



Milk And Techniques To Measure Milk Adulteration What Is Milk?

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A whitish liquid containing proteins, fats, lactose and various vitamins and minerals that is produced by the mammary glands of all mature female mammals after they, have given birth and serves as nourishment of their young. The milk of cows, goats, or other animals, used as food by humans.

Although milk from the cow is processed, it is not an engineered or fabricated food. It is about 87 percent water and 13 percent solids. The fat portion of the milk contains fat soluble vitamins. The solids other than fat include proteins, carbohydrates, water soluble vitamins, and minerals. These nutrients in milk help make it nature's most nearly perfect food.

Milk products contain high quality proteins. The whey proteins constitute about 18 percent of the protein content of milk. Casein, a protein found only in milk, contains all of the essential amino acids. It accounts for 82 percent of the total proteins in milk and is used as a standard for evaluating protein of other foods. Protein is needed to build and repair body tissues and to form antibodies which circulate in the blood and help fight infection.

Milk also contains the following nutrients: calcium, phosphorus, magnesium, and potassium. The calcium found in milk is readily absorbed by the body. Phosphorus plays a role in calcium absorption and utilization. Phosphorus is needed in the proper ratio to calcium to form bone. Milk provides these two minerals in approximately the same ratio as found in bone. Milk is also a significant source of riboflavin (vitamin B2) which helps promote healthy skin and eyes, as well as vitamins A and D.

In adults, a calcium deficiency, along with other factors, may result in bone

deterioration called osteoporosis. The recommendations for calcium are 1,000 milligrams for adults, 1,300 milligrams per day for adolescents, 500-800 milligrams per day for young children and 1,200 milligrams per day for adults over 51 years of age. One serving of milk has about 250 milligrams of calcium. It is difficult to obtain adequate calcium without milk and milk products in the diet. About 73 percent of the calcium available in the food supply is provided by milk and milk products. The following daily consumption of milk group foods is suggested by the government's Dietary Guidelines: Children 1-8 years old, 2 servings, Children 9 years and older, 3 servings, Adults, 3 servings

Milk is known for its richness in calcium and thus its importance for your bones, but milk contains more than 9 other essential nutrients. It contains protein, carbohydrates, vitamins, minerals and fat. Protein is important to fight diseases, renew cells, build muscles and maintain healthy hair and nails. That is why your diet should provide enough proteins. Milk is an important source of protein, since each glass contains almost 8 grams. The source of carbohydrates in milk is lactose which gives energy to the body. Minerals and vitamins: Milk is rich in many nutrients that are essential for good health, for stronger bones (Calcium, Vitamin D, Phosphorous), for more energy (B vitamins), for a stronger immune system and for healthier skin (Vitamin A). Fats in milk constitute essential fatty acids which are important for body cells, as long as they are taken in moderate quantities.

Milk and dairy products contain many nutrients and provide a quick and easy way of supplying these nutrients to the diet within relatively few calories. Milk, cheese and yogurt

all provide the following beneficial nutrients in varying quantities.

- Calcium - for healthy bones and teeth
- Phosphorous - for energy release
- Magnesium - for muscle function
- Protein - for growth and repair
- Vitamin B12 - for production of healthy cells
- Vitamin A - for good eyesight and immune function
- Zinc - for immune function

- Riboflavin - for healthy skin
- Folate - for production of healthy cells
- Vitamin C - for formation of healthy connective tissues.
- Iodine - for regulation of the body's rate of metabolism (how quickly the body burns energy and the rate of growth)

One glass of milk alone can make a contribution to the daily recommended intake of many important nutrients for all age groups. Contribution of 1 glass of milk to daily nutrient requirements

Nutrient	Amount present in a glass (200ml) skimmed milk	Contribution to semi recommended daily amount for females 11-18 years (%)	Contribution to recommended daily amount for males 11-18 years (%)
Protein (g)	7.2	13	16
Calcium (mg)	247	25	31
Phosphorus (mg)	194	25	31
Magnesium (mg)	23	8	8
Sodium (mg)	89	6	6
Potassium (mg)	321	9	9
Chloride (mg)	179	7	7
Iron (mg)	0.04	0.4	0.3
Zinc (mg)	0.8	8	11
Copper (mg)	Trace	-	-
Selenium (µg)	2	3	3
Iodine (µg)	62	44	44
Vitamin A (µg)	39	6	7
Thiamin (mg)	0	0	0
Riboflavin (mg)	0.5	38	45
Niacin (mg)	0.2	1	1.4
Vitamin B ₆ (mg)	0.12	8	10
Vitamin B ₁₂ (µg)	1.9	127	127
Folate (µg)	19	10	10
Vitamin C (mg)	4	10	10
Vitamin D (µg)	Trace	-	-

It is highly recommended to consume milk and dairy foods as part of a healthy balanced diet. A portion of dairy may be a 200ml glass of milk, 150g or a pot of yogurt and 30g or a matchbox sized piece of hard cheese. Portions

sizes will vary for different age groups. The following table gives the portion sizes to meet the daily recommended calcium requirements for different age groups.

Portion sizes and contribution to calcium intake

Age/Sex	RNI* for calcium (mg/d)	Dairy portion sizes
0-12months	525	No cows' milk as a drink for babies under 12 months. Breastfeeding is best, followed by cows' milk formula. Soya-based formula should be used only under medical advice. Cheese and yogurt can be given from 6 months.
1-3years	350	100ml whole/semi-skimmed milk**, 80g yogurt, 15g cheese. These portion sizes in total provide approximately 360mg calcium.
4-6years	450	130ml semi-skimmed milk, 100g yogurt, 20g cheese. These portion sizes in total provide approximately 465mg of calcium.
7-10years	550	150ml semi-skimmed milk, 125g yogurt, 25g cheese. These portion sizes in total provide approximately 570mg of calcium.
11-18years, male	1000	250ml semi-skimmed milk, 200g pot of yogurt, 45g of low fat cheese. These portion sizes in total provide approximately 1002mg of calcium.
11-18years, female	800	200ml semi-skimmed milk, 200g pot of yogurt, 30g of low fat cheese (small matchbox size). These portion sizes in total provide approximately 842mg of calcium.
19-50 years	700	200ml semi-skimmed milk, 150g pot of low-fat yogurt, 30g of cheese (small matchbox size). These portion sizes in total provide approximately 710mg of calcium.
50+ years	700	200ml semi-skimmed milk, 150g pot of low-fat yogurt, 30g of cheese (small matchbox size). These portion sizes in total provide approximately 710mg of calcium.
Pregnancy	700	200ml semi-skimmed milk, 150g pot of low-fat yogurt, 30g of cheese (small matchbox size). These portion sizes in total provide approximately 710mg of calcium.
Lactation	RNI for age group plus another 550mg increment i.e. if lactating teenager then 800+550mg/d, if lactating adult then 700+550mg/d	To achieve the RNI for calcium during lactation, teenage or adult mums will need to consume more than the portion sizes given above.

* RNI – reference nutrient intake. The amount estimated to be sufficient for 97% of a specified population group.

** Semi-skimmed milk may be introduced to children from the age of two if they are good eaters otherwise whole milk may continue to be given.

Health benefits of milk

Consumption for Milk has been associated with numerous health benefits including the following.

Bone Health:: Dairy products provide calcium, which is essential for bone growth and development. Bone growth is at its highest during childhood and the teenage years and therefore it is important that teenagers consume dairy products.

Teeth:: Dairy products contain calcium and other tooth friendly nutrients, which help teeth grow and keep them healthy. It is the only drink -excluding water which is recommended

by dentists to be safe to consume between meals.

Obesity:: Contrary to popular belief, research has shown that people who consume milk and dairy foods are likely to be slimmer than those who do not. Milk is also not a high fat product. Whole milk contains 4% fat, semi-skimmed milk contains 1.7% fat, 1% fat milk contains 1% fat and skimmed milk contains 0.3% fat. Studies have also found that consuming milk and dairy as part of a calorie controlled diet can help us to lose weight -especially from the abdomen, where fat deposits are associated with the greatest health risks -for more information see section on obesity.

Blood Pressure:: Dairy helps reduce blood pressure. A diet containing fruit and vegetables, low-fat dairy products and low salt helps reduce blood pressure (Dietary Approaches to Stop Hypertension: DASH diet). The potassium, magnesium and calcium found in dairy products are all linked to healthy blood pressure -for more information see section on blood pressure.

Cancer:: Studies have discovered that diets containing milk and dairy products may significantly reduce the risk of certain cancers. A study in 40,000 Norwegian women discovered that those who drank milk as children and continued to do so throughout adulthood has a significantly lower chance of developing breast cancer-for more information see section on cancer.

Cardiovascular disease:: Consumption of milk and dairy has also been associated with a reduced risk of suffering a heart attack-for more information see section on cardiovascular disease.

Type 2 diabetes:: Consumption of low fat dairy products has been linked to a reduced risk of developing type 2 diabetes. In fact studies have found that each extra portion of low fat dairy consumed each day is associated with increasingly lower risk!

Hydration:: Regular fluid intake throughout the day is essential to be well hydrated. Dietetic experts recommend drinking 6-8 glasses of fluid per day. As milk contains a high percentage of water, it is a useful vehicle for rehydration.

Eating habits People who consume dairy products have better intake of nutrients than people who do not consume dairy products. Introducing dairy products at an early age helps establish good eating habits for later in life.

Milk Categories

On the basis of composition of various important components milks majorly has been classified in the following categories;;

Toned Milk :: Toned Milk means the product prepared by admixture of cow or buffalo milk or both with fresh skimmed milk; or by admixture of cow or buffalo milk or both that has been standardised to fat and solids-not-fat percentage given in the table below in 1.0 by adjustment of milk solids. It shall be pasteurised and shall show a negative Phosphatase Test. When fat or dry non-fat-milk solids are used, it shall be ensured that the product remains homogeneous and no deposition of solids takes place on standing.

Double Toned Milk :: Double Toned Milk means the product prepared by admixture of cow or buffalo milk or both with fresh skimmed milk, or by admixture of cow or buffalo milk or both that has been standardised to fat and solids-not-fat percentage given in the table below in 1.0 by adjustment of milk solids. It shall be pasteurised and shall show a negative Phosphatase Test. When fat or dry non-fat milk solids are used, it shall be ensured that the product remains homogeneous and no deposition of solids takes place on standing.

Standardised Milk:: Standardised Milk means cow milk or buffalo milk or sheep milk or goat milk or a combination of any of these milk that has been standardised to fat and solids-not-fat percentage given in the table below in 1.0 by the adjustment of milk solids. Standardised milk shall be pasteurised and shall show a negative Phosphatase Test.

Flavoured Milk:: Flavoured Milk, by whatever name called, may contain nuts (whole, fragmented or ground) chocolate, coffee or any other edible flavour, edible food colours and cane sugar. Flavoured milk shall be pasteurised, sterilised or boiled. The type of milk shall be mentioned on the label.

Full Cream Milk:: Full Cream Milk means milk or a combination of buffalo or cow milk or a product prepared by combination of both that has been standardised to fat and solids-not-fat percentage, given in the table below in 1.0, by adjustment/addition of milk solids, Full Cream Milk shall be pasteurised. It shall show a negative phosphatase test. It shall be packed in clean, sound and sanitary containers properly sealed so as to prevent contamination.

Boiled Milk:: Boiled Milk means milk which has been brought to boil.

Mixed Milk:: Mixed Milk means a combination of milk of cow, buffalo, sheep, goat or any other milch animal and may be a combination of any of these milk which has been made and conforms to the standards given in the table below in 1.0

Recombined Milk:: Recombined Milk means the homogenised product prepared from milk fat, non-fat-milk solids and water. Recombined milk shall be pasteurised and shall show a negative Phosphatase test.

Skimmed Milk:: Skimmed Milk means the product prepared from milk from which almost all the milk fat has been removed mechanically.

Adultration in milk

Adulteration in milk these days has become very common. Adulteration in milk is causing severe health problems to consumers, as per knowledge related to adulterations in milk maximum number of persons feel that there is adulteration of water only, but current article shows the number of forms of adulteration in milk. There are many ways in which milk is adulterated. Most common and by far less harmful is adding water in the milk. Apart from impurities added from water, there are few dangers in consuming such milk.

To test adulteration from water

Milk slip test - Put a drop of milk on a polished vertical surface. If it stops or flows slowly, leaving a white trail behind, it is pure milk. Milk mixed with water or other agents will flow down immediately without a trace.

Reduction test - Boil some milk on a slow heat while moving it with a spoon till it becomes solid. Take it off the heat and wait for 2-3 hours. If the produced solid is oily, the milk is of good quality; if it's not, it means the milk is synthetic.

Synthetic milk

One more common form of adulteration is Artificial or synthetic milk. This is one of the most dangerous form of milk adulteration. In order to identify this type, you may follow the process as below,-
Synthetic milk gives a bitter after taste. It gives a 'soapy' feeling if it is rubbed between two fingers. Another indication is that, it turns yellowish on heating. With some experience, one can easily make out whether it is a pure natural milk or a synthetic liquid sold as milk.

Vanaspati / dalda in milk

Vanaspati is not good for health if consumed in big quantity. To check if milk is adulterated with vanaspati, add 2 tbps of hydrochloric acid and 1 tbsp of sugar to 1 tbsp of milk. If the mixture turns red, its impure.

Starch in milk

If your vendor has added starch to milk, you can detect it by adding 2 tablespoons to salt (iodine) to 5 ml of milk. Mixture will turn blue if milk is adulterated else it remains intact.

Formalin in milk

Formalin is used for preservation purposes. Since its transparent in color and can preserve milk for long time, packaged manufacturers use it for adulteration purposes. To test for formalin existence in milk, take 10 ml of milk in test tube and put 2-3 drops of sulphuric acid into it. If a blue ring appears at the top, milk is adulterated else not.

Test for urea in milk

One of the most common form of adulteration in milk is mixing of urea since it doesn't changes the taste and is little difficult to detect. To check for urea in milk, mix half tablespoon of milk and soyabean (or arhar) powder together and shake well. After 5 minutes, dip litmus paper for 30 seconds and if there is a color change from red to blue it means the milk has urea in it.

Quick tests for some adulterants in the milk

Name of Food Article	Adulterant	Simple Method for detection of Common Adulterants
Milk	Water	<ul style="list-style-type: none"> The presence of water can be by putting a drop of milk on a polished slanting surface. The drop of pure milk either or flows lowly leaving a white trail behind it, whereas milk adulterated water will flow immediately without leaving a mark.
Milk	Starch	<ul style="list-style-type: none"> Add a few drops of tincture of Iodine or Iodine solution. Formation of blue colour indicates the presence of starch.
Milk	Urea	<ul style="list-style-type: none"> Take a teaspoon of milk in a test tube. Add ½ teaspoon of soybean or arhar powder. Mix up the contents thoroughly

		by shaking the test tube. After 5 minutes, dip a red litmus paper in it. Remove the paper after ½ a minute. A change in colour from red to blue indicates the presence of urea in the milk.
Milk	Vanaspati	<ul style="list-style-type: none"> Take 3 ml of milk in a test tube. Add 10 drops of hydrochloric acid. Mix up one teaspoonful of sugar. After 5 minutes, examine the mixture. The red colouration indicates the presence of vanaspati in the milk.
Milk	Formalin	<ul style="list-style-type: none"> Take 10 ml of milk in a test tube and add 5 ml of conc sulphuric acid from the sides of the wall without shaking. If a violet or blue ring appears at the intersection of two layers then it shows presence of formalin.
Milk	Synthetic milk	<ul style="list-style-type: none"> Synthetic milk has a bitter after taste, gives a soapy feeling on rubbing between the fingers and turns yellowish on heating
Milk	Synthetic milk - test for protein	<ul style="list-style-type: none"> The milk can easily be tested by Urease strips (available in the Medical stores) because Synthetic milk is devoid of protein.
Milk	Test for Glucose/inverted sugar	<ul style="list-style-type: none"> Milk does not contain glucose /invert sugar, if test for glucose with urease strip found positive. It means milk is adulterated.
Ghee, cottage cheese, condensed milk, khoa, milk powder etc,	Coal Tar Dyes	<ul style="list-style-type: none"> Add 5 ml of dil. H₂SO₄ or conc. HCl to one teaspoon full of melted sample in a test tube. Shake well. Pink colour (in case of H₂SO₄) or crimson colour (in case of HCl) indicates coal tar dyes. If HCl does not give colour dilute it with water to get the colour.

Milk as it is considered to be a sacred food and from our childhood everyday we are consuming milk and related products, but now a days as high percentage of adulteration in milk and its products, it is causing severe effect on human health in multi dimensional ways. One of the most important ill effect is suppressed immune system, through which body becomes susceptible for infections. The article suggests and recommends safe use of milk for better human health.

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