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FAM
Swiss Federal Dairy Research Station
Liebefeld
CH-3003 Berne
Telefon +41 (0)31 323 84 18
Fax +41 (0)31 323 82 27
http://www.admin.ch/sar/fam
e-mail: info@fam.admin.ch

Author:
Melchior Schällibaum, Hans-Peter Bachmann, Konrad Pfister

Address for queries:
M. Schällibaum
e-mail melchior.schaellibaum@fam.admin.ch
Tel +41 (0)31 323 81 84
Fax +41 (0)31 323 82 27

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Quality and Safety of Swiss Raw Milk Cheese

M. Schällibaum, H.P. Bachmann, K. Pfister
Swiss Federal Dairy Research Station
Liebefeld, CH-3003 Berne

Introduction

On account of the climatic and topographical conditions in Switzerland dairy industry plays the most important role in Swiss agriculture. Milk production yields for approximately one third of the total agricultural gross income. In 1997 the total milk production amounted to 3.1 million metric tons. About 50% of the produced milk is used for cheese making; 80% of the cheeses is made from raw milk without prior heat treatment.

The microbiological safety of cheeses made from raw milk has been under discussion for many years and, especially in the light of questions concerning the international trade, is still discussed quite controversially. The different opinions on the safety of raw milk cheeses may be reflected in the following statements.

- In a position statement of November 1996 the IFST (Institute of Food Science & Technology, UK) comes to the conclusion that (quote): "In view of all these considerations the Institute of Food Science & Technology considers that it is important to draw attention to the real hazards to human health due to pathogenic bacteria in raw milk cheeses, particularly of the soft and semi-soft type and to encourage the use of pasteurized milk in the production of cheeses."

- In a paper entitled "Raw milk and cheese production – A critical evaluation of scientific research" Professor Verner Weelock (UK) concludes (quote): "In the light of even a crude risk assessment it is obvious that cheese made from raw milk certainly does not constitute a hazard which needs to be addressed. What is more, the very low risk is recognized by the vast majority of consumers who choose to eat this type of cheese. One must ask the question, is there any justification for insisting on a law requiring all milk for cheese production to be pasteurized – especially when there is no valid evidence to demonstrate that this would result in higher standards of food safety ?"

At the Thirtieth Session of the Codex Committee on Food Hygiene, Washington D.C., 20.-24. October 1997, the Committee agreed that the food hygiene provisions in the draft standard for milk and milk products should include the following paragraph (quote): "From raw material production to the point of consumption, the products covered by this standard should be subject to a combination of control measures, which may include, for example, pasteurisation, and these should be shown to achieve the appropriate level of public health protection."

In the following some aspects of hygienic safety of Swiss cheeses made from raw milk are discussed with special reference to research, control and knowledge transfer.

Research

The hygienic safety of Swiss hard and semihard cheeses made from raw milk was assessed in a scientific study at the Swiss Federal Dairy Research Institute. The occurrence of potentially pathogenic bacteria in raw milk and their behavior after inoculation in the vat milk in experimentally made hard and semihard cheese was examined.

Occurrence of Potentially Pathogenic Bacteria in Raw Milk

Table 1 lists the prevalence of potentially pathogenic bacteria in herd milk samples in Switzerland. *Listeria monocytogenes*, *Salmonella* spp., and *C. jejuni*, which cause severe forms of food poisoning, were only detected in very few samples. The occurrence of pathogens of lesser importance, such as *Y. enterocolitica* and *A. hydrophila* was also very low. For *Staph. aureus,* percentage of positive samples was extremely high; however vat milk samples from cheese factories were tested, and not herd milk.

Table 1: Occurrence of some potentially pathogenic bacteria in herd milk samples in Switzerland

Species	Year	No. tested	No. positive	% positive
Aeromonas hydrophila	1993	200	28	14
Campylobacter jejuni	1990	496	0	0
Listeria monocytogenes	1985 to 86	4046	14	0.4
Listeria monocytogenes	1992	340	2	0.6
Pseudomonas aeruginosa	1994 to 95	220	52	24
Staphylococcus aureus[1]	1985 to 86	331	331	100
Yersinia enterocolitica	1990	352	2	0.6

[1] vat milk samples from cheese factories

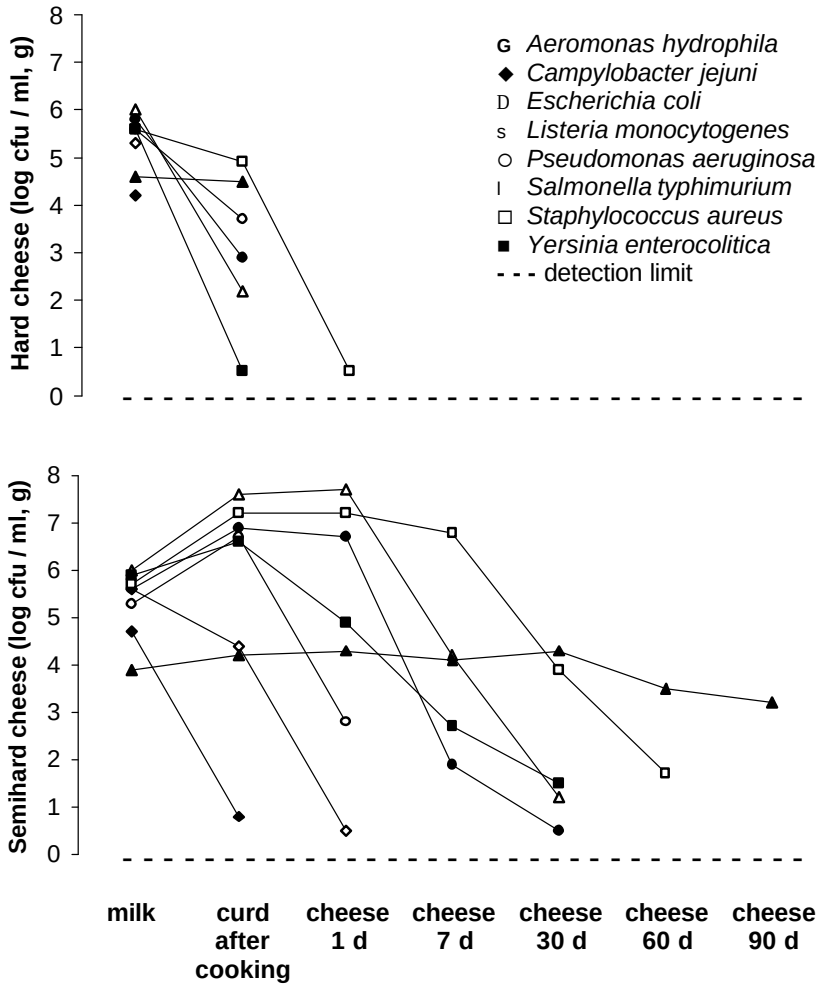
Behavior of Potentially Pathogenic Bacteria in Hard and Semihard Cheeses from Raw Milk

The survival of potentially pathogenic bacteria in hard and semihard cheese made from raw milk is presented in Figure 1. Only data of batches with longest survival are shown, because the worst case is always the most important with regard to hygienic safety.

None of the inoculated potentially pathogenic bacteria could be found in the experimental hard cheeses 1 d after manufacture, except for low numbers of *Staph. aureus*. All subsequent determinations were free from potentially pathogenic bacteria and toxins (data not shown). Generally, the technology of Swiss hard cheeses does not support well the growth of pathogenic bacteria and leads to a more rapid rate of death. The main factors are the use of raw milk, the high cooking temperatures, the low pH-value after overnight pressing, and the elevated ripening temperatures.

In the experimental semihard cheeses, potentially pathogenic bacteria survived longer than in the hard cheeses. After 90 d, when ripening was complete, the levels of all bacteria fell below the detection limit, except for *L. monocytogenes*. Rapid acid production is the principal factor responsible for the elimination of pathogens from semihard cheese. The use of an effective starter culture is not only critical for preventing growth of pathogens, but also essential for the production of good quality cheese. Lactic fermentation may also generate inhibitory substances that suppress the growth of pathogenic bacteria.

Fig. 1: Behavior of potentially pathogenic bacteria during manufacture and ripening of hard and semihard cheeses made from raw milk.



In the present study, the parameters used for manufacturing and ripening (pH, temperature, and salt content) were within the range used in commercial practice, and were generally on the lower side in terms of low antibacterial effect. Thus, the findings on the behavior of potentially pathogenic bacteria in experimental cheese are applicable for all commercial varieties of Swiss hard and semihard cheeses made from raw milk.

This conclusion laid the basis for the establishment of a quality management system on a legal basis for the Swiss dairy industry. Within the scope of a safety concept the compliance of the critical parameters used for manufacturing and ripening is controlled. Control points, which have to be fulfilled each day ensure that at the age of commercial ripeness, the hard and semihard cheeses are free from pathogens and their toxic metabolites, except for *L. monocytogenes*, which could survive the manufacturing and ripening process. Based upon the presented work the Swiss dairy industry runs a monitoring program for *Listeria* for cheese and other dairy products. Since its introduction, it has proved to be a suitable instrument for identification and management of contamination by *L. monocytogenes* at every stage of cheese production, ripening, and distribution.

Control: The Example of Listeria

Listeria are bacteria which are ubiquitous and grow even at refrigerator temperatures. Out of seven species only *Listeria monocytogenes* causes listeriosis. The disease occurs very rarely in humans (3 to 4 cases per million humans annually). Usually only individuals who's immune system is reduced by chronic diseases or other circumstances (e.g. pregnancy) may attract listeriosis. Infections with *Listeria monocytogenes* can easily be treated with antibiotics. Nevertheless, around 17 % of all infected persons die of the sickness.

Since several years the Swiss Federal Dairy Research Station runs a Listeria Monitoring Programme (LMP). Cheese in ripening centres and dairies is periodically analysed for the presence of Listeria. In addition, the Swiss Dairy Research Station has developed a consulting concept for enterprises having hygienic problems concerning Listeria. Both activities guarantee the exportability of Swiss Cheese and reduce to a minimum the possible health hazard by Listeria for the consumer.

According to the Swiss Ordinance on the Hygienic-Microbiological Standards for Foods *Listeria monocytogenes* should be absent in 25 g of cheese ready for consumption. The sample contains 25g of cheese body and rind, the rind share not exceeding 10 to 15 per cent of the whole sample (around 3g).

In a first step of the LMP only cheese rind is analysed. If a soft cheese or semi-hard cheese sample is positive for *Listeria monocytogenes* the cheese body will be analysed additionally. The LMP permits to screen occurring problems at an early stage (e.g. in manufacturing sites). In this case of positive results measures to prevent the propagation of the contamination into other ripening cellars or manufacturing sites or and contaminated cheese lots can be blocked before they enter the market.

Procedure in case of Listeria contaminated cheese surface

In the case of a contamination effective measures are necessary avoid cross contamination within and between cheese manufacturing plants. In addition concerned marketing organisations and hygiene consultants are be informed. Depending on the cheese variety several methods for bacterial reduction on the cheese surface are recommended (e.g. alcohol treatment, high pressure washing of the cheeses with water).

The Swiss Dairy Research Station provides not only analytical but also competent consulting services to support clients with Listeria problems. It's consulting service has developed a concept which tries to take into account all the possible measures to resolve the problem. By this means the Listeria contamination can be controlled in the long-term. With the current consulting experiences we are in the position to say that a Listeria contamination can be controlled with a quality management system which includes strict hygienic measures at the cheese manufacturing and ripening sites and regular bacteriological testing.

Knowledge Transfer

Swiss manufacturers of raw milk cheese have been meeting since 1968 in so called knowledge transfer meetings several times per year. The Swiss Dairy Research Station is organising these meetings. What started as a regional gathering was later expanded throughout the country. These meetings are an ideal possibility to inform the cheese industry about the latest developments in dairy research, including food safety issues and assure a widespread dissemination of knowledge and information to the praxis.

The meetings usually take place in all the regions of Switzerland 4 times per year. In a first step consultants and scientists of the Swiss Dairy Research Station transfer the knowledge to groups leaders and their

corresponding regional consultants. Then the leaders teach every cheese manufacturer in groups of 10 to 30 individuals. In every session the cheese manufacturer receives a profound written documentation. The Swiss Dairy Research Station always tries to inform about the latest results of national and international dairy research. On the other hand the Swiss Dairy Research Station receives important information on current problems and research needs directly from the cheese manufacturing praxis. This feed back ensures a practice oriented research.

The manufacturing of an excellent raw milk cheese is a demanding task. The manufacturer has to control many steps in order to be able to produce an aromatic, convenient and hygienically safe speciality. Swiss Cheeses have attained an excellent quality because of the close collaboration between research and the cheese manufacturers. The manufacturers are always informed about the latest news in cheese and other dairy research through the knowledge transfer meetings. Furthermore, the exchange with other cheese experts is enriching and helps the manufacturer to try new ways for solutions. In a deregulated dairy industry only informed manufacturers are in the position to be economically successful.

Therefore, the knowledge transfer meetings for cheese manufacturers organised by the Swiss Dairy Research Station is and will be of enormous importance for both sides in the future.

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