Policy on the Use of Xylitol

Review Council
Council on Clinical Affairs

Latest Revision
2015

Purpose

The American Academy of Pediatric Dentistry (**AAPD**) recognizes that there is considerable research on sugar substitutes, particularly xylitol, and their potential oral health for infants, children, adolescents, and persons with special health care needs. This policy is intended to assist oral health care professionals making informed decisions about the use of xylitol-based products with the aim of preventing caries in children.

Methods

This policy was originally developed by the Council on Clinical Affairs Committe and adopted in 2006. This document is an update of the previous version, revised in 2010. The update is based upon a review of current dental and medical literature related to the use of xylitol in caries prevention. A literature search was conducted using PubMed®/MEDLINE with the terms: xylitol AND caries prevention; field: all fields; limits: within the last 20 years, humans, English, birth through 18. Two hundred eighty articles matched these criteria; 47 controlled clinical trial papers were reviewed for this revision. When data did not appear sufficient or were inconclusive, recommendations were based upon expert and/or consensus opinion by experienced researchers and clinicians.

Background

Xylitol is a five-carbon sugar alcohol derived primarily from forest and agricultural materials. It has been used since the early 1960s in infusion therapy for post-operative, burn, and shock patients, in the diet of diabetic patients, and as a sweetener in products aimed at improved oral health.[1] Dental benefits of xylitol first were suggested from Finnish studies using animal models in 1970.[2] The first xylitol studies in humans, known as the Turku Sugar Studies,[3,4] demonstrated the relationship between dental plaque and xylitol, as well as the safety of xylitol for human consumption. Xylitol as well as other sugar alcohols are not readily metabolized by oral bacteria, and thus are considered non-cariogenic sugar substitutes.[4]

Xylitol is available in many forms (e.g., gums, mints, chewable tablets, lozenges, toothpastes, mouthwashes, cough mixtures, oral wipes, nutraceutical products).[5-7] The chewing process enhances the caries inhibitory effect, which may be a significant confounding factor for the efficacy of xylitol gum.[8] Xylitol studies show varying results in the reduction of the incidence of caries,[9-18] transmission of mutans streptococci (**MS**) from mothers to children,[19-21] and MS levels in children.[7,12,22-36] Such studies have been performed with xylitol intake ranging from four to 15 grams per day divided into three to seven consumption periods.[5,6,16,18,23] Abdominal distress and osmotic diarrhea have been reported following the ingestion of xylitol.[5,6,23]

Overall results of these trials are inconclusive, and there appear to be study design issues and/or bias in many of the studies (e.g., insufficient sample size, control group issues, issues with randomization, blinding, and conflict of interest).[6-35] Data is inconclusive for caries reduction for short-term use.[9,12-14] Data also is inconclusive for long-term effectiveness for reduction of MS[12,35] and caries reduction.[11,15-18] Most studies used a very large dose and at high frequency (generally four to five times a day)[18,20,23,24,27,32,33,35] which may be unrealistic in clinical practice.

Policy statement

The AAPD:

- Supports the use of xylitol and other sugar alcohols as non-cariogenic sugar substitutes.
- Recognizes that presently there is a lack of consistent evidence showing significant reductions in MS and dental caries in children.
- Recognizes that the large dose and at high frequency of xylitol used in clinical trials may be unrealistic in clinical practice.
- Supports further research to clarify the impact of xylitol delivery vehicles, the frequency of exposure, and the optimal dosage to reduce caries and improve the oral health of children.

References

1. Mäkinen KK. Biochemical principles of the use of xylitol in medicine and nutrition with special consideration of dental aspects. Experientia Suppl 1978;30:1-160.
2. Muhlemann HR, Regolati B, Marthaler TM. The effect on rat fissure caries of xylitol and sorbitol. Helv Odontol Acta 1970;14(1):48-50.

ABBREVIATIONS
AAPD: American Academy Pediatric Dentistry. **MS:** Mutans streptococci.

3. Scheinin A, Mäkinen 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 1975;33(5):269-78.
4. Scheinin A, Mäkinen 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;34(4):179-216.
5. Ly KA, Milgrom P, Rothen M. Xylitol, sweeteners, and dental caries. Pediatr Dent 2006;28(2):154-63; discussion 192-8.
6. Lynch H, Milgrom P. Xylitol and dental caries: An overview for clinicians. J Calif Dent Assoc 2003;31:205-9.
7. Zhan L, Cheng J, Chang P, et al. Effects of xylitol wipes on cariogenic bacteria and caries in young children. J Dent Res 2012;91(7 Suppl):85S-90S.
8. Mickenautsch S, Yengopal V. Anticariogenic effect of xylitol versus fluoride – A quantitative systematic review of clinical trials. Int Dent J 2012;62(1):6-20.
9. Seki M, Karakama F, Kawato T, Tanaka H, Saeki Y, Yamashita Y. Effect of xylitol gum on the level of oral mutans streptococci of preschoolers: Block-randomised trial. Int Dent J 2011;61(5):274-80.
10. Laitala ML, Alanen P, Isokangas P, Söderling E, Pienihäkkinen K. Long-term effects of maternal prevention on children's dental decay and need for restorative treatment. Community Dent Oral Epidemiol 2013;41(6):534-40.
11. Hujoel PP, Mäkinen KK, Bennett CA, et al. The optimum time to initiate habitual xylitol gum-chewing for obtaining long-term caries prevention. J Dent Res 1999; 78(3):797-803.
12. Oscarson P, Lif Holgerson P, Sjöström I, Twetman S, Stecksén-Blicks C. Influence of a low xylitol-dose on mutans streptococci colonisation and caries development in preschool children. Eur Arch Paediatr Dent 2006; 7(3):142-7.
13. Stecksén-Blicks C, Holgerson PL, Twetman S. Effect of xylitol and xylitol-fluoride lozenges on approximal caries development in high caries-risk children. Int J Paediatr Dent 2008;18(3):170-7.
14. Kovari H, Pienihäkkinen K, Alanen P. Use of xylitol chewing gum in daycare centers: A follow-up study in Savonlinna, Finland. Acta Odontol Scand 2003;61(6):367-70.
15. Sintes JL, Escalante C, Stewart B, et al. Enhanced anticaries efficacy of a 0.243% sodium fluoride/10% xylitol/ silica dentifrice: 3-year clinical results. Am J Dent 1995; 8(5):231-5.
16. Sintes JL, Elías-Boneta A, Stewart B, Volpe AR, Lovett J. Anticaries efficacy of a sodium monofluorophosphate dentifrice containing xylitol in a dicalcium phosphate dihydrate base. A 30-month caries clinical study in Costa Rica. Am J Dent 2002;15(4):215-9.
17. Alanen P, Holsti ML, Pienihäkkinen K. Sealants and xylitol chewing gum are equal in caries prevention. Acta Odontol Scand 2000;58(6):279-84.
18. Mäkinen KK, Benett CA, Hujoel PP, et al. Xylitol chewing gums and caries rates: A 40-month cohort study. J Dent Res 1995;74(12):1904-13.
19. Alamoudi NM, Hanno AG, Sabbagh HJ, Masoud MI, Almushayt AS, El Derwi DA. Impact of maternal xylitol consumption on mutans streptococci, plaque and caries levels in children. J Clin Pediatr Dent 2012;37(2):163-6.
20. Söderling E, Isokangas P, Pienihäkkinen K, Tenovuo J, Alanen P. Influence of maternal xylitol consumption on mother-child transmission of mutans streptococci: 6 year follow-up. Caries Res 2001;35(3):173-7.
21. Nakai Y, Shinga-Ishihara C, Kaji M, Moriya K, Murakami-Yamanaka K, Takimura M. Xylitol gum and maternal transmission of mutans streptococci. J Dent Res 2010; 89(1):56-60. doi: 10.1177/0022034509352958.
22. Hanno AG, Alamoudi NM, Almushayt AS, Masoud MI, Sabbagh HJ, Farsi NM. Effect of xylitol on dental caries and salivary *Streptococcus mutans* levels among a group of mother-child pairs. J Clin Pediatr Dent 2011;36(1): 25-30.
23. Campus G, Cagetti MG, Sale S, et al. Six months of high-dose xylitol in high-risk caries subjects—a 2-year randomised, clinical trial. Clin Oral Investig 2013;17(3): 785-91.
24. 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;35(4):1024-7.
25. Twetman S, Stecksén-Blicks C. Effect of xylitol-containing chewing gums on lactic acid production in dental plaque from caries active pre-school children. Oral Health Prev Dent 2003;1(3):195-9.
26. Autio JT. Effect of xylitol chewing gum on salivary *Streptococcus mutans* in preschool children. ASDC J Dent Child 2002;69(1):81-6.
27. Isotupa KP, Gunn S, Chen CY, Lopatin D, Mäkinen KK. Effect of polyol gums on dental plaque in orthodontic patients. Am J Orthod Dentofacial Orthop 1995;107 (5):497-504.
28. ElSalhy M, Sayed Zahid I, Honkala E. Effects of xylitol mouthrinse on *Streptococcus mutans*. J Den 2012;40(12): 1151-4. doi: 10.1016/j.jdent.2012.08.014.
29. Twetman S, Petersson LG. Influence of xylitol in dentifrice on salivary microflora of preschool children at caries risk. Swed Dent J 1995;19(3):103-8.
30. Simões Moraes R, Modesto A, Regina Netto Dos Santos K, Drake D. The effect of 1% chlorhexidine varnish and 40% xylitol solution on *Streptococcus mutans* and plaque accumulation in children. Pediatr Dent 2011;33(7): 484-90.
31. Juric H, Dukic W, Jankovic B, Karlovic Z, Pavelic B. Suppression of salivary *Streptococcus mutans* and lactobacilli by topical caries preventive agents. Cent Eur J Public Health 2003;11(4):219-22.

32. Ly KA, Riedy CA, Milgrom P, Rothen M, Roberts MC, Zhou L. Xylitol gummy bear snacks: A school-based randomized clinical trial. BMC Oral Health 2008;25(8): 20. doi: 10.1186/1472-6831-8-20.
33. Holgerson PL, Sjöström I, Stecksén-Blicks C, Twetman S. Dental plaque formation and salivary mutans streptococci in schoolchildren after use of xylitol-containing chewing gum. Int J Paediatr Dent 2007;17(2):79-85.
34. Mäkinen KK, Isotupa KP, Mäkinen PL, et al. Six-month polyol chewing-gum programme in kindergarten-age children: A feasibility study focusing on mutans streptococci and dental plaque. Int Dent J 2005;55(2):81-8.
35. Mäkinen KK, Alanen P, Isokangas, et al. Thirty-nine month xylitol chewing gum programme in initially 8-year-old school children: A feasibility study focusing on mutans streptococci and lactobacilli. Int Dent J 2008; 58(1):41-50.
36. Bader JD, Vollmer WM, Shugars DA, et al. Results from the Xylitol for Adult Caries Trial (X-ACT). J Am Dent Assoc 2013;144(1):21-30.