CHAPTER 4

Regulations and Production of Raw Milk

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4.1 DEFINING FRESH, UNPROCESSED MILK

It is necessary to delimitate the definition of fresh, unprocessed milk, a term which will be used rather than raw milk, being any raw material taken from the milk glands of mammals, (mostly herbivores) and gathered in bulk tanks for further processing. In the German language (Fink-Keßler, 2013) raw milk (Rohmilch) is distinguished from consumption milk being processed shop milk (Trink Milch; Trinken = to drink), as if only after processing (heating, homogenization) milk will be ready for consumption. Wightman et al. (2015) discuss how the term raw milk has been used commonly and has settled in the mind of consumers, farmers, and lawmakers. They say: “Raw milk is used to describe and in some laws is defined, as any milk that has not been pasteurized. However milk that is produced for pasteurization is different from milk that is intended to be consumed by people without processing. To clarify the distinction we prefer to identify the milk intended to be pasteurized as pre-pasteurized milk, whereas whole milk, which is produced specifically for direct human consumption, is called fresh, unprocessed milk. So, milk is not milk, and intentionally farmers produce milk from different perspectives or with different security measures in mind. If you know your milk will be pasteurized afterwards, safety should come from the heating process and the killing of all food-borne pathogens. In contrast, if you consciously produce milk, which will be consumed without these technical tools, you need insight and protocols, knowledge and interest on how to produce safe raw milk. The discussion on cons and pros of raw milk consumption is pretty much stuck in meanings and often one-liners, but serious questions and answers on raw milk are present (Gumpert, 2015) and scientific discussions are present (Baars, 2013; Claeys et al., 2013; Ijaz, 2014).
Words to describe progression and changes strongly depend on the era and country of living. In Zürich (Switzerland) in 1925 (Brand, 1925) people distinguished between Vorzugsmilch, raw milk, and milk specialties, which was the upcoming pasteurized milk. Medical doctors preferred Vorzugsmilch as child-milk, milk to cure or health-care milk before World War II and nowadays people who give raw milk to children are mentioned as raw-milk criminals. It shows that our attitude and judgement on fresh, unprocessed milk have changed dramatically in the last century and we do not distinguish between different unprocessed milk qualities in terms of risk and safety: every milk is suspect. In this chapter, the history and development of fresh milk, meant for direct human consumption will be in focus. The status quo of several examples to sell safe, fresh, unprocessed milk will be discussed.

4.2 HISTORY OF FRESH, UNPROCESSED MILK

In the 19th century, sweet cow’s milk started to be a commodity in several parts of the Western world (Atkins, 2010). Before that time, milk was mainly processed on farms into cheese and butter. Everyone living on the land had their own cow or goat and most people lived outside cities. Every profession was still connected with being a farmer, part-time or full-time. The main production areas in Europe for milk were connected with the rainy, mild climate of the coast as well as with mountainous areas. On paintings of the 17th century in The Netherlands gouda cheeses are already found. Gouda is a regional wheel-shaped cheese named after the city of Gouda in the west of The Netherlands, where enormous peat areas were grazed by cattle. The surplus of milk was processed twice a day on the farm. Local cheese markets were present all over the west of The Netherlands, whereas butter was processed mainly in the grassland areas of the Friesland province (De Vries, 1974). Nowadays the Gouda-trademark is a certification for a certain processing of cheese, independent of the region of production.

The living of people and the nutrition of their infants dramatically changed in the 19th century (Obladen, 2012, 2014). During the Industrial Revolution, the population of Europe doubled and people became city dwellers in the upcoming towns. To consume the fresh unprocessed milk, it was necessary to transport the milk into the towns, but distances became longer and at the start there was no insight in hygiene, cooling, and animal health. One way to overcome the distance
of the transport was to keep cows in the towns itself, which in several areas transformed into the production of swill milk (Schmid, 2009; Obladen, 2014). Swill milk was produced from cows fed large amounts of spent grains from the waste of distilleries or other wastes from town, unsuitable for ruminants instead of grass and hay. Those cows were often ill due to the lack of roughage in their diet, and the housing in towns of animals was not very hygienic. When the sale of swill milk was prohibited in the United States in 1861 due to food-borne zoonotic problems, it became necessary to organize the transport of milk from the countryside into the towns (Obladen, 2014). Fink-Keßler (2013) mentioned the increased urbanization as an important reason that cows and farmers were repressed from the cities. However, in Germany until the late 1990s dairy farms could be settled within the boundaries of the cities. In the city-state of Bremen over 15 Vorzugsmilk farmers were delivering certified raw milk for citizens in town. During summer, cows grazed outside the towns (oral communication Gerhard Windler, retired president Vorzugsmilk-Association in Germany).

A side effect of the industrialization in the 19th century was that people were no longer living in the countryside in the direct surrounding of farms and animals. Women were necessary for industrial labor. Women could not breastfeed their babies any longer and artificial milk feeding was needed. However, in 1899 the death rate among artificial fed children in f.i. Paris was 46% compared to 5% under breast-fed children (Obladen, 2012). Nursing practices based on cows’ milk existed, before any insight in bacteriology and hygiene. Poor decisions were made to give young children sterilized/pasteurized milk rather than the insight that clean and sterilized equipment, immediate cooling of milk and milk from healthy and clean cows could reduce the mortality of these young babies. Obladen, (2014) additionally described the technical development of the hand-feeding equipment and called it a bacteriological paradise. It took a while before proper rubber teats were developed, which could be cleaned and sterilized.

It was often quite a poor overall situation among the cows housed in towns (Schmid, 2009): sick cows, cows with ulcers, dirty, dark stables, no hygiene present, and no clean water. Milk sold in cities could be diluted with water, flour, chalk, and other substances were added to receive higher profits from milk sale. It was important to protect people from selling unreal milk (adulteration) and to protect children to get diseased milk (safety). At the end of the 1880s in different European countries, laws on milk and butter were formulated to protect the butter made from cream.
to artificial spreads or surrogate butter made by the industry. The English word “butterine” for surrogate butter was too close to the word butter and therefore margarine was accepted (www.techniekinederland.nl). The first and main goal was to prevent food adulteration. Milk should be milk and butter should be butter. Adoptions of the laws were in the direction of food safety, the prevention of food pathogens, like *Mycobacterium*, to enter the food chain.

Due to the poor cooling systems, the mixing of bulk milk in different parts of the transport chain (trains, depots, shop), it was preferred to bottle milk already at the farm. Control of the farms, the milk, milk contents, and bacteria slowly developed. Due to the enormous problems with a safe milk supply, the wish for milk pasteurization and sterilization arose. In cities all over the Western world pasteurization plants were built.

The discussion about criminalization of raw milk applied to young children, was already present at the end of the 19th century. One of the American philanthropists Nathan Straus started up large pasteurization plants and cooled transport of bottles of cows’ milk in New York City. In his review article Obladen, (2014) cited Straus, who wrote in 1895 to the mayors of every city in the United States: “I have held that the day is not far distant when it will be regarded as a piece of criminal neglect to feed young children on milk that has not been sterilized”. Brand, (1925) refers to the rapid increase of pasteurized milk sales in New York City. In 1903 only 3% of the milk consumed was pasteurized, 40% in 1912, 88% in 1914, and 98% in 1918. Similar data can be found for all other large cities in the United States (Atkins, 2010). It depended often on the number of citizens how quickly pasteurization was adopted. The smaller the town, the longer the milk was delivered unpasteurized (Brand, 1925). The process of in-bottle pasteurization, also mentioned pasteurization after Koch or Holder pasteurization (60–65°C; 20–30 minutes) is one of the methods that changed apparently less on the milk quality. Temperatures above 65°C were avoided, because in those days knowledge was already present that the albumin protein became coagulated (Brand, 1925). It was preferred to pasteurize the milk into the single bottles closed by waterproof caps to avoid reinfection.

Also in Germany, there was a discussion on the need of milk pasteurization. Although 22.5% of the slaughtered cows showed signs of Tuberculosis (TB), the first point of discussion was if human and cow TB were the same, and if cows could infect humans. The main form of Tuberculosis was the lung TB, which could be transmitted from cow to
cow or man to man or man to milk through coughing by infected milkers. All kinds of contacts (via hands, air) were possible, when people were still hand-milking in open buckets. Even up till 48% of the slaughtered swine in Berlin in 1905 were infected with TB due to the feeding of infected skim milk and mud from milk centrifuges (Fink-Keßler, 2013). A positive reaction to tuberculin test only meant that an animal had picked up the bacillus, not that it had active, shedding TB. It was estimated that only 0.2% of the cows were producing TB-infected milk. In contrast with the United States, the problem in Europe, however, was the high number of small producers and therefore the mixing of milk before sale. So, one infected animal could contaminate a large amount of milk (Barnett, 2000). In England and Wales two-thirds of those who died from TB in 1928 were under 15 years of age, with the under-fives hit hardest—not surprising, given the amount of milk in infants’ diets (Barnett, 2000). Therefore it was discussed, if raw milk for sale should be compulsorily pasteurized. There was a pragmatic acceptance of pasteurization to control the epidemic of TB, but only till the unhygienic circumstances at the farms involved, were solved. Pasteurization was seen as a compromise and temporary solution, a stopgap measure rather than a permanent solution. This argumentation was also found in other countries. One of the antipasteurization speakers was Lady Eve Balfour, founder of the Organic Movement and Soil Association in the United Kingdom. For her, “pasteurization was a confession of failure. The aim should be to abandon the practice just as soon as the need for it—unhealthy cows and dirty methods—can be eliminated”. (Atkins, 2000). Whereas the US cities were early adopters of pasteurization, in the United Kingdom Atkins, (2000) wrote: “Gradually, pasteurization spread in the 1950s from the large cities to smaller towns and rural areas. Tuberculosis was becoming less of a threat and the tuberculin-tested grade of milk was finally abolished in 1964 as no longer necessary.” Due to the culling of cows, Tuberculosis as well as Brucellosis became largely eradicated in industrialized Western countries. Nevertheless after the Second World War, pasteurization became the new standard of milk delivery. A new argument against compulsory pasteurization, like in Scotland, Canada, and a number of US states, arose as “the freedom of food choice” (Atkins, 2000). This argument was used in several discussions on raw milk consumption in the last few decades.

Early initiatives to produce safe, raw milk from dairy farms in the countryside rather than from swill milk within the city boundaries already started in the early 19th century (Atkins, 2010). In the 19th century new
transportation systems, mainly from railways made it possible to get milk quickly from the countryside into towns. Also industrial cooling techniques were necessary as a prerequisite before raw milk could be transported over longer distances and kept fresh during several days. Early initiatives for the production of safe raw milk were found in combination with enterprises of philanthropists. E.g. in Denmark, the Copenhagen Milk Supply Company was established in 1879: “the milk came from 40 selected farms and was brought by train in special sealed vans. It was cooled at 5°C by ice and filtered. The company was opposed to pasteurization.” (Atkins, 2010). All of their milk was delivered in bottles, much earlier than in Britain. Interesting is the focus of people, who were against pasteurization. As a matter of principle they wanted a healthy environment, healthy cows, and a healthy countryside: “there is no need of pasteurization if milk production conditions were properly controlled”. (Atkins, 2010). No end-of-pipe solutions through pasteurization of a poor milk quality, but safe, unprocessed fresh milk based on knowledge about cow’s health and feeding, based on educated farmers, their attention and interest at work, clean and adequate housing of animals and safety procedures during milking and cleaning of all equipment.

Attention was paid to hygiene of animals, stables and people, the construction of the buildings, water supply, sanitary conditions of production, bottling and labeling of the milk, cooling of the milk after milking, and during transportation. In the United States the development took place under the flag of a local medical commission, as part of the American Association of Medical Milk Commissions and the Certified Milk Producers’ Association of America (Atkins, 2010). These commissions were looking after farm hygiene and hygienic handling of milk, not at pasteurization. Also in Germany, medical doctors and hygiene workers introduced in 1875 the first sale of safe milk for young children from selected farms and controlled cows nearby cities. A start-up of raw milk sales was accepted only under conditions of sufficient and continuous check of the health status of the milking cows (Fink-Keßler, 2013). Vorzugsmilk was advised by MDs. Brand (1925) described the Swiss Vorzugsmilk, which was mentioned as Vorzugsmilch, Kindermilch, Krankenmilch, or Sanitätsmilch (respectively preferred milk, child milk, milk for suffering people, milk for medical service), in which special attention was paid on the strict hygienic conditions and health status of the farms, farmers, and cows. The immediate cooling down of the milk was part of the standard. Fink-Keßler (2013) mentioned that it was only
allowed to feed cows hay plus home-grown concentrates rather than distillery products (draff, molasses) used in the swill milk production. In parallel, education of the farmers delivering raw milk as well as demonstration farms, agricultural shows, competitions, and yearly meetings took place. Education was necessary, because farmers needed to change their daily practices of milking. At the same time grading of milk in different quality standards was used to stimulate farmers as well as to get a premium price for the milk delivered.

Atkins (2010) described that in 1920, Reading researchers (United Kingdom) summarized the experiences of raw milk production in a five-point scheme to maintain a safe milk quality:

- milk should be cooled within 3 hours of milking
- the prevention of dust, hairs, etc. to fall into the open milk buckets
- sterilization of milking equipment (dairy utensils)
- looking for the cleanliness of the cows, the udder, eventually washing the udder before starting milking
- training, motivation, and educating the staff involved into the milking process.

Their impulse was not very different from the standards for safe raw milk production today, described by the Association of Vorzugsmilkkproduzenten (Germany) (www.milch-und-mehr.de) and the Raw Milk Institute (California) (www.rawmilkinsitute.net). The main focus was clean and guaranteed milk, people wanted to get rid of impure milk, and looking for pathogen-free milk, at first for their infants. It was all about risk reduction. Certified raw milk does not seek to be milk with an extended shelf life, like in the normal large-scale dairy industry, transporting milk over very long distances (ARMM, 2015). Certified raw milk looks for freshness and safety of milk, which is consumed within a period of maximum 7–10 days. Like the rhythm of milk production, fresh, unprocessed milk should be delivered in local households at least two times per week, if possible more often.

An important new tool to reflect on milk quality was the possibility to detect germs in milk (total germ counts) as well as the identification of specific germs. In the last decade of the 19th century, testing of microbes came up, milk became suspect in the transmission of several infectious diseases (Typhus, Tuberculosis). In the United States the first bacteria in milk were counted in 1892 (Atkins, 2010). Bacteriological thresholds were defined for certified milk. Tuberculin-tested certified milk was one of the triggers in the certification of raw milk. Farmers could receive a
50% premium price for such milk, and like today the animals in their herd had to be tested individually. In the United States regular counting of bacteria in milk as a control measure of hygiene was already implemented before World War I. The availability of testing offered the possibility for an objective guarantee of the promised quality as Grade A milk. In between the World Wars, regional centers for dairy microbiology were developed in the United Kingdom to control the bacteriological milk quality.

Certification systems for Grade A milk were present in both raw and heat-treated milk. Due to the gradation of milk (Grade A raw, Grade A past, Grade B past, and Grade C past) creameries in cities of the United States were pushed to improve their standards of delivery. Within a short period of time the lower graded milk disappeared (Brand, 1925). For Grade A standards the total number of germs was used as one of the selection criteria. Grade A raw milk should not exceed 30,000, and Grade A past milk not 200,000 germs per mL (before pasteurization). In the United States there was a strict system of controlling and penalty. Samples were taken for bacteriological and chemical control and transgressions were followed by warning (first), penalties (second), or withdrawal of the license to produce (third) (Brand, 1925). For the delivery of safe Vorzugsmilch in Germany nowadays the system of control and withdrawal is still quite similar, although the checklist has changed: if certain threshold levels are exceeded, farmers get warned and immediate resampling, and testing of the milk takes place or delivery can be refused, until the farmer can proof that the milk is safe again (https://www.gesetze-im-internet.de/tier-lmhv/BJNR182800007.html).

One big problem for the sale of certified raw milk was the extra cost for the farmers (certification, testing, bottling, extra hygiene). Also, the license for production was expensive, which made it attractive mainly to owners of larger herds, whereas most UK cows lived in small herds in the 1930s. By 1930 only 480 of Britain’s 200,000 producers owned certified or Grade A (tuberculin tested) certificates (Barnett, 2000). Due to the high costs of certification the choice was made to reduce infections in the populations by pasteurization of milk rather than eradication of the disease.
4.3 EQUIPMENT, MILK-COOLING, AND CLEANING

There was a time that people only drank daily fresh milk from their own cows or goats, or from the neighbor farm. The time and distance between place of milking and place of consumption was short and in this period (within 12 hours) the milk did not change much due to the existing enzymes in raw milk, which could protect the first growth of bacteria. As mentioned earlier in the traditional areas of cheese processing, milk was transformed twice a day into cheese, a stabilized product that was kept for month or even years. The warm, fresh milk was processed within several hours after being milked.

Already in the early 20th century it was clear that raw milk was a risk for disease transmission and step-by-step the management around milking changed. Although the impact of single measures is hard to describe, it is clear that the buzz-words are attention for increased hygiene (cows, man and equipment), care for disease, and attention on the cooling chain. There is a huge impact of the technical development of milking, cooling, and transport on milk quality. Equipment for milking and processing went from wood till INOX and copper; systems developed from hand-milking till automatic milking; systems went from open to closed milking systems; closed pipelines rather than open buckets and cans; milk delivery in uncooled cans (30–40 L) was replaced by cooled bulk milk tanks.

To reach a high level of bacteriological milk quality (read: a low level of bacteria) traditional elements were used to change the farming practice: education and training, penalty and rewards, on-farm control and competition. Farmers received rewards, if they delivered a hygienic quality of milk over a long period of time. The reward could only be a yearly new shield on the wall in the milking room or at the barn that made farmers competitive.

The possibility to determine germs opened up the insight in spoilage and pathogenic bacteria, effect of temperatures, the way of cleaning. The impact of different choices during milking and processing led to the awareness for critical control points in the milk from single cow toward the consumer’s refrigerator. It also opened up the possibility for a price policy that positively or negatively affected the income from delivered milk. Penalties were paid for milk with repeated high levels of germs, somatic cell counts (SCCs), or if antibiotics were found in the milk delivered. In the delivery of fresh, unprocessed milk meant for direct consumption threshold levels of all kind of bacteria were low, much lower...
than in milk meant for pasteurization and additionally potential food-
borne pathogens were measured. Also here, there is a stepwise change of
content depending on the techniques into the laboratory.

An important change is the change in culturing of bacteria. In the tra-
ditional plate method, not every bacteria can be shown, due to the lack
of growth in specific media. DNA techniques (via PCR) are novel, strong
tools to detect every germ present in milk. In Italian raw-milk-vending
machines the positive samples based on real-time PCR was 2.7–9.4 times
higher than the culture-based method (Giacometti et al., (2013). Espe-
pecially as detection, in which farm area risks are present, this PCR
technique is a helpful tool. In times, when people are germaphobic, and
when quantitative risk assessment does not take place, the finding of any
bacteria can, however, lead to an over-reaction of officials and health
caretakers.

4.4 FRESH, UNPROCESSED MILK DISTRIBUTION NOWADAYS

The sale of fresh, unprocessed milk in the Western world is very different.
In the United States several states have legalized the sale, in others it is still
forbidden or limited. As the discussion on raw milk and food freedom is
an important part of the United States, the contradictive interpretations
and legislation between the 50 states are hard to explain. Across the
United States the following legalization is found (ARMM, 2015):
- legal retail sales: 10 states
- legal on-farm sales: 15 states
- legal herd- or cow-shares: 4 states
- no law on herd-shares: 6 states
- raw milk as ‘pet food’: 4 states.

Canada, Scotland, and Australia completely forbid the sale of any raw
milk (Ijaz, 2014), whereas in New Zealand, England, and Wales changes
in the legislation make the sale of certified raw milk easier. In contrast to
Australia the market for raw milk has been liberalized recently in New
Zealand as it is in England and Wales, where selling of raw milk must be
certified by the Food Standard Agency. Further in Europe there are still
very different interpretations of the EU food safety laws. In Germany,
certified raw milk (Vorzugsamilk) was allowed since the beginning of the
20th century. Also other countries had such legislation. In most EU-
countries, however, raw milk is not sold in retail stores, but only directly
from farms. This completely contradictive interpretation of risks within
the Western world shows that there is a huge political, rather than a scientific evaluation of the pros and cons of certified, fresh unprocessed milk, milk carefully produced by farmers with the final goal not to be heated for safety reasons. For the advocates of raw milk consumption the ban of raw milk sales is a denial of an informed personal choice, the freedom to choose for their own food and feeding pattern.

Five country cases will be presented in this chapter. One of the oldest systems still present, is the German Vorzugsmilk (1). This way of delivery and the control of the milk quality are very similar toward the upcoming voluntary self-certification via the Raw Milk Institute, an independent quality assurance body (Ijaz, 2014) (2) (United States, California). There is an upcoming interest to deliver fresh, unprocessed milk via milk taps (3) in towns rather than on the producing farm itself (Italy, Slovenia). Fresh milk can also be sent by post (4) (Canada, United Kingdom). Finally there are new legal bonds between farmers and consumers (5) to overcome the legal restrictions for delivery of raw milk, known as the system of cow- or herd-sharing (United States). Generally, in all places where farmers deliver fresh, unprocessed milk meant for direct consumption, attention is paid to hygiene at the farms, control of cooling chains, and presence of food-borne pathogens. The attention for specific germs is very similar between the systems, although threshold levels can be a bit different and the control of zoonotic pathogens depends partly on the specific circumstances and history within countries or regions.

4.4.1 German Vorzugsmilk

Vorzugsmilk is processed directly after each milking or if two milking times are collected, the morning after. This fresh, unprocessed milk can be delivered in shops, but is often delivered by the farmers themselves in daily milk tours in coolers or refrigerated cars, or distributed the milk to so-called drop-off sites. The character of Vorzugsmilk was the local delivery within a region. Farmers acted like the milkman in English towns, delivering fresh milk on a regular basis. Therefore the farmers needed to be in the immediate distance of cities or to be connected to distributors, who can guarantee a within 12 hours delivery. For safety reasons the legal best-before date of Vorzugsmilk is only 4 days, although consumers experienced that if such milk is handled properly, such milk can be kept for a period longer than 1 week (www.milch-und-mehr.de).
4.4.1.1 Prerequisites for Delivery of Vorzugsmilk

According to Regulation (EC) No. 853/2004 of the European Parliament it is necessary to label any raw milk for direct human consumption with the words raw milk. Each member state can maintain or adopt national rules based on local circumstances. Criteria are based on a total plate count (TPC < 100,000/mL), somatic cell count (SCC < 400,000/mL) and absence of Tuberculosis and Brucellosis (EU, 2004). In the practice of European countries the absolute values of plate count and SCC are maintained at much lower levels, whereas the list of germs to control for, is much longer than mentioned in these basic rules.

Since the 1930s Vorzugsmilk delivery already legally existed in several European countries (Austria, Switzerland, and Germany). Only in Germany the legal status of Vorzugsmilk is still present. After the first EHEC-crisis, lawmakers have forbidden the selling of any raw milk in kindergarten, elderly homes, and hospitals nursery school. A large part of the market therefore was broken away and several farmers saved their market through the installation of a pasteurization unit on their farm. Those farmers who continued the production of Vorzugsmilk changed their market toward private households and local stores (www.milch-und-mehr.de).

To maintain their legal status to sell Vorzugsmilk, farmers need to send one bottle of milk every month to the Veterinary State Control body. There are several markers, for which the milk is tested: markers for hygiene, udder infection, and zoonosis (Table 4.1). Two threshold levels are maintained: small m and large M. If the threshold “M” for one of the deliverables is exceeded, the delivery of milk can be stopped immediately. Based on a mandatory track-and-trace system of all milk charges the

<table>
<thead>
<tr>
<th>Marker</th>
<th>m</th>
<th>M</th>
<th>n</th>
<th>c</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacterial count/mL</td>
<td>20,000</td>
<td>50,000</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Enterobacteriaceae/mL</td>
<td>10</td>
<td>100</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Coagulase-positive bacteria/mL</td>
<td>10</td>
<td>100</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Somatic cell count/mL</td>
<td>200,000</td>
<td>300,000</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td><em>Salmonella</em>/25 mL</td>
<td>Negative</td>
<td>Negative</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Concentration pathogenic bacteria or their toxins</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensory abnormalities</td>
<td>Negative</td>
<td>Negative</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Enzyme phosphatase positive</td>
<td>Positive</td>
<td>Positive</td>
<td>5</td>
<td>0</td>
</tr>
</tbody>
</table>

To maintain their legal status to sell Vorzugsmilk, farmers need to send one bottle of milk every month to the Veterinary State Control body. There are several markers, for which the milk is tested: markers for hygiene, udder infection, and zoonosis (Table 4.1). Two threshold levels are maintained: small m and large M. If the threshold “M” for one of the deliverables is exceeded, the delivery of milk can be stopped immediately. Based on a mandatory track-and-trace system of all milk charges the
delivered milk will be recalled. Milk is still accepted for delivery, if only one item is above “m”. If failures are found (values between “m” and “M”, farmers have to re-test their milk. They sent in another five bottles of milk (Column n) and only two out of these five samples can be in between “m” and “M”, the other ones need to be below “m”. For all zoonotic diseases, samples always need to be negative and otherwise delivery will be stopped immediately (https://www.gesetze-im-internet.de/tier-lmhv/BJNR.182800007.html). In Box 4.1 an example is presented of a biodynamic farm delivering all its produced milk as Vorzugs milk. This farm shows the potential safety of this Vorzugs milk trading.

In contrast with farming in the past, nowadays the routine of milking has been adapted on the knowledge on the ecology of zoonotic bacteria, spoiling bacteria, environmental- and cow-depending mastitis bacteria. At milking there is an inspection of the teats and the udder; stable dirt, manure and soil is taken off the teats; the first milk is visually controlled on mastitis; teats can be predipped, washed and dried; there is a policy of one cloth per cow, if it is paper, cotton or even based on wood shavings; after milking teats can be dipped again with an antiseptical (often iodine based) to prevent penetration of germs in the open teat canal. If necessary, farmers use a sequence of milking, in which cows with a known subclinical mastitis are milked at last. Sometimes automatic systems are present that the teat cups are flushed with water in between two cows to avoid cross contamination.

The standard pathogen testing is to control for *Salmonella*, *Listeria*, *Campylobacter*, and toxins of EHEC. Depending on the local circumstances milk can be tested for additional zoonotic or mastitis germs. Additional requirements include the testing for udder infections of the cows that enter the herd as heifer or re-enter after the dry period (Box 4.2). The veterinarian monthly controls the health status of the herd during a farm visit.

Coenen (2000) described the results from Vorzugs milk-farms in comparison to “normal” farm milk (Table 4.2). Also the German Institute for Risk Assessment (Hartung, 2008) tested yearly both Vorzugs milk and general farm milk. Both studies concluded about the high hygienic standard of this type of Grade A raw milk, nevertheless zero-risk is absent.
BOX 4.1 Case Rengoldshausen, biodynamic farm, Überlingen, Lake Konstanz (Germany)

On this biodynamic farm 50 dairy cows produce Vorzugsmilk. The farm runs a system of nursing the calves with their own mothers, and raising all his male bull calves for meat production. The breed of cows is traditional brown cows (Orginal Braunvieh), and cows only receive grass (grazing) and hay as fodder. Ninety-five percent of the fresh, unprocessed milk is filled in bottles, sold directly from the farm, or via the neighbor organic trader (Bodan), who delivers the milk three times per week to larger cities in Baden—Wurttemberg and Bavaria.

In the below table, the data of milk samples (one bottle per month) regenerated by the state veterinarian are summarized. Data were taken into account from 2010 to 2014, presented per year and as average values. Below is the percentage of samples that exceed the accepted threshold levels (“m” and “M”).

<table>
<thead>
<tr>
<th>Year</th>
<th>Total germs (× 1.000/mL)</th>
<th>Enterococci (× 1.000/mL)</th>
<th>Coag. positive Staphylococci (× 1.000/mL)</th>
<th>Somatic cell counts (× 1.000/mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>1.4</td>
<td>2.7</td>
<td>2.7</td>
<td>36.7</td>
</tr>
<tr>
<td>2011</td>
<td>0.7</td>
<td>1.7</td>
<td>2.0</td>
<td>28.1</td>
</tr>
<tr>
<td>2012</td>
<td>1.0</td>
<td>8.0</td>
<td>1.5</td>
<td>23.9</td>
</tr>
<tr>
<td>2013</td>
<td>3.5</td>
<td>4.3</td>
<td>2.2</td>
<td>49.6</td>
</tr>
<tr>
<td>2014</td>
<td>3.2</td>
<td>2.4</td>
<td>2.0</td>
<td>22.6</td>
</tr>
<tr>
<td>Overall</td>
<td>Mean</td>
<td>1.6</td>
<td>3.2</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td>Median</td>
<td>1.7</td>
<td>1.7</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>5.0</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>90.0</td>
<td>142.0</td>
<td>811.0</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>0.0</td>
<td>3.2</td>
<td>2.9</td>
</tr>
</tbody>
</table>

Threshold level exceedance

M (capital) 1.8% 1.8% 1.8% 0.0%
m (lowercase) 3.5% 12.5% 7.0% 0.0%

Additionally seven food-borne pathogens or udder bacteria have been tested monthly: Verotoxins of *Escherichia coli*, *Campylobacter*, *Salmonella*, *Listeria*, *Yersina*, *S. agalactiae* plus multiple resistant *Staphylococcus aureus*. All milk samples always tested negative.

Source: Own data.
4.4.2 Raw Milk Institute (RAWMI)

Selling of raw milk in the State of California (United States) is legally allowed and the success of the farm Organic Pastures was the basis for the start-up of the RAWMI (www.rawmilkinstitute.net). The knowledge about raw milk safety and the experiences of Organic Pastures will be used to support other farmers in their search for the production of safe raw milk. In its mission statement RAWMI mentions that, “it will improve the safety and quality of raw milk and raw milk products through training and mentoring farmers, establishing raw milk guidelines, improving raw milk accessibility and production transparency, and education, outreach and research”. RAWMI will act as an independent, objective

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**BOX 4.2 Regulatory somatic cell count (SCC) levels in cow’s milk**

The threshold levels of somatic cells in bulk-tank milk have been lowered over the last decades. Nevertheless, the standards were set for prepasteurized milk, not milk meant for direct human consumption. In the United States, bulk tank SCC (BTSCC) were accepted till levels of 750,000 cells/mL since 1993, whereas in Europe the levels were already reduced to 400,000 in 1992 (Schukken et al., 1993). In several Nordic European countries this level of acceptance dropped to 150,000. The signal of the high SCCs is the presence of clinical and subclinical mastitis and the presence of mastitis bacteria in the milk. A linear relationship between the BTSCC and the percentage of infected udders was described (Eberhart et al., 1982). However, for all pasteurized milk produced, the safety of the consumption milk was taken over by the dairy plant. In contrast, raw milk produced for direct human consumption cannot accept such a high SCC level. If milk is not pasteurized, hazard bacteria, like *S. aureus* or *Streptococcus agalactiae*, have to be controlled through prevention strategies, the threshold levels of milk should be much lower.

The only method to accept a threshold level for a healthy udder is from the animal itself. In the first lactation of a healthy cow the monthly SCC of the complete milking are in between 40,000 and 60,000 cells/mL. Based on the total milk delivered of a single cow, a cell count above 100,000 cells/mL, was correlated with an infection in one of the four quarters of the udder (Hamann, 2002). His conclusions were based on a set of six changed milk components. If a cow gets older, her somatic cells always will get slightly higher, but a maximum of 150,000 in older cows is the limit. From an animal welfare point of view, the upper limit of the bulk tank should not exceed 100,000 (–150,000) cells/mL. Exceedance indicates the risk for unwanted bacteria in milk meant for direct consumption, however not for pasteurized raw milk.
Table 4.2 Prevalence of four food-borne pathogens in general raw milk and in Vorzugs milk (Coenen, 2000)

<table>
<thead>
<tr>
<th></th>
<th>General raw milk</th>
<th>Vorzugs milk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farms (N)</td>
<td>115</td>
<td>35</td>
</tr>
<tr>
<td>Milk samples (N)</td>
<td>149</td>
<td>74</td>
</tr>
<tr>
<td>Total germs</td>
<td>49,000</td>
<td>8,700</td>
</tr>
<tr>
<td><strong>Listeria</strong></td>
<td>10.1</td>
<td>*16.2</td>
</tr>
<tr>
<td>VTEC</td>
<td>0.7</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Salmonella</strong></td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Campylobacter</strong></td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

*All positive samples came from repeated milk samples of one single farm. Due to the control system this milk cannot be delivered for consumption.

third party, when it comes to certification standards of safe raw milk; it will list up certified farmers on its website and brings in transparency by the publication of data on milk quality and hygiene/safety of raw milk produced. RAWMI offers a mentoring and training program for farmers who wanted to become certified. RAWMI undertakes teaching activities and webinars to get farmers involved about all kind of issues relevant for selling of safe raw milk. Transparency of the farm is an important goal of becoming listed and a central document of each listed farm is its self-written Risk Analysis and Management Plan (RAMP) or Food Safety Plan: “Your listing portal will contain a biography about your farm operation and a link to your website. Consumers will be able to access your Food Safety Plan and accompanying checklists along with supporting documentation that your milk has been pathogen-free and low in bacteria counts. They can use this information to make purchasing decisions based on facts they can understand.” In this RAMP farmers describe how they will tackle, control, and solve important safety issues with regard to raw milk production. Through this procedure the farm crew is aware how to handle all kinds of potential risks in their farm. Organic Pastures writes about its own RAMP: “Our RAMP is a “Grass to Glass” comprehensive conditions and risk-based management system that assures consistent test outcomes through audited daily checklist-verification of all noncritical, GMP, SSOP and CCP raw milk safety elements. This management tool allows for regular team meetings and discussions to make any necessary changes to the plan as we learn more about safety issues and assess data” (ARMM, 2015).

Box 4.3 is a recent example, how Organic Pastures tackled and immediately solved the detection of a single EHEC positive milk sample.
Areas of risk, which need to be controlled, are: the introduction of new animals in the farm, handling of raw milk, environmental risks, feed sources, human, and nutritional factors. Like the German Vorzugsmilk farms, the farmer will regularly test their milk for indicator bacteria for hygiene as well as potential zoonotic bacteria. Also here there is a zero-tolerance, when it comes to the detection of zoonotic bacteria. The accepted levels of coliform bacteria are $<10/\text{mL}$, the total bacteria plate count should not exceed 5,000/mL.

### 4.4.3 Milk Sent by Courier

Father and son Phil and Steve Hook farm Longleys Farm organically. During three weeks a day Hook and Son (United Kingdom) distribute milk through a nationwide service in insulated cardboard boxes (“direct from our farm, direct to your door”): cooled transport overnight, delivered within 24 hours. For this purpose only the fresh milk of the morning milking is chilled to $2^\circ\text{C}$ and packed in polybottles (1 L). The organic, grass-fed herd lives in East-Sussex, south of the Capital of London, but Hook and Son deliver milk in Wales and Scotland. The testing procedure from the Food Standards Agency is only every 3 months (total germs and coliform bacteria). Additionally the company takes samples of raw milk, raw cream, and raw butter, which are tested every week at a commercial laboratory (total germs, coliforms, presence of pathogens). Yearly the cows are tested for TB, because of the presence of

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**BOX 4.3 Organic Pastures**

Organic Pastures (http://www.organicpastures.com) in California produces 3800 tonnes of milk per year, which is around 12 million servings of mainly fresh, unprocessed milk, and also raw milk products. In its internal controlling system in spring 2016, the farm tested positive for *E. coli O157:H7*. It was the first *E. coli O157:H7* case since the farm started a test and hold system for 15 years. There was an immediate recall of all milk sold and within 72 hours the internal biosafety control system detected one single cow shedding the bacteria. This action was possible due to the quick BAX PCR test present on the farm. Through a process of stepwise elimination, the problem could be traced back toward one single cow that was slaughtered. Before the State Control System on Food Risks could alarm for the situation, the farm already had detected and solved the problem.
infected baggers in different areas of the United Kingdom. Further the company follows a HACCP plan (Hazard Analysis Critical Control Point), which is a personalized, systematic preventative approach to food safety that has been drawn up with feedback from the local Environmental Health officers. All personal is trained for food safety issues (www.hookandson.co.uk).

4.4.4 Raw Milk Dispensing Machines

In most European countries tapping raw, chilled milk directly from the bulk milk tank, is allowed. The raw-milk-vending machine is a technological improvement, in which milk from a single farm is delivered into cities rather than people coming and visiting the farm on their own. This system is coming up in several European countries, like Poland, Slovenia, Estonia (Kalmus et al., 2015), and Italy. Remote locations of dispensers and therefore a disconnection between the farm and the milk, are not always allowed, which was shown after a test case in the United Kingdom. The farm Hook & Son placed a self-service machine in Selfridges Food Hall. After 3 months the Food Standards Agency intervened and the sale was postponed waiting for the judgment of the FSA. A similar situation exists in Germany and The Netherlands. In case of direct sale of milk from the bulk tank there must be a clear sign in the milking room, that raw milk should be kept chilled during transport and cooked at home before consumption. Since legalization in 2004, in Italy there are almost 1200 raw-milk-vending machines (www.milkmaps.com, accessed 01.07.2016). Italian milk intended for raw consumption via vending machines must fulfill specific criteria (Bianchia et al., 2013): “biosafety measures and own-check for producers, microbiological and chemical criteria for milk, and vending machine installation and management specifications.” Each dispenser is connected with milk from only one single farm. Since 2008 it must be a signposted that this milk should be boiled before consumption. So, the Italian regulation for milk from vending machines is made equal to milk sold directly from the farm bulk-tank milk. In seven Italian regions the zoonotic milk quality of these machines has been monitored (Giacometti et al., 2013). In total 61,000 samples were analyzed over a 4-year period. 178 positive samples (prevalence = 0.29%) were found for four food-borne pathogens tested (C. jejuni (0.09%), Salmonella (0.03%), Listeria monocytogenes (0.14%), and E. coli O157:H7 (0.04%)). There was an upward trend over this period of
time for both *Campylobacter* and *Listeria*. The paper mentions, that in “previous Italian studies performed at the regional levels confirmed the low prevalence of raw-milk contamination in comparison to international findings. This lower prevalence is probably due to the fact that farmers intending to sell raw milk must implement specific practices such as self-monitoring for meeting microbiological and chemical criteria for milk and management systems for meeting higher standards of good dairy-farming practices than other types of dairy farms.” Bianchia et al. (2013) tested Italian milk from vending machines in the Piedmont region. They found a significant correlation between a previous finding of pathogens and recurrence of contamination, which shows that the finding of pathogens is not always random, but can depend on the contaminations in a single farm. Bianchia et al. (2013) concluded that the number of positive samples in this type of milk is low. Further reduction can only be reached if the farmer is willing to adapt his herd management and follows further biosafety procedures. The existence of positive findings of food-borne pathogens at one single farm, although biosafety measures are already at a high level can be confirmed in other countries, where raw milk is sold for direct consumption. If we compare these results with the raw milk market in Estonia, the list of positive samples was much higher, although this milk was also certified for direct sale. Here, the frequency of control for zoonotic germs should be higher and threshold levels could be lower to protect the consumer of raw milk. Although several pathogens were not detected (*Salmonella* and *Campylobacter*), other germs were found (*S. agalactiae, S. aureus, Listeria*, and *E. coli*), plus the very high SCCs in general, there is a need for a better education of farmer and consumer (Kalmus et al., 2015). If such data were not found under German Vorzugsmilch-regulation much of this milk was not allowed to sell.

German veterinarians and health-care professionals do not control raw milk dispensers in the same way as the Vorzugsmilch. From a legal point of view milk tapped from an on-farm vending machine is similar to milk from the bulk tank. Such milk should be boiled and this is signposted by the farmer. The sale of raw milk from vending machines therefore should not be compared to the sale of fresh, unprocessed milk meant for direct human consumption (like RAWMI and German Vorzugsmilch-Association are promoting), unless the farms are certified as fresh milk producers. Without additional control of the milk and education of the farmers, the risk of milk sold through vending machines might be at the same level as general raw milk tapped from the bulk-milk tank.
4.4.5 Cow- or Herd-Sharing

In the United States the Farmer-to-Consumer Legal Defence Fund (FCLDF) supports farmers in the legal aspects of a cow-share program. On its website FCLDF writes: “in some US states sales of raw milk are illegal. The farmer can lose his or her Grade A-license and even go to jail for selling consumers unprocessed milk directly. In these states, consumers have been able to obtain raw milk directly from farmers by purchasing a share in a cow, goat, or in the whole herd. Even in states where sales of raw milk are legal, the permits (or inspection fees) are often very expensive. Cow or goat-share programs allow farmers to provide raw milk to consumers without cumbersome and expensive paperwork mandated by the state.”

About the US cow-share agreements Wightman et al. (2015) wrote: “herdshare, cow share, or agister agreements (the term agister is used in fresh milk herdshare agreements to refer to the person hired to provide boarding and other services for owners of the herd animals) are legal arrangements for obtaining fresh milk. Such contracts are legal and valid, as guaranteed by the Constitution of the United States of America. The consumer does not buy milk from the farmer. Rather, the farmer is paid for the service of keeping the dairy animal and his/her labor for milking and storing the milk. The amount of milk available to a shareholder depends on the number of shares being held, and the seasonal variation in milk production.” From the point of view of pathogen transfer, there is no difference between cow-share systems and a system in which farmers sell bottled raw milk or sent raw milk by chilled post. In all cases the safety of the milk has to be in the front of discussion, and for the daily management practice related to hygiene, mastitis, and cleaning, should confirm the highest standards.

To overcome the discussion on raw milk consumption, the FCLDF writes:
- The herd is tested free of TB and brucellosis.
- Teats of cows are cleaned with approved solution before milking.
- Cows are milked in a clean barn or milking parlor.
- Milk is kept chilled.
- Milk is tested regularly to ensure absence of pathogens.

4.5 ORGANIC AND BIODYNAMIC MILK PRODUCTION SYSTEMS WORLDWIDE

As mentioned earlier Lady Eve Balfour, founder of the Soil Association, saw “pasteurization as a confession of failure” and like the practice
nowadays in German Vorzugs milk as well as RAWMI in California, she principally wanted a safe, raw milk production based on intensive knowledge. Although there is not a direct necessary relationship between raw milk sales and organic agriculture, organic farmers often feel another interest, when it comes to raw milk and raw milk products. Based on their philosophy of farming, biodynamic farmers do not homogenize their milk, if pasteurized. Biodynamic and organic farmers are staying close to nature (Verhoog et al., 2007) and respect the integrity of life. Pasteurization therefore can already be one step too far, because it destroys the integrity, the origin of the product. Raw milk is not made for pasteurization, and organic farmers want to produce a whole product, whole in terms of undisturbed, nature-like. Another level in the discussion on the use of nature is, that organic farmers want to mimic nature, and use natural rather than artificial processes to develop a healthy farming system. For that reason organic cows should have access to pasture, eat hay or silage rather than maize and concentrates. The cow is a ruminating creature, which is present to digest roughage, not grains. Cows have a complex digestion stomach system present to digest roughage based on rumination. This choice of mimicking processes in nature results in organic milk with a different fatty acid pattern, based on higher poly-unsaturated fatty acid levels, especially when cows have plenty access to pasture (Kusche et al., 2014). Another aspect of the systemic approach in organic farming is that farmers look for preventive solutions rather than end-of-pipe solutions. If organic farmers choose for raw milk (products), it is because raw milk is connected with the support of health based on the whole product. Although scientists now are trying to unravel, which element(s) in raw milk is responsible for the suppression of asthma and atopic diseases, organic farmers are staying with raw milk and raw milk products, which should be safe. In their focus safety does not erase from an isolated part, but from milk as a whole. The German market for fresh, unprocessed milk (Vorzugs milk) for direct consumption has been declined dramatically, since the EHEC-crisis in the 1990s. Vorzugs milk was for almost 100% in the hands of conventional farmers. Most of them gave up the sale of unprocessed milk. Nevertheless still organic and biodynamic farmers converted to the sale of legalized raw milk. They experience this as a challenge of complex management to produce a safe, unprocessed food, like raw milk. From the point of view of a consumer, it makes sense that farmers combine several potential health aspects present in milk: milk should be (1) raw, unprocessed from (2) grass-based, extensive farm
holdings, and (3) the production without any use of antibiotics. In practice those farmers use (4) local, dual-purpose breeds, adapted to their environment.

4.6 CONCLUSION: ACTIVE CONTROL OF FRESH, UNPROCESSED MILK FOR DIRECT CONSUMPTION

Most papers on the food safety and the hazard situation of raw milk mention the potential hazard of any raw milk (Oliver et al., 2009; Claeys et al., 2013; Bianchia et al., 2013). Bianchia et al. (2013) for instance concluded that “unpasteurized milk can be vehicle of a variety of microorganisms and can be an important source of food-borne illness outbreaks, especially if consumers are young, elderly, or ill.” Others compare it with Russian roulette and you never know, when the guns fires (Gumpert, 2015). The conclusion that pasteurization is the most safest way to reduce the harmful microorganisms might be the right conclusion in general, however not in the case of farmers, who consciously produce fresh, unprocessed milk meant for direct consumption. In the case of the German Vorzugs milk farmers and in the methodology applied by RAWMI-Institute, farmers get tools to reduce the chance of transmission of food-borne pathogens. Therefore the conclusion of Bianchia et al. (2013) is, that it is important that farmers get “trained properly on food safety measures and the application of good practices for farmers selling raw milk.” An important element is a positive farmer’s attitude toward the production of raw food, and the meaning of this for good conditions management with daily checklists for controls and measurements. Since several food-borne pathogens are connected with the feces of the animal, proper milking practice, and proper cleaning of cows and equipment are the most important step to reduce the risk of contamination (Ricci et al., 2013). Another important theme is the maintenance of a low mastitis-level in the herd. Good praxis could be implemented according to HACCP procedures and the exchange of experiences between raw milk producers. In the case of Organic Pastures, who is one of the biggest raw milk sellers worldwide and a pioneer in this topic, there is an internal laboratory present to test all kinds of charges of milk in different rhythms. To protect the raw milk sellers from failures, a test and hold protocol with a low cost, on-farm lab monitoring every bottling for hygienic indicator bacteria (coliform and APC/SPC) will protect the consumer far more than a once-a-month postconsumptive pathogen test. An increase
of raw milk sales needs to be assisted by the latest rapid on-farm milk testing technology, which is available nowadays. Therewith certified, raw milk can be as safe as pasteurized milk.

Through law, farmers selling raw milk are responsible for the maintenance of the health of their customers. If raw milk is distributed in single packages by the farmer an active controlling system, often by the authorities, is present to prevent that people get sick and if there are problems, it must be clear, how a recall of the milk is organized or how problems can be tracked and traced, and finally solved.

4.6.1 Testing Records, Record Keeping, and Identification Systems

The control of the production of safe, fresh unprocessed milk is based on:

- chilling and cold chain control: Quickly chilling, maintenance of chilling during processing and handling, not breaking the cold chain during processing, storage and transport
- control of mastitis, mainly *S. aureus*, also *S. agalactiae*
- control of SCC per cow
- control of hygiene at milking, cleaning and in contact with milk equipment, mainly through total bacteria plate count, *E. coli* or *Enterococci*
- absence of zoonotic bacteria (zero tolerance), like EHEC, *Listeria*, *Campylobacter*, *Salmonella*, also *Brucella* or Tubercle bacteria.

4.6.2 Track and Trace Systems On-Farm

For the safe production of raw milk it is necessary to build-up such a system that a recall is possible. It depends on the intensity of the internal control system on the farm, how quickly a farmer can reply, if bacteriological mistakes are found. Two levels of control are possible, one from every batch of raw milk produced and bottled, secondly based on a systematic regular control at the farm and the maintenance of thresholds.

4.6.3 Teaching, Training, and Exchange

Maybe the most important of all, is to find motivated and skilled farmers. Farmers who are willing to produce safe, unprocessed milk, because of conviction not mainly for market purposes. In the environment of institutes, like RAWMI (United States) and the Vorzugsmilk-foundation (Germany), farmers can get information and training about raw milk handling.
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