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Original article

A Comparative Evaluation of Fruit and Mint - flavored sucrose free chewing gum on Salivary flow rate and pH

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ABSTRACT

Background: Chewing sugar-free gums is a convenient way to increase salivary flow. Salivary flow increases in response to both gustatory (taste) and mechanical (chewing) stimuli, and chewing gum can provide both of these stimuli. The aim of this study is to assess the effect of fruit and mint flavored sucrose free chewing gum on salivary flow rate and pH. **Methods:** Twenty dental student volunteers (8 men and 12 women) having good general and oral health with the mean age of 20 years, were instructed to collect unstimulated saliva for 5 min. Stimulated saliva was collected at the intervals of 0-1, 1–3, and 3–6 minutes after chewing one of the four flavored chewing gums. The salivary flow rate and pH was measured for five consecutive days. The amount of saliva was calculated as (1 g = 1 mL) and flow rate was calculated as (mL/min). **Results:** The flow rate of fruit flavored chewing gums reached its peak at 1st minute of stimulation compared to mint flavored which reached at the 6th minute. The mint flavored gums had about one whole pH unit greater than the pH of fruit-flavored gums. With fruit-flavored gums, the pH values slightly increased with each fruit-flavored gum pellet, but this effect was not statistically significant. **Conclusion:** Chewing sucrose free gum serves a critical function in caries reduction. Clinicians should stress to patients the additional positive benefits beyond caries prevention, including fresh breath, improved esthetics, and increased comfort, especially for those patients who have dry mouth.

Introduction

The evolution of the carious process is the result of losing the equilibrium between the de- and re-mineralization processes, all of these being dependent by the composition and the chemical status of the oral fluids - the saliva and plaque fluid[1]. Adequate salivary flow and composition are recognized as important for lubrication and protection of soft and hard oral tissues. Protection of soft tissues is provided against desiccation, penetration, ulceration, and potential carcinogens by mucin and anti-proteases. A major protective function results from the salivary role in stabilizing the ecological balance in the oral cavity via clearance, aggregation and reduced adherence, by both immunological and non-immunological means as well as direct antimicrobial activity[2]

Edgar describes the "pumping" effect (the saliva glands pumping saliva) of increased salivary flow as critical to reach the proximal areas that are most at risk for dental decay[3]. The prevalent use of chewing gum has prompted interest in its dental effects. Important defining aspects are the ability to use sugar substitutes in gum manufacture and the prolonged stimulation of a protective flow of saliva[4]. Chewing sucrose-free gum

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is known to stimulate salivary flow, and the results of studies of the role of stimulated saliva in the oral clearance of food particles, neutralization of dental plaque acids and reduction of the incidence of dental caries have been reported[5,6]. Gum base stimulates saliva via mechanical and gustatory stimulation when it is chewed. The magnitude of its stimulation is not as potent as with taste stimuli. The combination of flavor and sweetner, and also the presence of organic acids, influences the flow rate and pH level of chewing gum-stimulated saliva[7].

The first studies on the use of chewing gum in dentistry were done in the 1970s. The Turku Sugar Studies, carried out between 1970 and 1973, showed the excellent anti- caries properties of xylitol chewing gum. Since then, many dentists, particularly in Scandinavian countries, have studied the effect of chewing xylitol-sweetened chewing gum as another preventive strategy in the control of dental caries[8]. Chewing sucrose gum causes a moderate fall in plaque pH and some clinical studies have demonstrated an increase in caries incidence with the use of sugared gum, compared with controls who did not chew gum. The development of sugar-free gum provided the possibility of a non- cariogenic alternative to sugared gum. Chewing sugar-free gum results in a rise in plaque pH, in contrast to the pH fall observed with sugared gum. This is due to the stimulation of the flow of saliva, with the resulting increase in level of bicarbonate and thus alkalinity[9].

The aim of this study, therefore, was to assess the effect of fruit and mint flavored sucrose-free chewing gum on salivary flow rate and pH in healthy dental students in Rajah Muthiah Dental College, Chidambram, Tamil Nadu.

MATERIALS AND METHODS

Participants

A detailed protocol explaining the purpose and objectives of the study was prepared and submitted to the Institution Review Board of Annamalai University. The study was initiated after obtaining ethical clearance and informed consent from the participants, 20 dental student volunteers, in good general and oral health, (8 men and 12 women) mean aged 20 years were approached to participate in this study.

Exclusion criteria include:

- Allergy to gum ingredients
- Smokers
- Oral, Dental, or Systematic disease
- Medication likely to interfere with salivation
- Wearing any intra-oral appliances

Chewing Gum

Four different chewing gum of fruit flavored namely, mixed fruit and lime; and mint flavored namely spearmint and peppermint (Orbit, Wrigley, Poland, Sp. z o.o, Poznan) purchased from local store were used. The chewing gums tested were sucrose-free coating and contained 2% flavor compounds, 58% sweetener (xylitol and sorbitol), and 40% gum base.

Saliva Collection

Saliva collections were performed at the same time ie, from 9-11 am for five consecutive days in order to avoid possible confounding effects of circadian rhythms in salivary flow rate. The participants were instructed not to eat, drink, or chew gum for at least one hour prior to the saliva collection time. During each session unstimulated whole mouth saliva was collected from each participant before chewing any gum. After 5 minutes, the participants were asked to start chewing one pellet of four different gums of fruit and mint flavors. The whole mouth saliva was

Flavors	Unstimulated Mean (SD)	0-1 Minutes Mean (SD)	1-3 Minutes Mean (SD)	3-6 Minutes Mean (SD)	p Value
Spearmint	1.56(0.22)	3.15(0.12)	3.58(0.12)	4.02(0.01)	0.001 (s)
Peppermint	1.60(0.09)	3.37(0.10)	3.28(0.12)	3.78(0.13)	0.001 (s)
Mixed fruit	1.40(0.13)	4.29(0.15)	4.16(0.12)	3.37(0.14)	0.001 (s)
Lime	1.50(0.22)	4.44(0.27)	4.23(0.28)	3.67(0.36)	0.001 (s)
Unstimulated	0.00(0.00)	1.35(0.07)	1.75(0.05)	2.12(0.07)	0.001 (s)

Table 1: Comparison of Salivary Flow Rate at Different Time Intervals after Chewing Different Flavors of Chewing Gum

collected at intervals of 0-1, 1–3, and 3–6 min in unstimulated and after the start of chewing a single pellet of flavored gum in separate containers. For each participant, the order in which the four different gums were used was randomized, so that all the participants, over the 4 days, chewed all four different gums. Unstimulated whole mouth saliva was collected on the 5th day at the same three intervals. Collection of whole saliva was carried out through a disposable tube. Saliva was collected in the mouth and voided at regular intervals as this method tends to produce higher salivary flow rates. Saliva was allowed to dribble into a funnel and was collected in a graduated, disposable centrifuge tube. The tube along with the supporting stand was weighted before and after saliva collection. The amount of saliva was calculated as the difference between the two weights with two digits (1 g = 1 mL) and flow rate was calculated (mL/min). During these collection periods, the participants were instructed not to swallow any of their saliva. The pH of the sampled saliva was measured in unstimulated and before and after chewing gum. The pH was measured using a calibrated pH meter immediately after saliva collection in order to minimize any time-based pH changes.

Statistical Analysis

Collected Data were entered into Microsoft Spread sheet of Microsoft windows 2007 (Microsoft Office, United Status of America) and Statistics were calculated using Statistical Package for Social Sciences (SPSS version 19) software. (IBM, United States of America)

Results

This study assessed the effect of fruit and mint flavored sucrose free chewing gum on salivary flow rate and pH among 20 healthy dental students. Table 1 explains the salivary flow rate after chewing different flavors at different time intervals with fruit flavored reaching peak at the first interval after chewing compared to mint flavored gums. Table 2 explains the salivary pH after 6minutes of chewing all flavored chewing gums with mint flavored gums showed higher salivary pH compared to fruit flavored gums.

DISCUSSION

The initial stimulated flow rate with both fruit and mint flavored gums was found to be increased when compared to the unstimulated flow rate at 1, 3, and 6 minutes after the start of chewing gums. Dawes C et al[10] reported the initial stimulated flow rate with flavored gums was about 10- 12 times greater than the unstimulated rate. This was also inconsistent with the study done by Nogourani et al[6] who reported salivary

GROUP	SALIVARY pH		P Value
	Unstimulated Mean (SD)	Stimulated (after 6 Minutes)Mean (SD)	
Spearmint	6.21 (0.05)	7.46 (0.22)	0.001
Peppermint	6.26 (0.04)	7.37 (0.06)	
Mixed fruit	6.19 (0.04)	6.27 (0.03)	
Lime	6.16 (0.06)	6.30 (0.09)	

Table 2: Comparison of Salivary pH at Different Time Intervals after Chewing Different Flavors of Chewing Gum

flow rate increased in all the five flavored gums after the start of chewing gums.

In the present study, fruit flavored gums showed higher stimulation of salivary flow rate during the first interval, which is inconsistent with the study done by Nogourani et al[6] who reported strawberry-flavor caused slightly higher stimulation of salivary flow rate at 1st min stimulation. Mint flavored chewing gums showed the peak flow rate at the 3rd interval. Jensen et al[11] reported that a cinnamon-flavored gum elicited more saliva than one flavored by peppermint. The mechanisms whereby fruit flavored exerts higher stimulation on salivary flow rate are not clear. However, nasal chemosensory afferents may play a role for the salivary reflexes[11].

On salivary pH, mint flavored gums showed a significant increase compared to that of fruit flavored gums. The increase in salivary pH on stimulation is due to the increase in bicarbonate concentration which is proportional to flow rate[13]. Consistent with previous studies (14, 10, 15, 16) which had evaluated mint- or cinnamon-flavored gums, we found that fruit-flavored gums lesser than mint flavored affect salivary pH. Fruit-flavored contain citric and maleic acids, which can be responsible for less pH increase after chewing these fruity gums. On the other hand, presence of these two acids in fruity gums can lead to more salivary secretion after chewing these gums, compared with mint-flavored gums.

CONCLUSION

Chewing sugar free gum is a practical recommendation for caries prevention because the products are familiar and readily available for easy compliance by both children and adults. Gum-chewing also stimulates a protective salivary flow when used after an acidogenic stimulus, and may enhance salivary function, especially in subjects with low flow rates. Stimulating salivary flow through the chewing of sugar-free gum after meals has been shown to reduce the incidence of dental caries.

Although this study could draw criticism because of short follow-up period of 6 min chewing flavored and sugar-free gum promotes saliva's protective function and also provides relief to patients suffering from dry mouth symptoms.

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