Suppression of axillary odor by erythritol

Fujii, Tadashi[1]; Inoue, Shota[2]; Kawai Yu[2]; Tochio, Takumi[1]; Takahashi Kyoko[2]
1 Research & Development Center, B Food Science Co., Ltd., Aichi, Japan
2 Rohto Pharmaceutical Co., Ltd., Osaka, Japan

Poster ID
NT_78

Introduction:

Erythritol is a sugar alcohol with 4 carbon atoms that has approximately 75% of the sweetness of sucrose. It is a safe and widely used food component. Erythritol was previously reported to inhibit the growth of the caries-causing bacteria *Streptococcus mutans* [1], the oral indigenous bacteria *S. gordonii*, the periodontal disease bacteria *P. gingivalis* [2], and lactic acid bacteria [3]. We herein investigated the growth inhibitory effects on axillary odor-causing bacteria and axillary odor-reducing effects of erythritol.

Materials & Methods:

1. Growth tests *in vitro* were performed on *C. minutissimum* NBRC 15361 *and C. striatum* NBRC 15291, which are axillary odor-causing bacteria [4], and *S. epidermidis* NBRC 12993, which is a foot odor-causing bacterium [5].
2. An axillary bacterial flora analysis was conducted studying effects of the application of 10% erythritol-containing solution (test product) on axillary odor of 18 subjects.
3. An axillary odor sensory test was conducted at the same time as the axillary bacterial flora analysis .

Results & Discussion (1):

1. Erythritol significantly inhibited the growth of the causative bacteria of body odor.

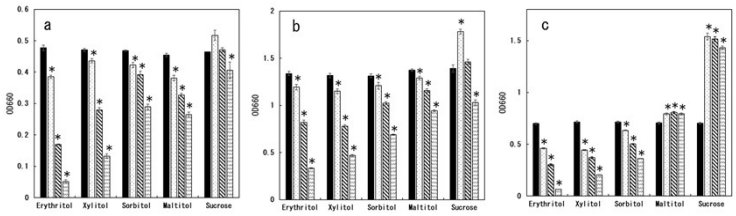


Fig. 1 The turbidity (OD660) of the culture medium of each bacterium *C. minutissimum* (a), *C. striatum* (b), and *S. epidermidis* (c) to which 0%, 5%, 10%, and 15% of each sugar was added (n = 4). The asterisk (*) indicates a statistically significant difference (P < 0.05) between the control group and the test group. (Modified citation from reference [6])

2. The analysis of axillary flora, although characterized for each individual, was classified into four clusters according to their flora. The diversity of the total bacterial flora was significantly higher in the test product application group.

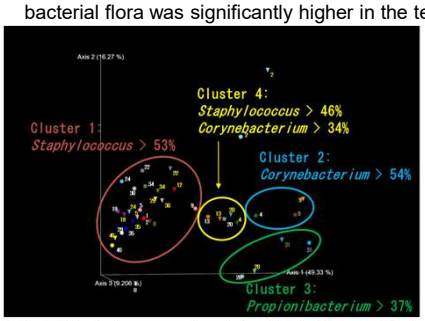


Fig. 2 Principal component analysis of bacterial flora of the test product application group (cone) and the placebo group (sphere). Yellow and White Numbers show the subject numbers of the test product application group and the placebo group, respectively. (Modified citation from reference [6])

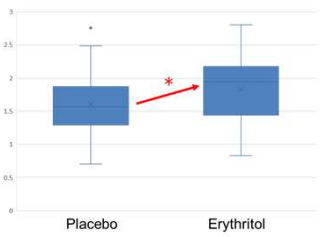


Fig. 3 Diversity of bacterial flora (18 subjects). The asterisk (*) indicate a significant difference (p < 0.05).

Results & Discussion (2):

3. In comparisons of the relative abundances of the bacterial flora, that of the most dominant bacteria was lower in the test product application group than in the placebo group.

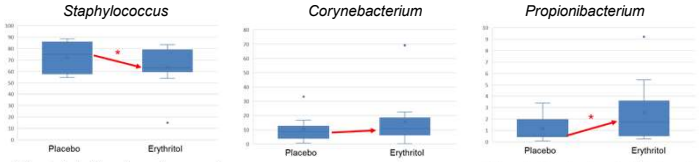


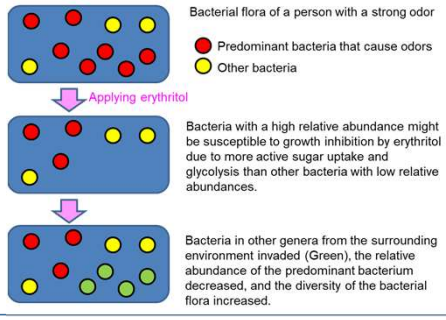
Fig. 4 Relative abundances of *Staphylococcus*, *Corynebacterium*, and *Propionibacterium* in Cluster 1, which is the group where *Staphylococcus* was the most dominant genus.

4. An axillary odor sensory test showed that median values for each odor intensity of Total intensity, Animal, Milk-fat, Damp-dried dust cloth (Dust-cloth), and Sourness were significantly lower in the test product application group, and the effect size was large for Total intensity, Dust-cloth, and Sourness.

	Odors	Median: Product application group	Median: Placebo group	Statistics (Z)	Probabilistic significance (p)	Effect size (r)
All subjects	Total intensity	2	2.75	-3.782	0*	0.630†
	Woody	1	1	-2.640	0.008*	0.440
	Animal	0	0.50	-2.236	0.025*	0.373
	Urine-like	0	0	-2.236	0.025*	0.373
	Milk-fat	0	1	-2.887	0.004*	0.481
	Dust-cloth	0	1	-3.742	0*	0.624†
	Sourness	0	1	-3.317	0.001*	0.553†
	Spicy	1	1	-1.732	0.083	0.289
Cluster 1	Total intensity	2	2.50	-2.994	0.003*	0.499
	Woody	1	2	-2.070	0.038*	0.345
	Animal	0	1	-1.732	0.083	0.289
	Urine-like	0	0	-2.000	0.046*	0.333
	Milk-fat	0	1	-1.633	0.102	0.272
	Dust-cloth	0	1	-3.000	0.003*	0.500†
	Sourness	0	1	-2.449	0.014*	0.408
	Spicy	0	1	-1.414	0.157	0.236

The asterisk (*) and red letter indicate a significant difference (p < 0.05).
The dagger (†) and blue letter indicate a large effect (r > 0.5).

5. A hypothesis of odor suppression and increased diversity by applying erythritol.



(*) All results in this poster were shown in our previous report [6].

Conclusions:

These results suggested that erythritol inhibits the growth of the predominant bacteria in the axilla, increases the diversity of the bacterial flora, controls the bacterial flora of the skin to a healthy abundance ratio, and consequently reduces axillary odor.

References:

1. P de Cock, K Mäkinen, E Honkala, M Saag, E Kennepohl, A Eapen (2016) Erythritol Is More Effective Than Xylitol and Sorbitol Managing Oral Health Endpoints. Int J Dent:9868421.
2. E Hashino, M Kuboniwa, SA Alghamdi, M Yamaguchi, R Yamamoto, H Cho, A Amano (2013) Erythritol alters microstructure and metabolomic profiles of biofilm composed *of Streptococcus gordonii* and *Porphyromonas gingivalis*. Mol Oral Microbiol 28:435-451.
3. T Fujii, K Tomiyama, Y Kashiwakura, T Tochio (2020) Suppression of rancidification in lightly pickled vegetables by sugar alcohols. Bulletin Appl Glycosci 10: 243-248.
4. N Abe, A Kaneko, F Miura (2015) BODY ODOR GENERATION INHIBITOR AND METHOD OF MANUFACTURING THE SAME:JP2015120677A.
5. Y Kawaguchi, R Matsushita, Y Mochizuki, K Uemura, H Yokoyama (2017) ISOVALERIC ALDEHYDE FORMATION INHIBITOR AND FORMATION INHIBITING METHOD: JP6723704B2.
6. T Fujii, S Inoue, Y Kawai, T Tochio, K Takahashi (2021) Suppression of axillary odor and control of axillary bacterial flora by erythritol. J Cosmet Dermatol: https://doi.org/10.1111/jocd.14201