

# An Overview on Milk

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**ABSTRACT:** *Because milk's components are complex, it should be processed using a combination of thermal and non-thermal methods to preserve its health benefits. Milk stability benefits from high-intensity pulsed electric fields with thermal exposure. In this review paper, the biological benefits of various milks such as cow, camel, and human milk were discussed. Camel milk increased anti-oxidant biomarkers in autistic children, reducing oxidative stress and thus improving autistic behavior. Anti-inflammatory compounds are produced by fermented dairy products like camembert cheese, which may have therapeutic benefits in Alzheimer's disease. The relationship between whole milk and blood lipid concentrations in relation to cardiovascular risk is also discussed in this paper; the milk did not cause significant changes in blood cholesterol. Moderate consumption of whole milk may be beneficial to one's health because it inhibits the activity of the mechanistic target of rapamycin complex 1, which is responsible for cancer cell growth. Infectious diseases, microbial resistance, and allergic disease were also discussed in this review paper.*

**KEYWORDS:** *Cancer, Cardiovascular Disease, Caseins, High Intensity Pulsed Electric Fields, Infectious Disease, Neurological Disorder.*

## 1. INTRODUCTION

Milk utilization from livestock products is expected to rise to 89.5 kilograms per person per year in 2030, up from 78.1 kilograms per year in 1997-1999. Milk contains valuable nutrients and contributes to our body's requirements such as calcium, magnesium, selenium, riboflavin, vitamin B12, and vitamin B5. This is well documented and known. Breast milk is the gold standard for growing young children, according to the World Health Organization (WHO). Consumption of human milk by full-term newborns for up to six months has resulted in fewer cases of diarrhoea, vomiting, and infections. Apart from that, it aids in the prevention of obesity and non-communicable diseases such as diabetes and cardiovascular disease in adulthood. Breast milk is the best option for a baby's survival, especially if he or she is born prematurely. Human milk consumption benefits preterm babies (those born with a low birth weight) because it promotes a positive neurodevelopmental outcome, protection against infections, and low rates of metabolic syndrome in the long term and during adolescent years, which is linked to lower blood pressure and a lower risk of insulin resistance. Prebiotic effects of milk glycan components in breast milk aid in the prevention of illnesses such as necrotizing enterocolitis, a frequent and deadly condition of premature babies [1]–[4].

*Composition of Milk:*

*Total Composition of the major components in milk:*

Water, lipids, proteins, lactose, and minerals are the primary components of cow milk. Pigments, enzymes, vitamins, lipids, and gases may all be found in tiny quantities in milk. Individual cow breeds and processing techniques may have a big impact on the percentage amounts of the components.

*Fat in Milk:*

Milk fat is almost entirely made up of neutral lipids. The largest category, triglycerides (triacylglycerols), constitutes for 95 percent of the lipid fraction and is made up of fatty acids of various lengths and saturations. Diglycerides comprise approximately 1-2 percent of this fraction, followed by monoglycerides, sterols, and free fatty acids in minor quantities. More than half of the fatty acids in milk are saturated, and although there are more than 200 different kinds of fatty acids in milk, only those that are present in substantial quantities are saturated.

#### *Proteins:*

Milk includes hundreds of different proteins, which are traditionally divided into caseins, whey proteins (also known as milk serum proteins), and other membrane proteins.

#### *Lactose, Caseins, and Whey Proteins:*

Caseins are the most common kind of protein in milk, and they are classified into four groups: -s1 casein, -s2 casein, -casein, and -casein. Caseins exist in the form of micelles, which self-assemble into huge clusters with spherical dimensions ranging from 50 to 500 nanometers. Milk gets its white color from colloidal particles that scatter light. Whey proteins (also known as milk serum proteins) are heat-sensitive, soluble proteins. Whey proteins denature rapidly at 70°C, preventing coagulation and gelling and therefore affecting stability and shelf-life. However, when curdling is required, such as in cheese manufacturing, this has a detrimental effect. In terms of nutrition, -lactalbumin is present in the milk of all animals and has a high nutritional value. Their amino acid profile is very near to that of a biological optimum. Lactose is a sugar that can only be found in milk. It's approximately a third of the sweetness of cane sugar[5].

#### *Minerals and Vitamins:*

Vitamins are abundant in milk. Some vitamins are soluble in water, whereas others are soluble in fat. A variety of minerals may be found in milk. Potassium is the most prevalent mineral in milk, followed by calcium. Calcium is needed to create bone mass, but its poor solubility makes it difficult for the body to absorb it for bone development. 70% of calcium in milk is contained in a combination of phosphate and citrate ions that our bodies can easily absorb.

#### *Processing of novel milk:*

#### *Technology for High-Pressure Milk Processing (HPP):*

This section compares sophisticated milk processing techniques to traditional milk processing techniques. Consumers today want milk that is fresh, nutritious, excellent in quality, and microbiologically safe. High-Pressure Processing (HPP) technology has proved to be extremely helpful in the milk processing industry. The temperature during this procedure may range from subzero to over 100°C, with exposure periods ranging from a few seconds to over 20 minutes. HPPs with pressures ranging from 300 to 600 MPa are efficient in inactivating milk-borne pathogens and improving rennet or acid coagulation of milk without compromising the quality of taste, flavor, vitamins, and nutrients.

#### *HIPEF (High Intensity Pulsed Electric Fields):*

The use of high intensity pulsed electric fields (HIPEF) as a non-thermal therapy for milk processing has gained popularity in the past decade. HIPEF is a technique for generating an electric field on a continuous flow of liquid media (milk). Interference in the conductivity of ions such as chlorides, phosphates, citrates, carbonates, sodium, calcium, and magnesium affects the electrical charges applied to milk, fat content, pH, and temperature. Furthermore, the use of HIPEF results in a substantial decrease in the size of milk fat globules. On the other hand, according to another study, using HIPEF on milk medium may result in the formation of a complex composition of high milk protein, which can inhibit microbial development during storage or transit[6]–[8].

*Milk's pharmacological effects on human health include neurological disorders:*

*Alzheimer's disease (AD):*

Breastfeeding mothers were shown to have a reduced chance of getting Alzheimer's disease than no breastfeeding mothers. Breastfeeding is thought to regulate hormone exposure in mothers and increase insulin sensitivity, lowering the incidence of Alzheimer's disease. Linoleic acid, linolenic acid, conjugated linoleic acid, stearic acid, and oleic acid are among the fatty acids found in milk. Oleamide is made from the milk fatty acid oleic acid during the fermentation of dairy products. Alzheimer's disease (AD) is a progressive neurodegenerative illness in which intercellular amyloid (A) plaques and intracellular neurofibrillary tangles are two major pathogenic characteristics in the brain. Furthermore, post-mortem brain examinations of people with Alzheimer's disease have shown higher expression of inflammatory mediators. Anti-inflammatory medications have been shown to reduce the risk of Alzheimer's disease in epidemiological studies.

*DHA and other omega fatty acids:*

Resveratrol and omega-3 fatty acids, which protect against Alzheimer's disease, are plentiful in red wine and fish, respectively. Neuronal depolarization initiates the development of synapses, and the number of synapses produced is determined by three important nutrients: uridine, the omega-3 fatty acid docosahexaenoic acid (DHA), and choline.

*Parkinson's disease (PD):*

When there is an overabundance of free radicals or a reduction in antioxidant levels, oxidative stress develops. Increases in oxidative stress indicators have been seen in Alzheimer's disease, Huntington's disease, and both familial and sporadic Amyotrophic Lateral Sclerosis (ALS). Unsaturated fatty acids and iron are abundant in the neurological system. Because the nerve tissue has high lipid content, it has a greater metabolic activity, which makes it more susceptible to oxidative injury. The loss of neurons in the substantia nigra, a brain area, is a major pathogenic characteristic of Parkinson's disease (PD). Antioxidant deficiency is often linked to tissue deterioration in the substantia nigra.

*Autism spectrum disorders (ASDs):*

Autism spectrum disorders (ASDs) are a set of disorders defined by social interaction impairment, communication impairments, and limited repetitive interests and behaviors. ASDs are caused by a combination of genetic and environmental factors. Autism is becoming more common at an alarming pace, with a current incidence rate of approximately 1% across different demographic cohorts.

#### *Other brain diseases:*

Cerebral hypoxia-ischemia (HI) is a form of brain damage that is often seen in preterm babies who go on to have neurodevelopmental problems. Lactoferrin, found in human milk, has antioxidant, anti-inflammatory, and antibacterial effects. Lactoferrin supplementation in maternal diet during breastfeeding has been proven to have a neuroprotective impact and is a hot topic of study for pre-term brain neuroprotection. Because chronic immunological activation of the microglia (central nervous system resident macrophages) is prevalent in neurodegeneration, including Alzheimer's disease, anti-inflammatory and anti-oxidant-rich diets may be helpful in avoiding neurodegenerative illness[9], [10].

#### *Child development:*

Vitamins A, D, and E are fat-soluble vitamins found in milk, and the amounts of these vitamins are reduced in low fat and skimmed milk. Vitamin A is essential for healthy growth, development, immunity, and vision. In a retrospective study of African-American teenagers, it was shown that a high maternal consumption of dairy products resulted in a substantial increase in the foetal femur length. A further research found a link between high maternal milk and protein consumption and increased head circumference, biparietal diameter, and belly circumference in children, as well as increased femur length. This is believed to be because milk is high in macronutrients, micronutrients, and minerals. Milk contains all of the nutrients needed for a newborn's development and growth. During the early days of breastfeeding, human colostrum, which is milk produced up to eight days after birth or milk produced at the start of casein production on the third day of lactation, is an important source of hormones, nutrients, and antibodies.

#### *Heart and blood vessel disease:*

##### *Milk's effect on cardiovascular disease:*

Cardiovascular diseases (CVD) include illnesses including coronary heart disease (CHD) and ischemic stroke, which are caused by constricted or blocked blood arteries. According to WHO, cardiovascular disease is now the leading cause of death worldwide (2011). CVD risk factors have been well-studied and recognized, and include both intrinsic and external environmental variables, including as age and genetics.

##### *Milk's effect on blood pressure:*

One of the most significant risk factors for CHD and ischemic stroke is high blood pressure, often known as hypertension, which is defined as blood pressures more than 120/80 mmHg. Evidence from epidemiological research indicates that increasing milk intake may help

hypertensive people lower their blood pressure. The Dietary Approaches to Stop Hypertension (DASH) research is one of the most important lines of evidence supporting this. For eight weeks, participants were allocated to either a control diet high in fruits and vegetables or a combination diet high in fruits, vegetables, and low-fat dairy products. According to the findings, those who followed the combo diet had lower blood pressure.

#### *Milk's Effect on Lipid Concentration in the Blood:*

Despite its reputation as a nutritious meal, whole milk contains at least 3% fatty acids, with more than half of them being saturated fats. According to some data, a high saturated fat consumption leads to increased blood cholesterol levels, which is another important risk factor for CVD. As a result, there is a widespread belief that drinking whole milk increases the risk of cardiovascular disease, and it is now advised that low-fat milk be consumed instead to minimize the risk.

## 2. DISCUSSION

Milk is a nutrient-dense liquid food produced by animals' mammary glands. It is the main source of nourishment for young animals, including breastfed human babies who have not yet developed the ability to digest solid food. Colostrum is a kind of early-lactation milk that includes antibodies that improve the immune system and therefore lower the risk of numerous illnesses. It also contains a variety of other nutrients, including as protein and lactose. Milk eating across species is widespread, especially among humans, who drink the milk of other animals. It's high in calcium, phosphorus, B vitamins, potassium, and vitamin D, among other minerals. It's also a great source of protein. Drinking milk and dairy products may help you avoid osteoporosis and bone fractures, as well as keep your weight in check.

## 3. CONCLUSION

Non-thermal milk processing is obviously superior in terms of improved shelf life and cost-effectiveness for long-distance shipping. Milk and its components, particularly camel milk, boosted antioxidant biomarkers in autistic children, reducing oxidative stress in autistic children and improving autistic behavior. Anti-inflammatory chemicals are produced by fermented dairy products like camembert cheese, which may have therapeutic advantages in Alzheimer's disease. Overall, the majority of research results indicate that dairy intake is protective against weight loss, stroke, coronary artery disease, hypertension, and most malignancies. Because there is such a wide range of milk consumption across the world, future research may look at the link between regional variances in milk and/or dairy intake and illnesses. Proteomics, glycomics, glycoproteomics, and lipidomics analysis using mass spectrometry to profile and characterize bioactive compounds in milk from various animal sources and human milk, as well as understanding their mechanism of action, may aid in the development of novel biomarkers (proteins/peptides, oligosaccharides, and lipids) for disease prevention and treatment.

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