

# Xylitol and caries prevention

## Abstracted from

Riley P, Moore D, Ahmed F, Sharif MO, Worthington HV.

Xylitol-containing products for preventing dental caries in children and adults.

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Address for correspondence: Luisa Fernandez Mauleffinch, Managing Editor, Cochrane Oral Health Group, School of Dentistry, The University of Manchester, JR Moore Building, Oxford Road, Manchester, M13 9PL, UK. E-mail: luisa.fernandez@manchester.ac.uk

## Question: How effective are different xylitol-containing products for the prevention of dental caries in children and adults?

**Data sources** Cochrane Oral Health Group Trials Register, the Cochrane Central Register of Controlled Trials (CENTRAL), Medline, Embase, CINAHL, Web of Science Conference Proceedings, Proquest Dissertations and Theses, US National Institutes of Health Trials Register (<http://clinicaltrials.gov>) and the WHO Clinical Trials Registry Platform for ongoing trials. No language or year restrictions were used.

**Study selection** Randomised controlled trials assessing the effects of xylitol products on dental caries in children and adults.

**Data extraction and synthesis** Two review authors independently screened the results of the electronic searches, extracted data and assessed the risk of bias of the included studies. Authors were contacted where possible for missing data or clarification where feasible. For continuous outcomes, means and standard deviations were used to obtain the mean difference and 95% confidence interval (CI). Continuous data was used to calculate prevented fractions (PF) and 95% CIs to summarise the percentage reduction in caries. For dichotomous outcomes, reported risk ratios (RR) and 95% CIs were used. As there were fewer than four studies included in the meta-analysis, a fixed effect model was used.

**Results** Ten studies were included with a total of 5903 participants. One study was assessed as being at low risk of bias, two were assessed as unclear risk of bias with seven at high risk of bias. Over 2.5 - 3 years, low quality evidence demonstrated that with 4216 children analysed, a fluoride toothpaste with 10% xylitol (exact dosage unsure) reduced caries by 13% when compared to a fluoride only toothpaste. (PF -0.13, 95% CI -0.18 to -0.08. Remaining evidence of the use of xylitol in children has risk of bias and uncertainty of effect and was therefore insufficient to determine a benefit from xylitol. Four studies reported that there were no adverse effects from any of the interventions. Two studies reported similar rates of adverse effects between study arms.

The remaining studies either mentioned adverse effects but did not report any usable data, or did not mention them at all. Adverse effects include sores in the mouth, cramps, bloating, constipation, flatulence and loose stool or diarrhoea.

**Conclusions** Low quality evidence suggested that fluoride toothpaste containing xylitol may be more effective than fluoride-only toothpaste for preventing caries in the permanent teeth of children. The effect estimate should be interpreted with caution due to high risk of bias and the fact that it was derived from two studies that were carried out by the same authors in the same population. The remaining evidence was low to very low quality and is insufficient to determine whether any other xylitol-containing products can prevent caries in infants, older children or adults.

## Commentary

The new Cochrane review investigating the effectiveness of xylitol is welcome. The use of xylitol, although common in Nordic countries, is not part of the usual diet of UK consumers. According to personal experience, products with low concentration xylitol have been available for some time in this country, but it is only recently that the marketing of high concentration xylitol has increased and high concentration xylitol is now available in some high street retailers. Similarly from an academic perspective the research of xylitol within the UK is limited. From a guidance perspective, despite former references to xylitol in historic SIGN publications 83,<sup>1</sup> and recommendations (again SIGN 83) for research involving xylitol, recent UK guidance Delivering Better Oral Health (2014)<sup>2</sup> and SIGN 2014,<sup>3</sup> did not advocate its use.

There is clear evidence that polyols such as xylitol are non-cariogenic; they are a recognised dentally safe substitute for sucrose in confectionery and other foods.<sup>4</sup> It is now over 40 years since this non-cariogenic nature was demonstrated in the Turku sugar studies. What is less clear is the evidence as to whether xylitol actually has a cario-static benefit.

The problem is that despite there being a large body of research investigating xylitol and its relationship to caries, the majority of xylitol reviews as Riley suggests are poorly designed, with inadequate sample sizes, inconsistent use of outcome measures and widely varying, and often very low doses of xylitol. Researchers need to ensure that future randomised controlled trials follow appropriate international standards such as laid down by CONSORT<sup>5</sup> to ensure the validity of future trials. However a number of xylitol studies have also suffered from high attrition rates and personal experience<sup>6</sup>

This paper is based on a Cochrane Review published in the Cochrane Library 2015, issue 3 (see [www.thecochranelibrary.com](http://www.thecochranelibrary.com) for information). Cochrane Reviews are regularly updated as new evidence emerges and in response to feedback, and the Cochrane Library should be consulted for the most recent version of the review.

has highlighted the challenges of both recruiting and retaining research participants.

It is generally considered that xylitol is effective at doses of 5 grams – however this is widely debated. There have been examples where xylitol has been effective at smaller doses.<sup>7</sup> Riley comments that the dosage of xylitol in the reviewed studies ranged from 200 mg per day to 8 grams per day. As the authors indicate the actual dosage of toothpaste used within the reviewed studies was not stated. From my perspective it would have been useful for the authors of the Cochrane review to estimate a dosage of the actual toothpaste. It is suspected that the effect of xylitol is dose dependent, and this calculation would have been useful to enable reproducibility of the studies, or to consider the viability of a public health programme involving the use of xylitol toothpaste.

With the current review it is difficult to understand the exact inclusion and exclusion criteria applied. The authors state that the review is to assess the effects of different xylitol-containing products on preventing dental caries, with an specified inclusion criteria of ‘children and adults’, and an exclusion criteria of studies in which the majority of participants were undergoing orthodontic treatment; the intervention was provided for less than one year; or participants were selected on the basis of having underlying health conditions. Keeping the exclusion criteria in mind, from my understanding this review should therefore have included most of the body of xylitol research. It is not clear if research relating to the maternal consumption of xylitol was included (and then excluded because it didn’t fit the inclusion criteria). As a co-author of another Cochrane review, currently underway<sup>8</sup> it is assumed that maternal consumption of xylitol papers were not included, as these will be picked up by this alternative but complementary review.

Riley and his colleagues at Cochrane point out a number of problems with the current xylitol literature. Firstly caries is reported using a number of different indices including dmfs and continuous outcomes, with two studies reporting caries simply as a dichotomous (yes/no) outcome. Caries was reported in some instances as cavitated lesions, and in other cases more precise indices were used to reflect non-cavitated lesions. Studies included different xylitol products and different comparators. It is understandable therefore that the simple diversity of most of these studies made it impossible to

combine them into a meta-analysis. Further studies were excluded as either placebos were used which contained sugar (making it difficult to understand if in comparison xylitol had a neutral or cariostatic effect) or placebos were used that actually have been shown to prevent caries (eg erythritol).

In conclusion Riley gives significant reasons for the exclusion in this review of the majority of xylitol research. By ignoring all research with bias the review inevitably also possibly misses an important body of research. However, increasingly Cochrane reviews are used to support evidence-based effective oral health promotion programmes. It is important therefore that only high quality research is included. There is no reason that xylitol should receive special attention.

There is some low quality evidence that the use of fluoride toothpaste containing xylitol may be more effective than fluoride only toothpaste in caries prevention in children. Further high quality research is required to confirm the benefit of xylitol to reduce caries in other situations.

**Brett Duane**

*Public Health England, County Hall North, Chart Way,  
Horsham, West Sussex, UK.*

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