ORIGINAL ARTICLE

EFFECT OF ZINC SUPPLEMENTATION ON SERUM FASTING BLOOD SUGAR AND HbA1c IN ADULT DIABETICS ON ORAL HYPOGLYCEMIC AGENTS

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ABSTRACT

Background: Studies on humans have shown the beneficial effects of zinc supplementation in patients with diabetes. The objective of this study was to determine the effects of zinc supplementation on fasting blood glucose and HbA1c% in adult diabetic patients on oral hypoglycemic agents.

Material & Methods: This single blinded, randomized control trial was conducted in JPMC, Karachi, Pakistan, from April, 2015 to July, 2015. Sample size was 101 adult diabetic type 2 patients selected through consecutive sampling technique. Subjects were randomly allocated to experimental and control groups. All adults with T2DM on oral hypoglycemic drugs were included. Those having any complications were excluded from the study. Zinc sulphate 20 mg/day plus oral hypoglycemic to intervention group, and placebo plus oral hypoglycemic to control group were given. Demographic variable was ethnicity. Research variables were FBG and HbA1c. Ethnicity had attributes of Pathan, Punjabi and Urdu speakers. Data was analyzed on SPSS. ANOVA test was applied to see the mean difference in experimental and control group, among different ethnicities.

Results: Out of 101 patients 49(48.5%) were males and 52 (51.5%) females. Thirty three subjects (32.2%) were pathan, 32(31.7%) were punjabi and 36(35.6%) were urdu speakers. The mean of difference between experimental and control groups for changes in FBG was 24.03 ($p<0.001$) in Pathans, 17.11 ($p<0.001$) in Punjabies and 19.56 ($p<0.001$) in Urdu speakers. While the mean of difference in HbA1c was 0.67 ($p<0.99$), 0.6 ($p<0.99$) and 0.56 ($p<0.99$) in Pathans, Punjabies and Urdu speakers respectively.

Conclusion: This study indicates significant improvements of Fasting Blood Glucose in zinc supplemented diabetic patients of different ethnic groups.

KEY WORDS: Type 2 diabetes; HbA1c%; Fasting blood glucose (FBG); serum zinc; ethnicity; oral hypoglycemics.

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INTRODUCTION

Diabetes is a global public health problem. According to the data published by international diabetes federation (IDF),[1] 415 million adults are suffering from Type 2 diabetes mellitus (T2DM) and it has been predicted that this figure would reach to 642 million by the year 2040. Asia is the epicenter of diabetes and presently 60% of all diabetic subjects live here. The mechanisms that result in T2D are complex, therefore, not completely understood. Nonetheless, some studies suggest that supplementation with zinc may modify T2DM characteristics, including dyslipidemia, chronic hyperglycemia, and insulin resistance.[2] Molecular and cellular studies reveal that mineral zinc plays a significant role in insulin biosynthesis and action under normal physiological conditions.[3] Epidemiological studies observe an

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association between reduced zinc status and T2DM.[4] This association may be because of loss of zinc through kidneys due to diabetic nephropathy. In several studies, urinary excretion of zinc is increased and serum levels decreased in T2DM patients as compared to controls.[5,6] Different studies examine the effect of zinc supplementation in T2DM patients and show an improvement in glycemic control, reduction in blood glucose and HbA1c%.[7-9] HbA1c and fasting blood glucose is an effective screening tool and a gold-standard method for initial detection of T2DM.[10,11] To the best of our knowledge, no data on the effects of zinc supplementation in combination with oral hypoglycemics in different ethnicities is available. The objective of this study was to determine the effects of zinc supplementation on fasting blood glucose and HbA1c% in adult diabetic patients on oral hypoglycemic agents.

MATERIALS AND METHODS

This single blinded, randomized control trial was conducted in Jinnah Post Graduate Medical Center (JPMC), Karachi, Pakistan, from April, 2015 to July, 2015. Sample size was 101 adult diabetic type 2 patients selected from diabetic clinic of JPMC through consecutive sampling technique. Subjects were randomly allocated to experimental and control groups consisting of 55 and 46 subjects each respectively. All adults with T2DM on oral hypoglycemic drugs were included. Those having renal insufficiency, liver failure or other chronic diseases taking hormonal replacement therapy, pregnant or lactating mothers, taking insulin for diabetes management, taking any other drug containing zinc were excluded from the study. The study was approved from Ethical Committee and Institutional Review Board of JPMC. Informed consent forms of all the patients were taken. Zinc sulphate 20 mg/day plus oral hypoglycemic (metformin and glabinclamide) to intervention group, and placebo plus oral hypoglycemic to control group were given. Blood samples were drawn from all patients before taking breakfast or drugs. For analysis of HbA1c% and total cholesterol, 3 mL blood was collected in EDTA tube, whereas remaining blood was collected in gel tube followed by centrifugation at 4000 rpm for 20 minutes and stored at -80°C for further analysis. The previously collected blood samples were further subjected to laboratory analysis. Serum zinc was measured on inductively coupled plasma-optical emission spectrometry (ICP-OES) (PerkinElmer, Optima 2000). HbA1c% was measured on D-10 (Bio-Rad) dual Program Kit (Reorder Pack Cat. No. 220-0101) High performance liquid chromatography, whereas fasting blood glucose, serum creatinine and total cholesterol were measured enzymatically. Demographic variables were gender and ethnicity. Research variables were FBG and HbA1c. Ethnicity had attributes of Pathan, Punjabi and Urdu speakers.

Data was analyzed on SPSS, IBM Version 22. Descriptive statistics were reported for fasting blood glucose (FBG) and HbA1c%. ANOVA test was applied to see the mean difference in experimental and control group, among different ethnicities.

RESULTS

Out of 101 patients, 33 subjects (32.2%) were pathan, 32 (31.7%) were punjabi and 36 (35.6%) were urdu speakers. Monthly changes in FBG and HbA1c levels for experimental and control groups stratified bay ethnicity along with mean difference in the two groups of each ethnic group are given in the table 1.

Table 1: Studied parameters of experimental and control groups stratified by ethnicity, (n=101)

Ethnic Groups	Group	Monthly change from 0 day to 3rd month	
		FBG (mg/dL)	HbA1c (%)
Patthan (n = 33)	Control (n = 15)	0.47 ±1.96	0 ± 0.03
	Zinc Sulphate (n = 18)	24.5 ±9.19	0.67 ±0.26
	Zinc Sulphate vs Control Mean diff (P-value)	24.03 (<0.001)	0.67 (<0.99)
Punjabi (n = 32)	Control (n = 15)	2.6 ± 4.07	0.03 ±0.15
	Zinc Sulphate (n = 16)	19.71 ±7.91	0.63 ±0.07
	Zinc Sulphate vs Control Mean diff (P-value)	17.11 (<0.001)	0.6 (<0.99)
Urdu Speaking (n=36)	Control (n = 16)	2.44 ±6.43	0 ±0.03
	Zinc Sulphate (n = 20)	22 ±6.03	0.56 ±0.17
	Zinc Sulphate vs Control Mean diff (P-value)	19.56 (<0.001)	0.56 (<0.99)

P-value ≤ 0.05 was considered as statistically significant.

DISCUSSION

The patients having serum zinc levels below 70μg/dL are considered as zinc deficient.[12] This low serum zinc level may be due to hyperzincuria or impaired zinc absorption, as shown in the previous studies.[7,13] Studies on humans show the beneficial effects of zinc supplementation in patients with diabetes by improving diabetes complication.[14-16] Serum zinc have an impact on HbA1c levels, as our results demonstrate that after three months zinc supplementation HbA1c% is decreased (statistically non-significant) in intervention group as compared to control group. With 30 mg/day Zinc supplementation in different countries, HbA1c% was reduced unevenly, like Tunisian adults with 30 mg/day zinc supplementation gave 1.2% reduction in mean HbA1c% at the end of study,[17] while, Iraqi population showed a reduction of 0.3% in HbA1c% with similar dose.[7] In addition to our own observation the reported data suggest that different ethnic groups have different sensitivity and specificity for HbA1c% that are related to genetic differences in the hemoglobin concentration, rates of glycation, and lifespan of red blood cell.[18] The beneficial effect of zinc supplementation on overall glycemic control has been studied by Gunasekara et al.[19] Considering that zinc has a key role in insulin biosynthesis, storage, release, action, and carbohydrates metabolism,[20] and also decrease glucagon and glucose-6-phosphatase levels.[21] Furthermore zinc supplementation also improves concentration of insulin like growth factor Ⅰ (IGF-Ⅰ) in T2DM patients.[22] A study conducted by Ezaki[23] addresses the translocation of zinc glucose transporter (GLUT) to the plasma membrane, which results in an increased glucose uptake in tissue cells, and thus leads to reduction of blood glucose levels. The reduction of FBG in this study is primarily related to above discussed reasons; however, different ethnic groups have a disparate response that can be attributed to difference in serum zinc absorption and HbA1c% reduction. When dosage of 660 mg/day zinc was studied in different countries like in Bangladesh by Hayee MA,[24] in India by Gupta R,[25] and in Israel by Raz I,[26] FBG reduction was again uneven, showing disparate response to zinc supplementation.

Beside the positive correlation of zinc supplementation and glycemic control in T2DM, a vast number of studies accomplished minor or no impact of zinc on glycemic control, except serum zinc enhancement.[27] However, results of this study demonstrate that FBG levels have significantly reduced in all ethnic groups, Indicating that serum zinc has an impact on overall glycemic control and.[28]

CONCLUSION

This study indicates significant improvements of Fasting Blood Glucose in zinc supplemented diabetic patients of different ethnic groups.

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CONFLICT OF INTEREST
Authors declare no conflict of interest.
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None declared.

AUTHORS' CONTRIBUTION

Conception and Design:	ZGB, MH
Data collection, analysis & interpretation:	ZGB, SB, WAF
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