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SENSORY ANALYSIS OF THE ODOUR OF GLUTEN-FREE BREAD WITH SOURDOUGH AND PEA FLOUR ADDITION

Saša Drakula, Valentina Kovač, Marina Krpan, Dubravka Novotni, Nikolina Čukelj, Bojana Voučko, Mirjana Hruškar, Duška Ćurić*

University of Zagreb, Faculty of Food Technology and Biotechnology, Pierottijeva 6, 10000 Zagreb

INTRODUCTION

Usual low nutritional value of gluten-free bread can be improved by legume flour addition. However, legumes can also negatively affect bread odour. Since odour plays a key role in the consumers' preference of bread, it is important that the product offers an olfactory satisfaction. Sourdough is often used to improve bread odour due to its rich aromatic profile.

AIM

The aim of this study was to develop a descriptive test, to conduct a descriptive and hedonic sensory analysis of the odour of gluten-free bread made with/without pea flour and sourdough addition, and compare it to the odour of a conventional wheat bread.

METHODOLOGY

Full factorial experimental design (2 factors)

- Addition of **yellow pea flour (±P)** (0 or 25 %, total flour basis)
- Addition of **sourdough** (0 or 20 %, dough basis) prepared with different lactic acid bacteria (LAB)
  - ***Lactobacillus reuteri* (LR)**, DSM 20016
  - ***Lactobacillus fermentum* (LF)**, DSM 20052
  - ***Lactobacillus brevis* (LB)**, DSM 20054

SAMPLES

- **Gluten-free bread**

  Ingredients: Water, wholemeal rice, yellow pea flour, wholemeal millet flour, corn starch, dry egg-white, corn extrudate, vegetable fat, baking powder, sugar, salt, instant dry yeast, carboxymethyl-cellulose, hydroxypropylmethylcellulose, emulsifier MONO 40

  Sourdough preparation

  Flours: wholemeal rice and millet flour (1:0.2),
  or wholemeal rice, millet flour and yellow pea flour (1:0.4:0.6)
  Dough yield: 250
  LAB Inoculation ~10^6 CFU/g of dough
  Fermentation 37 °C, 16 h

- **White wheat bread (CWB)**, commercial, purchased freshly baked

SENSORY ANALYSIS

- **18 trained panellists** (17 female, 1 male, age 26-54 y)
- Samples presented in 3-digit coded Petri dish, 1.5 h after baking
- **Crumb (CB)** and **crust (CT)** samples presented **separately**

Fig 1. Crumb and crust samples presentation

Descriptive test

intensity scale (Heitman, 2017)

0 not detectable — high intensity 10

Hedonic test

degree of liking (Hager, 2012)

1 extremely dislike — 5 neither like nor dislike — 9 extremely like

CONCLUSIONS

- The bread crumb was mostly characterized by 'pea-', 'cooked rice-', 'yeast-', 'sourdough-' and 'raw dough-like', while crust was characterized by 'fresh bread-', 'baked-', 'caramelised sugar-' and 'popcorn-like' odour attributes.
- 'Fresh bread-' and 'baked-like' odours were positively (r = 0.88 and 0.85, respectively), while 'peanut-like' odour negatively correlated (r = -0.78) with hedonic scores of bread crust.
- The addition of pea flour negatively affected odour acceptability as it increased intensity of 'pea-' and 'raw dough-like' odours of bread crumb. It also increased the intensity of 'pea-like' odour, and reduced the intensity of 'baked-like' odour of bread crust.
- Sourdough addition positively affected the odour acceptability.
- Odour of the bread prepared without pea flour addition and with added *Lactobacillus reuteri* sourdough resembled the most to the odour of wheat bread.

ACKNOWLEDGEMENTS

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DESCRIPTIVE TEST DEVELOPMENT

according to ISO 8586:2012

Recognition of odour attributes → Definition of key odour attributes, appropriate associations and vocabulary → Definition of intensities of odour attributes in prepared associations

Fig 2. Associations for odour attributes available for panelist during the analysis

Table 1. Key odour attributes, associations and their intensities

Key odour attributes	Sensory association	Intensity
Pea-like	yellow pea flour in water, 1:4 (heated)	10
Yeast-like	fresh yeast in water, 1:20	10
Cooked rice-like	rice in water, 1:4 (heated)	10
Corn-like	cornmeal in water, 1:4 (heated)	9
Sourdough-like	gluten-free sourdough	10
Raw dough-like	raw gluten-free dough	10
Fat-like	vegetable fat (heated)	9
Peanut-like	dehulled peanuts	8
Caramelised sugar-like	freshly caramelised sugar	7
Fresh bread-like	conventional white wheat bread	10
Popcorn-like	freshly popped popcorn	10
Burnt-like	carbonised bread crust	8
Baked-like	-	-

RESULTS

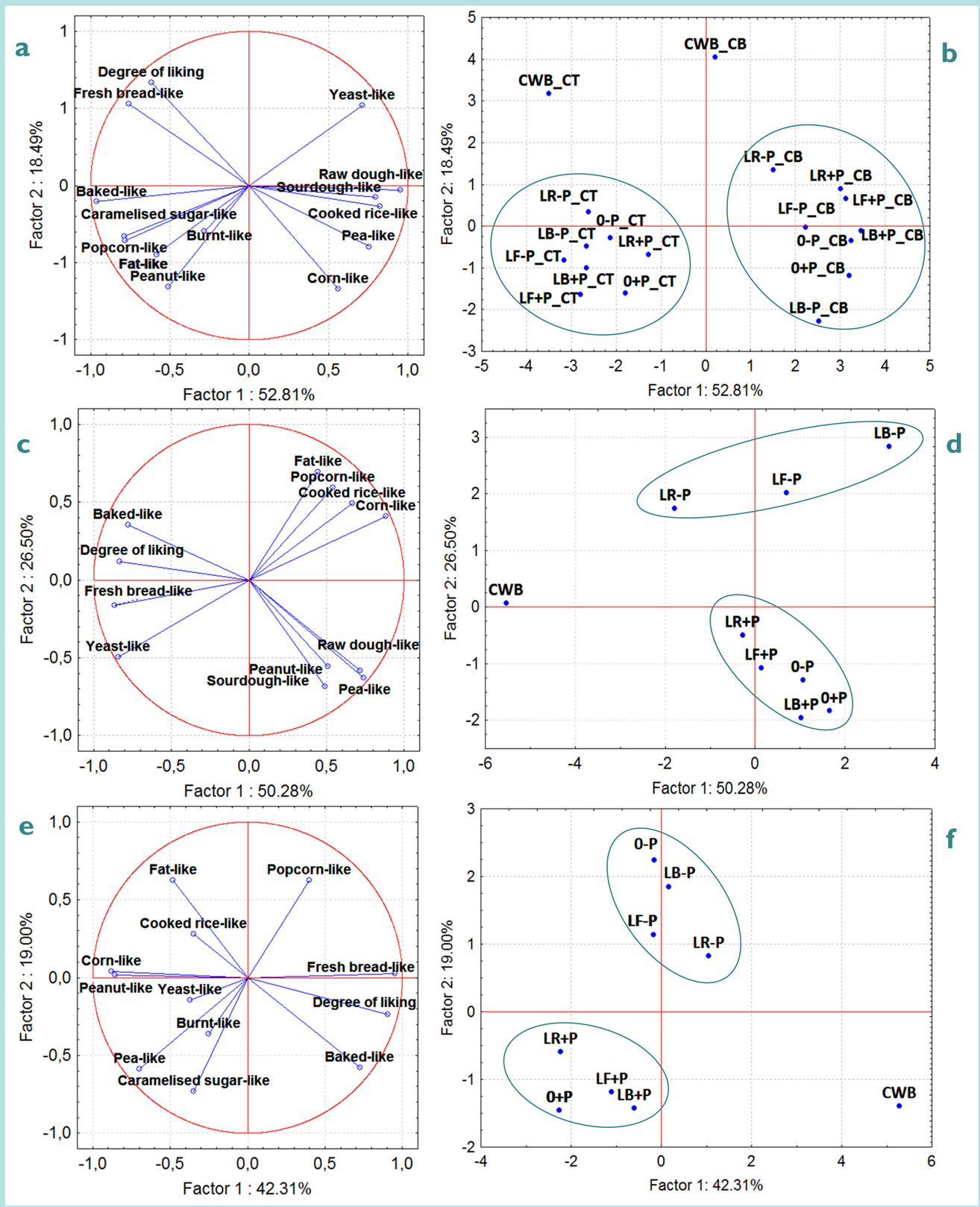

Fig 3. Loadings (a,c,e) and score plots (b,d,f) calculated by PCA of bread odour. **CB –** crumb; **CT –** crust; **± P –** with/without yellow pea flour; **0 –** without sourdough; **LR –** *L. reuteri* sourdough; **LF –** *L. fermentum* sourdough; **LB –** *L. brevis* sourdough

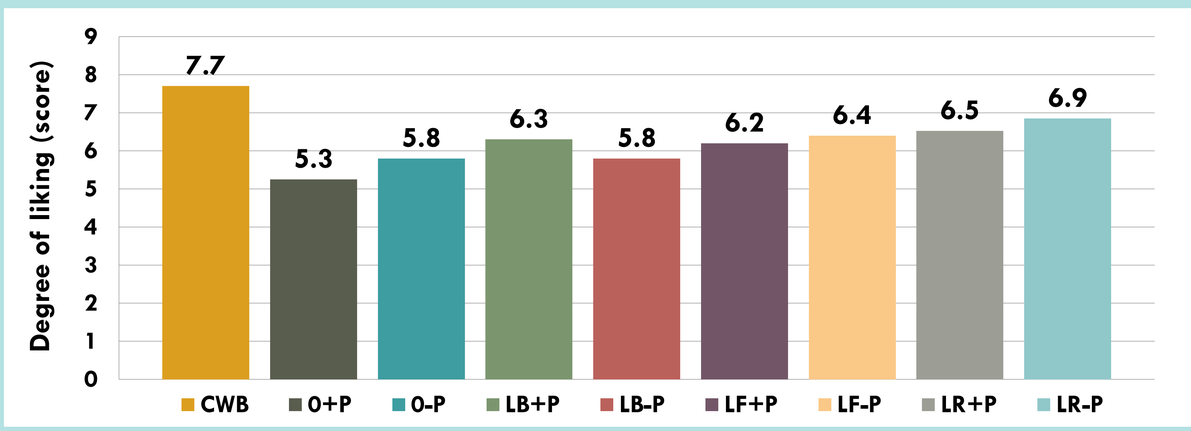

Fig 4. Overall degree of liking of bread crust and crumb odour *(legend according to description for Fig 3.)*