Comparison of Saliva Buffering Capacity in Stevia, Xylitol and Paraffin Wax in 5-17 Year Old Children

St. Barnabas Hospital, Bronx, New York

Saleem Siddiqui DDS, Paul K. Chu DDS, Rebekah Tannen DDS, Stacey Lubetsky DMD, David Yens Phd, Fordham University Pre-Dental Students, Dara Rosenberg DDS, MS, MPH

PURPOSE

The main objective of this study is to investigate if the naturally occurring sugar substitute stevia, impacts salivary buffering capacity in children ages 5-17. The salivary buffering capacity of stevia was compared to xylitol and paraffin wax.

BACKGROUND

Saliva provides the main host defense system against dental caries. It facilitates clearance of foods, buffering acids, mediates selective adhesion, colonization of bacteria on the tooth and contains several antimicrobial systems which may aid in the elimination of bacteria[1]. Salivary buffering capacity is important because it is one of the main factors on the reduction of dental caries. Saliva neutralizes acids within the mouth and as a result there is a direct correlation between salivary flow and risk of dental decay[2].

The simple act of chewing has been shown to increase salivary flow[2]. Numerous studies have concluded xylitol offers no more benefit in terms of reducing caries risk than sorbitol-sweetened gum and paraffin wax[3]. No studies have been conducted regarding the salivary buffering capacity of stevia.

Stevia (stevia rebaudiana bertoni) is a perennial herb native to Paraguay and Brazil used widely today in Asia and South America. It has been used as a sweetener for numerous drinks and candies. A considerable body of scientific evidence supports the effectiveness and safety in human health promotion of extracts of the leaf of the "sweet herb" stevia which is a potent nonsynthetic noncalroic sweetener. Stevia is unique in its natural non-caloric sweetening properties; extracts of the leaf of stevia have produced beneficial antihypertensive, antihyperglycemic, antioxidant, non-cariogenic, chemoprotective, anti-inflammatory, immunomodulartory, and antiviral effects[4].

In 2006, the Joint FAO/WHO Expert Committee on Food Additives (JECFA) announced a temporary accepted daily intake (ADI) of stevioside of up to 5.0mg/kg body weight. In addition to U.S. FDA recognition of high purity Reb A from key producers as "Generally Recognized as Safe (GRAS)." Stevia leaf extract and its major polyphenolic constituents, stevioside and rebaudioside A, are noncariogenic. For example, sucrose solution triggered the development of dental caries in rat pups while stevioside did not[4]. Studies have demonstrated variable levels of growth suppression of oral micro-organisms, and indicated that stevia was effective against some strains of streptococci and lactobacilli[5].

This study utilized the Sugar Snack Test (SST), which measures and visually demonstrates the changes in saliva acidity over a fifteen minute period following a standardized sugar challenge[6]. This helps determine if the naturally sweet herb stevia has an affect on salivary buffering capacity and bacterial challenge. It has been used has an instructional aid demonstrating the harmful effects of ingesting fermentable carbohydrates.

MATERIALS AND METHODS

90 patients total	Inclusion Criteria	Exclusion Criteria
30 .8gms of stevia	5-17 years old	Prior history of TMD
30 .4gms of xylitol	NPO for 2 hours	Xerostomia
30 paraffin wax		Intellectually disabled

All patients were randomly selected and asked if they were interested in participating in the study. The first 30 participants were given stevia, the next 30 xylitol and the last 30 paraffin wax. Approximately 20 minutes was spent with each participant and data was collected over a thirteen month period.

The SST measures the pH of saliva over a period of time. First resting pH was measured followed by a minute of chewing sugary gum, a minute after a lollipop, then five, ten, fifteen minutes and finally a minute after chewing gum.

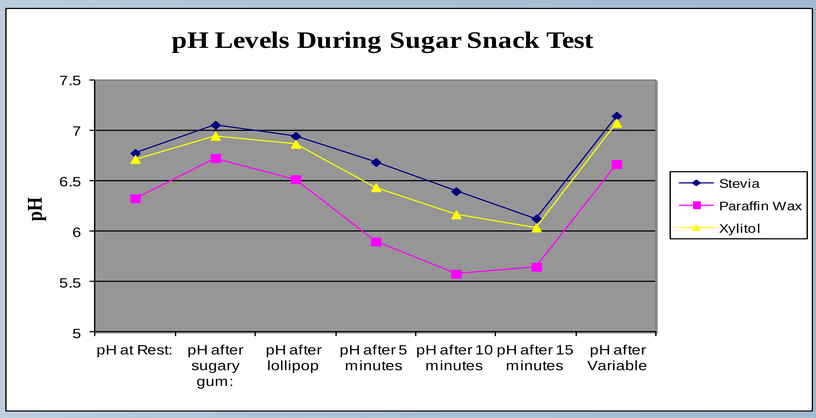
Data Collection:
pH at rest
pH after sugar gum
pH after lollipop
pH after 5 minutes
pH after 10 minutes
pH after 15 min
pH after stevia/xylitol/wax

RESULTS

Data was averaged to the nearest hundredths and are as follows:

Table 1	Paraffin wax	Xylitol	Stevia
pH at rest	6.33	6.72	6.78
pH after sugary gum	6.73	6.95	7.06
pH after Lollipop	6.87	6.52	6.95
pH after 5 minutes	6.44	5.90	6.69
pH after 10 minutes	6.17	5.58	6.40
pH after 15 minutes	6.04	5.65	6.13
pH after variable	7.08	6.67	7.15
Average Age	10.5 years		

Figure 1



DISCUSSION

The data collected for stevia, xylitol and paraffin wax were found to be statistically insignificant. The pH taken at all time points chewing stevia, xylitol and wax yielded similar pH levels, that varied by approximately one half to one point. (See table 1)

According to Stephan's curve, the pH of plaque drops after a sugar challenge then raises back to a normal pH of 7.25 after fifteen minutes. Figure 1 demonstrates this familiar drop and increase of pH that coincides with Stephan's curve after the SST. It is interesting to note that pH during the SST never fell below the critical pH of 5.5. An increase time of sugar exposure may have been required.

The SST proved to be a valuable educational tool to demonstrate the importance of proper oral hygiene after a cariogenic snack or meal. The patients learned how sugary foods affected their saliva and what they can do to reduce their negative outcome. In addition this exercise laid the framework to build a trusting dentist patient relationship. A disadvantage of using the SST is the time required with each patient. Training auxillary staff would reduce time spent however it would also reduce the potential increase in dentist patient relationship.

CONCLUSION

This study found there no statistically significant difference between the salivary buffering capacities of xylitol, paraffin wax and stevia.

The SST is a valuable tool to educate young patients about the carious process.

BIBLIOGRAPHY

1) Seow WK: Biological mechanisms of early childhood caries *Community DentOral Epidemiol* 1998; 26: Supplement 1: 8-27.
2) M. Ribelles Llop, F. Guinot Jimeno, R. Mayne Acien, L.J. Bellet Daimau: Effects of xylitol chewing gum on salivary flow rate, ph, buffering capacity and presence of Streptococcus mutans in saliva. *European Journal of Paediatric Dentistry* 2010; 11: 9-14.
3) Brian A. Burt: The use of sorbitol-and xylitol-sweetened chewing gum in caries control. *Journal of American Dental Association* 2006; 137: 190-196.
4) Jocelynn E. Thomas and Michael J. Glade: Stevia it's not just about calories. *The Open Obesity Journal* 2010; 2: 101-109.
5) Trevor H. Grenby. Dental aspects of the use of sweetners. *Pure & Appl. Chem* 1997; 69: No. 4: 709-714
6) Martin L. MacIntyre. The sugar snack caries risk test. 2000
7) Cristoph A. Ramseier, Isabelle Leiggener, Niklaus P. Lang, Robert A. Bagramian, Marita R. Inglehart: Short-Term effects of hygiene education for preschool (kindergarten) *Children. Oral Health PrevDent* 2007; 5: 19-2400

IRB # 2011.74