Milk may be defined as the whole, fresh, clean, lacteal secretion obtained by complete milking of one or more healthy milch animals, excluding the milk obtained within 15 days before or 5 days after calving or such periods as may be necessary to render the milk practically colostrum-free and containing the minimum prescribed percentages of milk fat and milk-solids-not-fat. In India, the term 'milk', when unqualified, refers to cow or buffalo milk, or a combination thereof. Milk SNF means Milk Solids-not-Fat, comprising protein, carbohydrates, vitamins, minerals, etc in milk other than milk fat.

As an agricultural product, milk is extracted from mammals during or soon after pregnancy and is used as food for humans. The different milks tend to vary according to the way they are produced, and their fat content. The fat content of milk varies depending on the product e.g. whole milk has a fat content of about 4% fat, whole standardised milk, that which is widely available for sale, has a minimum fat content of 3.5% fat, semi skimmed milk contains 1.7% fat, skimmed milk contains about 0.1% fat, and in addition there is 1% fat milk.
Dairies in India have to market milk by standardizing, as per the various types of milk prescribed under Food Safety Standard Act, 2006. These type of milk differ in their Milk fat and Milk SNF contents.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Type of Milk</th>
<th>Milk Fat (% Not less than)</th>
<th>Milk SNF (% Not less than)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Full Cream Milk</td>
<td>6.0</td>
<td>9.0</td>
</tr>
<tr>
<td>2</td>
<td>Baffalo Milk</td>
<td>5.0</td>
<td>9.0</td>
</tr>
<tr>
<td>3</td>
<td>Standardize Milk</td>
<td>4.5</td>
<td>8.5</td>
</tr>
<tr>
<td>4</td>
<td>Cow Milk</td>
<td>3.5</td>
<td>8.5</td>
</tr>
<tr>
<td>5</td>
<td>Toned Milk</td>
<td>3.0</td>
<td>8.5</td>
</tr>
<tr>
<td>6</td>
<td>Double Toned Milk</td>
<td>1.5</td>
<td>8.5</td>
</tr>
<tr>
<td>7</td>
<td>Skimmed Milk</td>
<td>Not more than 0.5</td>
<td>8.7</td>
</tr>
</tbody>
</table>

A. Types of Milk Based on Fat Content

Milk is processed on the basis of the maximum content of fat and solid not fat (SNF) it would ultimately possess.

**Standardized milk**- This is made by combining buffalo milk and skimmed milk. The fat percentage is maintained at 4.5% while the SNF is 8.5%.

**Whole milk**: *Natural whole milk* is milk with nothing added or removed. Whole milk, also called full cream milk is usually consumed by children, teenagers and
body builders. Whole milk is called so because it contains all the milk fat found in them. Whole milk is also creamier and full of flavour.

Whole milk must contain at least 3.25% milk fat and 8.25% milk solids by weight—which means it derives about 50% of its calories from fat. Because of this relatively high fat content, whole milk is best used only for infants and young children.

**Reduced-fat milk (2%)**: This milk contains 2% milk fat. The percentage of milk fat refers to the percentage of fat by weight, and much of milk’s weight is water. Once the water is subtracted from 2% milk, for example, a product that left with 20% fat contains by weight; such milk actually derives 35% of its calories from fat. Drinking 2% milk is a good way to wean oneself from whole milk at first, but is too high in fat as a permanent choice, unless the diet is otherwise very low in fat.

**Low-fat milk (1%)**: One-percent milk gets 23% of its calories from fat. Many people find low-fat milk more appealing and a good compromise. The EU regulations for milk classification previously divided milk into three categories defined by the fat content; whole, semi-skimmed or skimmed. Prior to 2008, any milk that contained a different fat content was defined as a ‘milk drink’.

On the 1st of January 2008 new regulations came into force to facilitate consumer choice. Now any milk with a fat content other than those laid out can also be
considered as ‘milk’, provided that its fat content is clearly indicated on the packaging in the form of % fat. However, these milks cannot be described as whole, semi-skimmed or skimmed.

The nutritional differences between semi-skimmed and 1% fat milk are small and dependent mainly on the difference in fat content. 1% fat milk contains 40% less total and saturated fat than standard semi-skimmed milk. In addition, it has lower energy content than semi-skimmed and slightly lower levels of vitamins A and E, but has higher calcium content. See nutritional composition of 1% fat milk.

**Skimmed milk/non-fat milk:** This type of milk has as much fat removed as possible. It may not contain more than 0.5% milk fat by weight, and usually contains less than 0.5 gm of fat per cup, deriving just 5% of its calories from fat. Skimmed milk has about half the calories of whole milk. It is the best choice for adults, and is the only type of milk that should be consumed by people on strict low-fat diets. Unfortunately, skim milk has a very "thin" flavor and an unappealing bluish cast.

It contains slightly more calcium than whole milk and lower levels of fat soluble vitamins, particularly vitamin A, as this is lost when the fat is removed—see nutritional composition of milks.
The lower level of fat in skimmed milk reduces its calorie (energy) content. For this reason it is not recommended for children under the age of 5 years as they need the extra energy for growth. However it is ideal for adults who wish to limit their fat or calorie intake. Skimmed milk has a slightly more watery appearance than other types of milk and has a less creamy taste due to the removal of fat.

**Toned milk:** Toned milk, also called the single toned milk is obtained by adding skimmed milk powder and water to whole milk. It contains about 3.0% fat and toned milk restricts the body from absorbing cholesterol from the milk to minimum. Toned milk contains the same nutrition as whole milk minus the fat soluble vitamins. One glass of toned milk provides around 120 calories.

**Double Toned Milk:** This milk is obtained by adding skimmed milk powder to whole milk and has about 1.5% fat content. Double toned milk is ideal for those trying to maintain weight as it keeps the calorie intake under check and aids weight loss.

**B. Processed Milk**

**Pasteurized milk:** Pasteurisation is the most popular method of heat treatment. It is a relatively mild form of treatment, which kills harmful bacteria without significantly affecting the nutritional value or taste of the milk.
The basic process for whole milk involves heating the milk to a temperature of no less than 71.7°C for a minimum of 15 seconds (max 25 seconds). This process is known as High Temperature Short Time (HTST).

After this the cold milk that enters the heat exchanger is heated by the hot milk leaving it, which in turn is partly cooled. Following heating, the milk is cooled rapidly to below 6°C using chilled water on the opposite side of the plate. This process also extends the keeping quality of the milk.

All milk that is available for sale to consumers through supermarkets and milkmen must be pasteurised i.e. heated to 71.7°C in order to make it safe for consumers and improve its shelf life. However UHT milks have a longer shelf life as a result of the higher temperatures to which they are heated and the packaging used to store them.

A side effect of the heating of pasteurization is that some vitamin and mineral content is lost. Soluble calcium and phosphorus decrease by 5%, thiamin and vitamin B12 by 10%, and vitamin C by 20%. Because losses are small in comparison to the large amount of the two B-vitamins present, milk continues to provide significant amounts of thiamin and vitamin B12. The loss of vitamin C is not nutritionally significant, as milk is not an important dietary source of vitamin C.
A newer process, ultrapasteurization or ultra-high temperature treatment (UHT), heats the milk to a higher temperature for a shorter amount of time. This extends its shelf life and allows the milk to be stored unrefrigerated because of the longer lasting sterilization effect.

**Microfiltration** is a process that partially replaces pasteurization and produces milk with fewer microorganisms and longer shelf life without a change in the taste of the milk. In this process, cream is separated from the whey and is pasteurized in the usual way, but the whey is forced through ceramic microfilters that trap 99.9% of microorganisms in the milk (as compared to 99.999% killing of microorganisms in standard HTST pasteurization). The whey then is recombined with the pasteurized cream to reconstitute the original milk composition.

**Homogenised milk:** Homogenisation of milk involves forcing the milk at high pressure through small holes. This breaks up the fat globules in order to spread them evenly throughout the milk and prevent separation of a cream layer.

This process basically results in milk of uniform composition or consistency and palatability without removing or adding any constituents. Homogenisation increases the whiteness of milk because the greater numbers of fat globules scatter the light more effectively. Most milk available on the market is homogenised at present.
Milk often is homogenized, a treatment that prevents a cream layer from separating out of the milk. The milk is pumped at high pressures through very narrow tubes, breaking up the fat globules through turbulence and cavitation. A greater number of smaller particles possess more total surface area than a smaller number of larger ones, and the original fat globule membranes cannot completely cover them. Casein micelles are attracted to the newly exposed fat surfaces. Nearly one-third of the micelles in the milk end up with participating in this new membrane structure. The casein weighs down the globules and interferes with the clustering that accelerated separation. The exposed fat globules are vulnerable to certain enzymes present in milk, which could break down the fats and produce rancid flavors. To prevent this, the enzymes are inactivated by pasteurizing the milk immediately before or during homogenization.

Homogenized milk tastes blander but feels creamier in the mouth than unhomogenized. It is whiter and more resistant to developing off flavors. Creamline (or cream-top) milk is unhomogenized. It may or may not have been pasteurized. Milk that has undergone high-pressure homogenization, sometimes labeled as "ultra-homogenized," has a longer shelf life than milk that has undergone ordinary homogenization at lower pressures.
Sterilized milk (UHT Milk): Sterilized milk is available in whole, semi skimmed and skimmed varieties. It goes through a more severe form of heat treatment, which destroys nearly all the bacteria in it.

Firstly the milk is pre-heated to around 50°C, then homogenised (see below for a brief outline of homogenisation), after which it is poured into glass bottles which are closed with an airtight seal.

There is no legally defined process for sterilising milk but, commonly, filled bottles are carried on a conveyor belt through a steam chamber where they are heated to a temperature of between 110-130°C for approximately 10-30 minutes. Then they are cooled using a cold water tank, sprays or, in some cases, atmospheric air and then crated.

The sterilisation process results in a change of taste and colour and also slightly reduces the nutritional value of the milk, particularly the B group vitamins and vitamin C.

Unopened bottles or cartons of sterilised milk keep for approximately 6 months without the need for refrigeration. Once opened it must be treated as fresh milk and used within 5 days.

C. Heat Treated Milk
**Evaporated milk:** Evaporated milk is a concentrated sterilised milk product. It has a concentration twice that of standard milk. The process of producing evaporated milk involves standardising, heat treating and evaporating the milk under reduced pressure, at temperatures between 60ºC and 65ºC.

The evaporated milk is then homogenised to prevent it separating under storage and then it is cooled. The evaporated milk is poured into cans, which are then sealed. At this point the cans are moved to a steriliser where they are held for 10 minutes. A cooling stage follows and the cans are then labeled and packed.

As a result of processing, evaporated milk possesses a characteristic cooked flavour as well as a characteristic colour. The shelf-life of canned evaporated milk is commonly stated as one year stored at ambient temperatures, though in practice the product will keep for longer.

**Condensed milk:** Condensed milk is concentrated in the same way as evaporated milk, but with the addition of sugar. This product is not sterilised but is preserved by the high concentration of sugar. It can be made from whole milk, semi skimmed or skimmed milk. The heat treatment used consists of holding standardised milk at a temperature of 110-115ºC for one to two minutes.

The milk is then homogenised, the sugar added and the sweetened milk is then evaporated at low temperatures (between 55-60ºC). The concentration of the
condensed milk is now up to 3 times that of the original milk. The milk is then cooled rapidly to 30°C and packaged.

Sweetened condensed milk is commonly used in the sugar confectionary industry for the production of toffee, caramel and fudge. It is also an alternative to liquid milk which was once traditionally used in these products.

**Dried or Powdered milk:** Milk powder is produced by evaporating the water from the milk using heat. The milk is homogenised, heat treated and pre-concentrated before drying. There are a number of ways to produce dried milk powder including spray drying and roller drying.

*Spray drying* process is the most commonly used. The concentrated milk is introduced into a chamber (usually as a fine mist) through which hot air is circulating. The droplets of milk soon lose their water and fall to the floor as fine powder. Skimmed milk powder can be mixed easily with water; however whole milk isn’t easily reconstituted due to its higher fat content.

*Roller drying* is comparatively older process of producing milk powder-this involves spreading the concentrated milk onto heated rollers. The water evaporates quickly and leaves a thin film of powder, which is scraped off the rollers. This powder has a cooked flavour and tends to form lumps when mixed with water.
Whole milk powder contains all the nutrients of whole milk in a concentrated form with the exception of vitamin C, thiamin and vitamin B12. Skimmed milk powder contains hardly any fat and therefore no fat soluble vitamins. However, the protein, calcium and riboflavin content remain unaffected. If stored correctly, skimmed milk powders can be kept for up to one year. Once they are reconstituted, they must be treated as fresh milk.

**Flavoured milk:** The flavoured milk market is one of the fastest growing dairy sectors. There are a wide variety of flavours and consistencies to cater for all ages and tastes with a choice of long-life (i.e. Ultra Heat Treated or sterilized or fresh flavoured milk. Most flavoured milk products are produced using reduced fat milk varieties and usually have a fat content of around 1%.

The most popular flavours are chocolate, strawberry and banana however more sophisticated flavours such as peach, mocha or products made with real Belgian and Swiss chocolate have been developed for the more adult market. In comparison with plain milks, flavoured milks tend to have slightly higher sugar content; however studies have suggested that they are still a favourable option for children and teenagers as they provide a wide range of beneficial nutrients.

**Health Benefits of different kinds of Milk**
Milk is an extremely beneficial drink for the health of the human body. Some of the advantages of drinking this life-giving nectar are as follows:

**Complete nutrition:** Milk is a complete food. It contains almost all vital nutrition in easily digestible and assimilable form, so it is good handy food for everyone, from infants to older people. Different kinds of milk make it more versatile in terms of taste, flavor, appearance and nutritional composition. We can get a very low calories containing skimmed milk to high calorie rich creamy whole fat milk. Condensed or powdered milk, homogenized or pasteurized milk fulfills all short of requirements suitable for food preparation and consumption.

**Healthy bone and teeth:** Milk is the best source of calcium to our body. Calcium protects the body from major chronic ailments such as cancer, bone loss, arthritic conditions, migraine headaches, pre-menstrual syndrome, and obesity in children. Milk is the quickest, least expensive, and most readily available source of calcium on the market. Calcium is an essential mineral in the creation of bone matter, and bone mineral. Milk helps children and youngsters to attain excellent dental health, as milk protects the enamel surface against acidic substances.

**Healthy Heart:** It has also been found that milk consumption reduces risk of heart diseases and the chances of strokes. Milk supply the magnesium and potassium both act as vasodilators, which reduces blood pressure, increases blood flow to vital organs, and reduces the stress on the heart and cardiovascular system. Milk
proteins also believed to inhibit the creation of (angiotensin-converting enzymes which increase blood pressure.

Rehydration: Fluids are an integral part of the human body, and the body needs to be frequently replenished with liquids as they are used up within the body. Milk contains a good quantity of water molecules and is considered the best fluid for rehydration, outside of drinking actual water. Water makes up more than 80% of our body mass, and the balance of fluids in our body is essential for every single process in our body.

Skin health: Milk is also good for treating dry skin, it is a good moisturizer. The milk solids nourish and smooth your skin. The lactic acid present in milk is known to aid in removing dead skin cells, thereby rejuvenating skin and keeping it fresh. Finally, simply drinking milk, due to its impressive content of vitamin A, helps to boost the health of the skin from inside the body, particularly since the antioxidant potential of milk helps to eliminate free radicals, the dangerous byproducts of cellular metabolism that are partially responsible for premature aging of the skin, resulting in wrinkles and age spots.

Anti Acidity effect: Consumption of milk products can also help in reducing acidity throughout the body. Drinking cold milk specifically provides relief from acidity.