

Assessment Of Salivary Flow Rate (Sfr) And Salivary Ph In Subjects With Smoking And Nonsmoking Habits – A Cross Sectional Study

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Abstract

Background: Saliva is a complex component comprised 99% of water, 1% of organic, inorganic substances and enzymes. It helps in the maintenance of homeostasis in the oral cavity. Saliva is the first fluid to get exposed to the harmful contents of tobacco products. Repeated exposure to these substances leads to functional changes of saliva such as decreased buffering capacity, decreased salivary flow rate and increased propensity for pathological changes in the oral cavity. These changes could be diagnosed earlier by measuring salivary flow rate and pH in nonsmoking and smoking patients. The purpose of our study is to estimate the salivary flow rate and pH in subjects with nonsmoking and smoking habits and to evaluate whether there is any difference between the salivary flow rate and pH in patients who are smokers and in the control group who are non-smokers.

Materials and Methods: In this prospective observational study, 70 male participants of age group between 20 – 50 years, with the habit of smoking and nonsmoking were divided into two groups, Group 1 (control group) includes patients without smoking habits and group 2 (study group), patients with smoking habits for a maximum period of 2 years. The samples were collected between 9 am and 12 pm. Schirmer's strips were used to measure the salivary flow rate. Rounded end of the strips were placed in the floor of the mouth for 3 minutes and the readings were noted by the moistened calibrations present on the strip and then the pH strips were used to measure the salivary pH, which were placed on the floor of the mouth and the colour change is matched with the colour coding on the pH strip.

Results: On comparing the salivary flow rate between the study and control group, there was a significant decrease in SFR noted in patients with smoking habit. With respect to the salivary pH, there was a marked reduction in smokers than in patients with nonsmoking habits.

Conclusion: Our study has shown a significant reduction in SFR and pH in smokers with no evidential reduction and difference in SFR and pH respectively in non-smokers. Assessment of SFR and pH using schirmer's and pH strips is an inexpensive, non-intrusive, easy to perform and trouble-free test for measuring dry mouth which identify the patients who are more susceptible for oral pathologies corresponding to the SFR and pH reduction.

Key Word: Smoking, Salivary flow rate, Salivary pH, Schirmer's strips.

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I. Introduction

Saliva is a more complex body fluid in the body, essential for the oral health of each and every individual. It has protective function over the oral mucosa by mechanisms for teeth remineralization, digestion, taste sensation, pH balance and phonation. Saliva possesses a variety of electrolytes, peptides, glycoproteins, and lipids with antimicrobial, antioxidant, tissue repair, and buffering properties. ⁽¹⁾93% of whole salivary rate is secreted by the major salivary glands and 7% secreted by minor glands. Saliva is composed of 99% of water,

1% of organic and inorganic molecules, and various antibacterial substances. Daily secretion of saliva ranges from 0.75 to 1.5 L/ day. Unstimulated whole salivary flow rate (SFR) is about 0.3–0.5 ml/min. The normal pH of saliva ranges from 6.7 to 7.3⁽²⁾As a whole, the quantity and quality of saliva play a significant role in maintaining the integrity of oral health. Any reduction in the salivary flow rate can result in Hyposalivation and dry mouth, followed by the development of inflammation, fungal infection, Dental caries, Inflammation of major salivary glands, and halitosis. In our present study it is aimed to measure the difference between the salivary flow rate and pH in patients with smoking and non-smoking habits.

II. Material and Methods

This prospective comparative study was carried out in the Department of Oral medicine and Radiology, Madha Dental College and Hospital, Chennai, Tamil Nadu from January 2022 to April 2022. A total of 70 participants, in which subjects with the habit of smoking for a minimum of 2 years, aged between 20 to 50 years and non-smokers were included in the study.

Study design: Prospective open label observational study

Study Location: Department of Oral Medicine and Radiology, at Madha Dental College and Hospital, Chennai, Tamil Nadu.

Study Duration: January 2022 to April 2022.

Sample size: 70 patients.

Sample size calculation: This sample size was estimated using G power software (3.1.2 software), calculated as 35 patients for each group (Group I – Nonsmokers, Group II – Smokers for a minimum of 2 years of smoking habit)

Inclusion criteria:

1. Male patients with age group between 20 and 50 years
2. Patients with history of smoking habits for a minimum of 2 years

Exclusion criteria:

1. Subjects with systemic diseases
2. Medication for systemic diseases (Anti hypertensives, Diuretics)
3. Subjects with history of radiotherapy
4. Trauma to head and neck
5. Denture wearers

Procedure methodology

The samples were collected between 9am to 12pm. Schirmer's strips were used to measure the salivary flow rate, by placing the rounded end of the strip on the floor of the mouth for 3 minutes, the readings are noted by the moistened calibrations present on the strip. pH strips are used to measure the salivary pH, by again placing the strip on the floor of the mouth and the color change is matched with the color coding on the pH strip.

Statistical analysis

Data were analyzed using SPSS version (IBM SPSS Statistics, Version 20.0, Armonk, NY: IBM Corp). Shapiro wilks normality test was used to test the normality of data distribution. Mann-Whitney U test for comparison of Mean age, Mean salivary flow rate & salivary pH between group I and II patients.

III. Result

The subjects in the present study were in the age group of 20 - 40 years. Group I individuals were the control and group II subjects with the habit of smoking for a minimum of 2 years were the study group. The mean salivary flow rate and pH of saliva were reduced in group II patients. The distribution of study subjects based on Mean age, Mean Salivary flow rate and Mean Salivary pH between the Groups were calculated.

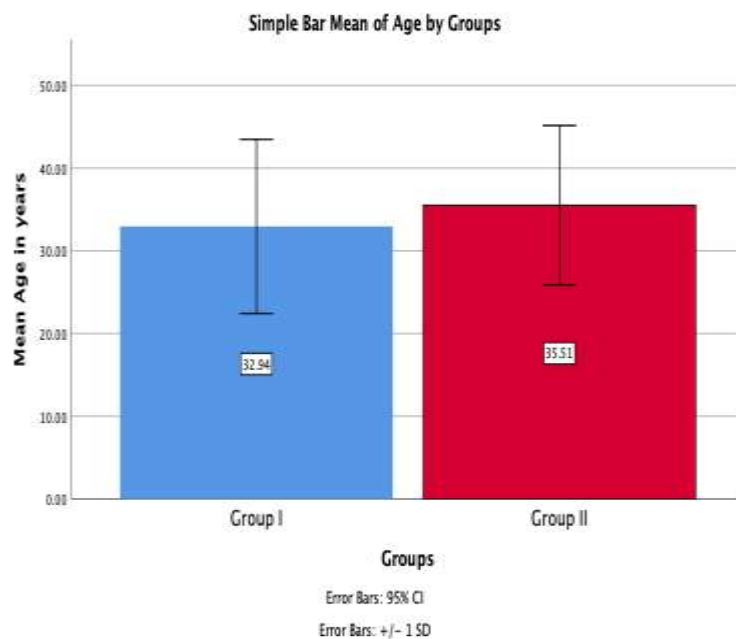


Figure 1.shows the distribution of study subjects based on Mean age between the Groups

Age	Groups	N	Mean	Standard deviation	Mann-Whitney U	P value
	Group I	35	32.94	10.52	497.50	0.17
	Group II	35	35.51	9.64		

Table 1.shows the mean distribution of age group and P value which is nonsignificant (>0.05)

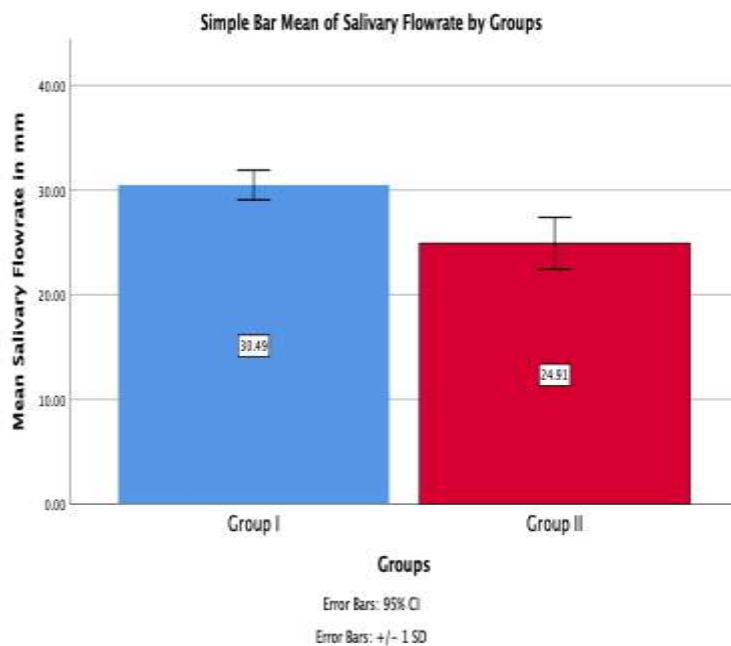


Figure 2.shows the distribution of Mean Salivary flow rate between the Groups

Salivary Flow rate	Groups	N	Mean	Standard deviation	Mann-Whitney U	P value
	Group I	35	30.49	1.42	11.50	0.001**
	Group II	35	24.91	2.47		

Table 2.shows the mean distribution of salivary flow rate in both the groups, in which the P value was statistically significant

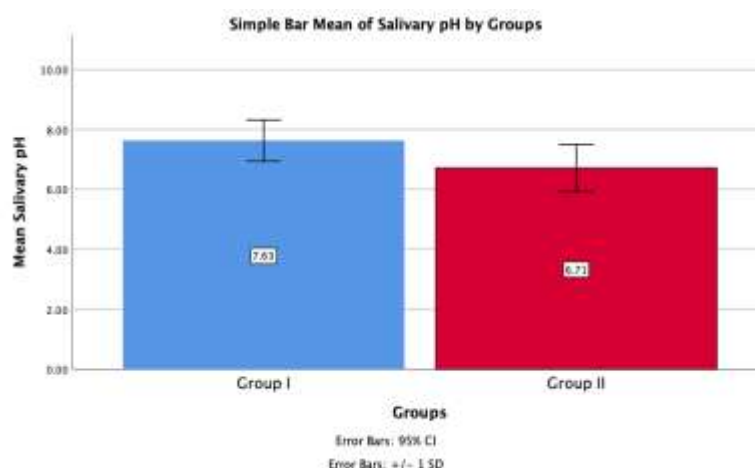


Figure 3.shows thedistribution of Mean Salivary pH between the Groups

Salivary pH	Groups	N	Mean	Standard deviation	Mann-Whitney U	P value
	Group I	35	7.63	0.69	261.50	0.001**
	Group II	35	6.71	0.79		

Table 3.shows the distribution of Mean Salivary pH between both the groups, in which the P value was statistically significant

IV. Discussion

Oral cavity, a vital cavity of the human body is always get moistened by a film of fluid called saliva whichprotects the teeth and the surrounding mucosa. It is the most accessible fluid and can provide a more feasible tool for non-invasive measurements of various body parameters in the near future. An alteration in the whole-mouth SFR plays a vital role in the pathologies of the oral cavity such as dental caries, erosions & periodontitis. Literature studies have shownthat duration of habits more than 5–7 years was considered as the longer period for changes to occur in the oral cavity.Chronic and repeated exposure to smokingcan result in the structural and functional alterations of saliva. ⁽³⁾Cigarette comprises of 4000 bioactive compounds and 300 carcinogenic contents, which acts on specificcholinergic receptors in the brain, inturn increasing the salivary flow rate for a short duration. Long-term duration of smokingcausesincreased epinephrine effect or inactivation of taste receptors by nicotine, thereby depressing the salivary reflex andpre- disposing to the degeneration of salivary gland⁽⁴⁾In the present study, there was a significant reduction in the SFR in patients with smoking habit. In accordance to the study, decreased SFR in subjects with smoking was observed in studies conducted by Rad et al. An increase in SFR in short-term smoking was observed in studies conducted by Rehan et al ⁽⁵⁾

In recent years, consuming smokeless tobacco has attained popularity as an alternative to smoking. Studies have shown thatdifferent forms of chewable tobacco have different effects on salivary flow rate. The presence of areca nut products in the tobacco produces alteration in the autonomic nervous system by increasing the plasma level of epinephrine and norepinephrine resulting in decreased SFR in Group II (smokers) subjects compared to the non-smokers. ⁽⁵⁾In accordance to our study, SFR was reduced in studies done by Kanwaer et al⁽⁶⁾In contrary, few studies done by Siddabasappa et al. showed an increase in SFR.⁽⁷⁾

The present study shows a significant reduction in mean salivary pH in smoking group. On comparing with the literature studies, asignificant reduction in salivary pH depends on the frequency and duration of smoking. The present study results were in accordance to the studies done by Kunwar et al ⁽⁶⁾In contrary, the salivary pH was increased in a study done by Rooban et al.⁽⁸⁾ No significant reduction in salivary pH was observed in a study done by Dyasanoor and Saddu.⁽⁹⁾

In our study, there was a significant reduction in SFR and salivary pH in subjects with smoking habit. Alteration in the quantity and quality of saliva, along with chronic irritation, makes the oral mucosa more vulnerable to changes. **Nicotine** is a biphasic component which is readily absorbed by the mucous membrane; once it is absorbed, it forms arachidonic acid metabolites which cause an increased cell division and vascular endothelial growth factor and cyclo oxygenase which cause an increased proliferation of abnormal epithelial cells and delay the apoptosis ⁽¹⁰⁾

Alterations in levels of SFR and pH in smoking can impair the salivary defence mechanism.

Hence, the quantitative and qualitative assessment of saliva in subjects with smoking habit aids in early detection of oral environment deterioration. It is inferred from the present study that smoking has a definitive effect on Salivary flow rate and salivary pH.

Measurement of SFR using modified Schirmer tear strips is a non-invasive, inexpensive, easy to perform, and well-tolerated test for assessing the dry mouth, that readily identifies patients

who are asymptomatic and those who experience profound xerostomia and hyposalivation due to smoking habits. Hence, SFR and salivary pH can be used for assessing the early pathological changes in the oral mucosa. Further, research with longitudinal study design is needed in assessing SFR and pH alteration in subjects with smoking and smokeless habits. Further studies are recommended for assessment of SFR and pH in larger sample of patients with smoking habits.

V. Conclusion

The conclusion of our study has revealed that the long-term effects of smoking significantly reduces SFR and pH, making oral mucosa vulnerable to changes such as dry mouth, especially cervical caries, gingivitis, tooth mobility, calculus and halitosis. Reducing the habit of smoking can help increase the salivary flow rate and pH which in turn reduces the chances of alterations in the oral hard and soft tissues.

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