

Comparison of Serum Zinc Level in Patients with Diabetes Type 1 and 2 and Its' Relation to HbA1c

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Article information	Abstract
<p>Article history: Received: 30 Apr 2012 Accepted: 27 Aug 2012 Available online: 12 Mar 2013 ZJRMS 2014; 16(1): 48-50</p> <p>Keywords: Diabetes Mellitus Glycated Hemoglobin Zinc</p> <p>*Corresponding author at: Department of Pediatrics, Arak University of Medical Sciences, Arak, Iran. E-mail: doreh.f@arakmu.ac.ir</p>	<p>Background: Diabetes Mellitus (DM) is a major health care problem. The relationship between DM and zinc has frequently been reported in various research. The present study aims to investigate serum zinc level in patients with type 1 (IDDM) and type 2 (NIDDM). Association between glycated hemoglobin and level of zinc is also evaluated.</p> <p>Materials and Methods: This cross-sectional study was conducted on 60 subjects with DM (Type 1: N=30; Type 2: N=30) who met inclusion criteria of the study. Patients' serum zinc level and HbA1c were measured. Data were analyzed using <i>t</i>-test and Mann-Whitney <i>U</i> test.</p> <p>Results: Seventy five percent of the subjects were female. The average age of the IDDM was 15.36±5.28 years and that of NIDDM was 48.70±11.45 years. The average HbA1c of subjects was 8.06±1.64%. The average serum level of zinc in IDDM group was 95.82±14.51 µg/dl and that of NIDDM was 97.47±32.36 µg/dl, no significant difference was found between the two groups. Serum zinc deficiency was detected in 20% of the patients with NIDDM and 16.6% of the patients with IDDM. However, no significant correlation between HbA1c and serum level of zinc was detected in this study.</p> <p>Conclusion: Zinc deficiency was detected among a significant percentage of IDDM and NIDDM patients, but no significant correlation between serum zinc level and HbA1c was detected.</p>

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Introduction

Diabetes mellitus type 1 and type 2 (IDDM and NIDDM) are among the main health care problems and, due to their increasing incidences, are the leading cause of disabilities such as renal failure, amputations, and blindness as well as mortality around the world. Numerous studies conducted on the etiology, pathogenesis, incidence and prevention of complexities associated with diabetes over the long run have shown that a major part of long-term pathogenesis and incidences are due to oxidative stress [1-7]. On the other hand, the relationship between diabetes and various types of minerals such as zinc, has been reported in several research. Zinc serves as the cofactor of more than 300 enzymes [8] and plays an important role in the function of insulin and carbohydrate and protein metabolism, and also contributes to antioxidant defense. Lack of zinc can result in irreversible damage to cells by oxidative stress and cause/aggravate complications of diabetes [9, 10].

Urinary zinc excretion and difficulties in absorbing it have shown to be the cause of zinc deficiency in diabetics and can worsen the underlying disease [1-11]. Since the results of previous studies indicate that serum level of zinc in diabetics, particularly in IDDM patients, varies, and some studies show an average serum level of zinc less

than, equal to, or more than the control group [5, 7, 12], and also because the relationship between serum zinc level in diabetics and metabolic control of diabetes, i.e. HbA1c, has not been fully verified, in this study we try to investigate the serum zinc level in IDDM and NIDDM patients and find out the relationship between this mineral and HbA1c in the patients.

Materials and Methods

The present cross-sectional study was conducted on 60 patients with DM (Type 1: N=30; Type 2: N=30) who referred to pediatric endocrinology clinics of Amir Kabir and Vali-e-Asr hospitals of Arak. The patients were selected using random sampling method and included in the study after their informed consent were obtained. Then, a form was completed for them which collected information about their age, gender, type of diabetes, duration of suffering from diabetes, type of diabetes treatment, incidence of other diseases, intake of medicine intervening with zinc level. The inclusion criteria allowed patients who did not use zinc supplements, were not diagnosed with acrodermatitis enteropathica, malnutrition, chronic diarrhea, fat malabsorption, liver failure, tumor,

Table 1. Frequency and percentage of DM patients referring to endocrinology clinics of Arak city based on zinc level

Patients	Over Normal Range N(%)	Normal Range* N(%)	Under Normal Range N(%)
IDDM	9(30)	16(53.3)	5(16.6)
NIDDM	5(16.6)	19(63.3)	6(20)
Total	14(23.2)	35(58.3)	11(18.3)

* The normal range of zinc level is 72.6-127 µg/dl for men, 70-114 µg/dl for women, 63.8-110 µg/dl for people under 18

recent surgery and burn, and did not use intervening medicine with zinc ingredient (diuretics, anticonvulsants, neomycin, antacids, cholestyramine, alcohol, laxatives, and penicillamine). Blood sampling (10 ml) was conducted after 12-14 hours of fasting. The serum was separated and the amount of zinc was measured using calorimetry method, RANDOX Kit (Randox Laboratories, Crumlin, UK), and spectrophotometry. Moreover, the amount of HbA1c was measured using immunoturbidometry method and 2018018 kit (Germany). Data analysis was conducted using SPSS-16. The relationship between HbA1c and zinc was tested using *t*-test and the difference between the amount of zinc in the two groups was tested using Mann-Whitney *U* statistic, with $p < 0.05$. This plan was proposed and approved by the ethics committee of Arak University of Medical Sciences.

Results

Of 60 patients participating in the study, 30 were diagnosed with IDDM (11 male and 19 female) and 30 were diagnosed with NIDDM (4 male and 26 female). Overall, 25% of patients were male and 75% were female. The average age of patients with IDDM was 15.36 ± 5.28 years and that of NIDDM patients was 48.7 ± 11.45 . The duration of suffering the disease was 3.89 ± 3.70 years for IDDM patients and 7.70 ± 6.66 years for NIDDM patients. All patients with IDDM used insulin, and of NIDDM patients, 19 used oral hypoglycemic drugs, 8 used insulin and 3 used both oral hypoglycemic drugs and insulin.

The average and standard deviation of HbA1c was overall $8.06 \pm 1.64\%$, 8.33 ± 1.53 (95% CI=7.47-8.65) for IDDM patients, and 7.79 ± 1.73 (95% CI=7.79-8.87) for NIDDM patients. Of all the subjects, 2 were in low control group, 14 in average control group, 16 in acceptable control group, and 5 fell within non-diabetic range. The average amount of zinc in the serum was 95.82 ± 41.51 µg/dl (95% CI=81.09-110.55) in IDDM patients, 97.42 ± 32.36 µg/dl (95% CI=85.88-108.96) in NIDDM patients, and no significant difference was observed between the two groups. The frequency and percentage of the patients in both groups in terms of zinc amount are presented in table 1. In this study, no significant correlation was found between serum zinc level and HbA1c.

Discussion

In the present study, a significant number of IDDM and NIDDM patients suffered from zinc deficiency. However, no significant relationship was found between

serum zinc level and HbA1c. More than half of the patients lacked adequate diabetes control in terms of HbA1c, particularly IDDM patients, who both had higher levels of HbA1c and more patients were in the low control group (HbA1c > 8%).

Nonetheless, the average of HbA1c in NIDDM group was less than that in the study conducted by Farvid et al. in Tehran [13]. Quraishi et al. showed that zinc deficiency is accompanied by insulin secretion deficiency and insulin resistance [14]. In a study on 36 DM patients conducted by Viktorinova, in 13.9% of NIDDM patients with HbA1c > 8% zinc deficiency was observed; however, in IDDM patients no zinc deficiency was seen, which can be due to the low number of IDDM patients who were just 11 individuals [15]. In our study, zinc deficiency was observed in both IDDM and NIDDM patients. Although the percentage of deficiency was higher in NIDDM group, the difference was not significant.

Moreover, in Viktorinova's study, increase in copper level and copper-to-zinc ratio, zinc and magnesium deficiency, and reverse relation between zinc and HbA1c were shown [15]. In a case-control study in Korea, comparison of NIDDM patients and healthy individuals showed that zinc deficiency was more among NIDDM patients, and that 4 weeks of intaking zinc supplements by DM patients with higher HbA1c and lower zinc was followed by better glucose control [16].

In Farvid's study in Tehran, using zinc supplements by NIDDM patients was accompanied by better blood glucose control and glomerular function of kidney [13]. In this study, zinc average was 98.9 ± 17.6 , which is similar to the results of our study. However, the patients in that study had higher levels of HbA1c compared to the patients in our study, which indicates lower control of diabetes in the patients. Unlike our study, in Cunningham's study conducted on IDDM patients, despite the twofold urinary excretion of zinc in insulin-dependent DM patients, serum zinc level in these patients was reported as normal and 50 mg supplement for 28 days was accompanied by increase in HbA1c in patients and was not recommended [17].

In the present study conducted on more IDDM patients with lower DM control, the level of serum zinc has been reported as low. In another study conducted on 20 IDDM patients in Brazil, serum zinc level was not different from that in the control group (it was normal) and 4-month intake of zinc supplement did not lead to any change in serum zinc level of the patients [12].

One of the limitations of this study is the absence of a control group. Moreover, as NIDDM is observed more at older ages and the disease lasts longer, the two groups were not homogeneous in this sense. Another limitation

of this study is heterogeneity of patients in terms of gender and insulin use duration, which are recommended to be considered in future studies. Although in this study no significant correlation between HbA1c and serum level of zinc was detected, zinc deficiency was detected among both IDDM and NIDDM patients. So other studies with more patients and clinical trial effect of zinc in lower diabetes complications are suggested.

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Authors' Contributions

All authors had equal role in design, work, statistical analysis and manuscript writing.

Conflict of Interest

The authors declare no conflict of interest.

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