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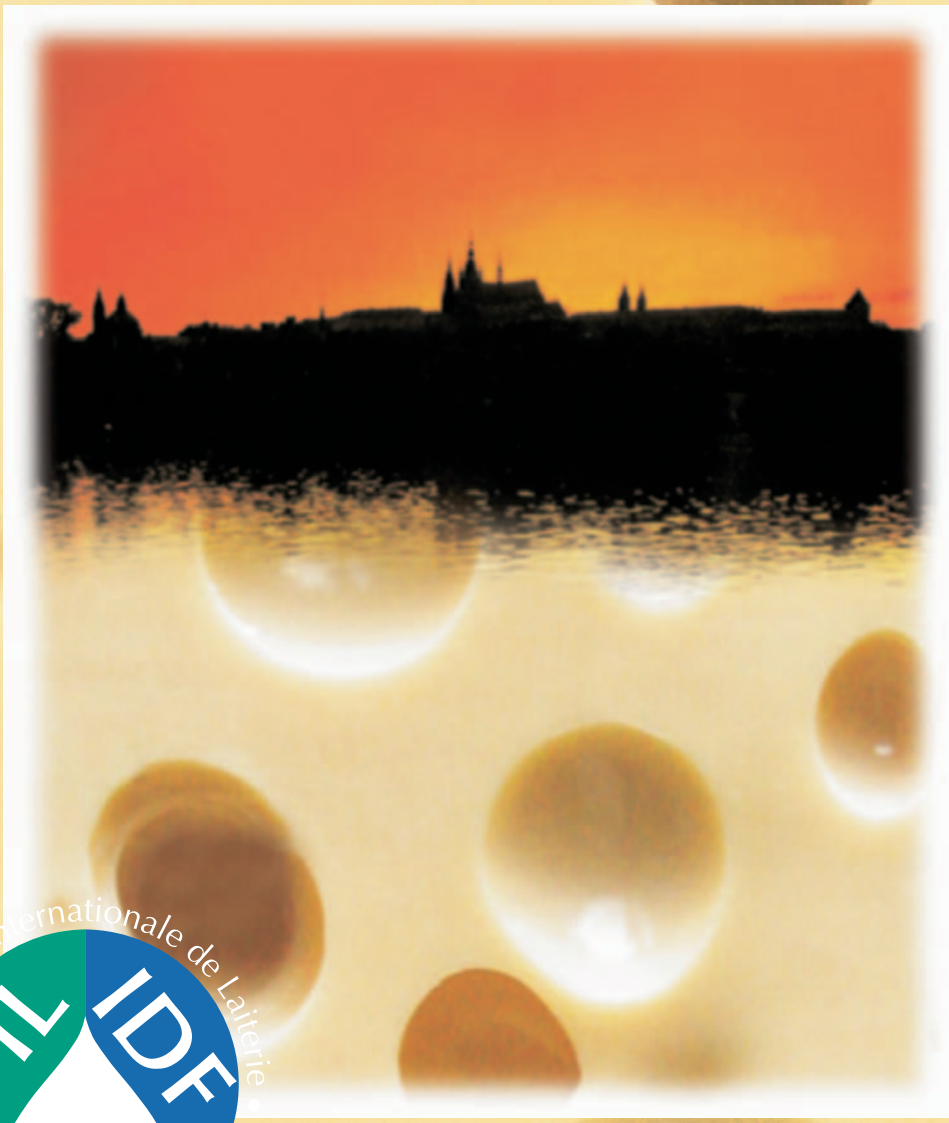

Ripening, Characterization & Technology

Book of Abstracts

Volatile (flavour) compounds produced by *Propionibacterium freudenreichii,* constituting the main secondary flora of Swiss cheese, were identified by gas chromatography–mass spectrometry in mini Swiss cheeses, and also in pure cultures of propionibacteria grown in cheese aqueous phase (juice). Selected compounds were quantified using calibration curves that were based on the addition of standards to juice or to cheese homogenate samples.

Propionibacteria significantly influenced the quantities detected of 57 out of the 69 volatiles identified in juice. Short-chain carboxylic acids (acetic, propionic, butanoic, hexanoic and isovaleric acids), esters (mainly esters of acetic and propionic acids), and some ketones and alcohols were more abundant in the presence of propionibacteria, whereas most aldehydes were less abundant. Many of these volatiles were branched-chain compounds. The presence of *P. freudenreichii* in mini Swiss cheese generated similar changes in the volatile profile as in juice, although changes were less pronounced. Carboxylic acids and esters are the most probable cheese flavour-active compounds produced by propionibacteria.

Keywords: *Propionibacterium*, volatile compounds, Swiss cheese, GC-MS

P083 THE USE OF MESOPHILIC LACTOBACILLI WITH GLUTAMATE DEHYDROGENASE ACTIVITY AS STARTER ADJUNCTS IN CHEDDAR CHEESE MANUFACTURE

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Glutamate dehydrogenase (GDH) is considered a key enzyme required for cheese flavour generation. The current study investigates the potential use of adjunct mesophilic lactobacilli with GDH activity to influence cheese flavour development. GDH activity was detected in all *Lactobacillus plantarum* strains tested but was usually absent in *Lb. paracasei* strains. Cheddar cheese was manufactured in triplicate using GDH positive *Lb. plantarum* DPC 2109 (G+) and GDH negative *Lb. paracasei* DPC 2022 (G-) strains as adjunct cultures. Four vats of cheese were manufactured in each trial containing either (a) no adjunct (Control), (b) G- adjunct, (c) G+ adjunct and (d) G- plus G+ adjuncts. Adjuncts were added at starter addition at ~10^4cfu/ml milk. After manufacture the chemical composition of all vats was within the required parameters for good quality Cheddar cheese. The addition of the adjuncts had no effect on make times of the cheese. At day 1, lactobacilli were absent from the control vat but were detected in the experimental vats at ~10^6 cfu/g of cheese. By day 14 lactobacilli were detected at ~10^8 cfu/g in the experimental vats and remained fairly constant throughout 6 months ripening. There was a slight decrease in numbers in vat (c) containing DPC 2109 after 3 months ripening but numbers remained above 10^7 cfu/g throughout. Lactobacilli did not exceed 10^3 cfu/g at 6 months in the control vats. Pulsed field gel electrophoresis analysis of 20 lactobacillus isolates, taken from the highest countable dilution of each cheese at 6 months showed that those strains that were added to the vat were present at high numbers. In vat (d) containing both G+ and G- adjuncts the *Lb. paracasei* strain dominated but the *Lb. plantarum* strain was still present. The effect of the adjunct cultures on flavour and on the production of volatile compounds at 6 months will be demonstrated.

Keywords: GDH, mesophilic lactobacilli, flavour

P084 ACIDIFYING AND AROMATIC PROPERTIES OF *ENTEROCOCCUS* STRAINS IN OVINE AND BOVINE MILKS

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Enterococci are lactic acid bacteria present in a wide variety of dairy and other food products. Although their presence in the former has been considered an indicator of poor hygienic conditions, nowadays a number of biotechnological and probiotic useful characteristics are already known. A few compounds resulting from the bacterium metabolism contribute to the aroma of cheese. Knowledge of those components, as well as of the acidifying capacity is very important to the dairy industry, including application toward selection of strains as better starters. The aim of this research effort was to study the role of some enterococci in ovine and bovine milks, in terms of acidifying properties and aroma potential.

A total of seven strains, previously isolated from traditional Portuguese cheeses, were assayed for: *Enterococcus faecium* 28A, *E. durans* 13 and *E. faecalis* 6 (from Serra da Estrela cheese); and *E. faecium* 42, *E. durans* 15, *E. faecalis* 3 and *E. casseliflavus* 40 (from Terrincho cheese). Sterilized ovine and bovine milks were inoculated with 2% (v/v) inoculum and incubated at 37 °C. Microbiological viable counts on M17 agar, pH and titrable acidity were determined in duplicate at 0, 1, 4 and 7 d of incubation. Free fatty acids, recognized as strong odorants in Serra da Estrela and other traditional Portuguese cheeses, were quantified in each sample using SPME – GC/MS.

All strains showed similar growth patterns, either in bovine or ovine milks, and reached levels of 10^8–10^9 cfu/ml by 1 d of incubation (except *E. durans* 13, which exhibited a better growth in bovine than ovine milk). An important decrease in pH was observed in both types of milk by 1 d, for all strains. The highest reduction was observed for *E. casseliflavus* 40 and *E. durans* 15 in bovine milk, and for *E. faecium* 42 and *E. durans* 13 in ovine milk. *Enterococcus faecalis* 6 revealed the poorest acidification power.

Keywords: enterococci, cheese, volatile compounds, acidification

P085 SENSORY AND CHEMICAL PROPERTIES OF WHITE PICKLED CHEESE PRODUCED BY USING KEFIR, YOGHURT AND COMMERCIAL CHEESE CULTURE AS A STARTER

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In this study, sensory and chemical properties of white pickled cheese produced by using kefir, yoghurt and commercial cheese culture as a starter were examined. In white pickled cheese samples produced by using different cultures, acidity, pH, total solids, fat, protein, salt, ash, water soluble nitrogen values were determined, also salt and fat in total solids and ripening degree values were calculated on the 15 day intervals during 120 days of ripening period. Moreover, appearance, structure, odour and taste of the cheese samples were determined.

According to the statistical evaluations carried out, it was determined that the effect of the culture variety on acidity, pH, salt, fat and salt in total solids values in the cheese samples was significant ($p<0.01$); that its effect on ash, appearrance and odour properties was significant ($p<0.05$). Regarding the ripening period, it effected titrable acidity, pH, total solids, fat content, protein content, water soluble nitrogen, ripening degree and scores of texture, odour, taste and over all sensory properties significantly ($p<0.01$) and also it has a significant effect ($p<0.05$) on ash content. The amounts of fat in the total solids in cheese samples was not effected by the culture variety and ripening period. In white cheese samples produced by using kefir culture appearance, structure and odour got the highest points. It was determined that culture variety did not have a statistically effect on cheese taste and it was concluded that kefir can be used as a starter culture in production of white pickled cheese.

Keywords: starter culture, kefir, white pickled cheese, chemical and sensory properties

P086 DIFFERENTIATION OF LACTIC ACID BACTERIA USING AN ELECTRONIC NOSE

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Facultatively heterofermentative *Lactobacillus* were isolated from Gruyère cheese (Swiss raw milk hard cheese) manufactured at four different cheese factories. These cheeses were noted by a panel of tasters. Strains of *Lactobacillus paracasei* and *Lb. rhamnosus* were found in the cheeses. The strains were classified into genetic variants using two methods, REP-PCR with $(GTG)_5$ primer and sequencing of an intergenic region of the chromosome of *Lb. paracasei*. The cheeses were shown to contain different genetic variants, which were found in several cheeses.

Reference strains of lactic acid bacteria, propionibacteria and different genetic variants of *Lb. casei* and *Lb. rhamnosus* from cheeses were selected for analysis with an electronic nose (SMARTNOSE, LDZ, Switzerland). The strains were incubated in a complex growth medium, centrifuged and resuspended in whole UHT milk supplemented with a cocktail of amino acids. The volatile compounds produced were analysed after incubation for ten days at 30 °C. The electronic nose used does not detect compounds individually after chromatographic separation, but it analyses the sum of the volatiles. The spectra of the masses are treated by multivariate analysis. Principal component analysis showed that the bacterial samples differed from the controls (water and uninoculated milk), indicating that volatile compounds were produced by the bacterial cultures. The different bacterial species clustered separately. Moreover, strains of the same genetic variants formed distinguishable groups, some of them completely separated from the others. Our results showed that it is possible to group genetically closely-related micro-organisms on the basis of their production of volatile compounds. Although some methodological improvements are necessary to increase the reproducibility of the results, this method is a powerful technique for screening aroma producers and for differentiating strains.

Keywords: lactic acid bacteria, *Lactobacillus*, electronic nose, screening technique