



Sources of microbial contamination of milk and milk products

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Milk secreted from uninfected animals udder is almost sterile and invariably, it becomes contaminated during milking, cooling and/or storage. It is an excellent medium for the growth of bacteria, yeasts and molds that are the common contaminants of any food material. Their rapid growth, particularly at high ambient temperatures can spoil the milk for liquid consumption and for manufacturing dairy products.

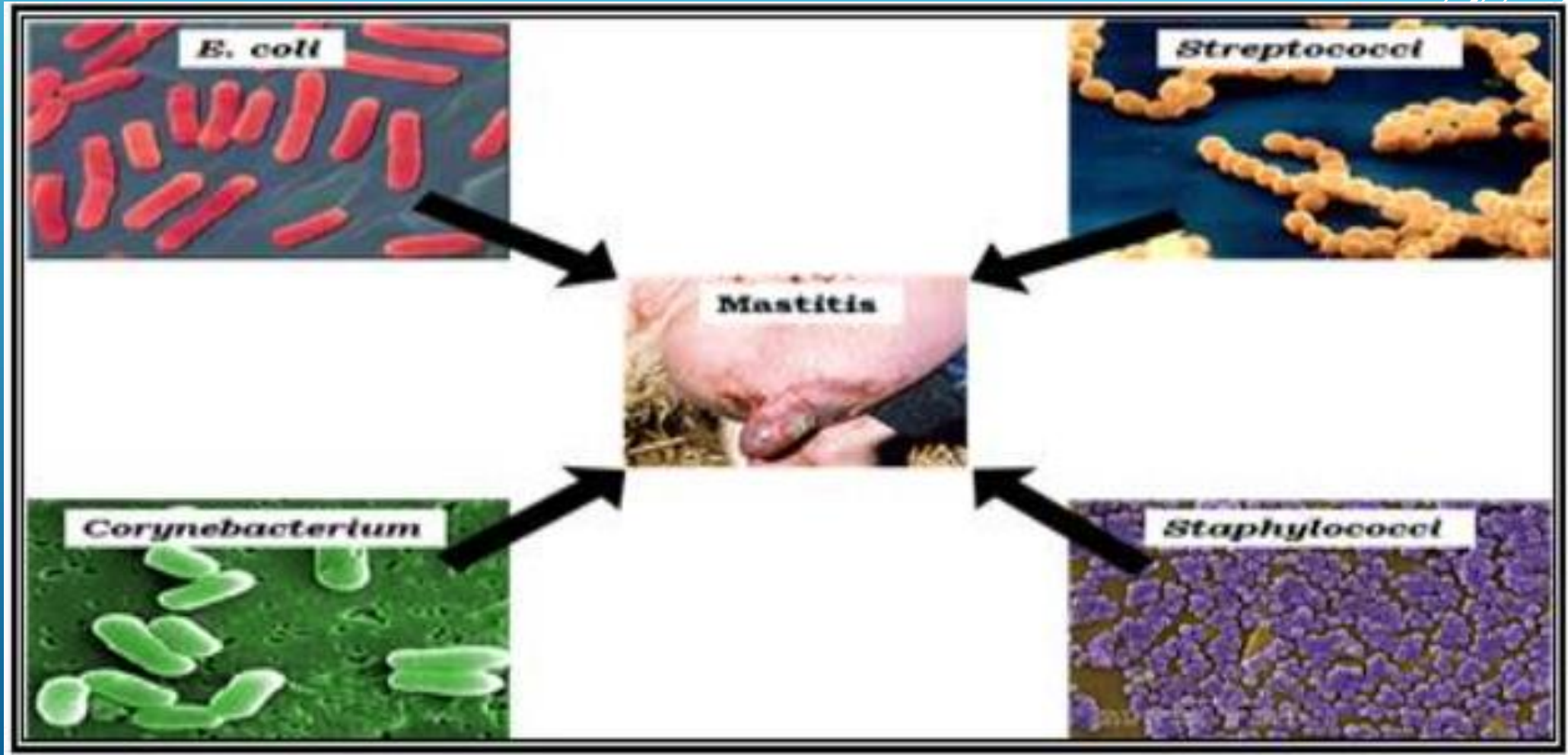
Interior of udder

Varying numbers of bacteria are found in aseptically drawn milk with the reported counts of <100-10,000 CFU/ml from normal udder, but an anticipated average is 500-1000 CFU/ml in advanced countries. Microorganisms enter the udder through the duct at the teat tip that varies in length (from 5-14 mm) and its surface is heavily keratinized. This keratin layer retains the milk residues and exhibit antimicrobial activity. Because of this discarding of first few streams of milk helps in lowering the counts of microbes in milk. Milk from different quarters also vary in numbers. Different species of bacteria that are found in milk, as it comes from udder are very limited as given in Table.

Presence of different microbial groups in raw milk

Group of microbes	Percent range
Micrococci	30-99
Streptococci	0-50
Asporogenous Gram positive rods	<10
Gram negative rods	<10
Bacillus spores	<10
Other groups of microbes	<10

The influence of mastitis on the total bacterial count of milk depends on the type of the infecting microbe. Most common microbial agents of mastitis in milch animals are *Staphylococcus aureus*, *Streptococcus agalactiae*, *Streptococcus dysgalactiae*, *Streptococcus uberis*, *Escherichia coli* and *Corynebacterium pyogenes*.



Animal shed and surroundings

Milk produced on farms with poor hygiene practices may undergo significant spoilage and have a shorter shelf-life, when compared to milk produced under hygienic conditions. Microbes associated with the bedding materials include:

- ◆ Coliforms
- ◆ Spore-formers
- ◆ Staphylococci
- ◆ Streptococci
- ◆ Other Gram negative bacteria

Milking equipment (storage containers and transportation systems)

Improperly cleaned milking and cooling equipment's are one of the main sources of milk contamination. Milk residues left on the equipment contact surfaces supports the growth of a variety of microbes. Although natural inhabitants of the teat canal and skin; microorganisms associated with contagious mastitis do not grow well on these equipment's, it is possible that certain strains associated with environmental mastitis may grow to a significant level.

Unclean or improperly cleaned milk cans and lids if they are still moist, results in multiplication of thermophilic bacteria like *Bacillus cereus*. Improperly sterilized milking machines contain thermoduric micrococci, *Bacillus* spp. and *Microbacterium* spp. predominantly compared to coliforms and streptococci. Rubber hoses predominantly contribute to pseudomonads rather than thermodurics.

Microorganisms are widespread. Microbes are distributed everywhere in the environment surrounding us. They are found in the

➤ Soil

➤ Water

➤ Air

➤ Plants

➤ Animals

➤ Food products

➤ In the human body and on the surface of the human body



Microflora of air

Air for microorganisms is less favorable environment, than soil and water.

There are almost no the nutritious materials necessary for reproduction of bacteria. Desiccation and the ultraviolet rays operate perniciously on microorganisms.

Nevertheless, many microbes in air can be saved more or less long time.

Main sources of microbial air pollution is the soil, water and man.

Airborne contamination

Aerial contamination of milk by bacteria is insignificant, in comparison to microbes with those that are derived from the teat surfaces. The microbial counts of air in sheds rarely exceed 200 cfu/l. Micrococci account for >50% of the aerial microflora. Air contains dust, moisture and bacteria; hence its entry should be minimized in milk.

Micrococci, Coryneforms, *Bacillus* spores, streptococci, and Gram negative rods are the major genera present in air. In general, more air incorporated into milk leads to the faster growth of bacteria. Following are some of the practices that increase aerial counts in milk:

- ◆ Sweeping of floors just before milking process
- ◆ Handling hay and feed shortly before milking process
- ◆ Brushing of animals prior to milking process
- ◆ Having the dusty bedding materials for animals
- ◆ Allowing dust and dirt to accumulate on the walls or ceiling of sheds

Water supplies

At dairy-farms, the water can be a predominant source of microbial contamination. Water used in production should be of good bacteriological quality. Inadequately or uncleaned, storage tanks, untreated water supplies from natural sources like bore wells, tanks and rivers, may also be contaminated with the faecal microbes (e.g. Coliforms, *Streptococci* and *Clostridia*). In addition, a wide variety of saprophytic bacteria (i.e. *Pseudomonas*, Coliforms, other Gram negative rods, *Bacillus* spores, *Coryneform* bacteria and lactic acid bacteria) may also be present in water and may contaminate the milk potentially. The warm water used for udder washing is potent source of *Pseudomonas* and Coliforms which may even cause mastitis.

Personnel Hygiene



Personnel handling milk and milk products constitute one of the most important sources of microbial contamination including potential pathogens in these products. Hence, personnel hygiene plays a very significant role in influencing the microbiological quality of the milk and milk products which, in turn, may affect the health of the consumers.

All stakeholders including producers, manufacturers, food handlers and consumers have a responsibility to assure that food is safe and suitable for consumption. Both government and industry have the responsibility to provide safe and suitable milk and milk products for consumers practicing principles of food hygiene. Any person who directly handles packaged or unpackaged food, equipment and utensils or food contact surfaces and is therefore expected to comply with food hygiene requirements. Food handlers are potential sources of microorganisms that cause illness and food spoilage. Parts of the body that contribute to the contamination of food include the skin, hands, hair, eyes, mouth, nose, respiratory tract, and excretory organs. These parts are contamination sources as carriers, through direct or indirect transmission, of detrimental microorganisms.

Employers should emphasize hygienic practices of employees as follows

1. Employees should be provided training in food handling and personal hygiene.
2. A regular inspection of employees and their work habits should be conducted. Violations of practices should be handled as disciplinary violations.
3. Incentives for superior hygiene and sanitary practices should be provided.
4. Food handlers should be responsible for their own health and personal cleanliness. Employers should be responsible for making certain that the public is protected from unsanitary practices that could cause public illness.

Personal hygiene is a basic step that should be taken to ensure the production of wholesome food.

Employee Responsibilities--- Although the employer is responsible for the conduct and practices of employees, responsibilities should be assigned to employees at the time employment begins.

- ❑ Employees should maintain a healthy condition to reduce respiratory or gastrointestinal disorders and other physical ailments.
- ❑ Injuries, including cuts, burns, boils, and skin eruptions, should be reported to the employer.
- ❑ Abnormal conditions, such as respiratory system complications (e.g., head cold, sinus infection and lung disorder), and intestinal disorders, such as diarrhoea, should be reported to the employer.
- ❑ Personal cleanliness that should be practiced includes daily bathing, hair washing at least twice a week, daily changing of undergarments and maintenance of clean fingernails.
- ❑ Employees should tell a supervisor that items such as soap or towels in washrooms should be replenished.
- ❑ Habits such as scratching the head or other body parts should be stopped.
- ❑ The mouth and nose should be covered during coughing or sneezing.
- ❑ The hands should be washed after visiting the toilet, using a handkerchief, smoking, handling soiled articles, or handling money.
- ❑ Hands should be kept out of food. Food should not be tasted from the hand, nor should it be consumed in food production areas.
- ❑ Food should be handled in utensils that are not touched with the mouth.
- ❑ Rules related to use of tobacco should be enforced.

GOOD HYGIENE HABITS

You Should Teach Your Kids Early



Oral Hygiene



Bathing Ritual



Hair Care



Foot Hygiene



Toileting Hygiene



Hand Hygiene



Coughing and
Sneezing Hygiene



Home Hygiene

To explore more, visit www.Top10HomeRemedies.com

Mechanized hand washers



Hygiene monitoring of Personnel

The scale of marks for judging the results of bacterial examination are "excellent" is given to the workers from whose hands washings show < 2000 , "good"- 2000 to 5000 bacteria, "fair" - 5000 to 10 000 CFU/ ml. and $>10,000$ is "bad".



Swab



Swabbing of hands



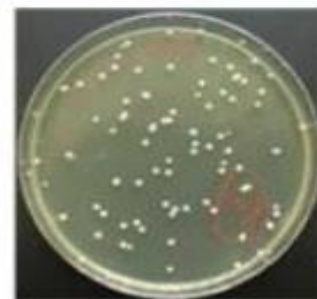
Plating on selective media



Listeria monocytogenes on PALCAM agar



Coliform on Violet red bile agar



Total bacteria count on Tryptone Dextrose agar

Thank you 