ABSTRACT

Tight glycemic control and prevention of secondary complications are the most important goals of pharmacological treatment of diabetes mellitus. The inadequate responses to oral hypoglycemic agents may be attributed to inadequate post-receptor events even when insulin levels are quite sufficient, and associated with oxidative stress induced by long-term hyperglycemia. The administration of antioxidants such as zinc, magnesium, selenium, vitamin A and vitamin E may improve tissue responses to insulin and increase the efficacy of drugs which act through this pathway. Further, there is a possibility of enhancing the drug effect by giving an antioxidant and the patients might be happy to take the low doses.

This study was designed to evaluate the effects of zinc with or without other anti-oxidants (magnesium, selenium, vitamin A and vitamin E) on the diabetic control, lipid profile and renal function in type 2 diabetic patients. Further, it was designed to establish serum zinc levels among healthy individuals. The study population consisted of previously diagnosed (for at least 2 years) adult patients with Type II diabetes mellitus who were being followed-up at the Teaching Hospital, Karapitiya outdoor clinics. Controls for the study were selected from healthy volunteers from the staff of the Teaching Hospital and Faculty of Medicine, Karapitiya as well as from the Bope-Poddala Health Division.

There were 96 patients with diabetes (33 males and 63 females) recruited for the study. Similar number of age and sex-matched healthy individuals were included in the control group. The age ranged from 37.0 to 65.0 years with a mean of 54.7±8.0 years in both groups. The mean fasting blood sugar (FBS) among diabetic subjects was 6.14±1.2mmol/L whereas it was 5.07±0.8mmol/L ($p<0.001$) in healthy controls. The mean post prandial blood sugar (PPBS) among those with diabetes was 9.76±2.7mmol/L and that of healthy subjects was 6.1±1.3mmol/L ($p<0.001$). The serum zinc level among subjects with diabetes (8.5±5.1μmol/L) was significantly low when compared with age and sex matched healthy subjects (13.8±6.0 μmol/L, $p<0.001$).There was no significant correlation between FBS and fasting serum zinc level among either diabetes subjects ($r=0.16$; $p=0.13$) or healthy subjects ($r=-0.012$; $p=0.91$).

In the second phase the diabetic subjects were randomly allocated to 3 groups; 29 subjects were supplemented, with oral zinc sulfate (22 mg/day) and multivitamin/mineral (zinc+MVM) preparation; 31 subjects the same MVM preparation without zinc; and 36 were given a matching placebo, for a period of 4 months in a single blinded study. After 4 months of supplementation,

investigations similar to the baseline were performed (i.e., blood glucose (fasting and post prandial), Hb_{A1C}%, serum zinc, insulin, creatinine and lipid profile). Compared to the baseline, the Zinc+MVM group had a mean reduction of FBS by -0.33 (SEM, 0.21) mmol/L (p =0.05). The FBS change observed in the MVM (+0.19±0.31mmol/L) and the control groups (+0.43±0.23mmol/L) were not statistically significant (p=0.89). The PPBS level also reduced significantly (p=0.04) in the Zinc+MVM group with a mean change of -1.55±0.56mmol/L after the intervention.

When FBS was >5.56mmol/L (>100mg/DL) the supplementation, with or without zinc had showed a significant effect on FBS but no such effect seen at FBS <5.56mmol/L. In Zinc+MVM group, FBS level dropped to 6.21±0.85mmol/L from the baseline 6.76±0.58mmol/L, whereas in the MVM group baseline FBS level of 6.96±1.20mmol/L dropped to 6.61±1.07mmol/L. At the PPBS level of >8.89 mmol/L (>160.0 mg/dL) reduction in mean PPBS was shown with the intervention in all groups. The Hb_{A1C}% level reduced irrespective of the baseline levels in Zinc+MVM supplemented individuals. When the baseline Hb_{A1C}% level was <6.0, the Zinc+MVM group had a significant net reduction (mean level of 5.63±0.15 at the baseline and 5.53±1.27 after the intervention, $p<0.05$). Zinc+MVM supplementation caused a significant decrease triglycerides (p=0.02), total cholesterol (p=0.005), LDL (p=0.05) and an increase in HDL (p=0.002) when compared with placebo supplementation.

This research programme adds useful information to the existing treatments for type II diabetes mellitus which may in future help to to reduce non-communicable disease burden in the country by helping better treatment of type II diabetes.