SESSION 3 : DAIRY LAND, SUSTAINABLE LAND?

Presided by Bernard Faye

Diversity of Dairy Products throughout the World

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Diversity of milk composition

Whatever their geographic origin, these different milks are unique in their composition. They contain water, proteins, fats, sugars, vitamins and minerals. However, their composition varies considerably from one species to another both from a quantitative and qualitative standpoint. For example, cow's milk from a European dairy farm and goat's milk as well as camel's milk contain 30 to 35 g/l of protein, 35 to 45 g/l of fat, 8 to 9 g/l of minerals and 50 g/l of lactose. Water buffalo and ewe's milk can contain up to 60 g/l of protein, 100 g/l of fat, 12 g/l of minerals and 50 g/l of lactose. Within one and the same species, variations in composition also exist depending on the breed, lactation stage, season, state of health and type of diet. There are also qualitative differences: for instance, unlike other types of milk, camel's milk contains no Ð-lactoglobulin. Due to these differences in quantitative and qualitative composition, not all milks have the same nutritional value and processing aptitudes.

Diversity of biochemical, biological and microbiological properties of milk

Depending on the place of production, breeding, milking and milk handling conditions, the stringency of dairy inspections, milk quality can also be very different. Milk is considered of high quality when it contains a minimum number of contaminating microorganisms, a somatic cell count (mammary epithelial + immune cells) of less than 200,000 per ml of milk. It should not contain external substances that have been added involuntarily or fraudulently (water, oil, antiseptics, antibiotics, etc.). These criteria are not always obeyed, and various milk qualities can be found throughout the world. It is not uncommon to find watered-down milk, milk having several million germs and several million somatic cells per ml of milk. These poor qualities often enter into the manufacture of dairy products that may be typical but not always satisfactory for the consumer in terms of taste and health safety guarantees.

Technological diversity: from traditional to industrial methods

By virtue of its richness, milk is an "ideal" milieu for the proliferation of ordinary microorganisms as well as potentially pathogenic microorganisms. To limit these negative effects, man consumes milk just after milking or once various technologies have been applied that make it possible to preserve milk and consume it over time periods that can range from a few days (in the case of milk pasteurized over a gas range or using industrial equipment) to a few months (in the case of UHT milk), to a few years (in the case of certain cheeses or milk powders). In addition to this improvement in conservation and safety guarantees of dairy products, dairy technologies are also used to manufacture new typical products and isolate certain compounds that have specific biological potential. Indeed, knowledge acquired in dairy science and technology has enabled us to manufacture milk and dairy products of which the composition has been altered qualitatively or quantitatively. These tools are:

- preservation technologies such as heat treatment;
- fractionating technologies that can separate, concentrate, purify or eliminate milk constituents;
- mechanical tools to slice, drain, wash and brush;
- salting methods;
- biotechnological methods that use microorganisms (bacteria, yeast, mold) and specific enzymes that can modify certain milk constituents;
- supplementation methods to enrich milk with interesting molecules.

Diversity of dairy products

Observations handed down from one generation to the next and knowledge gained on the composition of milk, the various methods and tools developed have enabled Man to create a variety of dairy products with broad diversity of properties, tastes and forms. Today in developed countries consumers have thousands of dairy products to choose from. These products include milk heated in different ways,

microfiltered milk, milk enriched with vitamins, minerals or fiber, flavored milk, fat-reduced milk, lactose-free milk, cheeses having original compositions, textures and tastes (fresh, soft paste, cooked or raw paste, melted…), creams, butters, milk fermented with various microorganisms, the best known being those used to make yoghurt (*Streptococcus thermophilus* and *Lactobacillus bulgaricus*), dairy specialties, infant milk, ingredients, powders, etc.

Certain non-food applications can also be noted. For instance, milk proteins, especially casein, are used in making glue and paint, lactose in pharmaceutical products, milk minerals in toothpaste. Recent research also makes it possible to envisage using cow milk proteins as constituents of biodegradable packaging and in textiles. Milk from mares and donkeys is used to make soap owing to its dermatological properties.

Milk of the future

All over the world, development of new dairy products remains a source of employment, research and innovation to enrich this diversity. These innovations are not all of the same nature depending on the country considered. They can roughly be placed into two main categories. In southern hemisphere countries, the main concern is to improve milk quality, particularly from a microbiological standpoint, so that it becomes foreseeable to manufacture quality products that can be diversified depending on consumer expectations in terms of nutritional and sensory needs. In northern countries where production has been optimized from a qualitative and quantitative standpoint, attention is more turned to the manufacture of sophisticated dairy products having typical flavors, specific functionalities and in some cases with intended and proven biological proprieties. Today, there is no lack of examples of this type of product and the dairy industry is in a position to offer various dairy products having positive impacts on the immune, bone, cardiovascular and nervous systems.

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