

Milk and Milk Products for Adding Value to Our Diet and Economy

Never cry over spilt milk, because it may have been poisoned. - W. C. Fields

Why is Milk an Important Commodity for Us?

Biochemically, the human body is made up of a myriad of molecules. The life is an organised state of some elements. A new-born human baby contains about two trillion cells whereas an adult about sixty trillions. A living organism is a self-regulating system, and has the ability to renew and recycle many of its components while maintaining the integrity of its overall structure and functioning continuously.

The role of milk in nature is nourishing and providing immunological protection for the mammalian young. Every single human being has consumed milk at least once in his life. Milk and honey are the only commodities whose sole function in nature is serving as food. All species of mammals, from man to whales, produce milk for this purpose. The human being is the only mammal that continues to use milk and milk products after the infancy. Animal milk is first known to have been used as human food at the beginning of animal domestication. Cow milk was first used as human food in the Middle East. Goats and sheep were domesticated in the Middle East between 9000 and 8000 BC. In addition, other species of mammals like buffaloes and camels too were domesticated in various parts of the world for the production of milk for human consumption. According to the studies based on DNA extraction of skeletons from the Neolithic period (or Stone Age about 10,000 BC), people in the northern Europe could not consume milk as they were missing the necessary genes to process lactose which is the main carbohydrate in milk. Later, after dairy farming was begun, a genetic mutation taken place in those people made the digestion of milk possible.

The role of milk in the traditional diet has varied greatly in different regions of the world. The tropical countries like Sri Lanka have not been traditional milk consumers whereas the northern regions of the world, Europe (especially Scandinavia) and North America have

traditionally consumed more milk and milk products in their diets. Our neighbouring country, India has been a traditional milk consumer. High temperatures and lack of refrigeration facilities in tropical countries, have constrained production and storage of fresh milk. Consequently, milk has traditionally been preserved through means other than refrigeration either by boiling or converting into more stable products such as fermented milk. Goats, donkeys, water buffaloes and sheep are domesticated and milked in various parts of the world, but, in most countries, milk is provided by dairy cows.

Milk and dairy products are usually high energy-yielding and nutritional foods required for a healthy life. The Medical Research Institute (MRI) of Sri Lanka recommends a consumption level of 60–65 kg/person per year. Per capita availability of milk is only about 36 kg/per year while demand for milk and milk products is continuously increasing. On the other hand, the global milk production is now projected to reach 678 million tonnes in 2007, up 2.3 percent from the last year, which is much lower than expected. This slowdown is now expected in a number of major milk products-exporting countries. Milk production of some leading exporting countries like Australia and European Union has declined due to several reasons like higher feed prices and increased land allocation for crop production. We, unlike other Asian countries, did not pay due attention to increase the milk production until last 2-3 years. The modest profit margin in the dairy sector has been often cited as the main constraint. Therefore, there is a real need to find out ways for the expansion of local dairy production which will certainly bring many socio-economic benefits to a larger proportion of people as the dairy sector is dominated by small-scale producers who are widely dispersed throughout the country.

Per capita milk consumption (as fluid milk and processed products) in Sri Lanka varies due to many socio-economic, demographical, cultural and religious factors. But creation of a culture based on milk and dairy products consumption requires sustainable development of the local dairy industry by adoption of new technologies with due consideration on the naturalness of the local dairy

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products. Sri Lanka spends about Rs. 18 billion annually to import milk powder alone. We need to develop the local dairy industry while changing our attitudes towards the consumption of milk in many dimensions, namely consumption of locally-produced milk and diversification of milk products from milk powder to fresh liquid milk and other value-added products.

In the regional context, Asia has become the world's largest milk production region in 2006. It now accounts for 34 percent of global output compared to 30 percent five years ago. According to FAO estimates, yearly production growth rates of around 5 percent were driven by the strong increase in the demand for milk and dairy products in the region, sustained by the strong economic growth. India, being the world's largest single milk-producing country, still continues to expand the milk production by over 3 percent per year, driven by increasing demand for value-added milk products on the consumer side and extensive dairy development programmes on the supply side. Pakistan too continues expanding its milk output by over 3 percent per year.

What does Milk Contain?

Milk is a complex mixture of an oil-in-water type emulsion (mixture of two immiscible substances) synthesised in the **mammary glands**. Milk contains numerous chemical components and scientists constantly find something new in milk. The nutritional value of milk is so high (Table 1) to nourish and provide the little mammals with immunological protection. Fresh whole milk contains about 88% water. The remainder is made up of solids that contain fat, protein and lactose (milk sugar). These constituents together give the milk its colour, taste and nutritional value. Fat makes up approximately 3% of whole milk and supplies the body with calories for energy. Milk contains significant amounts of saturated fat, protein and calcium.

Table 1
Composition of Milk from Different Mammalian Species
(per 100 g fresh milk)

Mammalian Species	Protein (g)	Fat (g)	Carbohydrate - Lactose (g)	Energy (kcal)
Cow	3.2	3.7	4.6	66
Human	1.1	4.2	7.0	72
Water Buffalo	4.1	9.0	4.8	118
Goat	2.9	3.8	4.7	67
Donkey	1.9	0.6	6.1	38
Elephant	4.0	5.0	5.3	85
Monkey, rhesus	1.6	4.0	7.0	73
Mouse	9.0	13.1	3.0	171
Whale	10.9	42.3	1.3	443
Seal	10.2	49.4	0.1	502

Source: Webb, B.H., A.H. Johnson and J.A. Alford. 1974. *Fundamentals of Dairy Chemistry*. Second Ed. AVI Publishing Co., Westport, CT., Chap. 1.

Milk is considered one of the world's 'complete' foods and is best known for its good taste, high quality and high content of phosphorus, protein and most especially calcium. In fact, there is no other drink available that contains such a large range of naturally occurring nutrients. Since milk is a natural substance, it is easily broken down and digested making the calcium, magnesium, phosphorus, zinc and other nutrients effortlessly available to be used by the body. Milk also contains important vitamins needed for growth and normal functioning of the body. It has large amounts of vitamin B₂ or riboflavin and some vitamin A. Some of the components of milk are only found in it and not anywhere else. These are the milk fat, milk sugar (lactose) and casein, which is the major milk protein.

How do Manufactures of Value-added Milk Products Look at Milk?

Milk can be defined in different contexts. It, from the manufacturers' point of view, can be defined as "a lacteal secretion, practically free from colostrum, obtained from the complete milking of one or more healthy cows. Milk in its final package form for beverage use shall have been pasteurised. According to food regulations, milk may have been processed by separating part of the milk fat there from, or by adding cream thereto, or into dry whole milk, skim milk, or non-fat dry milk. Milk may be homogenised. Milk solids are the non-water components of milk - protein, lactose, and minerals. Sometimes the combination of protein, lactose and minerals is called the solids non-fat content, and when the fat is included, it is called total solids content.

Dairy foods are incredibly rich in important nutrients and vitamins. Among them, proteins,

potassium, riboflavin, vitamins A, D and B₁₂ are of primary significance. Dairy products are also the main source of calcium in our diets, supplying 75-80% of our calcium intake. Milk calcium, sometimes called milk mineral complex or whey minerals, is a concentrated source of calcium and other minerals derived from milk. It is becoming an increasingly important source of calcium supplementation in the food industry. Consumption of milk or other dairy foods is the easiest way to obtain

enough calcium. Studies have shown diverse benefits of the nutrients contained in dairy products like cheese, yoghurt and milk, including better bone density, improved dental health, lower blood pressure, more effective weight management and even reduced risk of breast and colon cancers.

Properties of Milk that are Important in Processing and for Our Health

Milk processing has three primary objectives; destruction of human pathogens through pasteurisation, keeping the quality of the product without significant loss of flavour, appearance, physical and nutritive properties, and selective control of organisms which may produce unsatisfactory products.

It is worth understanding about some properties of milk to comprehend its behaviour during processing and storage. Among carbohydrates, lactose (also referred to as milk sugar consisting of two very simple sugars; glucose and galactose) is the characteristic carbohydrate of milk. It makes up around 2-8% of milk (by weight). Lactose is easily burnt for energy contributing about 40% of whole cow milk's calories. Lactose gives milk its sweet taste. Lactose and ions, especially chlorides, work together to maintain osmotic pressure of milk as in blood plasma. Lactose content in milks varies from species to species. Galactose obtained from lactose is essentially used for the synthesis of galatosides and cerebrosides needed by the nervous system.

Since lactose occurs mostly in milk, most mammals with maturity decrease the production of lactase, the enzyme capable of digesting lactose into glucose and galactose. Lactose intolerance is the inability to metabolise lactose in milk and other dairy products, because the required enzyme lactase is absent or its availability is lowered.

Therefore, adults may have tendency to suffer from lactose intolerance. Children having this complication need to consume lactose-free milk formula or other substitutes like soymilk. There are also kids having allergies to cow milk proteins.

Milk products contain high-quality proteins. This one of the reasons that health professionals and nutritionists recommend milk consumption. Milk proteins are needed to build and repair body tissues and to form antibodies which circulate in the blood and help to fight infections. The proteins in milk are in the form of casein and whey protein. Casein, accounting for 82% of the total proteins in milk, contains all of the essential amino acids. It is used as a standard for evaluating protein of other foods. The whey proteins constitute about 18% of the protein content of milk. Casein is not coagulated by heat. It is precipitated by acids and by rennet enzymes, a proteolytic enzyme typically obtained from the stomachs of calves. Conversion of these insoluble milk proteins to curds by using the enzyme rennin is the important principle applied in cheese making. Vinegar and some other food acids also can hydrolyse milk proteins, but the curds formed are much smaller than those formed from rennin. For example, **paneer** is one of the most common Persian and South Asian cheeses. It is an un-aged, acid-set, non-melting farmer cheese made by curdling heated milk with lemon juice or other food acid. Another product called **queso blanco** is produced by the same principle, and adding salts.

Like carbohydrate and proteins, milk fat is used to produce food commodities like butter. As we already know, milk is an emulsion or colloid of butterfat globules within a water-based fluid. The fat content of milk is of economic importance because milk is sold on the basis of fat. The fat content of milk is the proportion of milk made up by butterfat. The main milk lipids are a class called **triglycerides** and more than 95% of the total milk lipid is in the form of a globule ranging in size from 0.1 to 15 micrometres in diameter. Finely-dispersed fat globules in the oil-in-water type emulsion are stabilised by a milk protein membrane, which permits the fat to clump and rise. The rising action is called **creaming** and is expected in all unhomogenised milk. **Homogenisation** of milk prevents this creaming by decreasing the diameter and size distribution of the fat globules, causing the speed of rise to be similar for the majority of globules. Although homogenisation is the principal method to stabilise the fat emulsion in milk, **fat destabilisation** is necessary for structure

formation in butter, whipping cream and ice cream.

Milk fat or butterfat provides lubrication and imparts a creamy mouth feel as opposed to a dry texture. Butter flavour is unique and is derived from low levels of short chain fatty acids. But from the other extreme, if too many short-chain fatty acids are hydrolysed (separated) from the triglycerides, the product will taste rancid. Among short-chain fatty acids, butyric fatty acid is specific for milk fat of ruminant animals and is responsible for the rancid flavour when it is cleaved from glycerol. Milk fat also acts as a reservoir for other flavours, especially in aged cheese. Fat globules produce a 'shortening' effect in cheese by keeping the protein matrix extended to give a soft texture. As butter is not spreadable at refrigeration temperatures, vegetable oil-based spreads has become popular. Milk fat also provides energy and nutrients like essential fatty acids and fat soluble vitamins.

The fat content of cow milk is modified to make a variety of products. Usually, all milk fat is removed and then the required quantity is added to produce skimmed or semi-skimmed milk.

Different Forms of Milk and Dairy Products

Milk is the most versatile food and can be processed into a wide variety of dairy products. Different forms of milk include the following:

Whole milk - Milk as it comes from the cow is called whole milk and contains at least 3.25% fat and 8.25% other solids.

Cream - Whole milk may be separated into cream and skim milk. The cream consists of the fat of the milk with a decreased proportion of the other solids and water.

Low-fat and skim milk - Various amounts of fat may be removed from milk. Low-fat milk may contain from 0.5 to 2.5 % fat. Skim milk contains less than 0.5 % fat. Normally, it is recommended that the milk be fortified with vitamin A and D that have been lost with the removal of fat. The dry or powdered form of these low-fat and skim milks has the same nutrients as the milk from which it is made and readily mixes with water to form liquid milk.

A brief description of some important dairy products is presented below:

Powdered milk

Powdered milk is made from dried (dehydrated) milk solids. It has a far longer shelf life than liquid milk and does not need to be refrigerated

due to its low moisture content. It is found in many developing countries like Sri Lanka because of reduced transport and storage costs.

Whole milk or skimmed milk powder is usually made by spray drying of pasteurised milk. First milk is concentrated in an evaporator to about 50% milk solids which is then sprayed into a heated chamber where the water almost instantly evaporates, leaving behind fine particles of powdered milk solids. There are also some other drying methods like drum drying (use of a surface of a heated drum) and freeze drying. Freeze drying, although costly, has the advantage of preserving many nutrients in milk compared to drum drying.

Malted milk powder

Malting is a process applied to cereal grains, in which the grains are made to germinate and then are quickly dried before the plant develops. Any grain (typically barley) can be sprouted, kiln-dried and ground into a mellow, slightly sweet-flavoured powder. This powdered malt is used to produce malted milk powder. Malted milk powder is a dried product obtained from skimmed milk with or without milk/vegetable and soluble solids derived from barley, wheat or other cereals by its enzymic action of malt. Because of the enzymic action, complex food reserves in the grain have been converted to simpler ones. This is why malted milk is recommended for those who are weak due to illnesses.

Flavoured milk

Presently, milk is sold as flavoured milk increasing its palate. Flavoured milk is the milk to which some flavours have been added. When the term milk is used, the product should contain a milk fat percentage of at least equal to the minimum legal requirement for market milk. But when the fat level is lower than this minimum requirement, the term 'drink' should be used.

Yoghurt

Milk is extremely perishable and many means have been developed to preserve it. Fortunately, milk can be fermented by inoculating fresh milk with the appropriate bacteria and keeping it at a temperature which favours bacterial growth. Yoghurt is an ideal example for a cultured product. It is a very easy and economical to make. Yoghurt is a very unique product which is produced with the help of cultures of specific types of bacteria (*Streptococcus thermophilus* and *Lactobacillus bulgaricus*). These beneficial microorganisms produce lactic acid during fermentation of lactose. The lactic acid lowers the pH thereby causing the milk protein to thicken and acts as a preservative since pathogenic bacteria cannot grow in acid

conditions. The partial digestion of the milk by these bacteria makes yoghurt easily digestible. These microorganisms have also been linked to a strengthened immune system, improved digestive system functions and reduced risk of cancer. They help to settle gastrointestinal upset that follows oral antibiotic therapy by replenishing non-pathogenic flora of the gastrointestinal tract. We, Sri Lankans are yoghurt lovers.

Compared to other milk products such as cheese, ice cream or butter, yoghurt contains most milk constituents except for lactose which the bacteria convert into lactic acid. This acid gives the yoghurt a pleasant acidic flavour and sweetness formed from lactose. As mentioned above, live beneficial lactic acid bacteria protect the yoghurt from pathogenic microorganisms and thus give it a longer shelf life. The fat content in some yoghurt can be reduced if necessary. Some yoghurt may contain thickening agents in low concentrations. Thickening agents can be gums (various plant polysaccharides), gelatinised starch or gelatine. Their role is to firmly hold water in the body of the yoghurt. As already mentioned, coagulation of the milk proteins is induced by *L. bulgaricus* and *S. thermophilus*. These bacteria propagate well at an elevated temperature of 40°C to 45°C. The milk is coagulated by a slowly increasing concentration of lactic acid as the bacteria metabolise lactose. The proteins do not precipitate as would happen with addition of lactic acid but form a gel. Its ability to retain all the water present in the milk is the result of a peculiar microstructure of the protein network. It consists of short-branched chains of casein micelles and resembles a sponge with very small pores. Yoghurt is unique, because it is solid and has the highest water content of all solid milk products.

Cheese

Cheese is another great source of essential nutrients and has also been linked to dental health benefits. It also can be another very common dairy product, used in everything from pizza to salads to sandwiches. Cheese is made mostly from the milk of cows but also of other mammals, including sheep, goats, buffalo and camels. Around 4000 years ago, people have started to breed animals and process their milk. That was when the cheese was born. Although, we, in Sri Lanka do not have a large variety, cheese comes in many varieties. The variety determines the origin of the milk (including the animal's diet), whether milk has been pasteurised, ingredients added, the species of

bacteria and mould used and processing including the length of aging.

Cheese is made from milk in three distinct steps; formation of curd, treatment of curd and ripening. The first step in cheese making is curdling of the milk protein, casein. This is accomplished either as a result of acid production during lactic acid fermentation or by the addition of the enzyme rennin. This enzyme acts directly on the casein and curdling occurs within about 30 minutes. As a result of this process, casein coagulates, forming an insoluble clot (**curd**) and a straw coloured liquid (**whey**). After the curd has settled into a solid mass, it is separated from the whey by draining with or without applying pressure. Drainage without the use of pressure is used for soft cheeses (**cottage cheese**) whereas hard cheese are heated and pressed with weights until the curd forms a very compact and tough curd (**cheddar cheese**). The difference between soft cheese and hard cheese is that the latter requires pressing the drained curds in a cheese press, drying the pressed cheese and then aging for several months. After treatment with salt, the separated curd is moulded into the desired shape and is ready for ripening. Soft cheeses such as cottage cheese are usually not ripened. But the pressed, salted and shaped cheeses are ripened by the action of bacteria and fungi. During the process of ripening under carefully controlled conditions of temperature and humidity, the microbes alter the cheese in a number of different and characteristic ways, thereby change its texture, aroma and flavour accordingly.

Although Cheddar cheeses were originally made in England, they are the most widely-purchased and eaten cheese in the world. Cheddar is always made from cow's milk and has a slightly crumbly texture, if properly cured. Fully-cured Cheddar is a hard, natural cheese and is shaped like a drum. Normally, the colour of Cheddar ranges from white to pale yellow. Some Cheddars, however, have a colour added, giving the cheese a yellow-orange colour. If the cheese is too young, the texture is smooth. Cheddar gets a sharper taste the longer it matures. It is generally matured between 9 and 24 months.

Mozzarella cheese (Mozzarella di Bufala) is a creamery, stretched curd cheese made from mixture of buffalo's and cow's milk. Like most fresh cheeses, mozzarella is used to add texture rather than a specific taste to a dish. The juices oils and flavours of the other ingredients are absorbed and intensified by the mild, moist open layers of spun curd. Mozzarella cheese can be used as topping when Pizza is prepared. It is available in Sri Lankan supermarkets. The

production of mozzarella involves mixing of curd with heated whey, followed by stretching and kneading to produce a delicate consistency. According to Italian recipes, the cheese maker needs to knead it with his hands until a smooth, shiny paste is obtained.

Buffalo curd

Buffalo curd is another popular fermented milk product obtained from coagulation of buffalo milk. The microorganisms responsible for fermentation include *Streptococcus lactis*, *Streptococcus diacetylactis* and *Streptococcus cremoris* which work singly or in combination with *Leuconostoc* spp., *Lactobacillus bulgaricus* and *Streptococcus thermophilus*. Usually buffalo curd should have minimum milk fat of 7.5 % by mass and minimum milk solids not fat of 8.5 % by mass.

Butter

Butter is essentially the fat of the milk. It is a complex colloidal system. The cream used contains 30-40% milk fat. The butter comprises of milk fat and water in the form of tiny droplets and perhaps some milk solids-not-fat, with or without salt. Butterfat consists of many moderate-sized saturated hydrocarbon chain fatty acids. In addition to these constituents, it contains vitamins A and D, particularly the former. Butter is a natural product apart from the addition of salt as a preservative and colouring matter. Butter is water-in-oil emulsion and is made from cream by churning. The texture of butter is a result of working/kneading at appropriate temperatures to establish fat crystalline network that results in desired smoothness. The butter making process involves quite a number of stages.

Earlier, farmers let freshly-milked milk to sit for half a day and skimmed off the cream which had risen. This cream is allowed to set aside in a cool place around 10-15°C and topped up every day until several gallons had accumulated. In the meantime, naturally occurring bacteria in the cream cause it to sour slightly. This souring increases the efficiency of churning. The accumulated sour cream is then churned at the optimum temperature (approximately 15°C) so that the butter is firm enough to separate out but soft enough to stick together into a mass. The butter is removed and washed in very cold water to remove the remaining milk and salted it to preserve it. The remaining liquid after the butter is removed is called buttermilk.

Frozen dairy products

Ice cream, ice milk and sherbet are popular sweetened frozen dairy products. They vary in fat content: ice cream normally has about 10 percent

(about 14 percent in special varieties), ice milk 2 to 7 percent, and sherbet 1 to 2 percent. Also, growing in popularity is frozen yoghurt, served in a variety of ways. Milk and cream are sometimes frozen for preservation.

Ghee

Ghee is a Sanskrit word for a clarified butter used primarily in Indian and, to certain extent, Sri Lankan cuisines. As defined, ghee is a clarified butter without any solid milk particles or water. This is accomplished by heating the butter as slowly as possible. The butter will separate into three layers; the casein, a frothy layer on top; the clarified butterfat in the middle; and the water, milk solids and proteins in the bottom. The casein is skimmed off and the fat is then removed with a gravity separator or ladled off. The lactose remains with the watery portion and hence ghee can be used to cook for people who are lactose intolerant. Ghee will also smoke at a much higher temperature than standard butter and will keep longer as bacteria cannot digest pure oil. Good-quality ghee adds a great aroma, flavour and taste to the food. The highly characteristic flavour of ghee is generated mainly during the boiling down process where there is an interaction between protein and lactose. Ghee is now used more in high-quality cooking oil. For example, pulses are flavoured with ghee which is equivalent to cooking in butter. Unlike other butter-based products, ghee can be stored without refrigeration for weeks. As long as ghee is stored in air-tight containers, it does not spoil easily. Ghee is considered a saturated fat, since it is derived from animals. Nevertheless, some studies suggest that it is generally healthier than some other fats such as lard and margarine. Ghee uses a natural process to maintain stability without refrigeration, unlike the hydrogenated and partially-hydrogenated vegetable oils used in cooking.

Ghee can be made as a home-made product. Pure unsalted butter can be used as the ingredient but not margarine. First, butter needs to be heated in a saucepan in high-medium heat until it boils or bubbles. When it starts bubbling, reduce heat to medium-low and cook uncovered until butter turns to a clear golden colour. Butter usually begins to boil with lots of bubbles. At this stage, it may have foams on top of it which indicates that ghee is nearly done. Cool it and store it in dry container.

Ghee is properly done when water is completely evaporated from butter. To find out if water is properly evaporated follow the following procedure. Pour heated butter into small piece of paper. Light the paper on fire. If it gives

crackling noise, it is indicating the presence of water. Heat butter for some more time. With experience one can tell if ghee is done with the smell and colour.

Whey

Whey or **milk plasma** is the watery liquid that separates from the solids (curds) in cheese making. Whey is formed when the curds separate from the milk or cream. This liquid is watery and thin. Sometimes whey has a tinge of bluish colour, but this depends on the quality and type of milk used. Whey is also formed in the making of yoghurt, the thin liquid that forms on top of the settled yoghurt. This can be drained off and added to milk-shakes or other liquid drinks.

Whey is an excellent source of protein, vitamins, minerals and lactose. It is the base of many protein drinks for athletes or others wishing to build or repair muscle tissues. Whey is also an important supplement for those who have limited mobility in the limbs as it contributes to the prevention of atrophy of muscular cells. Whey is also used in pet foods as a source of protein and fats. It contributes to a healthy coat and proper muscle development. The whey protein separated from this mixture is often sold as a nutritional supplement. In addition, liquid whey contains lactose, vitamins, and minerals along with traces of fat. It has been discovered that whey appears to stimulate insulin release and that whey supplements can help regulate and reduce spikes in blood sugar levels among people with type II diabetes by increasing Insulin secretion.

Concentrated milk

Sweetened condensed and evaporated milks are forms of concentrated milk that are canned for consumer use. Condensed milks without added sugar are used commercially by candy manufacturers, bakers and ice-cream processors and are cooled and kept under refrigeration until used.

Promising Novel Dairy Products in Future Sri Lankan Market

Probiotic food milk products can be one of viable novel milk products which can be found in the local market in near future. Let's see what probiotic foods are. Probiotic food is food that contains live bacteria, which is considered beneficial and not harmful to humans. Probiotic bacteria, which are beneficial to the host by improving the intestinal microbial balance, may affect the immune response. The first example of probiotic food was the introduction of

acidophilus to milk, which in some cases helped people who had difficulty of digesting milk to be able to tolerate milk better. The specific bacteria used in probiotic food like acidophilus milk is *Lactobacillus acidophilus*.

Quality of Dairy Products

Milk is an ideal medium for the growth of microorganisms. Several kinds of bacteria get into milk during milking, processing and bottling, and multiply rapidly unless great care is taken to keep the cows' udders, milking machines, and bottling equipment cleaned. Bacteria may also enter the milk from inside or outside of the udder. Health condition of the cow is important to maintain milk yield and avoid the transmission of diseases. During and after milking, the milk is susceptible to contaminate from a vast number of sources such as vessels and equipment used for milking, collecting and storage of milk. Cleaning of the cow's udder and utensils is very important to reduce the number of bacteria from the possible contamination. Reduction of number of bacteria is very essential for the manufacture of the dairy products such as butter, cheese and fermented milk products. In developed countries, hand milking is now mostly replaced by machine milking. However in developing countries like Sri Lanka, hand milking is still predominantly practised by small-scale milk farmers, which may affect the quality of milk produced. Apart from that, if milk is kept at above 16°C, the multiplication of the bacteria is increased. In this case, the deterioration of the milk is taken place and thereby the shelf-life of the milk is reduced. At temperature below 10°C, the multiplication of bacteria is considerably reduced. When left for even a short time in a warm environment or exposed to light, milk loses its fresh taste and much of its vitamin content and quickly turns sour. Animal and personnel hygiene and sanitation of the environment and milking equipment are main factors that determine the quality of milk produced. Milk processing plant should be cleaned and sterilised to prevent further bacterial contamination of raw materials, to reduce bacterial numbers in milk and to protect the finished product from recontamination through careful handling, proper packaging and storage.

In the Sri Lankan context, the production of quality milk is the concern of several parties; dairy farmers, veterinarians, quality regulatory institutions, milk and dairy product processors and of course the consumers of dairy products.

Conclusion

The cattle and buffalo rearing in Sri Lanka for the production of milk and milk products have been carried out for centuries as an integral component of the country's agricultural production and pastoral

culture. There is a need to expand milk production and milk products in the country in view of the recent increase of prices of milk which may have adverse impacts on imports and consumption, the preference of the local consumers for powdered milk and the inability to sell smallholder-produced milk in consumer destinations owing to spatial transport and marketing difficulties. The high value that consumers attach to milk products is a guarantee of the market for the future growth and modernisation of traditional dairy products. The many advances that dairy technology has made will provide the tools to further explore and improve upon the quality and shelf-life of the time-tested products. The increase of milk production should be looked at not merely from the point of view of increasing liquid milk but for increasing the processing capacity of milk to powdered form as well. This can be achieved by commissioning several milk powder processing plants in different parts of the country. These processing plants can be developed along with the local dairy cattle farming. Diversification of value-added milk products will certainly make the local dairy industry viable and strong enough to compete with international counterparts.

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