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Comparison of discriminative and descriptive methods in detecting sweetness and specific attributes of alternative sweeteners

AIM

The objective of this study is to detect the sweetness of erythritol and stevia rebaudiana, but predominantly to investigate the influences of different methods and sample presentations for sensory profiling.

METHODS

Paired comparison tests [1] were done by 8-16 trained panellists to detect the sweetness of both alternative sweeteners in two or rather three repetitions. The tests were executed in comparison to a sucrose reference-sample with a sweetness of 1,0 in aqueous solutions (30g sucrose/1l water).

Sensory taste and texture profiles were realized with Quantitative Descriptive Analysis (QDA, acc. to DIN 10967-1) [2] using a balanced block design with monadic sample presentation for profiling the sucrose, erythritol and stevia samples (aqueous solution). These three sweeteners were profiled in one session after working out ten attributes for detailed description.

The same session was repeated, by using a comparative design. Furthermore splitting these sessions was the next step and profiling each sweetener separately, just in direct composition to the sucrose reference-sample. In these sessions the sucrose-sample was always ranked first.

The data of profiling were performed in two repetitions and were statistically evaluated by ANOVA and LSD test (alpha=0,05).

SAMPLES

Erythritol is an all-natural, non-caloric, non-glycaemic and non-cariogenic bulk sweetener with a high digestive tolerance. The starting material on the industrial manufacturing is a substrate obtained by the enzymatic hydrolyse of starch or sucrose.

Erythritol is available as white, odourless, non-hygroscopic and heat-stable crystalline substance with a sweetness approximately 60-80% compared to sucrose. The sensory taste profile is similar to that of sucrose [3].

Stevia or rather stevioside are natural intensive sweeteners, the main sweeteners extracted from the leaves of the plant stevia rebaudiana. Same as erythritol it reveals non-caloric, non-glycaemic and non cariogenic properties.

Stevia is a white crystalline powder with a sweetness between 100 and 300 times greater compared to sucrose. The primary taste characteristic of stevia is the sweet taste, but also a noticeable bitter taste as well as an unpleasant aftertaste [4].

Rebaudioside A, one of the main sweeteners extracted from the plant stevia rebaudiana was used in this study.

RESULTS

This poster shows the results in detecting sweetness of erythritol and stevia rebaudiana. Moreover the examination of their sensory properties compared to sucrose by using different methods and sample presentations.

Same intensities of sweetness were adjusted during all sessions as well as comparable test conditions.

Attributes which show significant differences between samples in the profiling data are marked by '*' in spiderwebs.

PAIRED COMPARISON TESTS

Results indicate the sweetness of erythritol with a intensity of 0,5, half as sweet as sucrose and definitely lower than published.

265 times higher than sucrose is the sweetness of the tested stevia rebaudiana sample.

QUANTITATIVE DESCRIPTIVE ANALYSIS

PROFILING DATA – MONADIC

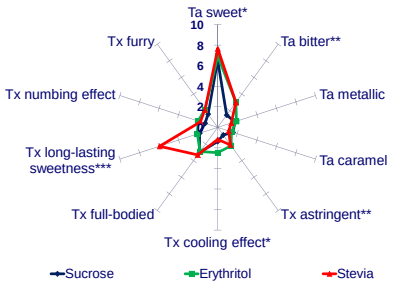

Fig. 1: Comparison of intensities between sucrose, erythritol and stevia **(monadic profile)**

- Stevia shows significant higher intensities in *sweet taste* compared to sucrose as well as the significant highest intensities in long-lasting sweetness.
- Stevia and erythritritol indicate significant higher intensities by the attributes *bitter* and *astringent*.
- Erythritol features the significant highest intensities in the *cooling effect*.

PROFILING DATA – COMPARATIVE

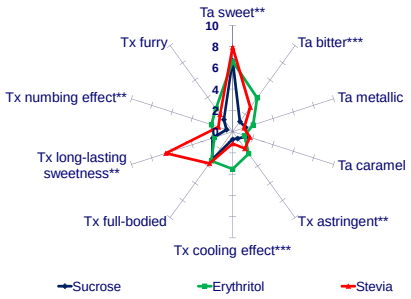

Fig. 2: Comparison of intensities between sucrose, erythritol and stevia **(comparative profile)**

- Stevia tastes significant *sweeter* and features a significant *longer-lasting sweetness* than sucrose and erythritol.
- Erythritol reveals the significant highest intensities in *bitter* taste, *cooling effect* and together with stevia in *astringent* texture.
- Additionally significant higher intensities in the *numbing effect* compared to sucrose.

PROFILING DATA – SUCROSE AND ERYTHRITOL

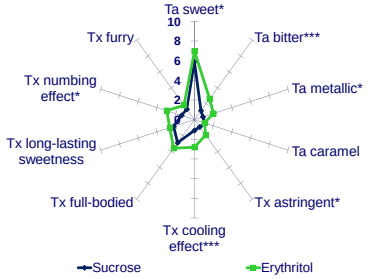

Fig. 3: Comparison of intensities between sucrose and erythritol

- Erythritol tastes significant *sweeter* and more *bitter* and *metallic* than sucrose.
- Furthermore it features significant higher intensities in the *astringent* texture and the *cooling* and *numbing* effect.

PROFILING DATA – SUCROSE AND STEVIA

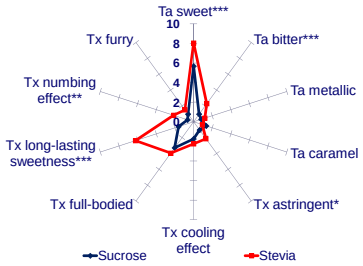

Fig. 4: Comparison of intensities between sucrose and stevia

- Stevia shows significant higher intensities regarding *sweet* and *bitter* taste, *astringent* texture, *long-lasting sweetness* and *numbing effect*.

CONCLUSION

Compared to sucrose the trained test panel recognised significant differences in the sweet and bitter taste, the astringency, cooling and numbing effect and long lasting sweetness between the sweeteners by using the ***monadic and comparative presentation design***.

In both sessions virtually identical intensities per sample and attribute were detected.

Consequently, although using different sample presentations almost same sensorialy results were realised.

The profiling data worked out in ***direct composition to sucrose*** capture another significant difference between erythritol and the reference sample in the metallic taste. It can be assumed that these direct line up of samples configurate a more specific comparison and therefore slightly more specified sensory data.

In each profiling session significant differences in the sweet taste between the three sweeteners were identified, although same intensities of sweetness in paired comparison tests were adjusted.

On the other hand the three profiling methods yield the same sweetness and significant differences in sweetness of sucrose, erythritol and stevia.

One explanation of these effects could be that during percepting attributes the more exact paired comparison test with examining only one attribute provides less influenced results than profiling methods where several attributes have to be evaluated which are influencing one another in rating of intensities.

Another explanation could be that stevia and erythritol have a longer-lasting sweetness than sucrose. During profiling the panelists have to sip the sweet solutions several times and by that sweetness changes. During paired comparison tests the decision for a difference is made just after the first sip and by that the perception of sweetness is at another point of cognition.

LITERATURE

[1] EN ISO 5435, Sensorische Analyse – Prüfverfahren - Paarweise Vergleichsprüfung (2007)

[2] DIN 10967-1, Sensorische Prüfverfahren – Profilprüfung Teil 1: Konventionelles Profil (1999)

[3] LAWSON, P.: Erythritol, in: Ingredients Handbook, Sweeteners.(Editor: Wolson, R.), Surrey (Leatherhead Food International Ltd), 2007

[4] Dalzell, J.; Geuns, J. M. C.: Stevioside, in: Ingredients Handbook, Sweeteners.(Editor: Wolson, R.), Surrey (Leatherhead Food International Ltd), 2007

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