Comparative fermentation of non-dairy milk alternatives using a newly developed vegan starter culture

Helena Stoffers, Barbara Guggenbühl, Ghazal Nemati, Gabriela Purtschert-Montenegro, Barbara Walther, Ueli von Ah
Agroscope, Schwarzenburgstrasse 161, 3097 Liebefeld, Switzerland; www.agroscope.ch

Objective

Non-dairy alternatives are becoming more popular but face challenges with nutrition and flavor. Fermentation can enhance their taste, nutritional profile, protein bioavailability, and vitamin content, though current dairy starter cultures aren't always suitable. This study tested the fermentation of seven non-dairy drinks using a newly developed vegan starter culture, examining the impact of carbohydrates and proteins on fermentation profiles.

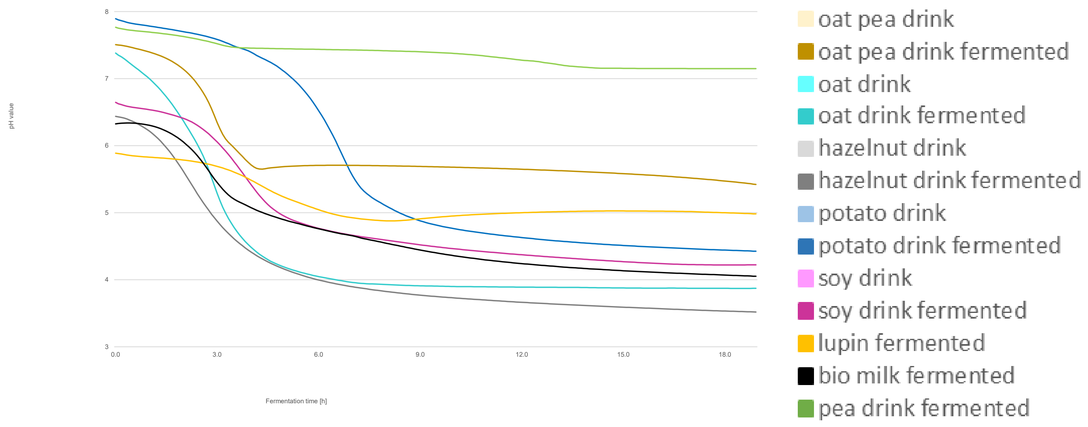

Figure 1: pH curves of the different plant based drinks with skim milk as control

Material and Methods

Products

- 5 plant-based drinks available on the Swiss market: potato, pea, oat oat-pea mix, oat-hazelnut mix, soy
- organic skim milk as a control

Fermentation

- Vegan starter culture (*L. delbrueckii subsp. lactis*, *St. thermophilus*, *Lactococcus* spp., and *Leuconostoc* spp.) from Agroscope
- Fermentation at 30°C for 18 h (pH measurement in 5 min intervals)
- Nutrient content was taken from the product labels

Sensory evaluation

- Products: 5 plant-based drinks + warm up (soy drink)
- Testing of the samples before and after fermentation
- Objective profiling by trained panelists (n=10)
  10 cm unstructured line scale, 10 attributes, 2 test runs

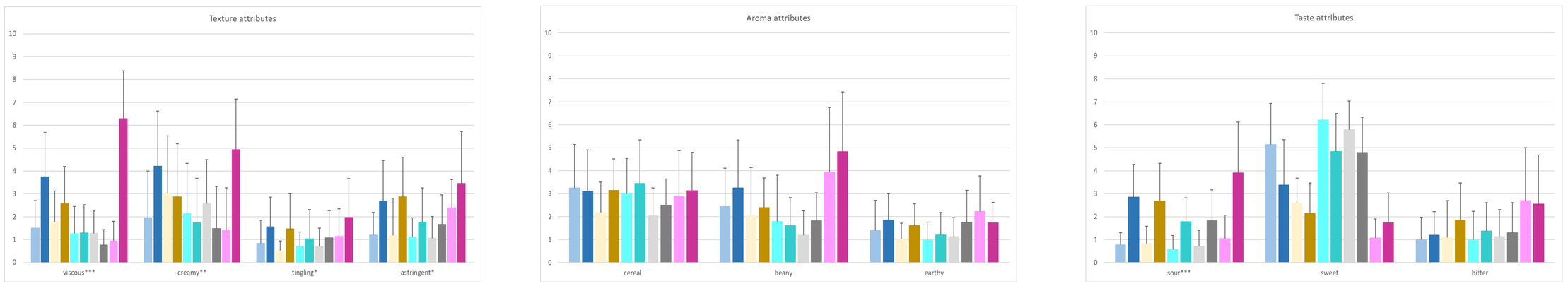

Figure 2: Intensity (mean and standard deviation) of selected sensory attributes of five non fermented and fermented plant based drinks
Statistics: Comparison of product type, i.e. fermented vs. non fermented (across all samples)
***: significant p≤0.001; **: significant p≤0.01; *: significant p≤0.05

Fermentation:

- Rapid fermentation in drinks with high initial carbohydrate (sugar) content: oat, oat-pea based, and oat-hazelnut-based
- Pea drink → low carbohydrate content → nearly no fermentation → minimal pH change
- High protein content of pea oat drink compared to the oat drink → buffering capacity of pea leads to higher final pH
- Oat and hazelnut drinks → low protein content → lower pH (↓ buffering capacity → lower final pH).
- Potato and lupin-based drinks showed a prolonged adaptation phase.
- Potato-based drinks, the high initial pH → inhibited *Lactobacillus delbrueckii subsp. lactis*
- Soy-based drinks and the organic milk displayed similar fermentation patterns.

Sensory evaluation:

- Fermentation of drinks with high carbohydrate (sugar) content → increase in perceived sourness (as expected)
- Low carbohydrate content → no pronounced influence on sensory profile
- Most pronounced differences in texture → coagulation of potato and soy drink → increase in viscosity and creaminess

Conclusion:

Plant-based drinks differed from dairy and within each other due to various characteristics such as buffering capacities, initial pH, carbohydrate and protein content as well as sensory characteristics. This necessitates tailored fermentation criteria and bacterial selection in order to produce plant-based fermented products which are accepted by consumers.

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