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Correlation between Dental Caries and Salivary Albumin in Adult Indian Population— An *In Vivo* Study

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Authors' contributions

This work was carried out in collaboration between all authors. Author MNH designed the study, performed the statistical analysis, and wrote the protocol, Author RB wrote the first draft of the manuscript, Author AP managed the analyses of the study. Author RB and Author CS managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Aim: To analyze the relationship between dental caries, albumin in young adults between the age group of 20 to 30 years from South Canara district, Karnataka with varying caries experience as determined by their caries progression

Methods and Materials: Eighty subjects from the outpatient department ranging between 20 to 30 years of age were screened and evaluated for their caries experience. Based on their level of caries a total of 80 subjects were selected and divided into four groups of 20 subjects each as follows; Group 1: enamel caries, Group 2: dentinal caries, Group 3: pulpal caries, Group 4: control group. The saliva was collected and analyzed for the presence of albumin levels in saliva and correlated to the same levels in serum. The statistical analysis was done using one way ANOVA test.

Results: According to the present study there is an increase in the levels of caries with decrease in the levels of albumin. Serum albumin levels were also found to be decreased in caries prone individuals, hence showing a significant correlation between serum and salivary albumin levels.

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Conclusions: In the present study we found an inverse relationship between the levels of albumin in saliva and dental caries confirming the importance of albumin levels in inhibiting caries progression. Besides a correlation was also found between the levels of albumin in saliva and serum. Hence it can be used as a biochemical indicator in evaluating the susceptibility of caries.

Keywords: Salivary albumin; serum albumin; dental caries.

1. INTRODUCTION

Saliva, the readily available and non-invasive bio-fluid of the human body, constantly bathes the oral cavity [1,2]. It is critical to the preservation and maintenance of oral health, yet it receives little attention until the quantity or quality is diminished [3]. Recent studies have revealed a large number of functions, mediated by both the inorganic and the organic components of saliva that should be considered in assessing the effects of human saliva on dental caries [4,5]. Nonetheless, additional factors have demonstrated an influence on the acceleration or slowing down of the development of new caries lesions [6]. Consequently, many researchers have been encouraged to study caries-inducing factors, as well as defense mechanisms against dental caries [7]. As saliva surrounds soft and hard oral tissues and contain the necessary elements required for host protection; it could be expected to be a useful biomarker for oral diagnostics, as has been observed in some studies with emphasis on proteomic analysis [7].

However, studies concerning salivary proteins and dental caries have presented conflicting results [7]. Serum albumin levels are a practical marker of general health and have been used to determine the severity of an underlying disease [8]. Studies have concluded that enamel is mainly protected from demineralization by the inhibitory effects of albumin penetrated into the pores, in addition to possible protection by the pellicle on the surface [9].

Despite these studies, the relationship between the levels of albumin in serum and saliva is unknown. Hence the purpose of this study is to explore the relationship between dental caries and the albumin levels in saliva and serum so we can evaluate the possibility of considering salivary proteins as biomarkers for dental caries or not.

2. MATERIALS AND METHODS

This study was approved by the committee of ethics in research, Dental college, Nitte university, Karnataka, India. A total of 12,400 healthy adult patients at the out-patient department of the Department of Conservative Dentistry and Endodontics, A.B. Shetty Memorial Institute of Dental Sciences, in the age group 20-30 years between December 2012 and June 2013, were randomly selected. The patients fulfilling the inclusion criteria were free of any systemic or local diseases which affect the salivary secretion and their caries status was assessed according to the WHO recommendations to calculate dental caries index [WHO 1997]. Patients with periodontal disease, diabetes, radiotherapy, chemotherapy, systemic disease of the vital organs and history of long term medication were excluded from the study. Teeth with root caries, periodontitis and gingivitis were also excluded from study. Gingivitis was detected by checking the bleeding on probing and the loss of stippling. Out of these patients 80 patients with dental caries were divided into four groups; enamel, dentinal and pulpal caries and caries free group by a single examiner. The

smooth and occlusal surfaces of the teeth were cleaned with a soft bristle brush, dried and examined. The caries free group consisted of patients with complete absence of caries and other earlier restorations. The enamel, dentinal and pulpal caries were evaluated radiographically. The patients were selected based on the levels of progression of caries; patients having both enamel and dentinal caries were considered as dentinal caries and the patients with both dentinal and pulpal caries were considered as pulpal caries. Saliva and blood samples were collected from each patient and analyzed for the presence of albumin.

2.1 For Saliva Sample Collection

- Saliva was collected under standardized conditions in the morning between 9am and 10am.
- Subjects were asked to abstain from smoking, brushing of teeth, use of mouth wash, eat or drink for 1 hour prior to the collection of sample.
- For saliva collection the subject sat in a relaxed position, with the head slightly inclined and passively drooled saliva from the floor of the mouth into a plastic cup.

2.2 For Blood Sample Collection

- 2mL of venous blood sample was drawn after applying a tourniquet, followed by proper aseptic precautions with a sterile disposable plastic syringe without any anticoagulant.
- The blood sample was then centrifuged for about 15min at 3000rpm.
- The hemolyzed samples were discarded.
- The supernatant layer of serum was then separated and poured in labeled glass bottles and stored in a deep freezer at 20°C.

The serum and the saliva samples were analyzed using the Agappe albumin kit.

The serum and the saliva samples were analyzed using the Agappe albumin kit. This kit consists of 5*50ml of reagent. The reagent consists of an albumin reagent and albumin standard. The principle is reaction between the albumin from serum or plasma and the dye, bromocresol green produces a change in color that is proportional to the albumin concentration. No specific treatment was done for the samples as the tests were done immediately. The samples and reagent were mixed and incubated for a minute and then the absorbance of standard and sample was measured against a reagent blank. The results obtained were analysed by the one way anova test.

3. RESULTS

One way anova test was done for the statistical analysis, the following results were obtained:

According to the present study, there is an increase in the levels of caries with decrease in the levels of salivary albumin (Fig. 1).

Serum albumin levels were also found to be decreased in patients with caries prone individuals, hence showing a significant correlation between serum and salivary albumin levels (Fig. 2).

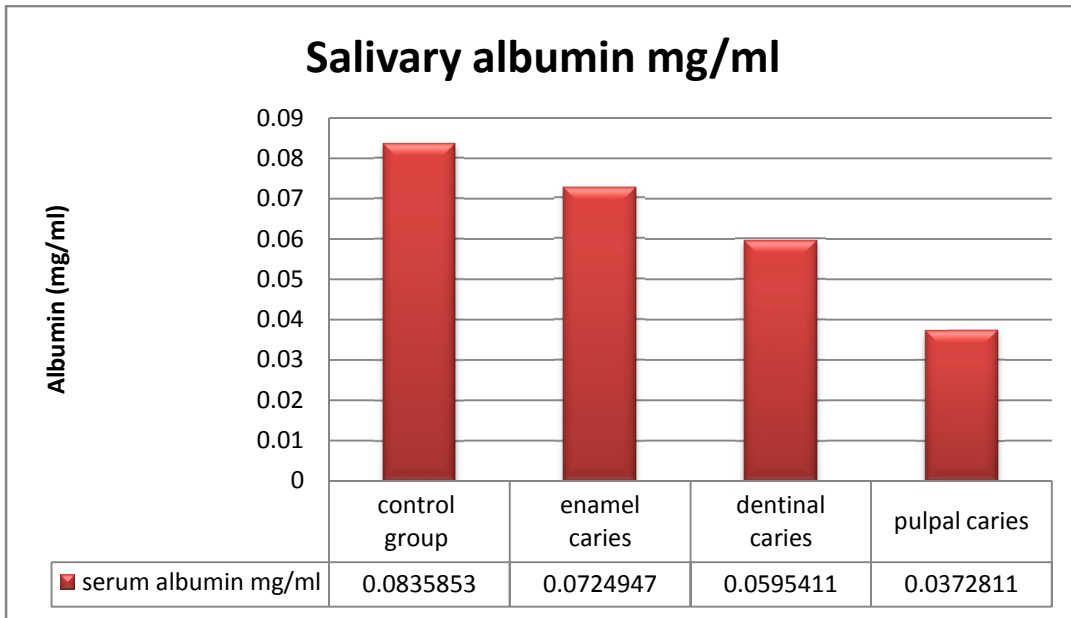


Fig. 1. The following graph depict the salivary albumin levels in comparison with dental caries at different levels

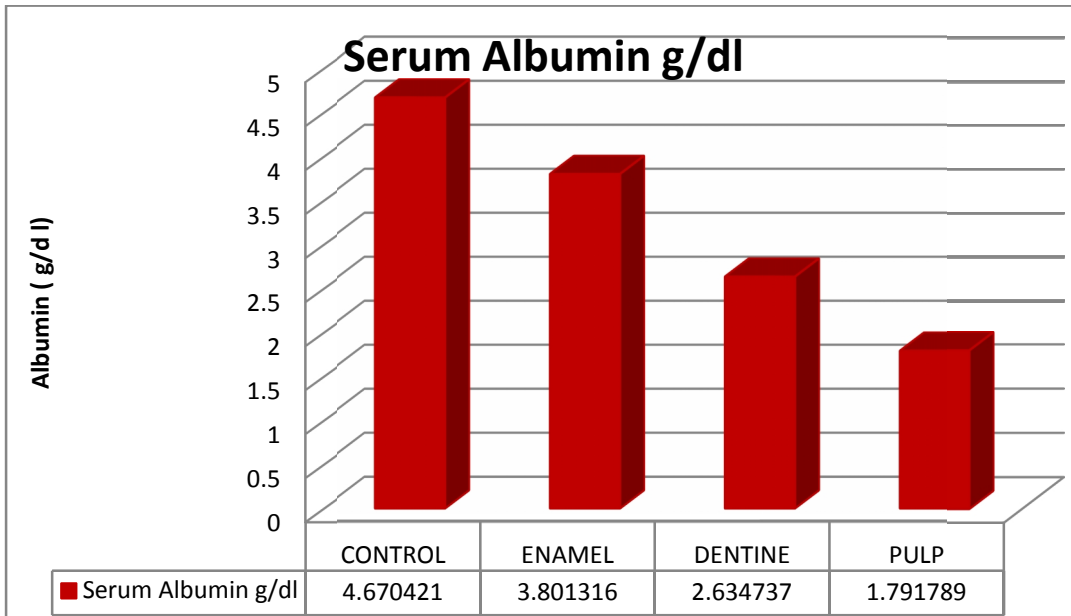


Fig. 2. The following graph depicts the serum albumin levels in comparison with dental caries at different levels

4. DISCUSSION

Saliva is vital to the integrity of the teeth as well as the soft tissues. It is a dilute, viscous solution whose electrolytes and proteins control the micro biota and prevent the tooth enamel from dissolving [10]. In the oral cavity, albumin is regarded as a serum ultra filtrate to the mouth and it may diffuse into the mucosal secretions [11]. Salivary albumin is increased in medically compromised patients such as in conditions of immunosuppression, radiotherapy and diabetes [12].

A group of salivary proteins namely, statherin, the acidic PRP's, albumin, histatins and cystatins are described as multifunctional proteins in a way that they are said to be partly responsible in the remineralization capacity of saliva [13]. These proteins are said to differ from other salivary host defense proteins by having a specific function only for the oral environment i.e. the maintenance of the homeostasis of the supersaturated state of saliva.

According to the results of the present study we found significant relationship between salivary albumin and dental caries in 20-40 year old individuals. These results are in accordance with the studies by Mungia et al wherein they found significant associations between caries and the salivary proteins namely albumin, lactoferrin, lysozyme and mucin [14]. Yoshihara et al. [8] conducted a cross sectional study wherein they indicated that an association exists between the oral health status and serum albumin levels. These findings also support the results of our study.

A recent study by Rui et al. verified a strong co-relation between large amounts of phosphopeptides, namely proline rich proteins, histatin and statherin and the absence of dental caries which reinforces the importance of these peptides in the maintenance of tooth integrity. Proteins in the protective pellicle such as statherin, histatin, cystatin and proline rich are too large to penetrate enamel pores. Therefore they remain on the surface bound to hydroxyapatite to aid in controlling crystalline growth of the enamel by allowing penetration of minerals into the enamel for remineralization and by limiting mineral egress. This enhances the stability of the hydroxyapatite in the outer tooth structure [15]. Albumin has a molecular weight comparable to the other proteins found in the protective pellicle. This might be the reason for the decrease in the caries levels in patients with higher albumin levels.

According to the present study we also found significant co relation between the salivary albumin levels and serum albumin levels. Serum albumin levels provide an index of the severity of an underlying disease conditions, such as malnutrition, inflammatory disorders, liver disease, and renal diseases, reduce serum albumin levels. In these cases, persons with hypoalbuminemia and malnutrition are likely to have decreased immunocompetence, with an increased risk of infection [16]. In confirmation to this, Yoshihara et al in his study concluded that persons with hypoalbuminemia are at a higher risk for caries [8].

While it is believed that proteins may protect enamel from demineralisation, recent work has indicated that such material may also hinder remineralisation i.e., albumin inhibits apatite crystal growth in vitro and is present in carious enamel in vivo. However, it is not clear whether the distribution of proteins within lesions is restricted to specific lesion zones or the origin of such proteins is endogenous or exogenous, originating in the saliva or gingival crevicular fluid [17]. A few studies nonetheless have found insignificant results in contrast to our study [18,19]. The variations in the results might be due to the differences in the method of collection of the sample, the selection of the subjects and parameters involved in the study.

5. CONCLUSION

In the present study we found an inverse relationship between the levels of albumin in saliva and dental caries confirming the importance of albumin levels in inhibiting caries progression. Besides a correlation was also found between the levels of albumin in saliva and serum. Hence we can conclude that it may be used as a biochemical indicator in evaluating the susceptibility of caries. However further analysis may be required in this aspect.

CONSENT

All authors declare that written informed consent was obtained from the patients for publication of this case report and accompanying images.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the ethical committee at NITTE university and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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