Study the status of oxidative stress markers and trace elements related to the antioxidative system in type 2 diabetes.

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Abstract

Objective: Study the status of oxidative stress markers and trace elements related to the antioxidative system in type 2 diabetes

Methods:70 Diabetic patients of age more than 30 years and 40 age and sex matched healthy nondiabetic individuals were included .Cases were divided in to two groups (1).Diabetic with microvascular or macrovascular complication (2). Diabetic without complication . Malondialdehyde, Zinc, Copper ,magnesium and level of selenium was assayed by using appropriate reagents.

Results: In DWC study group 21(65%) patients had microalbuminuria and 11 (34%) patients had macroalbuminuria. Mean serum MDA level in age/sex matched healthy controls were 1.87 ± 0.52 mmol/L, while in DWC group it was 2.66 ± 0.54 mmol/L (p=0.001). Mean serum level of all trace elements (selenium, zinc, copper and magnesium) were statistically significantly (p-value<0.001) lower in diabetic patients with complications group, as compared to age/sex matched healthy controls .Mean serum MDA level in diabetic patients without complications were elevated (p=0.001). Mean serum level of selenium, zinc, copper and magnesium were statistically significantly (p<0.001) lower in diabetic patients without complications group, as compared to age/sex matched healthy control .

Conclusion: This study showed that there is a definite role of these trace elements in oxidative stress in the pathogenesis and complications of diabetes. In order to better understand, further clinical studies are required enrolling larger number of patients and using more sophisticated techniques , so that antioxidants and mineral supplementation will be used for better management of diabetic patients.

Key Words: Antioxidative, Diabetes, Trace Elements

INTRODUCTION

Diabetes and its disabling chronic complications is usually associated with increased production of free radicals or impaired antioxidant defenses.[1-6,17] Decrease level of selenium, zinc and copper in diabetic patients may affect antioxidant system in diabetes.[7] The data pertaining to oxidative stress and trace elements in type 2 diabetes are scanty from our country and especially from this region.

METHODS

The study was conducted in the Department of General Medicine, Institute of Medical Sciences, Banaras Hindu University, Varanasi during the period of June 2011 to June 2012. 70 Diabetic patients of age more than 30 years and 40 age and sex matched healthy nondiabetic individuals were included .Cases were divided in to two groups [1].Diabetic with microvascular or macrovascular complication (DWC), (36 patients).[2] Diabetic without complication (34 patients). Detailed history and clinical examination along with routine investigations was done in all selected cases and controls. Malondialdehyde (MDA) was assayed by thiobarbituric acid reactive substances (TBARS) technique , Zinc was assayed using in-vitro colorimetric method with Nitro-PAPS reagents , Copper was assayed using in-vitro colorimetric method with Di-Br-PAESA reagent , level of magnesium was assayed using calmagite method and level of selenium was assayed using a simple and sensitive spectrophotometric method method based on oxidation of phenylhydrazine-P-sulphonic acid and coupling reaction in blood samples.

Statistical Analysis

The various parameters studied during observation period were compared using student's 't' test for parametric variables. For non-parametric variables Chi-square test was used. The critical value of 'p' indicating the probability of significant difference was taken as <0.05 for comparison.

RESULTS

Patients with complications had higher levels of HbA1c with respect to patients without complications. In DWC study group 21(65%) patients had microalbuminuria and 11 (34%) patients had macroalbuminuria [Table 1] . Mean serum MDA level in age/sex matched healthy controls were 1.87 ± 0.52 mmol/L, while in DWC group it was 2.66 ± 0.54 mmol/L. The difference between both group was statistically significant (p=0.001). Mean serum level of all trace elements (selenium, zinc, copper and magnesium) were statistically significantly (p-value<0.001) lower in diabetic patients with complications group, as compared to age/sex matched healthy controls [Table 2] .Mean serum MDA level in diabetic patients without complications were elevated (2.36±0.62), as compared to mean MDA levels in controls. The difference between both groups was also statistically significant (p=0.001).Mean serum level of all trace elements (selenium, zinc, copper and magnesium) measured in the study, were statistically significantly (p-value<0.001) lower in diabetic patients without complications group, as compared to age/sex matched healthy control [Table 3] . The serum levels of selenium, zinc and copper were lower in diabetic patients with complication, as compared to diabetic patients without complication. But this difference was statistically significant only for selenium (p-value<0.045). While serum levels of magnesium and malondialdehyde (MDA) was higher in diabetic patients with complication group, as compared to diabetic patients without

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complication. But this difference was again not statistically significant [Table 4] .

In this study the free radicals production was measured indirectly by malondialdehyde estimation in serum. Measured trace elements in this study are cofactor of enzymes of antioxidative system, so its level reflects status of antioxidant

DISCUSSION

Table 1: Important biochemical parameters

	Diabetic with complication No. (%)	Diabetic without complication No. (%)	Control No. (%)
	n=36	n=34	n=40
Haemoglobin			
<12 g/dl	26 (72.2%)	6 (17.6%)	2 (5%)
>12g/dl	10 (27.8%)	28 (82.3%)	38 (95%)
HbA1c (%)			
< 7 %	8 (22%)	19 (55.8%)	0
> 7 %	28 (77.7%)	15 (44.1%)	0
Proteinuria			
<30 mg/day	4 (11.1%)	34 (100%)	40 (100%)
30-299 mg/day	21 (58.3%)	0	0
>299 mg/day	11 (30.5%)	0	0

Table 2 Serum malondialdehyde (MDA) and trace elements level in diabetic patients with complication and controls

	Diabetic with complication	Control	p-value
Selenium (µg/l)	35.07±10.47	81.29±36.64	<0.001
Zinc (µg/dl)	92.23±13.96	118.65±22.95	<0.001
Copper (µg/dl)	87.77±16.44	125.54±36.88	<0.001
Magnesium (mg/dl)	2.36 ± 0.54	2.75 ± 0.42	<0.001
Malondialdehyde (mmol/l)	2.66±0.54	1.87±0.52	<0.001

Table 3 Serum MDA and trace elements level in diabetic patients without complication and controls

	Diabetic without complication	Control	p-value
Selenium (µg/l)	55.03±31.12	81.29±36.64	<0.001
Zinc (µg/dl)	99.43±16.16	118.65±22.95	<0.001
Copper (µg/dl)	94.63±11.05	125.54±36.88	<0.001
Magnesium (mg/dl)	2.25±0.22	2.75±0.42	<0.001
Malondialdehyde (mmol/l)	2.36±0.62	1.87±0.52	<0.001

System.[8] Serum malondialdehyde (MDA) was found to be significantly elevated in the diabetic patients (2.510.58) when the compared to healthy nondiabetic controls (1.870.52) . Similar results were observed in other studies also.[9,10] Malondialdehyde levels was found to be elevated in the diabetic patients with complications (2.660.54) when compared to the diabetic patients without complications (2.360.62) . However the difference was statistically not significant (p value <0.501). The above results were consistent with other previous studies.[10,11] Malondialdehyde level in patients of diabetic nephropathy was higher than that of diabetic patients without nephropathy, but this was statistically insignificant. While previous study by Hong-zhi P et al.shows statistically significantly higher MDA in diabetic nephropathy.[12] The concentration of MDA in patients with diabetic retinopathy was significantly elevated in comparison with patients with diabetes without retinopathy (p<0.05) in a previous study , whereas in our study there was no significant difference between these two groups.[12] Mean serum level of all trace elements (selenium, zinc, copper and magnesium) were significantly (p-value <0.001) lower in the diabetic patients, as compared to the age and sex matched healthy controls. These results were consistent the with other studies.[10,13-16] Our results are consistent with those obtained in other studies, suggesting that the deficiency and efficiency of some of essential trace metals have clinical value in the course of diabetes mellitus. In the present study copper level in diabetic patients were also significantly lower than controls, although this was not consistent with previous studies.[7,10,14] Serum magnesium level was significantly lower in diabetic nephropathy patients with respect to the diabetic patients without nephropathy . This was possibly due to the increase excretion of magnesium in urine in nephropathy patients.In the present study magnesium level was
not significantly different in between diabetic retinopathy patients and diabetic patients without retinopathy, which was not consistent with the finding of a previous study in which the magnesium was significantly (P<0.001) lower in diabetic retinopathy group than diabetic patients without retinopathy.[16] Serum selenium, zinc and copper level were significantly lower in the diabetic retinopathy patients when compared to the diabetic patients without retinopathy in present study.Serum selenium level was significantly lower in the diabetic neuropathy patients with respect to the diabetic patients without neuropathy in this study.

CONCLUSION

In order to better understand the role of these trace elements and oxidative stress in the pathogenesis and complications of diabetes, further clinical studies are required enrolling larger number of patients and using more sophisticated techniques, to reach any clear conclusion, so that antioxidants and mineral supplementation will be used for better management of diabetes.

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