Research Article

JRAD Journal of Research and Advancement in Dentistry

J Res Adv Dent 2020;10:3:271-275.

Antioxidant Warfare in Periodontal Pathogenesis

Meenakshi Boddun[1*] Vijayta Sharva[2] Swapnil Kumar Jain[3] Shweta Chouhan[4] Abhinav Dubey[5] Swapnil Thakur[6]

[1]Reader, Department of Periodontology, Peoples Dental Academy, Bhopal, India.
[2]Reader, Department of Public Health Dentistry, Peoples Dental Academy, Bhopal, India.
[3]Professor, Department of Public Health Dentistry, Peoples Dental Academy, Bhopal, India.
[4]Reader, Department of Oral pathology, RKDF Dental College and Research Centre, Bhopal, India.
[5]Reader, Department of Oral and Maxillofacial Surgery, Peoples Dental Academy, Bhopal, India.
[6]Senior Lecturer, Department of Periodontology, Peoples Dental Academy, Bhopal, India.

ABSTRACT

Background: This is universally accepted that bacteria present in plaque are crucial to initiate periodontal disease and push the inflammatory response in the periodontal tissues. At the consistent time, there is convincing indication that negative processes occurring as measure of the host inflammatory reaction are liable for the preponderance of the tissue breakdown running to the clinical signs of periodontitis. The characteristic clinical signs of chronic periodontitis happen primarily as a consequence of activation of host-derived immune and inflammatory defense apparatus. Under normal conditions, Reactive oxygen species (ROS) is fashioned at nominal levels and actions as a signaling molecule focusing to balance ROS production and rummaging. Deviation in oxygen concentration disturbs the ROS formation. When ROS concentrations surpass defense mechanisms, ROS causes oxidative stress. The congregation of antioxidants has synergistic effects and reduces oxidative stress, causing an attention towards evaluation of the antioxidative capacity. The study aimed to evaluate the levels of uric acid and albumin in serum as antioxidant determinants, as well as to relate these biomarkers to clinical guides of periodontopathy.

Keywords: ROS, Pathology, Diseases, Metabolism.

INTRODUCTION

Periodontitis is an inflammatory condition representing the response of the periodontal tissues to lipopolysaccharide derived from bacteria. The persistence of the bacterial stimulus results in the chronicity, but is not associated with progressive damage to the periodontal tissues (1). Some factors associated with progression have been identified. There may also be regulatory factors, not well characterized, which are protective and limit the progression of periodontal tissue destruction. In this context, antioxidant may have an important protective role. ROS (Reactive oxygen species) may be major contributors in cell signaling as well as metabolic processes and thought to be implicated in the pathogenesis of variety of inflammatory disorders causing increase in the oxidative stress (2,3). Antioxidant or an oxidizing agent interferes with production of reactive oxygen species. FR/ ROS are often essential for biological processes and that tissue damage can easily take place when antioxidant systems do not efficiently counteract their action (4,5). Shift in the ROS and antioxidant balance. Uric acid is by far the highest concentration in human blood serves as potent antioxidant (5). It acts by mitigating the oxidative stress, both prevents the disease or reduces it, is due to it's antioxidant properties (6). Albumin is another one of the most abundant circulating proteins in the blood, well known for its ability to bind molecules, with thus are able to trap the free radicals.

Received: May. 22, 2020**: Accepted**: June. 18, 2020
***Correspondence Dr. Meenakshi Boddun.**
Department of Periodontology, Peoples Dental Academy, Bhopal, India.
Email: boddunmeenakshi@gmail.com

pISSN 2278-0076
eISSN 2321-9270

AIM OF THE STUDY:

To find an association between serum antioxidant levels and chronic periodontitis.

OBJECTIVE:

To compare and evaluate serum uric acid in chronic periodontitis patients and healthy subjects.

To compare and evaluate serum albumin levels in chronic periodontitis patients and healthy subjects.

MATERIALS AND METHODS

The study design is cross sectional type study. The study setting were the subjects referred to the department of periodontology of Peoples Dental Academy, Bhanpur, Bhopal. The study group consisted of 2 groups namely group A and group B. The Group A consisted of 20 healthy subjects whereas, Group B comprised of 20 chronic periodontitis patients.

INCLUSION CRITERIA

- Subjects included in the study with age group ranging from 35-55 years.
- Subjects in group A (n=20) with no evidence of attachment loss and pocket probing depth more than 3 mm.
- Subjects in group B (n=20) presenting chronic periodontitis (probing pocket depth ≥5 mm, clinical attachment levels ≥5mm affecting at least 6 teeth of the permanent dentition.

EXCLUSION CRITERIA:

- History of diabetes and/or any other minor/major systemic infection.
- Non-steroidal anti-inflammatory drugs, antibiotic or steroids.
- Smokers or users of any tobacco products,
- Patients treated by periodontal therapy in past six months.
- Pregnant women or lactating mothers.
- Patients with BMI ≥ 30.

CLINICAL MEASUREMENTS

1. Medical and dental history is taken.
2. Sulcus Bleeding Index- Sulcus bleeding index taken on 4 sites per tooth (mesio-buccal, mid-buccal, disto-buccal and lingual/palatal)fully erupted permanent dentition.
3. Probing Pocket Depth.
4. Clinical Attachment Level.

Clinical evaluation was based on probing pocket depth (PPD) and clinical attachment level (CAL) at 6 sites/ tooth.

MEDICAL PARAMETERS:

Venous blood sample were drawn using a standard 3 ml syringe at the time of visit, the samples were obtained in an Eppendorf serum collecting tube containing clot activating factor. Immediately stored in a freezer after serum separation. Serum quantification for uric acid and albumin was done using Uricase PAP method for uric acid, and Bromocresol green test for albumin with the help of Automated Biochemistry Analyzer (Figure 1 2 and 3).

Fig 1: Eppendorf tubes.

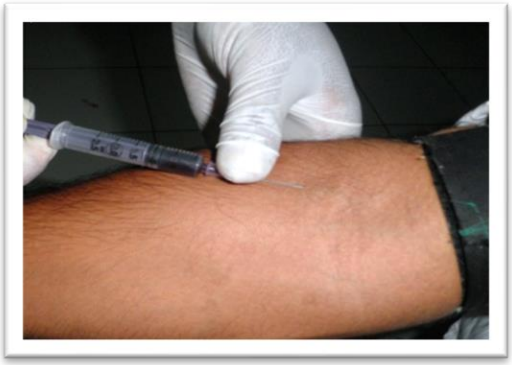


Fig 2: venous blood samples from subjects.

Fig 3: Automated biochemical analizer.

STATISTICAL ANALYSIS:

The mean and standard deviation (Mean ± SD) values were calculated for serum uric acid and albumin levels. The mean data was analyzed for statistical significance by student's unpaired 't' test ($p < 0.05$)

RESULTS

The result is demonstrated in the tables and graph below (Table 1,2,3,and4, Graph1):

TABLE 1: Demographic data of the patients				
Number of Patients	Males	Females	Mean age	BMI
Group A	12	8	35.55 years	25.08
Group B	10	10	36.46 years	26.95

Table 2: Mean values for clinical variables.

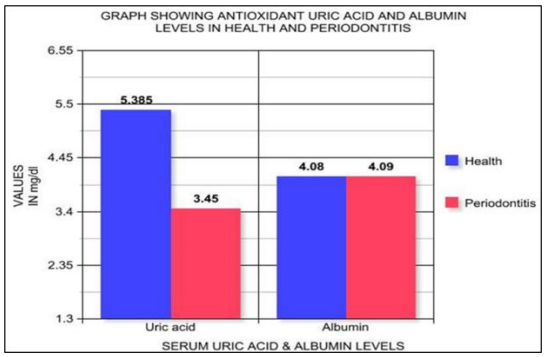
Variables	Group A	Group B
	Health	Periodontitits
SBI	0.22	*4.28
PPD	1.98	*5.69
CAL	0.00	*6.48
SBI- Sulcus bleeding index, PPD-Pocket probing depth, CAL- clinical attachment level		

Table 3: Proportion of the samples with detectable uric acid levels in serum compared between groups

	Serum uric acid levels in mg/dl		
Groups	N	X	SD
Group A: Health	20	*5.38	0.91
Group B: Periodontitis	20	3.45	1.34
N: Number of samples, X- Mean, SD- Standard deviation			

Table 4: Proportion of the samples with detectable Albumin levels in serum compared between groups

	Serum Albumin levels in mg/dl		
Groups	N	X	SD
Group A: Health	20	4.08	0.23
Group B: Periodontitis	20	4.09	1.19
N: Number of samples, X- Mean, SD- Standard deviation			



Graph 1: Graph showing antioxidant serum uric acid and albumin levels in health and periodontitis.

The statistical analysis shows that there is a significant difference in the uric acid levels between health and periodontitis, i.e. $P<0.005$, but no significant difference exists in albumin levels between the two groups.

DISCUSSION

The aim of the study was to find an association between serum antioxidant levels and chronic periodontitis. This study was done to establish

periodontitis as a possible cause for the decrease in the levels of antioxidant in the absence of any systemic or immunological disease. The results in the present study shows that the Healthy individuals were having uric acid levels of 5.38± 0.91 mg/dl and albumin levels of 4.08± 0.23 and subjects with chronic periodontitis having uric acid levels of 3.45±1.34 mg/dl and albumin levels of 4.09± 0.19 mg/dl. There was a significant decrease in the serum uric acid levels in chronic periodontitis as compared to health with a p value <0.005, But almost no changes in the serum albumin values. This is in accordance with the review that concluded oxidative stress as the underlying cause for periodontal tissue damage that results from host microbial interactions (1,2). The results shown by study by Brock et al in 2004, which uric acid in serum, saliva and GCF and found the similar findings with serum antioxidants. The results showed by longitudinal study by Linden et al in 2009 in which he found low level of antioxidant carotenoids were associated with increased prevalence of periodontitis in older individuals (7,9). Uric acid is the one of the major antioxidants present in serum. The present data states that in subjects with periodontitis the serum levels of uric acid is lowered, whether this reduced antioxidant defense is a cause or effect of the disease is unclear. Longitudinal investigations involving larger sampling are required to define the role of antioxidants in the pathobiology of chronic periodontitis. The possible reason behind the decreased antioxidants is the presence of hyperreactive neutrophils and monocytes in the peripheral blood in patients with periodontitis, these cells along with the etiological factors, could generate ROS (reactive oxygen species) and cause a reduction in serum antioxidants in periodontitis subjects (6,8). Albumin is a radical scavenging antioxidant found in blood proteins, the reason behind no changes in the serum levels in both the group is unclear.

Researches dedicated to ROS had been accomplished for times, however the outcomes stay debated. Through the unremitting work of studies, researchers have investigated the part of ROS in bio-system and several diseases. ROS are useful for bio system bestowing as signaling molecules and improving immunologic shield. Yet, they also have detrimental consequences such as triggering tissue and organ injuries. The study explores the mechanisms between the subject and ROS and potential effects of antioxidants present in the serum.

Conclusive perceptions

ROS encourage macrophage bacterial killing from side to side oxidative damage and apoptosis, participates in cellular pathways as signaling molecules along with negative outcomes like cytotoxicity. Nonetheless, other studies also indicate the progressive side of enhancing ROS in diseases. Thus, the mechanisms of how ROS impacts diseases stay obscure (9,11). The fundamental understandings of ROS continue principally unchanged in the previous 20 years. ROS are generally regarded as signaling molecules and harmful particles. A hypothesis was presented although recently that may justify the contesting results to this point. The hypothesis is that ROS do not just act as signaling molecules; they may exist as elementary energy particles like other nutrient particles involving proteins and carbohydrates. Plus they offer a much more essential control on cellular metabolism. It is further likely that ROS react to higher metabolism to achieve energy requirement, rather than straight winding the situation to oxidative stress, which decodes why diverse studies demonstrated debated (11).

CONCLUSION

This study demonstrated that subjects with chronic periodontitis have decreased serum levels of uric acid as compared to healthy subject's ROS could support immune system, but they become cytotoxic while overload. Oxidative damage leads to cellular damage on DNA, protein and lipids. The damage-induced apoptosis plays an important role in inflammatory diseases like periodontitis. A thorough understanding of the host inflammatory response in periodontal pathogenesis presents the opportunity for exploiting new treatment strategies for periodontitis by means of host response modulation. The rationale behind this approach is to aid the host in its fight against infectious agents by supplementing the natural inherent defense mechanism or to modify its responses by changing the course of inflammatory systems.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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