To Study Serum Uric Acid, Serum Lipid Profile in Type-2 Diabetes Mellitus

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Abstract:
Type 2 diabetes mellitus is a chronic disease characterized by relative or deficiency of insulin, resulting in glucose intolerance.
Aims and objectives*: The present study was planned to understand more about hyperuricemia, dyslipidemia, microalbuminuria and its complications in type 2 diabetes mellitus patients.*
Material and methods*: In present study, 565 type 2 diabetes mellitus patients and age and sex matched controls were included as study material.*

Observation and results*: We found increased levels of serum uric acid, total cholesterol, LDL-cholesterol, triglycerides and decreased levels of HDL-cholesterol in type 2 diabetic patients as compared to controls (p<0.001).*
Conclusion*: Due to long term duration of diabetes the serum uric acid and lipid profile are not only early diagnostic markers for atherogenic cardiovascular disease and renal disease but also prognostic monitoring of the disease in type 2 diabetes mellitus patients.*

Keywords: - *Blood sugar fasting and post-prandial, serum uric acid, serum lipid profile.*

I. INTRODUCTION

The prevalence of diabetes is rapidly rising all over the globe at an alarming rate. Over the past 30years, the status of diabetes has changed from being considered as a mild disorder of the elderly to one of the major causes of morbidity and mortality affecting the youth and middle aged people. [1] It has been estimated that the global burden of type 2 diabetes mellitus for 2010 would be 285 million people (2010) which is projected to increase to 438 million in 2030. [2] Diabetes mellitus is a chronic disease characterized by relative or deficiency of insulin, resulting in glucose intolerance. [2] Hyperuricemia is a condition that is significantly associated with markers of metabolic syndrome such as dyslipidemia, glucose intolerance, high blood pressure, and central obesity, which are accepted as risk factors for developing cardiovascular disease. Hyperuricemia is probably associated with glucose intolerance due to various mechanisms,

however, the most important is the association between insulin and renal resistance to absorption of urates. [1,2,3] Diabetic patients with type 2 diabetes mellitus are at greater risk of developing vascular diseases because of lipid changes. It has been well observed that controlling diabetes and lipid levels provide great benefit to diabetic patients. Impaired function of endothelium is an early indicator of cardiovascular discase. A normal endothelium is defined as blood flow response to a vasodilator which is denoted as increased vascular risk. Lipid abnormalities in type 2 diabetic patients with increased serum triglycerides, very low density lipoproteins, low density lipoproteins and lowering of high density lipoproteins. Inslulin resistance syndrome has been widely found that it is associated with type 2 diabetes mellitus in which high density lipoprotein is quite reduced and chances of cardiovascular complication. [1,2,3]

II. MATERIAL AND METHODS

The present study was carried out at the department of Biochemistry, Bharati Vidyapeeth Deemed University Medical College & Hospital, Sangli. Total five hundred sixty-five (565) of type 2 diabetes mellitus patients and five hundred sixty-five (565) healthy controls were included in this study. The patients were selected from O.P.D. Subjects who have not willing to participate and patients associated with infections, arthritis, cardiac and renal failure were excluded from the present study. Patients information

was filled in proforma contains patients name, age, sex, diet (veg/non-veg/mixed), habits, clinical history, family history of diabetes etc. All the patients and controls were asked to attend central clinical laboratory of Bharati hospital with overnight fasting. 2 ml blood sample was collected in fluoride vaccutainer for estimation of fasting blood sugar and 4 ml blood was collected in plain vaccutainer for estimation of serum uric acid and serum lipid profile. Post-prandial blood was collected after 1 ½ hrs of regular lunch for

estimation of blood sugar from all patients of type 2 diabetes mellitus and controls. Urine sample also collected from patients and controls for estimation of urine sugar. Estimation was done by Tulip corolyzer fully autoanalyzer for uric acid and lipid profile estimation.

III. RESULTS

Table no-1

Test parameters	Healthy controls (n-565) (mg%) Mean±SD		Type-2 DM patients (n-565) (mg%) Mean±SD	
	Veg diet	Mixed diet	Veg diet	Mixed diet
Fasting blood sugar	83.4±15.15	84.42±15.12	131.64±59.22	140.20±53.58
Post-prandial blood sugar	144± 15.4	147± 15.3	202.32±61.33	210.43±45.14
Uric acid	2.8± 0.50	2.93± 0.48	5.40± 1.82	5.95± 1.65**
Cholesterol	144.64±15.44	147.16±40.36	179.91±39.16	214.20±45.24**
HDL-cholesterol	43.67±8.00	45.61± 7.37	39.42 ±12.17	30.61±10.03**
LDL-cholesterol	83.65±14.59	85.03 ± 17.05	131.69±41.22	159.92±52.18**
Triglycerdies	79.28±15.17	83.55 ± 14.45	140.73±93.92	175.13±70.98**

Values are expressed in Mean±SD, ** Significant $p(<0.001)$

Table no- 2
Durationwise study of serum lipid profile in diabetes patients :-

Duration of diabetes	No. of T2DM	Total cholesterol (mg%) Mean±SD	HDL-cholesterol (mg%) Mean±SD	LDL-cholesterol (mg%) Mean±SD	Triglycerides (mg%) Mean±SD
6 months	26	166.40 ± 36.73	41.17± 11.01	109.28± 31.76	109.68± 38.43
1 yrs	33	178.03± 42.01	39.30± 9.12	111.84± 39.40	114.56± 44.50
2 yrs	91	178.03± 53.03	39.00± 12.67	112.09± 39.87	118.73± 52.50
3 yrs	67	179.10 ± 36.68	38.65± 8.11	113.23± 37.93	119.96± 53.14
4 yrs	58	181.27± 53.56	38.37± 8.66	113.96± 51.22	123.95± 47.26
5 yrs	44	181.57 ± 32.49	38.26± 13.55	115.31± 33.35	125.10± 53.17
6 yrs	29	181.70 ± 42.60	38.14± 10.66	117.21± 50.78	132.51± 76.61
7 yrs	28	182.28 ± 36.97	37.54± 8.81	118.14± 33.32	134.05± 66.49
8 yrs	22	184.46 ± 37.24	37.00± 9.65	122.82± 30.66	137.38± 72.22
9 yrs	21	185.93 ± 36.78	36.49± 10.47	123.53± 35.36	137.43± 72.94

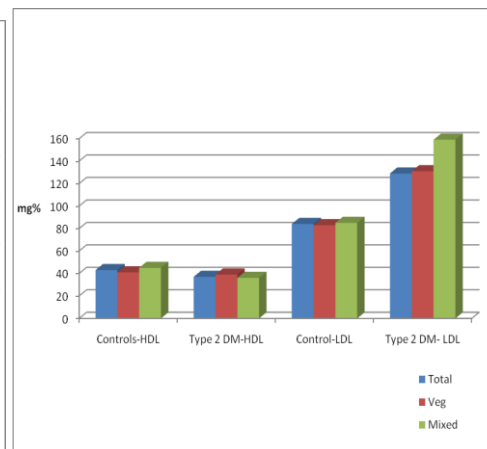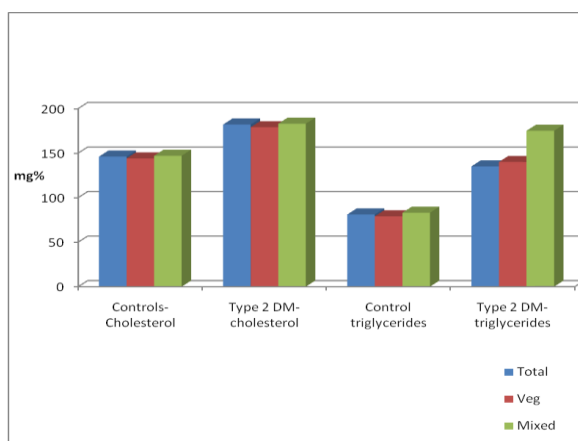| 10 yrs | 45 | 187.24 ± 42.53 | 36.24± 9.24 | 125.43± 34.06 | 140.65± 71.65 |
| 11 yrs | 48 | 189.96 ± 42.70 | 36.10± 10.68 | 127.08± 32.66 | 162.45± 81.00 |
| 12 yrs & above | 53 | 193.82 ± 51.46 | 36.01± 8.90 | 128.64±34.18 | 168.23± 97.42 |

Values are expressed in Mean±SD.

Fig:- Controls and diabetic patients with different dietary status:-
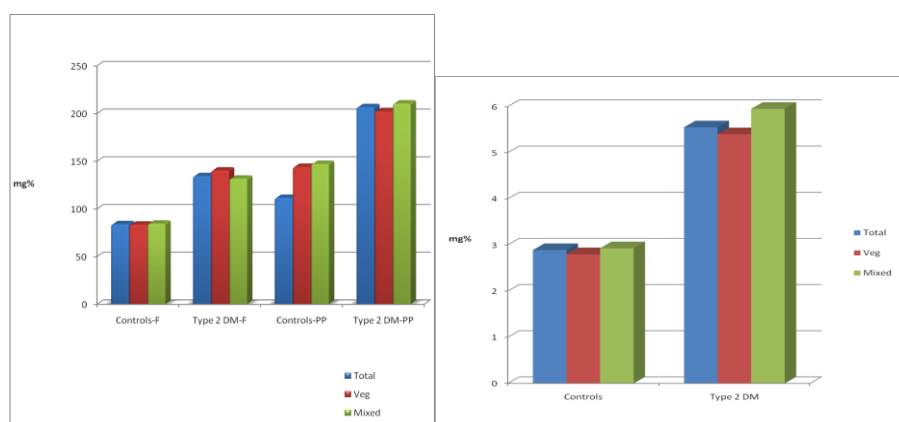
BSL(F&PP)   **Serum uric acid**

T.cholesterol & Triglycerides   **HDL and LDL cholesterol**

IV. DISCUSSION

Type-2 diabetes mellitus is a metabolic disorder. The hyperglycemia causes biochemical and structural alterations which lead to many complications due to organ dysfunction including micro and macro vascular diseases. The extent and duration in diabetic patients may contribute to the severity of diabetic complications like cholesterolemia, hyperuricemia and albuminuria caused by renal and cardiovascular dysfunction. With this view, we studied the levels of serum uric acid, serum lipid profile. All patients urine samples were positive for sugar, that is glycosuria was detected. Hyperglycemia with glycosuria is a characteristic feature of diabetes mellitus, due to relative or absolute deficiency of insulin secretary response which cause impaired carbohydrate metabolism.[4]

When considered dietary status of patients, as well as of controls, we observed very less and non-significant rise in fasting and post-prandial blood sugar in all subjects taking mixed diet (veg and non-veg) against pure vegetarian group (Table-1). Our finding

shows dietary status not much reflecting on blood sugar level. However non-significant raised levels in mixed dietary subjects may be explained as non-vegetarian component of mixed diet due to its palabaility may cause increase in consumption of food lead to higher sugar level.

Biologically uric acid plays an important role in worsening of insulin resistance by inhibiting the bioavailability of nitric oxide, which is essential for insulin-stimulated glucose uptake. Hyperinsulinemia as a consequence of insulin resistance causes an increase in serum uric acid concentration by both reducing renal uric acid secretion and accumulating substrates for uric acid production. [4] The mean serum uric acid levels were elevated statistically highly significant in type 2 diabetic patients as compared to healthy controls.($p<0.001$). Hyperuricemia is caused by muscle wasting and weight loss in diabetes mellitus. Chronic high glucose concentration causes tissue injury, in turn leads to increasing non-protein nitrogen substances. This well known phenomenon may account for increased uric acid levels.

The lipid profile cholesterol, LDL, Triglycerdies were markedly increased in mixed diet while HDL cholesterol were significantly decreased in mixed diet than vegetarian diet ($p<0.001$). Lipid profile except HDL were increased in mixed diet than veg diet due to non-vegetarian content. In type 2 diabetes mellitus enhanced lipolysis leads to high free fatty acid levels in plasma and consequent accumulation of fat in liver. Due to this, more Acetyl-COA is now available which cannot be efficiently oxidized by TCA cycle because the availability of oxaloacetate is limited. The stimulation of gluconeogensis is responsible for the depletion of oxaloacetate. The excess of Acetyl-COA therefore is diverted to cholesterol leading to hypercholesterolemia. There is hyperlipidemia, especially an increase in non-esterified free fatty acids, triglycerides and cholesterol. Other factors which are responsible for hypercholesterolemia are low fibre diet, lack of exercise, sedentary and inactive life style, high energy intake tends to obesity, stress etc. It is seen that approximately 20 % of type-2 diabetic patients are obese and older in age. Lipid abnormalities that occurs in this situations are hypertriglyceridemia, low levels of HDL and increased of LDL- cholesterol exposed to glucose undergo peroxidative damage. Glucose can undergo autoxidation and produce free radicals which can damage vascular function. [5,6]

Hyperlipidaemia as a metabolic abnormality is frequently associated with diabetes mellitus. Its prevalence depends on the severity of diabetes, glycaemic control, nutritional status and other factors.

Type 2 diabetic patients have a high probability of developing cardiovascular disease. [6]

The durationwise study of lipid profile (Table no-2) shows, low levels of HDL and increased of LDL-cholesterol. These results are supported by other studies. Riffat Sultan (2010) and H.O.Otamere (2011) et al in T2DM higher degree of atherosclerosis burden due to dyslipidemia. The national guidelines says that the risk factors of cardiac problems increases with ageing of diabetes. In Finnish East West study T2DM without known heart disease had 20 % chance of having a cardiac event over a 7 yrs time period. [38,45] Talat N.et al (2003) found similar observation that duration of diabetes was associated with higher incidence of dyslipidemia. In that study they found elevated total cholesterol, LDL- cholesterol and triglycerdies but normal HDL-cholesterol.[7,8] Derek Cook (1986) suggests that the hyperuricemia are more at risk factors of hypertension and cardiovascular disease. Hyperuricemia and hyperlipidemia are metabolic abnormalities and frequently associated with type 2 diabetic patients. Its prevalence are depending on the severity of diabetes, glycemic controls, nutritions status and other factors. Type 2 diabetic patients have high probabaility of developing cardiovascular disease and kidney disease. [9]

The previous studies of David.JA.Jenkis etal (2003) suggests that vegetarian diet contains whole-grain which reduces the risk of cardiovascular disease. [10] The nuts, visous fibers (oats, barley), soya proteins and plant sterols which may controls lipid levels. The vegetable proteins may also decrease renal hyperfiltration, proteinuria and renal acid load and reduce the risk of developing renal disease. The vegetarian diet therefore contains a portfolio of natural products and food forms of benefit for both the carbohydrate and lipid abnormalities.[10]

In mixed diet contains meat, dairy products, refined vegetable oils, sugars, white flour products which contains animal fat, animal protein, refined sugars, processed and complexed carbohydrates and trans fatty acids which increases risk of type 2 diabetes. Refined grains and foods are made from white breads, cookies, pastries, pasta and rice have been linked not only to weight gain but to increased risk of insulin resistance (the precursor of type 2 diabetes) and the metabolic syndrome (a strong predictor) of both type 2 diabetes and cardiovas- cular disease. [11]

V. CONCLUSION

Hyperglycemia with long term duration of type 2 diabetes mellitus is major risk factor for macro and microvascular complications which causes retinopathy, neuropathy and cardiovascular disease. Many factors like family history of diabetes, life style, obesity, hypertension and mixed diet are contributing in type 2 diabetic patients. In present study the levels of biochemical parameters serum uric acid and serum lipid profile were evaluated and these were correlated with duration of disease and effect of dietary status on these values were assessed with finding.

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