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STUDY OF SALIVARY CALCIUM, PHOSPHOROUS AND, ALKALINE PHOSPHATASE IN TOBACCO CHEWERS WITH DENTAL CARIES.

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ABSTRACT

Introduction - Chewing tobacco in different forms causes tooth decay. Coarse and hard particles from tobacco product may damage the enamel making teeth more prone to cavities. In long-term tobacco users the changes in saliva can render oral mucosa vulnerable to various oral and dental diseases. **Aims & Objectives** - To know the effect of tobacco chewing on the concentration of salivary calcium, phosphorus, and activity of alkaline phosphatase in dental caries. **Material & Methods** – Study includes 21 tobacco chewers having dental caries (Study group) and 117 caries free non tobacco chewers (Control group). Stimulated saliva was collected from all subjects and analyzed for estimation of salivary calcium, phosphorous, alkaline phosphatase activity. **Results** – Analysis of data showed significantly lower concentration of calcium ($p<0.024$) and phosphorous ($p<0.000$) in the study group than the control group. There is lowering activity of alkaline phosphatase in study group than control though the difference is not significant. **Conclusion** – Decreased flow rate of saliva in tobacco chewers, fermentation of food particles cause decrease in the pH of saliva which may diminish the activity of alkaline phosphatase. Lowering in the activity of salivary alkaline phosphatase may not release the phosphorous and calcium to compensate the demineralization.

KEYWORDS: Salivary calcium, phosphorous, alkaline phosphatase, dental caries, tobacco chewers.

INTRODUCTION

Saliva plays a critical role in oral homeostasis because it modulates the ecosystem within the oral cavity. Therefore any alterations in the salivary function may lead to local adverse effect.[1] Even though smokeless tobacco may be less dangerous than cigarettes, long term use of chewing tobacco and other smokeless tobacco products can cause serious health problems. Chewing tobacco and its other forms cause tooth decay. High amounts of sugars as sweetening agents in chewing tobacco (along with betel leaf, sweetened supari) contribute to cavities. Also coarse and hard particles from tobacco product may damage the enamel on the teeth, making teeth more prone to cavities.[2]

This study was aimed to know the effect of tobacco chewing on the concentration of salivary calcium, phosphorus and activities of alkaline phosphatase in dental caries.

MATERIALS AND METHODS

The present study was carried out in the department of Biochemistry, Bharati Vidyapeeth Deemed University Medical College & Hospital, Sangli.

***Study Design* – Case control study**

Study population

Adults having habit of tobacco chewing, visited dental OPD for the complaint of dental caries, at Bharati Vidyapeeth Deemed University Dental College & Hospital, Sangli as study group. Caries free healthy volunteer adults, who were non tobacco users in any form of tobacco, were considered as control group.

Sample size – 21 subjects in the study group and 117 control group, sample size was determined by using software – Primer of biostatistics. (Sample size is small because this is a subsection study of Major study as 'study of salivary calcium, phosphorous, alkaline phosphatase in dental caries').

Inclusion criteria

Adults having dental caries as well as having a habit of tobacco chewing from at least 10 years; within age group 18-50years and who were visited dental OPD for complaint of dental caries.

Exclusion criteria
Adults with oral afflictions, acute systemic infections, chronic debilitating disease, liver diseases and metabolic bone disorders.

Collection of samples
Stimulated saliva (directly expectorated whole saliva) was collected in clean, dry, sterilized glass bottles and fitted with proper rubber stoppers immediately. Sugar free polystyrene balls used for chewing to stimulate saliva.

Method
The samples were analyzed for biochemical assays - the estimation of activities of salivary alkaline phosphatase and concentration of salivary calcium, phosphorous with the help of fully automated biochemistry analyzer – Corolyzer.

The written consent was obtained from each individual for his willingness as a subject in this study before collecting the sample. IEC approval was obtained from the institutional ethical committee.

Statistical analysis
The data was analyzed by calculating mean and S.D. 'Z' test (standard error of difference between two means) was applied to compare the results of study group with control group results.

RESULTS

The concentration of mean salivary calcium in the study group was 7.64 ± 1.97 mg/dl and that was in control group was 8.76 ± 1.96 mg/dl ($p<0.024$). In the study group salivary phosphorous was 3.81 ± 1.46 mg/dl and that of control group was 5.46 ± 2.20 mg/dl ($p<0.000$). Activity of salivary alkaline phosphatase in the study group was 53.77 ± 36.23 IU/L and that in control group was 54.92 ± 24.26 IU/L. This difference is not significant. ($p>0.05$).

Observation Table – Concentration of Salivary Calcium, Phosphorous and activity of alkaline phosphatase in tobacco chewers with dental caries and in controls.

Group	Salivary Calcium mg/dl Mean ± S.D.	Salivary Phosphorous mg/dl Mean ± S.D.	Salivary Alkaline Phosphatase IU/L Mean ± S.D.
Study	7.64 ± 1.97*	3.81 ± 1.46**	53.77 ± 36.23#
Control	8.76 ± 1.96	5.46 ± 2.20	54.92 ± 24.26

* Statistically significant ($p<0.024$) difference between values of study and control group.
** Statistically significant ($p<0.000$) difference between values of study and control group.
# Statistically non significant ($p>0.05$) difference between values of study and control group.

DISCUSSION

Present study shows significantly decreased concentration of calcium in the study group than control group, which was similar to the observations by Khan G.J.[3] There is significant difference in the concentration of salivary phosphorous in the study group and those of control group.

Functions of saliva are mediated by both the inorganic and organic components of saliva. The most important caries-preventive functions of saliva are the flushing and neutralizing effects, commonly referred to as "salivary clearance" or "oral clearance capacity". The buffering capacity of saliva involves three major buffer systems: the bicarbonate (HCO^{-3}), the phosphate and the protein buffer systems. The long-term use of tobacco especially the smokeless form can cause significant decrease in salivary flow rate and pH. Decreased Salivary flow rate may be unable to dilute the acidic pH in dental caries. These changes can render oral mucosa vulnerable to various oral and dental diseases.[4, 5]

Mineralization is the deposition of calcium & phosphorous on the organic matrix. Alkaline phosphatase liberates phosphate from the substrate. So the ionic concentration of [calcium x phosphorous] is increased to supersaturation level,[6] and hence will easily be available for mineralization. This is the normal response to the demineralization process in dental caries, but here is a failure to respond by alkaline phosphatase.

Food particles from the cavities may get fermented by the bacterial enzymes leading to acid production. As well as long term tobacco chewing can decrease the pH of saliva.[5] At acidic pH alkaline phosphatase activity slowed down. This may be the reason for inability of the activity of alkaline phosphatase. Consequently the action of this enzyme for remineralization may not be sufficient resulting into the failure to release calcium and phosphorous for remineralization; decreasing the concentration of calcium and phosphorous than control group.

CONCLUSION

Failure in the activity of salivary alkaline phosphatase may be due to decrease in the salivary pH, which may not compensate the demineralization. This inability of saliva for remineralization may result into decreased concentration of salivary calcium and phosphorous.

LIMITATIONS

We did not record the amount of tobacco chewed daily. Only duration was recorded. So results were not related in terms of quantity of tobacco chewing. The sample size

for study group is small. Further study with large number of sample is necessary.

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