

Chapter 1

INTRODUCTION

(What is milk, Production status and importance of milk in national scenario, Definition of some common forms of milk/ milk products, Quality parameters of milk)

What is milk

Milk may be defined as the whole, fresh, clean lacteal secretion obtained by the complete milking of one or more healthy milch animals, excluding that obtained within 15 days before and 3 days after calving or such periods as may be necessary to render the milk practically colostrums free and containing the minimum prescribed percentage of milk fats and S-N-F.

(Milk in technical aspect is defined as the whole, normal, clean and fresh lacteal secretion obtained by milking a healthy animal 72 hours after calving.)

Importance of milk in national scenario

- India ranks first in milk production, accounting for 18.5 per cent of world production, achieving an annual output of 146.3 million tonnes during 2014-15 as compared to 137.69 million tonnes during 2013-14 recording a growth of 6.26 per cent.
- The Food and Agriculture Organization (FAO) has reported a 3.1 per cent increase in world milk production from 765 million tonnes in 2013 to 789 million tonnes in 2014.
- The target for milk production in the country fixed by the Government for the year 2016-17 was 163.7 million tonnes.
- The per capita availability of milk in India has increased from 176 grams per day in 1990-91 to 322 grams per day by 2014-15. It is more than the world average of 294 grams per day during 2013.
- The country's estimated demand for milk is likely to be about 155 million tonnes by 2016-17 and around 200 million tonnes in 2021-22. To meet the growing demand, there is a need to increase the annual incremental milk production from 4 million tonnes per year in past 10 years to 7.8 million tonnes in the next 8 years (210 million by 2021-22), (T Nanda Kumar, chairman, NDDB).
- India has about three times as many dairy animals as the USA, which produces around 75 million tons milk, over 80 per cent being kept in herds of 2 to 8 animals.
- Annual milk yield per dairy animal in India is about one tenth of that achieved in the USA and about one fifth of the yield of a grass-fed New-Zealand dairy cow.
- A peculiar feature in our country is the wide variation between regions in respect of consumption of milk.

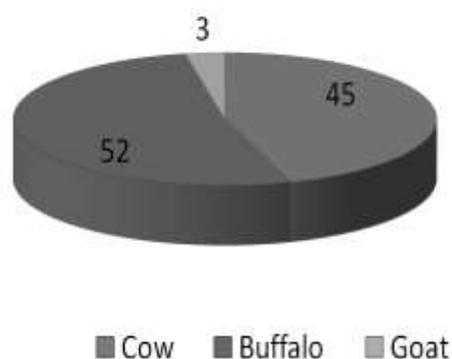
Table 1.1 Milk production in India

Year	Production (million tonnes)	Per capita availability (g/day)
1991-92	55.7	178
1995-96	66.2	197
2000-01	80.6	220
2005-06	97.1	241
2008-09	108.5	258
2014-15	146.3	322

Source: Department of Animal Husbandry, Dairying & Fisheries, Ministry of Agriculture, Govt. of India

*The per capita availability in different states vary widely.

- In 2001-02 India became the world leader in milk production.
- Recommended value of milk consumption is 250-450 g. (Minimum recommended by NIN is 80 to 310g/capita-day.
- Per-capita availability in India was only 114 g in 1975.

**Fig. 1.1 Species contribution in India (in percentage)**

The following points need consideration for improvement in dairy sector

- Low milk yielding capacity of average Indian cow
- Shortage of feed and fodder

- Lack of organized milk production and collection, restricted transport facilities (especially refrigerated)
- Shortage of processing and marketing organizations
- Poor quality milk, wide spread adulteration and lack of quality consciousness among the majority of consumers.

Definition of some common forms of milk/ milk products

Market milk	Refers to fluid whole milk that is sold to individuals usually for direct consumption. It excludes milk consumed on the farm and that used for the manufacture of dairy products.
Pasteurized milk	It is the milk, which has been heated (processed) for at least 30 minutes at 63°C or 15 sec at 72°C (or any time temperature combination that is equally efficient in approved and properly operated equipment). After pasteurization the milk is cooled immediately to 5°C or below.
Sterilized milk	Milk which has been heated to a temperature of 100°C or above for such lengths of time that it remains fit for consumption for at least 7 days at room temperature (Usually the process condition is 108-111°C for 25-30 min).
Homogenized milk	It is the milk which has been treated in such a manner as to ensure break up of fat globules to such an extent that after 48 hours of storage no visible cream separation occurs in the milk and the fat percentage of the milk in the top 100 ml of milk in a quart bottle or of proportionate volumes in containers of other sizes does not differ by more than 10% of itself from the fat percentage of the remaining milk as determined after thorough mixing (In sufficiently homogenized milk, the fat globules are subdivided to 2 microns or less in diameter).
Soft-curd milk	<p>It is the milk that forms a soft curd when coagulated with rennet or pepsin under standard procedure (Curd tension <25 g). Soft curd milk is characterized by low casein content and low Ca content.</p> <p>(Mother's milk is best for infants because it forms a soft curd when coagulated in the stomach and is apparently more quickly digested than cow or buffalo milk)</p> <p>Curd tension of human milk: 0 g, Boiled cow milk: 3 g, Homogenized milk : 14.5 g, Pasteurized milk: 44.5 g, Raw milk : 55g)</p>

Flavored milk	Milk to which some flavors have been added. When the term 'milk' is used, the product should contain a fat per cent at least equal to the minimum legal for the market milk. But when the fat level is lower (1-2 per cent), the term drink is used.
Vitaminized milk	Milk in which one or more vitamins have been added.
Irradiated milk	Milk in which Vitamin D content has been increased by exposure to U-V rays.
Mineralized milk	Milk in which minerals have been added (Addition of vitamins and minerals to milk is known as fortification and such milk is called fortified milk).
Frozen concentrated milk	The milk is partially concentrated and solidified by freezing
Fermented milk	Milk that has been made by employing selected microorganisms to develop the characteristic flavor and/or body and texture. (Fermentation has been defined as the metabolic process in which chemical changes are brought about on an organic substratum, whether carbohydrates, proteins or fat, through the action of enzymes liberated by specific microorganisms. In milk, the most important fermentation is the lactic acid fermentation or souring of milk.)
a. Natural butter milk	It is a by-product of churning cream for butter making. Ripened cream, which has undergone a clean, lactic fermentation, is usually preferred.
b. Cultured butter milk	Obtained by inoculation and incubation of pasteurized skim milk with lactic starter.
c. Acidophilus milk	Produced by development in milk of a culture of <i>Lactobacillus acidophilus</i> (It is claimed that acidophilus milk is therapeutic and has health promoting properties.).
d. Yoghurt	Manufactured by using whole or partially defatted milk containing small amounts of skim milk powder or concentrate. The fat content of yoghurt may vary from 0-5% and the solids content 9-20% (Fermented by <i>L. bulgaricus</i> and <i>Str. Thermophilus</i>)
Standardized milk	Whose fat and solids not fat (SNF) has been adjusted to a predetermined level
Reconstituted milk	Milk prepared by dispersing whole milk powder (also called

dried whole milk) in water approximately in the proportion of 1 part powder to 7-8 parts water (Usually spray dried milk is used since it is more soluble and produces less sediment.)

Recombined milk	Product obtained when butter oil (also called dried or anhydrous milk fat), skim milk powder and water are combined in the correct proportions to yield fluid milk (at least 3% fat and 8.5% SNF)
Toned milk	Milk obtained by addition of water and skim milk powder to whole milk (at least 3% fat and 8.5% SNF). In practice, whole buffalo milk is admixed with reconstituted spray dried skim milk for its production.
Double toned milk	Same as toned milk, but minimum 1.5% fat and 9.0% SNF
Humanized milk	When cow or buffalo milk is so modified in its chemical composition that it resembles human milk.
Filled milk	Same as recombined milk, except that the fat is derived from a vegetable source.
Imitation milk	A product resembling milk, but of non-dairy origin
Vegetable toned milk	The milk protein of skim milk powder is substituted by vegetable protein isolated from groundnut.
Soyamilk	Made from soybean
Cream	It is the portion of milk, which is rich in milk fat (when milk fat is concentrated in to a fraction of the original milk, the portion is known as cream). According to PFA rules (1976), cream, excluding sterilized cream is the product of cow or buffalo milk or a combination thereof which contains not less than 25% milk fat (The milk fat in cream varies from 18-85%; the SNF constituents occur in lower proportions than in milk.)
Butter	May be defined as a fat concentrate which is obtained by churning cream, gathering the fat into a compact mass and then working it. According to PFA rules (1976), table butter is the product obtained from cow or buffalo milk or a combination there of, with or without the addition of common salt and annatto or carotene, a coloring matter. It should be free from other animal fats, wax and mineral oils, vegetable oils and fats.
Butter oil	Refers to the fat concentrate obtained mainly from butter or cream by the removal of practically all the water and SNF content. The term milk fat, anhydrous milk fat, dry butter fat and

dehydrated butter fat are used synonymously for butter oil, but the raw material for their preparation is usually cream.

Cheese

A product made from curd (obtained from milk) by coagulating the casein with the help of rennet or similar enzymes in the presence of lactic acid produced by added or adventitious microorganisms, from which part of the moisture has been removed by cutting, cooking and /or pressing, which has been shaped in a mould and then ripened by holding it for some time at suitable temperature and humidity.

(According to PFA rules, (hard) cheese means the product obtained by draining after coagulation of milk with a harmless milk-coagulating agent, under the influence of harmless bacterial cultures). It shall not contain any ingredient not found in milk, except coagulating agent, NaCl, CaCl₂, etc.

Condensed milk

Products obtained by evaporating part of the water of whole milk, or fatty or partly skimmed milk with or without the addition of sugar. (The term condensed milk is commonly used when referring to “full cream sweetened condensed milk” while the term evaporated milk is commonly used for “full cream unsweetened condensed milk”. Skimmed milk products are known as sweetened condensed skim milk and unsweetened condensed skim milk, respectively.

Dried milk

Dried milk or milk powder is the product obtained by the removal of water from milk by heat or other suitable means, to produce a solid containing 5% or less moisture. The dried product obtained from whole milk is called dried whole milk or whole milk powder (WMP), that from skim milk is known as dried skim milk (SMP) or not fat dry milk (NFDM) from defatted milk.

Khoa / Mawa

Refers to partially dehydrated whole milk product prepared by continuous heating of milk in a big kettle over a direct fire, while also constantly stirring-cum-scrapping till it reaches a semi-solid (doughy) consistency. There after, the pan contents are removed from the fire and worked up into a solid mass known as khoa pat.

(According to PFA rules, khoa is the product obtained from cow or buffalo (or goat) milk or a combination thereof by rapid drying. The milk fat is not less than 20 % of the finished product.

Khurchan

This is concentrated sweetened whole milk product prepared by simmering milk without stirring it in a big kettle, so as to allow for the simultaneous formation of a thick creamy layer of skin on the surface of the milk and slow evaporation of the water, after

which sugar is added to the concentrated product. A thorough mixing of the product follows this.

- Rabri** This is especially prepared, concentrated and sweetened whole milk product, containing several layers of clotted cream. While the milk is slowly evaporated (without being stirred) at simmering temperature in a kettle over an open fire, pieces of skin, which form on the surface of the milk, are continuously broken up and moved to cooler parts of kettle. When the volume of milk has been considerably reduced, sugar is added to it; thin layers of clotted cream are immersed in the mixture and the finished product is obtained by heating the whole mass for another short period.
- Kulfi** This is an indigenous ice cream frozen in small containers. While the milk is boiling, it is sweetened by addition of sugar and the product is concentrated to approximately 2:1. After the concentrate has cooled, malai (indigenous cream), crushed nuts and a flavor (commonly rose or vanilla) are added to it. The mix is placed in a triangular, conical or cylindrical moulds of various capacities made from GI. The moulds are closed on top by placing small discs over them and the edges made air tight with wheat dough (Modern moulds are made of plastic, with screw cap plastic tops). The mix-in-moulds is frozen in a large earthen vessel containing a mixture of ice and salt in the ratio of 1:1.
- Malai** Creamy layer formed on the surface of milk, which has been heated, very slowly to boiling temperature and then left to cool undisturbed. The creamy layer is then screamed off. Owing to the higher fat content and larger fat globules, buffalo milk gives higher yields and is used for the preparation of *malai*.
- According to PFA rules, *malai* refers to the product rich in butter fat prepared by boiling and cooling cow or buffalo milk or a combination thereof. It should not contain less than 25 % milk fat.
- Dahi (Curd)** Prepared from pasteurized or boiled milk by souring, natural or otherwise, by a harmless lactic acid or other bacterial culture. Dahi should also contain same percentage of fats and SNF as the milk from which it is prepared. Broadly speaking, Curd can be classified into two types: (i) For churning into desi (or indigenous) butter (makkhan); (ii) For direct consumption (a) whole milk dahi, skim milk dahi, and (b) sweet (or mildly sour) dahi, sour dahi, sweetened dahi.
- Srikhand** It is a semi-soft, sweetish-sour whole milk product prepared from lactic fermented curd. The curd is partially strained through a

cloth to remove the whey and thus produce a semi-solid mass called chakka (the basic ingredient for Srikhand). The chakka is mixed with the required amount of sugar etc. to yield srikhand. The srikhand is further desiccated over an open pan to make the Srikhand wadi sweet.

Panir	Refers to the indigenous variety of rennet-coagulated, small sized soft cheese.
Makkhan	Refers to the country / desi butter normally obtained by churning whole milk curd (dahi with crude indigenous devices. Not less than 76% fat)
Ghee	Clarified butter fat prepared chiefly from cow or buffalo milk. Not less than 99-99.5% fat.
Chhana	Chhana refers to the milk solids obtained by the acid coagulation of boiled hot whole milk and subsequent drainage of whey (commonly used are lactic acid and citric acid). It has less than 70% moisture and not less than 50% milk fat of the total dry matter
Whey	The drained water obtained as a by-product of cheese making is known as whey. It is rich in lactose, different salts, TS and SNF.

Quality parameters of milk

When we buy milk, a lot of quality parameters come to our mind either in direct form or indirect form. For example, the property of milk in terms of its composition, microbial load, freshness are a group of quality parameters. Another set of quality parameters may be the effect on environment, ethics, ecology, etc. All these quality parameters affect our acceptability or otherwise for the milk. Figure 1.2 gives a representation of the different quality parameters of milk affecting the consumer acceptance.



Fig. 1.2 Quality parameters of milk affecting the consumer acceptance

CHECK YOUR PROGRESS

1. Define and distinguish between the different forms of milk and milk products ?
2. Write a two page note on dairy development in India and Odisha since independence.
(The answer should include the following:
 - Development of milk production since independence (India and Odisha)
 - Development of dairy processing industry in India and Odisha.
 - References