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Comparative Evaluation of iron levels in the serum of Diabetic and Chronic Periodontitis patients

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Abstract

Aim: The purpose of this study was to evaluate the serum levels of iron in diabetic patients with chronic periodontitis and compare with systemically healthy patients with chronic periodontitis and healthy controls.

Methods: The subjects were selected from the outpatient department of General Medicine and Department of Periodontology, Hazaribag College of Dental Sciences and Hospital, Jharkhand. A written informed consent was taken from each subject.

Method of collection of data: The study was a case control study comprising of 150 subjects, 50 in each group. Group 1 consisted of 50 subjects with Type 2 diabetes Mellitus & chronic periodontitis, Group 2 consisted of 50 subjects who are systemically healthy with chronic periodontitis and Group 3 consisted of 50 subjects who are systemically healthy and with a healthy periodontium.

Clinical Procedure: Severity of gingival and periodontal inflammation was assessed using gingival index and clinical attachment loss was recorded. Clinical attachment loss was measured using Williams graduated periodontal probe. The landmarks considered are CEJ and free gingival margin. Probing depth was measured from the gingival margin to the base of the pocket Method of collection of sample: All measurements and readings were taken before the collection of the blood sample. The samples were coded before being sent for laboratory investigations.

Result: The serum levels of Iron in diabetic patients with periodontitis showed a mean of 165.36 $\pm$ 16.39 when compared to healthy individuals with and without periodontitis with a mean of 142.12 $\pm$ 24.64 and 133.40 $\pm$ 23.84 respectively.

Comparison between Group 1 with group 2 ,group 1 with group 3 was statistically significant and between group 2 and group 3 was statistically not significant.

Conclusion: Serum levels of iron is increased in diabetes patients with periodontitis compared to healthy individuals with periodontitis and healthy controls.

Serum levels of iron are increased in healthy patients with periodontitis compared to healthy controls and this difference is statistically significant.

Keywords: Diabetes Mellitus, Chronic Periodontitis, Iron

Introduction

According to investigations, the mechanism of host mediated response in disease involves the activation of the broad axis of innate immunity, by the upregulation of the proinflammatory cytokines from monocytes/PMNs and downregulation of growth factors from macrophages. In periodontal disease the host response is characterized by the increase in production of reactive oxygen species and inflammatory mediators, cytokines, chemokines, and matrix metalloproteinases. The extent of periodontal damage is characterized by the balance between these factors – the antioxidant and endogenously synthesized antiproteinases [1,2].

Numerous risk factors modify periodontitis. The systemic risk factors identified by large epidemiologic studies include diabetes mellitus and cigarette smoking [3].

Diabetes mellitus is a clinically and genetically heterogenous group of (metabolic) disorders manifested by high levels of glucose in the blood. The two main causes of hyperglycemia are the result of a deficiency of insulin secretion caused by pancreatic ß cell dysfunction or resistance to the action of insulin (muscle and liver) or a combination of the above mentioned [4].

Evidence suggests that diabetes mellitus type 2 is associated with periodontal disease and Periodontitis has been recognized as the sixth complication of diabetes mellitus and they share a bi directional relationship [4].

Integrity of the periodontium is dependent upon adequate supply of nutrients proving that nutrition has a role to play in the maintenance of the periodontium. Deficiency may result in pathologic alteration in the periodontal tissue. Periodontal lesion is considered to be a wound and sufficient resources must be available for healing to take place [5].

Iron plays an important role in immune regulation, neutralization of the immune regulation and in antioxidant defense.

According to several studies the homeostasis of trace elements are disrupted by diabetes mellitus. Research has also shown that conversely the early imbalances of specific elements upsets the normal glucose metabolism [6].

Hence this study was designed to estimate and compare the serum levels of Iron in diabetes mellitus type 2 patients and healthy individuals with and without periodontitis.

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].

Criteria for selection

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 priorto study.

- 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 and clinical attachment loss was recorded before the collection of the blood sample. The 5ml of blood samples were coded before being sent for laboratory investigations , centrifuged at 3000 rpm for 15 minutes and the supernatant serum was collected. The digested sample was taken and nitric acid is added in the ratio 1:2 and kept over a heating plate till the colorless fumes appeared. Then the sample was made upto 10ml by adding deionised water.

Estimation of serum iron was carried out using the Bathophenanthroline method.

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

Results

First, the mean and standard deviations of the levels of serum iron in each group were calculated. The mean serum iron levels in Group 1 were found to be the highest (165.36 µg/dl) followed by Group 2 (142.12 µg/dl) and Group 3 (133.40 µg/dl) (Table2).

Table1: Mean and standard deviation of serum iron levels in the three groups

Iron In µg/Dl							
Group	N	Mean	Sd	Min	Max	F Value	P Value
Group 1	50	165.36	16.39	128.70	190.40	28.363	<0.00005 Significant
Group 2	50	142.12	24.64	99.00	193.90		
Group 3	50	133.40	23.84	96.26	183.00		
Total	150	146.96	25.65	96.26	193.90		

Statistical Analysis: ANOVA one way test.

This result suggests that the serum level of iron is the highest in those subjects having Type 2 diabetes mellitus with chronic periodontits and least in the systemically healthy subjects with a healthy periodontium.

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

Comparison between Group 1 and Group 3 and between Group 1 and Group 2 was found to be statistically significant and between Group 2 and Group 3 was statistically not significant (Table 3)(Figure1).

Table 2: Comparison of serum iron levels in three groups

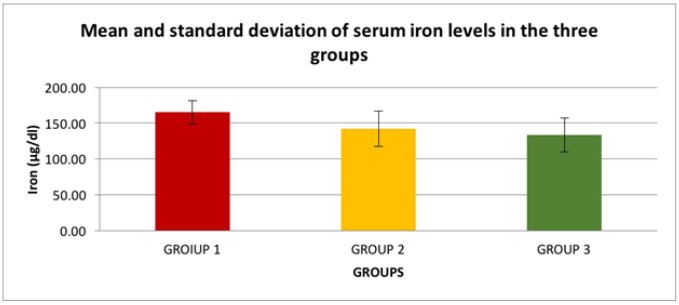
Statistical Analysis: Tukey Post Hoc test.

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	(J) Group	Mean Difference (I-J)	P Value	95% Confidence Interval	
				Lower Bound	Upper Bound
Group 1	Group 2	23.25	<0.00005 S	12.86	33.64
	Group 3	31.97	<0.00005 S	21.58	42.35
Group 2	Group 3	8.72	0.119 Ns	-1.67	19.11

Graph 1:



Discussion

The immune-inflammatory response that develops in the gingival and periodontal tissues in response to the chronic presence of plaque bacteria results in destruction of structural components of the periodontium leading, ultimately, to clinical signs of periodontitis. The host response is essentially protective, but both hypo-responsiveness and hyper-responsiveness of certain pathways can result in enhanced tissue destruction. The host response is initiated by the microbial challenge and it may vary among individuals.

Trace elements comprise metals in biological fluids at concentrations <1 µg/g of wet weight. Among the trace elements, iron and zinc are involved in the function of several enzymes for biochemical reactions in our bodies and hence are essential for maintaining health throughout life. Micronutrients play an essential role for constant regenerative processes, for coping with oxidative stress, and also for adequate immune responses.

Trace elements can cause diseases through deficiency, imbalance, or toxicity. Increased serum iron level has been attributed to various conditions like cirrhosis, cardiomyopathy and arthritis and diabetes [8,9].

Although poor nutrition does not cause periodontal disease directly, several lines of evidence strongly suggest that the disease progresses faster and may be more severe in people with nutrient-poor diets because of compromised host response. Micronutrients like iron are reported to have significant influence on the function of immune system and thus, critical in determining the host-microbial interaction.

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 micronutrients iron levels in diabetes mellitus type 2 patients with periodontitis and healthy individuals with and without periodontitis.

The results of the present study showed increase in iron levels in individual with periodontitis compared to control group without periodontitis and the difference is statistically significant. This result does not correlate with a recent study which found no significant difference between periodontitis patients and healthy control [10].

There is accumulating evidence that the metabolism of several trace elements is altered in insulin-dependent diabetes mellitus and that these nutrients might have specific roles in the pathogenesis and progress of this disease.

Excess iron levels have been implicated in the pathogenesis of diabetes and its complications [11,12]. In the presence of hyperglycemia and inflammation, these micronutrients may contribute to the development and progression of oxidative injury and involved in altered insulin secretion or its action [12,13].

The pathogenesis of periodontal disease is complex because it reflects a combination of the initiation and maintenance of the chronic inflammatory process by a diverse microbial flora and its numerous bacterial products. The subsequent host response to this infection mediates a complex cascade of tissue destructive pathways. Additional factors which contribute to this multifaceted local disease process in the oral cavity include a number of systemic diseases, especially diabetes that can exaggerate the host response to the local microbial factors resulting in unusual destructive periodontal breakdown.

An abundance of information accumulated from the studies on the complication of diabetes and periodontal disease have revealed that altered innate immune response (enhanced infiltration by monocytes and PMNS, increased expression of pro-inflammatory cytokines) may be antecedent of both disease, which may have a synergistic effect when they coexist in the host.

Elevated levels of iron in the serum are associated with an increased oxidative stress along with altered immune response which could lead to various diabetes complications including periodontitis.

Conclusion

The present study may have important therapeutic implications in terms of the use of micronutrients supplements in periodontal therapy to prevent tissue destruction. However, interventional trials done on humans are required to determine the exact therapeutic success.

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