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Class: Milk Hygiene

Sources of microorganism in raw milk

The initial number and type of microorganism in fresh raw milk depend on a number of sources:

1. The udder and teats (the interior and exterior conditions).
2. The milker and milk handlers.
3. Water supplies.
4. Air.
5. Milking equipment.
6. The subsequent storage and transport condition may further increase the microbial number if proper cooling (refrigeration) is not practiced.

I. Internal contamination

A- The interior of the normal udder:

Milk when secreted in the healthy udder is completely sterile but once permeated through ducts and reservoirs of the udder, organisms are carried into it especially from the walls of the teat canal. These bacteria enter through teat opening and spread in the interior of the udder (lactiferous ducts) by their physical movement; meanwhile, the majority of these bacteria come down in the foremilk. These bacteria may range from a few hundred to thousands per ml of milk. They are washed out by first few streams of milking with drawn from the udder; therefore, fore-milk usually contains the largest counts or number of bacteria. e.g: *Micrococci, Streptococci, and Corynebacterium.*

B- Interior of infected udder (mastitis):

1-Subclinical form of mastitis contributed about 10000 bacteria/ml of milk.

2- Clinical form of mastitis contribute to over 10 million bacteria/ml (such high numbers are excreted in Streptococcal and coliform mastitis).

Type of microorganism contributed by this type of sources:

- 1- *Staphylococcus aureus*
- 2- *Streptococcus agalactiae*
- 3- *Streptococcus dysagalactiae*
- 4- *Streptococcus uberis*
- 5- *Escherichia coli*
- 6- *Corynebacterium pyogenes*
- 7- *Leptospira*
- 8- *Bacillus cereus*
- 9- *Clostridium perfringens*
- 10- *Rickettsia*

C- **Blood (diseased animal):** circulate blood pathogens in blood stream in animals as the following common diseases:

- 1- Bacteraemia
- 2- Viraemia
- 3- Rickettsaemia.
- 4- Toxoplasmosis.

Through the blood streams, microorganisms are normally shed in the milk with absence of clinical signs.

The causative agent of these diseases is:

- 1- *Brucella* spp.
- 2- *Mycobacterium tuberculosis*
- 3- *Clostridium botulinum* (cause botulism)
- 4- *Coxiella burnetti*
- 5- *Leptospira* (cause leptospirosis)
- 6- *Listeria*

II. External contamination

As pointed out before, the milk when is secreted is completely free from bacteria but, this contamination occurred due to many factors contributed to the infectiousness.

A- The exterior factors related to the animal body (udder, teats, and belly, flanks, and tail):

The surface of animal body is always seen grossed with soil, manure, muds, and beddings. It represents a prolific source of bacteria can readily transmitted to the udder and cause mastitis. Cleanliness of udder very accurate that can be a protective factor from any probability of infection with a microorganism. Also, flanks and udder need to be clipped, washed and dried frequently. Microorganisms associated with dirt condition often forming gas such as Coliform and Clostridium groups of bacteria species.

B- Milkers or handler factor: different organisms may be transmitted from handlers to the udder when they practice milking. The milker hands probably are a source of pathogenic bacteria and convey from an infected cow to the healthier. Common diseases caused by bacteria due to milking process is:

- 1- Typhoid fever.
- 2- Diphtheria.
- 3-Scarlet fever.
- 4- Septic sore throat.

These as well transmitted from an ill person or carrier through milk to susceptible individual who consumed the contaminated milk. All milking tools or utensils should be clean with a good disinfected liquid and hot water to prevent infection. Clothes of handlers or animal owners need to be cleaned especially after finishing works in the farms. Another common microorganism that can be possibly transmitted in the animal farm and between handlers due to unhygienic practices is *Staphylococcus aureus*.

C-Milking utensils: the meaning of utensils includes all of equipment or containers that milk or milk products are handled, processed, stored, and transported. They include pails, cans, and milking machine. As soon as fresh milk comes into contact with inadequate cleaned and sanitised utensils, milk will be contaminated with one of the germs or may be more.

Type of microorganisms contributed by this source are:

- 1- *Streptococcus agalactia*
- 2- *Staphylococcus aureus*
- 3- *Bacillus cereus*

D- Aerial contaminated or atmosphere: Feeding of dusty hay and grains before shown to contaminate the milk to some extent. Brushing dairy also found to increase the bacterial contents because of the air borne contamination.

Type of microorganisms contributed to this source of contamination found it.

- 1- *Micrococci*.
- 2- *Bacillus* spores.
- 3- Mould spores.

E- Farm water supplies: Farmers always rely on water from river, lakes, and wells to supply their animals with water. These water resources may be contaminated with different type of microorganisms and transmission to the animals is quite possible especially if piped without being chlorinated to eliminated pathogenic agents. Chlorination is very important procedure to treat the water before used for suppling animals.

Type of microorganisms contributed to this source are:

- 1- Coliform (*Streptococcus* & *Clostridium*).
- 2- Saprophytic derived from soil and vegetation.
- 3- *Pseudomonas* and other gram-negative rods.
- 4- *Bacillus* spore.

F- Flies and Rodents: the contamination of milk from flies is very common, as they carry several types of microorganisms on their wings and legs from sewage or infected sputum, uterine discharges, and water supply. In this manner of transmission of pathogenic bacteria may be carried subsequently to the milk. The microorganisms are transmitted by this way of sources include:

- 1- Typhoid
- 2- Tuberculosis.
- 3- Diphtheria
- 4- Anthrax

G- Storage and transport: The improperly cleaned and sanitised equipment used for storage water (milk can or bulk tank) and transport tanks of raw milk might increase the bacteria counts depends on hygienic level. Improper cooling/refrigeration of raw milk during storage and transport leads to increase the number of bacteria particularly Psychrotrophic (*Bacillus* spore), *Pseudomonas* spp, *Proteus vulgaris*, *Streptococcus* spp, and *Lactobacillus* spp.

Management diary farm

Cleaning and Disinfection on the Dairy Farm

Cleaning and disinfecting are imperative to maintain the wellbeing and health of high producing animals, such as dairy cows. This is especially the case in intensive modern housing where high density and high productivity increases the infection pressure. Thorough cleaning and adapted disinfection can help decrease the pathogen level and prevent or break the disease cycle.

The reality is that one unique disinfectant cannot match all the different sources of contamination existing at farm level. The choice of the product to be used is made according to the answers given to the following questions:

- Against which germs am I disinfecting? Know your enemy before the fight!
- Which surfaces have to be disinfected? The disinfectant should be adapted to the material and to the level of organic matter.
- How and how often should I disinfect?

Housing hygiene

Unlike some livestock systems, the dairy farm does not have the luxury of an 'all in, all out' stocking policy. However, the terminal disinfection of individual buildings or boxes is possible. The reduction of bacteria in the immediate surroundings must reduce the opportunity for bacteria to gain access to the animal and cause diseases. Remove all bedding and equipment before soaking and cleaning. The nature of the surfaces will influence the efficacy of the disinfection. Rough, porous surfaces are harder to disinfect than smooth surfaces. Porous surfaces are also harder to clean than smooth surfaces. Porous surfaces will therefore have heavier soil loads after cleaning, which further increases the difficulty of disinfection. A broad-spectrum disinfectant with penetration enhancers should be used.

Milking parlour hygiene

The milking parlour is a high density place so should be disinfected twice daily. Surfaces should be cleaned regularly to avoid multiplication of pathogens in this frequented area. As the milking machine is cleaned every day, it should be the same for the milking parlour itself. After each milking, rinse the milking parlour with water. The automatic milking parlour is often even dirtier as the robot cannot do everything by itself and should be cleaned daily by hand.

Calf hut, calf pen and calving box hygiene

Calves are born without an immune system, so early exposure to pathogens can be deadly. Cows also experience a natural decrease in immune system function correlated to the stress of calving which can increase their risk of disease. By reducing exposure to pathogens at these

critical times, farms give calves the best possible start in life, and cows the best chance to ensure a good profitable lactation. **Against which germs am I disinfecting?** Calf pneumonia and calf scours cost the farming industry worldwide vast sums. The losses result not only from deaths, but from reduced feed conversion, poor growth and the cost and labor associated with treatment. Focusing on neonatal calf diarrhea (NCO), the most critical period is in the first few days following birth. Colostrum collection equipment should be cleaned immediately after every use and disinfected regularly to avoid development of a biofilm. Additional losses occur when calves are kept in close confinement, where the opportunity for transmission of the causative agents of NCO is enhanced by their build-up in the environment. Pathogens responsible for NCO can be viruses (rotavirus, coronavirus), bacteria (*E. coli*, salmonella) or parasites (*Cryptosporidium parvum*). The disinfectant used must have a spectrum covering those three types of pathogens. For bacteria and virus, there are a lot of active substances available on the market (iodine, glutaraldehyde). For *C. parvum* it is not so easy. Only a few alternatives are available on the market.

Calf hutches, calf pens and calving box must be cleaned and disinfected between calves. As the oocysts of cryptosporidium are highly resistant in the environment (survival for several months if not exposed to extreme temperatures), implementing a good cleaning and disinfecting program is critical to reduce the environmental oocyst load. Buckets, feeders and drinkers must also be disinfected and rinsed afterwards. How and how often should I disinfect? The infectious pressure increases with the accumulation of bacteria, viruses and oocysts in the environment. The best option is to clean and disinfect before each entry of animals and manage as an all in - all out system.

People hygiene

The hands of farmers, directly in contact with cows and equipment, can be a vector of pathogens. Fast killing effect, broad spectrum and soft for the skin are the required properties of the disinfectant used for hand hygiene. Decontaminating soap or disinfecting alcohol solution are available. The critical characteristics required from a disinfectant used in a boot bath are speed of disinfection and broad spectrum. Hand and boot disinfection should be applied by the farmer before and during milking, and also when going from one group of animals to another (for instance dairy cows to then handling calves). Boot baths should be regularly cleaned and refreshed with new disinfectant as many products will lose efficacy with organic material from the bottom of boots. To extend the life of boot washing stations, have employees/visitors rinse boots before disinfection. This should also be applied to all external people entering the farm with a boot washing station at the main entrance to the dairy.

Milking machine hygiene

The milking machine can be a source of infection resulting in an increase in clinical and subclinical mastitis and a decrease in milk quality. Therefore, it is of great importance that a strict cleaning and disinfecting protocol is followed. The milking machine should be cleaned after each milking with an acid or an alkaline. A chlorinated alkaline product allows

disinfection of the system. Peracetic acid combined with hydrogen peroxide are also sometimes used to disinfect the system. The dilution should be carefully selected as it can damage the rubber. Milking equipment should be cleaned after each milking, for farms where parlor pressure is high, the equipment should be cleaned at least once every 24 hour period and should be in use for the rest of the day (not sitting idle without washing). Issues with cleanliness can be monitored with bacteria counts from the lab. The exterior of the milking cluster (teat cups and liners) should be rinsed at the end of every milking and during milking if it gets manure on it. The milking clusters should be scrubbed with soap and water if manure does not easily wash off.

Animal hygiene

The three main diseases with major economic significance are mastitis, infertility and lameness. Two out of three have infectious components. Thus, using an adapted disinfectant is essential for the control of these diseases and consequently for farm profitability.

Teat hygiene

There are three dangerous periods when cows are more vulnerable to mastitis causing agents:

1. During milking, if teat preparation is not optimal.
2. After milking, if the cow lies down in a dirty area with opened teat sphincters.
3. During the dry period.

During milking, cows 'share' the milking machine and it is a source of contamination from one cow to another cow or one quarter to another quarter. Be aware: whatever bacteria are not removed from the teat surface before milking machine attachment, will end up in the milk!

Pre-milking preparation with teat disinfection is a requirement of the Pasteurized Milk Ordinance (PMO).

A detergent and disinfecting solution can be sprayed on the teats or applied with a dip cup as a liquid or foam, then the teats are dried with a single use paper towel or reusable cloth towel which are laundered between uses. Dip cups or spray bottles should be cleaned and disinfected regularly and can be put through the wash cycle in some systems. Reusable cloth towels should be laundered with hot water, have chlorine added to the washing machine and dried completely to reduce the bacterial load on the towels. Washing machines and dryers should not be overloaded to allow for thorough cleaning and drying.

After milking the risk of contamination is high because the teat sphincter is open and can stay open for two hours or more after milking (longer if there is higher unit on time or other stress to the teat at milking). The Food and Agriculture Organization (FAO) highlights the importance of the post-milking teat disinfection because it kills possible germs that get on the skin during the milking process (contagious pathogens which can result in mastitis). It is also

important to cover the period between milkings. As teat dips are applied 2-3 times daily on the skin of the cow, it is critical to use well tolerated formulations which will not cause dryness and cracking of the teat skin.

During the dry period

Hygiene of the cows, directly linked with environment hygiene, is of great importance in mastitis control and prevention during lactation AND the dry period. Again, with the prevention of a buildup of mastitis pathogens in mind, it is important to keep dry cow pens as clean as possible by making sure that stall beds are regularly scraped and new/clean bedding added regularly. Dry cows on a bedded pack should have fresh bedding added frequently and the pack should be fully cleaned out regularly.

Hoof hygiene

Considerable economic losses are attributable to lameness due to the cost of treatment, decreased milk production, decreased reproductive performance, and increased culling. The incidence of lameness has steadily increased over the last 20 years. Be proactive! Don't wait to have a high prevalence in the herd before setting up a prevention strategy. The challenge regarding hoof disinfection is to find a disinfectant efficient in heavily contaminated solutions. The disinfectant should also reach the bacteria that are often deep in the tissues. Herd measures like footbaths, hoof mats and foaming systems are essential to control the spread of the disease. Footbaths should be regularly dumped and replenished to ensure that solutions remain effective.