



Influence of alternative sweeteners on sensory properties and consumer acceptance of fruit spreads with different dry matters

INTRODUCTION

There are two types of sweeteners: natural sweeteners which have more and more obtained consumer acceptance in recent years as well as artificial sweeteners which are often applied in food development. Aim of this study is to establish sugar substitution in fruit spreads with different dry matters for realising sugar reduced or rather sugar free products without noticeable sensory differences and avoid a negative impact on acceptability by applying different alternative sweetener systems.

METHODS

Fruit spreads with three different dry matters (63%, 40%, 20 %) were realised containing the polyols erythritol and maltitol syrup as well as the intense sweetener saccharin, acesulfam-k, cyclamate and sucralose. Focal point is the all-natural polyol erythritol which is tooth-friendly, non-glycaemic, features a high digestive tolerance and indicates a caloric value of 0. Due to its rapid recrystallisation during storage its application is limited.

STEP 1 Sensory profiles were realized with Quantitative Descriptive Analysis (QDA, acc. To DIN 10967-1) [1] using a balanced block design with monadic sample presentation for profiling fifteen sugar reduced or rather sugar free fruit spreads split in four sessions. After working out twenty attributes for detailed description, the data were performed in two repetitions. **STEP 2** Nine of these fifteen products were tested with 90 consumers, performing hedonic tests in two separate sessions. Each test was carried out in comparison to a sucrose containing fruit spread with 40% dry matter.

Data of profiling and hedonic tests were statistically evaluated by ANOVA and Tukey test ($\alpha=0,05$). The subsequent Cluster analysis gives information about the existence of consumer groups with homogeneous preference structure. Both datasets were combined in External Preference Mapping for identifying the preference driving and preference inhibiting factors.

RESULTS

Technological tests determined that the exclusive application of erythritol is neither possible in fruit spreads with 63% nor with 40% dry matter. Using erythritol in lower amounts and/or in combination with other polyols or intense sweetener recrystallisation can be inhibited. Products with 20% dry matter do not feature recrystallisation. Hence the reason why just fruit spreads with 40% and 20% dry matters were sensorially analysed.

SENSORY DESCRIPTIVE ANALYSIS

Profiling reveals mostly significant differences regarding the flavour attributes sweet and sour but additionally in strawberry and typically sweetener flavour. Furthermore, erythritol provides a bitter flavour in fruit spreads when using exclusively. These bitterness occurring in fruit spreads with 20% dry matter is probably caused in the additional application of intense sweeteners (particular acesulfam-k). Product differences regarding the product trait appearance (smooth, clear, gel firmness, red) are mostly caused by the different dry matters.

Application of erythritol and maltitol syrup provides decreases in gel firmness compared to the sucrose containing reference sample. An increased amount of pectin can counteract this reduced gel firmness. Consequently, the ratios of these raw materials lead to similar gel firmness of the tested fruit spreads.

CONSUMER STUDY

Consumers were merged in clusters regarding their product preferences, listed in ascending order:

SESSION 1

Cluster 1	Cluster 2	Cluster 3
ERY_MAL_50:50_40	ERY_MAL_AC_40	ERY_MAL_50:50_40
ERY_MAL_SU_40	SAC_40	ERY_MAL_SU_40
ERY_MAL_CY_SA_40	ERY_MAL_CY_AC_40	ERY_MAL_AC_40
ERY_MAL_CY_AC_40	ERY_MAL_CY_SA_40	ERY_MAL_CY_AC_40
SAC_40	ERY_MAL_SU_40	ERY_MAL_CY_SA_40
ERY_MAL_AC_40	ERY_MAL_50:50_40	SAC_40

Fig. 1: Preferences in ascending order of each cluster (SESSION 1)

SESSION 2

Cluster 1	Cluster 2	Cluster 3
ERY_AC_20	ERY_CY_SA_20	ERY_AC_20
SAC_40	ERY_CY_AC_20	ERY_CY_SA_20
ERY_CY_SA	ERY_AC_20	ERY_CY_AC_20
ERY_SU_20	ERY_SU_20	ERY_SU_20
ERY_CY_AC_20	SAC_40	SAC_40

Fig. 2: Preferences in ascending order of each cluster (SESSION 2)

EXTERNAL PREFERENCE MAPPING

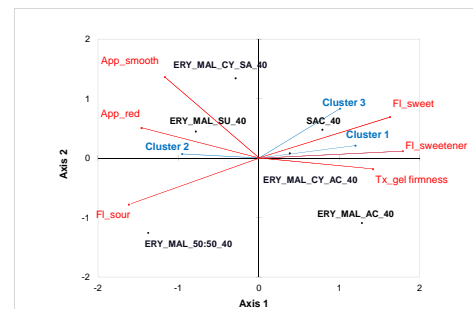


Fig. 3: External Preference Mapping of fruit spreads containing erythritol/maltitol blends in combination with intense sweeteners (40% dry matter)

The following preference driving factors were identified in Session 1:

CLUSTER 1 and **CLUSTER 3**: sweet flavour, gel firmness

CLUSTER 2: red and smooth appearance, sour flavour

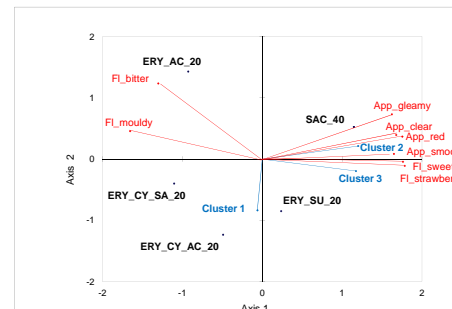


Fig. 4: External Preference Mapping of fruit spreads containing erythritol in combination with intense sweeteners (20 % dry matter)

The following preference driving factors were identified in Session 2:

CLUSTER 2 and **CLUSTER 3**: red, clear, gleamy and smooth appearance, sweet and strawberry flavour

CONCLUSION

Tests determined that the exclusive application of erythritol is neither possible in fruit spreads with 63% nor with 40% dry matter. The reason is its rapid recrystallisation during storage. Further tests showed that recrystallisation can be inhibited when erythritol is used in lower amounts and/or in blends with sucrose or maltitol syrup. Consequently, products with 20% dry matter do not feature recrystallisation. Nevertheless, the insertion of intense sweetener is indispensable to realise an adequate sweetness and flavour profile.

Hedonic responses identified that the combined application of polyol and intense sweetener leads to better consumer acceptance than the products only sweetened with maximum amount of erythritol and maltitol syrup. Sole exception is the fruit spread sweetened with sucralose. Accordingly, fruit spreads sweetened with erythritol/sucralose, erythritol/saccharine and erythritol/cyclamate blends (20% dry matter) do not differ significantly from the sucrose reference sample regarding preference. Based on the bitter flavour the fruit spread sweetened with the erythritol/acesulfam-k blend shows significant lower consumer acceptance.

Results indicated that sugar substitution with erythritol blends in combination with intense sweetener realises a sugar reduction up to 93%, accordingly a energy reduction of 70% (40% dry matter). Fruit spreads sweetened exclusively with erythritol as well as intense sweetener gain even a energy reduction of 93% (20% dry matter).

LITERATURE

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

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