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Role of milk in human health

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Abstract
Milk and dairy foods are nutrient-dense foods supplying energy and significant amounts of protein and micronutrients. Milk is widely consumed beverage that is essential to the diet of several millions of people worldwide because it provides important macro and micronutrients. Milk is recognized as being useful during childhood and adolescence because of its composition; however, its relatively high saturated fat proportion raises issues of potential detrimental effects, namely on the cardiovascular system. Good nutrition and access to an adequate diet and health are essential for child growth and development, body maintenance and protection from both infectious and non-communicable diseases (NCDs) in adult life. Adequate nutrition and a healthy productive population are increasingly recognized not only as resulting from but also as an important prerequisite for poverty reduction and economic and social development. The advantages of milk consumption and its effects on growth and bone health were likely to have been of considerable importance while its effects on chronic diseases later in life had limited relevance to reproduction and survival. In contrast, for contemporary human populations, while childhood growth and bone strength are important for health, it is the effects of milk and dairy consumption on individual well-being and on chronic diseases and their associated economic costs that are of greater relevance.

Keywords: Milk, human health, good nutrition, dairy consumption

Introduction
Milk is an essential component of the diet of ~6 billion people. The world production of milk reaches 730 million tons/y (FAO 2012). Even though mammals produce milk to feed their offspring, in many areas of the world humans continue to consume milk throughout their life. However, it must be emphasized that lactose intolerance is widespread throughout the world and that a large proportion of the world's population would not benefit from the putative benefits of milk. In addition to milk, several dairy products such as cream, butter, yogurt, kefir, and cheese have been produced and consumed worldwide for millennia. Therefore, the impact of milk and dairy products on human health is quantitatively relevant and has been the subject of several investigations, on both whole products and their isolated components. In particular, the fat portion of milk (largely composed of SFAs) and some of its minor components, notably calcium and oligosaccharides, are being actively researched for their potential health roles. Composition of milk of every mammalian species is unique in its sense and specifically designed in order to meet the requirements of that particular mammal species. It is very likely that the milk of one species may not suit the requirements of another species and even be harmful to them. Humans, not only the infants but also the adults, are the only species that drink the milk of another species, particularly cow's milk. But it should be noted that cows' milk has a different composition than human milk. For example, it contains three to four times more protein and five to seven time's high mineral content than human milk. This excess of nutrients is useless and even proves harmful to humans if consumed. Furthermore, it is strikingly deficient in essential fatty acids when compared to human milk. Human milk has six to ten times as much of the essential fatty acids, especially linoleic acid. Thus, cow milk is not designed for humans. Apart from this, to feed the increasing requirement and make profitable business today some progressive farmers are indiscriminately using the drugs, antibiotics, hormones, forced feeding plans and specialized breeding plan to enhance milk production. This all further aggravates the condition as many of these additives are having serious adverse effects on both animals and consumers. The contamination in milk due to mismanagement or so further deteriorates the quality of milk.

Contaminants in Milk

Contaminants in milk are a serious worry. Bovine growth hormone or BGH [1], a genetically engineered drug is being administered to cows by some progressive farmers to enhance milk production. Use of rBGH has shown to increase the milk production by even 20%. But it adversely affect human health by stimulating more production of Insulin-like Growth Factor-1 (IGF-1) which is responsible for breast cancer by transformation of normal breast cells into tumorous one. These breast tumors are very serious for life as they are of malignant i.e. they have the ability to metastasize at remote organs and also invade into surrounding tissues to further grow and increase in number. As it is well-known that the malignant tumors are dangerous for life in comparison to benign tumors, which are usually non-fatal. rBGH is also found to increase susceptibility in cows for clinical mastitis by about 50–70%. These animals further require antibiotics treatment to treat mastitis. Antibiotics cause side effects to the different body organs and also damage the immune system making animal more prone to infection and further more antibiotics administration as remedy. This overuse of antibiotics causes secretion of antibiotic residues in the cow milk. Similarly other hormones like oxytocin are indiscriminately being used by the farmers for increasing let down of milk. Consumption of raw milk having oxytocin residues have been found to create hormonal imbalance and thus reproductive disorders and gynaecomastia in humans. Apart from these organo-chlorine pesticides like pp'-DDT and pp'-DDE are being used in the agriculture as seed dresser, in sanitation, against parasites etc. in the agriculture and livestock industry [2, 3]. These pesticides accumulate in the surroundings and finally reach the animal body through contaminated water and feed. After circulating in the blood they finally deposits in the adipose tissues of the body as lipid rich tissues are good for their chemical stability and persistence. From there they are finally secreted as toxins in the milk [4]. β-HCH is one of the main contaminants followed by pp'-DDT and pp'-DDE. A level of PCB several times higher is noted in cow's milk. Along with this milk from infected cows may contain pus and blood. Milk also gets contaminated during milking with dirty hands of milkers and faecal material from the tail and perineum leading to heavy bacterial contaminations [5]. Salmonella, E. coli, and Staphylococcus infections can be traced easily in milk. After milking the milk is kept for long time before being distributed and utilized by consumers. At this room temperature the number of bacteria in milk multiply rapidly, increase in number and the milk quickly rottens. Few of them even survive pasteurization. Example being the Mycobacterium paratuberculosis avium (etiological agent for Johne's diseases in animals) can cause Crohon's disease in humans (needs further study for its establishment) and Mycobacterium tuberculosis which cause tuberculosis in humans.

Other than bacteria, Prions, an infectious protein without any genetic apparatus which is very similar to virus and responsible for bovine spongiform encephalopathy (BSE) and result in mad cow disease [6] have also been traced in milk. Several farmers have developed a fatal disease syndrome that resembles both BSE and CJD (Creutzfeldt-Jakob-Disease). The immuno-deficiency virus seen in cattle is closely related in structure to that of the human AIDS virus. Other than this few infected cow milk is also a source of bovine leukemia virus which causes blood cancers in individuals consuming this.

Proteins in Milk Cow's

Milk naturally contains the large amount of protein needed for her calf. That amount of protein is not only unnecessary but unhealthy for humans. Excess protein in our diets causes calcium to leach out of our bones. This can be a cause of osteoporosis. Studies have also shown that there are certain proteins in cow's milk which acts as allergen particularly to breast fed infants. These allergens cause hypersensitivity reactions, lymphadenopathy and hepato-splenomegaly. Studies have revealed that more than 100 distinct antigens are released by digestion of cows' milk which stimulates humoral responses and formation of different antibodies. The common problems in children are GIT disorders, acute gastrointestinal blood loss, milk borne infections, lack of minerals, abdominal pain, bedwetting, asthma, intestinal bleeding, colic and diabetes [7]. Adults can be affected with coronary deaths, hardened and narrowed arteries, kidney disorders, arthritis and the more serious questions of leukemia, lymphoma and cancer of different organs particularly genital organs. Some specific proteins in the milk may be responsible for insulin-dependent diabetes which usually begins in childhood [8]. It is probably because the cow's milk proteins stimulate the production of the antibodies which can destroy the β- cells of pancreas. When 80 to 90 percent of the insulin-producing beta cells are destroyed manifestation of diabetes starts. The number of cases is also influenced by genetic predisposition.

Milk sugar, lactose is not easily digestible by humans and can cause GIT disorders like gas and dysentery. If digested the end products of lactose are simple sugars like glucose and galactose. Galactose is a disaccharide which needs to be broken down into monosaccharides, namely glucose. Galactose as such has been implicated in genital cancers] and eye problem. Milk and its products except skimmed milk and non-fat products contain high amount of saturated fat and cholesterol which contribute to cardiovascular problems. It should be noted that there is no nutritional requirement for cow's milk fat to the children. Also, the cow milk is lacking in essential fatty acid like linoleic and linolenic acid.

Milk and Allergies

A food allergy is an immune response to proteins resulting in inflammatory symptoms involving the skin, respiratory system, and gastrointestinal tract. Some people think they are allergic to milk because they have symptoms of bloating, cramps, flatulence, and diarrhea after consumption of dairy products. This is not an allergic response but is a condition known as lactose malabsorption, which is discussed in a separate section below. Allergic responses have different mechanisms, and some are mediated by immunoglobulins, specifically IgE. The major food proteins that trigger allergic reactions are milk, eggs, peanuts, tree nuts, fish, shellfish, soy, and wheat. Prevalence of milk allergy in the population is about 2% in children and 1% in adults. Onset of milk allergy may occur within about 1 yr of age and most children outgrow this allergy by 6 years of age.

Milk and Arthritis

Arthritis is characterized by damaged joints and leads to physical disabilities. There are many forms of the disease caused by degeneration of the joint (osteoarthritis), autoimmune diseases and inflammation (rheumatoid, psoriatic arthritis), infection (septic arthritis), and others. It has been suggested that consumption of raw milk helps relieve arthritis. However, there are no studies in the literature that report an

effect of drinking milk and relieving arthritis. There are currently no scientifically supported dietary recommendations to help relieve arthritis aside from maintaining a healthy weight and balanced diet. For more information please see

Milk and Cancer

Cancer is a disease characterized by malignant growth in the body. Different cancers have different causes, modes of progression, treatments, and possible risk factors. The area of cancer research is very active and there is a considerable amount of data in the literature. Because of the variation in cancer types, individual metabolism, and factors evaluated in any given study there may be conflicting results published between studies on the same topic. Factors affecting the risk of cancer includes genetics, lifestyle choices such as smoking and exercise, diet and other environmental causes. Diets high in fat and calories and low in fiber and fruits and vegetables appear to increase the risk of some cancers. Diets high in dairy were thought to increase the risk of breast cancer because of the high fat content of some dairy products. However, there are conflicting research studies on the association between high fat (any type) intake and breast cancer. It used to be thought that dairy product consumption increased the risk of cancer, but we now know that there are several components in milk that are protective against cancer: calcium, vitamin D, conjugated linoleic acid (CLA), sphingomyelin, and whey proteins. Calcium and vitamin D may reduce the risk of colon cancer. The protective effect of calcium and vitamin D was observed in numerous human studies in several countries. The amount of calcium consumed in most of these studies was at least 700 mg/d from either food sources or supplements. Sphingomyelin and whey proteins were shown to inhibit colon cancer cell growth in laboratory settings.Calcium and vitamin D consumption have also been shown to have a protective effect against breast cancer in humans. Conjugated linoleic acid (CLA) is a very effective inhibitor in breast cancer development, as well as inhibiting skin, stomach, and colon cancers in laboratory settings. Whey proteins have been shown to inhibit breast cancer in laboratory settings. Some reports suggest that insulin-like growth factor (IGF-1) and growth hormones (GH) found in milk may promote breast cancer. However, the amount of IGF consumed in milk is very small compared to the amount produced by the human body, and bovine GH is not biologically active in humans.

Milk and Coronary Heart Disease

Coronary heart disease (CHD) is the leading cause of death in developed countries. Coronary heart disease is characterized by the accumulation of plaque inside the artery walls which narrows the arteries and reduces the flow of blood and oxygen to the heart muscle. There are many risk factors that contribute to CHD. Some risk factors cannot be modified such as being male, getting older, and a family history of CHD, while some risk factors can be modified such as smoking, high blood pressure, obesity, lack of exercise, and high blood cholesterol levels. The positive correlation of high blood cholesterol levels and increased risk of CHD is well-documented.

Total blood cholesterol consists of several components that have different effects on CHD. A high level of low density lipoprotein (LDL) has the strongest effect of increasing the risk of CHD, whereas a high level of high density lipoprotein (HDL) has a protective effect against CHD. Increased blood triglyceride, or triacylglycerol, levels also increase the risk of CHD. The blood cholesterol profile of an individual can be influenced by diet and thus modified, but there is also a strong genetic influence that cannot be modified. High intakes of total fat, saturated fat, and to some extent dietary cholesterol are associated with increased total and LDL cholesterol.

Research studies have shown that different fats have a different effect on blood cholesterol profile. As a category, saturated fatty acids have the largest effect on increasing blood cholesterol. However, chain length plays an important role in a fatty acid's influence on cholesterol. The short and medium chain fatty acids, 10 carbons and under in length, are metabolized by a different mechanism than the longer chain fatty acids, and have little effect on blood cholesterol levels. The 18 carbon (stearic acid) fatty acid also has little effect on blood cholesterol. The 16 (palmitic acid), 14 (myristic acid), and 12 (lauric acid) fatty acids have the most effect on increasing blood cholesterol. The monounsaturated fatty acids have a neutral effect on blood cholesterol and polyunsaturated fatty acids tend to decrease blood cholesterol levels. *Trans* - unsaturated fatty acids increase blood cholesterol. Individuals differ in their response to dietary cholesterol – it may increase blood cholesterol or have no effect, and may reduce the natural (endogenous) synthesis of cholesterol by the body. Milk fat is considered to be a highly saturated fat, with approximately 65% of the fatty acids being saturated. Milk fat typically contains 10% of fatty acids that are 10 carbons or under, 4% lauric acid (12 carbons), 10% myristic acid (14 carbons), 27% palmitic acid (16 carbons), and 14% stearic acid (18 carbons). Milk fat contains approximately 30% monounsaturated and 5% polyunsaturated fatty acids. With respect to blood cholesterol, if only the palmitic, myristic and lauric acids are considered then 41% of milk fat contributes to increased blood cholesterol rather than the total 65% saturated fatty acids.

Milk and Dental Caries

Dental caries occur when the enamel on the teeth loses its mineral content (demineralization) resulting in a pitted surface. Saliva protects teeth from caries by maintaining a balanced pH (approx. 7) in the mouth and by a continuous depositing of calcium and phosphorus on the enamel (mineralization). The formation of dental caries occurs when demineralization is greater than mineralization of the enamel. Fermentation of sugars by the bacteria in the mouth results in the formation of acids which then lower the pH (to 5.5) of the mouth and allows for mineral loss from tooth enamel. It has long been recognized that sugar consumption contributes to dental caries.

Milk contains the sugar lactose, but lactose may not have as much effect on dental caries as other sugars. Consumption of milk products, particularly cheese, has been shown in research studies to have a protective effect against dental caries. Although the mechanism by which cheese protects against dental caries is still not clear, milk proteins, calcium and phosphorus all contribute to this effect. Milk protein contains a large amount of calcium and phosphorus, thus increasing the concentration of these minerals in the mouth during the remineralization process. It is also thought that consumption of milk and cheese may have a buffering effect on mouth pH that prevents the pH from dropping to the conditions favorable for demineralization to occur (pH 5.5). Pasteurization of milk does not effect the function of milk protein, calcium, or phosphorus.

Milk and Diabetes

Diabetes is a disease of carbohydrate metabolism. Type I diabetes is caused by an inability to produce insulin and is controlled by insulin injections. Type I diabetes is often associated with childhood onset. Type II diabetes is caused by an inability to respond to insulin that typically occurs in adults, and can be controlled through diet and exercise.

There were some studies that suggested that milk consumption contributed to childhood diabetes. However, these data have not been confirmed in larger studies, and more definitive research on the effects of dairy product consumption on Type I diabetes is needed. There is also a lack of studies that directly evaluate the effects of dairy products in Type II diabetes. Several studies have evaluated the effect of whole diets on diabetes and conclude that people with higher dairy consumption have a lower incidence of Type II diabetes. Although the mechanism of this action is still unknown, it is possible that calcium, which also protects against hypertension, is active in protecting against diabetes..

Milk and Hypertension

Hypertension is characterized by high blood pressure. High blood pressure increases the risk of coronary heart disease, stroke, and kidney disease. Factors that contribute to high blood pressure include obesity, a sedentary life style, and high intake of sodium in some individuals. Dietary factors that have been studied and shown to reduce blood pressure are adequate intake of calcium, potassium, and magnesium. Calcium and potassium were identified as important nutrients for the reduction of blood pressure in the 1980s. Milk is a good source of calcium, potassium, and magnesium. Lowfat dairy products have been used successfully in dietary intervention studies as a combined source of these minerals to reduce blood pressure. Angiotensin-I-converting enzyme (ACE) is an enzyme in the body that regulates fluid and electrolyte balance which affects blood pressure. Inhibition of ACE activity helps control blood pressure. Recent studies have identified bioactive peptides from milk casein and whey proteins that inhibit ACE activity and reduce blood pressure. Milk proteins must be broken down into peptides (short amino acid chains) before they are bioactive, and this is accomplished by enzymes in the digestive tract or during the fermentation of milk.

Milk and Lactose Intolerance

Problems with lactose digestion result in bloating, abdominal cramps, flatulence, and loose stools. Many people consider these symptoms to reflect an intolerance to lactose, but there are several concepts surrounding lactose intolerance that need to be clarified. Lactose is a sugar that is unique to milk and requires the enzyme lactase (ß-galactosidase) for digestion. All humans, with a very small number of exceptions, are born with the ability to generate adequate amounts of the enzyme lactase in their digestive system. Milk is the only food newborns receive so their bodies must be able to digest lactose in order to obtain the energy required for growth and development. As humans age, the ability to produce the enzyme lactase decreases, a condition called *lactase nonpersistence*. Most people, even into adulthood, maintain some lactase activity in their gut. People that experience the symptoms described above after eating dairy products typically have exceeded the activity of the lactase available in their system and this is called *lactose malabsorption*. The term *lactose intolerance* is used to describe the above symptoms in response to a defined amount of lactose consumed, usually tested in a clinical setting. Another clarification that needs to be made is that fresh milk does not contain lactase. Lactase may be present in dairy products, but it comes from lactic acid bacteria that are either added specifically to milk for fermentation or through airborne or other contamination. It also should be noted that pasteurization does not affect lactose, and pasteurized milk is neither more nor less digestible, nor has a different lactose content than raw milk. Individuals vary in their ability to digest lactose, the severity of their symptoms, and their perception of their symptoms. Considerable research has been conducted on these topics. There is a greater incidence of lactose malabsorption in adults from countries that traditionally do not have a strong dairy industry. Products, when in fact they could include dairy products in their diets. Long term avoidance of dairy products, due to perceived lactose malabsorption, can result in decreased consumption of calcium, potassium, magnesium and other minerals and vitamins that can lead to problems with bone health, hypertension and other disorders. There are several strategies available for people with lactose maldigestion to allow them to enjoy dairy products with minimal discomfort. Consuming small quantities of dairy at a time will help to keep the lactose load manageable for the enzymes available. Consuming dairy products with a meal helps because the other foods in the meal will prolong gastric emptying, which means the stomach empties slower and therefore the amount of lactose reaching the small intestine is spread out over a longer period of time, thereby not overloading the lactase enzymes. Continued consumption of small quantities of dairy will not increase lactase activity, but the environment of the digestion system will begin to adapt to the presence of lactose and reduce unpleasant symptoms. Fermented dairy foods contain lactic acid bacteria that have lactase present, providing additional active enzymes to assist with human digestion. Fermented dairy products usually have less lactose present because the lactose has been partially used by the bacteria to produce the desirable flavors and textures of products like yogurt and cheese. There are also lactose-reduced dairy products on the market. Lactase enzyme can also be taken in pill form prior to consuming dairy products to ease digestion.

Milk and Osteoporosis and Bone Health

Osteoporosis is a disease that is characterized by decreased bone mass and deterioration of the bone tissue leading to an increased risk of fracture. Factors in osteoporosis include genetics, gender, race, exercise, and diet, particularly during growth years. Each individual has a genetically determined peak bone mass,that is the maximum amount of bone mass that one can possibly have. The higher the bone mass accumulated, the lower the risk of osteoporosis. The majority of bone mass is accumulated by age 20, and continues up to age 30. The size of the skeleton influences the risk of osteoporosis. In general, women are more prone to osteoporosis because they have smaller skeletons than men, and caucasians and Asians have smaller skeletons than people of African decent, who are less prone to osteoporosis. Estrogen has a protective effect on bone loss and women experience accelerated bone loss during early menopausal years because of decreased estrogen production at this time. Weight bearing exercise throughout life increases the load on the skeleton making it stronger and reducing the risk of osteoporosis. Bone is approximately 50% protein and 50% calcium phosphate. Bone serves as a reservoir for calcium in the body. Blood levels of calcium are tightly regulated to

remain at a constant level for proper body function. Bone is constantly undergoing a remodeling process where minerals are removed from bone and added to bone. If dietary intake is insufficient to replace the minerals then bone loss occurs. Bone remodeling is a complex process that involves hormones, protein, calcium, phosphate, vitamin D, and other vitamins and minerals. There is a large variation among individuals with respect to peak bone mass, bone loss, and fracture rates at different sites on the body. Many studies have been conducted to understand this complex behavior, and our knowledge about these relationships continues to change. An undisputed fact is that accumulation of maximum peak bone mass during childhood and early adulthood is the best protection against osteoporosis. Adequate calcium intake during this time is critical. Osteoporosis can be considered a disease of the elderly but conditions are set in childhood and early adulthood. Adequate calcium intake throughout life provides the minerals needed for bone remodeling and slows or reduces overall bone loss. The most important dietary source of calcium is dairy products. Calcium also may be obtained from other sources, such as leafy greens, fortified products, and supplements. However, fortified dairy products have the benefit of providing vitamin D, which regulates calcium absorption into bones, and other important components of bone metabolism such as phosphorus, protein, magnesium, and zinc. Dairy products contain a larger amount of calcium per serving than other foods. Many studies have shown that people with higher calcium consumption have a lower fracture rate, and often the calcium comes from dairy products. The importance of dairy as a source of calcium has led to dietary recommendations of 3 servings per day.

Milk and Probiotics

Probiotics are defined as live bacteria that provide a health benefit when consumed in adequate amounts. Probiotic bacteria can be consumed as powders, capsules, or as part of foods, which may be called “functional foods.” Many probiotic bacteria are lactic acid bacteria, meaning that they use lactose as an energy source, and hence are associated with dairy products. Yogurt is often associated with probiotics because the bacterial cultures used to ferment milk into yogurt are probiotic cultures, and it is a nutritionally complete food for the maintenance of other probiotics that are added for further health benefits. Most yogurt is made with milk that is pasteurized before fermentation and, therefore, the bacteria are alive at consumption. Some yogurts may be pasteurized after fermentation and this would inactive the probiotic organisms. An important goal of the use of probiotics is that the organisms reach their target location in the body alive and in sufficient numbers to be effective. However, the number of bacteria needed for health benefits is unknown in many cases, because the literature on the survival and persistence of organisms in the human body is sparse and further research is needed. The number of live organisms may or may not be stated on functional foods and probiotic supplements, at the discretion of the producer. The majority of the benefits of probiotics are seen in the digestive system. Probiotics improve the general health of the gastrointestinal tract, reduce the symptoms of lactose intolerance, help in the treatment of diarrhea, inflammatory bowel disease, and irritable bowel syndrome, and help prevent colon cancer. Probiotics also enhance the immune system and help reduce some allergic reactions. There is also an indication that probiotics may play a role in inhibiting *Heliobacter pylori* infections which cause ulcers, and in maintaining vaginal health.

Many different bacteria have been identified as probiotics. However, the benefits provided are often specific to the general type of bacteria and may be specific even to individual strains within a bacterial type. *Streptococcus thermophilus* and *Lactobacillus bulgaricus* are the primary organisms used in yogurt production and produce lactase which helps with lactose digestion in people with lactose malabsorption (intolerance). *Lactobacillus* species such as *L. acidophilus*, *L. bulgaricus*, *L. casei*, *L. rhamnosus*, *L. reuteri*, and *Streptococcus thermophilus* and *Sacchromyces boulardii* reduce the duration and severity of diarrhea associated with rotavirus and antibiotic use in children, and traveler's diarrhea. *Lactobacillus* and *Bifidobacteria* may help to treat the abdominal pain, flatulence and irregular bowl movements associated with irritable bowel syndrome, and the inflammation associated with inflammatory bowel diseases such as ulcerative colitis and Crohn's disease. The mechanisms behind these benefits are as varied as the diseases, and in many cases are still unknown. Probiotics may help by reestablishing the balance of the intestinal microflora and stimulating the beneficial organisms, changing the pH of the gastrointestinal tract, producing lactase and stimulating other enzyme activity, producing antimicrobial substances such as bacteriocins and organic acids, changing the permeability of the intestinal lining, and stimulating the immune system and antibody responses.

Raw Milk Consumption

Raw milk is often consumed by milk producers on their farms because of convenience and a preference for the taste of raw milk. Although not scientifically proven, people that grow up drinking raw milk often do not have adverse health reactions to raw milk consumption. However, there are many instances of farm visitors and others getting ill from raw milk and products made from raw milk. These are covered in the Disease Outbreaks section of this web site. Raw milk may be used to make cheese that has unique flavors, but raw milk cheeses are required by law to be aged for 60 days to reduce the likelihood of illness from disease causing organisms (pathogens) that may be present in the raw milk. The risk in drinking raw milk is real, and those that choose to do so should make informed decisions about the risks and benefits of drinking raw milk. Pathogens come from the farm environment and may be present in raw milk, even from healthy cows and in milk produced under sanitary conditions. The types of pathogens and their prevalence in raw milk is discussed in the Microorganisms of Concern section of this web site. While adults in good health may consume raw milk without adverse affects, that same milk may cause severe illness in the young, elderly, and people with compromised immune systems. A particular concern is the consumption of raw milk by children who are not able to make the risk-benefit decision for themselves. There have been several outbreaks of E. coli O157:H7 in children who drank raw milk that resulted in hemolytic uremic syndrome, which causes kidney failure and may lead to lifelong problems or death. These illnesses could have been prevented. There is a movement to consume raw milk because of perceived health benefits of raw milk compared to pasteurized milk. It is suggested that raw milk is easier to digest, particularly for people that are lactose intolerant, because enzymes present in raw milk are inactivated by pasteurization. However, as discussed above in the section on lactose intolerance, there is no lactase present in fresh milk. Lactase may be present in

lactic acid bacteria that are added purposefully to milk for fermentation or from airborne or other contamination. Enzymes used to digest food are found in the mouth, stomach, and primarily in the intestines of humans – enzymes present in the food play an insignificant role in their digestion. It is suggested that the pasteurization process canges the nutritional properties of milk fat, protein, lactose, vitamins, and minerals. Typical pasteurization conditions used for milk do not affect the nutritional or functional properties of milk fat, protein, lactose, minerals, and fat soluble vitamins, but there is a small reduction in the quantity of heat sensitive water-soluble vitamins. It should be noted here that milk is an insignificant source of vitamin C, so the small reduction that occurs during pasteurization is not important in the overall diet. In some products, like shelf-stable canned milk, the heat treatments need to be more severe in order to sterilize the milk and there may be changes in the nutritional qualities of these products.

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