

The purpose of this International Dairy Federation (IDF) symposium was to present and discuss new information about factors related to texture development in the various fermented milk products such as yoghurt (the predominant topic of the meeting), and its measurement by instrumental and sensory methods. The program of this two-day conference was divided on paper into four distinctly different segments: 'Texture and sensory evaluation' (Session 1); 'Microbiological factors' (Session 2); and 'Technological and logistic factors' (Sessions 3A and 3B). However, the more pragmatic segmentation of the topics that were presented emerged as: (1) basic physics and chemistry of milk and fermented/acidified milk systems; (2) processing approaches, especially with regard to the sequences and process conditions of traditional unit operations; (3) subjects related to microbiology, including the characteristics of special cultures that produce exopolysaccharides, their characterization and interrelationships with the chemistry and physics of milk; and (4) ingredient and formulation technology, including the use of non-dairy ingredients.

A common feature of the most of the presentations was the indication of the complexity of this area of dairy technology and the less-than-perfect state of the underlying scientific knowledge. Despite the title of the conference, there were virtually no contributions on sweet dairy desserts such as puddings; thus, the main focus of the conference was the structural aspects of acidified milk systems.

### Texture and sensory evaluation

The conference was opened by two introductory papers: 'Relation between structure and texture of cultured/fermented dairy products', by P. Walstra (Wageningen Agricultural University, The Netherlands), and 'Sensory evaluation of texture', by M. Lavanchy (Federal Dairy Research Institute, Liebefeld, Switzerland). These presentations set the stage for the two main aspects of the subject: the theoretical aspects of acidified milk gel formation, the properties of acid milk gels and their implications for the texture of consumer products such as yoghurt; and the methodology of texture evaluation, especially in relation to the consumer. Walstra's contribution clearly indicated that although existing scientific knowledge can be used to describe the characteristics of acid milk gels and explain the contributions made to their texture by casein particles, serum proteins after heating or fat globules after homogenization, the more pragmatic aspects of product quality evaluation with respect to texture are much less well defined; his plea for the development of a unified sensory methodology was heard loudly.

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# Texture of Fermented Milk Products and Dairy Desserts\*

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Three of the remaining four presentations in the first session reported results from research on yoghurt rheology. These were entitled 'Sensory and instrumental characterization of the texture of stirred yoghurt' (N.C. Martin *et al.*, INRA, Thiverval-Grignon, France); 'Linear viscoelasticity of yoghurt' (R. Lapasin *et al.*, University of Trieste, Italy); and 'Multi-component polymerization model for prediction of rheological properties' (P. de Jong and H.J.L.J. van der Linden, NIZO, Ede, The Netherlands).

However, various aspects of yoghurt rheology were also covered in several other papers that were presented later in the meeting; these included reports on the effects of manufacturing methods ('Stability of texture of fermented milk products in relation to the composition', by P. Schkoda and H.G. Kessler, Technical University Munich - Weihenstephan, Germany); the use of specific bacterial cultures ('Microorganisms producing polysaccharides: differentiation between ropy and thickening strains', by D. Lavezzari *et al.*, Centro Ricerche, Lodi, Italy); and the effects of various measurement techniques ('Rheological properties of stirred fermented milk products', by P. Dejmek and G. Cuvelier, Lund University, Sweden). Although the specific aspects of all of these contributions differed, the common message seemed to be that despite the relative ease of performing measurements, the meaning of the measured values – and their relationships to the underlying causes of the differences and variations in similar products – are much more difficult to understand.

### Microbiological factors

The production of exopolysaccharides (EPS) by some strains of lactic acid bacteria is currently an important subject for basic as well as industrial research. The texture of milk that is fermented by appropriate bacterial strains can be substantially affected by these 'natural' compounds without the need for any extraneous ingredients. The half-day session devoted to this subject was introduced by two lead papers that provided an overview of the exopolysaccharide-producing microorganisms ('Lactic acid bacteria: biochemical characteristics affecting the texture of fermented milks', by B. Bianchi-Salvadori, Centro Sperimentale del Latte, Lodi, Italy), and of the effects of the EPS produced by various cultures on the rheology of stirred yoghurt ('Texture

characterization of yoghurt fermented with different bacteria cultures', by A. Scriver, Chr. Hansen, Hoersholm, Denmark). These papers, together with the following shorter research reports, illustrated the complexity of all of the phenomena that used to be referred to as 'ropiness' and were considered to be major sensory defects in yoghurt. It was shown that the growth characteristics of various strains of specific thermophilic or mesophilic lactic acid bacteria (temperature, time, acidifying capabilities) may have a profound effect on the textural characteristics of the final product, and that rheological measurements of the final product may or may not correlate well with textural attributes as perceived by sensory panelists. One of the research papers already mentioned under the section heading 'Texture and sensory evaluation' illustrated the difference between those exopolysaccharide-producing strains that cause thickening of the final product and those that cause true ropiness. Another paper, 'Cultures for the improvement of texture in Quarg', by H. Sebastiani *et al.* (Federal Research Institute for Alpine Dairy Science, Rotholz, Austria), described the selection and combination of cultures that are suitable for modifying the texture of a fresh cheese – an example of the extension of the approach developed for yoghurt to another dairy product that has quite different textural characteristics. Discussion of ropy or non-ropy cultures also emerged in papers that were concerned with technological factors, and therefore presented on the second day. For example, the contribution by P. Zoon *et al.* (NIZO, Ede, The Netherlands), entitled 'Relation between the consistency of stirred yoghurt and the structure of yoghurt gel', drew attention to the differences in the types of EPS produced by various cultures by stressing the lack of correlation between the viscosity of stirred yoghurt and the concentrations of EPS produced by a ropy and non-ropy culture. The announced, but cancelled, contribution 'Rheological properties of acid milk gels and UF-fresh cheese obtained with ropy and non-ropy starters', by A. Schultz *et al.* (Humboldt University, Berlin, Germany), promised to combine all of the variables that interact in this complex issue: the use of proper microbial cultures, proper technology and proper rheological techniques for measurement.

### Technological and logistic factors

The second day's program turned out to be virtually dedicated to the interrelationships of technology with the topics discussed on the first day – the cultures, the rheology and the sensory aspects. Only one invited paper (and no follow-up research papers) considered the logistic factors of handling and storage. In the introductory paper 'Structure of fermented milk products as influenced by technology and composition', H.G. Kessler (Technical University of Munich – Weihenstephan, Germany) zeroed in on the complexity of technological approaches (membrane processing, heating, homogenization), the effects of such treatments on milk components (casein micelles, whey proteins, fat globules, mineral ions), and the resulting effects on the texture of

the final products. It was asserted that the state of current knowledge – such as the kinetics of whey protein denaturation – makes it feasible to choose the proper processing conditions required to manufacture products with precisely the textural properties that were intended. The next two research reports, from the same institution (one already referred to; the other, 'Continuous formation of gel structures and stable foams based on a heat treated and acidulated whey protein concentrate', by T. Spiegel and H.G. Kessler), illustrated this notion by describing process conditions and compositional modifications that are suitable for producing textures in gels or foams that are based on whey protein or total milk protein concentrates. Another process variable, the treatment of raw milk with hydrogen peroxide to activate the lactoperoxidase (LPS) system for milk preservation during collection, was also shown to affect the texture of Turkish yoghurt ('Some textural characteristics of yoghurts made from LPS treated milk', by A. Gursel and M. Atamer, Ankara University, Turkey). High-pressure treatment is still an experimental processing technique that is undergoing evaluation in many research establishments; the report by M.E. Guerzoni *et al.* (University of Bologna, Italy), which was entitled 'Effects of high pressure homogenization on biochemical and texture characteristics of yoghurt', also illustrated the potential use of high-pressure processing to modify the texture of the resulting products.

Various processing techniques that may be used to preconcentrate milk also contribute to differences in the rheological properties of final products that have the same final composition; this was shown for labneh, a 'concentrated yoghurt', by B. Ozer *et al.* (University of Reading, UK) in the contribution entitled 'Physical properties of labneh manufactured using membrane processes'.

A few of the presentations that were heard throughout the two days were sufficiently different from the main theme that they deserve separate attention. In the introductory paper of the final half-day session, entitled 'Difference between product design and consumption quality: the logistic damage', F.M. Driessen (Campina Melkunie, Heilbronn, Germany) stressed the need to consider the 'consumer factor' of mishandling and abuse when designing 'robust products' that are destined for general markets, and should therefore be capable of withstanding extended storage at suboptimal temperatures. Unfortunately, little attention (with no research data) was paid to the transportation effects and other 'logistic factors' that often result in a '...gap between what the industry produces and what the consumer gets...'. One of the tools at the disposal of the industry is the use of special stabilizers to improve yoghurt texture. A. Doreau (National Starch & Chemical, France), in his paper 'Advantages of speciality starches in the development of yoghurt-type formulations', discussed the two aspects of starch ingredients that can be used by yoghurt manufacturers for texture improvement or fat replacement. The microstructural effects of

another texture stabilizer, pectin, were examined by confocal scanning laser microscopy in the multi-authored paper 'Development in the microstructure of set yoghurt made from reconstituted non-fat dry milk', which was presented by M.H. Abd-El-Salam (National Research Centre, Dokki-Cairo, Egypt). In another presentation, J.H. Roskam (DMV International, Research Center, Veghel, The Netherlands) introduced his company's line of dairy-protein-based stabilizers that have been developed for use in yoghurts, obviating the need for non-dairy ingredients.

One paper that appeared to be particularly out of place on the first day ('New developments on rheological and physical analysis of frozen yoghurt', by F. Bray, Bray Consulting, Milan, Italy), as well as another announced, but cancelled, paper ('*Lactobacillus acidophilus* based fermented whey beverage and its concentrate', by D.N. Gandhi, National Dairy Research Institute, Karnal, India), reminded the participants that numerous other aspects of the texture of fermented dairy products were not included in the program yet should be a part of any ongoing global research efforts in this area. The diversity of products encompassed by the theme of this meeting, as well the diversity of technological approaches and the resulting textural characteristics (or sometimes defects) were also highlighted in the last paper of the program, 'Strategies for modifying the structure of fermented milks', by A.Y. Tamime and D.D. Muir (SAC Auchincruive, Ayr, UK).

In the closing session of the conference, participants heard a summary presentation by P. Jelen (University of Alberta, Edmonton, Canada), who, as a member of the Permanent Committee of Commission B of the IDF, highlighted the benefits of the two days of discussions

for the dairy industry and researchers worldwide, and suggested several ways in which the IDF could continue its leadership role in this important area of dairy technology. The participants approved the conference organizing committee's proposal, which urged the IDF to continue working in this area, organizing more technical meetings on this subject and establishing one or more IDF Groups of Experts to study two major subjects that emerged from the discussions: the influence of lactic acid bacteria on the structure and rheology of fermented milk foods; and the development of an internationally acceptable system for the sensory evaluation of fermented milk products.

The conference organizers received a huge, well-deserved vote of thanks for staging such an excellent event, which was organized as part of a Food Fair that was held concurrently at The Vicenza Fair Centre – an excellent venue, well worth keeping in mind for future such meetings.

All of the papers that were presented during the conference, including several poster papers on subjects that are more or less related to the main theme, will be included in the *Book of Proceedings* now being prepared by the IDF Secretariat (Brussels, Belgium). One-page abstracts of all of the oral papers, as well as the titles of the posters, were included in a 67-page *Abstract Book*; this may still be available from the conference organizers, the Italian National Committee of the IDF or the Symposium Secretariat (Dr Roberto Giangiacomo or Dr Tiziana Cattaneo, Istituto Sperimentale Lattiero Caseario, Via A. Lombardo 11, 20075 Lodi, Italy).

## In next month's issue

Effect of food composition and microstructure on volatile flavour release,  
by C. Druaux and A. Voilley

Advances in the predictive modelling of fungal growth in food,  
by Angela M. Gibson and Ailsa D. Hocking

Functional foods for athletes, by F. Brouns

Applications of laser Doppler anemometry in understanding food processing operations, by M. Chandrasekaran, H. Marcroft, S. Bakalis and M.V. Karwe

Towards an understanding of starch granule structure and hydrolysis,  
by Christopher G. Oates