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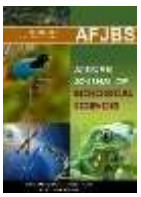

TO EVALUATE THE EFFECT OF TOBACCO ON SALIVARY pH: A COMPARATIVE STUDY

Dr. Ayeda Jehan[1] Dr. Rubeena Anjum[2] Dr Mandeep Kaur[3]

1. Post graduate student, Dept of Oral Pathology & Microbiology, Indira Gandhi Govt Dental College, Jammu.
2. Professor & HOD, Dept of Oral Pathology & Microbiology, Indira Gandhi Govt Dental College, Jammu.
3. Assistant Professor, Dept of Oral Pathology & Microbiology, Indira Gandhi Govt Dental College, Jammu.

Corresponding author: Dr Ayeda Jehan (*)
Address: Bankoot, Banihal
Distt Ramban, 182146, Jammu & Kashmir, India
Phone No: 7051907442
E mail ID: ayedajahan15@gmail.com

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ABSTRACT:

Introduction: Saliva plays a role in maintaining the environmental balance and oral commensal. The carbonic acid/bicarbonate system, phosphate system, and protein system all collaborate to maintain a consistent pH level in saliva. Tobacco consumption either smoke or smokeless form is considered as a major public health problem and is the most important etiological factor in the development of oral cancer.

Aims: This study aimed to assess and compare the effect of tobacco on salivary pH among tobacco chewers, smokers, and controls.

Materials and Methods: A total of 60 subjects aged 25–40 years were included in this study and divided into three groups: 20 Tobacco chewers (Group A), 20 tobacco smokers (Group B) and 20 controls (Group C). Saliva of each subject was collected under resting condition and Salivary pH was determined using the specific salivary pH meter.

Results: Mean and standard deviation for Group A was 6.59 ± 0.4399, Group B was 6.87± 0.4835 and Group C was 7.12 ± 0.1446 after comparison. The significant results indicate that Groups A and B had lower salivary pH levels compared to Group C. Group A showed lower salivary pH as compared to Group B and Group C.

Conclusion: Long term use of tobacco can cause significant alterations in salivary pH. These alterations can render oral mucosa vulnerable to various oral and dental diseases.

Keywords: Salivary pH, Tobacco, Unstimulated saliva, Arecanut

INTRODUCTION:

Saliva is produced and secreted from salivary glands. The basic functional units of salivary glands are clusters of cells called acini. These cells secrete a fluid that contains water, electrolytes, mucous and enzymes, all of which flow out of the acinus into collecting ducts. Small collecting ducts within the salivary glands merge into larger ones, culminating in a singular large duct that opens into the oral cavity [1]. Saliva serves several functions, including lubrication of the alimentary bolus, protection against viruses, bacteria, and fungi, buffering capacity, protection and repair of the oral mucosa, and dental remineralization [2]. The normal pH of resting saliva typically ranges between 6.2 to 7.6. The three buffer systems found in saliva, namely protein buffer, phosphate buffer, and carbonic acid/bicarbonate buffer regulate the normal salivary pH [3].

Tobacco consumption is one of the major public health problems in the world. Cigarette smoking can cause a spread of adverse oral effects, including gingival recession, impaired healing following periodontal therapy, oral carcinomas, mucosal lesions, periodontal disease, premature tooth loss, and tooth staining [4]. Areca nuts, which constitute four major alkaloids – arecaidine, arecoline, guvacine, and guvacoline can be chewed in the raw form and can cause a multitude of effects, which comprise cytotoxicity, genotoxicity, and mutagenesis. Short term use of tobacco increases the salivary flow rate and increases the concentration of sodium ions as compared to potassium and long term usage decreases the salivary flow rate and calcium concentration [5].

The present study was undertaken to evaluate and compare the long-term effect of tobacco on salivary pH in tobacco chewers, tobacco smokers and controls.

MATERIALS AND METHODS:

This comparative study was conducted in the Department of Oral Pathology, Indira Gandhi Government Dental College Jammu, over the period of four months. The study subjects were included from the patients reporting to the out-patient department of the institute after obtaining institutional ethical clearance from the ethical committee. All the study participants were explained about the study, and a written informed consent was taken.

The present study comprises 60 participants (both males and females) aged between 25 and 40 years, evenly distributed into three groups, each containing 20 subjects.

Group A: Tobacco chewers (20)

Group B: Tobacco smokers (20)

Group C: Healthy controls (20)

Inclusion criteria:

- Males and Females of age between 25 and 40 years
- Using tobacco, whether in smoked or smokeless form, for a minimum duration of approximately five years.

Exclusion criteria:

- Age over 40 years
- Alcohol consumption
- Combination of smoke and smokeless form of tobacco
- History of trauma to the head and neck
- Pregnant and postmenopausal women
- History of radiotherapy

- Patients with systemic or salivary gland diseases or under any drug therapy
- Patients with any oral lesion.

Saliva collection:

Salivary samples were collected between 10 am and 12:00 pm to minimize diurnal variations. Participants were instructed to abstain from eating, drinking, performing oral hygiene, chewing, or smoking for 60 minutes prior to and during study. Subjects were then asked to be seated on the dental chair and asked to spit 2–3 times in 1 min in a disposable container [Figure 1]. Measurement of salivary pH was done immediately after collection using digital salivary pH meter [Figure 2].

Figure 1: Unstimulated saliva sample collection

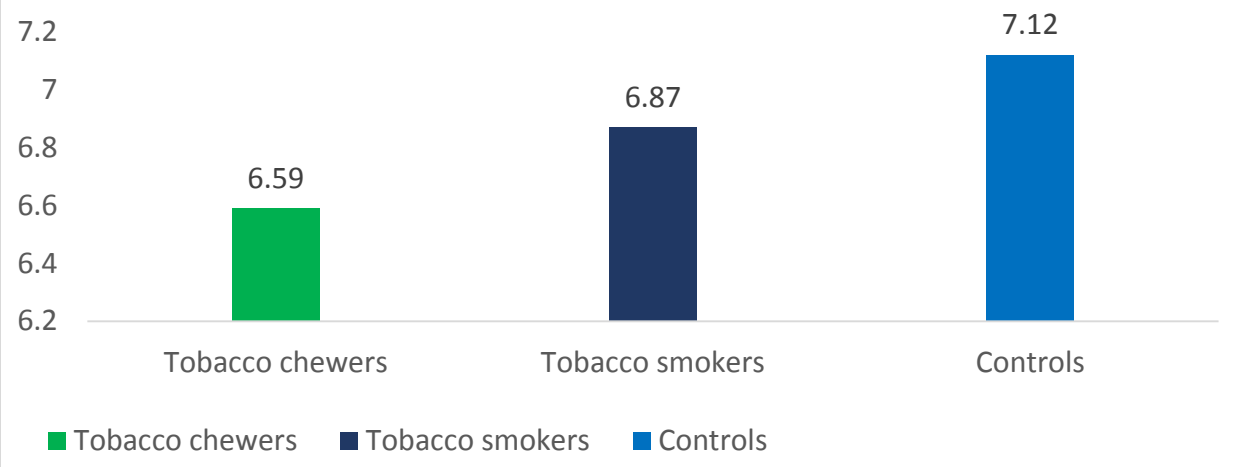
Figure 2: Digital pH meter

Statistics:

Collected data was analyzed using the Statistical Package for Social Service (SPSS) computer software. Unpaired Student's t-test, one-way ANOVA was applied to assess the pH difference between different groups. P value less than 0.05 was considered to be statistically significant.

RESULTS:

The mean pH scores of saliva in three different groups indicated that the control group had the highest pH scores, while the tobacco chewers group had the lowest (acidic) [Graph 1, Table 1].



Graph 1: Graph showing average pH scores of saliva in three groups

Mean and standard deviation of Group A was 6.5 ± 0.4399, Group B was 6.87 ± 0.4835 and Group C was 7.12 ± 0.1446 [Table 1].

GROUPS	**MEAN**	**STANDARD DEVIATION**	**VARIANCE**
Group A (Tobacco chewer)	6.59	±0.4399	0.1935
Group B (Tobacco smoker)	6.87	±0.4835	0.2337
Group C (Controls)	7.12	±0.1446	0.0209

Table 1: pH scores of saliva between tobacco chewers, smokers and controls

When an unpaired t-test was used to compare the salivary pH scores between different groups, the results showed an extremely significant difference between tobacco chewers and controls. However, the difference between tobacco chewers and smokers was not quite significant [Table 2].

PAIRS OF GROUPS	PROBABILITY OF UNPAIRED "T" TEST	P- SIGNIFICANCE
Tobacco chewers & Smokers	0.06	Not quite significant
Tobacco chewers & Controls	0.0001	Extremely significant
Tobacco smokers & Controls	0.0328	Significant

Table 2: Comparison of pH scores between different pairs of groups

When one-way ANOVA test was applied to compare the salivary pH scores among the three groups, P value was 0.0003 and it revealed a significant difference in pH scores among them [Table 3].

SOURCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	F STAT	P VALUE
Between groups	2	2.8643	1.4322	9.5844	0.0003
Within groups	57	8.5173	0.1494		
Total	59	11.3817			

Table 3: One way ANOVA F-table for comparing the pH scores of saliva among three groups

DISCUSSION:

Saliva, the easily accessible and non-invasive bodily fluid, consistently envelops the oral cavity and is primarily generated by three main pairs of salivary glands: the submandibular, parotid, and sublingual glands. Additionally, minor submucosal salivary glands contribute to its production [6,7]. Saliva is composed of a variety of constituents and physicochemical properties that are crucial for preserving oral health. It not only protects the teeth and oropharyngeal mucosa but also facilitates articulation of speech, and is imperative for mastication and swallowing. Moreover, saliva plays a crucial role in maintaining a balanced microbiota [8]. It contains numerous inorganic and organic compounds that serve as indicators reflecting the overall health of the body. In addition to its other functions, saliva may act as the initial defense against oxidative stress. Due to its composition and functions, saliva could have a significant role in controlling or modulating oxidative damages in the oral cavity [9].

The study of unstimulated salivary secretion provides an accurate assessment of the status of salivary gland whereas stimulated saliva is useful for evaluating functional reserve [10]. In the present study, the mean and standard deviation for Group A was 6.59 ± 0.4399, Group B was 6.87 ± 0.4835 and Group C was7.12 ± 0.1446 when compared. A significant relation was obtained, a lower salivary pH was observed in Groups A and B compared to Group C. Salivary pH was the lowest in Group A compared to Group B and Group C probably because of use of lime in smokeless form, which can react with bicarbonate buffering system resulting in a loss of bicarbonate. This interaction causes saliva to become more acidic, which can contribute to free radical injury and microstructural changes in the oral mucous membrane. Additionally, changes in electrolytes and ions due to lime usage can affect the pH of saliva by altering its buffering

capacity. Furthermore, there is a negative correlation between age and salivary pH, that is, as individuals age, their salivary pH tends to decrease. Studies have shown that males typically have higher salivary pH values compared to females. Decreased salivary secretion is also related to a greater frequency of oral dryness in females and decreased buffer capacity [11]. The consumption of areca nuts and various forms of tobacco can lead to alterations in salivary pH, making the oral mucosa more vulnerable to toxins released by these substances [12].

Khan et al. observed a lower salivary pH among smokers compared to nonsmokers which was consistent with the findings of the present study [13]. Grover et al observed that Salivary pH was the lowest in tobacco chewers compared to smokers and controls [2]. Rooban et al. conducted a cross-sectional study on areca nut chewers and non-chewers, in which subjects were divided into two groups (chewers and non-chewers) and pH was measured. They found that in individuals who were long-term areca nut chewers, there was a significant decrease in salivary pH. This decrease in pH makes the oral mucosa more susceptible to the toxic effects associated with prolonged areca nut chewing [14]. In contrast, according to Alpana Kanwar et al. the mean (±SD) pH for smokers, chewers and controls was 6.8 (±0.1), 6.7 (±0.1) and 7.04 (±0.1) respectively when compared and a nonsignificant relation was obtained though, lower salivary pH as was observed in Groups A and B [6]. Reddy et al. found no difference in salivary pH between the chewers and nonchewers [15]. This difference could be due to the factors such as the quantity of tobacco used, lime content, and other additives [3]. Lime (calcium oxide in aqueous forms calcium hydroxide) might potentially cause oxidative damage or interact with the body's natural pH buffering systems, leading to pH alterations [16]. Dohan et al observed lower salivary pH levels in the tobacco smokers compared to the non-smokers (7.058 and 7.168 respectively), however, these differences did not reach the significant level [17].

CONCLUSION:

Based on the findings of this study, it can be inferred that prolonged tobacco consumption, particularly in smokeless forms, can lead to notable increase in acidity (lower pH). These changes among long-term tobacco users may make the oral mucosa more susceptible to a range of oral and dental diseases. Salivary pH measurement can be used as chair side and non-invasive measure for assessing pathological changes in oral mucosa linked to vulnerable effects among people addicted to these adverse habits; thereby, early recognition can prevent morbidity and mortality. Further studies are required with larger sample size and long term use of tobacco chewers and smokers.

Conflicts of interest: Nil

Financial Support: Nil

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