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Agroscope

Safety and quality of raw milk cheeses: Two sides of the same coin

Hans-Peter Bachmann & Hans Ulrich Graber

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Our hypothesis: For raw milk cheeses, safety and quality are two sides of the same coin

Thesaurus

Synonym group

not to be considered (be) independently of each other - not to be seen (be) independently of each other ● belonging together inseparably **variable**

- two sides of the same coin (be) **fig.**

Structure of the lecture

- Model for testing the hypothesis
- Problem definition
- Solution by Agroscope and partners
- Implementation in practice
- Testimonials
- Verification of the hypothesis
- Future need for research
- Take home messages

Staphylococcus aureus as model of choice for testing the hypothesis

- Often the most significant pathogen in cheese made from raw milk - depending on the basis of assessment
- Process hygiene criterion in the legal requirements in the EU and Switzerland
- In line with Agroscope's internal risk prioritization

Staphylococcus aureus …
… causes major problems in four areas

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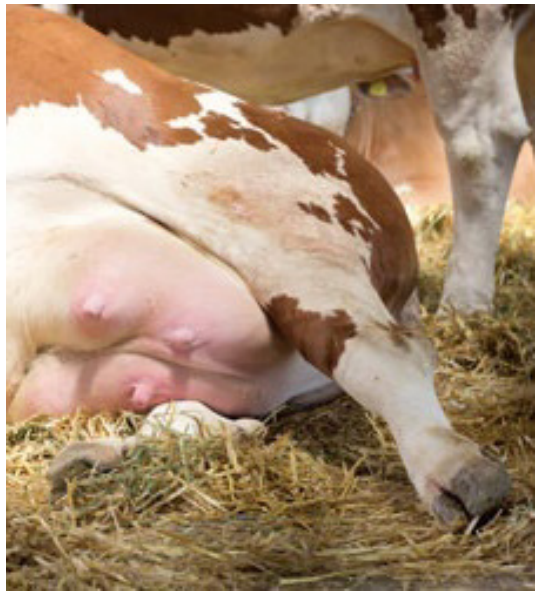
Staphylococcus aureus …
… makes our cows sick and suffering

- Mastitis (one of the most common cow diseases worldwide)
- In CH more than 50 % of mastitis caused by *S.aureus* (at herd level)
  - Very painful for the animals
  - Often subclinical, chronic, and diagnosed late
  - Many false-negative results when testing sterile milk samples with classical microbiology
- Risk factors for infection
  - Hotspot Alpine farms due to mixing of animals from different herds of origin
  - Milking order and hygiene
  - Purchase of untested cows
  - Poor stable hygiene



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Staphylococcus aureus … … makes us humans sick

- Forms heat-stable enterotoxins that lead to
  - Diarrhea and vomiting and,
  - In rare cases: more severe courses of disease
  - Only 5 of 27 enterotoxins can be detected with commercial kits
  - Certain strains can even survive the cooking temperatures of hard cheeses.
- **M**ethicillin-**R**esistant ***S****taphylococcus* ***A****ureus* (MRSA) strains are a major concern in clinics. Fortunately, they only occur very rarely in farm animals (species barrier).
- Exception CC398 (genotype S)
  - May be MRSA positive
  - Can jump species barrier

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Staphylococcus aureus …
… deteriorates the quality of our raw milk cheeses

- Milk composition altered
  - more components from the blood serum (whey proteins, lactoferrin, free fatty acids, various enzymes etc.)
  - Less casein, less lactose
  - Higher pH value
- Poorer coagulation properties and poorer syneresis (higher water content)
  - Delayed acidification (antimicrobial activity of leucocytes)
  - Somatic cells are concentrated in the cheese mass
- Higher activity of milk-originating enzymes (proteases, oxidases, lipase...)
- Negative impact on texture and flavour
  - More intensive proteolysis and lipolysis (off-flavours)
  - More biogenic amines
- It is not possible to produce high quality raw milk cheese with milk from sick animals (and that is a good thing !)

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Staphylococcus aureus …
… leads to high avoidable costs

- Lower milk yield. Fewer lactations.
- Costs for treatment and, if necessary, culling of the cows.
- Deductions from the milk price, or even a delivery ban
- Lower cheese yield (less casein, more cheese dust, higher fat losses)
- Total annual mastitis-related costs of around CHF 130 million in Switzerland (estimate from 2014).
- In the end, consumers pay for it

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Eureka! It depends on the genotype!

- The greatest problems are caused by the contagious genotypes
- Genotype B (GTB) is the only contagious subtype in Switzerland and in the countries surrounding Switzerland by far the most prevalent one.
  - Udder is the natural habitat of GTB
  - 20 - 100 % of cows positive in infected herds
  - Also by far the most common genotype in Swiss raw milk cheese
  - Forms enterotoxins A, D, J, R (Only A and D are detectable with commercial kits)
- This breakthrough was only possible thanks to the excellent cooperation with various partners, namely
  - the Federal Food Safety and Veterinary Office and
  - the Vetsuisse Faculty.

"Eureka" is also the title of a kinetic sculpture by Swiss artist Jean Tinguely

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Agroscope's newly developed test as the key to success

- qPCR method
- A gene (*adlb*) is detected that only occurs in GTB and other contagious subtypes
- Very sensitive: it does not matter how much the cow excretes *S.aureus*
- Very specific: only very few false-positive or false-negative results
- Very fast: analysis time = 1 day
- Reasonably priced:
  - Cost per test CHF 45 (mainly personnel costs)
  - Costs abroad probably lower due to lower personnel costs
- Easy sampling: There is no need for sterile sampling.
  The farmers can simply take the samples themselves.
- Possibility to test directly bulk tank milk.

Simple, practical sanitation concept

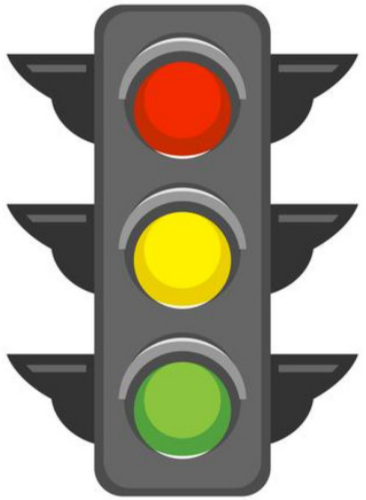
What is needed for the sanitation of GTB-positive farms?

1. The gene test specifically developed by Agroscope
2. Consistent implementation of 5 on-farm measures
3. The right choice of antibiotics

1. The gene test specifically developed by Agroscope

- Monitor bulk tank milk regularly
  - Agroscope's test is highly sensitive and allows the detection of 1 GTB-positive cow in the milk from over 100 cows.
  - It is therefore also suitable for identifying GTB-positive herds and monitoring sanitized farms.
- In case of a positive result in the bulk tank milk, all cows have to be tested individually.
  - During sanitation, each cow must be examined monthly.
  - To save costs, the samples can be pooled in the laboratory and only the positive pools can be tested individually.

2. Consistent implementation of five on-farm measures



1. **Strictly follow the milking order according to the grouping**:
   - First milk all cows in group 1 (GTB negative),
   - then group 2 (GTB unclear) and
   - finally group 3 (GTB positive).
2. **Clean the milking units and milking equipment completely in the morning and evening** according to the milking machine manufacturer's instructions.

Less important:

3. Each cow must have its own disposable milking cloth or ball of wood shavings for cleaning the teats and attaching the cluster.
4. Immediately after milking, all cows must have their teats dipped with an iodine-based agent.
5. Every milking installation must be serviced once a year by a specialist.

3. The right choice of antibiotics

- The sanitation itself and its professional supervision belongs in the hands of experienced veterinarians.
- Very high cure rate of over 90 % if the right antibiotic is used correctly. So far, no resistance towards penicillins have been observed in GTB.
- The cure rate is probably so high because our sanitation concept massively reduces the infection pressure. In addition, GTB is highly udder-associated.

Breakthrough in the treatment of mastitis

Agroscope's sanitation concept was used with great success:

- First in individual farms and
- Then in an entire region (Canton of Ticino)
  - Total 165 herds
    - 2017 (Start): 37 % positive
    - 2018: 8 % positive
    - No more GTB-related mastitis since 2019
  - Sanitation successful within 20 months
  - Cure rate 93 %
  - No more enterotoxin findings in cheese since 2018
  - High satisfaction: 97 % of participants would do the sanitation again
- The next goal must now be to get the cow herds in the whole of Switzerland and ideally also in the neighbouring countries free of *S.aureus* GTB.

Breakthrough in the Monte Ceneri Base Tunnel at Sigrino in 2015

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Lively exchange of knowledge and experience as an important success factor

- You have to convince people:
  - publications are important, but …
  - … it also takes level-appropriate presentations to all stakeholders.
- It is very important to first train practice laboratories so that they can master the method reliably and cost-effectively.
- Partly skeptical attitude among the veterinarians, because
  - the “conventional wisdom" was shaken (low treatment success and generally high infection rate) and probably also because
  - traditional fields of business were questioned.
- There needs to be a fair distribution of short-term costs and long-term savings throughout the whole value chain.

Testimonials

Rémy Boder, Farmer:
«We have reduced antibiotic use to a good 70%.»

Patrizia Riva, Consultant in dairy production:
«Cheesemakers are much more confident today that they can produce cheese of the best quality.»

Martin Reist, Head of Animal Welfare, Federal Food Safety and Veterinary Office:
«An exemplary research collaboration from basic research in the laboratory to successful implementation in the field.»

Carlotta Sartori, Regional Sales Manager at Multiforsa (recently joined Agroscope):
«A targeted diagnostic and a handful of preventive measures during milking are the keys to the sanitation success.»

The goal lies within arm’s reach

We need to get our dairy herds free of *S.aureus* GTB throughout Switzerland and ideally also in neighbouring countries.

...for the sake of

- our cows,
- our health,
- our raw milk cheeses
- and our wallets.

Agroscope

Our hypothesis is correct: For raw milk cheeses, safety and quality are two sides of the same coin

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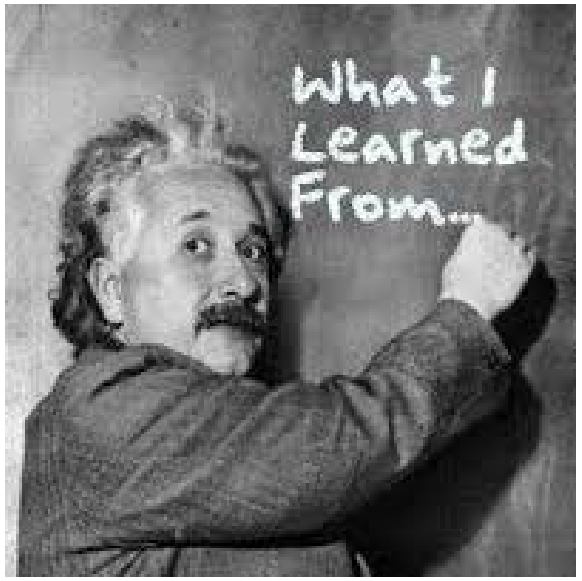
Future need for research

- Protective cultures for teats (instead of disinfectant)
- Promotion of a microbiota in the raw milk with harmless (or even health-promoting) micro-organisms.
  - Occupying ecological niches with "good guys”
  - The Competence Centre for Raw Milk Products wants to develop a simple practical tool for this purpose.
  - Poster presentation by Luca Bettera et al. (Number S02)
- Sanitation concepts for other transmissible mastitis pathogens, such as *Streptococcus uberis*

Take home messages



1. Raw milk cheese must claim quality leadership for itself, so much is gained in terms of food safety as well.
2. It is very possible to keep livestock free of *Staphylococcus aureus* GTB. Everyone benefits if we work consistently towards this goal.
3. To produce high quality and safe raw milk cheeses, a holistic production system is needed that must be constantly maintained and adapted to the increasing requirements.
4. Raw milk cheese is often sold below its value today because the trade and consumers are too little aware of how comprehensive and elaborate its production system is.

Further reading

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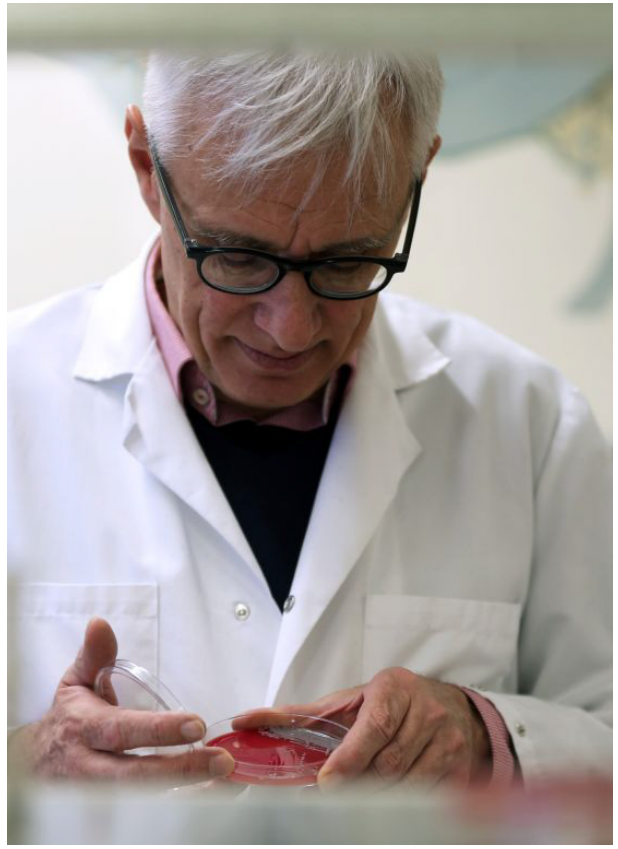
  - many colleagues from Agroscope
- To all those who are working every day with great enthusiasm and passion for the quality and safety of raw milk cheese.
- And to all of you for your participation in our conference and for your attention.







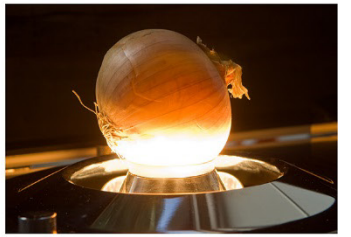










Thank you for your attention

Hans-Peter Bachmann
hans-peter.bachmann@agroscope.admin.ch

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