

Xylitol, a Dental Miracle Sugar?

Sugar addicts of the world: time to breathe a sigh of relief - tooth-friendly xylitol has come to the rescue.

While it seems like an oxymoron (contradiction in terms) that sugar should actually be good for your teeth - read on nevertheless. Whether you are fighting tooth decay, plaque build-up, bad breath, dry mouth or any combination thereof - products sweetened with the look- and taste-alike sugar substitute xylitol frequently provide effective help and constitute easy preventive dental care par excellence.

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What is xylitol?

Xylitol is a naturally occurring sweet substance which chemically belongs to the family of the so-called sugar alcohols [aka polyols]. In its store-bought form, xylitol looks and tastes like regular sugar (but has c. 40% less calories and, at least currently, is more expensive). The name xylitol derives from the Greek “xylon” [hardwood], with the suffix -itol denoting sugar alcohols (other sugar alcohols are for instance erythritol, mannitol, sorbitol, maltitol etc., names which you may recognize from various sugar free and/or diet food labels).

Xylitol in small amounts is found in many fruits and vegetables. The human liver also produces between 5 and 15 grams a day since xylitol forms an intermediate product in carbohydrate metabolism.

Xylitol's humble beginnings and rise to dental fame

Since its discovery in the late 19th century, xylitol was little used outside of laboratory settings due to the expense involved in its production. It only rose to greater significance when the former Finnish Sugar Company developed an economically viable procedure for xylitol manufacture in the 1960s (xylitol is extracted for instance from corn and birch wood). Things really started to "move" from the early 1970s when scientists at the Finnish Turku University set out researching and demonstrating xylitol's surprising dental health and caries-preventative benefits in a series of ground-breaking studies.

Xylitol's dental health benefits: anti-caries and caries-preventative

The following gives a simplified overview of what xylitol has been found to accomplish in the human dentition, dental plaque and oral flora via a number of clinical/prospective caries trials. Most of these studies have been carried out using chewing gums or large pastilles with high xylitol concentrations. (For greater details, the interested reader is referred to the published literature available online and offline [compare [Xylitol studies](#)].) So here are some of the virtues discovered in xylitol:

Xylitol effectively prevents caries.

- Xylitol does not support the growth of cariogenic *Streptococcus mutans* (“caries bacteria”) due to *S. mutans*' inability to metabolize Xylitol.
- Both after short- and long-term use, xylitol significantly reduces the amount of *mutans streptococci* in plaque and saliva.
- The growth of *lactobacilli* is reduced during long-term use of xylitol chewing gums.
- Xylitol shows effects which promote tooth remineralization.

Xylitol beneficially affects oral plaque properties and oral flora, i.e. makes plaque less cariogenic, for instance in the following ways.

- Xylitol is not transformed to harmful acids in dental plaque.
- When consumed after eating fermentable food components (sugar, starch...), Xylitol actively prevents acid production in dental plaque (enamel dissolves when the pH decreases below 5.7).
- Regular xylitol consumption reduces the adhesivity and amount of plaque, making it easier to brush off.

Xylitol protects children's teeth.

- In toddlers, xylitol consumption during the emergence of their primary dentition provides long-term protection against tooth decay. Xylitol consumption is particularly beneficial if early signs of tooth decay/caries bacteria colonization are present.
- Impressive mother-and-child studies involving three groups under different treatment (xylitol/chlorhexidine/fluoride varnish): one group of mothers started chewing xylitol gum c. 3 months after childbirth and continued that program over a period of 21 months (while their children received no treatment). Results: the children of those mothers who had used xylitol were infected with *mutans streptococci* to a significantly lower degree than the children of mothers who had not chewed xylitol gum (but had been treated with chlorhexidine or fluoride varnish).
Since caries can also be an infectious (transmissible) disease, early colonization of the child's teeth with *S. mutans* can occur via the mother's or other caretaker's saliva. As has been shown, a mother regularly consuming xylitol when the child's primary teeth are emerging decreases the risk of infecting her child with *S. mutans* 5-fold, which in turn significantly lowers subsequent caries incidence in her child.

Miscellaneous

- Xylitol apparently improves the absorption of B vitamins and calcium. In animal experimentation (with rats)¹, xylitol has been shown to have prophylactic effects re osteoporosis.
- The temporary suppression of *Streptococcus mutans* resulting from oral chlorhexidine rinses is maintained if the chlorhexidine application is followed by xylitol consumption.
- Xylitol enhances the effect of fluoridated toothpaste and other conventional caries prevention methods. Finnish professor Kauko K. Mäkinen, eminent xylitol researcher and author of the German-language book "Der Einsatz von Xylit in der Kariesprophylaxe"

[The Use of Xylitol in Caries Prophylaxis], writes, "Clinical studies carried out under 'real-life' conditions have shown that the xylitol ingested was at least as effective or more effective than various fluoride programmes tested simultaneously.... It's obvious that the best results are from studies where xylitol and fluoride were applied concurrently. Xylitol and fluorides use different chemical mechanisms against caries. In other words the effects of xylitol and fluorides are largely cumulative, which suggests that both should be used simultaneously to obtain the most effective caries prophylaxis." (but compare [Xylitol and/or fluoride?](#))"²

- Xylitol also boasts a number of confirmed non-dental medicinal benefits, one of which is that regular consumption of xylitol-containing products prevents or reduces acute middle ear infection (otitis media) in children by inhibiting pathogens associated with this ailment. Additionally, Xylitol is antiketogenic (lowers the level of free fatty acids in serum) and has no known adverse effects on the central nervous system, hormone production and neurotransmitters.

Xylitol safety issues

Long-term clinical studies have confirmed the safety (non-toxicity to humans) of xylitol, with reportedly even daily intakes of 200 resp. 430 g being tolerated by some people. Xylitol like most sugar alcohols has a laxative effect (due to the fact that sugar alcohols are not completely broken down during digestion) but thankfully, the effect is less harsh than for instance with its "cousin" sorbitol and the human body is able to gradually adapt. A slow increase in consumption is recommended (speaking from personal experience here ;-). The amounts considered sufficient for daily dental care (5-10 g) in any case are too low to cause such effects.³

The safety of xylitol is reflected in numerous "official" approvals in dozens of countries concerning its use in food (particularly oral hygiene or dietary products), pharmaceuticals and cosmetics. In fact the WHO itself has carried out xylitol studies in Thailand, Polynesia and Hungary.

Xylitol and diabetics

Since Xylitol's initial metabolism doesn't require insulin, is low glycemic and only slowly converted and absorbed (i.e. has a limited impact on blood sugar levels), it's also suitable for diabetics. In the later stages of xylitol metabolism, the xylitol molecule does become part of glucose and glycogen molecules, i.e. the glucose thus created does require insulin to be handled. For this reason, one author recommends limiting the daily xylitol intake of diabetics to 60 grams to avoid high blood sugar and related complications.

Xylitol for children

(Following up from [Xylitol protects children's teeth](#))

Xylitol products have been given to small children from two years upwards, with small children using small products and school children being able to also use products designed for adults (in fact, Finland has entire xylitol programs in place for its young generation). Due to xylitol's above-mentioned mild laxative effect, it is recommended to introduce it gradually until the effective dose is attained.

Xylitol for adults with special needs

People wearing orthodontic braces, suffering from dry mouth (xerostomia), (mechanically or otherwise) unable to brush their teeth properly as well as mentally retarded patients may find it difficult to keep dental plaque at bay. Thanks to its unique action on plaque and easy applicability, xylitol can help in these cases (more under [Other helpful xylitol applications](#)).

Xylitol and dogs (as well as other animals)

To be on the safe side, Xylitol is best not used with dogs and other non-humans. While there are conflicting observations and studies, the "negative" reports re hypoglycemic (insulin-increasing) effects on dogs are concerning enough to warrant total xylitol "abstinence" at least for your canine friend(s).

Factors that can interfere with Xylitol's beneficial effects

The presence of certain ionic surfactants (surface active agents) such as sodium lauryl sulfate (SLS) in toothpaste can prevent xylitol from functioning as it typically does. Also, ingesting large amounts of saccharose, glucose or fructose can sometimes "mask" the positive effects of xylitol. (Prof. Mäkinen)

A question of taste

Xylitol reportedly gives a pleasant cooling sensation when dissolving in the mouth (I haven't really noticed). This characteristic advantageously adds to its use in chewing gums and pastilles. Unlike some other sugar substitutes, Xylitol has no unpleasant after-taste.

Tips

When [making your own homemade toothpaste](#) from natural ingredients, you can add xylitol for a delicious sweet taste and all the mentioned benefits.

Due to its sweet taste, xylitol allows to disguise healthy things and products with it which do not taste good when eaten alone, including bitter supplements, herbs etc. This can be used to advantage for instance with fussy children who resist strong flavors (just make sure to not override what is actually the expression of a healthy instinct). You could make a healthy cocoa beverage for example sweetened with xylitol and with healing herbs etc. added.

Summary of a successful dental xylitol program for healthy adults

(translated from Prof. Mäkinen's above-mentioned book "Der Einsatz von Xylit in der Kariesprophylaxe")

- Eat small amounts frequently in the course of the day.
- Use sugar free products that are exclusively or mostly sweetened with Xylitol. Ideal are products for chewing or sucking which boast a high Xylitol content, if possible "sweetened 100% with Xylitol".

- Apply at least 3 times a day. 5 times daily could be even better.
- Use on a daily basis.
- Consume immediately after meals or snacks containing sugar and/or starch.
- Additional preventative effects can be obtained by using xylitol **before** any meals or snacks.

Following the above program, you will easily ingest the amounts considered sufficient for effective daily dental care (5-10 g). If feasible, the daily xylitol dose should be larger than 5 g.

Important update October 2010: see [rinsing mouth and brushing teeth with xylitol sugar](#), the best and most cost-effective way of using xylitol has stopped both tooth decay and healed periodontitis/gum disease.

Buying xylitol products

In addition to the simple xylitol sugar (available in both sugar-grain size and in more powdery consistency), a range of sugar free chewing gums, pastilles and similar candies as well as xylitol-based toothpastes is on offer both on and offline.

I would make sure to get a product 100% sweetened with xylitol and containing a minimum of artificial ingredients, particularly no aspartame (also marketed as 'NutraSweet', 'Spoonful', 'Equal Measure', 'Equal', 'Canderol' (E951), 'Benevia', etc.)⁴, artificial colours or other sweeteners.

Another important consideration may be to watch out for and avoid GMO-derived xylitol (such as xylitol produced from genetically modified corn).

If you don't want or can't chew xylitol gums

As mentioned above, there are various xylitol candies, mints etc. which can be used as alternatives e.g. in elementary schools where gum chewing may not be tolerated. These chewing gum alternatives are also helpful for dry-mouth patients, people with malocclusion, partial dentures etc.

Important update October 2010: see [rinsing mouth and brushing teeth with xylitol sugar](#), the best and most cost-effective way of using xylitol has stopped both tooth decay and healed periodontitis/gum disease.

Cooking with xylitol

See [Books: Xylitol - the dental miracle sugar](#).

Xylitol's dental applications & anticariogenic properties: studies galore!

Here is an incomplete but nevertheless extensive list of xylitol studies researching this low-calorie sugar substitute's effects on dental health, conducted in various countries (but mostly in Finland).

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Studies positing Xylitol-tolerant *S. mutans* strains

For the sake of completeness, I will add that there also seem to be certain studies showing some *Streptococcus mutans* strains becoming xylitol-resistant resp. tolerant. For those interested, feel free to look up the studies "Cariogenic traits in xylitol-resistant and xylitol-sensitive mutans streptococci" (www.ncbi.nlm.nih.gov/pubmed/11929556) and "How xylitol-containing products affect cariogenic bacteria" (www.ncbi.nlm.nih.gov/pubmed/11991460?dopt=Citation). I wouldn't rule out the possibility that there are flaws in these studies (such as introducing factors as cited above under "Factors that can interfere with Xylitol's beneficial effects" and others, too low concentrations etc.

In any case, as usual the proof of the pudding is in the eating, simply exchange the word pudding with xylitol :-)) and watch your own experience. If you notice your teeth feeling smoother and your breath being fresher as well as other signs of a less bacteria- and plaque-laden mouth, you know that xylitol is working for you. **Important update: see [Do *Streptococcus mutans* \(caries bacteria\) get used to xylitol?](#)**