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Xylitol — Cavity-Fighting Sweetener a Possible Solution for Osteoporosis

by Ward Dean, MD

In September, 2001 we featured an article about Xylitol.¹ Xylitol is a five-carbon sugar that has a number of unique properties. In addition to being a delicious, low calorie sugar substitute (40% fewer calories than an equivalent amount of table sugar [sucrose]), Xylitol does not cause significant changes in blood glucose or insulin (making it not only safe for diabetics and those trying to lose weight, but also a desirable sweetener for those who understand the importance of maintaining low levels of glucose and insulin as an anti-aging regimen.²

Among its other known benefits to health, regular Xylitol consumption results in fewer cavities (Figures 1 and 2), improved periodontal (gum) health, and reduction in nasal, sinus and oropharyngeal infections. Xylitol also is effective against *H. pylori*, the micro-organism that has been implicated in periodontal disease, bad breath, gastric and duodenal ulcers, and even stomach cancer (Table 1).³ It now appears that another highly significant effect can be attributed to Xylitol.

Osteoporosis – Age-related Bone Loss

Osteoporosis — loss of bone density — is another age related disease for which there is no widely recognized means of prevention and treatment. Osteoporosis strikes women four times as often as men. 80 percent of the more than 28 million Americans currently threatened with osteoporosis are

females.⁴ Incidence levels for both sexes are high; one in two women and one in five men are at risk of developing osteoporotic fractures during their lifetimes.⁵

Clinically Proven Effects of Xylitol

- Inhibits plaque and dental cavities by 80%
- Retards demineralization of tooth enamel
- Promotes remineralization of tooth enamel
- Increases saliva production
- Relieves “dry mouth” (xerostomia)
- Protects salivary proteins, has a protein-stabilizing effect
- Improves breath odor
- Reduces infections in the mouth and nasopharynx

Table 1. Benefits of Xylitol.

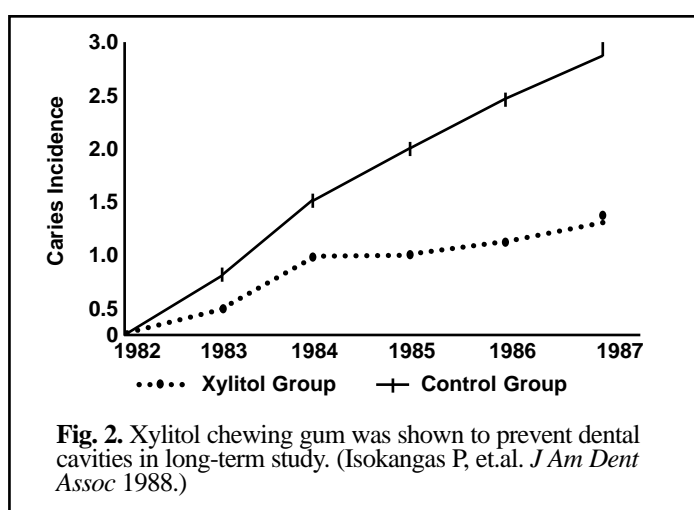
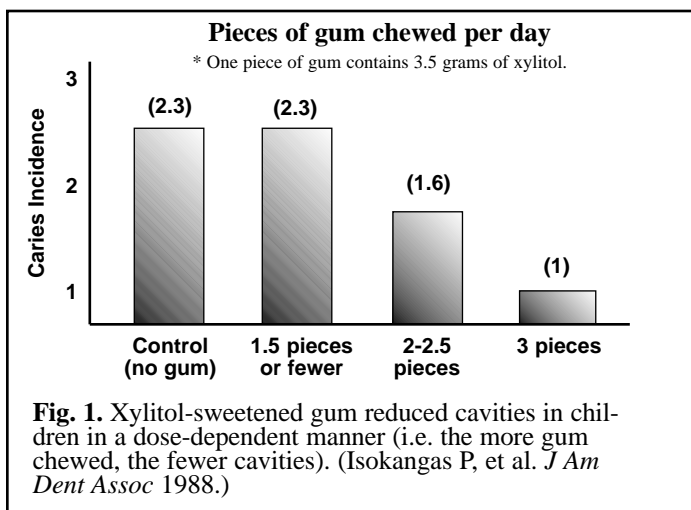
Osteoporosis is a metabolic bone disease that leads to deterioration of bone tissues and a loss of bone mass (Fig. 3). This contributes to bone fragility and increased susceptibility to fractures, particularly of the hip, spine and wrist. Fractures of the hip frequently require hospitalization and surgery, and can lead to permanent disability and death. Spinal or vertebral fractures, while not life-threatening, have serious consequences, including loss of height, severe back pain, and deformity.

According to figures compiled by the *American Academy of Orthopaedic Surgeons*, osteoporosis causes some 1.5 million fractures each year in the US. Costs for treating osteoporosis and related fractures approach 10 billion dollars annually.^{5,6} As the baby boomer population ages over the next 30 years osteoporosis-related costs are projected to increase to between 50 to 80 billion dollars annually. Hip fractures alone represent a tremendous socioeconomic drain, accounting for more than half of all health care expenditures for fractures, as well as increasing significant incidence of disability and mortality.⁶

Standard Osteoporosis Prevention and Treatment

Regimens and substances that have been used singly and in combination to prevent and treat osteoporosis include:

1. Hormone replacement therapy with estrogens, progesterone, testosterone and anabolic steroids
2. Dietary supplementation with calcium, magnesium, and other minerals (including Calcium Hydroxyapatite)
3. Vitamins D and K
4. The bioflavonoid Ipriflavone
5. Calcitonin nasal spray
6. Exercise
7. Growth hormone injections
8. Pharmaceutical agents in the bisphosphonate class



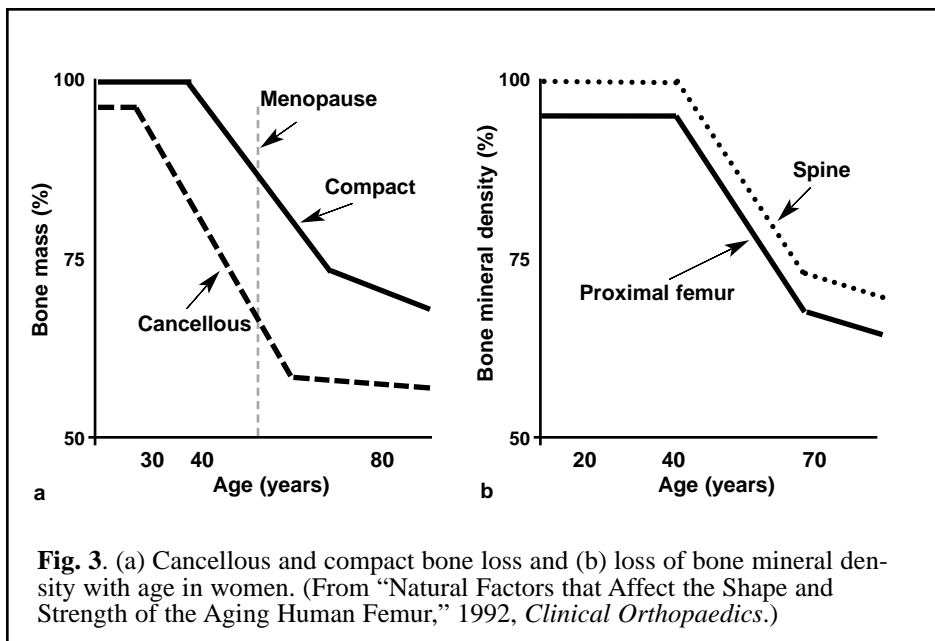


Fig. 3. (a) Cancellous and compact bone loss and (b) loss of bone mineral density with age in women. (From "Natural Factors that Affect the Shape and Strength of the Aging Human Femur," 1992, *Clinical Orthopaedics*.)

Although each of these modalities has been clinically tested with varying degrees of success, there is still no magic bullet that is universally effective in this chronic, debilitating illness.

Reversal of Bone Loss with Xylitol

A recent exciting study has shown that osteoporosis may be another condition for which Xylitol may be of help. In studies in Finland in 1994 (mentioned in our previous article), Xylitol was shown to be able to maintain bone density in rats which had their ovaries surgically removed.⁷ Without ovaries, estrogen levels in these rats plummeted — and so did the bone density in the rats which were not given Xylitol. However, in ovariectomized rats which had been given Xylitol, bone density actually increased.

This early study strongly indicated that Xylitol might help maintain bone density in normally aging intact (non-“surgerized”) animals. Now, this conjecture has apparently been confirmed. A recent report by the same team of Finnish scientists evaluated the effect of Xylitol on bone volume and bone mineral content in aged male rats, reinforcing their earlier study on female animals.⁸

Xylitol Reverses Bone Loss in Old Animals

In this recent study, 24 rats were given Xylitol in their diet for twenty months. At the end of this time, they were “euthenized” with carbon dioxide. The bone mineral content and volume of the bones was evaluated by several sophisticated analytical techniques.

The tibial (lower leg bone) density of control animals averaged 1.560 g/mm³,

while the density of the tibias of the Xylitol-fed animals averaged 1.725 g/mm³, indicating a Xylitol-induced increase of bone density of nearly 10%.

The authors stated that “Xylitol consumption resulted in significant protection against aging-related loss of bone,” and “The preserved bone volume indicates an anabolic and/or anti-catabolic effect...caused by Xylitol.” They concluded: “A continuous moderate dietary Xylitol supplementation leads to an increased bone volume and to an increased bone mineral content in the long bones of aged rats. This indicates a Xylitol-induced protection against aging-related osteoporotic changes.”

Xylitol Mechanisms and the Neuroendocrine Theory of Aging – Another Receptor Sensitizer?

The scientists speculated that xylitol’s bone density-enhancing properties were due to its ability to promote intestinal absorption of calcium. They pointed out that calcium absorption is impaired with aging. They believe that this is due to an age-related intestinal resistance to 1,25 dihydroxy vitamin D₃, and by an age-related decrease in intestinal vitamin D receptor concentrations. I think this is similar to the age-related loss of receptor sensitivity and associated hormonal resistance observed in many other receptor systems.⁹

The scientists proposed that Xylitol’s efficacy in enhancing calcium absorption and utilization may be independent of the apparent *vitamin D* resistance. It may be the mineral absorption- and utilization-enhancing effects of Xylitol combined with its *H. pylori*-killing effects that result in Xylitol’s

ability to reduce the number and size of cavities. Some cavities have even tended to “fill in.” Of course, it may be that Xylitol acts as a *vitamin D3* receptor sensitizer, enhancing the effects of vitamin D (see Table 2, page 6).

Xylitol May Prevent Osteoporosis in Humans

In a rare action for academic scientists, the Finnish researchers made bold recommendations for human application of their studies. Based on their study with rats (the rats were given about two grams of Xylitol daily — 7% of their daily caloric intake), the scientists extrapolated that a human dose would be about 40 grams daily. (Many people routinely take 30 to 60 grams of Xylitol per day.) Xylitol does not appear to have a toxic dose. People have safely taken doses as high as 400 grams daily for prolonged periods without significant ill effects (initially, such high doses may cause diarrhea).

Conclusion

The findings of the bone-building effects of Xylitol are exciting. Although clinical studies with humans should certainly be conducted, in view of (1) the overwhelming safety of Xylitol, (2) its numerous significant health benefits, and (3) the high likelihood that these animal results can be replicated successfully in humans, *I recommend that people replace their sucrose consumption to as great a degree as practical with this remarkable nutrient.*

Although Xylitol may seem to be expensive when compared to sugar, its cost is clearly a bargain when compared to the cost of most other anti-osteoporosis or weight loss agents, to say nothing of savings on dental bills and hip fracture-rehabilitation costs, and improved quality of life.

References

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