Invited Lectures

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INV-01

Designing Milk Protein Structures for Optimal Functionality and Nutrition

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Milk is an excellent source of value-added ingredients that are readily available and are utilized in a wide range of in foods for nutritional and functional purposes. The most widely used are milk proteins that can be specifically designed for particular applications. The commercial milk protein products include caseins and caseinates, whey protein concentrates and isolates and milk protein concentrates and isolates. Milk proteinspossesa wide range of inherent functional properties,such as emulsification, thickening, gelling, flavour binding and foaming, that contribute to textural, sensory and stability characteristics of traditional dairy products and other manufactured foods. Moreover, milk proteins provide all the essential amino acids required for human health and contain distinctive physiological properties. Recent developments in our knowledge of milk proteins and their interactions with other food components allow us to tailor specific functional property by altering the structure of the proteins and adjusting the balance of minerals, carbohydrates and individual proteins by carefully manipulating processing and handling conditions. Further scientific knowledge on interactions between different components as a result of processing and formulation will provide ideas for future innovative food products and enhance the functionality of dairy ingredients.

Currently, there is a growing demand by the food industry for dairy ingredients for high value applications, such as functional foods and nutraceuticals. For example, several milk proteins and derived peptides have been shown to possess physiological activity and thus potentially have positive health-promoting properties. There is an emerging trend to use milk proteins to form specific structures for designing encapsulation and delivery systems for bioactive compounds. There is limited understanding of how various structures in dairy foods are disintegrated after ingestion and mastication, i.e. in the stomach and intestine, and how they impact on the release and absorption of nutrients. This presentation will discuss the emerging trends and the future of dairy protein ingredients in these areas.

INV-02

Recent advances in ripened cheeses: biochemistry and functionality

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It is during ripening that the flavour and texture characteristic of the cheese variety develop. Three major pathways constitute the biochemistry of cheese ripening: (i) metabolism of residual lactose and of lactate and citrate, (ii) lipolysis and fatty acid metabolism and (iii) proteolysis and amino acid catabolism. Cheese ripening is mediated by metabolically active cells from the starter, non-starter and adjunct starter microbiotas and enzymes that contribute to ripening come from the coagulant (principally chymosin but sometimes other proteinases, and in cheeses made using rennet paste, also pregastric esterase), milk (plasmin, somatic cell enzymes and lipoprotein lipase), starter and non-starter lactic acid bacteria (cell envelope-associated proteinases and a wide range of intracellular peptidases, esterases and amino acid catabolic enzymes) and adjunct starters (proteinases, peptidases and lipases). The primary products of cheese ripening (peptides, amino acids and fatty acids) are metabolized further to volatile flavour compounds through metabolism of fatty acids and amino acid catabolism. Aspects of cheese ripening and functionality that will be discussed in this paper include the role of calcium equilibrium in cheese texture and functionality, bioactive peptides, non-starter lactic acid bacteria and cheese quality, factors affecting cheese translucency and oxidation-reduction potential and its effect on flavor development in cheese.

INV-03

Outlook for the dairy sector in the next decades*

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Global milk production in 2014 has reached a record level of 802 million tons, and average per capita milk consumption increased to 110.7 kg. Assuming that economic growth will continue, per capita demand is expected to further increase. Assuming that all people would want to consume as much as the average in South America, demand for milk in 2050 would be twice as high as production in 2012. To fill this 'nutritional gap' and nourish the world with safe and sustainable dairy products, the dairy sector needs to demonstrate excellent performance in the areas of food safety, nutrition, sustainability and standards.

Food safety is already at a high level compared to previous decades, but continuous vigilance is needed to maintain and further improve it.

The translation of science to dietary guidelines is a relatively slow process and the dairy sector needs to engage with policy makers to highlight the latest findings about the nutritional benefits of dairy products.

The most critical area is probably that of sustainability, which includes not only environmental but also socioeconomic sustainability, including animal welfare. As the global population expands, the pressure on food producers, processors and consumers to lower the environmental impact of food while maintaining socioeconomic sustainability will increase.

Global harmonization of standards and methods of analysis is needed to facilitate trade between countries with high milk production and countries with high demand but low production. Globally harmonized standards promote food safety, nutrition, sustainability and trade, as demonstrated by the more than 170 ISO/IDF standards established thus far.

To maintain a vibrant dairy sector, is it essential to maintain and improve technological expertise and to ensure high level representation in national and intergovernmental decision making bodies.

**A personal view, not an official IDF position*

INV-04

Dairy Fat: Friend or Foe

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Since the 1950s, research on dietary saturated fatshas suggested adverse effects on health. However, the data is heterogeneous and both epidemiological and interventional studies have produced contradictory results. Most studies have observed that consumption of saturated fatsis positively associated with blood lipids and chronic disease risk, although some have found no association or even a negative association. Recently it has become clear that not all the saturated fats are the same, therefore, may not raise blood cholesterol levels to the same extent. Milk and dairy products, unlike many other food sources of saturated fats, contain substantial amount of short and medium chain fatty acids, have conjugated linoleic acid and odd chain fatty acids, all with potential health benefits.

A recent meta-analysis of observational studies concluded that the consumption of saturated fat is not associated with an increased risk of cardiovascular disease (CVD). Another meta-analysis of randomized controlled trials suggests,however, that replacing saturated with unsaturated fatsreduces CVD risk provided the unsaturatedfat includes n-3 polyunsaturated fatty acids (n-3PUFA).

Notably, we do not consume saturated fats in isolation, therefore, interactions with other dietary fats (monounsaturated, polyunsaturated of both the n-6 and n-3 family) must be taken into consideration when examining the effects of saturated fats on blood lipid levels and CVD risk. We have recently hypothesised that n-3PUFA status of an individual is a major determinant of the health effects of dietary saturated fats (1). Provided n-3PUFA status is adequate, saturated fats are not likely to cause any adverse health effects. Saturated fats (dairy fat in particular) allows greater incorporation of n-3PUFA into blood lipids (2), therefore, has the potential to exhibit enhanced anti-inflammatory, hypotriglyceridaemic and anti-aggregatory effects and offer greater cardiovascular health benefits.