

# Evaluation of Salivary Zinc Level in Chronic Periodontitis Patients with Type II Diabetes Mellitus and Non-Diabetics in Khartoum State 2019: A Case Control Study

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## Research article

**Keywords:** Zinc, Chronic periodontitis, Type II diabetes mellitus, Saliva

**Posted Date:** May 13th, 2020

**DOI:** <https://doi.org/10.21203/rs.3.rs-28095/v1>

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# Abstract

**Background:** Zinc micronutrient is essential for human health, there is accumulating data that zinc level is altered in both diabetes mellitus and chronic periodontitis, but the exact role of zinc in the pathogenesis of those conditions stay unclear. The present study was done to evaluate the salivary zinc level in chronic periodontitis patients with type II diabetes mellitus and non-diabetics.

**Methods:** A Case-control study was conducted in Khartoum state between June and December 2019 at Khartoum dental teaching hospital, Jaber Abo-alezz diabetic center and Al-Neelain University. Chronic periodontitis was diagnosed with CAL  $\geq$  3mm. Patients with *Hemoglobin A<sub>1c</sub>*  $\leq$  6.5% were considered as controls for diabetes. Salivary zinc level was assessed in 64 subjects, 26 systemically healthy subjects without chronic periodontitis (Group A), 19 patients with chronic periodontitis otherwise systemically healthy (Group B) and 19 diabetic patients with chronic periodontitis (Group C). Atomic absorption spectrophotometry method was utilized to measure the zinc level in saliva. The data were statistically analyzed by analysis of variance and Scheffe multiple comparison test utilizing statistical software SPSS version 20.

**Results:** The results showed that salivary zinc level decreased in periodontitis patients with and without type II diabetes mellitus compared to healthy control (P-value < 0.05), whereas there was no statistically significant difference between salivary zinc level in periodontitis patients and diabetic patients with periodontitis(P-value > 0.05).

**Conclusion:** Low salivary zinc level may predispose to the risk of developing chronic periodontitis.

## Introduction

Diabetes Mellitus (DM) is a metabolic syndrome with hyperglycemia. Worldwide, people with DM are expected to increase from 180 million in 2000 to 320 million in 2025. It has many complications, including nephropathy, retinopathy, neuropathy and cardiovascular problems. In addition, patients may suffer from oral problems like xerostomia, odontogenic abscesses and periodontitis.<sup>(1)</sup>

Periodontitis is a microbial inflammatory disease that causes tissue destruction due to altered immunoinflammatory processes.<sup>(2)</sup> It affects (20–50%) of the world wide population.<sup>(3)</sup> Diagnoses of periodontitis are made by several periodontal parameters, including Plaque Index(PI), Gingival Index(GI), and Clinical Attachment Level(CAL).<sup>(4)</sup> It is mainly treated by the removal of the causative agents (dental plaque) by utilizing the scaling and root planning.<sup>(5)</sup>

Zinc (Zn) is one of the micronutrients that is very important for normal growth, maintaining the integrity of the cell membrane, and for insulin action .<sup>(2, 6)</sup> It is found mainly in foods of animal products.<sup>(7)</sup> Zn has a role in bone metabolism by stimulating osteoblastic bone synthesis. In addition to its antioxidant properties.<sup>(2)</sup>

In a study made by Sprren kiilerich et al. They observed that Zn absorption is decreased in diabetic patients, causing intracellular Zn depletion .<sup>(8)</sup> Another study concluded that Zn level was increased in type II DM without periodontitis, while its level decreased in patients with both DM and periodontitis. <sup>(6)</sup> In 2013, Biju Thomas and his team conducted a case- control study that showed a low serum level of Zn in patients with both periodontitis and type II DM.<sup>(9)</sup> Although a role of Zn in periodontitis is not fully understood.<sup>(2)</sup>

In the present study, whole saliva rather than blood is used because its non-invasive, as well as it can be used for diagnosis of different systemic diseases with oral manifestations.<sup>(1)</sup>

## Methods

This is a case control study conducted at Khartoum Dental

Teaching Hospital, Al-Neelain Dental Periodontology Clinics and Jaber Abo-alezz Diabetic Center in Khartoum state, Sudan, between June and December 2019. Chronic Periodontitis patients with or without type II DM attending the clinic are classified into three main groups, group A: 26 systemically healthy subjects without chronic periodontitis, group B: 19 subjects with chronic periodontitis but systemically healthy, group C: 19 subjects with type II DM and chronic periodontitis, age group was from 30–60 years including both gender with minimum 20 teeth.

The exclusion criteria included the presence of any systemic diseases for group A and B, patients with systemic disease other than DM for group C, or on medications other than those for DM, any patients with history of mouth wash within last 3monthes, smokers, alcoholic, snuffers, pregnant ladies or women taking contraceptive pills and patients with aggressive periodontitis.

After filling the questionnaire and taking medical and dental history, Periodontal clinical parameters (GI, CAL) were used to detect periodontal disease by qualified dentist (EA) using William's periodontal probe as follow: The Gingival Index (GI) was measured using index of Æe and silness (1963),<sup>(10)</sup> periodontal probe was inserted apical to the gingival margin and the tissues are gently stroked with the instrument. <sup>(11,12)</sup> GI should be  $\leq 2$  for group A. Clinical Attachment Loss (CAL) is the distance from the cemento-enamel junction (CEJ) to the base of the proeable crevice. <sup>(11,12)</sup> Chronic Periodontitis was diagnosed with CAL  $\geq 3$  mm. patients with *Hemoglobin A<sub>1c</sub>* (Hb A<sub>1c</sub>)  $\leq 6.5\%$  were considered as controls for diabetes. Saliva was collected in a quiet clinic, subjects were instructed not to eat, or drink one hour prior to sample collection, each subject was asked to rinse with deionized water immediately before the procedure, then to accumulate saliva in the mouth 2 min and to spit in sterile container. This procedure continued for 6 min to collect unstimulated saliva. Zn was analyzed by Atomic Absorbance Spectrophotometer, and the results were expressed in mg/L<sup>(9,13)</sup>

P-value for significance were applied (P-value < 0.05 was found to be statistically significant), data normality was tested using Kolmogorv-Smirnov and Leven's tests, intergroup comparison was done using

Scheffe test. ANOVA test showed statistical significant (P-value < 0.05). Mean and SD were calculated. The data were analyzed using SPSS version 20. Then the data were presented as tables and figures.

## Results

The age and sex distribution of all subjects in the study are shown in Table 1. The Mean and standard deviation of salivary Zn levels in different groups are given in Fig. 1. The salivary zinc level is highest in Group A (Control Group) which show mean and standard deviation of ( 0.614 ± 0.128) when compared to Group B and C, which show mean and standard deviation of (0.241 ± 0.103) and (0.295 ± 0.113) respectively. Data normality was tested using Kolmogorv-Smirnov and Leven's tests. Then statistical analysis by one way analysis of variance (ANOVA) showed statistical significance (P-value < 0.05). Intergroup comparison was made using Scheffe test for multiple comparisons, and it showed that there was a difference in means difference between Group A (control) and Group B (Periodontitis), and between Group A and Group C (Periodontitis with diabetes). With Zn amount in the Group A was on average of 0.374 greater than Group B, salivary Zn amount in group A was also higher by 0.319 than group C. On the other side there was no statistically significant difference in means detected between Group B and Group C Table 2.

Table 1  
Age and sex distribution in the study population (N = 64).

Groups	N	Range(Y)	Mean(Y) ± SD	Male (%)	Female (%)
Control	26	30–60	43.46 ± 6.813	12 (46%)	14 (54%)
Periodontitis	19	30–60	47.11 ± 7.81	8 (42%)	11 (58%)
Periodontitis and Diabetes	19	30–60	51.53 ± 7.59	12 (63%)	7 (37%)

N = number of sample size for each group, SD = Standard Deviation.

Table 2  
Inter-Group comparison with Scheffe test.

(I) Group	J	Mean Difference (I-J)	Sig.
Control	Periodontitis	*0.374	0.000
	Periodontitis and Diabetes	*0.319	0.000
Periodontitis	Control	*-0.374	0.000
	Periodontitis and Diabetes	-0.054	0.363
Periodontitis and Diabetes	Control	*-0.319	0.000
	Periodontitis	0.054	0.363

## Discussion

In general, zinc plays a major role in humans through its role in regeneration, for coping with oxidative stress, and for satisfactory immune response<sup>(9)</sup>. The present study was undertaken to evaluate salivary Zn level in chronic periodontitis patients with or without type II DM. The results of the study demonstrated lower salivary Zn level in periodontitis patients compared to the control group. Frithiof et al. and Tulin et al, in separate studies, found diminished serum Zn levels in individuals with periodontitis.<sup>(14,15)</sup> In contrast, Freeland et al. found no difference.<sup>(16)</sup> other objective of the present study, was to evaluate the salivary zinc level in type II diabetics with chronic periodontitis, the result of the study illustrated lower levels of zinc in type II DM patients with chronic periodontitis when compared to healthy individuals. Whereas there was no statistically significant difference found between diabetic patients with chronic periodontitis and systemically healthy individuals with chronic periodontitis. Although both animal and human studies have suggested a role of decreased Zn level in the pathogenesis of type II DM. Thomas et al. found that salivary zinc levels decreased in diabetics with chronic periodontitis compared to healthy individuals with and without periodontitis.<sup>(9)</sup> The present study may have therapeutic implications in the use of Zn in periodontal therapy. Zn citrate-containing dentifrices have a remarkable effect on reducing gingivitis in humans.<sup>(17)</sup>

This study was limited primarily by its small sample size. Another limitation is that salivary zinc concentration may not be the best record of micronutrient levels in periodontal tissues.

## Conclusions

Salivary Zn level was decreased in patients with chronic periodontitis when compared to the control Group, it is also decreased in Diabetic patients with chronic periodontitis when compared with the control group. Whereas there was no statistical significant difference in the salivary Zn level in patients with chronic periodontitis compared with diabetic patients with chronic periodontitis. More longitudinal studies with a larger sample size are recommended to be carried out, with a separate group of diabetic patients without periodontitis to know the exact relation between diabetes and Zn, evaluation of salivary Zn level before and after periodontal therapy and Zn supplements in the form of mouthwashes or tooth paste are recommended to be carried out.

## Abbreviations

ANOVA: Analysis of variances; CAL: Clinical attachment loss; CEJ: Cemento-enamel junction; DM: Diabetes mellitus; GI: Gingival index; Hb A<sub>1c</sub>: Hemoglobin A<sub>1c</sub>; Zn: Zinc.

## Declarations

## Acknowledgements

EA is very thankful to her teacher and her senior Dr. Lamis kaddam and Dr. Nour Elkhair respectively, for their great advice, encouragement and assistance.

## Funding

Not applicable

## Availability of data and materials

The data used during the present study are available from the corresponding author on request.

## Author's contributions

EA and AA participated in writing manuscript and in the study design, they also analyzed and interpreted the results. EA performed data collection and laboratory studies. All authors read and approved final manuscript.

## Ethical approval and consent of participate

Patients asked to sign an informed consent after full explanation of the procedure. Ethical clearance was obtained from the university ethical committee, Khartoum state ministry of health and from Khartoum dental teaching hospital.

## Consent for publication

Not applicable

## Competing interests

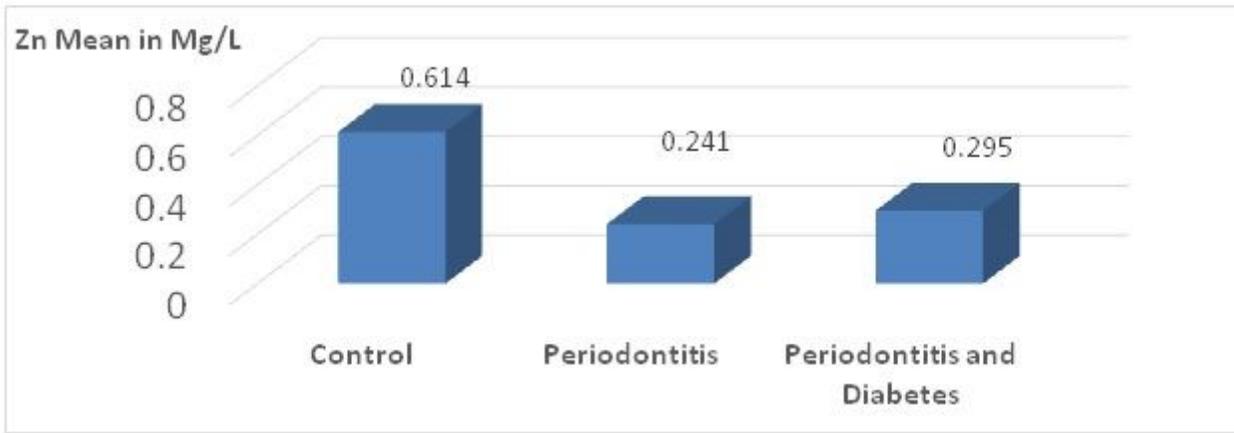
The authors declare that they have no competing interests.

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## Figures



**Figure 1**

Comparing Mean of salivary Zn levels in Group A (control), Group B (Periodontitis), and Group C (Periodontitis and diabetes).