

# The Impact of Milk with Xylitol on Dental Caries –A Review

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**Abstract:** Dental caries is a infectious microbiologic disease of the tooth that results in localized dissolution and destruction of calcified tissues. Its seen in all age groups, few preventive agents have been evaluated to prevent the caries. Xylitol, a polysugar, obtained from birch tree has been shown to reduce dental caries when mixed with food, chewing gums and milk. Dental caries are prevalent in acidic pH where Streptococcus mutans (MS) ferment and does resulting in demineralization of tooth this acidic pH is created by consumption of carbohydrate foods which results in decreased salivary secretion which in turn result demineralization of tooth, where as Streptococcus mutans cannot ferment xylitol thus it reduces MS by altering their metabolic pathway and enhance remineralization and helps arrest dental caries. Reduction in caries rate are greater, when xylitol is used as the sugar substitutes. This review discuss the taste acceptability of xylitol in milk as a step towards measuring the effectiveness for the reduction of dental caries.

**Keywords:** Carbohydrates, Caries, Remineralisation, Xylitol, Demineralization.

## INTRODUCTION:

### DENTAL CARIES:

This is the disease that dentist deals with more than 90% of the time. According to acidogenic theory, dental decay is caused by acids produced by microbial enzymatic action on ingested carbohydrates. These acids will decalcify the inorganic portion of the tooth; then the organic portion is disintegrated, creating cavities. The proteolysis theory, on the other hand, claims that the organic portion of the tooth is attacked first with certain lytic enzymes. This leaves the inorganic portion without a matrix support, causing it to be washed away, creating cavities. In a third theory, microbiotic

secretions, or metabolic products of microorganisms, have the ability to chelate calcium from tooth substances, leaving the organic matrix to be disintegrated. Each of these theories fails to explain all ramifications of the disease, but all three agree on the following[1]. For the decay process to be established there must be:(fig 1.1)

1. Host(tooth)
2. Parasite (plaque microorganisms)
3. Medium, (carbohydrates in the diet)
4. Time

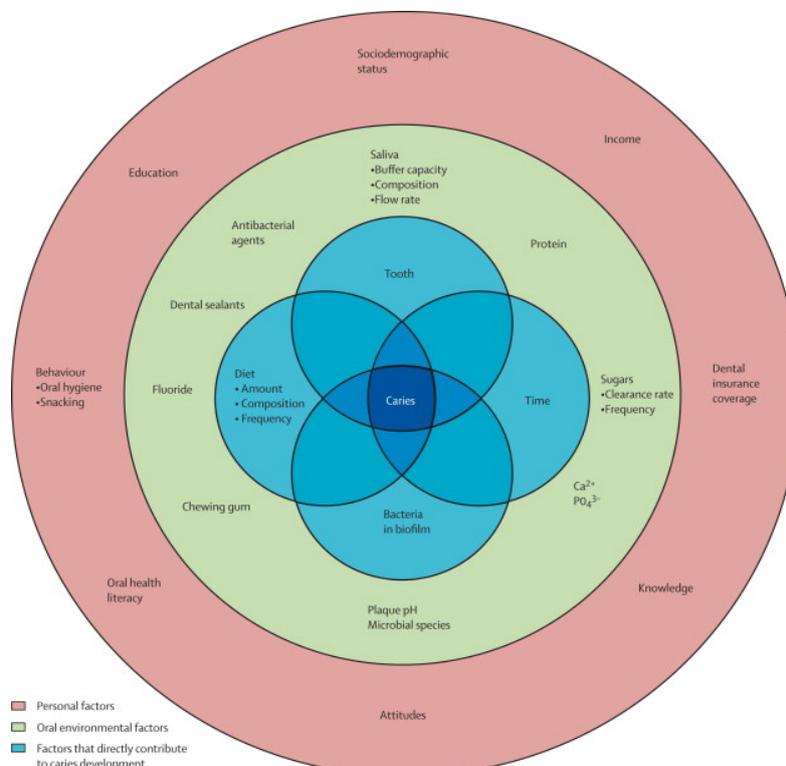
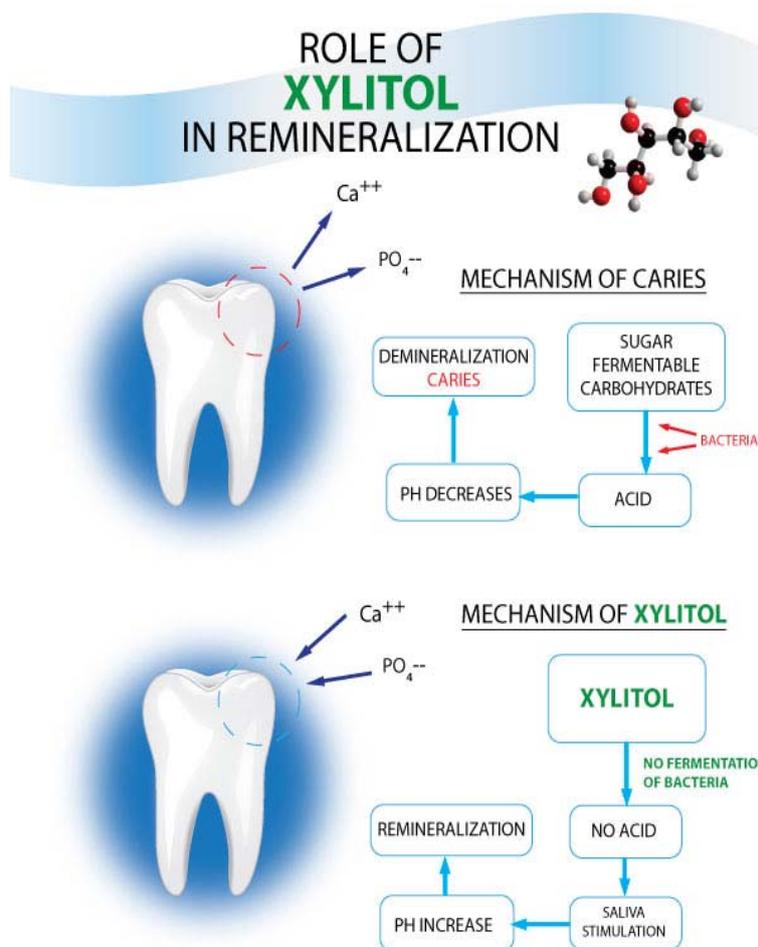


Fig 1.1- DETERMINANTS OF DENTAL CARIES[2]

**XYLITOL:** Xylitol is a natural five carbon sugar obtained from birch tree[3]. It is a non-nutritive sweetener that has demonstrated effectiveness for preventing dental caries[4]. It has been introduced in different foods for childrens including gum, candies, gelatin, sorbets, syrups and other products including multivitamins, lozenges, tooth paste, and oral rinses. Studies have demonstrated that daily ingestion of 5g of xylitol in different format reduces the level of dental caries. Reduction of dental caries can be explained by the effect of xylitol on cariogenic bacteria[5]. Xylitol has the same sweetness and bulk of sucrose but with fewer calories[6]. Snacks made with xylitol are well accepted[7]. The perception of flavors in milk is one of the human infant's earliest sensory experiences, and there is support for the idea that this early experience with flavors has an effect on milk intake and on later food acceptance [8]. There have been attempts to use milk as a vehicle for caries prevention. While milk per se may have some protective action against dental caries [9], evidence suggests its impact is negligible to low if consumed in normal amounts [10]. Milk supplemented with fluoride has reduced dental caries rates in studies in Chile [11] and Hungary [12]. The purpose

of this review is to examine the taste acceptability of xylitol in milk as a first step prior to measuring the effectiveness of xylitol in milk for the reduction of dental caries in a public health program. Xylitol is the only sugar alcohol that has the same sweetness as sucrose [13]. Sorbitol is 40 percent less sweet than xylitol and sucrose [13]. Maltitol is the next closest in sweetness to sucrose (20 percent less sweet) [13].  
**Role of dental caries in demineralization:** Carbohydrate food results in the fermentation of bacteria by producing acid pH which results in the demineralization of tooth structure by the release of calcium and phosphate from the tooth structure resulting in dental caries.[14]  
**Role of xylitol in remineralisation :** When xylitol is incorporated in milk, chewing gums or any other food products there was no fermentation of bacteria since there was no acidic nature. This resulted in the stimulation of salivary secretion thus alkaline environment was produced in the oral cavity. So the oral pH increases resulting in the remineralization of tooth thus helping in the prevention of dental caries . [14]



Fig(1.2) [14]

**Sugar substitutes:**

Xylitol is commonly used sugar substitute especially in chewing gums. A non fermentable sugar acts as a carrier or reservoir for calcium phosphate [15]. A study showed that sugar free gum containing xylitol produces superior remineralisation [16]. The abilities of xylitol and sorbitol to remineralise early enamel caries seem to be similar [17].

**Chewing gums:**

Xylitol as chewing gums are effective method for caries prevention when chewed for long period they stimulate saliva and have wash off effect on debris. They can also be used to carry desired medicaments to the tooth, thus having beneficial effect. It has been observed that the effect of xylitol along with calcium lactate improved remineralisation[18].

**Casein Phosphopeptide:**

Casein phosphopeptides are the latest entry in to the prevention of dental caries. They are alone or as CPP with amorphous calcium phosphate or CPP- ACP. CPP-ACP has shown to reduce demineralization and enhance remineralisation of the enamel surface various lesion [19]. The calcium phosphate in CPP is available for remineralisation of the enamel subsurface lesion in tooth enamel [20,21]. CPP is believed to have an antibacterial and buffering effect on plaque and interfere with growth and adherence of *Streptococcus mutans* and *streptococcus sorbinus*. Addition of CPP-ACP to soft drinks reduces their erosion capacity[22]. The effect of CPP-ACP solutions on remineralization of artificial lesions in human teeth has been investigated. A series of solutions containing various amounts of CPP(0.1-1%), calcium(6-60mM) and phosphate (3.6-36 mM) at different pH values(7.0-9.0) have been studied. The association between the activities of various calcium phosphate species in solution and the rate of enamel lesion demineralization for this series of solution were then determined. The activity of neutral ion species CaHPO<sub>4</sub> in the various remineralizing solution was found to be highly correlated with rate of lesion remineralization. ACP-CPP acts a reservoir of calcium phosphate ions including the neutral ion pair CaHPO<sub>4</sub> which are formed in the presence of acid. The acid can be generated by dental plaque bacteria, under the conditions, the CPP bound ACP would buffer plaque pH and so doing would dissociate to calcium phosphate ions including CaHPO<sub>4</sub>. The increase in plaque calcium and phosphate ions and ion pairs would offset any fall in pH there by preventing enamel remineralization [21].

**CONCLUSION:**

Milk with xylitol is well accepted by both children and adults. Relevant effect of xylitol in milk on cariogenic bacteria has been reviewed. The beneficial effect of milk along with xylitol demonstrate that xylitol in milk has an anti-caries effect and further research have to be carried out to demonstrate this anti-cariogenicity activity of milk along with xylitol.

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