Original Article

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Assessment of the Serum Levels of Nitric Oxide Among Diabetic Patients and its Correlation with Lipid Profile as Well as Oxidative Stress

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Abstract

Background: Diabetes mellitus is a disease with a rapidly increasing prevalence needing continue research for novel methods to both prevent and treat this disorder. The present study was conducted to assess the serum levels of Nitric Oxide (NO) among diabetic patients and its correlation with lipid profile as well as oxidative stress. **Subjects & Methods:** 120 patients with diabetes were divided into three groups: Group I typed 2 diabetics with dyslipidemia and hyperuricaemia, group II have typed 2 diabetics with dyslipidemia and normouricaemia and group III was type 2 diabetics with normolipidemic and normouricaemia. A thorough clinical assessment was performed. Lipid profile and nitric oxide were determined. **Results:** Age group 20-40 years had 10 in group I, 15 in group II and 10 in group III, 40-60 years had 15 in group I, 13 in group II and 20 in group III and age group >60 years had 15in group I, 12 in group II and 10 in group III. There were 25 males and 15 females in group I, 22 males and 18 females in group II and 20 males and 20 females in group II. BMI (Kg/m^2) was 18.5- 24.9 seen 2 in group I, 4 in group II and 6 in group III, 25- 29.9 seen 14 in group I, 12 in group II and 22 in group III, 30-34.9 seen 8 in group I, 20 in group II and 10 in group III and >35 seen 16 in group I, 4 in group II and 2 in group III. There was a non-significant difference in HbA1c, TC, TG, HDL and LDL among different differences (P> 0.05). **Conclusion:** There was a role of Nitric Oxide (NO) in the pathogenesis of type -2 diabetes mellitus with dyslipidemia and hyperuricaemia.

Keywords: Diabetes Mellitus, Hyperuricaemia, Nitric Oxide.

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Introduction

Diabetes mellitus is a disease with a rapidly increasing prevalence needing continue research for novel methods to both prevent and treat this disorder. Now it is obvious that obesity and decreased physical activity are the well known major risk factor for the development of diabetes.[1]

Depending on the intensity and duration of exposure to hyperglycemia, structural damage may occur in vascular endothelium and nervous tissue, leading to the dysfunction, and even failure of different organs and tissues, characterizing the diabetic chronic complications. These complications are divided into macrovascular- (coronary artery disease, peripheral vascular disease and stroke) and microvascular-complications (diabetic kidney disease, diabetic retinopathy, and neuropathy), and are associated with high morbidity and mortality rates among diabetic patients.[2]

Free radical nitric oxide (NO) has emerged as a fundamental signaling device regulating virtually every critical cellular function and is a potent mediator of cellular damage in many conditions.[3] Vascular injury in diabetes consequential from hyperglycemia has been associated with oxidative stress that leads to depletion of intracellular glutathione with an augmented plasma extracellular superoxide dismutase which intervenes lipid peroxidation and diabetic complications.[4] Elevated concentration of superoxide dismutase causes impairment of endothelial isoform of nitric oxide synthase (eNOS) by triggering advanced glycation end products and poly (ADP-ribose) polymerase. NO is synthesized as a byproduct of the conversion of its physiological precursor l-arginine to l-citrulline. This reaction is catalyzed by a family of enzymes known as NO synthases (NOS).[5] Malondialdehyde

(MDA) is known to be a by-product of reactive oxygen species metabolism.[6] The present study was conducted to assess the serum levels of Nitric Oxide (NO) among diabetic patients and its correlation with lipid profile as well as oxidative stress.

Subjects and Methods

The present study was conducted among 120 patients of diabetes of both genders. All patients were informed regarding the study and their consent was obtained.

The demographic profile of patients was recorded. Patients were defined as diabetes mellitus using the following criteria: those with symptoms of diabetes with random blood glucose level >200 mg/dl or fasting plasma glucose >126 mg/dl or HbA1C>6.5% or impaired oral glucose tolerance test with two-hour postprandial plasma glucose level > 200mg/ dl. The patients were divided into three groups: Group I were type 2 diabetics with dyslipidemia and hyperuricaemia, group II was type 2 diabetics with dyslipidemia and normouricaemia and group III was type 2 diabetics with normolipidemic and normouricaemia. A thorough clinical assessment was performed.

FBS and PPBS were measured using a glucose oxidase (GOD/POD) method. Cholesterol (TC), Triglycerides (TG), Low-Density Lipoprotein (LDL), Very Low-Density Lipoprotein (VLDL), High-Density Lipoprotein (HDL), and serum creatinine levels were estimated and nitric oxide was determined by a colorimetric kit. Results thus obtained were subjected to statistical analysis. A P-value of less than 0.05 was considered significant.

Results

[Table 1] shows that age group 20-40 years had 10 in group I, 15 in group II and 10 in group III, 40-60 years had 15 in group I, 13 in group II and 20 in group III and age group >60 years had 15in group I, 12 in group II and 10 in group III. There were 25 males and 15 females in group I, 22 males and 18 females in group II and 20 males and 20 females in group II. BMI (Kg/m^2) was 18.5- 24.9 seen 2 in group I, 4 in group II and 6 in group III, 25- 29.9 seen 14 in group I, 12 in group II and 22 in group III, 30-34.9 seen 8 in group I, 20 in group II and 10 in group III and >35 seen 16 in group I, 4 in group II and 2 in group III. The difference was significant (P< 0.05).

[Table 2, Figure 1] shows that there was a non-significant difference in HbA1c, TC, TG, HDL and LDL among different differences (P> 0.05).

[Table 3] shows that there was poor correlation of antioxidants with antioxidants (P> 0.05).

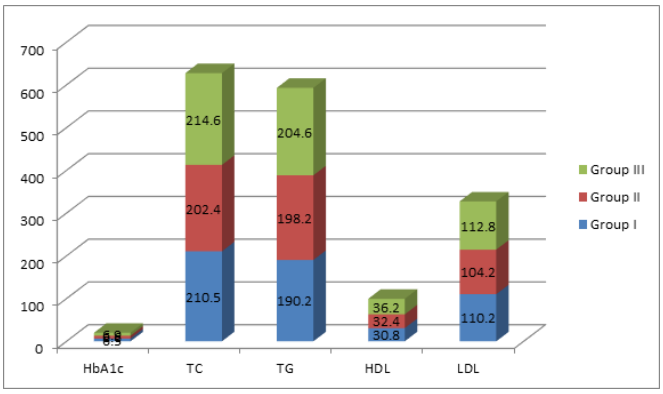

Figure 1: Assessment of biochemical parameters

Discussion

Endothelial dysfunction appears to be a consistent finding in all diabetic patients. Indeed, there is a general agreement that chronic hyperglycemia and DM lead to impairment in nitrous oxide. It is a short-lived gaseous free radical secreted by endothelium.[7] Modifications in its bioavailability have been found to cause endothelial dysfunction, increasing susceptibility to hypertension, the progression of atherosclerosis. Nitric oxide is produced in endothelial cells from the substrate l-arginine via eNOS. Elevated asymmetric dimethylarginine levels cause eNOS uncoupling, a mechanism that leads to decreased NO bioavailability.[8] The endothelial dysfunction associated with diabetes has been attributed to a lack of bioavailable NO due to reduced ability to synthesize NO from l-arginine.[9] New basic research insights provide possible mechanisms underlying the impaired NO bioavailability in type 2 diabetes. So, the nitric oxide is reduced in the course of vascular disease (e.g., diabetes and hypertension).[10] The present study was conducted to assess the serum levels of Nitric Oxide (NO) among diabetic patients and its correlation with lipid profile as well as oxidative stress.

In the present study, age group 20-40 years had 10 in group I, 15 in group II and 10 in group III, 40-60 years had 15 in group I, 13 in group II and 20 in group III and age group >60 years had 15in group I, 12 in group II and 10 in group III. There were 25 males and 15 females in group I, 22 males and 18 females in group II and 20 males and 20 females in group II. BMI (Kg/m^2) was 18.5- 24.9 seen 2 in group I, 4 in group II and 6 in group III, 25- 29.9 seen 14 in group I, 12 in group II and 22 in group III, 30-34.9 seen 8 in group I, 20 in group II and 10 in group III and >35 seen 16 in group I, 4 in group II and 2 in group III. Ghosh et al,[11] assessed serum nitric oxide level among type 2 diabetic patients along with other biochemical parameters. There was a significant difference when age- and sex-matched cases and controls were compared in regard to waist circumference and

Table 1: Baseline characteristics

Parameters	Group I	Group II	Group III	P-value
Age group (Years)				
20-40	10	15	10	0.02
40-60	15	13	20	
>60	15	12	10	
Gender				
M:F	25:15	22:18	20:20	0.91
BMI				
18.5- 24.9	2	4	6	0.01
25- 29.9	14	12	22	
30-34.9	8	20	10	
>35	16	4	2	

Table 2: Assessment of biochemical parameters

Parameters	Group I	Group II	Group III	P-value
HbA1c	6.5	6.6	6.9	0.91
TC	210.5	202.4	214.6	0.82
TG	190.2	198.2	204.6	0.94
HDL	30.8	32.4	36.2	0.17
LDL	110.2	104.2	112.8	0.09

Table 3: Correlation of NO levels with antioxidants

Antioxidant	Group I		Group II		Group III	
	r	p	r	p	r	p
MDA (nmol/l)	0.12	0.28	-0.12	0.32	0.04	0.65
CAT (Umg/ml)	0.09	0.42	0.16	0.19	0.21	0.02
SOD (Umg/ml)	-0.13	0.27	0.031	0.71	-0.04	0.74
GR (Umg/p)	0.07	0.51	-0.017	0.72	-0.092	0.42
GPx (UmgHb)	0.17	0.19	-0.041	0.74	-0.23	0.34

body mass index. The values of fasting and postprandial serum glucose, and lipid profiles between the study group and the control group differed significantly. The mean serum level of NO in the study and control group was 43.83 ± 11.3 μmoles/L and 58.85 ± 12.8 μmoles/L respectively, and this difference was statistically significant.

We found that there was a non-significant difference in HbA1c, TC, TG, HDL and LDL among different difference (P> 0.05). There was poor correlation of antioxidants with antioxidants (P> 0.05). Kumar et al,[12] included subjects suffering from type 2 diabetes for more than 1 year and age between 30 to 50 years with hyperuricaemia. The patients were divided into three groups: Group I- Type 2 diabetics with dyslipidemia and hyperuricaemia, Group II- Type 2 diabetics with dyslipidemia and normouricaemia and Group III- Type 2 diabetics with normolipidemic and normouricaemia. The nitric oxide level was significantly lower in Group I and Group II than Group III. The oxidative stress parameters had poor correlation with NO level in all the groups.

Conclusion

Authors found that there was a role of Nitric Oxide (NO) in the pathogenesis of type -2 diabetes mellitus with dyslipidemia and hyperuricaemia.

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