

International Journal of Dental Science and Innovative Research (IJDSIR)

IJDSIR : Dental Publication Service

Available Online at: www.ijdsir.com

Volume – 2, Issue – 5, September – October - 2019, Page No. : 204 - 208

Evaluation and comparison of serum levels of copper in diabetic and chronic periodontitis patients – a biochemical

study

¹Dr. Sneha Suresh, PhD Scholar, Pacific University, Udaipur, India.

²Dr. Smitha Naik, Professor and PhD guide, Department of Oral Pathology and Microbiology, Pacific Dental College and Hospital, Pacific University, Udaipur, India.

³Dr. Anshuman Gautam, Reader, Department of Periodontology, DR. B.R. Ambedkar Dental College and Hospital, Patna, Bihar, India.

⁴Dr.Shashi Ranjan, Reader, Department of Oral pathology and Microbiology, DR. B.R. Ambedkar Dental College and Hospital, Patna, Bihar, India.

⁵Dr. Satish Kumar, Reader, Department of Oral medicine and Radiology, Kusumdevi Sunderlal Dugar Jain Dental college and hospital, Kolkata, W.B.

Corresponding Author: Dr. Sneha Suresh, PhD Scholar, Pacific University, Udaipur, India.

Type of Publication: Original Research Paper

Conflicts of Interest: Nil

Abstract

Diabetes mellitus type 2 is a chronic metabolic disorder affecting about 90% of the population worldwide. It is characterised by an increase in glucose levels in the blood and also an increased resistance of the tissues to insulin and in some cases this leads to an insufficiency of insulin production altogether. It is also known that diabetic individuals are more prone to complications (neuropathy, nephropathy, retinopathy etc) and Periodontitis is the sixth complication. The increased blood glucose levels do not explain all the complications and it has been found that reactive oxygen species (ROS) and advanced glycation end products (AGEs) are responsible for tissue destruction. Periodontitis is an inflammatory condition affecting the supporting structures of the tooth such as the gingiva, alveolar bone, periodontal fibres and cementum. Although one of the common causes of periodontitis is bacterial induced immuno-inflammatory reactions, it is known that reactive oxygen species (ROS) and advanced glycation end products (AGEs) play an important role. To maintain homeostasis in the body, the effect of ROS is balanced by antioxidants and micronutrients. Copper has been found to play an important role in diabetic individuals and individuals with chronic periodontitis. However, studies are still being carried out to confirm the same. Hence, the objective of this study was to evaluate and then compare the serum copper levels among individuals who had diabetes mellitus type 2 and chronic periodontits (Group 1), those who were systemically healthy but had chronic periodontits (Group 2) and systemically healthy individuals without chronic periodontits (Group 3). Materials and method: a total of 150 subjects (50 in each group) were selected from the outpatient department of General medicine and Periodontology, Hazaribag Dental college and hospital, Jharkand and a written informed consent was taken from each individual.5ml samples of blood from each individual was collected and sent for evaluation (atomic

Dr. Sneha Suresh, et al. International Journal of Dental Science and Innovative Research (IJDSIR)

absorption spectrophotometry). The collected data were assessed using ANOVA and Tukey multiple comparison tests. Statistical software MS EXCEL and SPSS17 was used to analyze the data. Result: It was found that the levels of serum copper were the highest in Group 1 and least in Group 3. The comparison between each of the three groups was found to be statistically significant.

Keywords: diabetes mellitus type 2; copper; chronic periodontitis

Introduction

Type 2 Diabetes Mellitus is a chronic and complex disease of energy metabolism, characterized by hyperglycemia. It accounts for 90% of all diabetes cases worldwide. Evidence suggests that chronic periodontitis is the sixth complication of diabetes mellitus and they share a bi directional relationship [1].

The elevated serum glucose levels do not explain all the diabetes complications and there are many studies demonstrating an increase in oxidative stress by high levels of Reactive Oxygen Species (ROS) and Advanced glycation end products (AGE).

It has been shown that the imbalance of different transition metals, mainly copper participates in the formation of ROS and AGE. It has also been proposed that copper chelation therapy can be considered for the treatment of Diabetes Mellitus [2].

Although periodontal diseases are highly connected to special kinds of pathogenic bacteria, most of the gingival tissues could be damaged when host response is not sufficiently resistant against microorganisms, as well as due to lack of balance between nutrition conditions and destructive factors [3].

The daily requirement for micronutrients especially copper is around 100 micrograms and is essential for enzymatic systems in the body as well as for DNA and RNA [4]. It has been reported that the deficiencies of several essential macro and micronutrients adversely influence the prognosis of periodontal infections although the exact mechanisms have still not been adequately defined [5].

Several studies suggest that the homeostasis of trace elements can be disrupted by diabetes mellitus. Conversely, research also suggests that early imbalances of specific elements may play an important role in upsetting normal glucose and insulin metabolism [6].

Hence, this study has been carried out to assess the serum levels of copper in diabetes mellitus type 2 patients and chronic periodontitis patients and compare the levels in each group.

Materials and methods

A total of 150 subjects were selected from the outpatient department of Medicine and department of Periodontology, Hazaribag College of Dental Sciences and Hospital, Jharkhand. A written informed consent was taken from each subject.

All the subjects were divided equally into three groups based on the Criteria for selection [7].

Inclusion criteria

- Patients categorized as Type 2 diabetes mellitus who are under treatment for atleast 6 months and are on oral hypoglycaemic drugs, in the age group of 30 – 60 years.
- Patients with clinical attachment loss > 4mm in more than 30% of the site for group 1 & 2.
- Subjects who have a gingival index score of less than 2 in group 3.
- Subjects with minimum complement of 20 teeth
- All measurements and samples were taken before starting any periodontal therapy.

Exclusion criteria

• History of any antibiotic /anti inflammatory therapy for three months prior study.

© 2019 IJDSIR, All Rights Reserved

Dr. Sneha Suresh, et al. International Journal of Dental Science and Innovative Research (IJDSIR)

- History of any systemic diseases for group 2&3.
- History of any systemic disease other than diabetes mellitus type 2 for the group1.
- Pregnancy/lactation.
- Subjects with a history of smoking and any form of tobacco consumption.
- Subjects with a history of use of mouth wash within 3 months prior to study.
- Subjects with a history of vitamins /minerals or antioxidant supplements intake during the last 3 months.
- Subjects who had undergone any periodontal treatment for at least threemonths prior to study.

Group 1 consisted of 50 subjects who had Type 2 Diabetes Mellitus and Chronic Periodontitis, Group 2 consisted of 50 subjects who were systemically healthy but had Chronic Periodontitis and Group 3 consisted of 50 systemically healthy subjects who had a healthy periodontium.

A standard Performa consisting of the following data: name, sex, occupation, address, chief complaint, past medical and dental history, personal history, nutritional supplement history, clinical attachment loss and gingival index for each subject was recorded.

Severity of gingival and periodontal inflammation was assessed using gingival index [8] and clinical attachment loss was recorded before the collection of the 5ml sample of blood from each subject.

Atomic absorption spectrophotometry method was used to evaluate the level of copper in serum [9].

The results obtained were tabulated and subjected to statistical analysis using one way ANOVA and Tukey multiple comparison tests. Statistical software MS EXCEL and SPSS17 was used to analyze the data.

Results

The mean and standard deviations of serum copper levels in the three groups were derived and it showed that the mean serum levels of copper were lowest (77.15 μ g/dl) in systemically healthy subjects without chronic periodontitis and highest (157.01 μ g/dl) in those subjects with Type 2 diabetes mellitus and Chronic periodontitis. (Table 2) (Graph 1)

 Table 1: Mean and standard deviation of serum copper

 levels in the three groups

Statistical Analysis: ANOVA one way test.

S: The mean difference is significant at the 0.05 level.

NS: The mean difference is not significant at the 0.05 level.

Copper In µg/Dl										
Groups	N	Mean	SD	Min	Max	F Value	P Value			
Group 1	50	157.01	9.15	140.40	172.80	. 725.298	<0.00005 Significant			
Group 2	50	86.18	16.94	65.00	138.60					
Group 3	50	77.15	5.00	69.24	85.20					
Total	150	106.78	37.60	65.00	172.80					





After obtaining the mean and standard deviations of each group, the serum levels of copper were compared between each of the three groups.

Comparison between Group 1 and Group 2, Group 1 and Group 3 and between Group 2 and Group 3 was found to be statistically significant. (Table 3) Table 2: Comparison of serum copper levels in three groups

Statistical Analysis: Tukey Post Hoc test.

S: The mean difference is significant at the 0.05 level.

NS: The mean difference is not significant at the 0.05 level.

(I) Group		Mean Difference (I-J)		95% Confidence Interval	
	(J) Group		P Value	Lower Bound	Upper Bound
Group 1	Group 2	70.83	<0.00005 S	65.40	76.27
	Group 3	79.86	<0.00005 S	74.43	85.30
Group 2	Group 3	9.03	<0.00005 S	3.59	14.47

Discussion

It is already known that deficiency and overload of some trace elements have different effects on health [10]. Turnlund, et al. (1998) showed that the increase in copper scores in plasma could change the immunological function and the conditions of antioxidants [11]. Other studies showed that the higher records of copper in plasma could change the collagen metabolism, and it could also prepare a good environment for an inflammation to take place in the periodontal tissues [12].

However, the results of this study was not compatible with those previously published by Freeland et al. 1976, who found higher records of copper in plasma in patients affected by periodontal diseases.

On the other hand, the process of inflammation in general could make an increase in the records of copper in plasma. For instance, Pekarek, et al. (1972) showed that copper in blood, which exists in the form of "Ceruoplasmin", could be released as a feedback signal initiated by some immunological mediators related to the white blood cells. However considering higher records of copper in plasma as a risk factor for periodontal disease is still a debate and The role of a balanced nutrition or a supplementation of nutrients have not been thoroughly evaluated in periodontal research, although reports of the possible effects of nutrient deficiency and supplementation have appeared early in the periodontal literature.

The objective of this study was to evaluate and compare serum copper levels in diabetes mellitus type 2 patients with periodontitis and healthy individuals with and without periodontitis. The results showed that the serum levels of copper were increased in healthy subjects compared to those with diabetes mellitus type 2 and chronic periodontitis.

Conclusion

Thus, it can be suggested that inadequate intake of copper may lead to suppressed immunity along with increased oxidative stress and poor regenerative capacity in an individiual which can predispose to periodontitis.

References

- Brian L. Mealey, Thomas W. Oates. Diabetes Mellitus and Periodontal Diseases.2006;77(8):1289-1303
- Jennifer Lowe, Rosilane Taveira-da-Silva, Elaine Hilario-Souza.(2017)Dissecting Copper Homeostasis in Diabetes Mellitus.IUBMB.69(4):255-262
- Van Dyke TE, Lester MA, Shapira L (1993)The role of host response in periodontal disease progression: implications for future treatment strategies. J Periodontol 64:792-806
- 4. Nizel AE, Papas AS (1989) Nutrition in clinical dentistry.
- Cyril O Enwonwu. Interface of malnutrition and periodontal diseases. Am J Clin Nutr. 1995; 61: 430S-6S.
- Tasneem Gul Kazi et al. Copper, Chromium, Manganese, Iron, Nickel, and Zinc Levels in Biological Samples of Diabetes Mellitus Patients. Biol Trace Elem Res 2008; 122: 1–18

needs more comprehensive studies [13].

Dr. Sneha Suresh, et al. International Journal of Dental Science and Innovative Research (IJDSIR)

- Thomas B, Gautam A, Prasad BR, Kumari S. Evaluation of micronutrient (zinc, copper and iron) levels in periodontitis patients with and without diabetes mellitus type 2: A Biochemical study. Indian J Dent Res 2013;24:468-73
- 8. Loe H. The gingival index, plaque index and retention index systems. Journal of periodontal 1967;38:61.
- Braun, R.D. Instrumental Analysis; McGraw-Hill: New York. 1987; 176.
- 10. Flores et al.(2011) Trace elements status in diabetes mellitus type 2: possible role of the interaction between molybdenum and copper in the progress of typical complications. Diabetes Res.Clin.Pract.91:333-341.
- 11. Turnlund JR (1998) Human whole body copper metabolism. Am J Clin Nutr. 67:960-964.
- Burch RE, Hahn HK, Sullivan JF (1975) Newer aspects of the roles of zinc, manganese, and copper in human nutrition. Clin Chem 21: 501-520.
- Pekarek RS ,Wannemacher Jr RW, BeiselWR(1972)The effect of leukocytic endogenous mediator (LEM) on the tissue distribution of zinc and iron. Proc Soc Exp Biol Med 140:685-688.