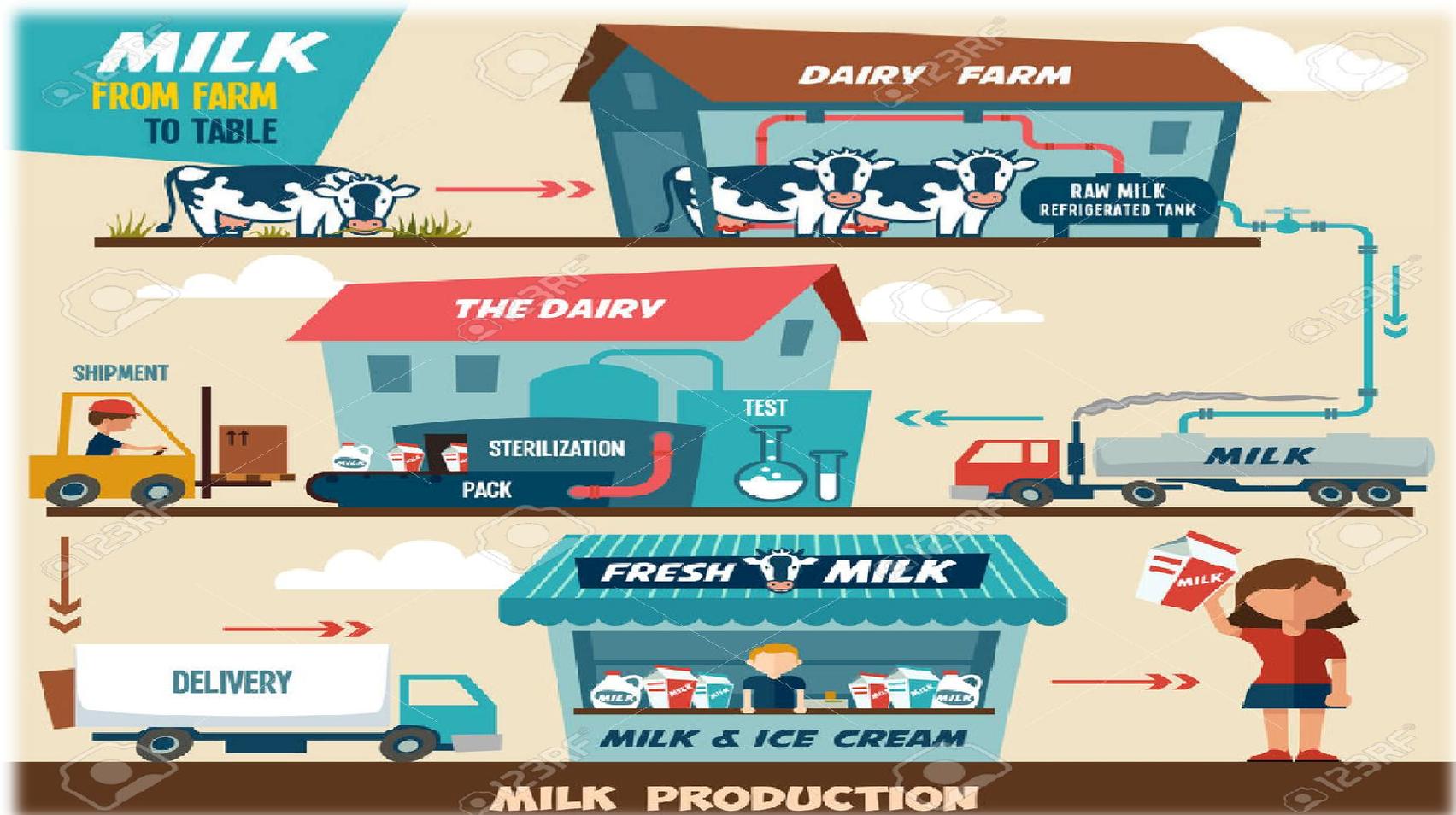
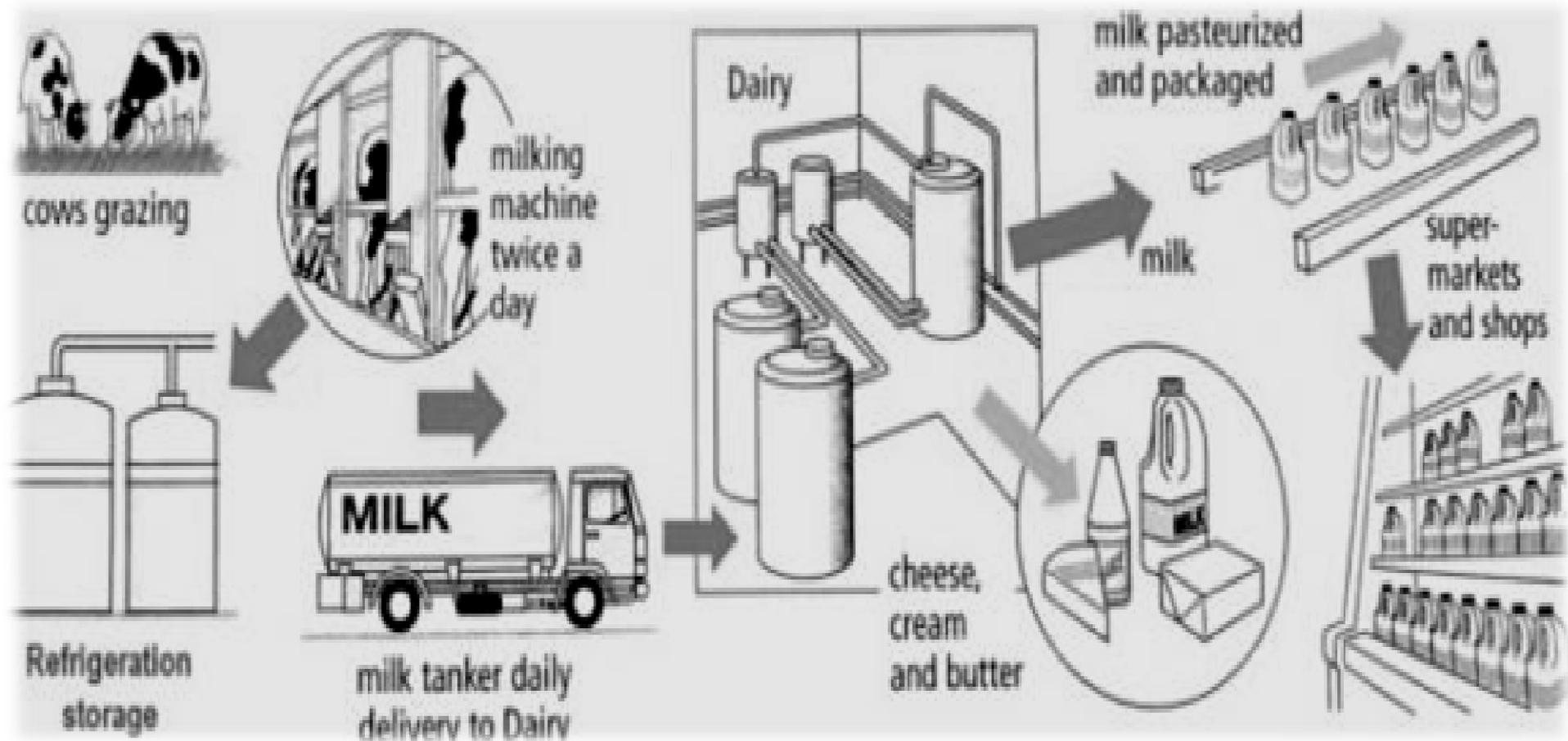


Factors Affecting the Microbiological Quality in reference to Production, Processing, Storage and Distribution



Production and Processing



- **The various stages in the milk processing chain, from milking the cow to consumption, must be properly controlled to assure the quality and safety of milk and dairy products.**
- **Adherence to basic good agricultural practices and good manufacturing practices is one of the first steps. HACCP can be applied as a tool to assess hazards and establish control systems to focus on preventive measures.**
- **Critical key aspects with respect to milk and dairy products are ensuring that raw materials are of good quality, and the elimination of spoilage and pathogenic bacteria from raw milk and other raw materials by heat treatment, prevention of subsequent contamination, and growth limitation of undesirable microorganisms during storage prior to consumption.**

Farm:

- ❖ **Microorganisms and spores are widespread in soil, water, plants and animals serving as reservoirs. Some degree of contamination of raw milk during production is expected, with milking and milk storage equipment as major sources of contamination.**
- ❖ **Transmission of microorganisms to raw milk occurs through the farm environment by contamination of the exterior of teats, the interior of teats, and milking installation.**
- ❖ **The most common contamination sources in the farm environment are feeds, faeces, bedding material and soil. The impact of feed as a hazard with regard to microbial contaminants is feed can be a source of pathogens causing infection in cattle, and source of bacterial spores. Pathogenic microbes associated with feed are *L. monocytogenes*, *E. coli* and *Salmonella*.**
- ❖ **Contamination of the exterior of teats and subsequent contamination of raw milk is due not only to exposure of teats to faeces, but also contact with bedding materials and soil.**

❖ Sterile milk when secreted in the alveoli of the udder in healthy cows, mastitis organisms can enter the teat canal and infect the interior of the teats. When infection progresses, these microorganisms can be shed to the milk during the milking process. The concentration of mastitis associated microorganisms in bulk tank milk depends on the type of organism, infection status of the herd (clinical/sub-clinical), stage of infection and fraction of the herd infected. The most important contagious pathogens include *S. aureus*, *Streptococcus agalactiae* and *Corynebacterium bovis*.

❖ Milking installation as a source of bacterial contamination of raw milk when bacteria adhere to surfaces or when milk residues remain in the equipment after the cleaning cycle. Growth of bacterial contaminants may occur in the installation, followed by shedding of organisms in the milk during the next milking procedure. Occurrence of bacterial sp. adhering to rubber and stainless steel can be *Acinetobacter*, *Pseudomonas* and *Flavobacterium*.

❖ **The numbers and types of microorganisms that develop subsequently during refrigerated storage in the bulk tank and during refrigerated transport to the factory are determined by the temperature and duration of the storage. Temperature must be under 6 C when milk is not collected daily and under 8 C when milk is collected daily.**

Minimize contamination at the farm by control of microbial contaminants in feed, facility hygiene, cleanliness of cows (teats and udders), good animal health management to avoid mastitis, effective cleaning and disinfection procedures of the milking installation, and rapid cooling to temperatures of 4 C

Processing:

- ❖ Good hygiene of the manufacturing plant is essential to ensure that the product is not (re)contaminated after heat treatment of raw milk.**
- ❖ Sources of post-pasteurization include equipment, packaging materials, air, aerosols, (condensed) water, lubricants, etc. Pasteurization equipment should be properly designed, installed, maintained and operated to ensure that the milk is heated at least the specified temperature for at least the specified time.**
- ❖ Cleaning programmes should be established. Most of the equipment used for handling milk and milk products is cleaned and disinfected by CIP systems at least daily. Start-up of closed processing lines in the dairy industry is usually done by circulating hot water in order to decontaminate the equipment.**

- ❖ The pasteurizer can be a source of contamination of *Bacillus* spp. The growth of *S. thermophilus*, on the surface in the regeneration section of plate heat exchangers can contaminate milk with 10^5 - 10^6 bacteria per ml and/or their metabolic products.
- ❖ The hygienic design of processing equipment is of great importance in avoiding biofilm formation. Biofilm control relies on cleaning and sanitizing procedures.
- ❖ The filling machine is a significant source of post-pasteurization contamination leading to fouling which not only affect the quality of products manufactured from milk, but necessary extra cleaning procedures also lead to increased use of energy.

Storage



Temperature and Time:

❖ Hygienic milking conditions are vital to ensure high initial microbiological quality; however, milk storage conditions (temperature) influence bacterial growth. Some psychrotrophic bacteria can increase during milk cold storage, producing lipases and proteases thereby, affecting milk functionality.

❖ Storage for longer duration can also deteriorate the microbiological quality but bulk tank milk can be stored for 96 h at 4 C with minimal bacterial contamination.

Distribution



Mode of packaging:

- ✓ Pasteurized milk is distributed in glass bottles, plastic sachet or in bulk in the consumers own utensils. Any dirt left in bottles during washing has a direct ill-effect on milk quality.
- ✓ Risk of adulteration is far less with glass bottles in comparison to polythene rolls/pouches which are made in small scale sector and there is possibility of cockroaches and other insects entering in the layers during manufacture or storage.
- ✓ Bulk vending is economical and hygienic as bulk vending machines could best fit into the scheme of economic distribution. The cold chain in this system (transport in cold form by insulated tanks, storage at booth in cold form, delivery in cold form) ensure a low temperature milk to consumers.
- ✓ For dairy products like ice-cream, microbial multiplication can be there with the usage of low quality packaging material together with power failure.

Holding and storage-temperature, time and environment:

- ❖ The exposure of raw milk to higher ambient temperatures during collection, transport and sale leads to poorer bacteriological quality under tropical conditions.**
- ❖ In pasteurized milk, which is sold by organized dairies in chilled state, power failures or inadequate cooling may affect the microbial multiplication.**
- ❖ Spoilage of cheeses during marketing may also be due to temperature effect.**
- ❖ No bacteriological deterioration is there in dried milks during marketing because of low levels of moisture in the product.**
- ❖ Humidity, dust, oxygen and light may also affect the microbiological quality thereby, adding contaminants to the product. In butter, cheese and khoa, the surface growth of molds is quite common in humid environment.**

Marketing Personnel:

- ❖ Unhealthy persons involved in marketing of milk and milk products may affect the bacteriological quality.**
- ❖ In fluid milk marketing, the handling of bottles, packets or loose milk in utensils with dirty or unhealthy personnel (infectious) may affect with microbial contaminants.**
- ❖ The retail marketing of indigenous milk products in the unorganized sector by unaware halwais, shopkeepers and other uneducated people may further deteriorate product during marketing and result in food poisoning outbreaks.**