

Samples of four mild and four mature cheddar brands were purchased on each of six consecutive months and subjected to compositional analysis plus fracture testing. Significant inter- and intra-brand variation was found, suggesting the effects of seasonal variations in composition that were not sufficiently compensated by the producers' operating procedures. In a separate report, low-fat cheese milks were fortified with different levels of microparticulated whey protein (MWP), up to 0.5% by weight. These milks were made into low-fat cheddar cheese (about 7.3% fat). Addition of MWP increased yield slightly by improved water retention and was associated with decreased meltability and firmness that was beneficial for shredding and slicing.

Traditional Minas cheese is made on an artisanal scale from raw bovine milk in Brazil. The lack of a standard practice is reflected in a wide range of cheese quality. Data from physico-chemical analysis of semi-cured cheeses were examined by artificial neural networks and discriminant analysis, which enabled classification of cheeses by region. A similar evaluation of caprine cheeses from Canakkale in Turkey exhibited a high variation in composition, with *enterococci* complementing the *lactococci* and *lactobacilli*.

Experimental blends of bovine and buffalo milks were used to make white soft cheese. The addition of buffalo milk increased the fat and protein contents in the blends, which were reflected in higher cheese yields, plus higher fat in dry matter and associated sensory changes. Cheese from buffalo milk was preferred.

Oaxaca cheese is a pasta filata type of cheese produced in Mexico. An analogue was produced using a fat replacer based on soya bean oil, soya protein and carrageenan. Fat reduction and consequent higher moisture resulted in a tougher, less ductile texture, while casein-carrageenan interaction, especially with the lambda variant, resulted in a softer and more adhesive texture giving a greater spread on melting.

Pico cheese is a semisoft raw milk artisanal cheese made only on the island of Pico in the Azores and has Protected Designation of Origin (PDO). An assessment of cheese quality throughout maturation indicated that the main hygiene problems were high numbers of Enterobacteriaceae and coagulase-positive

# Changing times and cheese

The current issue of the 70th *International Journal of Dairy Technology* starts with a review of changes in dairy practices over the last 70 years, says Andrew Wilbey



staphylococci. Maturation indices correlated with water availability and some of the data obtained suggested that the PDO standard might need to be revised.

A trial was carried out on a commercial scale to quantify the effect of humidity on the maturation of Stilton cheese. Increasing the relative humidity from 70% to 85% reduced variation in moisture and final weight as well as decreasing evaporative losses.

## Fortified cheeses

A series of feta cheeses fortified with up to 80mg iron/kg cheese were produced using iron salts and examined after 60 days of ripening. Metallic off-taste, oxidation, colour and sensory scores were significantly affected by the iron source and concentration; the best quality being found for the cheese with 40mg/kg of microencapsulated ferrous sulphate.

Soft cheeses were produced with reduced cholesterol plus zinc fortification. Changes in the melting properties were associated with homogenisation during the cholesterol extraction but there

were no significant differences in sensory properties on zinc fortification or between the use of zinc chloride or sulphate.

## Cheese microbiology

Cheddar cheese was made from pasteurised buffalo milk using a commercial lactococcal starter plus probiotic adjunct starters. The effect of the probiotic starters, *Lactobacillus acidophilus*, *Bifidobacterium bifidum* or *Bifidobacterium longum*, was to increase production of acetic and lactic acids, the effect being greater if the ripening temperature was increased to 12-14°C. Though all the probiotic cultures remained viable over the maturation period, higher numbers were recovered on storage at 4-6°C.

Semi-hard Coalho cheese is made in northeast Brazil from raw milk. Wild *Lactobacillus* strains were isolated from artisanal cheese to create a starter culture with pasteurised milk. These were identified as *Lb. rhamnosus*, *Lb. fermentum* and *Lb. plantarum*. Four of these strains then demonstrated good performance in pilot scale cheese making experiments.

Fat reduction in cheese can lead to texture and flavour defects. Three starter cultures were trialled in low-fat Tulum cheese production. The inclusion of *Lb. delbrueckii subsp. bulgaricus*, *Streptococcus thermophilus* and *Lb. helveticus* increased proteolysis, which was associated with improved sensory scores.

A study of the microbiota of Brazilian Minas artisanal cheese, made from raw milk, sought to assess the probiotic potential of constituent organisms. Thirty-six samples of the *Lactobacillus/Pediococcus* group were selected for in vitro examination, from which *Lb. plantarum* and *Ped. acidilactici* showed the best results. These organisms were tested for their ability to protect mice from oral infection by *Salmonella Typhimurium*, with the *Lb. plantarum* giving better protection. **Dii**

