

# Policy on the Use of Xylitol in Caries Prevention

Originating Council  
Council on Clinical Affairs

Adopted  
2006

## Purpose

The American Academy of Pediatric Dentistry (AAPD) recognizes the benefits of caries preventive strategies involving sugar substitutes, particularly xylitol, on the oral health of infants, children, adolescents, and persons with special health care needs. This policy is intended to assist oral health care professionals make informed decisions about the use of xylitol-based products in caries prevention.

## Methods

A MEDLINE literature search was conducted using the terms “xylitol AND dental caries”, “caries prevention”, “plaque reduction”, “maternal *Streptococcus mutans* (MS) transmission”, and “*Streptococcus mutans* long term suppression with xylitol”.

## Background

Xylitol is a five-carbon sugar alcohol derived primarily from forest and agricultural materials. It has been used since the early 1960's in infusion therapy for post-operative, burn, and shock patients; in the diet of diabetic patients; and, most recently, as a sweetener in products aimed at improved oral health.<sup>1</sup> Dental benefits of xylitol first were recognized in Finland in 1970, using animal models.<sup>2</sup> The first chewing gum developed with the aim of reducing caries and improving oral health was released in Finland in 1975 and in the United States shortly after. The first xylitol studies in humans, known as the Turku Sugar Studies,<sup>3,4</sup> demonstrated the relationship between dental plaque and xylitol, as well as the safety of xylitol for human consumption. These early studies showed the decayed, missing, and filled (dmf) incidence in teeth in a sucrose chewing-gum group was 2.92 compared to 1.04 in the xylitol gum group. The most comprehensive study with xylitol gum, conducted in 1995, compared the effect on caries incidence for xylitol, sorbitol, and sucrose consumption.<sup>5</sup> The group that received 100% xylitol gum 5 times/day had significantly lower levels of sucrose and free sialic acid in whole saliva than at baseline, and significantly lower plaque index scores.<sup>5</sup> The xylitol group also exhibited the lowest levels of salivary lactobacilli at endpoint, and this group did not experience the age-related increase in MS as did the other groups.<sup>5</sup>

Xylitol studies show varying results in the reduction of the incidence of caries or MS levels.<sup>5-11</sup> Studies suggest xylitol intake that consistently produces positive results ranged from 4-10 grams per day divided into 3 to 7 consumption periods.<sup>5-11</sup> Higher amounts did not result in greater reduction in incidence of caries and may lead to diminishing anticariogenic results.<sup>5-11</sup> Similarly, consumption frequency of less than 3 times per day at optimal xylitol amount

showed no effect.<sup>12-14</sup> Abdominal distress and osmotic diarrhea have been reported following the ingestion of xylitol.<sup>15-16</sup> Diarrhea has been reported in patients who have consumed 3-60 grams of xylitol per day.<sup>17-21</sup>

Xylitol reduces plaque formation and bacterial adherence (ie, is antimicrobial), inhibits enamel demineralization (ie, reduces acid production), and has a direct inhibitory effect on MS. Prolonged use of xylitol appears to select for a “xylitol-resistant” mutant of the MS cells.<sup>22</sup> These mutants appear to shed more easily into saliva than the parent strains,<sup>23</sup> resulting in a reduction of MS in plaque<sup>24</sup> and possibly hampering their transmission/colonization from mother to child. Long-lasting effects have been demonstrated up to 5 years after 2 years of using xylitol chewing gum.<sup>25</sup> Use of xylitol gum by mothers (2-3 times per day) starting 3 months after delivery and until the child was 2 years old, reduced the MS levels in children up to 6 years of age, and was significantly better than applying fluoride varnish or chlorhexidine varnish at 6, 12, and 18 months after delivery. At 5 years of age, the xylitol group had 70% reduction in caries (dmf) as compared with the varnish and chlorhexidine groups. Fluoride varnish alone had little effect on total salivary levels of MS.<sup>25</sup> Some studies suggest the chewing process may enhance the caries inhibitory effect of xylitol chewing gum.<sup>26-29</sup>

Xylitol currently is available in many forms (eg, gums, mints, chewable tablets, lozenges, toothpastes, mouthwashes, cough mixtures and nutraceutical products).<sup>30</sup> Xylitol chewing gum has been shown to be effective as a preventive agent; however, the usefulness of other xylitol products that have not been studied is uncertain and cannot be recommended at this time because the delivery system and dose/frequency of use both impact the effectiveness of products.

## Policy Statement

The AAPD:

1. supports preventive strategies aimed specifically at long term caries pathogen suppression and caries (dmf) reduction using commercially available non-cariogenic sugar substitutes such as xylitol.
2. recommends further research on xylitol to improve the evidence-based knowledge, the impact of delivery vehicles, and the identification of optimal prevention strategies to reduce caries (dmf) and improve the oral health of children.
3. encourages xylitol-containing products to be labeled clearly to enable dentists and consumers to evaluate fully their therapeutic value.<sup>29</sup>

## References

1. Makinen KK. Biochemical principles of the use of xylitol in medicine and nutrition with special consideration of dental aspects. *Experientia Suppl* 1978;30:1-16.
2. Muhlemann HR, Regolati B, Marthaler TM. The effect on rat fissure caries of xylitol and sorbitol. *Helv Odontol Acta* 1970;141:48-50.
3. Scheinin A, Makinen KK, Tammisalo E, Rekola M. Turku sugar studies. XVIII. Incidence of dental caries in relation to 1-year consumption of xylitol chewing gum. *Acta Odontol Scand*. 1975a;335:269-278.
4. Scheinin A, Makinen KK, Ylitalo K. Turku sugar studies. V. Final report on the effect of sucrose, fructose and xylitol diets on caries incidence in man. *Acta Odontol Scand* 1976;344:179-216.
5. Makinen KK, Benett CA, Hujuel PP, et al. Xylitol chewing gums and caries rates: A 40-month cohort study. *J Dent Res* 1995;7412:1904-1913.
6. Makinen KK, Hujuel PP, Bennett CA, et al. A descriptive report of the effects of a 16-month xylitol chewing-gum programme subsequent to a 40-month sucrose gum programme. *Caries Res* 1998;322:107-112.
7. Milgrom P, Ly KA, Roberts M, Rothen M, Mueller G, Yamaguchi DK. *Mutans Streptococci* dose response to Xylitol chewing gum. *J Dent Res* 2006; 85:177-181.
8. Hujuel PP, Makinen KK, Bennett CA, et al. The optimum time to initiate habitual xylitol gum-chewing for obtaining long-term caries prevention. *J Dent Res* 1999;783:797-803.
9. Makinen KK. The rocky road of xylitol to its clinical application. *J Dent Res* 2000;796: 1352-1355.
10. Makinen KK, Chiego DJ, Allen P, et al. Physical, chemical, and histologic changes in dentin caries lesions of primary teeth induced by regular use of polyol chewing gums. *Acta Odontol Scand* 1998;563:148-156.
11. Makinen KK, Makinen PL, Pape HR, et al. Conclusion and review of the Michigan Xylitol Programme (1986-1995) for the prevention of dental caries. *Int Dent J* 1996;461:22-34.
12. Isokangas P. Xylitol chewing gum in caries prevention. A longitudinal study on Finnish school children. *Proc Finn Dent Soc* 1987;83(Suppl 1):1-117.
13. Rekola M. Correlation between caries incidence and frequency of chewing gum sweetened with sucrose or xylitol. *Proc Finn Dent Soc* 1989;851:21-24.
14. Thaweboon S, Thaweboon B, Soo-Ampon S. The effect of xylitol chewing gum on *mutans streptococci* in saliva and dental plaque. *Southeast Asian J Trop Med Public Health* 2004;354:1024-1027.
15. Scheie AA, Fijerskov O. Xylitol in caries prevention: What is evidence for clinical efficacy? *Oral Dis* 1998; 4: 268-278.
16. Makinen KK. Dietary prevention of dental caries by xylitol - Clinical effectiveness and safety. *J Appl Nutr* 1992;44:16-28.
17. Akerblom HK, Koivukangas T, Puuka R, Mononen M. The tolerance of increasing amounts of dietary xylitol in children. *Int J Vitam Nutr Res Suppl* 1982;22:53-66.
18. Giertsen E, Emberland H, Scheie AA. Effects of mouth rinses with xylitol and fluoride on dental plaque and saliva. *Caries Res* 1999;331:23-31.
19. Salminen EK, Salminen SJ, Porkka L, Kwasowski P, Marks V, Koivistoinen PE. Xylitol vs glucose: Effect on the rate of gastric emptying and motilin, insulin, and gastric inhibitory polypeptide release. *Am L Clin Nutr* 1989;496:1228-1232.
20. Uhari M, Kontiokari T, Koskela M, Niemela M. Xylitol chewing gum in prevention of acute otitis media: Double blind randomized trial. *Brit Med J* 1996;313(7066):1180-1184.
21. Waler SM, Rolla G. [Xylitol, mechanisms of action and uses]. *Nor Tannelaeforen Tid* 1990;1004:140-143.
22. Trahan L, Mouton C. Selection for *Streptococcus mutans* with an altered xylitol transport capacity in chronic xylitol consumers. *J Dent Res* 1987;665:982-988.
23. Trahan L, Soderling E, Drean MF, Chevrier MC, Isokangas P. Effect of xylitol consumption on the plaque-saliva distribution of *mutans streptococci* and the occurrence and long-term survival of xylitol-resistant strains. *J Dent Res* 1992;7111: 1785-1791.
24. Soderling E, Trahan L, Tammiala-Salonen T, Hakkinen L. Effects of xylitol, xylitol-sorbitol, and placebo chewing gums on the plaque of habitual xylitol consumers. *Eur J Oral Sci* 1997;1052:170-177.
25. Soderling E, Isokangas P, Pienihakkinen K, Tenovuo J, Alanen P. Influence of maternal xylitol consumption on mother-child transmission of *mutans streptococci*: 6 year follow-up. *Caries Res* 2001;353:173-177.
26. Machiulskiene V, Nyvad B, Baelum V. Caries preventive effect of sugar-substituted chewing gum. *Community Dent Oral Epidemiol* 2001;29:278-288.
27. Scheie AA, Fejerskov O, Danielsen B. The effects of xylitol-containing chewing gums on dental plaque and acidogenic potential. *J Dent Res* 1998;77:1547-1552.
28. Van Loveren C. Sugar alcohols: What is the evidence for caries-preventive and caries-therapeutic effects? *Caries Res* 2004;38:286-293.
29. Ly KA, Milgrom P, Rothen M. Xylitol, sweeteners, and dental caries. *Pediatr Dent* 2006;28:154-163. Discussion 92-98.
30. Lynch H, Milgrom P. Xylitol and dental caries: An overview for clinicians. *J Calif Dent Assoc* 2003; 31:205-209.