ACCEPTABILITY OF MUFFINS WITH RESISTANT STARCH (RS)

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OBJECTIVES

The aim of this work are to evaluate the consumer acceptability of muffins enriched with resistant starch and to study the influence of this type of fibre on the typical muffin attributes using a trained descriptive panel.

MATERIALS AND METHODS

Batter and muffin preparation

Five formulations were prepared using the same quantity of all the ingredients except the proportions flour/RS, which were 26/0, 21/5, 16/10, 11/15 and 6/20 per cent respectively. The batter formulation and it preparation are the same as Baixauli et al. (2007). Muffins were evaluated two days after baking.

Sensory evaluation

Testing was carried out in a sensory laboratory equipped with individual booths. The different samples were presented to the consumers in identical containers. Data acquisition was performed using Compusense® *five* release 4.6 software (Compusense Inc., Guelph, Ont., Canada).

Consumer test

Fifty consumers were recruited among workers from the Instituto de Agroquímica y Tecnología de Alimentos, Valencia, Spain. Each panelist received one muffin from each different RS concentration, serving orders were random and balanced. For each sample they had to score appearance, texture, taste, overall acceptance and consumer attitude of the product. Two types of scales were used to make the test: a nine-box scale for sensory evaluation (from 9= like extremely to 1= dislike extremely) and a FACT (food action rating) scale for muffin acceptance by the frequency of eating measurements (consumer attitude) as described by Schutz (1965) (from 9= I would eat this every opportunity that I had; to 1= I would eat this only if I am forced).

Descriptive analysis

a) Selection of terms and panel training.

A panel of 8 assessors with wide experience in descriptive analysis selected the descriptors using the Check List Method (Moskowitz, 1983; Powers, 1988; Lawless and Heymann, 1998). During the training sessions, the panelists suggested a list of meaningful sensory quality attributes for the product and discussed the definition and evaluation of each attribute. Selected descriptors are shown in Table 1. Once the terms had been selected, a consensus about their usage was reached, the panel also agreed upon the tasting procedure. For standardization of descriptors and panel training, various samples of muffins were used: control (0% RS) and 20% RS in order to obtain samples with extreme characteristics.

Training involved two stages, the first one used, for each descriptor, ranking tests of three muffins with different RS concentration, until the panel was homogeneous in its assessments – Kendall's W coefficient≥0.7. At the second stage the panelists used 10 cm unstructured scales to score muffins with different RS concentrations, and the performance of the panel was followed by means of Principal Component Analysis, until there were no outliers in the group.

b) Formal assessment

A balanced complete block experimental design was carried out in duplicate to evaluate the samples. The intensities of sensory attributes were scored on a 10 cm unstructured line scale labelled from "low" to "high". On each session, the samples were randomly selected and served in random order, one muffin on a plastic tray, and identified with three digit random codes.

Statistical analysis

Principal Component Analysis (PCA) was used to follow panel performance during training. It was conducted for all panellist across all samples on the mean judge scores for each sensory attribute.

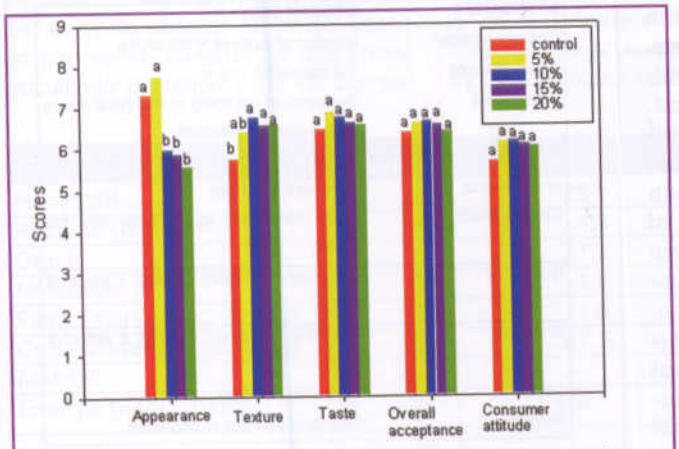

Figure 2. Scores of sensory characteristics of muffins with different RS concentrations.

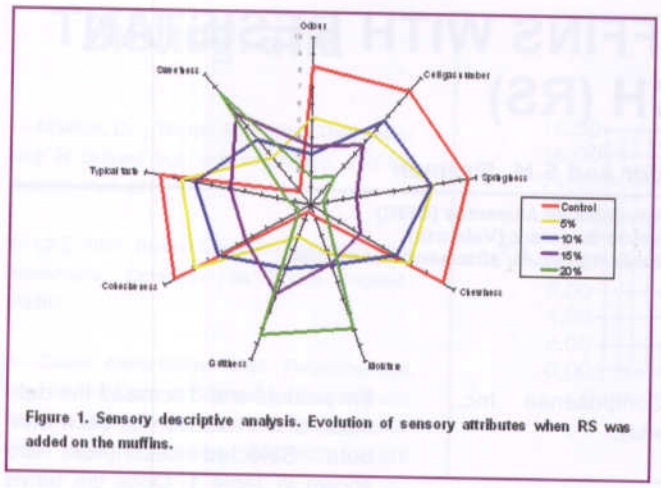

Figure 1. Sensory descriptive analysis. Evolution of sensory attributes when RS was added on the muffins.

Analysis of variance (ANOVA) was performed on the consumer and trained sensory panel data using percentage of RS, panellist and their interaction as variation factors. In order to study the differences among the samples, Tukey's comparison ($p \leq 0.05$) were applied. These analysis were performed using SPSS for Windows Version 12 (SPSS Inc., USA).

RESULTS

Consumers' evaluation

The mean scores of the sensory characteristics (appearance, texture, taste overall acceptance and consumer attitude) of muffins with different RS concentrations are presented in Figure 1. The statistical analysis showed that the muffins did not differ significantly ($p<0.05$) in taste, overall acceptance and consumer attitude. About appearance attribute, there were no found significant differences between control and 5%; and between 10, 15 and 20%. The scores were lower at higher RS concentrations. On the FACT scale, there were not significant differences between the samples. RS muffins were rated higher for texture attribute than control. By the other there were no significant differences between samples in taste attribute. The significant differences found in appearance and texture attribute did not affect the overall preference of this product because there were not found significant differences when RS was added. All these verify the importance of assessing these attributes with an expert panel.

Sensory descriptive analysis

The mean scores given by trained panellists for the sensory characteristics of the muffins with different concentrations of RS are presented in Figure 2.

There were significant differences for all the descriptors. It may be observed that between muffins with 5% RS and 10% RS there were no significant differences for the descriptors "cell gas number", "springiness", "chewiness", "moisture", and "typical taste". It may be observed that the values for "odour", "bubbles number", "springiness", "chewiness", "cohesiveness" and "typical taste" fell with the addition of RS, and the other descriptors rose with the addition of RS. The presence of RS altered the product by giving a gritty mouthfeel (this value of "grittiness" rose with the addition of RS). Despite all the samples have the same level of sucrose, perceived "sweetness" increased with RS content.

CONCLUSIONS

Although RS producers consider that sensory properties of bakery products are not modified when RS is added, the results obtained in this study demonstrate that some differences existed. The different attributes studied in the muffins with different levels of RS have some effect on the consumer perception, although this perception does not affect the consumer acceptance of the muffins.

Table 1. Descriptive terms and definitions used in sensory analysis of muffins

ATTRIBUTES	DESCRIPTION
Cell gas number	Number of bubbles in the crumb
Odour (crumb)	Typical muffin odour
Springiness	Swiftness of returning to the initial shape after moderate pressure
Masticability resistance or chewiness	Degree of perceived resistance to chewing the sample
Cohesiveness	Force necessary to crumble into the mouth
Moistness	Moistness felt when chewing a piece of muffin
Grittiness	Grittiness felt when chewing a piece of muffin
Taste	Typical muffin taste
Sweetness	Degree of sweetness perceived

Bibliografía

1.- Baixauli, R., Salvador, A. and Fiszman, S.M. (2007). Textural and colour changes during storage and sensory shelf life of muffins containing resistant starch. European Food Research and Technology DOI 10.1007/s00217-007-0565-4.

2.- Lawless, H.T. and Heymann, H., 1998. Sensory evaluation of food. Principles and practices. Chapman & Hall, New York.

3.- Moskowitz, H.R. (1983). Product Testing and sensory Evaluation of Foods: Marketing and R&D Approaches. Food&Nutrition Press. Westport, Conn.

4.- Powers, J.J. (1988). Current practices and applications of description methods. In Sensory Analysis of Foods. J.R. Piggot, ed. pp. 187-266, Elsevier, London.

5.- Schutz, H.G., (1965). A food action rating scale for measuring food acceptance. Journal of Food science 30(2), 365-374