

Clean Milk Production: Ensuring for a Healthier Tomorrow

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Abstract

Clean milk refers to milk extracted from the udders of healthy animals, collected in a clean, dry milking pail, and free from any contaminants such as dirt, dust, flies, hay, manure, or other foreign matter. The essential aspects of clean milk production practices include maintaining animal hygiene, ensuring milking hygiene, keeping equipment sanitary, and following strict processing hygiene protocols. Milk is an extremely nutritious food, but its quality can be affected by various factors, starting with the collection method from the animal and continuing through its processing and storage conditions. Clean milk production ensures high-quality, safe, and nutritious milk for consumers, reducing the risk of contamination and foodborne illnesses. Moreover, it enhances the shelf-life of dairy products and boosts consumer trust in the dairy industry. Additionally, it promotes better animal health and sustainable farming practices. Various precautionary measures should be adopted in order to ensure that milk remains clean, fresh and safe for consumption. Hence, clean milk production is crucial not only for preserving the quality of dairy products but also for safeguarding the health and well-being of consumers.

Keywords: Animals, Clean milk, Dairy, Equipment, Health, Hygiene

Introduction

Clean milk is defined as milk obtained from healthy dairy animals, with a natural flavour, free from dirt and impurities, containing an acceptable level of bacteria, and free from adulterants, harmful pathogens, toxins, abnormal residues, pollutants, and metabolites. Producing clean milk is a key factor in the country's economic growth. By implementing clean milk production practices, there is significant potential to enhance the quality of milk produced. Clean milk production requires maintaining cleanliness throughout various stages of handling animals, processing, and transporting milk and dairy products. The key elements to focus in

clean milk production practices include animal hygiene, milking hygiene, equipment hygiene, and processing hygiene. In the modern era, growing consumer awareness regarding milk quality, hygiene, and sanitation has made clean milk production a vital component of the dairy industry. Consequently, producing quality milk and educating farmers on scientific clean milk production practices are crucial aspects of the milk value chain.

Therefore, it is necessary to understand the extent to which farmers adopt practices related to animal housing, milker hygiene, animal feeding, health management, and milking procedures, including the use of milking equipment, to ensure the procurement of clean milk.

Keywords: Animals, Clean milk, Dairy, Equipments, Health, Hygiene

Factors Affecting the Nature of Milk

Milk is a highly nutritious food, but its quality can be influenced by several factors, starting from the way it is harvested from the animal, to its processing and storage. Understanding these factors is crucial to ensure that milk maintains its desired qualities and remains safe for consumption. Below are some key factors that impact the nature of milk:

- ✚ **Milking Practices:** The method used for milking, significantly impacts milk composition. Incomplete milking, where the cow is not fully milked, can result in lower milk yield and affect its fat content. The last portion of milk, often referred to as "strippings," contains more fat than the initial milk. Therefore, failing to fully milk the animal can lead to milk with less creaminess and reduced overall fat content, affecting its flavor and texture.
- ✚ **Stage of Lactation:** The stage of lactation plays a crucial role in determining the chemical composition of milk. During the first five days after calving, known as the colostrum phase, the milk has more alkaline properties due to higher levels of antibodies and essential nutrients. This milk is particularly rich in proteins, immunoglobulins, and fat-soluble vitamins, but it is not suitable for regular consumption. As lactation progresses, the milk composition stabilizes, offering a balanced mix of fats, proteins, and carbohydrates.
- ✚ **Feeding Practices:** The diet of dairy animals greatly influences the quality of milk they produce. Cows fed on a diet that lacks sufficient forage or roughage tend to produce milk with lower butterfat content. Forage is essential for proper digestion and fermentation in the cow's rumen, which directly affects the milk's fat composition. A



well-balanced diet with adequate fiber is necessary for producing rich, creamy milk with an optimal fat percentage.

- ✚ **Cold Storage:** Proper cold storage is vital in preserving milk's freshness and preventing spoilage. Storing milk at low temperatures immediately after milking slows down the growth of harmful bacteria. However, if milk is stored in cold conditions for over 72 hours, it can start to spoil, even at low temperatures. Prolonged cold storage can adversely affect the flavor and texture of milk-based products, like cheese and yogurt, by altering the balance of microorganisms involved in fermentation.
- ✚ **Heating and Pasteurization:** Heat treatment is a common method used to ensure milk's safety by eliminating harmful pathogens. However, excessive pasteurization or prolonged heating can lead to the denaturation of proteins, which can alter the texture and nutritional value of milk. It can also cause a loss of certain water-soluble vitamins, such as vitamin B and C, reducing the overall nutritional benefit of the milk. Careful control of heating processes is essential to balance safety with maintaining milk's natural qualities.
- ✚ **Antibiotic Residues:** The presence of antibiotics in milk is a critical concern for both consumers and dairy producers. Antibiotics are often administered to dairy cattle to treat infections, but traces of these drugs can remain in the milk if proper withdrawal periods are not observed. Milk containing antibiotic residues can cause allergic reactions in sensitive individuals and may contribute to the development of antibiotic resistance in the general population. Therefore, it is important to monitor and regulate the use of antibiotics in dairy animals to prevent the contamination of milk.

Thus, these factors are key to maintaining the quality, safety, and nutritional value of milk. By paying attention to each stage of production and processing, producers can ensure that consumers receive high-quality milk that is safe and beneficial for health.

Benefits of Clean Milk Production

- ✚ **Reduces Contamination and Ensures Safe Milk Production:** Clean milk production practices significantly lower the risk of microbial contamination during milking, storage and transport. Contaminants such as bacteria, dirt, or chemicals can not only spoil the milk but also pose health risks to consumers. By adhering to clean practices, farmers ensure that milk is safe for consumption, reducing health hazards and

maintaining consumer trust. This safety aspect is particularly important as milk is consumed by vulnerable populations, such as children and the elderly.

- ✚ **Increased Shelf Life of Milk and Better Keeping Quality:** Milk that is produced under hygienic conditions tends to have a longer shelf life because it is less likely to be exposed to harmful bacteria or spoilage agents. With minimal contamination, milk remains fresh for a longer time without requiring preservatives or advanced storage technologies. This longer shelf-life benefits both consumers and retailers, as it reduces waste and ensures that the product retains its quality until it reaches the consumer. Improved keeping quality also enhances the flavour, aroma and nutritional value of milk.
- ✚ **Prevents Transmission of Food-borne and Zoonotic Diseases:** Clean milk production plays a critical role in preventing the spread of food-borne illnesses and zoonotic diseases, which are transmitted from animals to humans. Pathogens like *Escherichia coli*, *Salmonella* spp., and *Listeria* can be present in contaminated milk. Adopting strict hygiene measures during milking and handling ensures that these harmful pathogens are eliminated or kept to a minimum, safeguarding public health. Additionally, it prevents the risk of transmitting diseases like tuberculosis and brucellosis that can pass from livestock to humans through milk.
- ✚ **Increases Income to Farmers:** When farmers produce clean, high-quality milk, they can command a higher price in the market due to the superior quality of their product. Clean milk production reduces spoilage, meaning more milk can be sold instead of being discarded. Additionally, dairy processors and buyers often offer premiums for milk that meets strict hygiene standards, further increasing farmers' profitability. Consumers are willing to pay more for milk that is perceived as safe and nutritious, leading to better market opportunities for farmers who maintain cleanliness and quality in their milk production processes.

Precautionary Practices for Ensuring Milk Quality and Safety

Maintaining high standards of hygiene and following proper milking techniques are essential to ensure that milk remains clean, fresh and safe for consumption. These precautionary practices, when implemented consistently, can prevent contamination, spoilage, and health risks associated with milk production. Some key practices to be followed for ensuring milk quality and safety are as follows:

1. Source Hygiene

Maintaining hygiene at the source is crucial to prevent contamination during the milking process.

- a) **Milker's Hygiene:** The person handling the milking process plays a critical role in ensuring milk safety. Milkers should be in good health and maintain cleanliness at all times. They must wash their hands thoroughly using disinfectants before each milking session. This helps eliminate any bacteria or germs that could transfer from their hands to the milk. In addition, it is essential that milkers avoid consuming medicines, smoking, or handling food items during the milking process to avoid cross-contamination. A clean and healthy milker ensures the first line of defense in milk safety.
- b) **Utensils:** The cleanliness of utensils used for milking and storing milk is another key factor. Plastic containers should be avoided as they are prone to scratches, which can harbor bacteria. Instead, it is advisable to use utensils made from stainless steel or aluminum, as they are easier to clean and disinfect. Washing stations should be regularly cleaned, and utensils should be rinsed thoroughly. Extensive use of detergents during cleaning ensures the removal of milk residues, which can otherwise become a breeding ground for harmful microorganisms.

2. Milking Process

Correct milking techniques and preparation ensure that the animal remains calm and the milk is extracted in a hygienic manner.

- a) **Preparation:** Consistency in milking intervals is essential to avoid stress on the animal and maintain milk quality. Establishing a regular milking schedule also contributes to the overall health of the cow. The milker should avoid any actions that might startle or intimidate the animal, as this can disrupt the flow of milk and cause stress. Following best practices for milking preparation, such as gently wiping the udder and ensuring a calm environment, helps ensure a smooth milking process.
- b) **Method:** The correct technique during milking is important for both the cow's comfort and milk quality. The teat should be gently squeezed, not pulled, to avoid injury to the udder. After each milking session, a teat dip solution should be applied. This disinfects the teats and helps prevent infections such as mastitis, a common disease in dairy cattle.

3. Milk Handling Hygiene

Once milk has been collected, proper handling techniques are essential to maintain its freshness and quality.

- a. Filtering:** Milk should be filtered immediately after milking to remove any physical contaminants. A white cloth filter is ideal for this process, as it is easy to spot impurities. The filter cloth should be washed regularly with disinfectants to prevent any residual bacteria from contaminating future batches of milk. Ensuring the cleanliness of filtering tools can significantly reduce the risk of milk spoilage.
- b. Storage:** Proper storage conditions are crucial for maintaining milk's freshness. Milk should be stored in cool and clean spaces. It is important that milk storage rooms are used exclusively for this purpose and are not shared with other chemicals or food items, which could contaminate the milk. Maintaining a low temperature helps preserve the quality of milk for a longer period.
- c. Transportation:** Timely transportation of milk is essential to prevent spoilage, especially during warmer months. Milk should be transported to markets, processing units, or warehouses during the cooler parts of the day, such as early morning or late evening, to avoid exposure to the afternoon heat. Excessive heat can accelerate the growth of bacteria and spoil the milk before it reaches its destination.

By following these precautionary practices, dairy farmers and milk handlers can significantly reduce the risk of contamination, ensuring that the milk remains fresh, safe, and nutritious for consumers. Maintaining strict hygiene standards throughout the entire process, from source to storage helps in protecting the health of both the animals and the people consuming the milk.

Milk Borne Infections

Failure to meet precautionary requirements results into poor quality milk at dairy dock. Milk is one of the key food items to get spoiled, and spread food borne illnesses, such as food poison. Raw milk is one of the breeding grounds for bacteria causing tuberculosis, paratuberculosis, typhoid, Q-fever, listeriosis, staphylococcosis, streptococcosis, campylobacteriosis and brucellosis. Unhygienic milk may result into post processed contamination.

Strategies of clean milk production

- 1. Awareness and training:** Educational training and awareness programs at school as well as designed for farmers and farm owners, in the form of posters, announcements, workshops should be conducted.
- 2. Feeding practices:** Avoid chemical or microbiological contaminants in the milk, procurement and storage should be well handled.
- 3. Housing management:** Comfortable and spacious housing arrangement, including arrangement of regular supply of feed and water to animals, as well as continuous removal of urine and dung. If electric appliances are setup in the area, in such cases, constant electric supply and sufficient backup is required. Regular cleaning and sanitation are essential, with check on animal health and quality of milk outcome. Watering and feeding troughs, equipment, utensils should be thoroughly cleaned. Disinfecting animal sheds, and associated equipment needed to be disinfected thoroughly using hot water, bleaching powder, quick lime etc.
- 4. Handling of milking vessels:** Stainless steel made milking and carrying vessels reduce mixing of milk with chemicals or plastic components. Vessels should be cleaned with hot water and recommended / certified detergents. Milker and staff handling milk vessels should maintain hygiene practices. Spitting or smoking beside milk vessels should be prohibited as there is a danger of mixing tobacco with milk resulting in degradation of milk quality.
- 5. Udder hygiene:** Udder hygiene is one of the key aspects of milk hygiene. Cow or any dairy animal rests in a position where, udder skin remains in contact with floor or bedding of animal sheds. Udder can be defined as that body part of female dairy animals which consists of mammal glands. Poor udder hygiene results into milk contamination. It is important to take care of milking teats, implement hygienic prophylactic measures in maintaining cleanliness. Clean udder part and teats with warm water/disinfectant solutions. The implementation of udder hygiene before and after milking is necessary to maintain udder health. It is important to immerse udder into disinfectant solutions. Prioritize nature friendly and ecologically acceptable disinfecting agents those are not harmful to animals and the environment.

6. **Health management:** Regular vaccination and health monitoring of diseases like mastitis should be a part of the routine work. Separate shed for sick animals should be built. Only healthy animals should be milked. Improper use of medicines should be avoided.
7. **Storage and transportation:** Cooling tanks are necessary to reduce bacterial load. Competitive pricing based on bacterial load identified at milk reception dock will improve handling of milk and adopting best practices. Lid of milk cans should close and possibly airtight to get rid of dust and rain. Milk tanker, vehicle should be with proper insulation, so that external temperature should not affect quality of milk. Cooling milk below 10° C prevents milk spoilage for maximum 3 days.

Conclusion

The production of clean milk is the first important step that farmers in our country should focus on to address the challenges posed by globalization. With the growing demand for safe, high-quality dairy products, clean milk production must remain a priority in the dairy industry, contributing to both public health and economic sustainability. By implementing hygienic practices at every stage right from animal care and milking to handling and storage, dairy producers can prevent contamination and enhance milk's nutritional value. Sustainable farming practices, proper housing, regular veterinary care and strict cleanliness protocols are key elements in achieving this goal. Therefore, clean milk production is essential not only for maintaining high-quality dairy products but also for ensuring the health and safety of consumers.

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