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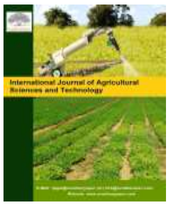

Review Article **Open Access**

Bio-Production of Fermented Dairy Products and Health Benefits: A Review of the Current Scenario and Prospects

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Abstract

The quality and safety of fermented milk products, which make up a sizeable portion of human nutrition, are greatly influenced by both the milk itself and the starting cultures employed to ferment it. Lactic acid bacteria (LAB) create a variety of metabolites throughout the fermentation process, altering the organoleptic properties of the substrates. The final product's nutritional value and digestibility are enhanced by fermentation of the raw materials, which also adds vitamins, vital amino acids, and fatty acids. The quality and safety of fermented milk products, which make up a sizeable portion of human nutrition, are greatly influenced by both the milk itself and the starting cultures employed to ferment it. The inhibition of the growth of pathogenic microbes, which lowers the likelihood of the emergence of foodborne diseases, is another crucial function of LAB. A variety of pathogenic bacteria are frequently present in raw (unpasteurized) milk, and other raw materials; these pathogenic bacteria should be removed during the fermentation process. As a result, a variety of LAB metabolites, such as hydrogen peroxide, organic acids, and bacteriocins, function as bio preservative agents, enhancing food safety and lengthening the shelf life of the finished products.

Keywords: *Dairy Products, Health Benefits, Lactobacillus, Microorganisms, Milk Adulteration, Nutrients*

1. Introduction

Dairy products or milk products, also known as lacticinia, are food products made from milk (de los Reyes-Gavilán *et al.*, 2015). These products provide essential elements required for the human body as it is a good source of calcium, vitamin D, proteins, and other necessary nutrients. Along with this, it also serves as a source of phosphorus, potassium, magnesium, and various vitamins viz. vitamin A (retinols), vitamin B12 (cyanocobalamin), and riboflavin (Wouters *et al.*, 2002). Milk and its derivatives are the most essential component of the diet, particularly during childhood and adolescence as it helps in promoting muscular, neurologic, and skeletal development and is consumed by several million people

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worldwide (Soukoulis *et al.,* 2007; Button and Dutton, 2012). In specific, the fat portion of milk which is composed of saturated fatty acids and its minor components, especially calcium and oligosaccharides, has been an active scope of research for their prospective role in the health area (Visioli and Andrea, 2014). There are different types of fermented milk and derived products which have been manufactured in all parts of the world each with its characteristic history and nature depends very much on the pre-treatment of the milk, type of milk used, factors like temperature, climate, conditions required for fermentation and on the relevant technological treatments (Kapaj *et al.,* 2017; Wodajo *et al.,* 2020; Bórawski *et al.,* 2021).

India is considered the world's largest milk producer, with 22% of global production, followed by the United States of America, China, Pakistan, and Brazil (Douphrate *et al.,* 2013). The highest milk-producing countries are New Zealand, the United States of America, Germany, France, Australia, and Ireland. The highest milk deficit countries are China, Italy, the Russian Federation, Mexico, Algeria, and Indonesia (Witthuhn *et al.,* 2005). The food and agriculture organization of the United Nations states different age groups categorized as children, adults, older adults, school children and adolescents, and pregnant women require different micronutrients in milk. Calcium, magnesium, vitamin A, and Vitamin B12 are the main micronutrients needed 41-57%, 28-46%, 22-25%, and 60-139% of the respective micronutrients for children. 22-29%, 11-13%, 18-22%, 52% of respective micronutrients for adults. 22%, 12-14%, 18%, 52% of respective micronutrients for older adults. 22-41%, 13-28%, 18-22%, 52-69% of respective micronutrients for the school children and adolescents, and 24%, 13%, 14%, 48% for respective micronutrients for the pregnant women (Story *et al.,* 2004).

Microorganisms are important in the production of dairy products like yogurt. Lactobacillus a gram-positive bacterium is one of the fermenting bacteria (Chandan *et al.,* 2009). Even though dairy products should be absent from pathogens such as *Listeria monocytogenes* and *Salmonella*. Fermented dairy products are available for consumers in a wide range. Most of these fermented dairy products are produced industrially and a small section of these products are homemade (Teneva-Angelova *et al.,* 2018). The production of these products has become a very important part of economic stability worldwide and the demand for these products is incrementing day by day. The first-ever example of fermented milk was assumption-based and known to be produced coincidentally by nomads Under the impact of various microorganisms, the milk turned sour and coagulated. Fortunately, it was showing non-toxic, harmless, and acidifying type bacteria (Fusco *et al.,* 2020). The nature of the fermented milk products is dependent mostly on the pre-treatment of the milk, the type of milk used, conditions required for fermentation, temperature, and the ensured industrial treatments. Curd, yogurt, cheese, kefir, and kumis are the most regularly used dairy products (Wouters *et al.,* 2002). In this paper, we discussed milk and dairy products and their health benefits, microbes responsible for fermentation, and adulteration of milk.

1.1. Fluid Milk, and Cultured Dairy Products

The primary ingredients in dairy products is fluid milk. Milk constitutes a complex element. Mostly dominated by a 98% 0f triacylglycerols (TAGs) milk fat, with small amounts of monoglycerides, diglycerides, and free fatty acids, and with a small number of various other lipid classes. Milk lipids constitute more than 400 separate fatty acids (Mehta, 2015). Twenty are the major components while the remainder is minor and trace quantities**.** The other constituents include cerebrosides and sterols (cholesterol and cholesterol esters), fat-soluble A, D, and E vitamins, tocopherol (antioxidants), carotene (pigments), ketones (flavor components) and aldehydes, lactones, and, phospholipids (0.8% phosphatidylcholine, phosphatidylethanolamine), and sphingomyelin (SM) are also present. The breed of the cattle, stages, and intervals of milking, lactation period, season, nutritional content, feed various udder quarters, age, weather, health state, estrus cycle, exercise, and gestation length all have an impact on the milk's composition (Lusk, 2011). Standard Plate Count (SPC) measures the total number of bacteria present in milk, and if a large number of bacteria are present, it affects the milk's shelf life and quality. For instance, a high number of coliform bacteria indicates that the milk was not properly cleaned, milked, or processed. Laboratory Pasteurized Count (LPC) is a bacteria present after the pasteurization takes place in the laboratory using 62.8 °C for 30 min and counting the bacteria using the SPC method. The standard count is 500 CFU/mL. If the SPC of LPC becomes 750 CFU/mL it reduces the shelf life and quality of the milk. Preliminary incubation count determines the growth of bacteria by resisting refrigeration conditions at 10 °C for 18 h. and followed by an SPC test. Somatic cell count is measuring the white blood cell content in the milk (Martin *et al.,* 2011).

A high white blood cell count completely changes the nature of the milk including the test or flavor becoming salty. Pasteurized milk ordinance standards are not higher than 750,000 cells/mL of individual milk. The lactic acid content of milk is measured using titratable acidity with a normal value of 0.13% - 0.16%. a lower value indicates the presence of chemicals (Serafeimidou *et al.,* 2012). Temperature is another factor that changes the nature of milk if exceeds 7 °C according to PMO standards. The flavor is another parameter of the milk quality. The elevated number of bacteria in the milk completely changes the flavor into bitter, sour, or acid. For the indication of the quality of milk but not as criteria appearance of the milk is necessary with a recommended standard white, no debris, clean, and filter screen of 2 or less sediment test (Chandan, 2011). Drugs or any antibiotics used in cattle are not used for milking during the 12 months of treatment. Adulteration using water is illegal when the freezing point becomes above –0.530° Hortvet scale during the

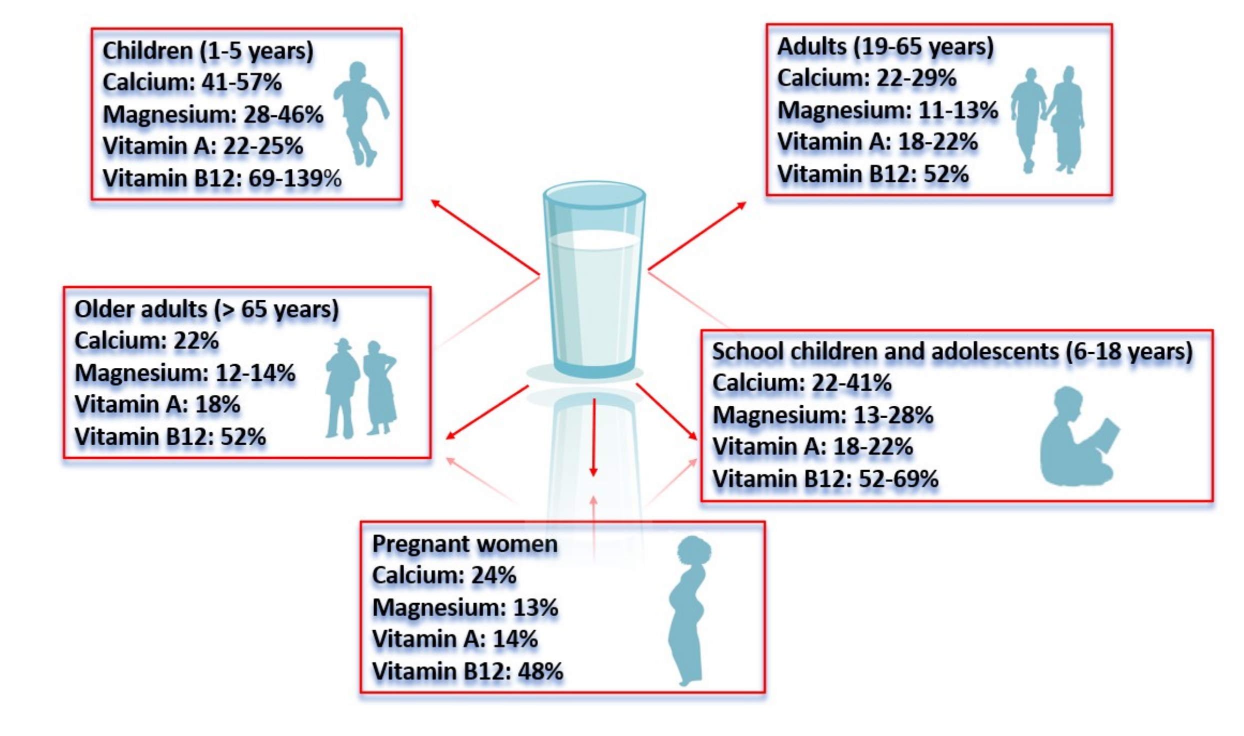

Figure 1: Percent of Essential Micronutrients of Milk For Various Age Groups

cyroscope test. Sediment test by drawing 1 pint of the sample through a cotton disk and assigning a grade of 1-4 to the filter. A grade of 1 or 2 is acceptable while 4 is a bad value. Fat and milk-solids, not fat (MSNF) recommended concentration in the milk is 3.25% fat and 8.25% MSNF (Chandan, 2011).

Micronutrients are needed for the body in different age groups. Children, adults, older adults, school children and adolescents, and pregnant women require a different number of micronutrients in milk. Calcium, magnesium, vitamin A, and Vitamin B12 in different amounts are relevant according to their age need (Figure 1).

1.2. Cultured Dairy Products

There are different types of fermented dairy products prepared by various microbial strains. This process is considered one of the ancient practices to extend the shelf-life of milk, and people have been doing it for thousands of years now (Tamang *et al.,* 2020). Fermentation of carbohydrates present in milk is done by microbes, which mainly convert lactose to lactic acid and some other products. Because of the acid precipitation of proteins present in milk; fermented products have a thicker consistency than milk and factors like low pH, and high acidity impede the growth of microbes (bac.) including pathogens (Wouters *et al.,* 2002).

It is difficult to consider the specificity of the origin of the production of fermented milk, but it is safe to assume that it could date to more than 10,000 years ago as the way of life of humans changed from food assembly to food production. This change also included the domestication of the most common dairy animals which includes Cow, Sheep, Buffalo, Goat, and Ewe (Floros *et al.,* 2010; Tamime, 2002). Nowadays, fermented milk and its derivatives production are done in many countries in a huge variety. The production of fermented milk and its derivatives is economically important in many countries (Fernández *et al.,* 2017; Abdelgadir *et al.,* 1998).

Yogurt is the most regularly used dairy product. To produce Yoghurt, the milk is heated up to 80 °C to kill the additional bacteria which might be present and can have the ability to denature proteins. After that, milk is allowed to cool slowly at around 45 °C, and then bacteria are inoculated in it and is followed by fermentation at room temperature. Generally, it can be produced by using any type of milk, but the most considered type is cow's milk (Shiby and Mishra, 2013). Adding to it, yogurt can be produced from different varieties of milk which include skimmed, dried, semi-skimmed, evaporated, and the whole. The bacteria used are *Lactobacillus delbrueckii subsp. Bulgaricus* and *Streptococcus Salivarius subsp. Thermophilus.* In case of the unavailability of bacteria, a spoonful of yogurt can also be used as it contains the required bacteria. Some probiotic bacteria are also responsible for instance*, Lactobacillus bulgaricus, Streptococcus salivarius, and Streptococcus thermophiles*, and it is generally referred to as bioyogurt. Collectively, these bacteria are also called Lactic Acid Bacteria or LAB (Shiby and Mishra, 2013).

There is different evidence that supports that the intake of 'probiotic' microorganisms is very helpful in maintaining a desired favorable microbial profile and leads to various therapeutic benefits. The lactose present in the milk is fed by bacteria which leads to the release of lactic acid as its waste product. Then, the curdling of protein is caused by the lactic acid which is produced by feeding bacteria that is, the Casein present in milk gets converted into a solid mass commonly known as curd (Kalsoom *et al.,* 2020). The taste of yogurt and its jelly-like texture is imparted by the fermentation of lactose sugar into lactic acid. Lactic acid formation leads to the increased acidity of yogurt which itself is beneficial to prevent the proliferation of other undesirable pathogenicity-causing bacteria. To complete this process of fermentation, two or more bacterial cultures can be used together. Yogurt is then flavored and sweetened, or the fruits can be added at the bottom (Robinson, *et al.,* 2006).

Industrially, the yogurt is produced in large quality and is affected by various factors that are, the standardization of milk, milk additives, choice of culture, de-aeration, choice of milk, homogenization, heat-treatment, and plant design. The milk which is used to produce yogurt must have the highest bacteriological quality and must have a low content of substance and bacteria which can obstruct the growth of the yogurt culture. It must be free from sterilizing agents, bacteriophages, and antibiotics (Marshall and Tamime, 1997). The standardization should be made for the fat and dry solid contents of milk and additives (sweeteners, sugar) can be used. For retaining the stability and viscosity of yogurt, the air content of milk should be as low as possible. Homogenization is done to prevent the creaming of milk during incubation time which leads to a uniform distribution. The heat is provided to milk before incubation to enhance the properties as a substrate for bacterial culture. Various yogurt cultures are available which can be selected based on their production (Hickisch, *et al.,* 2016).

Curds are milk proteins or casein. Curd is produced by coagulation of the milk which can be achieved by mixing edible acidic substances into the milk, like vinegar or lemon juice. The addition of these substances to the milk leads to the curdle formation and forms two discrete parts. The liquid part is the whey, and the solid milk is the curd. Often, the old milk might get soured itself and discrete without any addition of any acidic substance. The reason behind it is the special bacteria responsible, as raw milk generally contains *Lactobacillus* (Wouters *et al.,* 2002). *Lactobacilli* are the genus of bacteria that converts sugars into lactic acid with the process known as fermentation. The sugar contained by *Lactobacillus* is lactose, a disaccharide that is also known as compound sugar and has a β-1, 4- the glycosidic bond between glucose and galactose. Lactose of the milk is converted into lactic acid which gives the sour taste to curd by Lactobacillus (Chen *et al.,* 2017).

Cheese is a fermented milk product with the historical purpose of preservation of milk. Its making process gradually occurs in three main stages: In its first stage, milk is changed into liquid whey and solid curd by coagulating the milk protein, casein. The coagulation of milk protein and casein is done through two methods: acidification and proteolysis (Dave *et al.,* 2003). Acidification takes place when the bacteria producing lactic acid ferment the disaccharide lactose to produce lactic acid. Earlier, it can be done by naturally existing lactic acid bacteria in milk, but nowadays, because of the advancement in dairy industries, the standardization of the process is done by adding domesticated bacterial cultures, which involve *Lactobacillus* sp*., Strains of Lactococcus lactis,* and *Streptococcus thermophilus*. The production of acid by these bacteria leads to the slow coagulation of milk protein, and casein. The enzyme involved in this process is chymosin (the active ingredient in rennet) (Santarelli *et al.,* 2013). It helps in removing the portion having a negative charge that results in faster aggregation of milk protein, casein. In the second stage, the separation of curd takes place which contains casein and milk fat. Based on the type of cheese, the curd can be heated, salted, pressed, and changed into different sizes and shapes. Cheese is transformed from fresh cheese into myriad flavors, and textures during the aging stage. The variety of microbes leads to the diversity in the flavors and textures of cheese. The flavor of the cheese is associated with the catabolism of amino acids. The catabolism of various amino acids gives a variety of flavors, for instance, branched-chain amino acids are converted to malty, fruity, and sweaty flavors (Smit *et al.,* 2005).

Kefir is a fermented milk beverage and has its ancient origin in Eastern Europe. Kefir has a high alcohol content because mare's milk contains more sugars than other kinds of milk. It is common in countries such as Mongolia, Kazakhstan, and some regions of Bulgaria and Russia. It is spontaneously made by fermentation of lactose to lactic acid and alcohol. This is prepared by inoculating the raw milk with gelatinous white/yellow grains which have an irregular shape and are known as kefir grains (Liu *et al.,* 2021). These Kefir grains have diversifying microbial composition including species of lactic acid bacteria, yeast, acetic acid bacteria, and mycelial fungi. Lactic acid bacteria included in kefir are *Leuconostoc mesenteroides, Lactobacillus parakefiri, Lactobacillus fermentum, Lactobacillus brevis and Lactococcus lactis, Lactobacillus acidophilus, Lactobacillus helveticus, Lactobacillus casei, Lactobacillus kefiri.* Acetic acid bacteria include Acetobacter rasens, and Acetobacter aceti. Yeasts include *Kluyveromyces marxianus, Torula kefir, Candida lambica,* and *Saccharomyces exiguous* (Kabak and Alan, 2011).

Kefir and Kumis are almost similar dairy products, but kumis is produced from liquid starter culture whereas Kefir is produced from kefir "grains". Depending on the content of lactic acid, kumis is of three types: strong, moderate, and light. Strong kumis: generated by lactic acid bacteria such as *Lactobacillus rhamnosus. Lactobacillus bulgaricus* (Yvon and Rijnen , 2001). There is acidification in milk which ranges from pH 3.6-3.3 and the conversion ratio of lactose into lactic acid is about 80-90%. Moderate kumis: It involves Lactobacillus bacteria such as *L. Casei, L. fermentum L. Acidophilus, and L. Plantarum* and has restricted acidification properties which lower the pH 4.5-3.9 at the end of the process and the conversion ratio averages 50%. Light kumis: It is a slightly acidified product (pH 4.5-5.0) and the bacteria involved includes *Streptococcus thermophilus* and *Streptococcus cremoris*cremoris (Ardö , 2006).

Ayran is one of the common drinkables a fermented diluted or beverage product of yog**urt.** Even though the preparation of Ayran is completely different from other drinkable yogurt products and does not contain fruit syrup, sweeteners, sugar, aroma compounds, and colorings. Ayran is produced by adding water into the yogurt to decrease the sour taste, this was claimed by Göktürks during the war and so many countries adopt this idea, and currently become the appropriate definition for the preparation of Ayrani (Nilsson *et al.,* 2006). In Turkey, Ayran is the most consumable yogurt product and claimed an additional definition "Ayran is a drinkable fermented product prepared by the addition of water to yogurt or by the addition of yogurt culture to standardized milk" (Köksoy and Meral, 2003). Aryan preparation is classified into two in Turkey, i.e., homemade, and industrially made. From 1 million tons of Ayran consumption annually only 15-25% is industrially made Ayran whereas the rest is homemade Ayran (Makwana and Subrota, 2019).

Microorganisms *Streptococcus thermophilus and Lactobacillus delbrueckii subsp.*Bulgaricus is responsible for the fermentation process, which has a tremendous effect on giving flavor and texture to Ayran milk. To begin the process starter bacteria selection is important for the high quality of the product and therefore mixed strain yogurt cultures (slow fermenting starter cultures & Low-viscosity culture strains) are preferable for a stable product (Nilsson *et al.,* 2006). Temperature and starter culture is one of the factors to change the pH of the Ayran due to this both factors must be controlled to have a stable pH of the yield. pH 4.2- pH 4.4 is preferable to have a high viscosity of the product. The microflora used for the production of Ayran and yogurt is similar. Although, during industrially Ayran production the composition of the microflora is stable, which means only contains yogurt bacteria and no chance for the growth of other bacteria but in homemade Ayran there is a chance of contamination or growth of other bacteria, and this change or fluctuate the pH and texture of the Ayran. For instance, yeasts like *Kluyveromyces* and *Saccharomyces*, are often present in the final product (Deshwal *et al.,* 2021).

Butter is the minimum fat component of 80% of the milk and 16% water and 2% non-fat milk solid (Paduret, 2021). There is various classification of butter, sweet cream salted, sweet cream unsalted, cultured salted butter, cultured unsalted, or traditional sour cream butter. Before the eighteenth century, wood materials were used to make butter. After the construction of butter-making equipment in a modern way, butter-making get better attention, and barrel churn was innovated (Budhkar *et al.,* 2014). The microbiological quality is one of the major importance for the quality of butter. The coliform count in the butter is < 1 CFU/mL. From various types of fatty acids in butter fat, Octadecadienoic acids are present in a significant amount: there are traces of octadecatrienoic acids, hexadecadienoic acid, and highly unsaturated fatty acids C20 (Arachidonic acid) and C_{22} (Docosanoic acid) (Sharma *et al.,* 2021). Traces of dihydroxy stearic acid and hydroxypalmitic acid have been**.** According to studies 66% of one octadecenoic acid content is normal linoleic acid, and the remainder consists of the cis-9, trans-12, or the trans-9, cis-12 isomers**;** other positional and geometric isomers are also present**,** whereas a small proportion of the octadecenoic acid consists, vaccenic acid, oleic acid, trans-11, 12 isomers. The composition of the butter fat may vary depending on different factors. For instance, the fatty acid composition of butter fat varied according to the season due to the difference in the feed of the animals in different seasons, the iodine number units become high during summer than in the winter season. The duration of lactation and the age of the animal and animal species are also other factors (Collier *et al.,* 1982).

β-carotene or other carotenoid pigments which are directly transferred to the butterfat without change in the feed of the cows plays a major role in the content of Vitamin A. 1 IU of vitamin A is the amount possessing the biological activity of 0.6 ìg of pure β-carotene or the biological equivalent of 0.3 μg retinol**.** The green feedstuff of the cow is the source of the carotenes (Sruamsiri, 2007). For instance, vitamin A content always increases in the summer when the dairy herds are in pasture and decreases in winter when there are no green feedstuffs. The green feeding of the cow and the variation of the content of Vitamin A is directly proportional. The appearance of the yellow color due to carotene pigment indicates the presence of vitamin A. The vitamin content of butter fat is usually between 6–12 mg/g, whereas the carotene content in butter fat is 2-10 mg/ g (Elgersma,, 2015). The firmness of the butter mainly depends on the content of milk fat. Primarily the animal diet is the main factor in changing the milk fat composition. The fatty acid composition has seasonal variation according to the green feed in different seasons. The amount of saturated fatty acid in the milk decreases whereas unsaturated fatty acid increases due to green fodder. The physical characteristics of the fat are maintained by the structure of the triglycerides in the milk fat along with the fatty acid composition. The softening point of the fat increases during interesterification (Ozdemir and Kilic, 2004).

Ghee is a clarified butter fat prepared from several cattle species like buffalo, goat, cow, and camel also prepared from mixed milk. The fermentation or heating process of milk, cream, or butter is the processing method that gives a special flavor. Ghee can be easily digested due to its short chain fatty acid content and is known as superior fat to other fats (Sserunjogi *et al..,* 1998). Ghee contains ingredients such as glycerides in mixed milk, phospholipids, sterol esters, free fatty acids, hydrocarbons, sterols, carotenoids, fat-soluble vitamins, are minor constituents whereas charred casein and traces of calcium, phosphorus, and iron are small constituents of ghee cholesterol constitutes 0.5% of the remaining 2% constituents of the ghee (Mehta *et al.,* 2009). Ghee contains a unique flavor which increases its acceptance due to the flavoring compounds like free fatty acids, lactones, and carbonyls. Ghee is consumed by all age groups due to its nutrients. The major nutrients are vitamins A, D, E, K, and linolenic and arachidonic acid fatty acids, cholesterol level ranges between 0.2–0.4%. The ghee composition is ~98 % triglycerides; 4-6 ug/g carbonyl, 0 to 80 mg/l00 phospholipids, 0.1-0.2% monoglycerides, 1-10 mg/100 g free fatty acids, 1-2% diglycerides, cholesterol, 1.8-2.3 u M/g alcohols, fat-soluble vitamins, and 0.8 uM /g glyceryl ethers are minor constituents (Wani *et al.,* 2022). Animal feed is important for the level of nutrients. For instance, the level of fat-soluble vitamin A, carotene, and tocopherols mainly depends on the green feed of the animal (Noziere *et al.,* 2006).

Ghee is not contaminated easily like other dairy products and can be kept outside the refrigerator for a long time. lactose or casein are removed from the ghee which is also comfortable for consumers that are intolerant of these components (Kwak *et al.,* 2013). Ghee mainly constitutes a fat-soluble vitamin A and E (Sindhuja *et al.,* 2008; St-Onge *et al.,* 2008). Vitamin K and conjugated linoleic acid are beneficial for health to treat diseases like cancer and viral diseases (Nosaka, 2009). Due to the high nutritional value of ghee, it becomes the athlete's main energy source. The medium chain fatty acid is used to burn excess fats and helps to reduce obesity (Kumar *et al.,* 2015). The unique flavor and easy digestibility of ghee are due to the presence of Butyric acid: a short fatty acid that is another component in ghee other

Table 1: The Composition of Species Identified Milk and Various Classes of Milk

Milk Type	Mineral Constituent	Health Benefits
Cow milk	3-4% fat, 3.5% protein, 5% lactose, a good source of calcium, proteins, and nutrients such as vitamin B12	weight loss, building strong bones and teeth, boosting the immune system, reducing fat.
Buffalo milk	twice of cow milk, 2:1 fat to protein ratio in buffalo milk, high calcium content	supports bone health, and antioxidant activity, and improves heart health.
Camel milk	similar composition to cow milk, Rich in vitamin C, unsaturated fatty acids, and B vitamins	lower blood sugar and improve insulin sensitivity, immune boosting
Sheep milk	higher fat and protein contents than goat and cow milk, higher lactose content than milk from cows, buffaloes, and goats	boosts immunity, regulates blood pressure, and prevents birth defects, and bone mineral density.
Goat milk	similar composition to cow milk	built strong bones, anti-inflammatory properties, metabolism booster, and improve nutrient uptake efficiency.
Yak milk	15 and 18 percent solid content, 5.5 to 9 percent fat, and 4 to 5.9 percent protein	The antioxidative effect, Favorable for infants, helps to gain weight, Absorbs Calcium & Vitamin B

Table 1 (Cont.)

Milk Type	Mineral Constituent	Health Benefits
Equine milk	low in proteins (particularly caseins) and ashes and rich in lactose, low levels of fat and protein	Smooth digestion, beauty treatments, overcoming eczema, good for bone health, maintaining blood pressure, and detoxifying the body.
Standardized milk	4.5% fat	Nutritive value
Toned milk	3.0 % fat	Reduces high blood pressure, and promotes easy digestion.
Double Toned milk	1.5 % fat	Rich in vitamin D, helps in weight loss
Skimmed milk	Not more than.0.5 %, Potassium source,	helps in lowering blood pressure
Full Cream	6.0 %, a Good source of calcium	maintain healthy teeth.

Source: Dairy production and products: Milk composition (fao.org) accessed on August 14/2022, FSSAI Categorization of Milk Products and their Standards - Food Safety Mantra Blog accessed on August 14/2022, 6 Incredible Cow Milk Benefits | Organic Facts accessed on September 12/2022, Buffalo Milk: Nutrition, Benefits, and How It Compares (healthline.com) accessed on September 12/2022, 6 Surprising Benefits of Camel Milk (And 3 Downsides) (healthline.com) accessed on September 12/2022, 7 Amazing Benefits of Sheep Milk | Organic Facts accessed on September 12/2022, 9 Surprising Goat Milk Health Benefits | Organic Facts accessed on September 12/2022, Yak Milk Benefits (nutriarena.com) accessed on September 12/2022, 9 Incomparable Health Benefits of Horse Milk #1 Proven - DrHealthBenefits.com accessed on September 12/2022.

than oil products (Bugaut, 1987). The fiber in the body is converted to butyric acid by the beneficial intestinal bacteria used for the production of energy and intestinal wall support (Ongol *et al.,* 2009).

Lactic acid bacteria and yeasts play a great role in the fermentation process of ghee. Lactic acid bacteria species such as *Lactobacillus helveticus*, *Lactobacillus perolens, Lactobacillus brevis, Lactobacillus paracasei, Lactobacillus acetotolerans, Lactobacillus plantarum, Lactobacillus* sp., *Lactococcus raffinolactis, Lactococcus lactis subsp. lactis* and *Streptococcus salivarius.* The acetic acid bacteria such as *Acetobacter aceti, Acetobacter lovaniensis, Acetobacter orientalis,* and *Acetobacter pasteurianus*. yeasts in the fermentation process like *Brettanomyces custersianus, Candida silvae, Geotrichum sp., Issatchenkia occidentalis, Issatchenkia orientalis, Kluyveromyces marxianus, Saccharomyces cerevisiae,* and *Trichosporon asahii* (Ongol *et al.,* 2009).

1.3. Adulteration of Milk

Milk adulteration is the removal or adding of substance into the milk to increase or decrease the quality and to decrease the quantity of the milk. Milk easily can be adulterated, especially in underdeveloped and developing countries. Lack of control in the market, weak law enforcement, lack of knowledge or proper awareness, also acquiring greater profit are the main factors for the high adulteration in the world (Afzal *et al.,* 2011). The adulteration may have a negative health impact on the consumers. Common chemical aulterants are ammonium sulfate, sugar, salt, starch, formalin, hydrated lime, water, sodium carbonate, caustic soda, chlorine, H_2O_2 and non-milk proteins, urea, refined oil, and common detergents. Some countries practice the production of Synthetic milk by mixing caustic soda, common detergents, refined oil, and urea to meet the deficit of milk, but have a huge health impact (Hattersley, 2000).

Water is one of the common adulterants of milk targeted to increase the quantity of the milk but affects the nutritive value. During adulteration water cleanliness is another issue for the consumers, the contaminated water leads to develop various diseases in the users (Afzal *et al.,* 2011). Hydrogen peroxide is used in adulteration for preservation or to keep the milk fresh for a long time. It is a poisonous chemical and harmful to human health by penetration of peroxide into the gastrointestinal and causes inflammation to the intestine and leads to damage to the organ. An antioxidant in our body become malfunctions and leads to aging by disturbing the natural immunity (Watt *et al.,* 2004). Chlorine is used after the adulteration of milk using water. It helps to increase or compensate for the diluted milk but also changes the acid-base balance of the milk. This adulteration leads to the development of atherosclerosis or blocked the arteries and causes heart problems, lowers blood pH (Cheng *et al.,* 2010).

Melamine is a compound used to increase the protein content falsely and followed by the addition of milk powder. This adulteration leads to the development of renal failure and even death (Guan *et al.,* 2005). Milk powder is added to fresh milk as an adulterant. This adulteration is done in a country that has an excess amount of milk powder and helps to balance the fluid milk (Haasnoot *et al.,* 2006)]. Urea is used as an adulterant also for the preparation of synthetic milk. Adulteration of milk using urea is to maximize the consistency of the milk and non-protein nitrogen content, for optimizing the contents of solid nonfat presence in the milk, and to increase the whiteness of the natural milk. Urea led to various health hazards such as acidity, ulcers, indigestion, cancers, heart, and liver damage. Urea is removed from the body by the work of the kidney; therefore, the kidney does extra work to remove this area, and this leads to the failure of the kidney. The production of ammonia in milk develops sensory disturbances, loss of acquired speech, and regression (Mudgil and Sheweta, 2013).

Non-milk proteins such as soluble wheat proteins, pea, and soy are used as an adulterant in dairy products, milk, and milk powder. BRW (bovine rennet whey) is used in milk powder (Jha and Matsuoka, 2004). Fats from the milk are removed and used for other purposes by manufacturers due to their high price and Fats from other sources or non-milk fat like vegetable oils are used in place of milk fat and this adulteration leads to the complication of health (Sukumaran and Hemanth, 2014). Detergents are used as an adulterant to emulsify and dissolve the oil in water giving a frothy solution, the characteristic white color of milk (Sukumaran and Hemanth, 2014). It increases the cosmetic nature of milk, and this adulteration leads to gastrointestinal disease (Haasnoot *et al.,* 2004). Low-valued milk adulteration is the addition of high-valued milk to low-valued milk to compensate for the diluted milk (Pappas *et al.,* 2008). For instance, goat milk is adulterated with cow milk for profit, and cow milk is added to buffalo, ewes, and sheep milk (Das *et al.,* 2016). Even though this milk adulteration practice's impact on health has not been explained, some may have allergies for instance cow milk but still, it is an ethical concern (Sukumaran and Hemanth, 2014).

Milk adulteration using starch and sometimes rice flour, arrowroot, and wheat flour, aims on increasing the solid-not-fat (SNF) concentration. During adding of starch, the appropriate amount must be added otherwise the high amounts of starch in the milk becomes undigested in the colon and causes diarrhea. The accumulation of starch in the body of a diabetic patient may be fatal (Qi *et al.,* 2019). Food colors are dyes, pigments, or substances used to give extra color to food, and this harms health (Stich, 2016). Neutralizers help to decrease the acidic effect. For instance, adulterant sodium hydroxide is used in synthetic milk to decrease its acidity. Synthetic milk contains caustic soda which hindered the use of essential amino acids and lysine by depriving the body mainly seen in babies needed by a growing baby (Nyakayiru *et al.,* 2020). Caustic soda is also constituting sodium which is harmful to hypertension and heart problems patients. Synthetic milk is not advised for a pregnant woman due to high adulteration of the milk like substitute of milk fat, refined oil is mixed, and detergents to dissolve the oil in water and to give a frothy solution, Carbonates lead to the disruption of signaling that maintain development and reproduction and carbonates and bicarbonates leads to the gastrointestinal problem like gastric ulcer, electrolytes disturbance, colon ulcer and diarrhea (Singh and Neeraj , 2015).

Preservatives such as Sodium carbonate (Na_2CO_3), Formalin, Sodium azides, Sodium bicarbonate ($NaHCO_3$), Boric acid, Benzoic acid, and Salicylic acid uses to preserve the milk for a long time and prevent the growth of microorganisms and spoilage of milk. Even though these chemicals are hazardous to health and can lead to death. The symptoms like vomitation, diarrhea, and abdominal pain may develop (Recio *et al.,* 2000). Antibiotics are used in animals for the treatment of mastitis disease. 80% of veterinarians use antibiotics. Antimicrobial residues have existed in the milk which contains antibiotics. After the treatment of the veterinarian, aromatic amines, tetracycline, gentamicin residues, chloramphenicol residues, neomycin residues, sulfamethazine residues, aflatoxin M1 contamination, etc. are also a concern as milk adulterants. The administration of antibiotics via Intramammary infusion leads to milk contamination. The major health impacts of this contamination are interference in intestinal flora such as sulfamethazine residues, allergic reactions, high antibiotic resistance, may have carcinogenic properties, tissue damage, and urticaria due to a Very low amount of penicillin residue (De Briyne *et al.,* 2014).

Liquid Whey is used as an adulterant to increase the volume of the milk. Milk powder and liquid milk are mostly mixed with low-priced rennet whey and are commonly found in milk. For excess profit, the manufacturers produce whey using cheap muriatic acid which is hazardous to the health. adultering Ultra High Temperature (UHT) milk using rennet whey solid leads to the development of low blood pressure (Das *et al.,* 2016). Sugar is used as an adulterant in water-diluted milk to increase the density of the milk or lactometer reading of the milk or SNF (solid nonfat) content of the milk (Singh *et al.*, 2015). Pesticides are used for the preservation of milk by killing, inhibiting, and resisting the growth of microorganisms. Pesticides are hazardous and carcinogenic (Al-Waili *et al.,* 2012).

1.4. Activity of Lactic Acid Bacteria (LAB)

Lactic acid bacteria are a gram-positive bacterium under the family of *Lactobacillaceae* which can convert sugar into lactic acid, or ferment carbohydrates and produce lactic acid as the end product. Lactic acid bacteria are mainly used in the production of several foods including dairy products in the fermentation process due to their harmless property and are recognized as safe microorganisms (GRAS) (Sharma *et al.,* 2012; Steele *et al.,* 2013; Liu *et al.,* 2011). LAB can be existed in the milk either purposely inoculated as a starter culture or spontaneously, sometimes milk is known as the natural habitat of LAB. A procedure known as back slopping is the fermentation of milk by LAB by spontaneous growing in the milk and this was a traditional method of preparation for a long time, for instance, lben and artisanal cheese, kurut, and kumis (Widyastuti *et al.*, 2014). It helps to prolong the shelf life of a fermented dairy product, preserve the nutritious component of the milk, healthy and yields a good quality of milk and dairy product (Griffiths *et al.,* 2013). The fermentation takes place by the bioactive compounds in the Lactic acid bacteria (Mathur *et al.,* 2020).

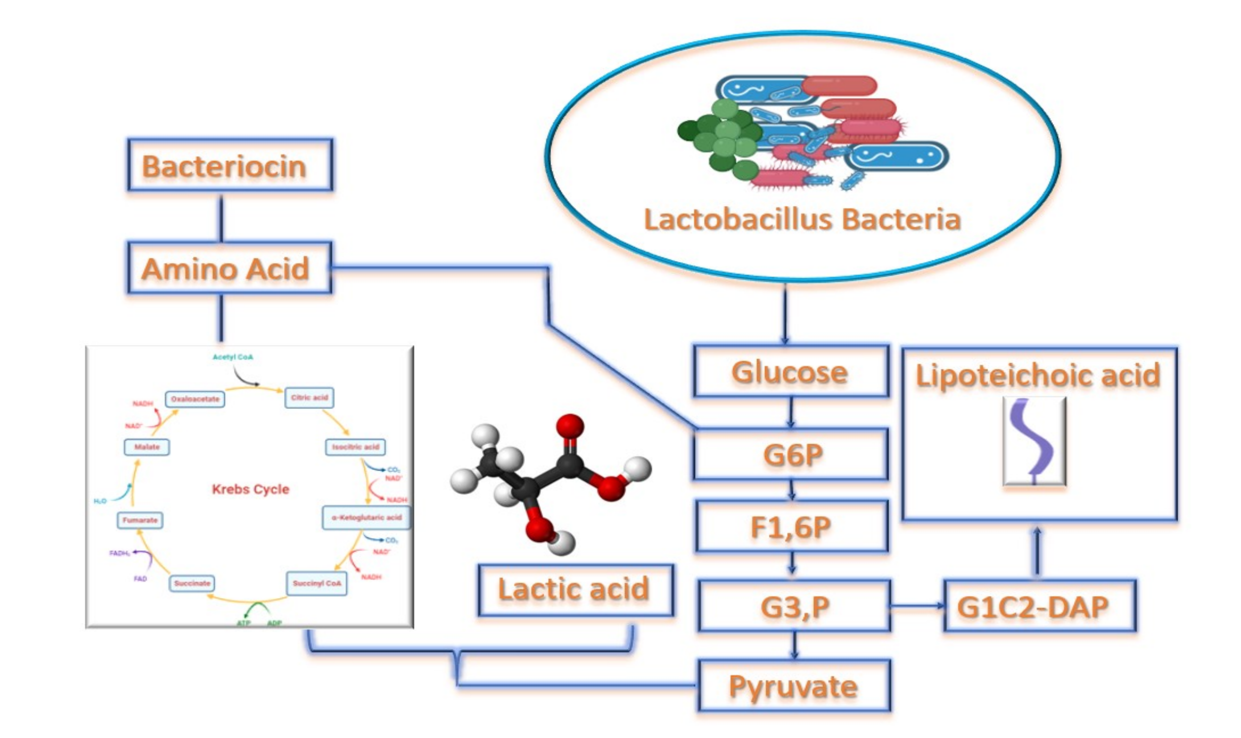

Figure 2: Schematic Representation of Lactic Acid Fermentation of Lactobacillus Bacteria

LAB includes various unrelated bacteria but most are grouped under the families of *Streptococcaceae* and *Lactobacillaceae*, being the most important genera in the first family are *Lactococcus, Leuconostoc*, and *Pediococcus,* whereas *Lactobacillus* in the second family (Kongo, 2013). To process industrialized milk fermentation, process a sequence of activities performed for the selection of a starter LAB a process isolation, selection, and confirmation will be done. The properties of each strain of LAB have been established such as, acidifying milk and generating flavor and texture by proteolytic activity (Kok *et al.,* 1994). To initiate the desired fermentation, process a starter LAB culture is carefully selected and added (Figure 2). LAB has a tremendous effect on the economy. In industry using the starter culture LAB for the fermentation process helps in the standardization and product quality (Sheeladevi and Ramanathan, 2011).

The lactic acid fermentation that takes place by LAB is the reduction of glucose without the utilization of oxygen. Glycolysis involves the conversion of glucose into glucose 6 phosphate, Fructose 1,6-bisphosphate, Glyceraldehyde 3-phosphate, Pyruvate is the conjugate base of pyruvic acid, formed lactic acid and goes to the Kreb cycle then amino acid will form which gives to a proteinaceous toxin bacteriocin will be produced at G6P phase.

Dairy products are mainly produced by the fermentation process by the effect of a controlled manufacturing environment containing microorganisms, milk can be easily converted into different dairy products with different flavors and textures (Law, *et al.,* 1976; Leroy *et al.,* 2004). Most LAB starter culture's primary technological requirement is the production of lactic acid and volatile flavored compounds, also the growth of the bacterial helps for the breaking down of protein or proteolysis and lipid break down or lipolysis of the raw material, and inhibition of pathogenic and spoilage microorganisms. These starter cultures help in the maintenance of the shelf life, organoleptic, rheological, and safety properties of fermented products. They all functioned well maintained by high densities of starter cultures in the milk (Leroy *et al.,* 2004). To maximum growth in milk, lactic acid bacteria convert lactose sugar into galactose and glucose which is used as a carbon source, and free amino acids and small peptides are the nitrogen source. These amino acids are essential for growth (Hugenholtz and Michiel, 1999; Harutoshi, 2013). In raw milk, free amino acids have existed with small peptides that help the growth of lactic acid bacteria increasing the cell density corresponding to 25% of those found in fully-grown milk cultures (Thomas and Pritchard, 1987; Kok, 1990; Law *et al.*, 1983). The protein content of Bovine milk is 3.0- 3.5% (w/w), and about 80% of it consists of αs_1-, αs_2-, ß-and k-casein. The major organic nitrogen source for lactic acid bacteria to grow in milk is caseins (Crow *et al.,* 1995).

1.5. Proteolytic System and Properties of LAB for Milk Fermentation

The proteolytic system of the strain *Lactococcus* has been studied for several years, although the study of a proteolytic system of bacteria started due to their high involvement in the industrial production of food. The proteolytic activity in lactic acid bacteria takes place by the involvement of extracellular proteinase (s), extracellular peptidases, amino acids and peptide transport systems, and intracellular peptidases enzyme. *Lactococci* constitute the cell envelope proteinase which is responsible for the degradation of casein during the pathway. The breakdown of casein has varied technological importance, and this creates huge attention for researchers' study over the last few years and determines its biochemical, genetic properties, and immunological have been determined (Law and Jens, 1983; Thomas *et al.,* 1987; Dhasmana *et al.,* 2022). The *Lactococcal* proteinases enzyme of *Lactococcus lactis* strains have the characteristics of high molecular weight proteins (80-145 kDa molecular size), a pH optimum close to 6.0, Ca^{++}-ions, in low concentration, either activated or stabilized activity, (Thomas *et al.,* 1987) and, inhibited by phenyl methyl sulphonyl-fluoride of diisopropyl-fluorophosphate, both specific inhibitors of serine-type proteinases (Coolbear *et al.,* 1992).

Proteolytic activity of *L.lactis* subsp. *Cremoris* MLI takes place by the whole or partial release from the cell by treatment of lysozyme or by incubation in a Ca^{++}-free buffer (Law, 1978). A different strain of *L. lactis* attached the proteinase system on the cell wall until genetic studies of proteinases and the corresponding genes were undertaken. Lactic acid bacteria present a size restriction between 4 and 6 amino acid residues of peptides (Bolotin *et al.,* 2001; Rice *et al.,* 1978; Smith *et al.,* 1975; Monnet *et al.,* 1989). Hydrolysis is important for the conversion of large peptides into smaller products. The size of the peptides is much smaller than those generated from caseins by the proteinases (Monnet *et al.,* 1986; Monnet *et al.,* 1989; Reid *et al.,*1991; Visse *et al.,* 1986; Visse *et al.,*1991; Neviani *et al.,* 1989). The second stage of the casein breakdown is taken over by several peptidases. Various type of peptidase enzymes are extracted and purified from lactic acid bacteria such as general aminopeptidase C (Wohlrab *et al.,* 1993; Exterkate *et al.,* 1987) aminopeptidase A (Hwang *et al.,* 1981), di-peptidases (Van Boven *et al.,* 1988; Wohlrab *et al.,* 1992; Bacon *et al.,* 1993), tri-peptidases (Bosman *et al.,* 1990; Atlan *et al.,* 1990), X-prolyl dipeptidyl aminopeptidase (Bockelmann *et al.,* 1991; Booth *et al.,* 1990), prolidases (El Abboudi *et al.,* 1992), prolyl aminopeptidases (Khalid and Elmer, 1990) and endopeptidases (Kiefer-Partsch *et al.,* 1989; Lloyd *et al.,* 1991; Meyer *et al.,* 1987). The amino acid and peptide contain three transport systems in addition to passive diffusion (Miyakawa *et al.,* 1991). Those are secondary transport systems that take most of the amino acids by coupling with pmf (proton motive force). For instance, glycine, leucine isoleucine, valine, serine, methionine, threonine, alanine, lysine isoleucine, and valine are transported by proton motive force (Zevaco *et al.,* 1990; Kaminogawa *et al.,* 1984; Baankreis *et al.,* 1991), and primary transport system catalyzes the uptake of asparagine glutamate, aspartate, and glutamine and driven by adenosine triphosphate (ATP) (Driessen *et al.,* 1987), Arginine is taken up in exchange for ornithine with 1:1 stoichiometry (Poolman *et al.,* 1987; Thompson *et al.,* 1987; Zacharof *et al.,* 2012) by the concentration gradient of two amino acids driving force, and without the energy to translocate the arginine in the system.

Lactic acid bacteria have different properties, those properties are helpful in dairy production. For instance, for preservation, acid production, flavor formation, texture development, and health-promoting. The conversion takes place by the proteolytic activity of the bacteria in the milk. This conversion gives an acidic taste and pleasant smell to the converted milk product, such as cheese and yogurt. Microorganisms grow in milk and any milk products, and this causes the spoilage of the milk (Leroy and Luc , 2004). During the growth of the LAB in the milk, acid production takes place and this in turn helps for the antimicrobial activity in the milk and the property known as preservative property. This acidification helps the milk protection from spoilage microorganism growth and pathogens proliferation. Apart from acid production bacteria produces bacteriocins which are antimicrobial metabolites. Bacteriocins are produced at the lag phase of bacterial growth. Both bacteriocins and acids are used for food preservation and are known as safe natural preservatives (Moon *et al.,* 2012). Carbohydrate is metabolized by BAL and gives organic acid as the product. Sugars are converted by Homofermentative species of LAB into lactic acid in the milk, whereas acetic acid, lactic acid, CO_2, and ethanol are produced by the heterofermentative species lactose conversion. *Lactobacillus paracasei subsp. Paracasei* CHB2121 produces 192 g/L lactic acids from a medium containing 200 g/L of glucose, with 3.99 g/(L.h) productivity, and 0.96 g/g yield, with 96.6% L(+)-lactic acid optical purity. The strain is also used for the industrial production of lactic acid (Zalán *et al.,* 2010). Ten strains of *lactobacillus* were investigated for their acid production in different de Mann Rogosa Sharpe (MRS) broth, skimmed milk, and Jerusalem artichoke media and *Lactobacillus casei Shirota* produced the highest acid, and *Lactobacillus rhamnosus VT1* the lowest. Two *Lactococcus* lactis strains *L. lactis subsp. lactis biovar. diacetylactis suppresses* the bacterial pathogens *E. coli* and *Salmonella enteritidis* strains by fast acid production which resulted in rapid pH reduction (Mufandaedza *et al.,* 2006; Delavenne *et al.,* 2012) and this makes *lactis subsp. lactis biovar. diacetylactis* strains to use as starter culture 2% (v/v) *Lactobacillus casei* AST18 inhibits the growth of *Penicillium* sp. *Lactobacillus casei* AST18 can produce antifungals like lactic acid and cyclo-(Leu-Pro), increasing the yield of lactobacillus.

LAB extracted from raw milk of ewe, goat and cow have antifungal activity against *Kluyveromyces lactis, Penicillium expansum, Mucor plumbeus, Penicillium expansum,* and *Pichia anomala*. Especially, *Lactobacillus* spp. colonies have the highest antifungal activity mainly due to the production of organic acids or ethanol which fungi are sensitive to resist, also acetic acid has certain antifungal activity (Routray and Hari, 2011). The main reason for the availability of various fermented milk products is the use of LAB strain and technology. For instance, one of the criteria for the variety of cheese types is the addition of LAB strains in the ripening process. LAB is classified into two main categories starters, and non-starters. *Lactococcus*, *Leuconostoc, Streptococcus,* and *Lactobacillus* are starter cultures for yogurt preparation (Callanan *et al.,* 2008). Starter cultures produce acid and help during ripening, whereas nonstarter culture helps only in the ripening process. Many cheese products are produced from the bacteria *Lactobacillus helveticus* which is a dairy niche species and specialized milk species also give a flavor (Slattery *et al.,* 2010; Settanni *et al.,* 2010) cheese ripening is mainly performed by the activity of nonstarter LAB bacteria. The process takes place by the enzyme release of LAB that participates in the transformation of curd in cheese. Nonstarter LAB population is uncontrol, hence strain selection is important to give a specific cheese flavor (McSweeney *et al.,* 2000). Both starter and nonstarter culture help with flavor development during the ripening process. Cheese flavor development by LAB takes several steps like metabolism of lactose, lactate, and citrate, lipolysis, and proteolysis where the liberation of free fatty acids and degradation of casein, respectively and followed by amino acid catabolism (Routray and Hari, 2011) *Streptococcus thermophilus* and *Lactobacillus bulgaricus* are the most common LAB cultures used in yogurt manufacture. The synergistic effect produces volatile metabolites responsible for the varied flavor of yogurt and produces more aromatic compounds and lactic acid (Tunick *et al.,* 2015).

1.6. Health Benefits of Dairy Products

Milk and milk products have a tremendous effect on health. various studies show the benefits of dairy products such as optimizing child growth, the strength of bone, muscle building, low-density lipoprotein cholesterol, prevention of tooth decay, and lowering blood pressure, cancer, diabetes, and obesity. Some studies show the benefits might also provide by organic milk and by probiotic microorganisms using milk products as a vehicle (Sanchez *et al.,* 2009). The health benefits or nutritional benefits of dairy products are mostly dependent on the major elements present in them like Calcium, Sodium, Potassium, Chloride, Phosphorus, and Magnesium. Sources of these major elements are cow, sheep, goat, and human. Calcium constitutes about 1.5-2% of the whole-body mass of an adult human, 99% parts of it are present in teeth and bones in the form of Calcium phosphate and the left 1% part is present in cell membranes, fluids present in the extracellular matrix as well as in the structure of the intracellular matrix. Milk is the main source of Calcium. It plays a crucial role in the regulation of the various vital functions like activation of enzymes and hormones, clotting factors present in the blood, and most importantly balancing the ideal cardiac rhythm (Zamberlin *et al.,* 2012; Massey and Whiting, 1996). Sodium is required for maintaining or regulating the osmotic pressure in the body and it acts as a cation in the fluids of the extracellular matrix. Another most important function of Sodium is to facilitate the movement of molecules/substances through the cell membrane via active transport.

The source of sodium is cream and cheese. Chloride, its main role is to balance the electrolytes in the body, and it acts as an extracellular anion (Rude, 1998). The intake of sodium, potassium, and chloride in the form of milk is directly related to the nutritional value of infants. It plays a very important role in the growth and development of infants. Magnesium acts as a cofactor for various enzymes and is involved in processes like bone growth, the transmission of neuromuscular, and muscle contraction. The deficiency of magnesium leads to the disease known as osteoporosis (Paulina and Bencini,

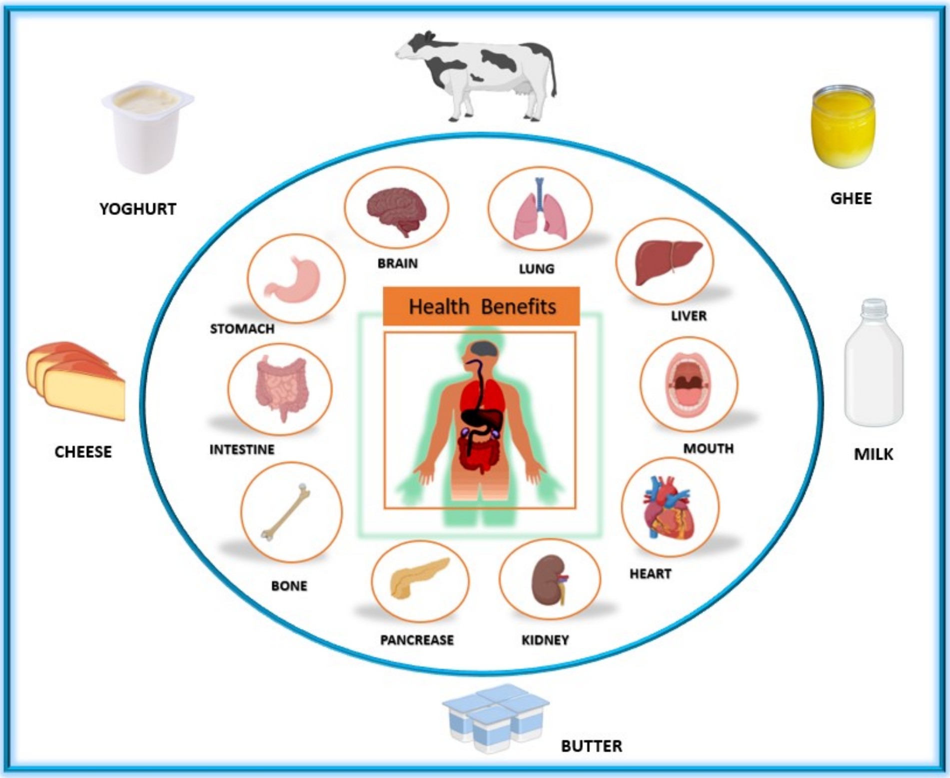

Figure 3: The Health Benefits of Various Dairy Products

2004) . Other than the major elements, some trace elements are also present in dairy products but at low concentrations and constitute about 0.01% of the whole-body mass. Among the total essential minerals, 14 out it is trace elements that are: iron, silicon, boron, molybdenum, nickel, selenium, copper, zinc, chromium, fluorine, arsenic, manganese, nickel, and selenium. Some of the trace elements among these are toxic in nature but because it is present in low concentration in milk, it does not reach the threshold of causing disease or health hazard and can be easily consumed (Ganpule *et al.,* 2006). Milk and milk products have a vital role in the maintenance and increasing efficiency and long functionality and beauty of our various organs through their constituent's micro and macro nutrients which are very vital. For instance, liver, bone, brain, pancreas, stomach, skin, oral teeth, etc. (Figure 3).

Dairy and dairy products have tremendous health benefits for a human. Due to the nutrients available in milk and dairy products like micronutrients and macronutrients human health is maintained through the healthy development of organs and high life expectancy.

For many decades milk and milk products have been a crucial part of the human diet and give an immense health benefit (Dekker *et al.,* 2019); Cole *et al.,* 2009). For the development of bones, dietary calcium is considered the most important factor even before birth. Calcium is associated with an increase in bone size, the overall skeletal growth. Calcium intake is also known for the prevention of osteoporosis and for lowering the risk of fractures in adults (Astrup *et al.,* 2015). Dairy products also function in balancing metabolically active muscle mass and muscle protein synthesis (Abargouei *et al.,* 2012). It is also responsible for facilitating improvement in the composition of the body, reduction in body fat, or weight loss (Lampe, 2011). Dairy products in association with cancer have both positive as well as negative outcomes because of the presence of different bioactive compounds in them. The positive factor is directly related to the importance and requirement of calcium, and lactoferrin in our body (Xiong *et al.,* 2018). The World Cancer Research Fund (WCRF) reports states the analysis which shows the probability that dairy products reduce the risk of Bladder Cancer, Colorectal cancer, Gastric cancer, and Breast Cancer (Merritt *et al.,* 2006).

Milk and its alternative consumption are also known to contribute to oral hygiene by inhibiting biofilms, tooth remineralization, by inhibiting bacterial colonization because of the presence of a vast array of proteins in it. It makes teeth stronger and promotes overall oral health (McKeever *et al.,* 2008). As we know that dairy products are rich in fats, and various nutrients, mainly vitamin D, and their high intake is directly tagged up with the increased function of the lungs (Gopinath *et al*., 2011). Adding to it, its low-fat intake is directly linked to the reduction in the risk of kidney diseases. Dairy product consumption is also associated with better brain health, calcium not only helps in bone strengthening but also plays a crucial role in the betterment of the brain. It is considered a great source for protecting the brain from oxidative stress. So, overall dairy product consumption is very important for the growth and development of our body as it is associated with the enhancement of almost every part of our body (Sies, 1991).

2. Conclusion

The bioprocessing of various dairy products and the microorganisms associated with the product at the Industrial level has been extensively studied since earlier decades. Fermentation property helps in standardization and maintains product quality. The common factors involved in adulteration are water, hydrogen peroxide, chlorine, melamine, milk powder, urea, non-milk protein & fats, detergents, low-valued milk, starch, food colors, neutralizers, preservatives, antibiotics, whey, sugar, and pesticides. They can reduce the actual health benefits that are provided by milk. Dairy products help in providing balance to muscle protein synthesis, some contribute to oral hygiene, some for the betterment of the brain, and some are even associated with cancers. Further research is required to get a better understanding of these dairy products. Its therapeutic properties still need to be explored in a better manner as dairy products have a direct link with human health. It can be a potent source of benefit for the future health sector, food industry, and pharmaceutical industry.

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Conflicts of Interest

The authors declare no conflict of interest.

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