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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

Eman A. Alhannan[1] and Azza O Alawad[2]

[1]Lecturer, Department of Physiology, Faculty of Medicine, Al Neelain University, **Sudan**
[2]Associate Professor, Department of Physiology, Faculty of Medicine, Al Neelain University, **Sudan**

***Correspondence:** aoalawad@gmail.com **Received 08-06-2022, Revised: 15-07-2022, Accepted: 16-07-2022 e-Published: 17-07-2022**

Zinc micronutrient is essential for human health. There is accumulating data that zinc level is altered in both diabetic patients and patients with chronic periodontitis; however, the zinc status results in those who have the conditions is not conclusive. The present study aims to compare the salivary zinc level in chronic periodontitis patients with and without type II diabetes mellitus. We conducted a case-control study in three medical centers in Khartoum, Sudan. The level of zinc was assessed in 64 subjects, 26 systemically healthy control 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). Chronic periodontitis was diagnosed with Clinical Attachment Level (CAL) ≥ 3mm. Atomic absorption spectrophotometry method was utilized to measure the salivary zinc level. The data were analyzed by Scheffe multiple comparison test and analysis of variance, utilizing the Statistical Package for the Social Sciences (SPSS Inc., Chicago, IL, USA), version 20.The results showed that salivary zinc level is decreased in periodontitis patients with and without type II diabetes mellitus compared to healthy controls (P-value<0.05), whereas the difference in salivary zinc level between periodontitis patients with and without diabetes was statistically insignificant (P-value > 0.05).Decreased salivary zinc level is associated with chronic periodontitis.

Keywords: Zinc; Chronic periodontitis; Type II diabetes mellitus; Saliva.

INTRODUCTION

Diabetes Mellitus (DM) is a common metabolic syndrome with many short-term and long-term complications including oral findings like xerostomia, odontogenic abscesses and periodontitis (Bakianian-Vaziri et al. 2010).

Periodontitis is a microbial inflammatory disease that causes tissue destruction due to variable immune-inflammatory reactions (Taruet al. 2017). It affects (20-50%) of the world-wide population (Nazir et al. 2017). Diagnoses of periodontitis are made by several periodontal parameters, including Plaque Index (PI), Gingival Index (GI), and Clinical Attachment Level (CAL) (Bezerra-Júnior et al. 2010). It is mainly treated by the removal of the causative agents (dental plaque) using the scaling and root planning (Najeeb et al. 2016).

Zinc (Zn) is one of the micronutrients that is very important for normal growth, integrity of the cell membranes, and for normal insulin action (Taru et al. 2017; Pushparani et al. 2014). It is found principally in foods of animal products (Al-Maroofand Al-Sharbatti, 2006). Zn has a role in bone metabolism by stimulating osteoblastic bone synthesis. In addition to its antioxidant properties (Taru et al. 2017).

Many previous studies investigated the association of Zn, periodontitis and diabetes mellitus. Kiilerich and colleagues observed decreased Zn absorption in diabetic patients, causing intracellular Zn reduction (Kiilerich et al. 1990). 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 (Pushparani et al. 2014). In 2013, 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 (Thomas et al. 2013); however, the role of Zn in periodontitis is not fully understood (Taru et al. 2017).

In the present study, whole saliva rather than blood was used for evaluation of the Zn status. The aim of the study is to evaluate the zinc level of saliva in chronic periodontitis patients with and without type II diabetes mellitus.

MATERIALS AND METHODS

A case control study was conducted in Khartoum Dental Teaching Hospital, Al-Neelain Dental Periodontology Clinics and Jaber Abo-Alizz Diabetic

Center in Khartoum, Sudan, between June and December 2019. Chronic Periodontitis patients attending the clinic were classified into three main groups, group A, 26 systemically healthy control 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. All the patients were between 30 and 60 years old, including both gender and has a minimum of 20 teeth.

The exclusion criteria were presence of any systemic diseases for group A and B, a systemic disease other than DM for group C, use of medications other than those for DM, history of mouth wash within the last 3monthes, smoking, alcohol consumption, sniffing, pregnancy or use of contraceptive pills and presence of signs of aggressive periodontitis.

Each participant was asked to fill a questionnaire and give full medical and dental history. The periodontal clinical parameters (GI, CAL) were used to detect periodontal disease by qualified dentist (EA) using William's periodontal probe. The Gingival Index (GI) was measured using index of Lŏe and Silness (1963) (Fischman, 1998). The periodontal probe was inserted apical to the gingival margin and the tissues were gently stroked with the instrument (Loe, 1967; Armitage, 1996). Clinical Attachment Loss (CAL), as a distance from the Cemento-Enamel Junction (CEJ) to the probing depth, was measured for all participants (Loe, 1967; Armitage, 1996). Chronic Periodontitis was diagnosed with CAL ≥ 3mm. All control subjects had *Hemoglobin* A_{1c}(HbA_{1c}) ≤ 6.5%. For saliva collection, subjects were instructed not to eat, or drink one hour prior to sample collection. Each subject was asked to rinse his mouth with deionized water immediately before the procedure, then to accumulate saliva in the mouth for 2 min and to spit in sterile container. The procedure continued for 6 min to collect unstimulated saliva. Zn was analyzed by Atomic Absorbance Spectrophotometer, and the results were expressed in mg/L(Thomas et al. 2013; Ayinampudi and Narsimhan, 2012).

Statistical analysis was conducted by utilizing the Statistical Package for the Social Sciences (SPSS Inc., Chicago, IL, USA), version 20. The data normality was tested using Kolmogorov-Smirnov and Leven's tests and intergroup comparison was done using Scheffe test. The results mean and SD were calculated for each group. The difference in means between the three groups was analyzed by the ANOVA test. Statistical significance was accepted for $p< 0.05$.

RESULTS

Table 1 shows general characteristics of the participants in each group. The mean (SD) ages were 43.46 (6.81), 47.11(7.81) and 51.53(7.59) for the groups A, B and C, respectively. Figure 1 shows the mean and standard deviation of salivary Zn level of the different groups. The zinc level is highest in group A (0.614 ± 0.128) when compared to both group B (0.241±0.103) and C (0.295 ± 0.113). Intergroup comparison showed significant differences between group A (control) and group B (Periodontitis), and between group A (control) and group C (Periodontitis with diabetes). The absolute differences were about 0.374 greater in group A than group B,and 0.319 greater in group A than group C. The difference between group B and C was statistically insignificant (table 2).

Table1: 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.

Table2: 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

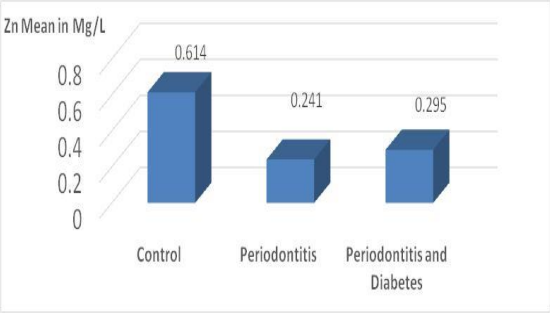

Figure1: Comparing Mean of salivary Zn levels in Group A (control), Group B (Periodontitis), and Group C (Periodontitis and diabetes).

DISCUSSION

Zinc plays an important role in regeneration of cells, proper function of the immune system and coping with oxidative stress (Thomas et al. 2013). The results of this study demonstrated lower salivary Zn level in periodontitis

patients compared to the control group. Similar findings were reported by Frithiof et al. and Tulin et al who reported diminished serum Zn levels in individuals with periodontitis (Frithiof et al. 1980;

Kuraner et al. 1991). A recent experimental study showed better oral and periodontal health in zinc-fed rats compared to zinc-deficient rats (Seyedmajidi et al. 2014). In contrast to these results, Freeland et al. found no difference between the two groups in humans (Freeland et al. 2019). Our finding further confirms the importance of zinc in oral health.

In this study, we also investigated the association of zinc status with type II diabetes mellitus. We found insignificant difference between diabetic patients with chronic periodontitis and systemically healthy individuals with chronic periodontitis. On the other hand, the comparison between diabetic patients with chronic periodontitis and the healthy control subjects (without diabetes or chronic periodontitis) showed lower levels in the first group, indicating that the association is related to periodontitis rather than diabetes. This finding is not consistent with other animal and human studies that suggested a role of decreased Zn level in the pathogenesis of type II DM. For example, Thomas et al. found decreased salivary zinc levels in diabetics with chronic periodontitis compared to healthy individuals with and without periodontitis (Thomas et al. 2013). Our results could be influenced by the small sample size or the duration of diabetes.

CONCLUSION

In conclusion, zinc is an essential trace element for the maintenance of periodontal health. The present study approves and recommends the use of zinc in periodontal therapy. Further study with a larger sample size can be carried out to investigate the relation of zinc deficiency with glycemic control. Health education programs that focus on the micronutrients, including zinc, their benefits and best sources in diet are highly recommended.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

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AUTHOR CONTRIBUTIONS

EAA designed the study and and performed the data collection. AOA supervised all phases of the study. EAA and AOA performed the data analysis and prepared the results. EAA and AOA wrote and reviewed the manuscript and approved the final version.

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