



Advantages and Disadvantages of Cow's Milk Consumption for Human Health Regarding Cancer, Cardiovascular, Asthma, Autism, and Another Disease - An Overview

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Abstract

Cow's milk (CM) and its products are of great importance as food for human consumption. This study highlights the advantages and disadvantages of using CM for human health. The use of CM in nutrition has been known for a very long time and occupies a special place in nutrition. CM is a complete nutrient, provides us with energy in the form of lactose and fat, is rich in protein, the most important building block of all body cells, and contains numerous vitamins and minerals, especially bone-friendly calcium. Therefore, a diet without CM and its products is not possible in many countries today. However, according to current knowledge, the consumption of CM and its products can cause problems in some people, such as cancer risk, protein allergies, lactose intolerance, cardiovascular and heart diseases, asthma, autism, and other diseases. High CM consumption significantly increases the risk of prostate, breast, bladder, and ovarian cancer, while conversely CM consumption reduces the risk of stomach and colon cancer. Furthermore, there is no clear association between CM consumption and other types of cancer such as pancreatic cancer and lung cancer. The association between CM and cardiovascular disease (CVD) is also unclear, as the presented results are contradictory. It was found that no clear connection could be established between asthma symptoms and milk consumption. It is noteworthy that milk-derived opioid peptides are potential factors in the pathogenesis of autism.

In conclusion, further research is needed to clarify the exact role of milk and dairy products in the risk of cancer, asthma, autism, and other diseases.

Keywords: Asthma; Autism; Breast Cancer; Cardiovascular Disease, Cow's Milk; Prostate Cancer

Introduction

Milk is a white, cloudy emulsion or colloidal dispersion of proteins, lactose, and milk fat in water. Milk is also defined as a biological fluid and at the same time as a dynamic system that is affected by structural changes. However, factors such as the instability of the fat globule membrane, the pH and temperature dependence of the milk salts and proteins, and the activity of the enzymes play a role. The growth of microorganisms and gas exchange processes of carbon dioxide also lead to changes in the milk structure. The consumption of milk and milk products has shown a steadily increasing trend worldwide in recent decades and comes from lactating domestic animals such as cows, buffaloes, goats, sheep, and camels (Figure 1).

Milk is a polydisperse glandular secretion with a species-specific composition. This depends on the very different nutritional needs of each individual young animal. Milk is therefore a good food to meet the body's needs for fats, proteins, carbohydrates, minerals, and vitamins (Table 1).

During this time, cows are the most important source of milk worldwide. However, the role of cow's milk in human nutrition and health has been widely discussed over the past decade [9, 10]. It should be noted that the consumption of cow's milk can cause the following diseases: lactose intolerance, protein allergy, cancer, and other diseases [10, 11]. Therefore, attempts have been made to replace cow's milk with other types of milk to treat or prevent such diseases. Camel, donkey, and goat milk were used instead of cow's milk. The aim of this review study was to discuss the benefits and harms of cow's milk consumption for human health regard to cancer, cardiovascular disease, asthma, autism, and other conditions.

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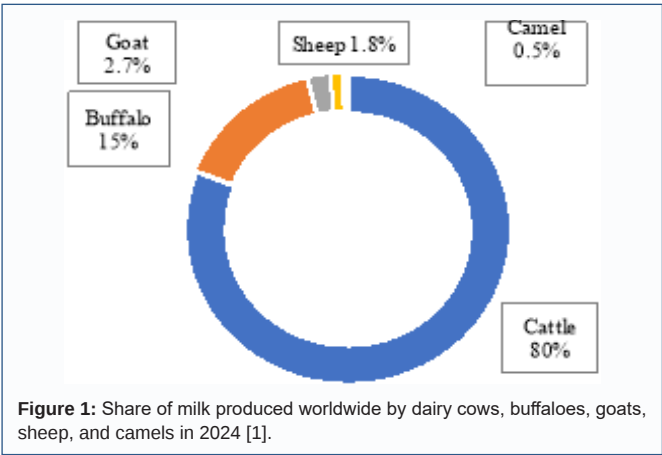


Figure 1: Share of milk produced worldwide by dairy cows, buffaloes, goats, sheep, and camels in 2024 [1].

Types of milk	Milk composition				
	Dry Matter %	Fat %	Protein %	Lactose %	Ash %
Human	13.0	3.3	2.1	7.3	0.3
Cow	13.0	4.0	3.4	4.9	0.7
Buffalo	16.7	7.3	3.5	5.2	0.7
Goat	13.2	3.5	3.4	4.1	0.8
Sheep	18.1	7.5	5.1	4.5	1.0
Camel	10.6	3.5	2.3	4.0	0.7
Donkey	9.1	0.6	1.7	6.3	0.4

Advantages of Consuming Cow's Milk for Human Health

Cow's milk is a special food because it is an important natural food for the consumer. The consumption of cow's milk by humans has long been known. It has been used for about 9000 [12] or 6000 years [13]. Unlike animals, humans continue to drink milk even after weaning. Cow's milk consists of 87% water, 4% fat, 3.4% protein, 4.9% lactose and 0.7% minerals [2, 3, 9], with certain variations depending on breed, stage of lactation, parity, feeding, husbandry, and climatic conditions. Milk fat consists of triacylglycerols (98%), di- and monoglycerides, free fatty acids, phospholipids, and various traces of lipid components. Milk fat occurs in the aqueous phase of milk in a special form, the fat globules with a diameter of 0.1 to 10 µm. The surface of the fat globules consists of a complex and structured membrane of phospholipids, glycolipids, and proteins, which are equipped with numerous enzyme activities and are involved in various metabolic processes [14, 15]. Cow's milk proteins are a group of diverse compounds with very different molecular structures and properties (Table 2).

Milk proteins have a high biological quality because they contain all the necessary amino acids, which are very easily digestible and bioavailable [15]. In addition, milk contains several minerals, especially calcium, phosphorus, potassium, magnesium, zinc, and selenium in high concentrations. Cow's milk also contains a variety of water-soluble vitamins from the B group as well as fat-soluble vitamins [16]. The minerals in milk, particularly calcium and potassium, can also help regulate blood pressure. It should be noted that in most European countries more than two-thirds of dietary calcium intake comes from the consumption of milk and dairy

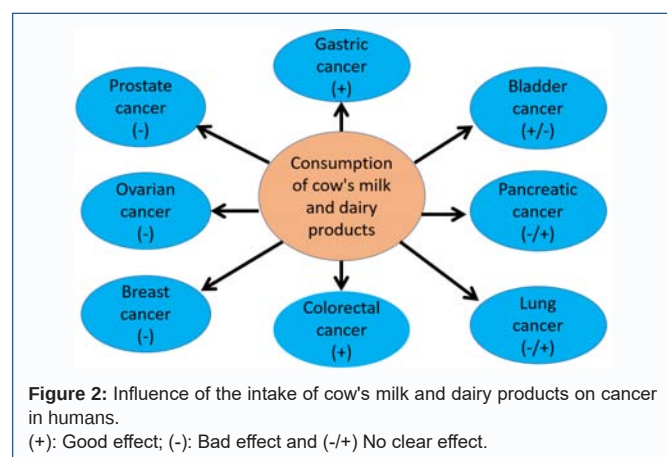
Table 2: Protein fractions in cow's milk [9].

The main proteins	Protein subclasses	Concentration g/kg
Caseins	αs1-Casein	10.3
	αs2-Casein	2.7
	β-Casein	9.6
	k-Casein	3.5
	γ-Casein	0.8
Whey proteins	α-Lactalbumin	1.2
	β-Lactoglobulin	3.4
	Serum Albumin	0.4
	Immunoglobulins	0.7
	Lactoferrin	0.1
	Transferrin	0.1
	Other minor Proteins: free secretory component, fibronectin, β microglobulin, butyrophilin, ceruloplasmin	0.1
Enzymes	Lysozyme, Lactoperoxidase, and ca. 60 others	Traces
Peptide hormone	Growth hormone, Insulin Growth Factor (IGF), prolactin, and sex hormones.	Traces
Non-protein-nitrogen	Creatine, creatinine, free Amino acids, hippuric, orotic acid, nucleic acids, peptide, urea, uric acid.	1.1

products [17]. Consequently, milk consumption in childhood may increase bone formation in adults. Adults who drank large amounts of milk as children have better bone density than those who drank little or no milk [11, 18, 19]. Calcium and phosphorus deficiency due to low milk consumption in childhood and adolescence has been shown to lead to an increased incidence of osteoporotic fractures in older women [20]. However, Willett and Ludwig [21] noted that research did not show consistent benefits for bone health from high milk consumption. In addition, lactose has been proven to be the only carbohydrate component in the diet of babies in the first months of life [22] and its value as a carbohydrate and energy source supports the absorption of calcium, phosphorus, magnesium, manganese, and zinc [16, 23]. Calcium, phosphorus, magnesium, and vitamin D have been shown to affect human metabolism and health [24]. Reports from the American Heart Association/American College of Cardiology show that adults should consume three servings of dairy products daily to stay healthy [25]. On this basis, current scientific research suggests that regular and healthy consumption of cow's milk and dairy products can have a positive impact on the nutritional guidelines of all age groups, with the exception of certain conditions such as lactose intolerance or milk protein allergy [15]. Above all, milk and dairy products contain vital micro and macro nutrients that are particularly needed for bone growth in infancy and childhood. After all, lactic acid bacteria are consumed by many people and are used to produce special foods. Due to the many benefits of cow's milk and dairy products, it is no longer possible to do without these foods.

Disadvantages of Cow's Milk Regarding Cancer and Other Diseases When Consumed

Although cow's milk is a very important food in the human diet, it causes many diseases in some people, such as increased risk of allergies (especially in children), cardiovascular disease, osteoporosis, cancer, and mortality. It is known that dairy cows are often pregnant during lactation, which means that the milk and dairy products produced contain hormones such as insulin-like growth factor 1 (IGF-1),



oestrogens, progestins and other hormones that have negative effects on the health of consumers [26]. Below are listed diseases that may occur after consuming CM and dairy products.

Cancer disease

In the last decade there has been serious discussion about CM consumption and the increased risk of cancer [15] (Figure 2). Several biological mechanisms could potentially explain the positive association between milk consumption and cancer in humans. Studies have shown that increased milk consumption can lead to higher plasma levels of insulin-like growth factor I (IGF-1), which plays a special role in cell proliferation and cancer development in the body [27-30]. On this basis, a link was found between higher IGF-1 levels in milk consumed and a higher risk of various types of cancer [29-31]. It should be noted that consumption of milk containing insulin-like growth factor 1 may cause prolonged growth retardation in some people. This means that the proliferation and spread of cells means a higher risk of cancer [32]. Based on observations, it has been found that taller people (who are still growing) have an increased risk of bone fractures [33].

Numerous studies have shown that there is an increased link between increased milk consumption and prostate cancer [21, 32, 34, 35]. However, some epidemiological studies have well documented a positive association between milk consumption and the risk of developing prostate cancer [35]. According to the World Fund for Prostate Cancer Report, there may be a link between milk consumption and an increased risk of prostate cancer, although there is limited evidence for this [36]. Based on the observed results, Aune et al. [37] showed that high consumption of milk, skim milk, cheese and calcium was associated with a 3-9% increased risk of prostate cancer. Extensive studies show that there is a link between the consumption of dairy products and an increased risk of prostate cancer [38]. There are several factors that influence the development of prostate cancer when consuming milk and dairy products.

1) Consumption of cow's milk can increase IGF-1 levels in the blood, which can lead to cell proliferation in the prostate [39, 40];

2) Calcium from milk and dairy products would impair vitamin D metabolism (1,25-dihydroxyvitamin D3), which leads to increased cell proliferation in the prostate [39];

3) Milk and dairy products may be risk factors for prostate cancer because they contain fat and saturated fatty acids (SFA) [41];

4) Milk and dairy products can be carcinogenic because they can produce metabolites of branched-chain fatty acids [42]; and

5) Milk and dairy products sometimes contain high concentrations of oestrogens, which are considered carcinogenic. These and other factors have been extensively studied by Parodi [43] in relation to cancer.

Regarding the above causes, it has been shown that the most important factor for prostate cancer could be increased calcium intake through milk consumption [44]. In addition, it is important to know that prostate cancer is a complex disease with multifactorial causes, including genetic factors, diet, and environmental influences.

According to the WCRF report [45], the evidence on the risk of bladder cancer from milk and dairy products is conflicting and inconclusive. This means that there is no significant association between total milk intake and bladder cancer risk [46, 47]. However, a meta-analysis found that high cow's milk consumption is associated with an increased risk of bladder cancer [48]. On the other hand, it has been shown that high milk consumption reduces the risk of bladder cancer [49, 50]. Accordingly, nobody has found an adverse effect of milk and milk consumption on bladder cancer or a beneficial effect on bladder cancer. Therefore, further investigations are necessary.

In addition, consumption of cow's milk and dairy products has been shown to reduce the risk of gastrointestinal cancer [11, 38, 49, 51-54]. Barrubés et al. [54] and Lumsden et al., [55] reported that high milk consumption was associated with a reduced risk of colon cancer. However, the effect depends on the type of milk. Consumption of low-fat milk was significantly associated with a reduced risk of colorectal cancer [54]. Therefore, it suggested that an increase in milk consumption by 200 g/day was associated with a reduced risk of metabolic syndrome and obesity. The percentages of reduced risk were 13% and 16% respectively [56, 57]. It was also pointed out that a protective effect against colon cancer was possible through the consumption of milk and dairy products [52, 58, 59]. Ralston et al. [60] reported that men who consumed 0.5 L milk per day had an approximately 26% lower risk of colon cancer, while no association was found in women. Reviews by Keum et al., [61] observed that calcium intake (900 mg/day) from milk reduced the risk of colorectal cancer by 24%. One explanation for the above effect is the binding of calcium to bile acids and ionized fatty acids, which reduces their proliferative effect in colorectal epithelium [62-64]. In addition, calcium can affect several intracellular pathways that can lead to differentiation of normal cells and apoptosis in transformed cells [65]. Some studies on calcium intake in consumers of milk and dairy products have shown that high doses of calcium are necessary to protect against colon cancer and polyps [66-71]. In Europe and North America, adding vitamin D to milk and its products is believed to protect against colon cancer [72, 73], but in Africa, Asia and the Middle East, less vitamin D is added to milk due to exposure to the sun there. Therefore, regular consumption of milk and dairy products is recommended for both men and women to prevent colon cancer.

An interesting aspect is that breast cancer is the most leading cause of death in women [26, 74, 75]. Both endogenous and exogenous factors can influence the occurrence of breast cancer [26,76-78]. Cohort studies have shown an association between cow's milk consumption and the risk of oestrogen receptor- α -positive breast cancer [26]. Consequently, recent prospective epidemiological and pathobiochemical studies have identified commercial milk

consumption as a major risk factor for breast cancer [26]. Kakkoura et al. [79] found that higher milk consumption was associated with a higher risk of breast cancer in women. This study was the largest prospective cohort study in China showing a positive association between cancer risk and milk consumption. A similar study showed a positive association between milk consumption and overall breast cancer risk in 53,000 North American women [80].

On the other hand, there is overall limited evidence of an association between milk consumption and breast cancer before and after menopause [81, 82]. A meta-analysis showed other results that high milk consumption (> 600 g/day) was associated with a reduced risk of breast cancer (10%) compared to low milk consumption (< 400 g/day) [83]. Therefore, some components of milk and dairy products, such as calcium, vitamin D and unsaturated fatty acids, can protect against breast cancer [84, 85]. In fact, the main risk factors for breast cancer are diverse and include, for example, reproductive and hormonal factors, lack of exercise, alcohol consumption, obesity, and others [81]. It is worth noting that general consumption of milk and dairy products is not associated with breast cancer risk, according to a cohort study [86]. However, heterogeneity was observed with respect to the type of dairy products, life stage and tumor subtypes.

Referring to new research suggesting that milk and dairy products may increase the risk of breast cancer [55, 80]. Several lines of evidence suggest that higher consumption of cow's milk is associated with a higher risk, while no association has been found between consumption of soy milk and breast cancer risk. For many consumers, the question arose again whether the consumption of cow's milk increases the risk of breast cancer or not? [87]. A mechanism between breast cancer and the consumption of cow's milk can be clarified by the following aspects:

- 1) Cow's milk contains the hormone IGF-1, which may promote the growth of breast cancer cells. [80, 84, 87]. It has been found that higher circulating IGF-I concentrations are present in milk consumers compared to non-consumers [88-90]. Consequently, a higher concentration of circulating IGF-I was associated with a higher risk of breast cancer [87].
- 2) It is noteworthy that cow's milk and dairy products still contain growth factors and sex hormones that can increase the risk of breast cancer [91, 92]
- 3) High-fat milk and dairy products are harmful to women because they are high in saturated fatty acid [93]; and
- 4) Finally, cow's milk and its products can contain pesticides that can promote carcinogenicity [94, 95].

In general, consumption of cow's milk and its products can increase the risk of breast cancer in women [96]. However, the differential effects of cow's milk and its products on different types of breast cancer and menopausal status must be considered.

In addition, some epidemiological studies have shown an association between milk consumption and the risk of ovarian cancer [97]. Faber et al. [98] indicate that a slightly increased risk of ovarian cancer is associated with the consumption of milk and dairy products. A new study has shown that there is a positive association between ovarian cancer and milk consumption [96]. However, the intake of lactose through the consumption of milk and dairy products has been linked to the development of ovarian cancer. Based on the above and other findings, the effects of milk and dairy products on

ovarian cancer are ambiguous and contradictory [99].

An interesting aspect is that lung cancer is the leading cause of cancer-related death worldwide. Epidemiological studies examining the association between lung cancer risk and the consumption of milk and dairy products showed conflicting results [51, 100, 101]. Several lines of evidence suggest that there is no significant association between calcium intake from cow's milk and dairy products and lung cancer risk [102, 103]. A meta-analysis evaluating the association between milk consumption and lung cancer risk showed that there was no significant association between the consumption of cow's milk and its product and the risk of lung cancer [102]. Referring to the above results, it became clear that there is no significant association between the consumption of cow's milk and the risk of lung cancer.

Furthermore, research has shown that there is no link between the consumption of cow's milk and the risk of pancreatic cancer [104]. In general, consumption of cow's milk, its products, calcium, or vitamin D by adults is not associated with the risk of pancreatic cancer.

Studies have shown that higher milk consumption is associated with a higher risk of liver cancer [79]. Chen et al. [105] reported that liver cancer is the most common cancer in China and accounts for half of all liver cancer cases and deaths worldwide. However, this high rate of liver cancer is mainly due to the high prevalence of hepatitis B infections and aflatoxin exposure, as well as the increasing role of smoking and alcohol [105, 106]. Therefore, this association between dairy product intake and liver cancer is limited and inconsistent [107]. A meta-analysis of studies from the US and Europe found that higher consumption of milk and dairy products is associated with an approximately 30 percent higher risk of liver cancer than lower consumption [108]. Kakkoura et al. [79] provided important new evidence that the association between liver cancer risk and milk consumption exists independently of hepatitis B infection. Due to observation, lymphomas are also one of the most common types of cancer worldwide [109]. Several studies have examined the association between milk consumption and lymphoma risk. However, none of these studies found a significant association. [110, 111]. Conversely, a meta-analysis found that higher milk consumption was associated with a 20% (2-42%) higher risk of lymphoma [112, 113, 114].

Cardiovascular and Heart diseases

The link between cow milk and cardiovascular disease (CVD) is unclear as the results presented are inconsistent. Whole milk contains saturated fatty acids, which are known to increase total cholesterol and increase both bad LDL (low density lipoprotein) and good HDL (high density lipoprotein) cholesterol levels in the blood [11]. The LDL usually predicts the risk of cardiovascular disease [115]. However, high fat dairy products like cheese, despite their high saturated fat content, do not appear to raise LDL cholesterol compared to butter, which is high in saturated fat [116, 117]. In general, low-fat, and calcium-rich milk and dairy products are considered to lower blood pressure because the LDL cholesterol level in the blood does not rise after consuming such products. On the other hand, research results from various studies in different countries showed an association between the consumption of cow's milk and dairy products and the cardiometabolic risk factor [11, 118-124]. Hu et al. [125] also found that in women, consumption of 1-2 glasses of whole milk or more per day was associated with a 1.5-fold increased risk of heart disease. Conversely, the results showed that consumption of skim milk was associated with a lower risk of heart disease. In addition, Soedamah-Muthu et al. [123] showed that there is no consistent

association between consumption of cow's milk or dairy products and cardiovascular disease, coronary heart disease or stroke. A study of three large cohorts of men and women found no association between dairy fats, including milk, and overall cardiovascular disease risk [126]. The meta-analysis by Hu et al. [127] reported no association between milk consumption and stroke risk, but showed a risk reduction of 7–8% with a milk consumption of 200–300 ml/day. Meta-analyses by De Goede et al. [117] and Rice [128] showed an inverse association between the risk of stroke or cardiovascular disease and the consumption of milk, cheese, or yoghurt. Similarly, Qin et al. [129] found that consumption of milk and dairy products was associated with a 12% lower risk of cardiovascular disease and a 13% lower risk of stroke compared with individuals who consumed no or less milk and dairy products. Additionally, there is no evidence that total intake of milk or specific dairy products is associated with increased cardiovascular mortality [130]. Dose-response analysis showed that an increase in milk intake by 200 ml per day was associated with a reduced risk of cardiovascular disease, stroke, and high blood pressure [11, 29]. Finally, there is evidence that moderate consumption of milk and dairy products (approximately 200–300 ml/day) does not increase the risk of cardiovascular disease [11].

Furthermore, a study in Germany, France and Ireland showed that there is an association between the consumption of the milk protein A1 milk (A1- β -casein) [9] and mortality from ischemic heart disease with a correlation value of $r^2=0.86$ [131]. Similar results in 20 countries studied showed that consumption of A1- β -casein from cow's milk and cream was significantly and positively correlated with ischemic heart disease [132, 133]. It is important to note that these associations are supported by case-control studies in humans [134]. An important aspect is that β -Casomorphin (BCM-7) released from A1 milk actually represents the hypothetical risk element [9]. BCMs released from A1- β -casein are thought to play a role in the development of atherogenesis. However, this occurs through the stimulation of LDL oxidation by BCM-7 [134].

As an interesting aspect, it was noted that a significant reduction in cardiovascular disease risk was observed in Asian countries than in Western countries [11]. In this situation the unsaturated fatty acids in the diet play an important role in heart health. In addition, there is evidence that C18:0 and C18:1 fatty acid lower plasma cholesterol level when both are included in the human diet [135]. Likewise, omega-3 fatty acids such as α -linolenic acid exhibit various cardioprotective effects and are associated with a lower incidence of cardiovascular diseases such as coronary heart disease and stroke [136, 137]. In addition, a diet rich in omega-3 fatty acids have been observed to reduce cholesterol levels, blood clot formation, platelet aggregation and blood triglyceride levels, and to have both antithrombotic and anti-inflammatory effects [136–138].

Asthma disease

Asthma is a chronic disease that is widespread throughout the world and the number of people affected has increased over the last 50 years. Milk has been forbidden for patients with asthma since the 12th century [139, 140]. Milk is believed to stimulate mucus production in the airways, leading to increased airway resistance and worsening of asthma [141]. Spock and Needham [142] believed that asthma and other respiratory diseases could be aggravated by the consumption of cow's milk and therefore recommended eliminating milk completely from the diet. It is noteworthy that the fat content of cow's milk can impair gas exchange in asthmatics [141]. However, Woods et al. [143]

concluded that there is no clear picture regarding an association between milk consumption and the prevalence of asthma-related symptoms. This means that previous studies could not provide a clear connection for this recommendation [140]. Therefore, consumption of cow's milk or dairy products does not cause asthma. A study of adults with asthma showed that drinking cow's milk did not worsen their symptoms [144]. Additionally, it has been observed that mothers who drank a large amount of cow's milk during pregnancy had babies with a lower risk of asthma and other allergic conditions such as eczema [145]. On the other hand, a diet without cow's milk protein proves to be a sensible approach in the treatment of asthma patients and can be regarded as the “missing link” in asthma therapy [146]. These results underscore that cow's milk and dairy products can aggravate asthma symptoms in patients with asthma and milk allergy. James [147] and Schroeder et al. [148] point out that food allergies and sensitizations to allergens such as cow's milk are a risk factor for later persistent asthma in young children. However, food allergies can usually develop as early as the first year of life. An interesting aspect is that the identification and subsequent elimination of food allergens in the diet of children, such as cow's milk, may improve asthma control in patients, especially in children with severe refractory asthma [149]. Most studies investigated IgE-mediated mechanisms to determine the association between asthma and food allergy [146]. It is striking that children with food allergies are up to four times more likely to suffer from asthma or other allergic diseases than children without food allergies. New research has shown that breastfeeding (BF) babies for the first 3 days or more of life appears to reduce the risk of asthma or recurrent wheezing compared to BF plus a small amount of cow's milk formula [150].

Autism disease

Autism is a group of disorders characterized by neurodevelopmental deficits, social deficits, and repetitive behaviour [151, 152]. It has been observed that autism can be caused by opioid peptides [153]. This means that excessive amounts of endogenous or exogenous opioid peptides from dietary proteins may have a pathophysiological influence on autism [152, 154, 155]. Opioid peptides released during the digestion of cow's milk (e.g. casein) are thought to be responsible for the development of autism. Therefore, an excess of opioids is found when cow's milk is consumed. This could lead to autism [152]. In some people, casein from cow's milk is incompletely metabolized in the intestine, producing short neuroactive peptides such as β -Casomorphins. It is important to know that β -casomorphin has long been considered a risk factor for autism [152, 156]. Therefore, peptides such as β -Casomorphins (BCM-7) are believed to play a role in the development of autism [9]. Kost et al. [157] have shown that breastfeeding babies after birth is beneficial for child development in the first months of life compared to artificial feeding. These results support the hypothesis that impaired BCM-7 excretion after cow's milk consumption is a risk factor for psychomotor developmental delays and other disorders such as autism. El-Hodhod et al., [158] clearly showed that improvement in language, cognition and behaviour was observed in one of the autistic children after cow's milk elimination. Autism is generally an autoimmune disease that, surprisingly, begins in the gut rather than the brain. [159]. In conclusion, opioid peptides ingested by dairy cows may be a potential factor in the development of autism. However, research is insufficient and limited. Therefore, further research is recommended.

Table 3: The possible contamination of raw cow's milk with various types of bacteria and the symptoms and complications in sick people after consuming such cow's milk.

Type of bacteria	Symptoms and complications
<i>Brucella</i> sp.	Blood infections, Heart infections
<i>Campylobacter</i> sp.	Bloody diarrhea
<i>Cryptosporidium parvum</i>	Diarrhea
<i>E. coli</i> O157:H7	Diarrhea, Kidney failure, Death
<i>Listeria monocytogenes</i>	Meningitis, Blood infections
<i>Salmonella</i> sp.	bloody Diarrhea
<i>Mycobacterium tuberculosis</i>	Ruberculosis; Pneumonia
<i>Staphylococcus aureus</i>	Vomiting
<i>Yersinia enterocolitica</i>	Diarrhea
<i>Coxiella burnetti</i>	High fever, Severe headache, Muscle aches (can infect the liver and/or heart)

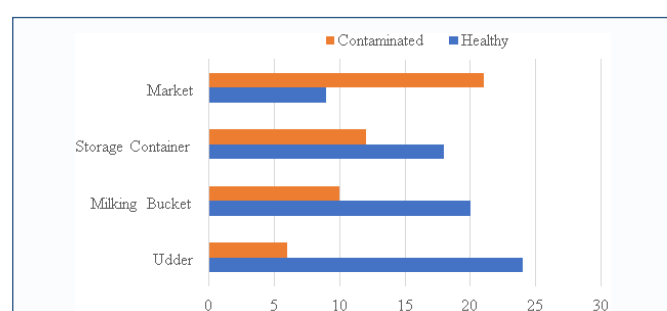


Figure 3: Isolation of pathogenic bacteria from milk samples from cows at four different locations in eastern Ethiopia [161].

Lactose intolerance

In the first months of life, the only nutrients available to infants are milk sugar (lactose) and other milk components. However, with the mother's milk, the human infant receives about 60 g of lactose with a daily intake of 800 ml milk. The ingested milk is hydrolytically split into glucose and galactose in the small intestine by the enzyme lactase. It is noteworthy that after childhood, lactase activity in the body decreases (except in people of European descent), as the ability to synthesize new lactase is lost [22, 23]. This is why adults can no longer tolerate large quantities of cow's milk. Since lactose is not broken down into its basic building blocks glucose and galactose, the lactose enters the large intestine and is broken down into organic acids by intestinal bacteria. These degradation products bind water and lead to diarrhea [10]. Hereditary (physiological) lactose intolerance after breastfeeding is a normal condition for the majority of the world's population. It has been shown that about 70-100% of the adult population in Africa and Asia and only about 10% of Caucasian adults are lactose intolerant. This means that these people suffer from lactose deficiency syndrome [10].

Other dangerous diseases related to cow's milk

Pathogenic bacteria in milk pose a serious threat to human health and are responsible for about 90% of all milk-related diseases [160]. Raw cow's milk is an excellent feeding ground for the growth of microorganisms and unheated raw milk and raw milk products are the leading cause of illness caused by foodborne pathogens. However, milk is practically a sterile liquid when secreted into the alveoli of the healthy udder [161]. On the other hand, raw cow's milk can be contaminated with pathogens even if it comes from clinically healthy dairy cows [162]. This microbial contamination occurs post-

harvest (after raw milk has been removed from the udder). However, numerous scientific studies have shown that bacterial contamination of raw milk can occur at three levels: in the udder, on the surface of milking machines, and during storage and transport. It should be noted that raw milk can contain pathogens despite apparently good quality (low total bacterial count) [163, 164]. Thus, several reports indicate that raw cow's milk can occur contaminated with many human pathogens such as *Brucella*, *Campylobacter*, *Cryptosporidium*, *Escherichia coli*, *Listeria*, *Salmonella*, tuberculosis, *Mycobacterium bovis*, *Staphylococcus* sp., coliform and others that can pose serious health risks to humans [161, 165-168]. Below are some diseases that are associated with the consumption of raw cow's milk (Table 3).

Contamination of cow's milk with pathogens can have various causes, including milking systems and equipment, milkers, air, water, hygiene measures, farm management, stable, feed, season and others [168, 169]. The studies by Reta et al. [161] showed that in the town of Jigjiga in the Somali Regional State in eastern Ethiopia, the following organisms were found in raw cow milk: *Escherichia coli* (58%), *Staphylococcus aureus* (24.2%), *Shigella* sp. (17.5%), *Proteus* sp. (7.5%) and *Salmonella* sp. (3.3%) (Figure 3).

Studies in New Zealand, Europe and the USA have shown that various pathogens can be present in raw cow's milk. However, bacteria such as *Campylobacter jejuni* and *Listeria monocytogenes* have been detected in up to 13% (Table 4).

Some studies have found that almost a third of all raw milk samples contained at least one type of pathogen [164]. However, the presence of pathogenic bacteria in cow's milk appears to pose a major risk to public health, especially for people who wish to consume raw and unpasteurized milk [171]. The studies of Owusu-Kwarteng et al. [172] in Ghana showed that *Listeria monocytogenes* was detected in raw cow's milk (8.8%; 10/114), whereas no *Listeria* spp. was detected in boiled milk. It should be noted that raw milk and dairy products may be contaminated with pathogenic microorganisms such as *Listeria monocytogenes* due to inadequate hygiene measures in the dairy industry in Ghana. The way to prevent such bacteria in cow's milk and dairy products is to treat the milk with heat processes such as pasteurization. Pasteurization kills pathogens and increases the shelf life of the milk.

Conclusion

Milk is a valuable food. It contains high-quality protein, easily digestible fat, and the energy supplier lactose. It is also a source of the fat-soluble vitamins A, D, E and K as well as B vitamins (including the important vitamin B12) and important minerals such as calcium, phosphorus, iodine, and fluorine. The human body needs all of this to stay healthy. However, milk is also criticized and is blamed for serious chronic diseases in some people, such as cancer, cardiovascular diseases, asthma, autism, and lactose intolerance. In addition, milk is dangerous for humans if it is contaminated with pathogenic microbes.

Table 4: Occurrence of various pathogens in raw cow's milk according to various studies [162, 164, 168,170].

Human Pathogens	Presence in raw cow milk (%)		
	New Zealand	Europe	United States
<i>Escherichia coli</i>	0.3	0.0-5.7	0.0-3.8
<i>Listeria monocytogenes</i>	4.1	2.2-10.2	1.0-12.6
<i>Salmonella</i> spp.	0.0	0.0-2.9	0.0-8.9
<i>Campylobacter jejuni</i> and <i>coli</i>	0.58	0.0-6.0	0.0-12.3

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