Original Article

Use of chewing gum to increase the pH of saliva

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Abstract

Aim:

The main aim of this study was to see the effect of two chewing gums on pH of saliva.

Methods:

Previous studies have demonstrated that the chewing of sucrose-free increases the pH of saliva after meal. To investigate the extrapolation of these fmdings to the clinical setting, a study on 445 school children in Kathmandu was conducted for which four schools in Kathmandu valley which were randomly chosen.The students of these schools were divided into two groups; sugar-free group (n= 222) and sugar-based group (n=223). The pH was measured with Universal pH indicator at different time intervals; 5 minutes before meal & 10 minutes after meal. Then 15 minutes after meal each group were given two different types of chewing gums; sugar-free and sugar-based. Then the students were allowed to chew for 5 minutes and the pH was measured, i.e. 20 minutes after meal.

Results:

In sugar-based group, the mean pH 5 minutes before meal was 6.9484 and the mean pH 10 minutes after meal was 4.8161. In sugar-free group, the mean pH 5 minutes before meal was 6.927 and the mean pH 10 minutes after meal was 4.7927. The mean pH after 20 minutes after meal in sugar-based chewing gum was 8.977 whereas in sugar free, pH was 9.240.

Statistical methods:

The differences between sugar-free gum and sugar-based gum groups were analyzed by Student's T-test at the 5% level of significance. It shows that, though after using chewing-gums, the pH of saliva raised but statistically, there was no significant difference between sugar-free and sugar-based chewing gum groups.

Conclusion:

The chewing gum stimulates the pH of saliva which demonstrates the beneficial effects on the oral health. In this study, there is no significant difference between sugar-free and sugar-based chewing gum.

Key words:

Chewing Gum, dental caries, pH of saliva, saliva,

Introduction:

Dental caries is an irreversible process that results from imbalance between the remineralization and demineralization processes, which is dependent on chemical status of the saliva and plaque[1]. The pH of saliva drops to highly acidic levels for a period of time following the ingestion of food, thus enhancing the demineralization of teeth and contributing to the development of caries[1]. Further, the chewing of gum increases the salivary flow rate and the pH[2]. In particular, numerous studies[3,4] have been performed which demonstrated this effect when the ingestion of food was followed by the chewing of a sucrose-free gum. Additionally, the chewing of gum after meals both enhances remineralization and stops or prevents demineralization.

In this context, this study is the first in Nepal regarding the pH of saliva. This study was done in two different groups of children; sugar-free group and sugar based

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group and the main aim of this study was to see the effect of two chewing gums on pH of saliva and this also help to investigate whether there is difference in pH after taking sugar-free and sugar-based chewing gum.

Methods

Study population: The study population consisted of 445 children (ranging from 4 to 15 years of age). The 4 different boarding schools of Kathmandu were chosen randomly from 10 schools which were selected according to the suitability for investigators between January and May 20l0. The consent was taken from school prior to commencing the study.The study was conducted in weekdays in morning in their respective dining rooms (Figure l and 2). The investing team was made up of one dental specialist, two dental surgeon and 10 staffs of each school. The children were instructed before eating breakfast. The students were divided into 2 groups; sugar-free group (n= 222) and sugar- based group (n=223). For sugar free chewing gum, sorbitol containing chewing gum (Orbit, Wrigley Company) were given and for sugar based chewing gurn, commercially available sweetened chewing gums were given (Figure 3 and 4). Each child was given three 5 ml bottles for the collection of the saliva samples.

Saliva samples:

The saliva sample were collected from the children sitting upright and relaxed position in 5 ml bottle separately from the children at 5 minutes before meal and 10 minutes after taking the meal. The children were allowed to spit into the bottles. Then, 15 minutes after the meal, sugar free and sugar based chewing-gums were given in each group and allowed to chew for 5 minutes after which the pH was measured. For measuring pH, Universal pH Indicator (Merck KGaA, Germany) was used following specifications of the manufacturer (Figure 5).

Figure 1: Children having breakfast

A Figure 2: Children with small bottles to collect saliva samples.

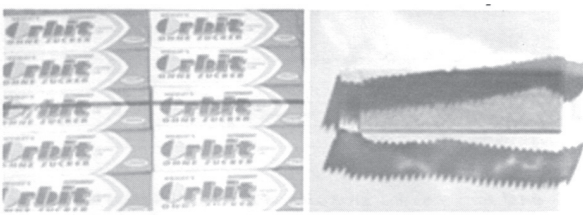

Figure 3 and 4: Sugarfree chewing gum

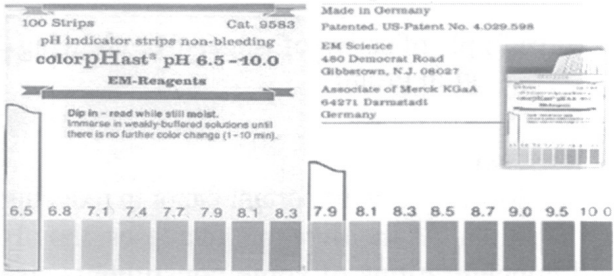

Figure 5: Universal pH Indicator

Statistical analysis:

Standard deviation was used as an index of variability. The differences between sugar-free gum and sugar-based gum groups were analyzed by Student's T-test at the 5% level of significance,

Results

In sugar-based group, the mean pH 5 minutes before meal was 69484, 10 minutes after meal was 4.816 and 20 minutes after meal was 8.977, whereas in, sugar-free group, the mean pH 5 minutes before meal was 6.927, 10 minutes after meal was 4.792 and 20 minutes after meal was 9.240 (Table 1). There was no significant difference between sugar-free and sugar-based chewing gum groups (Table 2).

Table 1: Comparison of pH of saliva after chewing sugar-based and sugar-free gum group

Time	pH of saliva of sugar-free chewing gum group	pH of saliva of sugar-based chewing gum group
5 minutes before meal	6.927	6.9484
10 minutes after meal	4.7927	4.8161
20 minutes after meal after chewing gum	9.2409	8.9775

Table 2:Mean pH of saliva after chewing-sugar based and sugar-free gum

	Sugar-free chewing gum group (SD)	Sugar-based chewing (SD)	P Value
Mean	9.2409 (1.2650)	8.9775 (1.6640)	0.061*

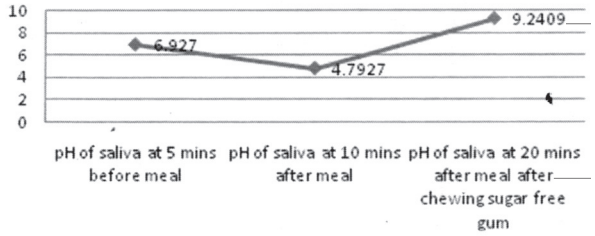

Figure 6: *pH of saliva of sugar-based chewing gum group*

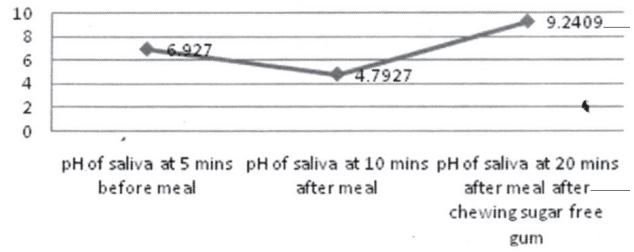

Figure 7: *pH of saliva of sugar-free chewing gum group*

Discussion

Saliva flow rate is an important factor in reducing pH of saliva. As the flow rate increases, the pH and concentrations of some constituents rise (protein, sodium, chloride, bicarbonate), while those of others fall (magnesium and some types of phosphates)[5]. The pH of human saliva is considered normal limits when values are between 6.0 and 7.5.[3] In recent years, much research has focused on investigation into the effect of chewing gum use on dental caries.[1-3] The preventive approach is based on the mechanical and gustatory action of saliva stimulated by the chewing of gum itself as the primary factor in deriving an anti-caries benefit.

In our study, after the meal, pH drops down from normal in both chewing gum groups (Figure 6 and 7). This may be because the salivary flow rate would have been increased the buffering action of saliva caused to neutralize the salivary pH and the pH would have been increased. The increase in pH levels could be related to bicarbonate concentrations in the blood, probably due to the continuous infusion received during 48 hours, time enough to allow the passage of sodium bicarbonate from the blood to the saliva.[1] Though the mean pH of saliva after using chewing gum was more on chewing sugar-free group, statically the difference between sugar- free and sugar based gum was not significant (Table 2).

In another study conducted by Christina et al[1] when they used the sugared chewing gum, even the salivary stimulated flow rate was greater than those obtained with sugar-free chewing gum and paraffin wax. Therefore, even the sugared chewing gum seems to have a favorable effect for the dental health through an important increasing of the salivary flow rate, this effect being reduced by the simultaneous presence of the fermentable carbohydrates, with unfavorable consequences on the bacterial dental plaque pH.

Regarding the buffering ability of saliva, the rising of the bicarbonate level with the increasing rate and the duration of stimulation is the most important factor, which has to be considered when the effect of the chewing gum is discussed. Bicarbonate concentration varies from less than l mmol/1 in unstimulated parotid saliva to almost 60 mmol/l at very high flow rates, with whole saliva elicited by chewing-gum having a bicarbonate concentration of about 15 mmol/l[1]. This increasing of the bicarbonate concentration is followed by the increasing of the salivary pH. The limitation of our study is that the study was conducted in schools not in home so the food habit may differ which may affect the pH of saliva. In this pH was measured only after 20 minutes of chewing gum. So, further changes may be different than the result after 20 minutes after chewing gum. The presence of local factors such as dental caries, plaque level and gingivitis could have influenced our findings.

Conclusion

From our study, it can be concluded that, after using chewing gum, pH is increased. Increasing the pH of saliva has beneficial effects on the oral health.In addition, from our study there is no significant difference between sugar-free and sugar-based chewing gum. So, both types of chewing gums may be beneficial.

Acknowledgement

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