Original Research Article

Glycaemia, antioxidant activity, fibrinogen, BMI and cholesterol in type 2 diabetes mellitus

Ashok Kumar Jeppu,[1] Sushith,[1] Dipak C. Patil,[2] Vijaya Marakala[3]

[1]Department of Biochemistry, A.J. Institute of Medical Sciences, Mangalore, India
[2]Department of Community Medicine, A.J. Institute of Medical Sciences, Mangalore, India
[3]Department of Biochemistry, Srinivas Institute of Medical Sciences and Research Centre, Mangalore, India

Abstract

Antioxidant activity, plasma fibrinogen, cholesterol and LDL cholesterol are risk factors for cardiovascular disease. These factors are assessed in diabetic patients. Study group consisted of 39 controls and 34 diabetics. Plasma levels of antioxidant activity, fibrinogen, cholesterol and LDL cholesterol were estimated. Plasma antioxidant activity is decreased in diabetics compared to control group. Plasma fibrinogen, BMI, cholesterol and LDL cholesterol is higher in diabetics when compared to the control group. There was a negative correlation between antioxidant activity and the glycated Haemoglobin (HbA1c). There was a significant positive correlation between glycated haemoglobin and plasma fibrinogen. These observations point towards increased risk of cardiovascular disease in diabetics when compared to control group.

1. Introduction

World Health Organization has estimated that the number of diabetics is expected to rise to 300 million by 2025. In India, the number of diabetics is expected to increase from 19 million to 57 million by 2025. Oxidative stress and reactive oxygen species are formed under the normal physiological conditions but become harmful when they are not scavenged by the antioxidant systems. There are reports showing impaired antioxidant status in diabetes mellitus. Free radicals are disproportionately produced due to glucose autooxidation, polyol pathway and nonenzymatic glycation of proteins. High level of free radical and decrease in the antioxidant defence mechanism can lead to changes in cell membrane, enzymes, cellular organelles which can lead to complications of diabetes mellitus.[1] It is supported by the evidence that antioxidant treatment can delay the disease progression.[2,3]

Fibrinogen is a protein involved in the blood coagulation. In addition to its role in coagulation of blood it is also a marker of inflammation and an acute phase protein. There is a link between insulin resistance and inflammation which can precipitate diabetes mellitus.[4] Fibrinogen has been identified as a major independent risk

factor for cardiovascular disease.[5,6] Fibrinogen has also been associated with traditional cardiovascular risk factors suggesting that elevation of fibrinogen may be a pathway by which risk factors exert their effect.[7,8,9]

Prevalence of type 2 diabetes mellitus is expected to rise more rapidly in the future because of increasing obesity and reduced physical activities. A significant association between overweight, obesity and diabetes mellitus, hypercholesterolemia has been identified. In diabetics, dyslipidemia (triglyceride rich remnants and LDL) mainly contributes to the disease process and increased risk for cardiovascular disease.[10,11] This study aims at evaluating glycaemia, antioxidant activity, fibrinogen, BMI and cholesterol in type 2 diabetes mellitus.

2. Materials and methods

This prospective research was conducted on 34 known type 2 diabetic patients (cases) and 39 age and sex matched healthy individuals (controls) attending one of the tertiary health care centre and teaching hospital of Southern India during 2009-2010. Blood sample was obtained in heparinised and EDTA tubes using aseptic precautions. Heparinised blood was immediately processed to obtain plasma. A plasma level of antioxidant activity was

measured by the method described by Koracevic et al.[12] Plasma fibrinogen, total cholesterol and

LDL cholesterol (direct LDL) were estimated by using commercially available reagent kits and automated analyzer. EDTA blood was used to estimate HbA1c using commercially available reagent kit and the automated analyzer. Data were analyzed by student t test and Pearson's correlation. A p<0.05 was considered statistically significant.

3. Results

Table 1 depicts comparison of antioxidant activity, fibrinogen, body mass index (BMI, kg/m^2), HbA1c, cholesterol and LDL cholesterol between cases and controls. Antioxidant activity was decreased in cases (0.573 ± 0.169 mmol/L) when compared to controls (1.293 ± 1.309 mmol/L) indicating the oxidative stress. Plasma fibrinogen level was increased in cases (434.29 ± 118.27 mg/dl) when compared to controls (281.71± 55.65 mg/dl). BMI was higher in cases (27.3 ± 3.2 kg/m^2) compared to control (23.8 ± 2.7 kg/m^2). HbA1c as expected was increased in cases (9.9 ± 1.3 g%) when compared to controls (4.9 ± 0.65 g%). Plasma cholesterol was also found to be increased in cases (263 ± 65 mg/dl) when compared to controls (197 ± 39 mg/dl). LDL cholesterol value was increased in cases (175 ± 46 mg/dl) when compared to controls (129 ±28 mg/dl).

Table 1: Comparison of antioxidant activity, fibrinogen, BMI, HbA1c, cholesterol and LDL cholesterol between cases and controls

	Control	Cases	p value
Antioxidant activity (mmol/L)	1.293 ± 1.309	0.573 ± 0.169	< 0.001
Fibrinogen (mg/dl)	281.71± 55.65	434.29 ± 118.27	< 0.001
BMI (Kg/m^2)	23.8 ± 2.7	27.3 ± 3.2	0.183
HbA1c (g%)	4.9 ± 0.65	9.9 ± 1.3	< 0.01
Cholesterol (mg/dl)	197 ± 39	263 ± 65	<0.01
LDL cholesterol (mg/dl)	129 ±28	175 ± 46	<0.01

Pearson's correlation was used to find correlation between different parameters estimated in cases. We found a negative correlation between the HbA1c, BMI and antioxidant activity which was not statistically significant. Positive correlation was observed between HbA1c and BMI, cholesterol, LDL cholesterol, but it was not statistically significant.

Positive correlation between HbA1c and plasma fibrinogen was statistically significant. A positive correlation was observed between antioxidant activity and plasma fibrinogen, cholesterol, LDL cholesterol without any statistical significance. A positive correlation was found between fibrinogen and cholesterol, LDL cholesterol which was not statistically significant.

4. Discussion

Diabetes mellitus is a global health problem. The incidence is expected to increase in near future. It is also a risk factor for cardiovascular disorder. In the present study an attempt was made to evaluate antioxidant activity, fibrinogen, BMI, HbA1c and cholesterol in diabetes mellitus type 2. We observed a decrease in antioxidant activity in the diabetic group when compared to the controls. Kumar and Augusty reported that oxidative stress was increased in metabolic syndrome and diabetes mellitus type 2.[13] It was found that in diabetes mellitus non-enzymatic glycation of proteins form advanced glycation products which has got a role in development of complications of diabetes mellitus. Glycooxidation is a process indicating the close link between glycation and oxidative stress. Gillery reported decrease in the antioxidant activity in type 2 diabetics.[14] Jonathan et al demonstrated the decreased total antioxidant status in diabetes type 1 and negative association between the antioxidant activity and coronary artery calcification.[15]

There are reports indicating that the effect of insulin on plasma fibrinogen synthesis is inhibitory rather than stimulatory.[16] It was reported that fibrinogen level is higher in diabetics when compared to controls.[17] We observed an increase in plasma fibrinogen level in the diabetic group when compared to controls. There was a significantly high correlation between plasma fibrinogen and HbA1c.

Plasma fibrinogen levels influence thrombogenesis, blood rheology, blood viscosity and platelet aggregation. Epidemiological studies have found a significant association between fibrinogen levels and insulin levels. Markers of fibrinolysis are abnormal in people with metabolic syndrome, and fibrinolytic dysfunction is markedly increased in subjects with diabetes mellitus and abdominal obesity.[18,19,20] Studies have shown that non–insulin-dependent diabetes mellitus had an increased prevalence of hyperfibrinogenemia and that plasma fibrinogen level was independently associated with HbA1c value and hyperfibrinogenemia could be a mechanism of the increased cardiovascular risk faced by patients with non–insulin-dependent diabetes mellitus.[21]

BMI has been used as a measure of general obesity. BMI has been shown to be associated with type 2 diabetes. Studies have demonstrated consistently strong associations of BMI with incident of diabetes.[22] In the present study we found an increase in BMI in the diabetic group when compared to controls but it was not statistically significant.

The total cholesterol and LDL cholesterol were increased in the diabetic group when compared to the control group. Diabetics have a higher degree of risk for atherosclerosis due to dyslipidemia than people without diabetes.[23] Talat et al. found that duration of diabetes was associated with higher incidence of dyslipidemia.[24] There was a sharp and definite

increase in the percentage of patients having >200mg/dl total cholesterol after 4 years of diabetes mellitus.[25]

5. Conclusion

Alteration in antioxidant status, plasma fibrinogen level and dyslypidemia was observed in diabetics. There is a good correlation between glycaemia and plasma fibrinogen level in diabetics. A negative relation is observed between BMI, glycaemia and antioxidant activity. These are risk factors for the cardiovascular disease. This study needs to be conducted on a larger population.

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Corresponding author

Dr. Ashok Kumar Jeppu
Professor & Head
Department of Biochemistry
A.J. Institute of Medical Sciences
Kuntikana, Mangalore-575004, INDIA
E-mail: drashokkumarj@gmail.com