Research Article

Glycosylated proteins (fructosamine) and albumin levels in diabetic patients after multi-vitamin multi-mineral supplementation

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Abstract

Introduction: Prolonged hyperglycemia is known to cause an increase in levels of non enzymatically glycosylated proteins which is thought to contribute to long term complications of disease by enzyme inactivation, inhibition of binding of regulatory molecules, decreased proteolysis and cross-linking of glycated proteins. In present study, fructosamine and albumin levels were measured in normal healthy controls and Diabetic patients before and after supplementation of Multi-vitamin multi-mineral tablets. Serum fructosamine level was decreased significantly in diabetic patients after multi-vitamin multi-mineral supplementation.

Keywords: Multi-vitamin multi-mineral supplementation, Type II Diabetes Mellitus, Glycosylated albumin, Fructosamine.

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INTRODUCTION

Type II diabetis mellitus (TYPE II DM) is a metabolic disorder due to relative or absolute deficiency of hormone insulin. It is characterized by significant hyperglycemia, commonly associated with glycosuria and variable tendency to develop ketoacidosis and metabolic abnormalities by long term complications involving eye, kidney, nerves and blood vessels. Prolonged hyperglycemia is known to cause an increase in levels of non enzymatically glycosylated proteins which is thought to contribute to long term complications of disease by enzyme inactivation, inhibition of binding of regulatory molecules, decreased proteolysis and cross-linking of glycated proteins. Glycosylated albumin i.e. fructosamine is a result from non-enzymatic glycation which corresponds to the average mean blood glucose level of preceeding 2 to 3 weeks. The carbonyl groups from glucose molecule combines with the amino groups of protein to form aldimines, a labile schiffs base which is an intermediate product which undergoes the Amadori rearrangement to form the stable ketoamine i.e. fructosamine. The clinical usefulness of fructosamine during management of patients on antibiotic therapy was observed by Watts B.F. in 1991[1] where as Charles M A *et al* showed the usefulness of fructosamine in detection of recent metabolic changes in diabetic patients[2]. There are no systematic study reports of fructosamine estimation in TYPE II DM patients with supplementation of multivitamins and minerals along with ant diabetic treatment. Thus was thought to undertake this study which may find out the correlation ship between the degree of glycosylation and the micronutrient intake in TYPE II DM patients.

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MATERIAL AND METHODS

As a study group diagnosed TYPE II Diabetes Mellitus patients both males and females from 30 to 75 age group, having fasting glucose levels above 130 mg% were selected. Blood samples were collected from normal healthy controls and Diabetic patients before and after supplementation of multi-vitamin multi-mineral tablets along with antidiabetic treatment. Blood sugar (Plasma glucose) was estimated by the enzymatic (GOD-POD) method[3] where as the serum fructosamine was determined by method at San gil[4]. Serum total proteins and albumin were determined by Biuret and BCG method[5,6].

RESULTS

Table No. 1 Shows values of fructosamine, serum total proteins and albumin in Diabetic patients under multi-vitamin multi-mineral tablet supplementation for 30 days along with hypoglycemic treatment. There was a highly significant increase (P C 0.001) in fructosamine levels in Diabetic group as compared to normal control. There was no significant variation observed in total protein an albumin levels in Diabetic patients and controls. The frctosamine levels in diabetic patients after multi-vitamin multi-mineral tablet supplementation showed significant decrease as compared to the level before supplementation, but there was no significant change observed in the serum total protein and albumin levels. The 30% rise in fructosamine which was observed in Diabetic patients as compared to controls was found of decrease after supplementation of 5%.

Table 1: Fructosamine and Serum proteins, albumin levels in Diabetic patients under supplementation of Multi-vitamin multi-mineral supplementation for 30 days

	Fructosamine Mol/L before suppl. of multi-vitamin multi-mineral tablets	Total Protein dl Before suppl. of multi-vitamin multi-mineral tablets	Albumin g/dl before suppl. of multi-vitamin multi-mineral tablets	Fructosamine Mol/L with suppl. of multi-vitamin multi-mineral tablets	Total Protein g/dl with suppl. of multi-vitamin multi-mineral tablets	Albumin g/dl with suppl. of multi-vitamin multi-mineral tablets
Normal	193.77	7.025	4.15	188.62**	6.98 ns	3.77***
Controls[14]	±14.92	±0.29	±0.24	±14.62	±0.30	±0.11
Diabetic	325.10***	7.15	4.09	205.23 ***	7.06 ns	3.75 ***
Patients[14]	±22.69	± 0.43	±0.20	±18.33	±1.07	±0.14

Value expressed as Mean ± SD

P < 0.001 - ***, P < 0.005, ns – Non significant

Table 2: BSL fasting, postprandial BSL and fructosamine levels in Diabetic patients under supplementation of Multi-vitamin multi-mineral tablets

	BSL F before suppl of multi-vitamin multi-mineral tablets mg/dl	BSL PP before suppl. of multi-vitamin multi-mineral tablets (mg/dl)	Fructosamine before suppl. of multi-vitamin multi-mineral tablets (Mol/l)	BSL F with suppl. of multi-vitamin multi-mineral tablets (mg/dl)	BSL PP with suppl. of multi-vitamin multi-mineral tablets (mg/dl)	Fructosamine with suppl. of multi-vitamin multi-mineral tablets (Mol/l)
Normal	92.1	124.5	193.77	88.5	115.2	185.62**
Controls[14]	±9.09	±7.97	±14.92	±5.03	±9.21	±14.62
Diabetic	152.3 ***	240.5***	325.10***	126.5***	215.5 ***	205.23 ***
Patients[14]	±27.38	±26.71	±22.69	±25.17	±28.42	±18.33

Value expressed as Mean ± SD

P < 0.001 - ***, P < 0.05 **

Table No. 2 shows values of Plasma Glucose fasting and post-prandial, serum Frucosamine in Normal Control subjects and Diabetic patients under the supplementation of Multi-vitamin multi-mineral tablets for 30 days along with hypoglycemic treatment. There was a highly significant increase (P<0.001) observed in Blood sugar fasting and Blood sugar Post-prandial in Diabetic patients as compared to control subjects. Serum fructosamine levels in Diabetic group were significantly high as compared of to normal control. There is no significant variation observed in total protein and albumin levels in Diabetic patients and normal controls. The fructosamine levels in diabetic patients after supplementation of Multi-vitamin multi-mineral tablets for 30 days showed significant decrease as compared to the level before supplementation. Fasting blood sugar and Post-prandial sugar also shows significant. Decrease in Diabetic patients as compared to normal controls, but there was no significant change observed in the serum total protein and albumin levels in both the groups.

Table 3: Plasma Glucose, Fructosamine, Protein levels after Multi-vitamin multi-mineral supplementation for 30 days and 60 days

	Control	Control 30 days	Control 60 days	Diabetic	Diabetic 30 Days	Diabetic 60 days
BSL fasting (mg/dl)	89.8 ±6.56	86.0 ±3.6	84.8 ±3.04	146.6 *** ±23.13	117.0 *** ±4.47	113.0 *** ±6.70
BSL PP (mg/dl)	121.0 ±3.60	102.0 ±6.4	102.2 ±6.24	247.0 *** ±13.03	227.0** ±12.5	219.0*** ±10.2
Fructosamine (Mol/1)	186.0 ±13.6	184.0 ±12.8	184.0 ±11.2	296.6*** ±34.35	211.0*** ±11.4	208.1*** ±15.24
Serum T. Protein (gm/dl)	6.76 ±0.29	6.84 ±0.15	6.82 ±0.17	7.08 ±0.75	7.02 ±0.55	7.06 ±0.43
Serum Albumin (gm/dl)	3.52 ±0.18	3.84 ±0.11	3.86 ±0.07	3.94 ±0.82	4.18 ±0.69	4.20 ±0.56

Value expressed as Mean ±SD
P < 0.001 - ***, P < 0.05 **

Table No. 3 shows values of Plasma Glucose (fasting and post-prandial), serum Fructosamine, serum total Protein and albumin in Normal Control subjects and Diabetic patients under the supplementation of Multi-vitamin multi-mineral medication along with hypoglycemic treatment for 30 days and 60 days. There was a highly significant increase (P < 0.001) observed in BSL fasting and PP. Serum fructosamine levels in Diabetic group were significantly high as compared of to normal control. There is no significant variation observed in total protein and albumin levels in Diabetic patients and controls. The fructosamine levels in diabetic patients after Multi-vitamin multi-mineral supplementation for 30 and 60 days showed significant decrease as compared to the level before supplementation, but there was not significant change observed in the seruu total protein and albumn levels. There is no significant variation observed in levels at 30 and 60 days in any parameter.

Table 4: Plasma Glucose, Fructosamine, Protein levels after Multi-vitamin multi-mineral supplementation for 30 days and withdrawing the supplementation for next 30 days

	Control	Control +30 days	Control -30 days	Diabetic	Diabetic +30 Days	Diabetic -30 days
BSL fasting	94.4 ±10.2	88.0 ±5.15	90.8 ±6.76	158.0 *** ±25.70	135.0*** ±24.82	136.6 *** ±26.19
BSL PP	128.0 ±9.08	114.4 ±0.77	118.8 ±9.94	234.0*** ±30.5	204.0** ±26.4	207.6*** ±24.9
Fructosamine	193.0 ±16.0	187.0 ±13.03	185.0 ±14.6	333.6*** ±19.42	200.0*** ±23.45	205.6*** ±19.60
T.Protein	6.72 ±0.24	6.82 ±0.20	6.84 ±0.15	7.06 ±0.26	3.92 ±0.18	6.98 ±0.04
Albumin	3.72 ±0.19	3.94 ±0.13	4.04 ±0.09	3.68 ±0.22	3.92 ±0.11	4.02 ±0.05

Value expressed as Mean ±SD
P < 0.001 - ***, P < 0.05 - **

Table No. 4 shows values of Plasms Glucose (fasting and post-prandial), serum Fructosamone, and serum total Protein and albumin in Control subjects and Diabetic patients under the multi-vitamin multi-mineral supplementation along with hupoglycemic treatment for 30 days and withdrawing the supplementation for next 30 days. The fructosamine levels in diabetic patients after supplementation of multi-vitamin multi-mineral tablets for 30 days and withdrawing multi-vitamin multi-mineral supplementation for next 30 days showed significant decreaed as compared to the level before supplementation, but there was no significant change observed in the serum total protein and albumin levels.

DISCUSSION

It is well understood that there occurs a glycosylation of proteins in Diabetes, which leads to formation of reactive carbonyl groups which may contribute to complication of disease by inactivation of enzymes, inhibition of binding of regularity molecules, decreased proteolysis, cross linking of glycoproteins and generation of free radicals[7] Some works have determined the levels of various

glycosylated proteins and came with a conclusion that there was an increase in glycosylation of proteins in Diabetes and the measurement of these glycosylated proteins can be a index of glycemic control in management of Diabetes. Holecek *et al* in 1995 observed decreased glycosylated proyein levels in TYPE II DM patients after supplementation with a multivitamin and trace element mixture with antioxidant activities[8] Vit. B_6 supplementation in TYPE II DM patients has also been reported to decrease glycosylated hemoglobin levels[9] Experimental results indicate that vit C may inhibit glycosylation of proteins and therefore serve as means of preventing or delaying some of he long term complications associated with Diabetes[10]. Vit E can decrease the oxidative modification of LDL Cholesterol, reduce glycosylation of hemoglobin and normalize thromboxane production and platelet aggregability[11]. Enhanced requirement of micronutrients in diabetics is due to;; more demands because of acute or chronic complications. Studies observed decreased glycosylated protein levels in TYPE II DM patients with multivitamin and mineral mixture[12]. It is apparent from our observations that the Diabetic patients with multi-vitamin multi-mineral supplementation for 30 days showed a significant decrease in the glycosylated protein fructosamine levels, which is a good indication, with support to the earlier studies which observed the lowing of glycosylation of proteins after supplementation of multivitamins and minerals. In our studies we found that there is no correlation of fructosamine and the serum, otal Protein s and Albumin levels. Our studies are in agreement with the findings of J.R. Baker, who stated that fructosamine level did not depend on the albumin or total protein concentration, provided that the serum albumin concentration remains above 3 gms/dl[13].

CONCLUSION

Fructosamine is a product of glycosylation of proteins which is observed to be significantly increased in Diabetic patients as compared to control. Various vitamins and minerals with antioxidant properties have shown beneficial effects on degree of glycosylation of proteins. There was a significant decrease in the concentration of fructosamine in patients who received Multi-vitamin multi-mineral supplementation a multivitamin mineral compostion. There was no significant variation in total protein and albumin in Diabetic group as compared to control, also no no relationship was observed in fructosamine and the serum albumin concentration. From these observations we can conclude that the micronutrient deficiency which occurs in the Diabetics, if fulfilled by supplementation along with the ant diabetic treatment can reduce the degree of glycosylation of proteins, and prevent the development of the long form complication in diabetics. Further studies are in progress.

REFERENCES

1. Watts G.F. *et al*, Diabetic Med. July; 8(6) : 573-9; 1991
2. Charles M.A. *et al*, Diabetes care Aug, 13(8) : 898-900; 1990
3. Trinder P. Ann, Clin Biochem. 6: 24; 1969
4. Sangil F., Schier G.M. *et al*; Clin Chem. 31 : 2005-06, 1985
5. Doumas B.J., Clin Chem acta; 21:1159, 1975
6. Doumas B.J. Watson W.A.; Clin chem... Acta;31 : 87,1971
7. Hunt S.V., Dean R.P., Wolff S.P., Bio chem… J 256:205-15, 1988
8. Holecek V, Racek J and Jerabek Z; Casopis Lekaru Ceskych; 134(3) 80-83, 1995
9. Urban M. and Zemeh M.B.' Metabolism; 36 : 896-99, 1987
10. Emil Glinter, Viera Chorvathova Res. Init Human Nutr. Health, 2:3-11,1983
11. Reaven P.D., Herold D.A. and Edelsman S., Diabetes care, 18(6), 807-19, 1995
12. Holecek V., Racek J and Jerabek Z, Casopis Lekaru Ceskych; 134(3) 80-87, 1995
13. John R. Baker, John P.O. carrier *et al*, Br, Med. Jr., 287(24): 863-866, 1984.

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