Evaluation of the Possible Effect of Gender, Age and Duration of Diabetes on the Serum Zinc Levels of Diabetic Patients in Murzuk Area-Libya

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Abstract—The aim of this study was to demonstrate the possible effect of some variables such as age, gender, blood sugar level, and duration of diabetes on the serum level of zinc in diabetic individuals from Murzuk area. Serum zinc (Zn), Fasting blood sugar (FBS), hemoglobin HbA1c (HbA1c) were evaluated in 46 type I diabetic subjects (group 1), 48 type II diabetic subjects (group 2) and 43 healthy individuals (control) of both genders aged (30-81) years. Data showed that both diabetic groups have significantly higher (P<0.05) serum levels of Zn, FBS and HbA1c compared with controls. No significant (p>0.05) differences in serum Zn levels were observed between Males and Females. Serum Zn levels were non-significantly decreased with increasing age. In type II diabetic subjects, serum Zn levels were non-significantly decreased with increasing duration of disease whereas those in type I were non-significantly increased.

Keywords—Blood sugar, diabetes, HbA_{1c}, zinc.

I. INTRODUCTION

DIABETES mellitus is a heterogeneous disease characterized by an absolute or relative deficiency of insulin as well insulin resistance. It is a multi system disease that is widespread throughout the world, affecting carbohydrate, protein and lipid metabolism. Along with hyperglycemia, diabetes is associated with different complications, which are the major causes of morbidity and death in diabetic subjects (3.2 million yearly all over the world) [1]. The relationship between diabetes, insulin and zinc is complex with no clear cause and effect relationships. Zinc is required for the metabolic activity of 300 enzymes, which are involved with the metabolism of carbohydrate, protein and lipid [2]. Zinc also plays a clear role in the synthesis, storage and secretion of insulin [3]. On the other hand diabetes is responsible for the increased urinary loss and decreased in total body zinc [4]. Several of the complications of diabetes may be related to increased intracellular oxidants and free radicals associated with decreased in intracellular zinc and in zinc dependent antioxidant enzymes [3]. Reports in the literature on the zinc status in both types of diabetes contain contradictory results. Some have shown decreased serum zinc concentration [5],[6], while others have found elevated levels [7],[8], as compared to non-diabetic controls, a few observed no changes [9],[10]. No study has been reported to date on the zinc status in patients with diabetes in Libya. Thus the objective of this study was to evaluate zinc status based on the serum zinc level in diabetic patients in Libyan population from Murzuk area in an effort to evaluate the status of this element in such patients.

II. MATERIALS AND METHODS

A. Patients and study design

Diabetic patients attending the medical outpatient clinic of Murzuk general hospital (south of Libya) and non-diabetic subjects selected from apparently healthy individuals attending the staff clinic of the hospital were included in this study. A total of 137 subjects (61 male, 76 female), aged between 30 to 81 years, and were recruited for this study. 46 type I diabetic patients (group1), 48 type II diabetic patients (group2) and 43 healthy individuals were used as control group. According to their age they were subdivided as follows (30-45 years), (46-61 years), (62-81 years). And according to the duration of diabetes they were subdivided as follows: (1-5 years), (6 -10 years), (≥11 years).

B. Samples & Analytical Method

Fasting blood samples were collected from subjects, after an overnight fast, and analyzed for serum zinc, fasting blood sugar (FBS), hemoglobin A_{1c} (HbA_{1c}), creatinine and urea. For zinc determination, serum samples were digested with 75% nitric acid and 0.1N HCL, and were analyzed with a flam atomic absorption spectrophotometry (GBAM, 932 PLUS). FBS, HbA_{1c}, urea and creatinine were measured by glucose oxidase method [11], Ion-exchange chromatography (NycoCard RerderII), the modified jaffes reaction method [12], diacetyl monoxime method [13], respectively.

C. Statistical Analysis

Data are expressed as Mean ± SD. The significance of difference between the groups was assessed by student's t-test. Variations within and among groups were tested using ANOVA test. Pearson's correlation was used to determine the association between different variables. The SPSS statistical software was used for analysis. P value < 0.05 was considered statistically significant.

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III. RESULTS AND DISCUSSION

The mean values for FBS, HbA$_{1c}$, urea, creatinine and zinc in the serum of diabetic patients and controls are shown in table (I). The FBS and HbA$_{1c}$ levels in both of the diabetic groups were significantly higher (P<0.001) than the control group, but there was no significant difference (P>0.05) between type I and type II diabetic groups. Data also showed that 86.9% and 85.4% of patients in group 1 and group 2 respectively had an HbA$_{1c}$ level of ≥ 7%, which is the recommended value by ADA [14], to avoid diabetic complications, indicating that blood sugar levels in those patients were poorly controlled. The mean serum zinc levels in type I and type II diabetic patients were significantly higher (P<0.05) than in the control subjects, however no significant (P>0.05) difference was found between the diabetic groups. Results of our study were in agreement with some other investigations [7], [8]. In contrast some researchers have found decreased levels [5], [6], and some have found no changes [9], [10], as compared with healthy subjects. High values.

Obtained in this study could be attributed to the existence of zinc in the insulin doses that injected to the patients especially type I diabetic group or may be due to heterogenecity of patients. Data obtained in this study also indicated that serum zinc levels had no significant correlation with either FBS or HbA$_{1c}$, which support the findings of some other observations [9], [15].

Serum creatinine and urea levels (as markers for kidney function) of the diabetic patients and controls are presented in Table I. Serum creatinine levels in both diabetic groups were non-significantly higher (p>0.05) than the control group, whereas serum urea levels in diabetic patients were significantly higher (p<0.05) than the control subjects. However, both urea and creatinine levels in all groups were within the normal range, which was consistent with some other observations [16]. It is noteworthy that both types of diabetes are associated with unusual urinary zinc excretion [4], [16].

Table II shows the mean values of serum zinc levels in diabetic patients and healthy controls according to their age groups. Data obtained for type II diabetic patients and control subjects indicating that there was non-significant decrease in serum zinc levels with increasing age. These results were in agreement with that observed in Nigerian population [16]. These results could be attributed to the increased urinary loss of trace elements associated with ageing [4], [16], due to a reduction in renal function, diabetic nephropathy and gastrointestinal malabsorption. On the other hand, the age group (46-60 years) of type I diabetic patients showed a noticeable elevation in serum zinc level, which may be attributed to the presence of zinc in the insulin injections used to treat those patients.

TABLE I
ZINC, HBA1C, FBS, CREATININE AND UREA LEVELS IN THE SERUM OF DIABETIC AND CONTROL GROUPS

	Group 1	Group 2	Control Group
Zinc	0.72ppm ± 0.35	0.47ppm ± 0.48	0.21ppm ± 0.16
HbA1c	9.5% ± 2.32	9.63% ± 2.4	5.54% ± 0.81
FBS	209.84mg/dl ± 69.2	190.33mg/dl ± 65.69	89.72mg/dl ± 26.22
Creatinine	0.77 mg/dl ± 0.56	0.68 mg/dl ± 0.34	0.55 mg/dl ± 0.19
Urea	11.17 mg/dl ± 4.43	11.50 mg/dl ± 4.70	8.95 mg/dl ± 4.10

TABLE II
SERUM ZINC CONCENTRATION IN DIABETIC AND CONTROL SUBJECTS ACCORDING TO AGE GROUPS

Age group	Group 1	Group 2	Control Group
30 – 45 years	0.45 ppm ± 0.36	0.56 ppm ± 0.35	0.25 ppm ± 0.21
46 – 61 years	0.84 ppm ± 0.16	0.514 ppm ± 0.327	0.22 ppm ± 0.142
62 – 81 years	0.49 ppm ± 0.06	0.379 ppm ± 0.32	0.134 ppm ± 128

Table III shows the relationship of gender with the serum zinc levels in both types of diabetic patients and control subjects. No differences in serum zinc levels were observed between males and females in type II diabetic and control groups. However, in type I diabetes group female subjects showed non-significant higher values than males. This may be attributed to the higher urinary excretion of zinc in diabetic males compared with diabetic females [16]. Similar study found a significant higher serum zinc values in type II. diabetic females when compared with males [16]. In contrast serum zinc levels showed no significant difference between male and female in type II diabetic patients [15], and in healthy individuals [15].

TABLE III
SERUM ZINC CONCENTRATION IN DIABETIC AND CONTROL GROUPS ACCORDING TO THE GENDER OF THE SUBJECTS

	Group 1	Group 2	Control Group
Male	0.56ppm ±0.78	0.49 ppm ±o.46	0.21 ppm ±0.17
Female	0.83 ppm ±1.5	0.43 ppm ±0,5	0.23 ppm ± 0.17

Table IV shows the effect of duration of diabetes on the serum zinc levels in diabetic patients. The obtained results showed that in type I diabetic group there was a non-significant increase in serum zinc levels with increasing duration of diabetes. On the other hand, type II diabetic group showed non-significant decreasing in serum zinc levels along with increasing duration of diabetes .Our findings on type II diabetic group were consistent with some other investigations [16]. which could be attributed to the increased urinary excretion of zinc with increasing duration of diabetes [16], however in type I diabetic patients it seems that increased urinary loss of zinc did not overcome the accumulation of zinc (that injected with insulin doses) with increasing duration of diabetes.

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TABLE IV
SERUM ZINC CONCENTRATION IN DIABETIC PATIENTS
ACCORDING TO THE DURATION OF DIABETES

Duration of diabetes	Group 1	Group 2
1 – 5 years	0.469 ppm ± 0.527	0.5 ppm ± 0.47
6 – 10 years	0.748 ppm ± 0.8	0.46 ppm ± 0.6
≥11 years	0.86 ppm ± 0.15	0.36 ppm ± 0.21

IV. CONCLUSION

In conclusion the obtained data indicate that age, gender, blood sugar level, and duration of disease have no significant effect on the serum zinc levels in diabetic patients. Although some of the present findings were in agreement with previous findings of other researchers, more work is required to clarify the effect of diabetes on zinc metabolism and vice versa.

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