Microbial diversity of cheese: Why is it important?

Steve Labrie, Marie-Hélène Lessard and Typhaine Morvant, Université Laval

The dairy industry continues to invest in discovery research to expand our knowlede of the microbial profile and sensory qualities of dairy products, like cheese. Here are some of the latest findings from research on how the microbial diversity of milk plays a role from farm to cheese.

Key Points

- **The microbial community of cheese is critical** for the development of cheese flavor and the nutritional benefits gained from its consumption.
- **Cheesemakers add ferment and ripening cultures, which influence the microbiota of the cheese.** However, indigenous microorganisms from the cheese plant environment can also develop in the cheeses.
- To understand the origins of cheese microbiota, samples were collected from 6 cheese plants in Québec, including dairy fluids, surfaces, cheeses, and air.
- **In total, more than 1,500 bacteria, yeasts and molds were isolated and identified.**

Improving our understanding to enhance cheese quality

Cheesemakers carefully select ferment and ripening cultures to develop high quality cheeses; however, some microbial species can also be introduced throughout the production process, influencing quality.

Based on this, it is critical to understand the process of microbiota development, as well as all of the possible reservoirs for bacteria in the cheese production process, such as milk and cheeses, in-house microbiota of cheese plants, and the environment. Understanding these processes will allow cheesemakers to improve their product quality.

The microbial diversity of cheesemaking facilities

A project was conducted at Université Laval to characterize the microbiota of milk and cheese plant environments in order to understand their contributions to the microbiota of cheese.

A total of 6 cheese plants were visited in Quebec in the fall of 2021 and summer of 2022. Samples were collected from raw and heat-treated milk, as well as from cheeses, surfaces, and the air within the plants. The samples were cultured to get bacterial and fungal counts, then were identified by sequencing to determine the microbiota of the samples.

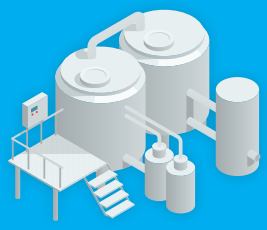
The complexity of cheese

Cheese is a nutrient-rich food that contains high-levels of vitamins, minerals, proteins, and fats. It is also a favorable environment for the development of high diversity microbiota.

The microbiota vary tremendously depending on the environmental and processing conditions, such as ferment cultures, use of raw or pasteurized milk, temperatures, and ripening conditions. This microbiota contains bacteria, yeasts, and molds, which are critical for cheese production and are responsible for cheese flavor development, as well as the nutritional benefits gained from consuming cheese.

So, what did the researchers find?

A total of 1,546 microorganisms (1,265 bacteria, 159 yeasts, and 122 molds) were isolated from dairy fluids, surfaces, cheeses, and air samples in both washed-rind and Cheddar cheese plants.



As expected, **heat treatment substantially reduced the total microbiota in milk by 99%,** with the major remaining bacteria being Lactic Acid Bacteria, *Microbacteriaceae,* and *Micrococcaceae.* These bacteria were also detected in washed-rind cheese samples.

THE ROLE OF SURFACES

Interestingly, the surfaces of ripening rooms for washed-rind cheese had a wide range of microbiological counts, with similar total counts to the dairy fluids. Cheddar cheese plant surfaces were found to have a lower level of contamination and diversity.

THE ROLE OF AIR

When evaluating the air samples within the cheese plants, **washed-rind ripening rooms had the highest microbial population, which was composed of bacteria that can grow in low temperatures** (i.e., psychrophilic) and high salt concentrations (i.e., halophilic). In addition, these ripening rooms were the only ones where fungi were found, mostly because they are part of the desired microbiota of wash-rind cheeses.

WHAT ABOUT THE CHEESE ITSELF?

When an evaluation of cheese samples was conducted, **washed-rind cheeses had a higher level of bacteria on the surface** compared to the core and fungi were also found mostly on the surface.

For Cheddar cheese, bacterial levels declined during aging. In the early stages of ripening (first 5 days after cheese production), the bacteria and yeasts isolated from the cheese corresponded to the starter or ripening microorganisms added by cheesemakers, whereas, in washed-rind cheeses, the microbiota originated from the smear solution and brine.

What does this all mean and where is this heading?

The project provides a survey of the bacterial and fungal diversity that can be found in different cheese plants.

Understanding the microbial profile of cheeses, as well as the contribution of the environment that they are produced in, allows action to be taken against potential harmful and unwanted microorganisms to protect desireable microorganisms that positively affect cheese ripening.

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