



RESEARCH ARTICLE

EFFECT OF SMOKING AND CHEWING TOBACCO ON RESTING SALIVARY FLOWRATE AND pH

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ABSTRACT

Aim: The aim of the study is to analyze and compare the long term effect of tobacco on salivary Flowrate and pH among tobacco Chewers, Smokers and Controls.

Materials and Methods: The study group consisted of 60 patients, categorized into three sub groups of 20 non-tobacco users, 20 Tobacco chewers and 20 Tobacco smokers. Salivary flowrate was measured using graduated tubes and pH of salivary flowrate using pH strips. Data were analyzed using one way ANOVA. Probability value .05 is considered as statistically significant.

Results: Alterations in salivary flowrates are observed in different form of tobacco users. The mean salivary flowrate and pH were 0.2200 in the smokers group, 0.1500 in chewers (paan masalas) group and 0.4300 in control group was noted, when compared a Significant difference was noted (P=.000). The mean (\pm SD) salivary pH of whole saliva, was 6.12 (\pm 0.5) in the smokers group, 5.47 (\pm 0.61) in the chewers group and 6.97 (\pm 0.11) in the control group.

Conclusion: From the present study, it can be concluded that the long-term use of tobacco significantly reduces the Salivary flowrate and salivary pH. Alterations in these parameters could be an early sign of oral mucosal deterioration.

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INTRODUCTION

The oral cavity is kept moist by a film of fluid called saliva that coats the teeth and the mucosa (Alpana Kanwar *et al.*, 2013). It is an important body fluid which is very essential for oral health. It constitutes the unique and dynamic ecologic milieu of oral cavity (Abhay K. Pandey, 2014). Saliva is necessary for protection, lubrication of oral mucosal tissues, remineralization of teeth, digestion, taste sensation, stimulation, pH balance, phonation. Saliva, the fluid in the mouth is a combined secretion of three pairs of Salivary glands: the Parotid Gland, the Submandibular Gland, the Sublingual Gland; together with numerous minor salivary glands (Khan *et al.*, 2010). The three major salivary glands contribute to 90% mixed fluid in the mouth that is known as Whole Saliva. Approximately, 0.5 L-1.5 L of saliva is secreted per day (Indirani Barman and Umesh Chandra Prasad, 2015). The resting salivary flowrate are 0.3ml/min. Usage of tobacco influences the salivary flowrate and pH. Tobacco can be consumed through the mouth in variety of Forms, varied from Smoking to Smokeless Tobacco. Smoking and chewing of tobacco has a number of well documented side effects on the oral cavity (Indirani Barman and Umesh Chandra Prasad, 2015).

pH of the saliva raises during smoking but over long time most study indicates that smokers have reduced pH (Indirani Barman and Umesh Chandra Prasad, 2015). The pH in the saliva plays an important role in the life, growth and multiplication of oral bacteria (Rooban *et al.*, 2006). Given the paucity of literature on the influence of tobacco and areca nut use on the salivary flowrate and pH, this study was undertaken to analyze the alteration in salivary flowrate and pH between tobacco users, Areca nut users and persons with no deleterious habits.

MATERIALS AND METHODS

This is a prospective, randomized, cross sectional study in which a total of 60 subjects were selected from the outpatient Department of ORAL MEDICINE AND RADIOLOGY, Meenakshi Ammal Dental College and Hospital, Chennai. The study was categorized into three sub- groups. 20 subjects who are Non-Tobacco users, 20 Tobacco Chewers, 20 Tobacco Smokers

Saliva collection Method

Saliva collection was done between 9am to 12.00 pm to avoid diurnal variation. Each subject was advised not to drink, eat or perform oral hygiene or smoke 60 minutes before and during the study. Subjects were asked to spit the saliva on a

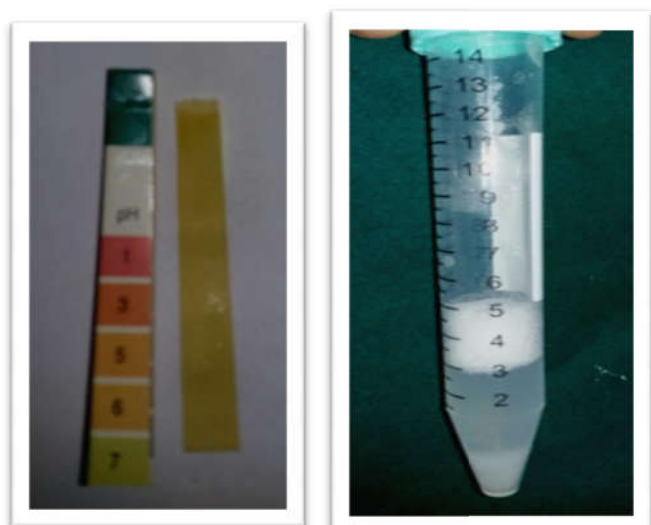
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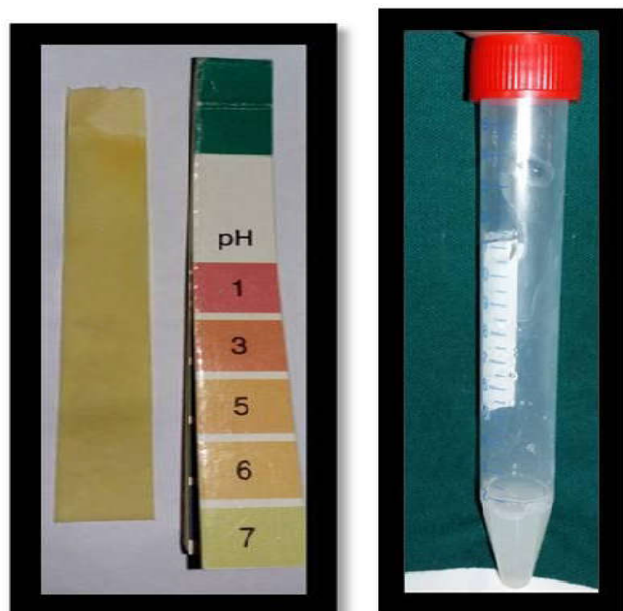
saliva collecting container for 5 minutes and later transferred to a graduated container. During saliva collection patients were instructed not to swallow. After collection the salivary flowrate was measured and expressed in ml/minute on the graduated tube. Salivary pH was measured immediately after measuring salivary flowrate using pH strips.

Inclusion Criteria: Consists of patients in the age group of 20 to 60 years who are Chronic tobacco users of more than 6 months.

Exclusion Criteria: consists of Subjects suffering from systemic illness, Subjects undergoing Radiotherapy, Chemotherapy, Clinically proven Potentially Malignant Disorders



Salivary flow rate and salivary pH in tobacco smokers



Salivary flow rate and salivary pH in tobacco chewers

RESULTS

The collected data were analysed with IBM. SPSS statistics software 23.0 Version. To describe about the data descriptive statistics mean & S.D were used. In all the above statistical tools the probability value .05 is considered as significant level.

Control

S.no	Age	Salivary flow rate	Salivary ph
1	34YEARS	0.5ml/min	7
2	35	0.3ml/min	7
3	24	0.3ml/min	7
4	40	0.5ml/min	7
5	34	0.5ml/min	7
6	47	0.5ml/min	6.5
7	27	0.5ml/min	7
8	46	0.4ML/MIN	7
9	23	0.4 ml/min	7
10	38	0.4 ml/min	7
11	21	0.4 ml/min	7
12	37	0.4 ml/min	7
13	35	0.4 ml/min	7
14	23	0.4 ml/min	7
15	20	0.4 ml/min	7
16	31	0.4 ml/min	7
17	36	0.4 ml/min	7
18	25	0.5ml/min	7
19	40	0.5ml/min	7
20	36	0.5ml/min	7

Smokers

S.no	Age	Duration	Salivary flow rate	pH
1	26	8 years	0.2ml/min	6
2	36	30 years	0.2ml/min	5.5
3	44	12 years	0.2ml/min	6
4	42	15 years	0.2ml/min	6
5	48	16 years	0.3ml/min	6
6	37	5 years	0.3ml/min	6.5
7	58	20 years	0.2ml/min	6
8	33	40 years	0.1ml/min	6
9	45	10 years	0.3ml/min	7
10	29	6 months	0.3ml/min	7
11	47	5 years	0.2ml/min	6.5
12	30	3 years	0.3ml/min	7
13	31	40years	0.2ml/min	5.5
14	59	8 years	0.2ml/min	6
15	27	5 years	0.2ml/min	6.5
16	42	20 years	0.2ml/min	6
17	28	5 years	0.2ml/min	6
18	38	10 years	0.2ml/min	6
19	45	20 years	0.2ml/min	5.5
20	38	12 years	0.2ml/min	5.5

Chewers

S.No	Age	Duration	Salivary flow rate	ph
1	26	8 years	0.2ml/min	6
2	36	30 years	0.2ml/min	5.5
3	44	12 years	0.2ml/min	6
4	42	15 years	0.2ml/min	6
5	48	16 years	0.3ml/min	6
6	37	5 years	0.3ml/min	6.5
7	58	20 years	0.2ml/min	6
8	33	40 years	0.1ml/min	6
9	45	10 years	0.3ml/min	7
10	29	6 months	0.3ml/min	7
11	47	5 years	0.2ml/min	6.5
12	30	3 years	0.3ml/min	7
13	31	40years	0.2ml/min	5.5
14	59	8 years	0.2ml/min	6
15	27	5 years	0.2ml/min	6.5
16	42	20 years	0.2ml/min	6
17	28	5 years	0.2ml/min	6
18	38	10 years	0.2ml/min	6
19	45	20 years	0.2ml/min	5.5
20	38	12 years	0.2ml/min	5.5

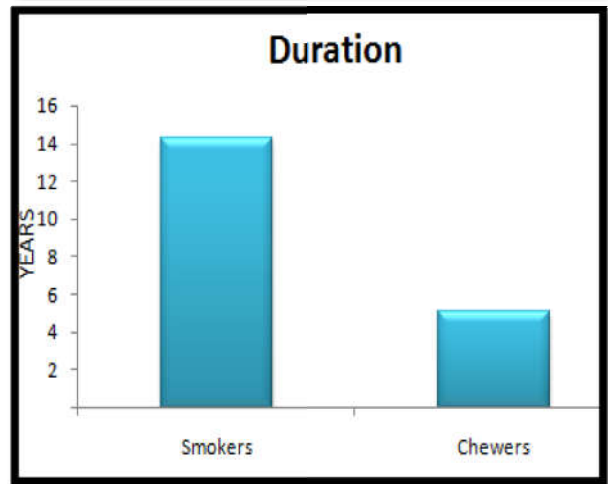
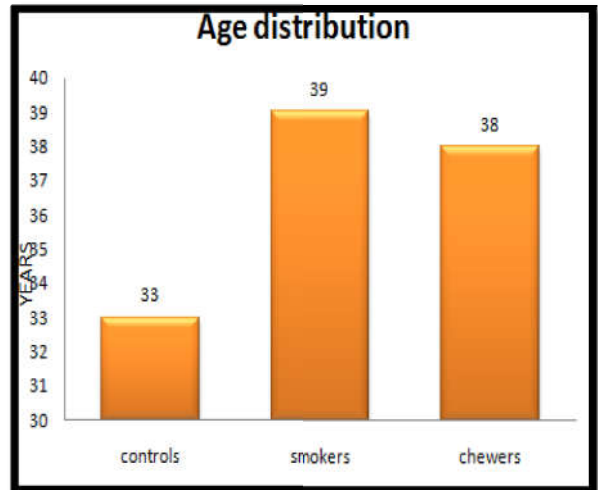
		Descriptives				95% Confidence Interval for Mean	
		N	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound
AGE	Controls	20	32.60	8.035	1.797	28.84	36.36
	Smokers	20	39.15	9.599	2.146	34.66	43.64
	Chewers	20	38.05	8.959	2.003	33.86	42.24
	Total	60	36.60	9.201	1.188	34.22	38.98
SALIVARYFLOWRATE	Controls	20	.4300	.06569	.01489	.3993	.4607
	Smokers	20	.2200	.05231	.01170	.1955	.2445
	Chewers	20	.1500	.07609	.01701	.1144	.1856
	Total	60	.2667	.13613	.01757	.2315	.3018
pH	Controls	20	6.9750	.11180	.02500	6.9227	7.0273
	Smokers	20	6.1250	.48327	.10806	5.8988	6.3512
	Chewers	20	5.4750	.61719	.13801	5.1861	5.7639
	Total	60	6.1917	.76519	.09879	5.9940	6.3893

P - Value ** Highly Significant at P ≤ .01

P - Value * Significant at P ≤ .05

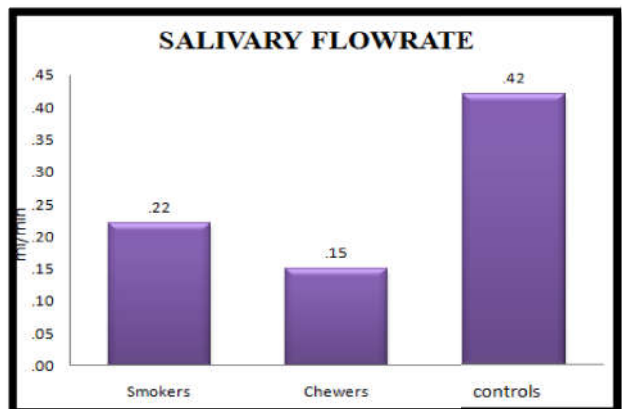
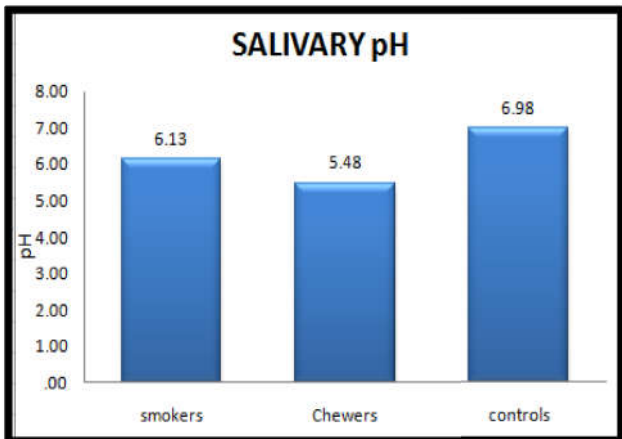
P - Value # No Significant at P > .05

		ANOVA				
		Sum of Squares	df	Mean Square	F	Sig.
AGE	Between Groups	492.100	2	246.050	3.115	.052
	Within Groups	4502.300	57	78.988		
	Total	4994.400	59			
SALIVARYFLOWRATE	Between Groups	.849	2	.425	99.205	.000
	Within Groups	.244	57	.004		
	Total	1.093	59			
pH	Between Groups	22.633	2	11.317	54.149	.000
	Within Groups	11.913	57	.209		
	Total	34.546	59			



DISCUSSION

Saliva is an important body fluid, which is very essential for oral health. It is composed of various electrolytes, peptides, glycoproteins, and lipids having antimicrobial, antioxidant, tissue repair and buffering activities. Unstimulated whole saliva reflects basal salivary flowrate, it is present in the oral cavity for about 14 h a day and it is the secretion that provides protection to oral tissues. Stimulated saliva represents the secretion during food intake (physiologic stimulation) and is present in our mouths for up to 2 hours. Hence, the study of unstimulated salivary secretion is an accurate method to analyze salivary gland status while stimulated saliva is useful for the study of the functional reserve. The adverse effect of cigarette smoking and other forms of tobacco are numerous, and tobacco use has been associated with gingival, oral mucosa and dental alterations. Salivary Flowrate has an important role in the pathogenesis of oral and dental diseases. Saliva is the first biological fluid that is exposed tobacco (smoked/smokeless form), which contains numerous toxic compositions responsible for structural and functional changes in saliva. The pH in the saliva plays an important role in the life, growth and multiplication of oral bacteria. The number of acidophilic bacteria is increased when the pH in the saliva is very low, whereas the number of the acid-sensitive bacteria is decreased. The increased number of acidophilic bacteria in the dental plaque and saliva above 105 colony forming units colonies, as well as a low pH and caries risk test-buffer capacity of the saliva, can indicate a high risk of caries. Therefore, altered whole-mouth Salivary Flowrate has an important role in the pathogenesis of oral and dental diseases. Alterations in salivary



function may lead to impairment of oral tissues and have a large impact on the patient's quality of life. A higher incidence of dental caries, oral mucositis, dysphagia, oral infections and altered taste has been reported in individuals with reduced salivary flow. In the long-term use of tobacco the taste receptors, a primary site for salivary secretion, are repeatedly exposed to tobacco for long-time thus presumably affecting the salivary reflex.

In the present study the mean age group in three groups are, In smokers (mean age, 39.15 years), in chewers (38.05 years) and the control group (mean age, 36.60years) each group consisted of 20 males and a total of 60 males. In the present study, the mean (\pm SD) Salivary flowrate was found to be 0.2200 in the smokers group, 0.1500 in chewers group and 0.4300 in control group was noted, when compared a Significant difference was noted ($F=99.025$, $P=.000$). This decrease in Salivary flow rate is due to the effect of nicotine on the taste nerve Apparatus. Khan *et al.* observed that some individuals develop tolerance to the salivary effects of smoking in the long term use. A number of studies have shown that cigarette smoking would typically cause a noticeable short term increase in Salivary FlowRate, which is still unclear (Khan *et al.*, 2010). It has also been observed that some individuals develop tolerance to the salivary effects of smoking in the long-term use. (Maryam Rad *et al.*) However, studies have shown that long term consumption of tobacco in any form, especially smokeless form, is one of the risk factors for reducing saliva, which was observed in the present study. These findings were also consistence with the finding of Rad *et al* in which the mean Salivary FlowRate was lower in smokers that is, 0.38 ± 0.13 ml/min as compared to nonsmokers that is, 0.56 ± 0.16 ml/min

On the contrary, in the study conducted by Fenoll-Palomares *et al.* (2004). The mean Salivary Flowrate was in which the mean Salivary Flowrate was lower in smokers that is, 0.38 ± 0.13 ml/min as compared to nonsmokers that is, 0.56 ± 0.16 ml/min higher in smokers that is, 0.52 ml/min as compared to nonsmokers that is, 0.45 ml/min. Similarly, Khan *et al.* showed that Salivary Flowrate was 0.46 ± 0.05 ml/min in smokers while 0.43 ± 0.05 ml/min in nonsmokers. There was no statistically significant difference was observed. Furthermore, Rooban *et al.* observed that the raw form of areca nut (RAN) has a highest mean Salivary Flowrate (4.18 mL/10 min) as compared to the nonchewers (3.5 mL/min for 10 min) and other chewers (Rooban *et al.*, 2006). A no. of studies shown that while cigarette smoking would typically cause a noticeable short-term increases in Salivary flowrate because it increases the activity of salivary glands in anyone who begins smoking, but in long-term use it has been observed that some individuals develop tolerance to the salivary effect of smoking so it reduces Salivary flowrate. And also smoking is one of the risk factors for reducing saliva and xerostomia. Most recent studies have concluded that cigarette smoking is certainly associated with an increased caries rate but a cause-and-effect relationship is still not proven (Bouquot and Schroeder, 1992).

Moreover, in the present study it was also observed that the mean (\pm SD) salivary pH of whole saliva, was $6.12 (\pm 0.5)$ in the smokers group, $5.47 (\pm 0.61)$ in the chewers group and $6.97 (\pm 0.11)$ in the control group. In the present study, salivary pH was found to be lower (acidic) in tobacco smokers and tobacco chewers than in controls. The difference was highly significant. ($p=0.000$) between the groups. On the contrary, the study

conducted by Al-Weheb10 showed that the mean salivary pH was higher in smokers that is, 7.32 as compared to nonsmokers that is, 7.27. Salivary flowrate influences the pH of saliva (Yeh *et al.*, 2000). The decrease in Salivary Flowrate alters salivary pH by decreasing bicarbonate secretion and this decrease in saliva bicarbonate in turn decreases the salivary pH. An increase in Salivary Flowrate alters salivary pH by increasing bicarbonate secretion (Kaufman and Lamster, 2002). Subjects in tobacco chewers group has lowest salivary pH probably because of use of lime in smokeless form, which can react with bicarbonate buffering system by the loss of bicarbonate, turning saliva more acidic. The statistical significant correlation between Salivary Flowrate and pH in chewers shows an increasing pattern may reflect an alteration in the electrolyte constituent of saliva in chewers. Lime (calcium oxide in aqueous forms calcium hydroxide) could cause a free radical injury or the high alkaline content probably reacts with the salivary buffering systems and alters the pH. Formation of reactive oxygen species in the oral cavity during betel-quid chewing has been demonstrated. In-vitro studies have shown that the generation of reactive oxygen species is due to auto-oxidation of the Polyphenols in areca nut and catechu. This reaction is enhanced by alkaline pH and by the presence of the transition metals, copper and iron. The alteration in electrolytes and ions alters the pH as they interact with the buffering systems of saliva (Rooban *et al.*, 2006; International Agency for Research on Cancer, 2004).

Conclusion

From the present study, it can be concluded that the long-term use of tobacco significantly reduces the Salivary flowrate and salivary pH. A significant negative association is found between salivary flowrate among tobacco chewers and smokers suggesting that a notable decrease in salivary flowrate and pH occurs with increased tobacco usage in the chewable form followed by smoking. Alterations in these parameters could be an early sign of oral mucosal deterioration. Hence salivary flow rate and salivary pH measurements can be used as a chair side, non-invasive measures for assessing the pathological changes in oral mucosa linked to the vulnerable effects among people addicted to these adverse habits thereby early recognition can prevent morbidity and mortality caused by Oral Potentially Malignant Disorder and Malignancy.

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