The whole dairy spectrum

Everything from original research to peptides from milk proteins is covered in the first issue of the *International Journal of Dairy Technology*, says Andrew Wilbey

The first issue of this year's *International Journal of Dairy Technology (Volume 71)* is a bumper issue, including 31 original research reports, plus a review of immunomodulation by hydrolysates and peptides derived from milk proteins. Immunomodulation has potential health benefits and peptides derived from both casein and whey proteins display bioactivity, though most activity is attributed to the peptides from casein. This suggests the potential for milk proteins as functional foods.

Yogurt

Production of Greek-style yogurt involves straining the fermented milk, leading to the production of acid whey as a by-product of little economic value. Partial and full pre-concentration of the milk base was compared to straining in a cloth bag, all yogurts finishing at 23 per cent total solids. Full pre-concentration gave the softest product with the greatest syneresis, while partial pre-concentration followed by reduced straining gave the firmest product with least syneresis, with 78 per cent less acid whey production than from the traditional process.

A comparison of six commercial yogurt starters in caprine milk showed varying rates of acidification, post-acidification on storage, texture and visual properties. This underlined the importance of starter selection in achieving the desired sensory properties in yoghurt.

Fortification of yogurt with pullulan, a linear polysaccharide produced by a yeast, was found to weaken the gel network when added at one per cent. Increasing the addition to two per cent increased gel firmness and adhesiveness and lowered syneresis, though firmness and susceptibility to syneresis did increase on storage.

The conversion of milk to yogurt can be influenced by the choice of starter culture, inoculation rate and temperature. Changes in viscosity were noticeable before changes in particle size as measured by dynamic light scattering. Raman infra-red spectroscopy was suggested for monitoring exopolysaccharide synthesis.

Sweetened yogurt is desired for some market sectors, but sometimes the sucrose addition is not wanted. Trials with the intense sweeteners aspartame and neotame indicated that neotame was the more stable in heat treatment, though both sweeteners were stable on subsequent storage of the yogurts.

A blend of yogurt with pumpkin puree was found to give 4.5 per cent fibre while raising the levels of the antioxidants vitamin C and β-carotene to 8.5 and 8.9 mg/100g respectively. The viscosity was slightly lower at higher shear rates. In a separate report, encapsulated grape seed extract was added to yogurt, giving a threefold increase in total phenolic content and a fourfold increase in antioxidant capacity, without affecting the viability of the starter culture. Sensory properties were better than for a non-encapsulated extract. A further report illustrated the contribution of fruit flavourings to mineral micronutrients in the diet.

Fermented milks

Camels' milk was fermented using starters based on either *Lactobacillus acidophilus* and *Streptococcus thermophilus (S1)* or *Lactobacillus helveticus* and *Str. thermophilus (S2)*. The SI fermented milk's greater angiotensin converting enzyme (ACE) inhibitory activity and antimicrobial activities against *Bacillus cereus*, *Salmonella typhimurium* or *Staphylococcus aureus* were apparent throughout 15 days of storage, whereas no antimicrobial effects were noted for unfermented milk. In a separate report, lactic cultures were used in combination with kefir grains to produce a series of kefirs whose ACE-inhibitory properties were variable during the 28-day storage period.

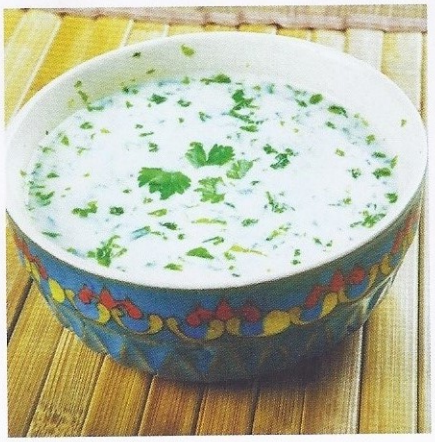
Conjugated linoleic acids (CLA), present as minor components in milk fat, are now recognised as having strong health-promoting effects. A strain of *Lactobacillus fermentum* was used in optimisation of bioconversion of linoleic ▶

acid to CLA in a modified skim milk medium. The highest conversion to CLA isomers was found in a medium with 0.5 mg/L of linoleic acid at pH 6.0, with the culture in stationary phase.

The antibiotic enrofloxacin was added to batches of caprine milk at up to 150 μg/kg and the milks fermented. Coagulation times were unaffected but the majority of the antibiotic remained throughout the shelf life of the yogurts. Since this antibiotic was not detected by the usual inhibitor tests it was proposed that detection methods should be improved and that safe limits for residues be established.

A soluble polysaccharide fraction containing β-glucan was added to lactose-depleted milk at five g/L for a kefir fermentation. Addition of the polysaccharide gave a firmer kefir with better consistency and reduced tendency for syneresis.

Doogh, a diluted, salted, yogurt-based drink, is susceptible to serum separation. Addition of whey protein concentrate (WPC) plus variation of salt addition and



pH resulted in a decrease in serum separation at three per cent WPC and 1.6 per cent salt at pH 4.5. Viscosity increased with WPC levels, changing to non-Newtonian for the sample containing four per cent WPC and two per cent salt at pH 4.5.

Flavoured milk

Like fermented milks, acidic milk drinks are susceptible to serum separation. Combinations of long and short-chain inulins, gum tragacanth, Persian gum and guar gum were used to stabilise a sour-cherry flavoured milk at pH 4. Long chain inulin stabilised the drink but mixtures of long and short chain inulins only stabilised if used at high levels. Some blends of inulin and guar gum were effective, but gum tragacanth and Persian gum did not aid stabilisation.

Milk fat technology

Yogurt butteroils made from bovine and ovine milks were compared with cottonseed oils in a feeding trial at 10 and 20 per cent (w/w) with rats. There was no significant difference between the two milk sources and no adverse effects associated with the butteroils, whereas the higher dose of cottonseed oil was reported to have induced leukosis, dyslipidaemia and liver steatosis.

Eshabwe, or ghee sauce, is a traditional condiment produced in Uganda from ghee or butter plus saline water to give a product with approximately 33 per cent fat and 2.7 per cent salt. The report included a description of the production process plus development of a list of descriptors and compositional data. Microbial counts were found to be in excess of specifications.

Adulteration of ghee with buffalo tallow is a problem in India. Coupling the use of gas-liquid chromatography of triglycerides with rapid species-specific polymerase chain reaction (PCR) identification of buffalo tallow, enabled adulteration to be confirmed at a 10 per cent level.

Lycopene is a red carotenoid associated with many fruits and vegetables. Its antioxidant capacity was compared to that of butylated hydroxyanisole (BHA) in anhydrous buffalo milk fat. Samples containing 30-150 ppm of lycopene were found to be effective in delaying the development of oxidative rancidity and at levels of 120-150 ppm were equivalent to that containing 200 ppm BHA.

Ice cream

Addition of by-products rich in dietary fibre could boost viability of probiotic cultures, creating a synbiotic combination in ice cream. Ice creams including fibre-rich fruit and cereal by-products plus *Lactobacillus acidophilus* and *Bifidobacterium animalis subsp. lactis* were stored frozen for up to 60 days. These products exhibited improved survival of the probiotic strains without adverse effects on sensory properties.

Residue from grape juice production is rich in phenolic antioxidants and could be used for fortification of foods. Ice creams containing up to 10 per cent of grape juice residue were produced and stored for up to 40 days. There were no significant differences in sensory properties, though there was a slight drop in antioxidant properties on storage.

Ginger was also proposed as a source of antioxidants in addition to its flavouring properties. Ginger juice, paste, candy and powder were all incorporated into ice cream, increasing the times to first drip and reducing the melting rates, while sensory scores varied slightly with ginger addition rates.

Milk enzymes

A comparison was made between preheated milk subjected to a pulsed electric field (PEF) and that undergoing LTLT and HTST pasteurisation, followed by storage for up to 21 days. Inactivation of alkaline phosphatase was comparable for all three processes, while PEF initially reduced xanthine oxidase activity and plasmin activities, though these subsequently recovered to similar levels to that in the initial untreated milk. Microbiological stabilities were similar for the three treatments.

Donkeys are a potential milk source in some countries. A study of freezing and heat treatments indicated that freezing had little effect on levels of lysozyme, lactoferrin and native β-lactoglobulin, while heating to 65°C was sufficient to denature 37 per cent of the lactoferrin, with denaturation complete following heat treatment at 75°C. Lysozyme suffered 60 per cent deactivation at 85°C, with native β-lactoglobulin being reduced by 87 per cent.

Protein hydrolysates display antioxidant activity, as well as other functions. Caseins from the milks of four species were each hydrolysed using chymotrypsin, pepsin and trypsin. Rates of hydrolysis varied with the species and enzyme used; the antioxidant activity reaching a maximum after 24 hours of hydrolysis, with tryptic hydrolysates displaying higher antioxidant activity than peptic hydrolysates. Camel casein gave hydrolysates with the greatest activity.

In a separate paper, a tryptic hydro-

lysate of whey proteins gave the highest antioxidant activity and was judged to be suitable for preventing oxidation in polar food matrices. The hydrolysate had higher antioxidant activity, digestibility and bioaccessibility than the native whey proteins currently used in food supplements.

Microbiology of milk products

A review of 91 commercial Brazilian UHT milk samples identified 46 spore-forming bacterial species. Sporulated bacteria were identified as four species of bacilli, with 31 per cent exhibiting proteolytic activity and 33 per cent with lipolytic activity. Almost half of the brands had counts in excess of 100 cfu/mL, suggesting potential for spoilage during the commercial shelf life.

Cronobacter species have been identified as opportunistic pathogens that can be a threat to neonates and infants. Detection may be more difficult in powdered infant formulae. A combination of real-time PCR and high resolution melting analysis was shown to be able to detect two desiccated *Cronobacter* species at two cfu/25g after four weeks storage at room temperature.

A survey of raw milk in Inner Mongolia indicated that over a third of samples contained *Bacillus cereus*, with a higher occurrence in summer, particularly in milk from small to medium-sized herds.

Other products

Conjugation of whey protein isolate (WPI) with an equal mass of maltodextrin was achieved by dry heating at 60°C and 70 per cent relative humidity for up to 24 hours. The resulting product had limited colour development and increased solubility at pH 4.5 compared to the unheated and heated WPI controls. The conjugated product also displayed enhanced stability and clarity in solutions with 50 mM added salt when heated to 85°C for 10 minutes.

Heat treatment of milk can bring about denaturation of whey proteins, which can either self-aggregate or become complexed with casein micelles. These can alter the properties of milk and milk products. A study was made of the effects of heat treatment for 10 minutes at 80°C and 90°C on reconstituted low-heat skim milk, standardised to different pH values. Correlation was found between casein micelle size and bound whey protein. Dii

SDT Events in 2018

- The SDT Spring Conference "Innovations in Dairy Technology and Engineering" is being held 25-26 April at Sheffield Hallam University in the UK.
- The SDT's Summer Symposium and Annual Dinner is on 23 July in Nantwich, UK.

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