid as a marker.

Conclusion:

Sialic acid was significantly elevated in the healthy offsprings of parents with T2DM,

however further studies are required to be done to establish the validity of sialic acid as a marker.

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