

# Processing and Standardization of Milk in Saras Dairy, Jaipur

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**ABSTRACT:** Approximately 150 million households around the globe are engaged in milk production. In most developing countries, milk is produced by smallholders, and milk production contributes to household livelihoods, food security and nutrition. Milk provides relatively quick returns for small-scale producers and is an important source of cash income.

In recent decades, developing countries have increased their share in global dairy production. This growth is mostly the result of an increase in numbers of producing animals rather than a rise in productivity per head. In many developing countries, dairy productivity is constrained by poor-quality feed resources, diseases, limited access to markets and services (e.g., health, credit and training) and dairy animals' low genetic potential for milk production. Unlike developed countries, many developing countries have hot and/or humid climates that are unfavourable for dairying. Some cities like Jaipur in India have a long tradition of milk production, and milk or its products have an important role in the diet.

## I. INTRODUCTION

Towards fulfillment of the national objective of making India self sufficient in milk production, a small step was taken in March 1975 and Jaipur Zila Dugdh Utpadak Sahakari Sangh Ltd., Jaipur (popularly known as Jaipur Dairy) was registered under Cooperative Act 1965 to work in then Jaipur District. Initially this union did not have the processing facilities. It started with a modest beginning of procuring 250 liters of milk per day.



**Jaipur Saras Dairy**

Dairy development is a sustainable, equitable and powerful tool for achieving economic growth, food security and poverty reduction because dairying:

- provides a regular source of income;
- provides nutritious food;
- diversifies risk;
- improves the use of resources;
- generates on- and off-farm employment;
- creates opportunities for women (e.g., milk money);
- provides financial stability and social standing (e.g., store savings, asset creation).

Factors that drive Jaipur dairy development include changes in demand; advances in production, transportation and communication technology; improved on-farm productivity; and more efficient dairy chains. To achieve sustainable smallholder dairy development it is vital to form active producer associations and establish reliable dairy chains (it is important to create value in every activity of the dairy chain). The success of dairy development programmes in Jaipur has been largely influenced by traditional dairy consumption habits.(1)

## II. DISCUSSION

Jaipur dairy development is constrained by refrigeration, marketing, processing, transportation, nutritional and husbandry issues. In addition, small-scale dairy producers lack the skills to manage their farms as enterprises; have

poor access to services such as health, breeding, training and credit; have little or no capital for investment; and are thwarted by small herd/flock sizes, low milk yields and poor milk quality.

The development of the Jaipur dairy sector generally results in an increased workload for women, but it also increases women's participation in income-generating activities and the process of change. Dairy development can also contribute to reducing the time women spend in low-productive activities. For example, with better organization of milk collection and marketing, women can be released from selling small quantities of surplus milk in the informal market.(2)

### III. SIGNIFICANCE OF MILK

Milk is a valuable nutritious food that has a short shelf-life and requires careful handling. Milk is highly perishable because it is an excellent medium for the growth of microorganisms – particularly bacterial pathogens – that can cause spoilage and diseases in consumers. Milk processing allows the preservation of milk for days, weeks or months and helps to reduce food-borne illness.

The usable life of milk can be extended for several days through techniques such as cooling (which is the factor most likely to influence the quality of raw milk) or fermentation. Pasteurization is a heat treatment process that extends the usable life of milk and reduces the numbers of possible pathogenic microorganisms to levels at which they do not represent a significant health hazard. Milk can be processed further to convert it into high-value, concentrated and easily transportable dairy products with long shelf-lives, such as butter, cheese and ghee.(3)

Processing of dairy products gives small-scale dairy producers higher cash incomes than selling raw milk and offers better opportunities to reach regional and urban markets. Milk processing can also help to deal with seasonal fluctuations in milk supply. The transformation of raw milk into processed milk and products can benefit entire communities by generating off-farm jobs in milk collection, transportation, processing and marketing.



Pasteurization units of milk in Saras Dairy Jaipur

### III. PASTEURIZATION

- There is a general and urgent need for rapid procedures, applicable to process control, to monitor food safety and quality.
- Pasteurization is a process in which certain packaged and non-packaged foods (such as milk and fruit juice) are treated with mild heat, usually less than 100 °C (212 °F), to eliminate pathogens and extend shelf life.
- The process safeguards foods by destroying or inactivating organisms that contribute to spoilage, including vegetative bacteria but not bacterial spores.
- The process was named after the French scientist Louis Pasteur, whose research in the 1880s demonstrated that thermal processing would inactivate unwanted microorganisms in wine.
- Today, pasteurization is used widely in the dairy industry and other food processing industries to achieve food preservation and food safety.(4)

#### IV. TYPES OF PASTEURIZATION

- **Thermization:** Heat the milk to between 57°C to 68°C and hold for 15 minutes. Thermization targets pathogenic bacteria while leaving the good bacteria in the product. The low temperatures do not alter the structure and taste of the milk.
- **Batch pasteurization:** Also known as low-temperature long time (LTLT) pasteurization. Heat the milk to 63°C for 30 minutes. The extended holding time causes the alteration in the milk protein structure and taste.
- **Flash pasteurization:** Also known as high-temperature short time (HTST) pasteurization. Heat the milk to between 72°C to 74°C for 15 to 20 seconds. Targets resistant pathogenic bacteria spores (*Clostridium botulinum* spores).
- **Ultra-high temperature (UHT) pasteurization:** Heat the milk to between 135°C to 140°C for 2 to 4 seconds. The extreme heat targets *Coxiella burnetii*, which causes Q-fever. The heat kills all the vegetative forms of bacteria and the milk can survive for 9 months.
- **Canned sterilization:** This is a wet treatment of canned milk products in an autoclave/specialized treatment chambers. Heat to between 115°C to 121°C for 10 to 20 minutes.(5)

##### High-Temperature Short Time (HTST) Pasteurization

- This type of pasteurization is also known as flash pasteurization.
- Flash pasteurization involves heating milk to 71.7°C for 15 seconds to kill *Coxiella burnetii*, which is the most heat resistant pathogen in raw milk.
- Since it is technically impossible to bring the milk to that exact temperature, it is always safe to work with a range of temperatures. To be safe, you can heat the milk to between 72°C to 74°C for 15 to 20 seconds.
- This will ensure that the milk is heated uniformly to the required temperature.
- This method is most suitable in continuous pasteurization systems.
- Flash pasteurized milk will keep for between 16 and 21 days. For commercial reasons, some manufacturers intentionally reduce the number of days to push the products out of the shelves.

##### Low-Temperature Long Time (LTLT) pasteurization

- Here, the temperatures used for pasteurization are reduced to 63°C and held for 30 minutes.
- The prolonged holding period alters the structure of the milk proteins making it better suited for making yogurt.
- This method is best for batch pasteurization where the milk is held in a jacketed vat for effective pasteurization.
- There are many designs of batch pasteurizers in the market that are suitable for both domestic and commercial use.

##### Ultra High Temperature (UHT) Pasteurization

- This is a completely closed pasteurization method. The product is never exposed even for a fraction of a second during the entire process.
- It involves heating milk or cream to between 135°C to 150°C for one to two seconds, then chilling it immediately and aseptically packaging it in a hermetic (air-tight) container for storage.
- Despite the risk of Millard browning, UHT pasteurization remains the most popular milk preservation method for safe and stable milk.

##### 1. Milk chilling

- Chilling is not a pasteurization process but it is a necessary step when dealing with large volumes of milk.(6)
- Milk leaves the cow's udder at temperatures above the ambient, which encourages rapid bacterial multiplication that speeds up spoilage.
- However, reducing the temperatures to between 2° C to 5° C arrests bacterial growth and metabolism.
- This provides a head start at keeping the quality before proper pasteurization commences.

##### 2. Pre-heating (regeneration) and Standardization Stage

- After bulking, the chilled milk is heated to about 40°C to facilitate easy separation of butterfat during standardization.
- The system uses regenerative heating, i.e., it uses the heat of the already pasteurized milk to heat up the incoming chilled milk. The chilled milk, in a counter current flow, cools down the pasteurized milk.
- The purpose of standardization is to obtain a product with uniform content of butter fat.

### 3. Clarification stage

- Clarification is essential for removing all foreign matter from the product.
- Large solid particles are removed by straining the milk through tubular metallic filters.
- A centrifugal clarifier (not the one used for standardization) is used to remove all soil and sediments from milk.
- The filters, usually fitted in parallel twins permits continuous processing as one can be cleaned while the other is running.
- Clean the filters regularly (between 2 to 10 operational hours depending on the level dirt) to avoid growth of bacteria.(7)

### 4. Standardization stage

- It is important to standardize milk fat to ensure that you end up with a product of consistent quality in the market. Different consumers prefer different products.
- There are customers who will consume skim milk only while there are those who will take low fat milk. There are those who will take standardized milk while there are those who prefer high fat milk.
- Standardization is necessary to ensure that all the customers are catered for. Again, it is during the process of standardization that you get to separate the butterfat that is used for making cream and other fat based products such as butter and ghee.

### 5. Homogenization stage

- Homogenization is a physical process of breaking down the the milk fat globules into tiny droplets to discourage cream separation.
- Tiny droplets of fat do not rise in a milk column since reducing their sizes also increases their density in the milk.
- A milk homogenizer working at between 100 to 170 bars splits all the fat globules into very tiny droplets that increases the level of integration of the fat in the milk.
- As a result, the milk fat remains uniformly distributed in the milk.

### 6. Heating section

- Utilizes heat from steam to raise the temperatures of the milk from about 60°C to the required 72°C that is effective to kill the Clostridium botulinum spores.
- The steam exchanges heat with the milk across the PHE plates in a counter current motion.
- At the end if this section, there is a temperature sensor, which controls the flow diversion valve.
- Any milk that does not attain the required temperature is diverted back to the heating section until it attains the required temperatures.

### 7. Holding section

- After heating, milk flows into the holding tubes whose lengths have been calibrated with the milk flow rate to ensure that milk takes at least 16 seconds in the tubes. All the milk must maintain the required pasteurization temperatures at the end of the tubes.
- In case of a breach, a sensor will trigger the flow diversion valve to take the milk back to the heating section to bring the milk to the required temperature.
- Once the milk has attained the required temperatures at the end of the holding tubes, milk flows back to the regeneration section to heat the incoming chilled milk while in itself being cooled down to about 30°C.

### 8. Cooling/chilling section

- After regenerative cooling of pasteurized milk, it moves to the cooling section of the PHE where chilled water/PHE coolant lowers the temperature of pasteurized milk to 4°C.
- The chilled milk is then pumped to the packaging machines for aseptic packaging and subsequent storage in the cold room.

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