

Effect of Different Fruit Juices on PH of Dental Plaque: An In Vivo Study

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ABSTRACT

Aim: The aim of the study is to evaluate the effect of different juices on the ph of dental plaque.

Materials and method: 28 subjects were included in the study among 18-25 years of age group. Comparative evaluation of 4 different fruit juices (apple, lemon, mango and orange) was done on the ph of plaque. All the subjects were divided randomly into 4 groups 1, 2, 3 and 4 (7 subjects in each group). Oral prophylaxis was done for all subjects one week prior before the experiment. Ph of plaque was recorded before the administration of juices (at baseline), and after administering 100 ml of fruit juice from the index teeth(16,26,36,46) at 1min, 5 min, 10 min 15 min and 30 mins. Changes in Mean-plaque pH levels and mean pH difference after consumption of four different fruit juices at different time intervals was calculated using student t test.

Results: In this study group C (lemon juice) had more delirious effect on ph of plaque with statistically significant results at 1 and 5 mins post administration of juice.

Conclusion: All the fruit juices tested in the study were acidic and plaque ph values for all the four groups were below baseline at 30 mins.

Keywords: Dental plaque, fruit juices, plaque ph.

INTRODUCTION

"HEALTH IS THE GREATEST OF ALL POSSESSIONS". The concept of health has prevailed for centuries and dietary habits are constantly changing with modernization and urbanisation. The desirability of a healthy lifestyle has led to an increased consumption of juices.^{1, 2} Fruit juices have gained popularity among people of all age groups worldwide. They are sweet, perceived to be healthy and marketed as healthy drinks.³ People are aware of harmful effects of carbonated beverages and prefer fruit juices over them. But these fruit juices

also have erosive effect, which has been recognised for long time and is evident in the studies of Darby⁴ and W.D. Miller⁵.

Dental plaque is "a specific but highly variable structural entity, resulting from sequential colonization of microorganisms on tooth surfaces, restorations & other parts of oral cavity, composed of salivary components like mucin, desquamated epithelial cells, debris & microorganisms, all embedded in extracellular gelatinous matrix" (W.H.O ,1961). The acidogenic properties of dental plaque reflect both the dietary habits and the caries

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status of the patient. Thus, a high level of dental plaque acid production indicates that the diet and lifestyle is conducive to the growth of acidogenic microorganisms.

Diet we are consuming has become more refined with increase access to readymade drinks.⁶ It may be high in fermentable substrates, acids (particularly from fruit juices, soft drinks, and energy drinks), and caffeine. In fact, virtually all foods which contain carbohydrates cause the pH of plaque to fall below 5.5.⁷

AIM & OBJECTIVE

The present study was conducted to evaluate and compare the effect of 4 fruit juices on the pH of the plaque at various time intervals.

MATERIALS AND METHOD

Study design

1. Four commonly consumed fruit juices namely apple juice, mango juice, orange juice and lemon juice were included in the study.
2. Material used in the study is depicted in fig 1,2 and 3.
3. 28 subjects aged 18-25 years were chosen randomly from the students of DJ college of Dental Sciences and Research, Modinagar, informed consent was taken from all the subjects 2 days prior to the test and study was performed in the department of Periodontology and Implantology.
4. Ethical clearance was obtained from ethical committee of the college.
5. All the subjects were divided randomly into 4 groups 1, 2, 3 and 4 (7 subjects in each group). Oral prophylaxis was done for all subjects one week prior before the experiment.
 - Group 1 subjects were given apple juice
 - Group 2 subjects were given mango juice
 - Group 3 subjects were given lemon juice
 - Group 4 subjects were given orange juice

6. The subjects were instructed to refrain from any kind of oral hygiene methods 24 hours prior the experiment.
7. Subjects were instructed not to take any food and liquid item from 2 hours prior the appointment.
8. Endogenous ph of all the test juices was measured on the examination day using Digital ph meter.(Fig 3,4)

Plaque Sampling

9. Plaque samples were collected by a single examiner.
 - 4 index teeth -16, 26, 36 and 46 were selected representing 4 quadrants of oral cavity.
 - Sample were collected from buccal surface of 16 tooth with spoon excavator and baseline plaque sample will be collected (approximately 2 mg)
 - The collected plaque was suspended in 10 ml of distilled water in a dapin dish and pH was measured with pH meter.
 - Sample collection was done at baseline.
 - Each of the subject was given 100 ml of specific fruit juice and instructed to swish the drink all around the teeth for atleast 1 minute before they swallow.
 - Post consumption plaque samples were taken using the same method as for the baseline samples at following time intervals:
 - ❖ 1 minute
 - ❖ 5 minute
 - ❖ 10 minute
 - ❖ 15 minute
 - ❖ 30 minute



Fig 1: Instruments used in the study.



Fig 2: Measuring Cylinder.



Fig 3: Digital pH meter

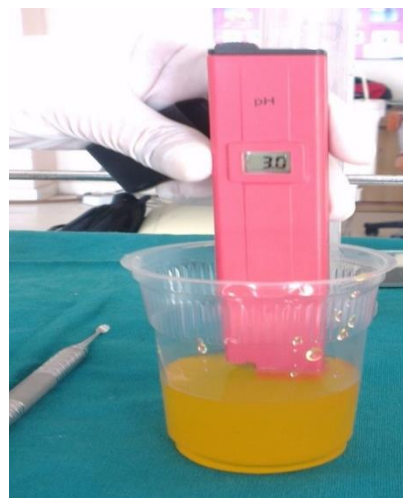


Fig 4: Endogenous pH measurement

RESULTS

Endogenous pH of all fruit juices was acidic. In the present study, it was found minimum for lemon juice (2.7) and maximum for mango juice (3.4). Details are shown in Table 1.

Table 1: Endogenous pH of fruit juices.

S.NO	FRUIT JUICES	ENDOGENOUS pH
1	Apple	3.1
2	Mango	3.4
3	Lemon	2.7
4	Orange	2.9

Graph 1: Changes in Mean-plaque pH levels after consumption of four different fruit juices at different time intervals.

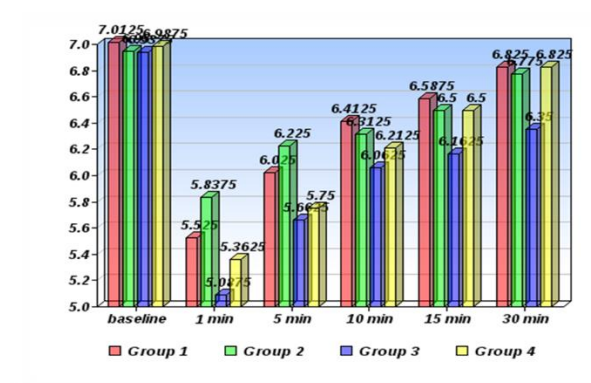


Table 3:Changes in Mean-plaque pH levels and mean pH difference after consumption of four different fruit juices at different time intervals.

S.NO	FRUIT JUICES	BASE LINE (mean +- SD)	1 MIN		5 MIN		10 MIN		15 MIN		30 MIN	
			ph	diff	ph	diff	ph	diff	ph	diff	ph	diff
1	Apple	7.0125 +- 0.0834 5	5.525 +- 0.471	1.487 5	6.025 +- 0.319	0.987 5	6.4125 +- 0.1807	0.6	6.5875 +- 0.1246 4	0.4 2	6.825 +- 0.070	0.18 7
2.	Mango	6.95+- 0.1851 6	5.837 +- 0.266	1.125	6.225 +- 0.212	0.725	6.3125 +- 0.1126	0.637 5	6.5+- 0.1195 2	0.4 5	6.775 +- 0.103	0.17 5
3.	Lemon	6.9375 +- 0.0916 1	5.087 +- 0.364	1.85	5.662 +- 0.277	1.275	6.0625 +- 0.1407	0.875	6.1625 +- 0.1407 9	0.7 7	6.35+- 0.141	0.63 7
4.	Orange	6.9875 +- 0.1126	5.362 +- 0.358	1.325	5.75+- 0.226	1.237	6.2125 +- 0.2167	0.775	6.5+- 0.1309 3	0.4 8	6.825 +- 0.128	0.16 2
P Value		P<0.001	P<0.05		P>0.05		P>0.05		P>0.05		P>0.05	

The mean baseline plaque ph values were found to be 7. 0125 +/- 0.08345, 6.95+/- 0.18516, 6.9375 +/- 0.09161 and 6.9875 +/- 0.1126 for apple, mango, lemon and orange juices respectively and differences were highly significant (**p<0.001**). The mean ph value of apple juice was found to be 5.525+/- 0.471(critical ph 5.5) immediately after swishing, whereas ph of lemon and orange juices reached below critical ph. Maximum fall in ph was seen in lemon juice at 1 and 5 min from baseline. Differences were statistically significant at 1 min (p<0.05) and were not statistically significant at 5 min (p>0.05). Plaque ph values remained below baseline value even at 30 minutes. Details are mentioned in Table 2 and 3.

DISCUSSION

Foods and beverages, especially fruits and fruit juices, contain a variety of acids(citric and ascorbic acids) that have the potential to damage the teeth.⁸ Some contain fermentable carbohydrates may serve as a source of substrate, diffusing into the dental plaque from which micro-organisms

inhabiting the plaque can generate the acid that brings about the destructive process of dental caries, initially in the sub-surface of the enamel beneath the plaque.⁹ The resting (baseline) plaque ph usually ranges from 6- 7. When a low pH drink is consumed, it causes a fall in this resting plaque ph. The length of time for which this low pH remains at its minimum is important, since if it reaches the so called critical pH value, it initiates dissolution of enamel.¹⁰ Listed below are examples of some acid tolerant bacteria.

Table 2: Examples of acid-tolerant oral bacteria.

Acid tolerant @ pH = 4	Acid tolerant @pH = 5
Streptococcus mutans Streptococcus sanguis Streptococcus oralis Lactobacillus spp. Actinomyces odontolyticus Enterococcus faecalis	Streptococcus intermedius Streptococcus mitis Streptococcus salivarius Actinomyces viscosus

The present study resulted in maximum fall of pH after consuming lemon juice with statistically significant results at 1 and 5 mins. A variety of factors come into play in determining the cariogenicity of sugar containing drinks.¹ The erosive potential of a fruit juice is dependent upon the immediate effect of the drink & time taken for its clearance on the tooth, the drinking method, the protective effect of saliva, the amount of residual drink after swallowing, the actual amount of beverage consumed and the frequency of consumption (if small sips are taken at frequent intervals or the entire bottle is consumed quickly). A single acid attack is of minor importance, but if repeated, ability of saliva to deal with acid attack decreases. Hence the main concern is frequent consumption of these drinks over time.⁶

CONCLUSION

Fruit juices included in the study imposed deleterious effect on pH of plaque. Hence their intake should be restricted as a preventive measure and should be important part of diet counselling. As dental professionals, following measures should be taken care of while consuming such drinks;

- Ideally serve drinks only at mealtimes.
- Keep drinking times short.
- Use a straw whenever possible.
- Chilled fruit juices should be avoided.
- Fresh fruits can be preferred in places of juices.¹¹

Further studies are needed to study other factors that are responsible for erosive and cariogenic potential of fruit juice including type of acid, chelating properties, temperature and protective action of saliva.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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