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Evaluation of change in salivary ph, following consumption of tea and comparing it with change in salivary ph after rinsing with normal saline and consumption of chewng gum

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Abstract

Introduction: Tooth decay; is a chronic disease that starts a long time before it becomes clinically visible in the mouth. Therefore, it is of utmost importance that the individuals with high risk of decay are identified in advance and taken the necessary precautions.

Methodology: This study is a clinical trial to evaluate the changes in salivary pH after consumption of tea. The study is carried out on 16 volunteers (8 females, 8 males) aged 18-24 years, who fulfil the inclusion criteria and are able to give informed consent.

Materials Used

1. Red Label tea: Popular and easily available tea brand in India which is commercially available
2. pH paper: pH paper manufactured by Thermo Fisher Scientific India Pvt. Ltd. was used having 'Full Range' (pH 1.0 to 14.0)
3. Solution of Normal saline: It is commonly used phrase for a solution of 0.90% w/v of NaCl, 308mOsm/L or 9.0 per litre.
4. Chewing gum: A sugar-free coated gum which contained Xylitol as its main ingredient was used. Happy dent chewing gum was selected as it is easily available.

Result: There was statistically significant difference ($p<0.05$) in salivary pH after rinsing with normal saline followed by chewing gum.

Discussion: Changes in salivary pH are important for dental health. The majority of the studies dealing with salivary pH and food intake are carried out in relation to bacterial plaque and caries development. Therefore, we aimed to evaluate the effect of tea on saliva pH in this study.

Conclusion: In order to prevent tooth decay, there is a need to raise awareness about conscious and controlled consumption of beverages that may lead to significant reductions in salivary pH.

Keywords: Tooth decay, salivary pH, tea, chewing gum, normal saline.

Introduction

Tea's origin story is infused with a blend of myth and fact and coloured by ancient concepts of spirituality and philosophy. .According to Executive Summary of Study on Domestic Consumption of Tea in India, 'India is the 2nd largest producer of tea in the world and accounts for the highest tea consumption globally' .As Dentists, it then becomes important for us to evaluate if consumption of tea has some effect on pH of saliva and if it is associated with dental caries. Dental caries is a widely spread disease of calcified tissues of teeth. The basic patho-physiology of the disease involves the demineralization of the inorganic component and the subsequent breakdown of the organic moieties of enamel and dentin. According to Miller, the etiology of dental caries has been associated with acid dissolution of the mineral tooth components, the acid being produced by oral bacteria using dietary carbohydrates as a substrate. In other words, dental caries is a multi-factorial disease which requires a susceptible host, a cariogenic microflora and a suitable substrate that must be present for a sufficient length of time. Several recent reports have presented concerns with the levels of caries that have been identified in populations in diverse parts of the World[1] . Although largely preventable, dental caries and periodontal diseaseare the two biggest threats to oral health [1-2] .Tooth decay; is a chronic disease that starts a long time before it becomes clinically visible in the mouth. For this reason, it is of utmost importance that the individuals with high risk of decay are identified in advance and advised to take thenecessary precautions[1-3-4] . Saliva plays a critical role in the maintenance of oral health. Saliva is one of the most important factors in the defensive mechanism of the mouth. In a healthy mouth, saliva contains antimicrobial enzymes, glycoproteins and basic electrolytes and protects the oral mucosa. Saliva is important for digestion, taste and bolus formation, protection of the teeth and antimicrobial effect. For the continuation of the good oral and dental health, the importanceof saliva and its components is well known [5-6].Organic and inorganic components, the buffering capacity, pH, viscosity and quantity of the saliva are very important to assess the caries risk. Saliva plays a fundamental role in maintaining the physical, chemical integrity of tooth enamel by modulating remineralization and demineralization. The present study attempts to evaluate the interaction between salivary pH and changing pH of plaque in order to prevent dental caries.

Materials and Methods

1. Red Label tea: Popular and easily available tea brand in India which is commercially available
2. pH paper: pH paper manufactured by Thermo Fisher Scientific India Pvt. Ltd. was used having 'Full Range' (pH 1.0 to 14.0)
3. Solution of Normal saline: It is commonly used phrase for a solution of 0.90% w/v of NaCl, 308mOsm/L or 9.0 per litre.
4. Chewing gum: A sugar-free coated gum which contained Xylitol as its main ingredient was used. Happy dent chewing gum was selected as it is easily available.
5. Preparation of Tea: A freshly prepared tea by adding two teaspoons of sugar and one teaspoon of Red label tea dissolved in one cup of water will be used.

Methods and Methodology

The present study is a clinical trial to evaluate the changes in salivary pH and flow rate after consumption of tea which is the most commonly consumed local beverage in India. It was performed in 'The Department of Public Health Dentistry' of Yogita Dental College and Hospital, Khed.'

Study Population: Subjects were selected from the general population of khed taluka. The study was carried out on 16 volunteers (8 females, 8 males) aged 18-24 years, who fulfilled the inclusion criteria and were able to give written informed consent.

Inclusions

1) Subjects with DMFT zero
2) Subjects with fully erupted 28 teeth
3) Subjects free from any systemic disease
4) Subjects should not have used mouthwash from 1 week before the start of the study.
5) Subjects consuming atleast two cups of tea daily.

Exclusions

1) Subjects suffering from diseases and having medication from last 1 week.
2) Subjects with a history of any antibiotic therapy in previous 1 month from the start of the study.
3) Subjects having retained deciduous dentition
4) Subjects with crowding
5) Medically compromised patients.
6) Patients undergoing any kind of orthodontic treatment.
7) Smokers

Ethical Clearance. Before carrying out the present study, the ethical clearance was obtained from the institutional ethical clearance committee.

Informed Consent. Before the start of the study, the purpose and methodology of the study was explained to each of the subject and informed consent was obtained.

Methodology

Pre-study preparation: The DMFT values were checked for all the subjects and those with DMFT values zero were selected for the trial. These selected subjects then were asked to brush their teeth twice a day with Colgate strong teeth toothpaste for a week before the study and a brand sample was provided for the same to maintain standardization or to nullify the effect of paste on salivary pH. One week prior scaling was advised to the subjects.

Actual phase: (Figure1)

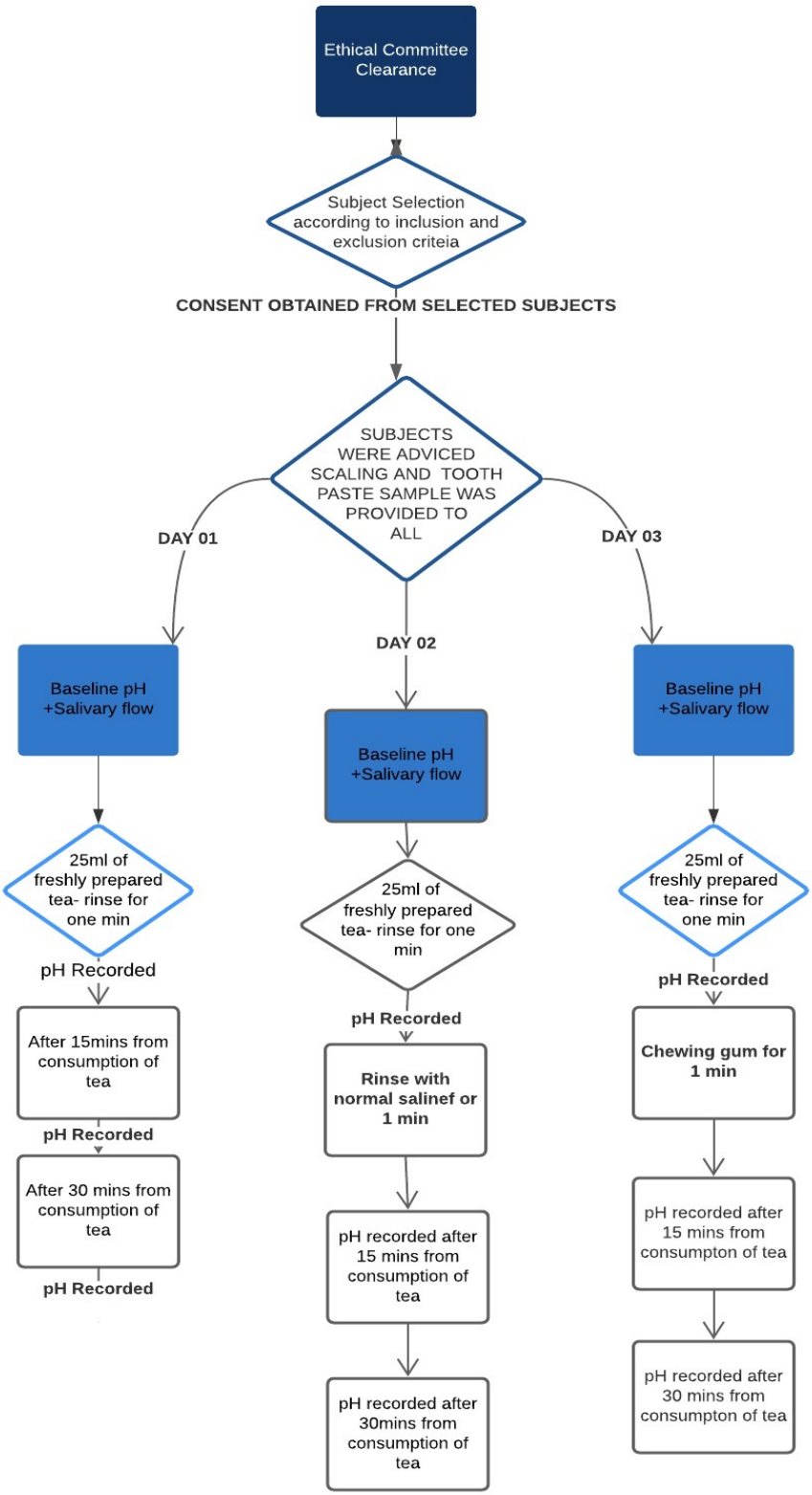
Day 1 : Early morning the subjects were called after brushing their teeth with the given sample of toothpaste without having breakfast. The baseline pH of each subject was recorded. Each subject was then given 25ml of freshly prepared tea. They were told to hold this tea in mouth for one min. pH was recorded for each subject after 15 mins from the consumption of tea and 30 mins from the consumption of tea and was analyzed.

Day 2: Early morning the subjects were called over after brushing their teeth with the given sample of toothpaste without having breakfast. The baseline pH of each subject was recorded. Thereafter, each subject was given 25ml of freshly prepared tea and told to hold it in the mouth for one min. The pH was recorded. The subjects were then given normal saline solution to rinse their mouth with. pH values of their saliva were recorded once after 15 mins from the consumption of tea and again after 30 mins from the consumption of tea.

Day3: Early morning the subjects were called over after brushing their teeth with the given sample of toothpaste without having breakfast. The baseline pH of each subject was recorded. Each subject was given 25ml of freshly prepared tea. They were told to hold this tea in mouth for one min. The pH was again recorded. The subjects were then given Happydent white chewing gum to chew. pH values of their saliva were recorded once after 15 mins

from the consumption of tea and again after 30 mins from the consumption of tea.

All the data obtained in three days of trial was tabulated and analyzed.



Sample Size: It was estimated based on previous articles.

Recording Ph of saliva: A pH meter was used to measure pH of saliva.

Results: Data that was obtained after carrying out the clinical trial was arranged in the Microsoft Office Excel spreadsheet 2007 and analyzed. The test used for the analysis was Repeated Measures ANOVA for intragroup comparison over a period of time. Three groups were compared by ANOVA.A statistically significant difference was observed at third and fourth intervals (15 min and 30 mins) with $p<0.001$ (Table 1)

Descriptive Statistics						
day		N	Minimum	Maximum	Mean	Std. Deviation
Day1	Baseline pH	16	6.00	7.00	6.3125	.47871
	pH after consumption of tea	16	5.00	7.00	5.6875	.60208
	15 mins afterconsumption of tea	16	5.00	6.00	5.3438	.47324
	30mins afterconsumption of tea	16	5.00	7.00	5.9688	.38595
Day 2	Baseline pH	16	5.00	7.00	6.4375	.62915
	pH after consumption of tea	16	5.00	7.00	5.9375	.44253
	15 mins afterconsumption of tea	16	7.00	8.00	7.1250	.34157
	30 mins afterconsumption of tea	16	6.00	7.00	6.6938	.44041
Day3	Baseline pH	16	6.00	7.00	6.3250	.47258
	pH after consumption of tea	16	5.00	6.00	5.6250	.46547
	15 mins afterconsumption of tea	16	6.00	8.00	7.0000	.36515
	30mins afterconsumption of tea	16	6.00	7.00	6.7500	.44721

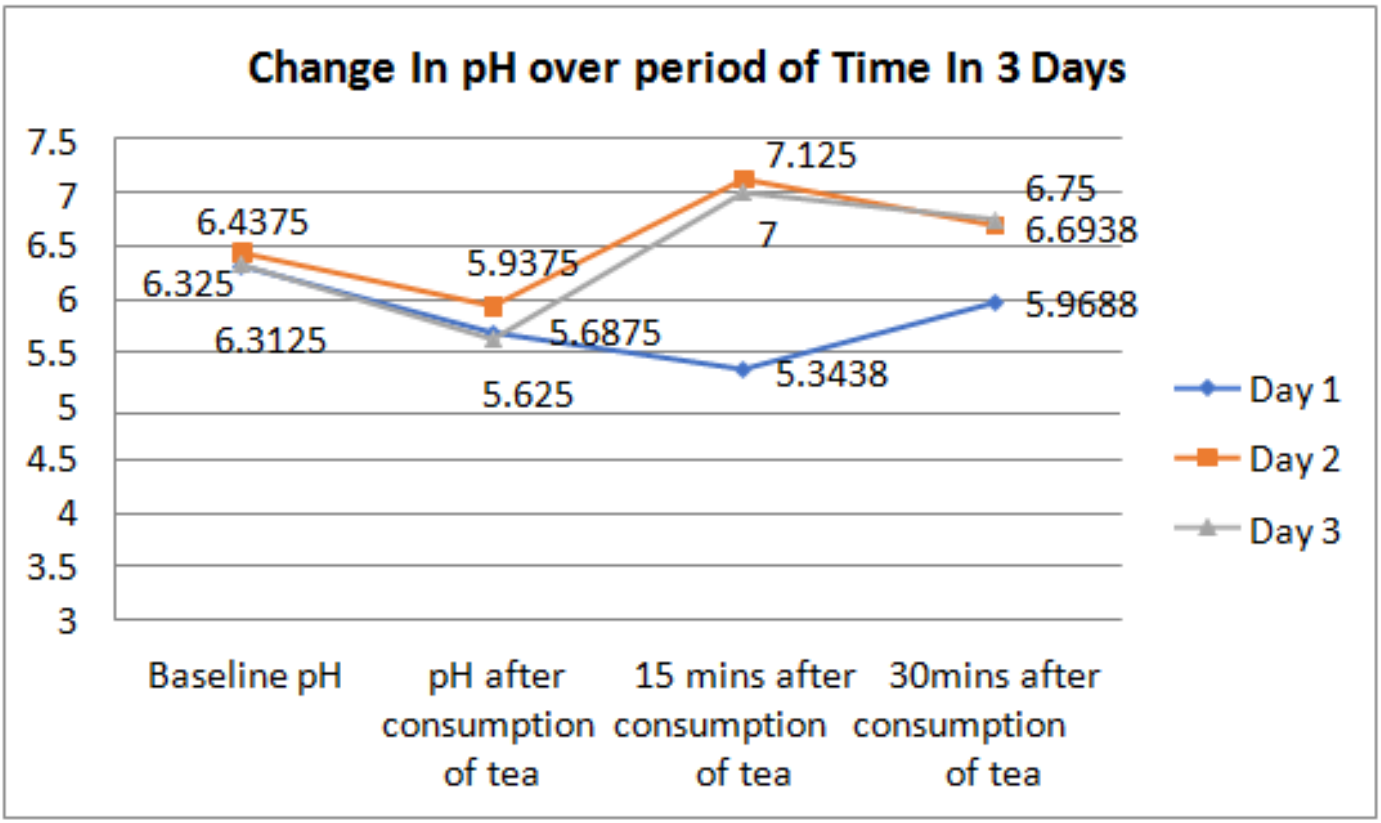


Figure 2

At baseline, mean salivary pH levels in different groups ranged from 6.31 to 6.43. There was a maximum drop seen in the salivary pH right after the consumption of tea where the mean pHof saliva was found to be between 5.6 to 5.9. This indicates that the pH of saliva turned acidic after the consumption of tea.

On the first day of the clinical trial, it was observed that the pH of saliva started coming back to its baseline value, 15 minutes and 30 minutes after the consumption of tea. On day 2 of the trial, pH was recorded 15 mins and 30 mins from the time tea was consumed after rinsing the mouth with normal saline, where it was observed that pH of saliva that had become acidic rightafter consumption of tea, came back to its baseline score with mean values 7.12 and 6.69 respectively.

On the third day, subjects were told to chew gum after consumption of tea and it was found that there was a statistically significant rise in salivary pH, mean of which was 7.00 and 6.75, 15 mins and 30 mins from the time tea was consumed. At all subsequent follow-up intervals, a statistically significant intergroup difference was observed (p = 0.001) (Figure 2)

Discussion

Saliva performs a multiplicity of roles within the mouth. The various functions of the oral tissues like the chewing, deglutition, taste sensation, speech and initial digestion of the carbohydrates would be impossible without the salivary secretions. It plays a critical role in the maintenance of oral health and is one of the most important factors in the defensive mechanism of the mouth. In a healthy mouth, saliva contains antimicrobial enzymes, glycoproteins, and basic electrolytes and protects the oral mucosa. Saliva is important for digestion, taste and bolus formation, protection of the teeth and antimicrobial effect 8-9 for the continuation of oral and dental health, the importance of saliva and its components is well known. Organic and inorganic components, the buffering capacity, pH, viscosity and quantity of the saliva are very important to assess the caries risk 8-10 It is such a complex biological fluid which is practically impossible to duplicate it from individual components. In a healthy state, the pH of saliva is maintained usually between 6.7to7.4.saliva affords both static protective effects, that act endlessly and dynamic effects, that act during the course of time salivary buffering capacity and sugar clearance are vital dynamic effects of saliva that prevent the demineralization of tooth structure11. The current study was conducted to evaluate the change in salivary pH after consumption of tea and was carried out on sixteen subjects with the mean age of 22 years selected among the general population of Khed taluka, in Ratnagiri district in Yogita Dental College and Hospital, Khed. The study subjects were similar concerning their age, dietary habits, oral hygiene measures and other lifestyle factors that may have considerably affected the study results. within the present study, consumption of tea caused an immediate drop in salivary pH that was statistically important. A variety of factors play a role in determining the change in secretion pH after the consumption of any liquid. when a beverage is consumed, an admixture of saliva and food is formed. The enhanced rate of flow of saliva, as a result of its consumption, increases the pH of saliva however the change depends on the sugar content, intrinsic pH, buffering capacity and manner within which thefoodisconsumed12.In the current study, it was found that chewing gum containing sugar led to an increase in salivary pH immediately after consumption. Dawes et al. reported an increase in salivary pH when the consumption of chewing gum containing sugar13. It was found that though there was an increase in salivary pH at 15minutes and 30minutes interval which was statistically significant. This could be because

chewing gum stimulated salivary flow, which augments rapid oral clearance of fermentable carbohydrates from the oral cavity is at peak solely among the first few minutes of chewing14. Within the present study chewing gums containing sugar substitute were found to increase the pH of saliva (immediately after consumption) and these results are in agreement with alternative studies that have reported that chewing gum containing sugar substitute increase buffering capacity of saliva, thereby increasing the salivary pH on top of the baseline salivary score15,14 Xylitol, above all, has antimicrobial action and causes stimulation of saliva resulting in enhanced buffer capacity and increase in pH14. Similar changes were seen once the subjects got to rinse their mouth with a solution of normal saline; it was found that there was a statistically significant rise in salivary pH at 15 and 30minutes interval where the pH of saliva was returned to its baseline values.

Conclusion

The present study concluded that the consumption of tea causes an immediate drop in the salivary pH which begins to rise after 15 minutes of its consumption until it reached the baseline salivary pH values. The drop in the salivary pH was found below the critical pH after the consumption of tea. Rinsing the oral cavity with normal saline or Chewing a gum containing sugar substitute leads to a rise in salivary pH after its consumption which can prove to be beneficial in maintaining oral health.

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