Zerose® erythritol reduces the risk of dental caries

Erythritol is a low molecular weight polyol. It is used as a sweetener, but unlike sugar, it is not fermented by oral bacteria. This noncariogenic property makes erythritol suitable for use in toothpastes, oral rinses, sugar-free gums and mints, and in other noncariogenic products that may be formulated with other polyols such as sorbitol and xylitol.

However, a newly published clinical study shows evidence that erythritol demonstrated significant caries, dental plaque and *Streptococcus mutans* reduction versus sorbitol and xylitol.

In a three-year clinical study,* the dental effects of erythritol, xylitol and sorbitol were compared among elementary school-age children. The results showed that while each polyol sweetener had dental benefits, erythritol outperformed xylitol and sorbitol in the following ways:

- The amount of dental plaque was lower in the erythritol group.
- The number of dentine caries on teeth were lower in the erythritol group.
- Counts of *Streptococcus mutans* in saliva and upper dental plaque were lower in the erythritol group.

Clinical Study: The Caries Preventative Effect of Erythritol, Xylitol and Sorbitol*

Methodology

In a double-blind, parallel, randomized, controlled three-year study, 485 primary school children in Tartu, Estonia, were given 2.5g polyol tablets three times per day during school days (200 days per year).

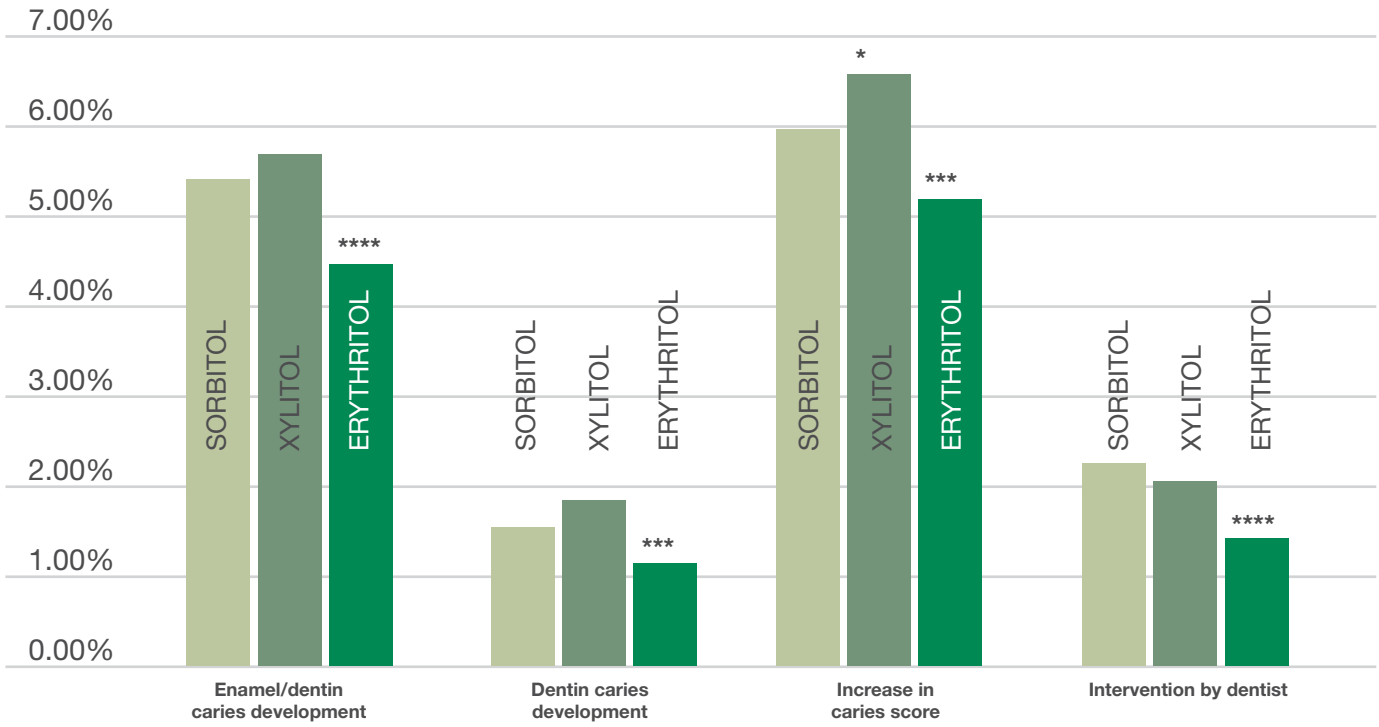
The study tested the efficacy of long-term daily intake of erythritol and xylitol candies as compared to sorbitol (control) candies. The subjects were examined annually to collect the following data:

- dentin caries development
- plaque weight
- oral counts of *Streptococcus mutans* and *Lactobacilli*

Enamel and dentine caries lesions were determined with ICDAS (International Carries Detection and Assessment System) criteria by four calibrated dentists.

RESULTS

Dentin Caries Development: Number (%) of surfaces with caries development or restoration during entire study.

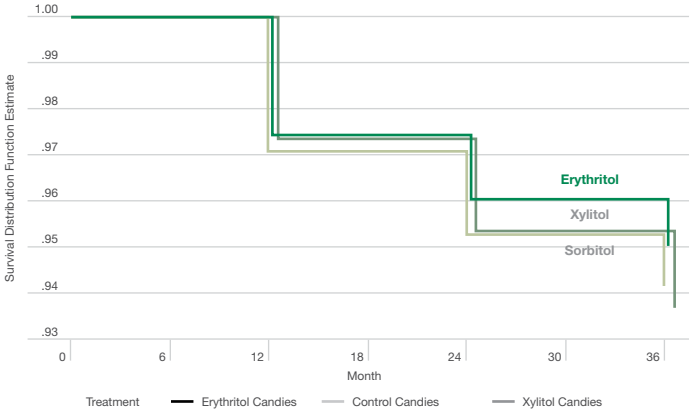


*p<0.05, **p<0.01, ***p<0.001, ****p<0.0001, all vs. sorbitol

Dentin Caries Development: Survival Analysis

TIME TO DEVELOP ENAMEL/DENTIN CARRIES (CARIES SCORE 0-3 TO 4-6)

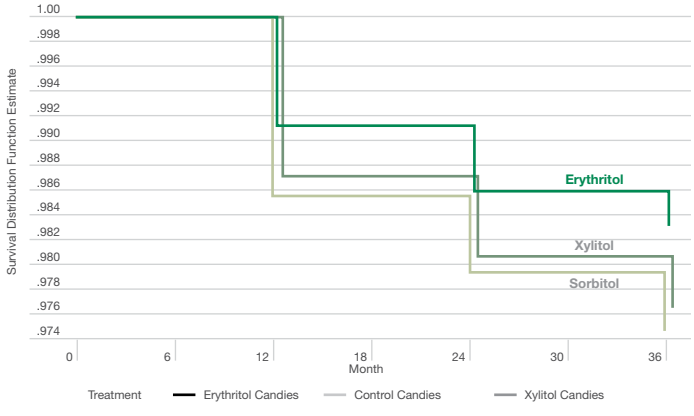
Erythritol exposed surfaces demonstrated slower enamel/dentin caries development compared to xylitol and sorbitol (control).



Log-Rank Test p-value=<0.0001; Pairwise to Control: Xylitol p-value=0.3345; Erythritol p-value=0.0002

TIME TO DENTIST INTERVENTION (RESTORATION SCORE 0 TO 3-8)

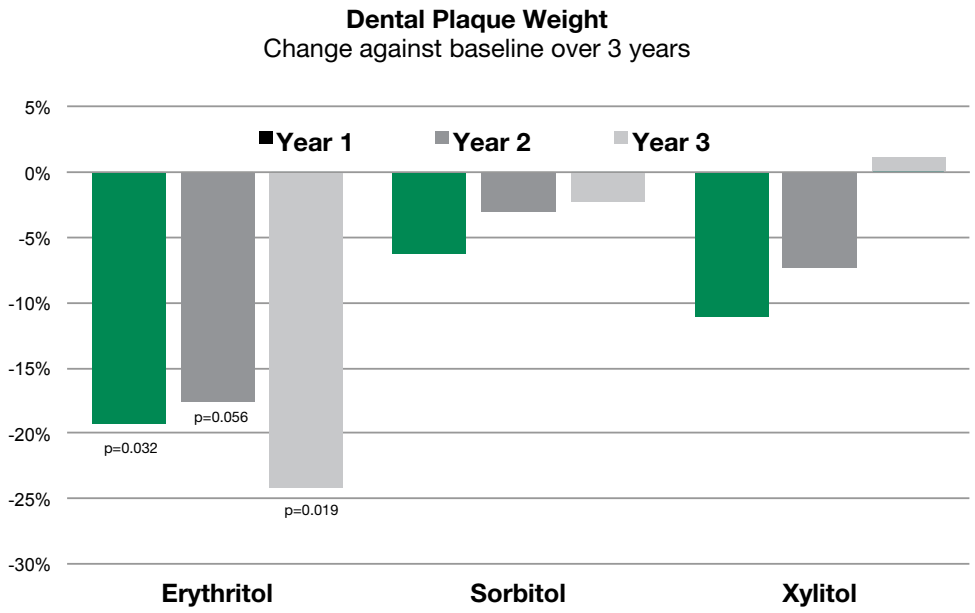
Erythritol appears to postpone the need for dentist intervention compared to sorbitol and xylitol.



Log-Rank Test p-value=<0.0001; Pairwise to Control: Xylitol p-value=0.2478; Erythritol p-value=0.0001

Plaque Weight

Erythritol reduced dental plaque weight. Sorbitol and xylitol did not.



Oral Counts

Saliva *Streptococcus mutans* (SM) count and plaque SM counts in quadrants 1 and 2 were significantly lower in erythritol group than in the sorbitol (control) group.

	Erythritol				Sorbitol				Xylitol			
	2008 n=165	2009 n=141	2010 n=138	2011 n=128	2008 n=164	2009 n=149	2010 n=142	2011 n=130	2008 n=156	2009 n=145	2010 n=137	2011 n=131
Saliva SM*	**1.76** (0.08)	**1.56** (0.08)	**1.58** (0.08)	**1.21** (0.09)	**1.74** (0.08)	**1.44** (0.08)	**1.62** (0.09)	**1.65** (0.08)	**1.85** (0.08)	**1.61** (0.08)	**1.68** (0.08)	**1.47** (0.09)
Plaque SM1	**1.55** (0.08)	**1.34** (0.08)	**1.38** (0.09)	**1.11** (0.09)	**1.48** (0.08)	**1.44** (0.08)	**1.35** (0.08)	**1.45** (0.09)	**1.68** (0.08)	**1.41** (0.08)	**1.41** (0.08)	**1.24** (0.09)
Plaque SM2	**1.52** (0.09)	**1.41** (0.08)	**1.29** (0.08)	**1.10** (0.09)	**1.60** (0.08)	**1.45** (0.08)	**1.44** (0.08)	**1.40** (0.09)	**1.77** (0.08)	**1.50** (0.08)	**1.45** (0.08)	**1.37** (0.09)
Plaque SM3	**1.66** (0.09)	**1.57** (0.09)	**1.43** (0.09)	**1.23** (0.10)	**1.67** (0.09)	**1.54** (0.09)	**1.42** (0.10)	**1.33** (0.09)	**1.80** (0.09)	**1.48** (0.09)	**1.47** (0.09)	**1.41** (0.10)
Plaque SM4	**1.69** (0.09)	**1.36** (0.09)	**1.49** (0.09)	**1.13** (0.09)	**1.60** (0.08)	**1.36** (0.09)	**1.48** (0.09)	**1.31** (0.10)	**1.78** (0.08)	**1.34** (0.09)	**1.39** (0.09)	**1.23** (0.09)
	2008 n=161	**2009 n=137**	**2010 n=137**	**2011 n=125**	**2008 n=161**	**2009 n=148**	**2010 n=141**	**2011 n=128**	**2008 n=149**	**2009 n=138**	**2010 n=129**	**2011 n=125**
Saliva LB	**4.36** (0.13)	**3.94** (0.16)	**3.37** (0.17)	**3.46** (0.18)	**4.47** (0.13)	**4.11** (0.15)	**3.81** (0.16)	**3.52** (0.18)	**4.36** (0.13)	**4.28** (0.14)	**3.82** (0.17)	**3.93** (0.17)

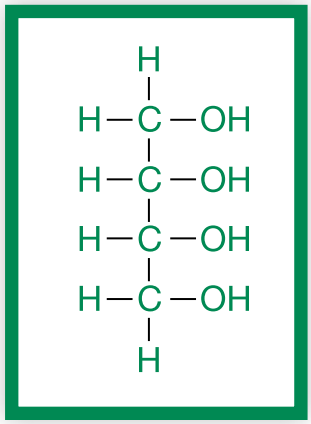
Significant p-values: 2011 Saliva SM p-0.0019. Plaque SMI p=0.0256. Plaque SM2 p=0.0280

** "The Caries Preventative Effect of Erythritol, Xylitol and Sorbitol," conducted by Prof. Mare Saag, Prof. Eino Honkala, and Prof. Kauko Mäkinen, the Department of Stomatology, Faculty of Medicine, University of Tartu, Estonia. This study was funded by Cargill.*

Technical Aspects and Production of Erythritol

Erythritol is a low molecular weight polyol, comprised of four carbon atoms ($C_4H_{10}O_4$). It appears as a white crystalline product that rapidly dissolves in water (up to 60 g/100 ml at 30°C). It is manufactured by a fermentation process. The starting material is a simple sugar-rich substrate that is fermented by a yeast to yield erythritol. The product is then crystalized to at least 99.5% purity from the filtered and concentrated fermentation broth.

Erythritol ($C_4H_{10}O_4$)



Comparison of Xylitol and Erythritol

		Xylitol	Erythritol
TECHNICAL	Relative sweetness (sucrose is 1)	1	2/3
	Qualitative synergy with HIS	?	yes
	Heat of solution (cal/g)	-35	-43
	Solubility at 20ºC (g/100ml water)	170 (63%)	47 (32%)
	Speed of crystallization	slow	fast
	Glass transition temperature (ºC)	-22	-42
	Melting temperature (ºC)	94	121
	Deliquescent point at 25ºC (%)	79	92
	Moisture barrier properties	low	high
NUTRITIONAL	Metabolized	yes	no
	Rate of absorption (%)	25-50	~ 90
	Fermented in the colon	yes	no
	Maximum bolus dose not causing laxation (g)*	~ 20	~ 40
	Glycemic response, relative to glucose (%)	13	0
	Insulinemic response, relative to glucose (%)	11	0
REGULATORY	Regulatory status in US	additive	GRAS
	Caloric value in US and EU (kcal/g)	2.4	0

** consumed in a liquid on an empty stomach by adults*

CONTACT

15407 McGinty Rd W
Wayzata, MN 55391-2399
Phone: 866-456-8872
Fax: 952-742-1708

FORM-000 (12/13)

www.cargill.com

Zerose® Erythritol