



Focus on fermentation

Many prebiotic flours are sources of inulin, oligofructoses and sometimes galacto-oligosaccharides. The high molecular weights of inulins and some oligosaccharides enhance viscosity, as well as promoting the growth of probiotic organisms. A review of technological and sensory aspects of prebiotic flours in dairy food processing was in the special issue, followed by 25 reports of original work.

Starter selection

Selection of starter strains is a continuing interest. Six strains of *Streptococcus thermophilus* were genotyped and their fermentation properties compared, indicating greater functional than genotypic disparity.

Five strains of *Lactobacillus plantarum* were isolated from traditional dairy prod-

ucts and assayed for antifungal properties. One strain with a strong inhibitory effect was used for further investigation and found to produce an antifungal peptide with relative molecular mass of 40.32 kDa that might have further use as a bio-preservative.

In a separate paper, a strain of *Leuconostoc mesenteroides* was fermented in a whey-based medium. The activity of partially purified bacteriocins from the cell-free extract was measured by inhibition of *Listeria monocytogenes*, while molecular weights (3.5 to 8.5 kDa) were estimated by electrophoresis.

A special issue of the *International Journal of Dairy Technology* 71 (S1) concentrated on fermented dairy products, Andrew Wilbey reports

Yogurt

Non-milk ingredients can modify the characteristics of yogurt. Addition of Fuzhuan brick-tea – a black tea – was shown to reduce syneresis, increase viscosity and antioxidant activity plus counts of *St. thermophilus* and *Lb. acidophilus*. In a separate report, addition of grape-seed oil at 0.5-1.5 per cent was shown to increase total phenolic content and radical scavenging activity in set yogurt without significant effect on sensory properties.

Low fat yogurt bases were supplemented with oven dried and freeze dried Jerusalem artichoke powders, which are

sources of inulin. Overall, the lower-cost oven dried powder gave better consistency while both sources exhibited prebiotic properties in increasing the microbial counts from the mixed starter (*Lb. delbrueckii subsp. bulgaricus*, *St. thermophilus*, *Lb. acidophilus* and *Bifidobacterium animalis subsp. lactis*). A similar starter blend was also used in a comparison of six prebiotic ingredients in low fat probiotic yogurt, where supplementation by 1.5 per cent of either Hi-maize resistant starch or β -glucan was recommended.

Probiotic yogurts including *Lb. rhamnosus* were produced from bases containing skimmed milk prepared with a series of cereal and legume seeds. There were no significant differences in the effect of the seed addition on microbial counts.

Addition of β -glucans, from either barley or oats, to the reconstituted skim milk base prior to fermentation with a starter including *B. animalis subsp. lactis*, gave set yogurts. The glucans modified the properties of the set yogurts, including the viscosity, and enabled higher counts of the probiotic bacteria.

Probiotic set yogurts were made with supplementation by whey protein concentrate (WPC), a sodium-calcium caseinate or a mixture of the two. The initial angiotensin converting enzyme inhibitory (ACE-I) activity was highest with the casein supplement but after 14 days the highest ACE-I and proteolytic activities were associated with WPC addition. WPC was also associated with a higher viability of *B. animalis subsp. lactis*.

Fermented milk beverages

Yogurt starter was complemented with *Lb. acidophilus* and *B. animalis subsp. lactis* plus juices from black mulberry, red grape or cornelian cherry. Addition of the fruit juice increased antioxidant levels without interfering with growth of the probiotic cultures.

ACE-I activity can be important in avoiding hypertension. Fermented skim milks were produced using probiotic lactic cultures and *Kluyveromyces marxianus*. Proteolytic activity and ACE-I activity were measured. The milk cultured with *K. marxianus* alone displayed higher activity than when used in combination with the lactic cultures. Another paper described fermentation with *Lb. helveticus* plus an aminopeptidase (Flavourzyme) to enhance cell viability and yield of ACE-I peptides. Sensory

properties of the products were compared to those of Yakult.

An investigation of the effects of fortification of Doogh, an Iranian yogurt drink, with zinc, vitamin B12, thyme and aloe vera extracts, on the viability of a strain of *Lb. acidophilus* suggested a greater benefit from zinc addition than from B12. Addition of the plant extracts was also beneficial, with the greatest effect from a combination of zinc plus aloe vera extract.

Kefir

Kefir continues to see global interest. An examination of Tibetan kefir grains saw concentration of lactic acid bacteria on the outside with acetobacteria growing internally, bound by polysaccharide. A study of kefir grains and beverages reported similar ranges of *lactobacilli* plus yeasts,



thus indicating a stable microbiota.

Spray drying was used to produce a stable kefir starter using maltodextrin and/or gum arabic to aid microencapsulation – hydrocolloid addition gave better product stability.

In the fourth paper, a comparison was made between kefirs from buffalo and bovine milks that had been standardised to the same total solids. The kefir from buffalo milk had a higher exopolysaccharide (EPS) content, which could be associated with the firmer rheological properties and better sensory scores.

Microbiota of cheese

The seasonality of the microbiota of Chihuahua cheese made from raw milk was examined. Salmonella species were

absent and there was no seasonal variation in coliforms, but the season had a significant effect on levels of *Staphylococcus aureus*, presumptive *lactococci* and mesophilic *lactobacilli*.

The use of *Lb. kefirifaciens* ZW3 as an EPS-producing adjunct starter in mozzarella manufacture was associated with improved stretchability, meltability and fat leakage but had little effect on the cohesiveness, elasticity and resilience of the cheese. The microstructure appeared to be more filamentous, ropy and compact than that of the controls.

Divle Cave cheeses made from raw ovine milk were monitored over 120 days. *Staphylococci* and *enterobacteriaceae* declined over the first 60 days while yeasts and moulds declined more slowly over 120 days. *Lactococci* peaked at over 108 at 30 days then declined to 106 cfu/g while *lactobacilli* remained dominant at 108 cfu/g at 120 days. Peptide profiling exhibited extensive proteolysis while lipolysis generated a steady increase in free fatty acids, averaging 100 mg/kg/day.

Semi-hard Dutch-type cheeses are susceptible to clostridial spoilage. *Lactococcal* and enterococcal adjunct starters were evaluated in milks contaminated with *Clostridium tyrobutyricum*. Two strains of *Lactococcus lactis subsp. lactis* were found to have significant anti-clostridial activity.

Experimental mascarpone-type cheese including inulin and *B. animalis subsp. lactis* was subjected to simulated gastrointestinal conditions. Viable counts of bifidobacteria remained above 106 and survived the treatment, indicating a protective effect of the cheese matrix.

Despite copper being recognised as a potent pro-oxidant, some cheese has been reported to taste better if made in copper rather than stainless steel vessels. Growing *Lb. helveticus* under copper stress was found to lower acid and bile tolerance but improve other desirable properties such as auto-aggregation, cell surface hydrophobicity and antibacterial activity.

Fermentation of whey with a bacteriocinogenic strain of *St. thermophilus* resulted in a high titre of *thermophilin T*. Ovine milk was added to the whey at 10%, and the Myzithra cheese exhibited antimicrobial properties, sufficient to inhibit growth of coliforms and micrococci, while giving stable sensory properties that might enable a longer shelf life. **DOI**