The cheese world view

Seasonal and other sources of variation in milk composition are major complications in the production of consistent dairy products, especially in cheese making where standardisation of the casein to fat ratio is a critical parameter. The second issue of the International Journal of Dairy Technology starts with a review of milk protein standardisation by membrane filtration, especially low concentration factor ultrafiltration and nanofiltration. This review is accompanied by 29 reports of original research, with an emphasis on cheese and whey.

Cheese

A comparison of the effects of fat content and coagulant on the quality of ricotta cheese indicated that the fat-free product was harder and whiter than half and full-fat products. Coagulation by citric acid reduced the moisture content, firmness and yield, while addition of calcium chloride gave high acceptability with white colour and the desired firmness.

Traditional Iranian kope cheese is matured in clay pots, resulting in some moisture loss accompanying the proteolysis. While both storage and loss moduli increased, the elastic characteristics became dominant. Microstructural changes included increases in pore size and regularity as well as increased casein network density.

Reduced-fat labneh cheeses were produced with and without inulin and beta-glucan as fat replacers. Reducing the fat from 18 to 12 per cent had little effect on sensory properties but further reduction to six per cent fat reduced acceptability. Inulin addition was more beneficial than beta-glucan. Another study, with low-fat brined cheese, investigated casein-gum interactions when zedru gum was used as a potential fat mimetic. The gum addition gave a softer texture and more open microstructure to the cheese.

Raw caprine milk is often used for white-brined cheese in Macedonia. A comparison between the use of raw and pasteurised milks indicated that pasteurisation was associated with slower proteolysis and less evolution of volatiles on storage.

Kradi cheese, indigenous to the Indian Jammu and Kashmir provinces, is a semi-soft fresh cheese from buffalo milk. Typically, it is made on an artisanal scale and an investigation into the textural and microstructural properties also set out an optimised process for its manufacture.

An investigation of milk homogenisation and high-shear mixing of cream cheese curd indicated that the smaller fat globules following homogenisation were associated with firmer texture in the curd. Increasing the mixing speed and duration reduced curd particle size and increased its spreadability.

Iron is deficient in many diets. Paneer in the form of 15mm cubes was coated with solutions of iron salts and whey proteins to give a range of iron content up to 110ppm on a dry basis. Differences in colour and sensory properties were noted, with ferrous sulphate heptahydrate being the best-accepted fortificant.

Proteolysis during maturation of cheese results in the generation of water-soluble peptides. An assessment was made of anti-inflammatory and anticancer water-soluble peptide extracts from cheddar cheeses. The extracts inhibited nitrous oxide production in the activated macrophages and exhibited growth inhibition of HT-29 cells plus extensive apoptosis in colon cancer cells.

Whey and whey proteins

A study of lactose crystallisation from whey concentrate at 50–60’Brix with different stirrers indicated that faster crystallisation rates were achieved with a centrally mounted stirrer than with an offset stirrer in a wider, squatter vat.

Whey protein isolate solutions were subjected to different heat treatments after calcium fortification. Whey protein denaturation increased with the severity of heat treatment and calcium addition, demonstrating the role of calcium in whey protein aggregation.

A comparison between whey powder, concentrate and isolate demonstrated that functional properties increase with protein content. Tests included foaming performance and emulsifying capacity plus curd tension, viscosity and syneresis when incorporated into yogurt.

Peptides from trypsin hydrolysis of whey proteins were separated, purified and assayed for their hypocholesterolaemic properties and their stability to simulated gastric digestion. Peptides within the molecular weight range 1900–3100 Da exhibited the better activities and were relatively stable to digestion, with 2454 Da being the best.

A separate study of in vitro gastric digestion of whey protein-alginate com-
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plexes indicated slower proteolysis, suggesting future applications in increasing satiety.

Fermented milk
Arabian donkey milk was proposed as an alternative source for those with a bovine milk allergy. The Arabian donkey milk had half the protein of bovine milk and a higher proportion of whey proteins, giving slightly different fermentation properties when using a mesophilic starter.

Other dairy products
Consumers frequently expect products to be coloured to match the flavouring but for the pigment to be natural. Pineapple ice creams were produced with curcumin-loaded nanoemulsions, giving similar sensory and physical properties to the commercial preparation.

The structure of many protein-based expanded snacks can be heterogeneous as well as protein being an expensive ingredient. Partial substitution of sodium caseinate by soya protein did not improve acceptability but the addition of waxy rice starch at up to eight per cent in microwave-puffed chips did improve the product.

Analysis
While much analysis is aimed at supporting production, detection of adulteration remains an important activity. Attenuated total reflectance: Fourier transform infrared spectroscopy (FTIR) was used to detect and quantify adulteration of bovine milk by soya bean oil at 0.2-2% and by sucrose at 1-10%. The optimal wave numbers were 1262-1164 cm-1 and 1010-910 cm-1 respectively. A separate report used Fourier transform near infrared to examine bovine and buffalo ghes in the 10000-4000 cm-1 region, and found higher absorbance values for the bovine ghee.

Detection of oestrus and diagnosis of pregnancy are important in dairy animal management. The development of a sensitive and rapid method using magnetic nanoparticle-based fluorescent immunoassay for progesterone in raw milk was reported, with a progesterone detection limit of 0.065 ng/mL and concentration range 0.25-25 ng/mL.

Levels of bioactive protein and lipophilic vitamins were compared between Simmental cattle on intensive and certified organic farms. Higher levels of beta-lactoglobulin, lactoferrin, lysozyme, beta-carotene, vitamins A, D, and E were found in milks from the organic sources.

The effect of heat treatments on milk DNA quality was reported, together with physicochemical parameters. Heat treatment affected DNA quality, reducing the content of both mitochondrial and nuclear DNA recovery and would thus affect any milk authentication process using polymerase chain reaction-based methods.

Glycomacropeptide may be recovered from whey and is a useful nutraceutical additive. A comparison between protein estimation methods demonstrated differences in estimated values.

However, problems with dose response were found with Bradford and Lowry methods, while the biuret and bichoninic acid methods gave linear responses, with the latter being the most sensitive.

Applied microbiology
The characterisation of spore-formers isolated from extended shelf life milks suggested that *Bacillus pumilis* was dominant in raw and pasteurised milks but other species, notably *B. subtilis, B. licheniformis* and *B. cereus*, were also recovered from packaged ESL milks.

An investigation of the survival of *Listeria monocytogenes* through the production process of mozzarella cheese from water buffalo milk used both wild-type and reference strains. While the wild-type strain was unaffected by the stretching process, the viable count of the reference strain dropped below 100 cfu/g. Pathogen counts increased on storage at 20° and 30°C. *Bacillus cereus* biofilms can be a source of spoilage as well as a potential health hazard. A study of alkaline CIP procedures was made to optimise the process and investigate the effect of adding a serine protease. While optimisation improved removal, further gains were made by serine protease incorporation.

Scanning electron microscopy and energy-dispersive spectroscopy were used to demonstrate that pitting of stainless steel can be induced by biofilms of common milk spore-forming organisms, using *B. sporothermodurans* and *Geobacillus stearothermophilus*.

It was found that both 304 and 316 grades of stainless steels were affected, emphasising the importance of good plant hygiene in minimising biofilm formation and retention within dairy processing plants.