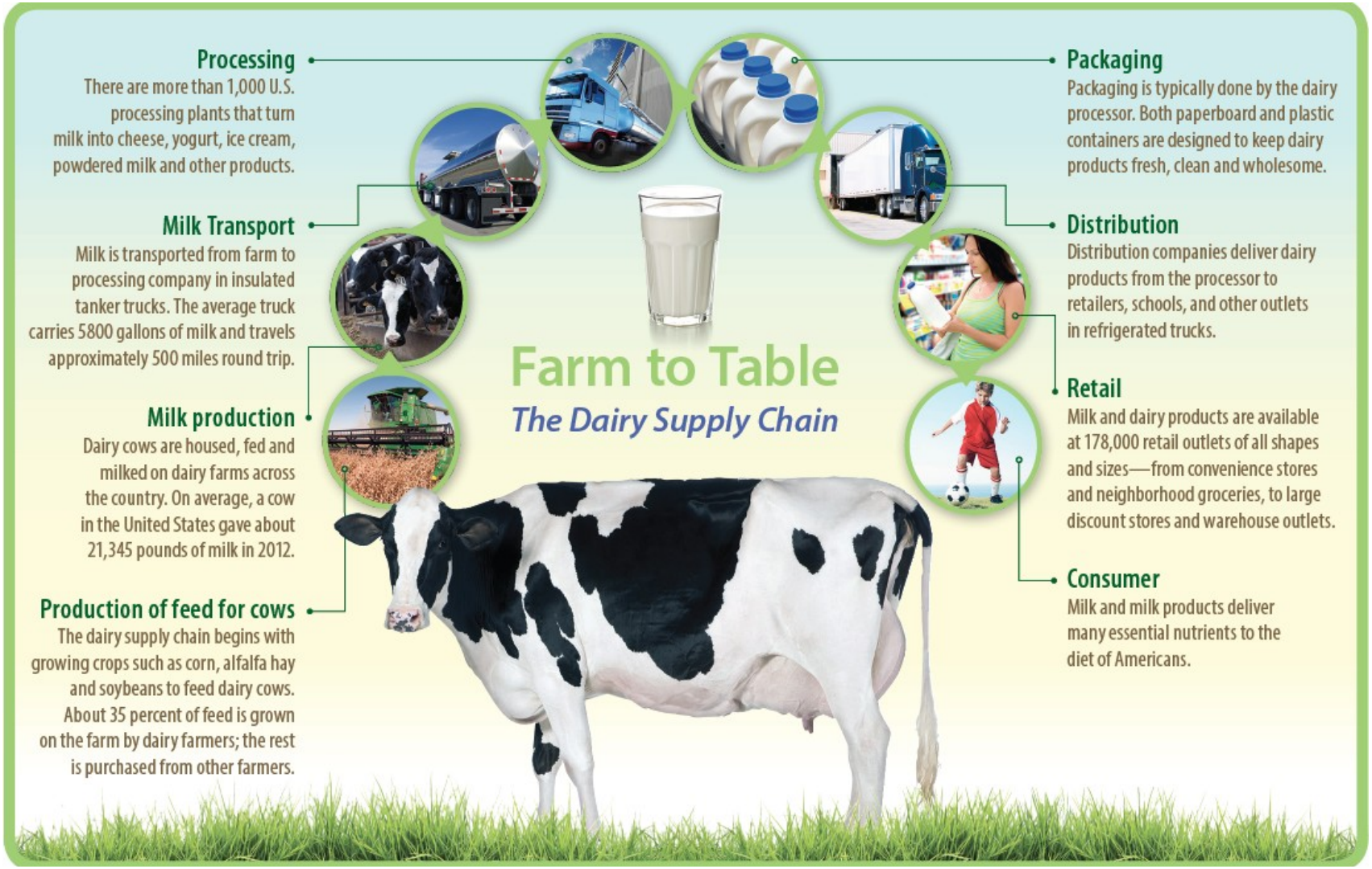
CLEAN MILK PRODUCTION

FARM to TABLE Concept:
The Dairy Supply Chain



Introduction

High quality milk, certain hygienic practices such as appropriate

- Sanitation and disinfections of the teats,
- Dairy utensils and equipment,
- Properly good quality water
- Mastitis control measures

✓ The ultimate quality of dairy products offered to the consumer, is determined by the complete process (from animals production till consumers utilization).

✓ The practices for milking ensure that milk is produced and stored under hygienic conditions and utensils/equipment used in the whole processes of milk production are well maintained as per the recommendation.

Principles of Clean Milk Production

Clean milk means that it comes from the udder of healthy animals, has good flavor, free from dirt, contains relatively fewer bacteria and none of those are harmful to human health. High quality milk should have:

- Longer keeping quality
- Proper nutritive value
- Normal taste, colour, odour
- Free from extraneous matter

Unhygienic Practices

- Practices related to milch animals
- Practices related to milker
- Practices related to milking process
- Practices related to environment

Steps of clean milk production

A) Animal Management
- Clean and healthy cows

B) Animal housing management

C) Feeding management

D) Personal Hygiene and management
- Disease control
- Cleanliness

E) Milking management

F) Management during collection

G) Hygiene of milking utensils

Cleaning of milking equipments
- Detergent cleaning
- Cold water rinse
- Hot detergent wash
- Final clean rinse

Sterilization of Milking equipments
- Steam sterilization
- Sterilization by chemicals

H) Hygiene of milking environment

Management during collection and transport of milk

Animal housing management

Management of personal hygiene

Fundaments of Clean Milk Production

Feeding management

Animal health management

A) Animal management

Clean and Healthy Cows

- **The animals apparently with good health should only be purchased and quarantined, aside from testing for contagious diseases, if any annual testing for tuberculosis and brucellosis invariably should be done. Also examine periodically for udder and other infections. Infected animals should be treated by a qualified veterinarian and should be isolated from the normal herd so as to avoid the further spread of infection.**

- **Clip long hair around flanks, udder and teats regularly. Animal should also be washed and groomed daily probably before milking so that the dirt particles in the air do not fall into milk. Time to time, hair from hind legs, udder and tail of the animal should be shaved-off. This is important in the case of buffaloes, as they usually wallow in dirty ponds and carry mud and filth on their body.**

- **The udder and teats should be definitely washed gently with antiseptic solutions prior to milking in such a manner that no damage is done to the orifices and clefts between the quarters of the udder. Keep two separate soft cloths for wiping after washing with plain water and disinfecting solution. A third washing with a mild detergent solution and a separate cloth is recommended for wiping the teats after milking.**

- **Addition of hypochlorite (500 ppm) helps in disinfecting the udder. Quaternary ammonium compounds (200-400 ppm) are better substitutes due to their less harmful effect on tissues. Under Indian subcontinent conditions, the easily available *Dettol* or *Savlon* may be diluted suitably and used to disinfect the udder and teats. Disposable paper towels may be used instead of cloth, if affordable. Milk of the infected animal should never be pooled with bulk milk, until the animal recovers from the illness fully.**

B) Animal housing management

- A neat and clean housing is quite important to have healthy animal that will produce hygienic milk at farm. At many instances, the animal sheds are the breeding places for flies and mosquitoes that attack the animal, causing various kinds of physical discomforts and infectious diseases. If the design of animal shed is not appropriate, the metabolic gases like methane, moisture and carbon dioxide produced by the animals and ammonia gas produced by the microbes acting on the dung will not find an easy exit that will not only adversely affect the health of the animals residing there but also the human workers.
- In many cases, animals are kept inside where the people live, which may be dangerous to both the animal as well as humans. Similarly, the flies and the mosquitoes also will find their way to the milk, directly from the environment or when the animal flips during milking. Hence, the sheds needed to be designed along the following recommendations:

- Animal stables have to be located on high ground with a natural sloppy drainage
- Have concrete floor, water proof, hard and easy for cleaning
- Drains constructed have a decent width and depth, and slope
- Ensure proper drainage of dung and urine directly to the sewer or frequent removal
- Mangers should be smooth without sharp angles.
- Ensure proper aeration in shed
- Ensure maximum comfort to the animal by providing air space of 500 cft per animal
- Have provision for regular supply of clean and fresh water
- Periodical lime washing has to done.

The existing sheds should be maintained properly by:

- Keeping the shed clean, wash regularly and dry as far as possible
- Milk houses should be free from dust and stable odours
- Removing the dung, urine frequently, away from the shed
- Spraying a recommended chemical in dung pit to stop the breeding of mosquitoes
- Use fly repellents (i.e. phenyl) inside the shed and/ or at the farm premises

C) Feeding Management

- Always feed the animal with a high nutritional valued diet, as a healthy animal will yield the cleaner milk
- Feeding the animals with healthier diets will reduce the chances of occurrence of diseases
- Clean the water tubs and the feeding manger regularly to avoid microbial growth
- Never feed dusty feed concentrates. Feed either pellets or slightly moistened feed
- Avoid feeding silage and hay during milking
- Never feed the animal with leftover feed that may be spoiled with molds or other microbes
- Never allow the animal to drink dirty water as it may lead to waterborne infections

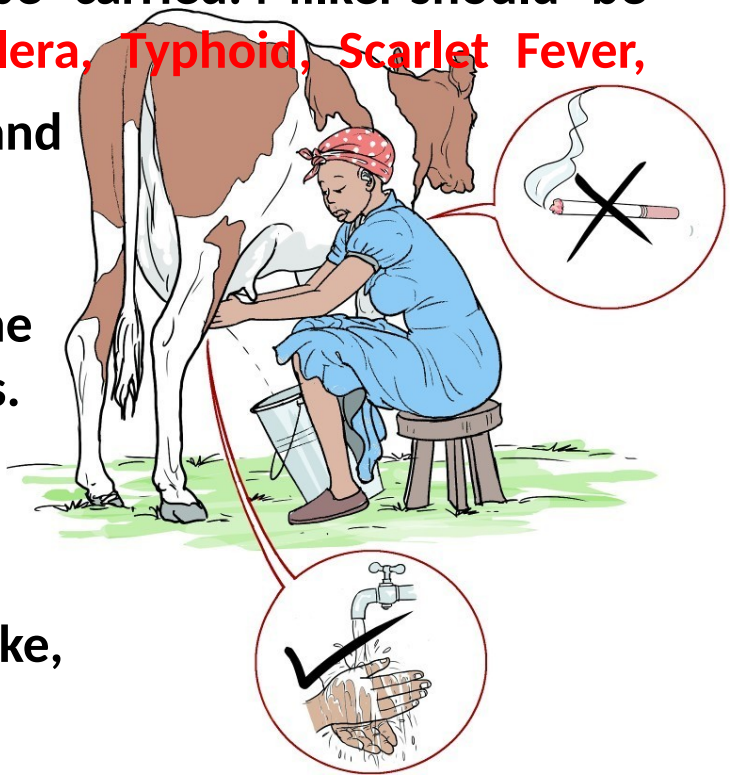
D) Personal hygiene and management (Milker)

Disease control

- Milker should never have the symptoms of any communicable disease.
- They should not also have open cuts including sores, boils or infected wounds that will definitely be the source of microbial contamination to milk.
- In case of stomach upset, the milker should never be allowed for milking the animal. This will prevent the communication of udder disease and also contamination of milk.
- Periodic medical check up for milkers should be carried. Milker should be healthy, free from infectious diseases like Cholera, Typhoid, Scarlet Fever, Tuberculosis etc.

Cleanliness

- Milker should always wear neat and clean clothing and caps.
- Milker should also maintain adequate personal cleanliness (haircut, trimming of beard and cutting the nail regularly) to avoid any microbial contaminations. Cuts, blisters or boils must be covered with clean dressing
- Washing of hands with detergents and drying with clean towel is must prior to hand milking. Never smoke, eat drink or spit while milking



E) Milking management

- Better, if the animal let out milk without the calf
- Clean the shed before milking and dispose the dung away from the shed
- Clean the animals and wash the udder with clean water
- Properly wipe and dry the udder after washing using clean dry napkin
- Washing of hands with detergent and drying of hands.
- Use utensils preferably made up of stainless steel without any crevices that are easy to clean
- Correct milking practices should be adopted to prevent any damage/ injury to teats
- Carry gentle, fast and complete milking
- Practice dry, full hand milking
- Separate utensils are recommended for washing of udder and for milking
- Never pour the milk of animals having contagious diseases
- Milking should be as fast as possible because the excitation by the animal lasts approximately only for 7 mins.

- **Always ensure complete milking as the microbes will grow on the left over milk in udder resulting in mastitis**
- **Always keep the milk covered to avoid airborne contamination**
- **Disinfect the teats by teat dip (i.e. disinfectants, iodophor, etc) after milking, to restrict entry of microbes to the teat canal**
- **Never allow milk to flow from animals affected by any disease.**
- **Always discard the milk from the animal treated with antibiotics for the prescribed days, as the milk may have antibiotic residues that may affect the quality of the milk, starter failure or health of a consumer**
- **Never use paper, cloth etc to air tight the lid of the milk can**
- **If the calf is used for excitation, wash the udder after suckling.**

F) Management during collection

- The place of milk collection should be maintained absolutely clean to prevent any microbial contamination.
- Adequate provisions should be made for cleaning and sanitizing the utensils/ vessels used for milk collection and transport.
- Sanitizers should be kept away from the milk collection place.
- Lids of cans should not be kept on the ground and should be tightly fitted on cans to prevent spillage.
- Do not use hay, grass etc. to give a proper fitting to the lid. Milk should always be kept covered.
- Ensure that milk cans are kept in shade before loading in the truck. Trucks without covers or hood should not be used, as they will expose the milk to sunlight and hence, accelerate the growth of microbes.
- Transportation of other materials along with the milk cans should be avoided, as this may lead to contamination.
- Careless handling of cans lead to dents, which also act as points for the growth of microbes, and it also becomes very difficult to clean such cans. Most of the microbial growth takes place during the time lag between milk collection and its receipt at the dock. This time has to be reduced to the possible extent to minimize the microbial growth.
- One that produces and handles milk should attempt to prevent microbial contamination at each stage.

G) Hygiene of milking utensils

- The milking utensils should be of uniform size. Having small mouths to avoid external contamination.
- These should be preferably made up of non-rusting and non-absorbent materials (i.e. aluminium or galvanized iron). Stainless steel is ideal, but costly.
- All the utensils should be free from dents, cracks and crevices. The utensils should be scrubbed and cleaned before and after each milking.
- The detergents and chemicals used should be non-injurious, and non-abrasive in nature.
- At farm, use of washing soda coupled with exposure to sunlight or use of detergents-cum-disinfectants (iodophors) is recommended.
- Properly cleaned vessels should be placed in inverted positions for the complete drainage of water after milking, so as to avoid contamination from air, insects, rodents, reptiles etc.
- In villages, where milk collection is done by co-operative societies, the use of community milking parlours with facility to clean and disinfect udders teats as well as milking equipments is needed.

Cleaning of milking equipments

- Cleanliness and sterility of equipments are of prime importance. Cleaning and sterilization are complementary to each other as none alone will achieve the desired results. These can either be separate or combined processes as in the case of chemical sterilization. The term cleansing is frequently used to indicate cleaning combined with sterilization and satisfies the condition that all equipment surfaces are free of milk residues and microbes.
  - Pre-rinse with water to remove all extraneous soil and to wet the surface
  - Removal of soil from the surface by solution, saponification or a combination thereof
  - Dispersion of un-dissolved soiling matter
  - Removal of detergent solution along with suspended and dissolved soil, and
  - Final rinse to remove trace of detergent.

Detergent cleaning

- The detergents help to free the surface of the milking equipments from fat and other milk residues. The type and strength of detergents used depend on the method of washing.
- Detergents in general are not disinfectants, however, strong alkaline detergents, if used in hot are bactericidal in nature. When alkaline detergents are used for hand washing, the concentration should not be more than the equivalent of 0.25% sodium carbonate. This is not applicable in cleaning in place.

Cold water rinse

- The outside dirt and residual milk from the surfaces should be removed by a lukewarm water rinse. This should be done immediately after the vessels are emptied because, if the milk solids are allowed to dry on the surface, it will be extremely difficult to remove these by rinsing.

Hot detergent wash

- Hot detergent wash is best done in a wash trough; however the temperature of the solution should not exceed 46°C. The amount of detergent used should be nearly equal to 115 g of soda ash or 230 g of washing soda per 45L of water. If the concentration of alkali is stronger than this, it may lead to the gradual defatting of the skin. The milking equipments should be brushed in hot detergent with suitable brushes to remove the surface residues effectively.

Sterilization of Milking equipments

Hot water sterilization

- The boiling or scalding water may be used in small farms, where the number of equipments to be sterilized is too small to warrant the installation of a boiler. As with steam, scalding water is used after the cleaning process. Temperature should be as near the boiling point as possible and never below 85°C. The utensils should be immersed for 1 min or boiling water should be poured over the milk-contact surfaces till they are too hot to touch.

Sterilization by chemicals

- Sterilization of farm equipments with the use of chemicals is preferred overuse of steam, as it does not involve high capital expenditure. Steam sterilization is controlled by time and temperature, chemical sterilization is dependent on:
  - Strength of the disinfectant
  - Effective contact time
  - Temperature
  - Speed of action of the disinfectant and its specificity against different microbes
  - Ability of the disinfectant to wet and also to penetrate any deposit on the surface, and type of surface.
  - The common groups of chemical sanitizers used are hypochlorites (calcium and sodium), organic chlorine-containing chemicals (chloramines and trichloroisocyanuric acid), quaternary ammonium compounds and iodine compounds (iodophor).

H) Hygiene of milking environment

- **The places, where housing, feeding and milking are done, need special attention to minimize the contamination of milk.**
- **The animal house should be carefully designed and constructed so as to provide comfortable and healthy housing for the animal and enable them to be milked in clean conditions.**
- **The major points such as siting, planning and layout, walls and floors of the housing and ease to clean them, stall divisions, adequate water supply, lighting and proper ventilation, drainage facilities, dung disposal and isolation chambers for sick animals should be taken into consideration for clean milk production.**

Straining of Milk

- A clean muslin cloth should be tied on the mouth of milk-collecting vessel to strain off all the extraneous matter. Although, the straining would not remove but reduce the number of microorganisms, by expelling all the particulate matter thus, improving the aesthetic appeal of milk for consumer.

Cooling of milk

- The strained milk should preferably be chilled immediately to 4°C to prevent the proliferation of micro-organisms. In places, where milk is stored in cans before transportation, bulk can coolers are the best options. Some of the other cooling options practiced may be air-cooling, water-cooling, and mechanical cooling. An effective cooling will prevent growth of mesophilic and thermophilic microbes.

Transportation of Milk

- The basic system of milk transportation in India comprises the transport from farm to the collection centre (either in small vessels or cans), from collection centre to the chilling centre (in small tankers) and from chilling centre to the processing plant (in insulated road tankers).
- The quality of milk will deteriorate during transit, if the surfaces that are in contact with milk are not sufficiently clean and milk is at high temperature supporting the growth of microbes.

- Milk should be held for minimum time at farm at ambient temperatures. In general, transport of uncooled milk can be justified only if great care has been taken in its production and if the milk is processed or chilled to a low temperature not more than 3 h after its production.

- The collection centre should be equipped with a basic cooling system. For larger quantities of milk, a surface cooler is recommended, especially if the holding period between reception and transport to the dairy is long.

- The milk should be chilled to 4°C at the chilling centre. At dairy, the temperature of the milk should not exceed 4°C.

- Cleaning and sterilization of all equipment used, whether small containers, cans or road tankers, should be carried out immediately after emptying. The tankers are usually cleaned in processing dairies using manual method or cleaning in place.