

## Where there is a Laiche there will be victuals

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### Abstract

Milk is a white liquid nutrient-rich food produced by the mammary glands of mammals. It is the primary source of nutrition for infant mammals (including humans who are breastfed) before they are able to digest other types of food. Early-lactation milk contains colostrum, which carries the mother's antibodies to its young and can reduce the risk of many diseases. It contains many other nutrients including protein and lactose. Interspecies consumption of milk is not uncommon, particularly among humans, many of whom consume the milk of other mammals.

As an agricultural product, milk is extracted from farm animals during or soon after pregnancy. Dairy farms produced about 730 million tones milk in 2011, from 260 million dairy cows. India is the world's largest producer of milk, and is the leading exporter of milk powder, yet it exports few other milk products. The ever increasing rise in domestic demand for dairy products and a large demand-supply gap could lead to India being a net importer of dairy products in the future. The United States, India, China and Brazil are the world's largest exporters of milk and milk products. China and Russia were the world's largest importers of milk and milk products until 2016 when both countries became self-sufficient, contributing to a worldwide glut of milk.

**Keywords:** Milk, Protein & Dairy.

### Introduction<sup>1,2</sup>

Milk may be defined as the whole fresh, clean, lacteal secretion obtained by the complete milking of one or more healthy mulch animals, excluding that obtained within fifteen days or five days after calering or such periods as may be necessary to under the milk practically colostrums-free and containing the minimum prescribed percentage of milk fat and milk solid not fat.

Milk is a complete food. It is an important part of most people's diet; it is secreted by animals to serve as the sole and wholesome food for their suckling young ones. It is a fine blend of all the nutrients necessary for growth and development of the young ones. It has been called the most "nearly perfect food", because it is an outstanding source of nutrients.

### History<sup>1,3</sup>

No one knows when people first used animal milk for food. However, the people of variant, Babylon, Egypt and India reared dairy cattle as early as 4000BC. At that time the family cow was the chief source of milk. A family used as much milk as it needed and traded or sold the rest to neighbours. This practice is still common in some parts of the world.

With the growth of cities, laws were based prohibiting cows within city boundaries. Dairy farmers outside the cities began to increase the size of their herds and to establish dairy businesses. Several inventions and new processes helped speed the growth of the milk industry.

### Composition of Milk<sup>1,4-6</sup>

**A) Proteins:** Chief protein of milk is casein; it occurs in combination with calcium as calcium caseinogenate. The other proteins are lactalbumin and lactoglobulin. Animal milk contain(s) nearly 3(three) times as much protein as human

milk. Milk proteins contain all the essential amino acids. Proteins are building foods, they help the body grow and maintain itself and also supply energy.

**B) Fat:** Fat content of milk varies from 3.4% in human milk to 8.8% in buffalo milk. Human milk contains a higher percentage of linoleic acid and oleic acid than animal milk. Milk fat is a good source ofretinol and vitamin D.

**C) Sugar:** The carbohydrate in all milk is lactose or milk sugar. It is found nowhere else in nature. It is less sweet than cane sugar and is readily fragmented by lactic acid bacilli. Human milk contains more sugar than animal milk.

**D) Minerals:** Milk contains almost all known minerals needed by body such as calcium, phosphorous, sodium, potassium, magnesium, cobalt, copper, iodine, etc.

**E) Vitamins:** Milk is a good source of all vitamins except vitamin C. vitamins are essential for growth, maintaining body tissue and prevention of diseases like beriberi and rickets.

The following daily consumption of milk group food is suggested by WHO

1. Children – 3 cups
2. Teenagers – 4 cups
3. Adults – 3 cups
4. Adults over 50 years – 4 cups

### Milk Borne Diseases<sup>1,7-10</sup>

A joint FAO/WHO expert committee (1970) on Milk Hygiene classified milk borne diseases as under.

1. Infections of animals that can be transmitted to man:
  - i. Primary importance- Tuberculosis, Brucellosis, Streptococcal infections, Staphylococcal enter toxin poisoning, Salmonellosis.
  - ii. Lesser importance – Cow pox and mouth disease, Anthrax, Leptospirosis.

2. Infections primary to man that can be transmitted through milk:
  - i. Typhoid and Paratyphoid fevers, Shigellosis, Enteropathogenic Escherichia Coli(EEC), Non diarrhoeal diseases

### Detailed Description of the Milk Dairy Plant in Doddabathi

**Purpose of the Visit:** Milk is an efficient vehicle for great variety of disease agents. The sources of infection or contamination of milk may be from:

1. The dairy animal
2. Human handler
3. The environment (e.g. – Contaminated vessels, polluted water, flies, dust, etc.)

So, as the future Dental professionals and Public Health Dentist, we are provided with an opportunity to have all insight about the milk processing which in turn help us to

motivate the community to consume clean and uncontaminated milk which helps to reduce the occurrence of milk borne disease.

**Team Visited:** A group of 39, III year BDS students from Department of Public Health Dentistry visited the milk dairy plant at Doddabathi along with one Assistant Professor and one postgraduate student and a driver.

There were about 25 staff members 20-30 labourers working in the milk dairy plant in separate departments.

**Plan for Visit:** A team of 39, III year BDS students from Department of Public Health Dentistry of Bapuji Dental College and Hospital visited the milk dairy plant situated at Doddabathi which is 12 km from Davanagere after obtaining official permission. From the administrative authorities of milk dairy plant, team visited the milk dairy plant on 11<sup>th</sup> October 2014 at 10.30 AM.



**Fig. 1: Students standing in front of milk dairy plant**

### Production, Collection, Processing, and Distribution of Milk

#### Production of Milk<sup>1,11-13</sup>

The milk that cows produce is called cow milk until it has been pasteurized. Harmful bacteria grow rapidly in the raw milk unless it is kept clean and cool. Dairy farmers therefore see that their cows and milking sheds are clean and they sterilize their milking equipment. Most farmers store raw milk in the refrigerator tank until it can be delivered to a processing plant. Government bodies set standards of cleanliness for dairy farms and processing plants.



**Fig. 2: Collection of milk**

Milk is collected from the farmers of the village societies and then transported to the dairy plant. Total numbers of societies which collect and dispatch milk to this dairy plant are about 60. The payment is made to the farmers directly on the basis of quality of the milk. Any foul

smelling milk is rejected at this stage itself to eliminate the risk factors. The milk collected is a mixture of cow milk and buffalo milk. A dairy plant operates large tank trucks to transport the milk from the farms.

**Processing of Milk<sup>1,14-17</sup>**



**Fig. 3: Electronic milk tester**

A large proportion of milk produced is processed into various kinds of fluid milk and cream and the rest is made into some dairy product as butter, cheese, ice cream. As soon as the tank truck arrives at the processing plant, laboratory technician check the smell, taste and appearance of milk. They also measure the fat content, number of bacteria, amount of milk solids, and the acidity. Technician further tests the milk during and after processing. All these testing helps ensure the quality and purity of milk. Milk is the most highly tested of the foods.

**Testing of Milk for it's Standard<sup>1</sup>**

**Methylene Blue Reduction Test:** It is an indirect method for detection of microorganism in milk. This test is carried out on the milk accepted for pasteurization. It is based on the observation that bacteria growing in milk brings about decrease in colour imparted to milk. In conducting the test, definite quantities of methylene blue are added to 10 ml of milk and the sample is held at a uniform temperature of 37°Celcius until the blue color has disappeared. The milk which remains blue for long period of time is considered to be of the best quality and a scale of grading different samples, on the basis of time required to reduce a definite quantity of methylene blue has been worked out, the test thus serves as confirmation of heavy contamination and compared with direct count of bacteria, it saves time and money.



**Fig. 4: Methylene blue reduction test**

**Acidity Test:** To assess the quality of the milk by assessing the lactic acid.

Sodium hydroxide titrated + phenolphthalein indicator is used

0.135 % - 0.153% lactic acid - milk is good

> 0.153 % lactic acid – (clot on boiling) contaminated milk

**Fat Test:** Used to assess the exact amount of fat in the milk using centrifugal machine.



**Fig. 5: Centrifugal machine to do the fat test**



**Fig. 6**

**SNF test (Solid Not Fat):** Using lactometer to assess the dilution of milk.





**Fig. 7: Lactometer**

After the test the milk goes through 5 basic steps:

1. Separation or standardization
2. Pasteurization
3. Homogenization
4. Fortification
5. Packaging

### Separation or Standardization<sup>1,18-21</sup>

Some of the milk that comes from the storage tank is separated. The rest is standardized. In separation, the cream color or fat is mechanically skimmed from the milk. Some of the cream is then either bottled or used to make butter or other dairy products. Some of the remaining skimmed milk is also either bottled or used to make such foods as cottage cheese. The rest of the cream and skimmed milk is used to standardize. The rest of the cream and skimmed milk is used to standardize the milk that has not been separated.

In standardization, fat content of milk is regulated by addition of cream or skimmed milk. The fat content is measured as milk flows through a pipeline. If the content becomes lower than the desired level, cream is pumped in. standardization enables dairies to produce 2% milk and other low fat milk with the uniform fat content. It also ensures that the fat content of whole milk meets the government requirements.



**Fig. 8: Standardization of milk**

### Pasteurization<sup>1,22-26</sup>

Pasteurization is defined as the testing of milk to such temperature and for such periods of time as are required to destroy any pathogens that may be present while causing minimal changes in the composition, flavors and nutritive value. Pasteurization kills nearly 90% bacteria in milk which are more heat resistant tubercle bacilli and Q fever organisms.<sup>49,50</sup> Nearly all milk sold in industrialized countries is pasteurized. Most is pasteurized by high temperature short time or HTST. Some of the methods used for pasteurization are:-

**HTST Method:** High temperature and short time method. The milk is rapidly heated to a temperature of nearly 72°C is held at that temperature for not less than 15 seconds and then it is rapidly cool to 4°C, this is now the most widely used methods. Very large quantity per hour can be pasteurized by this method.

**HOLDER (VAT) Method:** In this process milk is kept at 63° to 66° for at least 30 minute, and then quickly cooled to 5°. Vat method is recommended for small and rural communities. In large cities it is going out of use.

**UHT Method (Ultra High Temperature Method):** Milk is rapidly heated usually in two stages (second stage usually being under pressure) to 125° c for a few second only. It is then rapidly cooled and bottled as quickly as possible.

In order to check the growth of microorganisms, the pasteurized milk is rapidly cooled to 4° c. It should be kept cold until it reaches the consumer.

### Test of Pasteurized Milk<sup>27-29</sup>

**Phosphatase Test:** This test is widely used to check the efficiency of pasteurization. The test is based on the fact that raw milk contains an enzyme called phosphatase which is destroyed at routine at temperature which corresponds closely with the standard time and temperature required for pasteurization. At 60° c for 30 min, phosphatase is completely destroyed. Consequently, the test is used to detect inadequate pasteurization or the addition of raw milk.

**Standard Plate Count:** The bacteriological quality of pasteurized milk is determined by standard plate count. Most countries in west enforce a limit of 30,000 bacteria count per ml of pasteurized milk.

**Coliform Count:** Coliform organisms are usually completely destroyed by pasteurization and therefore their presence in pasteurized milk is an indication either of improper pasteurization or postpasteurization. The standard in most countries is that coliforms be absent in 1 ml of milk.



**Fig. 9: Milk pasturizer**

fat globules and gives every drop of milk the same amount of cream. Milk that has been homogenized tastes richer than non-homogenized milk.



**Fig. 10: Homogenization**

**Fortification<sup>40,41</sup>**

It improves the food value of milk by adding certain nutrients especially vitamins and proteins.

**Packaging:<sup>37-39</sup>**

It is the final step in the processing of milk. Automatic packaging machines fill and seal milk containers which are transparent plastic pouches or in plastic coated flexible paper containers.

**Homogenization<sup>42,48</sup>**

Almost all the whole milk and low fat milk are homogenized. Homogenized breaks up the fat globules in the milk so the globules do not rise to the top. A machine called homogenizer forces the milk through tiny openings under great pressure. The process increases the number of



**Fig. 11: Packaging of milk**

**Distribution of Milk<sup>34-36</sup>**

The production of milk from this dairy is about 35,000 L per day. November-December is the plush season for milk production and the figures can reach up to over 50,000 L per day. It is due to the fact that the milking breeds give more

milk in this season. In the summer season, the production can fall to as low as 25,000 L per day. Refrigerated trucks delivered the processed and packaged milk to shops and homes.

## Milk Products<sup>1,30-33</sup>

Milk is consumed in a variety of forms- as whole milk, butter, ghee, cheese, dried and condensed milk, evaporated milk, khoa, icecream, peda, yoghurt etc.

**Skimmed Milk:** milk from which fat has been removed is known as “skimmedmilk”. It is devoid of fat and fat soluble vitamins, but a good source of milk proteins (86%) and calcium.

**Toned Milk:** The term ‘toned’ is an Indian coinage. It is a blend of natural milk and made up of milk. It contains 1 part of water, 1 part of natural milk and 1/8<sup>th</sup> part of skimmed milk powder. The mixture is stirred, pasteurized and supplied in bottles. Toned milk has a composition nearly equivalent to cow’s milk. It is cheaper yet a wholesome product.

The products of this milk dairy plant is marketed under the brand name Nandini, 38-40 products are manufactured under this brand name.

This milk dairy comes under “Shimogaunion” which includes 3 districts Davangere, Shimoga and Chitradurga. All together there are about 13 milk unions in Karnataka which produce milk from “Primary Dairy Cooperative Societies” and distribute milk to the consumers in various towns, cities, rural markets in Karnataka. The milk union is controlled by the Karnataka Cooperative Milk producers ‘Federation limited’. It is the apex body in Karnataka, representing dairy farmers’ cooperatives. It is the second largest dairy cooperative in the country.

## Conclusion

Milk is a complete food. To have good healthy life we should use pure milk which is pasteurized and purified to the standard of WHO.

Milk and the milk products improve the life of farmers who are the backbone of our developing nation.

As public health dentist we should recommend the public to consume pasteurized and purified milk that meets the WHO standards which is necessary for systemic health.

Finally I would like to conclude that this program was a beneficial visit as we got to know about pasteurization method for milk in large scale for community and its quality and also about its packing and distribution. It is not as easy as opening of milk packet for consumption. There is involvement of disciplined work of hundreds of people and technology.

## Acknowledgement

“We become strong only after we have acknowledged our weakness. Gather knowledge, insight, and experience and then make your own decision”

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