

Maternal Transmission of *Strep mutans* to Infants Through Saliva

Children of mothers who chew xylitol-sweetened gum during the first two years of the child's life are five times less likely to acquire *Strep mutans*. Researchers in Japan wanted to know if this was true for Japanese mothers and babies.

Pregnant women visiting an OBGYN clinic in Okayama, Japan were tested for salivary *Strep mutans* to identify those with high counts. These mothers were randomly assigned to either the xylitol chewing gum group or the no gum group. The study began at the sixth month of pregnancy and continued for two years. Both groups were given basic oral hygiene instruction and the gum group was supplied with 100 percent xylitol-sweetened chewing gum and instructed to chew the gum at least four times daily. At

each three-month visit the gum chewers were given enough chewing gum for the next three months. They also recorded exactly how much and how often they chewed the gum and any side effects.

Unstimulated saliva and plaque samples from the infants were taken from the tongue and the ridges/teeth when present at six, nine, 12, 18 and 24 months. Children of moms in the no gum group acquired *Strep mutans* nine months earlier than the other children, at 12 months versus 21 months. Of the 56 xylitol mothers, 37 percent of their children were *Strep mutans* negative at 24 months, compared to 13 percent of the no gum group.

Clinical Implications: Pregnant moms should begin chewing xylitol-sweetened gum beginning at six months of pregnancy to lower oral *Strep mutans* levels, thus preventing transmission to their babies through saliva. ■

Nakai, Y., Shinga-Ishihara, C., et al: Xylitol Gum and Maternal Transmission of Mutans Streptococci. *J Dent Res*, 89: (1) 56-60, 2010.

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What Xylitol Dose is Needed to Effectively Reduce Bacteria

For xylitol to be a cost-effective public health measure, we need to know the lowest dose and ingestion frequency needed to achieve clinical benefit. Researchers at the University of Washington compared three total daily xylitol doses of chewing gum given to 120 adults over six months. A fourth group was given gum sweetened with sorbitol and maltitol. Subjects were instructed to chew three pellets for five minutes or more, four times daily. To ensure compliance, the assigned gums were distributed weekly for the first five weeks and then biweekly for the remainder of the six months. The daily doses tested were: 3.44 grams, 6.88 grams and 10.32 grams. Plaque and saliva were collected at baseline, five

weeks and six months. Plaque was scraped off all buccal surfaces of all the teeth.

Strep mutans levels in the plaque were reduced tenfold from baseline to five weeks and also at six months for those chewing 6.44 grams and 10.32 grams of xylitol. Based on cultures of the plaque, the xylitol affected the *Strep mutans* without altering the numbers of other bacteria in the plaque. Salivary levels of bacteria were also lower for these two groups, and unchanged in the group chewing 3.44 grams per day. Researchers are now comparing the effects of 10.32 grams per day spread over two, three and four daily doses.

Clinical Implications: Xylitol chewing gum needs to be chewed four times per day for a total dose of six to 10 grams per day. Achieving a xylitol daily dose of less than six grams will not provide the anticariogenic effects desired. ■

Milgram, P., Ly, K., Roberts, M., Rothen, M., Mueller, G., Yamaguchi, D.: Mutans Streptococci. Dose Response to Xylitol Chewing Gum. *J Dent Research* 85 177-181, 2006.

Gummy Bears – an Alternative to Chewing Gum

Three to five daily exposures to xylitol-sweetened products will reduce *Strep mutan* levels, reduce acid production, elevate oral pH and prevent caries. Xylitol is most often delivered in chewing gum. However, the use of chewing gum by children during school hours is discouraged or forbidden. The disposal of chewing gum after it's been chewed presents a significant problem. An alternative xylitol delivery system for school children is candy, specifically gummy bears.

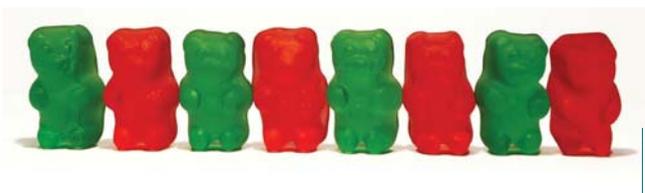
Researchers at the University of Washington used five-gram gummy bears produced by Santa Cruz Nutritionals (not available to the general market). All the candies were strawberry flavored and colored red or green. One formulation contained 1.3 grams of xylitol and another contained 3.7 grams of maltitol. Three-unit dose packages were created with different percentages of sweeteners: 1) four xylitol gummy bears, 2) three xylitol gummy bears and one maltitol gummy bear and 3) four maltitol gummy bears.

154 students in grades first to fifth from two rural schools participated. Students adapted to the xylitol products by gradually increasing from one dose to three over six days. The children ate their assigned four gummy bears three times each school day for six weeks.

At baseline, 42 children did not test positive for *Strep mutans*. After six weeks, 38 additional children changed from positive to negative for *Strep mutans*. All three formulations resulted in reduced bacterial levels, with no added benefit with 15.6 grams of xylitol compared to 11.7 grams per day.

Clinical Implications: Xylitol-sweetened gummy bear candies might be an effective alternative to xylitol-sweetened chewing gum for school children. ■

Ly, K., Riedy, C., Milgrom, P., Rothen, M., Roberts, M., Zhou, L.: Xylitol gummy bear snacks: a school based randomized clinical trial. BMC Oral Health 8:20, 2008.



Xylitol Long-term Study

Caries is a bacterial disease that can affect quality of life and consumes considerable health-care resources. Despite widespread use of fluoride in many forms, caries remains a staggering public health and economic burden.

Researchers have suggested that chewing gum stimulates saliva, which should help reduce the incidence of caries. This was the first study designed to compare, side-by-side, several chewing gum formulations.

Researchers from the University of Michigan compared nine treatment groups among fourth graders in Belize. The study included the 19 public schools in Belize City and lasted 40 months. The nine test groups were:

1. No gum control
2. Sugar stick gum five times daily
3. Sorbitol pellet gum five times daily
4. 45 percent xylitol/30 percent sorbitol pellet gum five times daily
5. 15 percent xylitol/45 percent sorbitol pellet gum five times daily
6. 60 percent xylitol stick gum three times daily
7. 60 percent xylitol stick gum five times daily
8. 65 percent xylitol pellet gum three times daily
9. 65 percent xylitol pellet gum five times daily

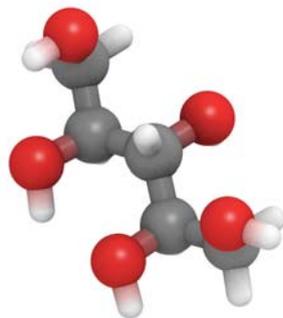
Gum chewing was supervised while at school. One of four dentists examined each child at baseline, 16, 28 and 40 months. The sugar gum resulted in a slight increase in caries compared to the control group. All the sorbitol and xylitol gums showed various levels of anticaries effects. The most effective gum for caries prevention was the xylitol-sweetened gum chewed five times daily.

Clinical Implications: Encourage patients to chew only xylitol-sweetened chewing gum five times per day to achieve the greatest anticaries benefit of xylitol. ■

Mäkinen, K., Bennett, C., Hujuel, P., Isokangas, P., Isotupa, K., Pape, H., Mäkinen, P.: Xylitol Chewing Gums and Caries Rates: A 40-Month Study. J Dent Research 74: 1904-1913, 1995.

Xylitol's Impact on Biofilm Formation

The first step in biofilm formation is the development of a salivary protein and enzyme layer on the tooth surface. The enzymes are glucosyltransferase and fructosyltransferase. Bacteria are attracted, form micro-colonies and continue to proliferate. Biofilms associated with caries and periodontal disease are difficult to control. Chemicals that control planktonic cells are not as effective against an organized biofilm. Researchers have investigated anti-adhesion compounds to prevent the bacteria from colonizing tooth surfaces. Xylitol seems to be a promising molecule as a non-cariogenic sweetener that inhibits growth and acid production of *Mutans streptococci*.



Researchers at the Université Victor Ségalen in Bordeaux, France compared the effects of xylitol and saline on biofilm growth in the laboratory. Bacteria associated with both caries and periodontal disease were grown in the biofilm. Bacteria included: *M*

streptococci, *S sobrinus*, *L rhamnosus*, *A viscosus*, *P gingivalis* and *F nucleatum*. Before anaerobic incubation, three treatments were provided and one control group. One group of biofilm samples was treated with one percent xylitol, another with three percent xylitol. The third group of biofilm samples was treated with saline. The fourth group of biofilm samples were untreated controls.

The saline-treated biofilms were similar to the control biofilms in thickness and bacterial growth. The xylitol-treated biofilms lacked cohesive formation and four of the bacterial species were not recovered at all and the other two were significantly reduced.

Clinical Implications: Xylitol reduces both the acid produced by caries causing bacteria and the ability of bacteria to form a biofilm. Xylitol has benefits for prevention of both caries and periodontal disease. ■

Badet, C., Furiga, A., Thébaud, N.: Effect of Xylitol on an In Vitro Model of Oral Biofilm. Oral Health and Preventive Dent 6: 337-341, 2008.

Xylitol Most Effective Before Tooth Eruption

Most xylitol studies have focused on the caries activity relating to permanent teeth. Between 1990 and 1992, 510 children with a mean age of six at the start of the study were evaluated for the effects of xylitol, sorbitol and a combination of the two delivered in chewing gum. Effects were measured on both primary and permanent teeth. The study took place in Dangriga, Belize. Five years after completion of the study, researchers returned to Belize to determine if any long-term effects were evident from the xylitol or sorbitol chewing gums.

After completion of the two-year study, no xylitol or sorbitol gums were commercially available to the children. Of the 510 original study children, 301 were available for re-examination. At-risk tooth surfaces were divided into four

subgroups based on eruption: 1) before gum chewing, 2) first year of gum chewing, 3) second year of gum chewing and 4) after gum chewing.

The highest caries experience was found in the no gum group and the 100 percent sorbitol group, with no significant difference between these two groups. The least caries experience was in the 100 percent xylitol group. The combination group with xylitol and sorbitol was better than no gum, but not as effective as 100 percent xylitol. The proportion of decayed surfaces was 1.2 percent in the xylitol group compared to 3.3 percent in the no gum group. Xylitol reduced risk by 88 percent and xylitol/sorbitol by 64 percent.

Clinical Implications: For long-term effects, xylitol use should begin one year before permanent teeth erupt. ■

Hujoel, P., Mäkinen, K., Bennett, C., Isotupa, K., Isokangas, P., Allen, P.: The Optimum Time to Initiate Habitual Xylitol Gum-Chewing for Obtaining Long-Term Caries Prevention. J Dent Res 78 (3) 797-803, 1999.