



Consensus of the Brazilian Association of Nutrology and the Brazilian Society for Food and Nutrition on the consumption of cow's milk by humans

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Introduction

In recent years, a worrying trend has been evident among the Brazilian population: the reduction in consumption of cow's milk is associated with doubts about the health benefits of this important food. This behavior change is a reason for attention since milk is recognized for its nutritional value, being considered a source of nutrients that can help in the composition of a balanced diet and healthy growth. We know that a lot of conflicting information circulates about milk, especially on social media, generating doubts for consumers and even health professionals.

Given the relevance of the topic today and the nutritional aspects involved in the consumption of cow's milk, and in response to a request for clarification made by the Brazilian Association of the Long-Life Milk Industry (ABLV), the Brazilian Association of Nutrology (ABRAN) and the Brazilian Society for Food and Nutrition (SBAN) agreed to seek clarifications on the topic, which are presented in the form of this consensus, helping to clarify the main doubts that exist on the subject based on robust and current scientific evidence, bringing an analysis critique of the studies available in question and answer format.

It is worth highlighting that breast milk must be offered exclusively to the baby until the sixth month of life and, in a supplementary form, until two years or

more [1]. The following information refers to milk consumption for children from one year of age (if breastfeeding is impossible) [2,3], adolescents, adults, and the elderly.

Questions and Answers

1) Taking into account that we are the only mammals that drink milk after weaning, can we say that cow's milk is suitable for human consumption?

Yes. Cow's milk is not only suitable for human consumption, which acquired this habit due to its evolutionary and adaptive capacity, but it is also a relevant source of proteins, vitamins, and, especially, the main food source of calcium.

Discussion

Drinking milk after the lactation period has been a habit acquired by human beings throughout history [4]. This is because human beings, due to their enormous evolutionary and adaptive capacity, created special habits, which allowed them to differentiate themselves from other animals. For example, cooking meat was a highly relevant achievement in ensuring greater protein consumption [5], an essential aspect for the central

nervous system to develop differently between humans and other mammals [6].

Along the same lines, several other aspects of nutrition were incorporated as new foods were discovered, different ways of cultivation and preparation, possibilities for conservation, storage, etc. Furthermore, genetic adaptations at different times and civilizations promoted the ability of adult humans to digest and take advantage of milk components [7], such as maintaining, beyond the lactation period, the production of lactase in the digestive tract [7], and the adaptation of the microbiota with the ability to ferment lactose [8].

Cow's milk is not only suitable for human consumption but is also a relevant source of nutrients, mainly calcium and protein. A glass of milk (200 mL) contains approximately 244 mg of calcium and 6.4 g of protein [9], which represents a supply greater than 10% of the Recommended Dietary Allowance (RDA) of the two nutrients for all age groups in a single serving of the food (Table 1).

Table 1. Recommended Dietary Allowance (RDA) of Calcium and Protein.

Age group Male and female (years)	Calcium RDA (mg/day)*	% of RDA in a glass of milk	Protein RDA (g/day)**	% of RDA in a glass of milk
1 - 3	700	35%	13	49%
4 - 8	1000	24%	19	34%
9 - 13	1300	19%	34	19%
14 - 18	1300	19%	52 (M) e 46 (F)	12% (M) 14% (F)
19 - 50	1000	24%	56 (M) e 46 (F)	11% (M) 14% (F)
51 - 70	1000 (M) e 1200 (F)	24% (M) e 20% (F)	56 (M) e 46 (F)	11% (M) 14% (F)
> 70	1200	20%	56 (M) e 46 (F)	11% (M) 14% (F)
Pregnant and Lactating				
≤ 18 years	1300	19%		
19 - 50 years	1000	24%		

y: years; M: male; F: female

* IOM, 2011 [10]

** IOM, 2005 [11]

Not only the quantity, but the quality of the nutrients present in milk deserves to be highlighted. Regarding the protein fraction, 20% corresponds to whey proteins, while 80% corresponds to casein [12]. The biological activities of caseins derive from their amino acid content and their mineral-binding activity,

which assists in the passive absorption of these nutrients [13]. Whey contains dozens of high-quality proteins when considering essential amino acid content, bioavailability, and bioactivities [14]. Of the 9 essential amino acids, whey proteins are notably rich in lysine, methionine, leucine, and tryptophan, which are generally the most limiting amino acids in other foods and 1 or more of these 4 amino acids are always limiting in plant proteins [15].

Regardless of the type, milk proteins, due to their essential amino acid profile, digestibility, and bioavailability, are classified as having high biological value by the Food and Agriculture Organization (FAO) [16]. According to the Protein Digestibility – Corrected Amino Acid Score (PDCAAS) indicator, established to evaluate protein quality, milk proteins have the maximum quality level (=1), comparable to albumin, the gold standard in this regard [17]. The Digestible Indispensable Amino Acid Scores – DIAAS method proposed by FAO in 2014 also indicates that concentrated cow's milk protein and cow's milk itself have the highest values in the digestibility score, in addition to the absence of limiting amino acids. However, some technical issues mean that DIAAS cannot be fully adopted [18].

About calcium, no food replaces milk in the supply of this nutrient, considering not only the amount of calcium present in its composition but also the percentage of absorption of the mineral, which reflects the amount of calcium that the body has will receive. Other foods do not present an association between good calcium concentrations and the high percentage of absorption that milk has (Table 2), making it the main food source of calcium for human nutrition [16].

Table 2. Comparison between milk and other absorbable sources of calcium.

Food	Portion (g)	Calcium (mg)	Absorption (%)	Estimated absorbable calcium ¹ (mg)	Equivalence glass of milk ¹
Milk	200	244	32.1	78.3	1
Yogurt	200	244	32.1	78.3	1
Beans	172	40,5	24,4	9,9	7.9 (1.358 g)
Broccoli	71	35	61.3	21.5	3.6 (255 g)
Kale	85	61	49.3	30.9	2.5 (212 g)
Spinach	85	115	5.1	5.9	13.2 (1.122 g)

For leaves: portion 1/2 cup;

¹ Calculated: calcium content x absorption ÷ 100

Source: adapted from Weaver et al., 1999 [19]

Thus, we can say that milk is appropriate and an important food for human consumption.

2) What are the real benefits associated with consuming cow's milk at different stages of life?

In food, dairy products fulfill several functions. The benefits associated with its consumption in different age groups are related to its high nutritional density, supply of proteins, calcium, and components with functional properties, and include aid for correct growth and bone structure in childhood and adolescence, reduced risk of osteopenia and osteoporosis, reduction in the risk of chronic diseases (diabetes, obesity), cardiovascular diseases, hypertension and help in preventing sarcopenia in senescence.

Discussion

For children, the use of milk guarantees benefits for growth, dental health, hydration, cognitive performance, and appetite control [20]. Children over one year of age [2,3] who meet dairy recommendations are less likely to be deficient in several essential nutrients, including calcium, magnesium, phosphorus, protein, riboflavin, vitamin A, vitamin B12, vitamin D, selenium, potassium, and choline [21]. On the other hand, the lack of milk consumption, as can occur in cases of allergy [22], has already been one of the causes of rickets described in the literature [23].

Continuous and adequate intake of bioavailable dietary calcium is essential to ensure maximum bone mass within the genetic potential. Osteopenia and osteoporosis manifest themselves when there is a negative calcium balance, so intake from birth, especially in childhood and youth, combined with regular physical exercise, prevents bone demineralization. Maintaining a diet that meets calcium recommendations and in which this nutrient is bioavailable, as is the case with milk, should be encouraged as one of the strategies for preventing osteopenia and osteoporosis [24]. Considering that peak bone mass occurs at the end of adolescence, it is possible that matrix losses occurring before the age of twenty may not be completely recovered, increasing the risk of osteoporosis in adulthood [25], making intake adequate calcium intake at this stage is essential.

Reducing age-related bone loss is also a strategy to consider for preventing osteoporosis. Therefore, adequate calcium intake is extremely important in an osteoporosis prevention and treatment program, as well as for general bone health at any age [26]. Data from economic studies suggest that adequate milk

consumption can reduce the costs linked to osteoporosis by up to 20% [27].

For adult individuals, in addition to providing nutrients, studies show that milk consumption can help control blood pressure [28] and reduce cardiovascular risk [29]. Several studies including meta-analysis have consistently found that consumption of three or more daily servings of dairy products is inversely associated with the risk of high blood pressure [28,30-32]. The Rotterdam Study found a 20% reduction in the incidence of hypertension associated with the intake of dairy products [33], in addition to the combination of calcium, phosphorus, and potassium, which is essential for controlling blood pressure [34]. This balance of nutrients probably explains why milk is superior in reducing the risk of hypertension compared to using mineral supplements [35].

Also, the casein present in milk may be associated with anti-obesity and anti-diabetic action. This is because the low solubility in the pH of the stomach causes casein to curdle, slowing gastric emptying, prolonging digestion and absorption, and increasing satiety [36,37], and casein peptides reduce post-meal glucose increases, by inhibiting the digestive enzyme α -glucosidase or modulating the hormone GLP-1 [13], leading to their antidiabetic action. According to Alvarez-Bueno et al 2019 [38], dose-response analyses showed that the risk of type 2 diabetes (T2DM) decreased with each unit increase in the consumption of total dairy products and low-fat dairy products.

Despite these benefits, data indicates that less than half of Americans consume dairy products within recommendations [39] and, if they did, it is estimated that billions of dollars could be saved annually by reducing various cardiometabolic diseases, certain types of cancer, and neurological disorders [40].

With advancing age, there is a set of physiological changes in skeletal muscle that culminate in a reduction in muscle mass and strength [41]. Sarcopenia and osteoporosis, when associated, can lead to muscle weakness and restricted mobility, loss of autonomy, and reduced life expectancy [42]. One of the main causes of muscle mass loss is the negative balance between muscle protein synthesis and degradation. Adequate protein consumption associated with regular physical exercise is essential for maintaining/increasing skeletal muscle mass.

Regardless of age, for individuals enrolled in regular training programs (physical exercise), the protein supply must be higher than that recommended for the sedentary group [43,44]. Protein offered in adequate quantity and quality will help promote health and sports performance. In this context, milk and dairy products are foods that can be part of the eating habits

of those who practice physical exercise and sports, in all age groups, as they contain a quantity of proteins and an amino acid profile, as well as vitamins and minerals.

Finally, some milk components, such as MFGM ("milk fat globule membrane") and bioactive peptides, have functional properties that have been widely studied (Table 3). To date, milk proteins are considered the most important source of bioactive peptides that are often multifunctional and show two or more different biological activities [13,45,46].

Table 3. Functional Properties and Components of Milk [13,15,39,45-67].

Biological activity	Milk component
Antihypertensive action	β -casein, α -lactalbumin, β -lactoglobulin
Antithrombotic action	k-casein, lactoferrin, α -lactalbumin
Antioxidant action	casein, α -lactalbumin
Antilipemic action	β -lactoglobulin, MFGM
Anti-inflammatory and immunomodulatory action	caseins α , β , and k, glycomacropeptides, whey protein, and lactoferrin
Antidiabetic action	caseins and whey proteins
Appetite control and anti-obesity action	caseins and whey proteins
Antimicrobial action	Lactoferrin, lysozyme, lactoperoxidase, β -lactoglobulin and α -lactalbumin
Action on intestinal microbiota	MFGM, lactoferrin, glycomacropeptide – GMP, α -lactalbumin, lactose
Anticarcinogenic action	Lactoferrin

Source: Own Authorship.

More and more scientific surveys point to the importance of good colonization of the intestinal microbiota and its relationship with different aspects of our body, and some components of milk can promote eubiosis, including MFGM [39], α -lacto-albumin [15] and glycomacropeptide - GMP [63-65]. Lactose, for example, can serve as a substrate for the intestinal microbiota, favoring the development of beneficial bacteria, especially bifidobacteria, which can protect the gastrointestinal tract from infections [66].

Lactoferrin is a protein with a functional profile naturally present in milk [68,69]. In the intestine, lactoferrin exerts protective effects against infections by modulating the permeability of the intestinal epithelium and stimulating cell multiplication and differentiation of enterocytes, in addition to exerting effects on the intestinal microbiota, resulting in a higher concentration of bifidobacteria [62]. Among its other roles, anti-inflammatory [47] and anticarcinogenic [67] actions

stand out, due to the suppression of free radicals and oxidative products [70], as well as antiviral [48-51], antifungal [52-54] and antibacterial [55-60], the latter being due to its ability to limit the availability of iron to microorganisms [61].

A recently published study that aimed to evaluate the best available evidence on milk consumption and multiple health-related outcomes carried out a comprehensive review of meta-analyses and systematic reviews in humans and concluded that milk consumption is associated with several benefits. Beneficial associations were found for cardiovascular disease, stroke, hypertension, colorectal cancer, metabolic syndrome, obesity, osteoporosis, T2DM, and Alzheimer's disease, and the authors stated that the results support the consumption of milk as part of a healthy diet [71].

3) What is the relationship between cow's milk and inflammation?

To date, there is no scientific evidence that milk or its derivatives are "inflammatory" foods. Several studies indicate that dairy intake can improve inflammatory biomarkers in adults and explain mechanisms of action that may be associated with this benefit. Milk consumption will be associated with inflammatory processes only in people diagnosed with Cow's Milk Protein Allergy (CMPA) and, in this case, the consumption of any amount of milk, dairy products, and any product containing milk in its composition should be excluded.

Discussion

Current studies indicate that the consumption of milk or dairy products does not have a pro-inflammatory effect in healthy adults or among adults who are overweight or obese or with metabolic syndrome or T2DM [38,72,73]. Furthermore, most studies that evaluated the topic documented a significant anti-inflammatory effect in healthy individuals or those with metabolic changes [72].

As for the popular belief, spread over the internet, of an association between casein, which has a high molecular weight, and the inflammation caused by its passage through the intestinal villi, the following should be clarified. In the intestine, casein is divided into individual proteins, α -casein, β -casein and k-casein, which represent 38, 35 and 15% respectively, and are made up of 199, 209, and 169 amino acid residues with a molecular weight of 23, 24, and 19 kDa [74] and which show anti-inflammatory action. Thus, the exploration of the effects of these bioactive peptides on the expression of the inflammatory phenotype of

endothelial cells and their effects on the migration and adherence of monocytes to these cells, reports the inhibition of NF- κ B (nuclear factor kappa beta) through activation of PPAR- γ (gamma-type peroxisome proliferator), a nuclear receptor that prevents signal transduction and activation of pro-inflammatory factors [45].

A meta-analysis of 11 randomized controlled trials with 663 adult participants showed that, compared to low or no dairy intake, high dairy intake could result in decreased concentrations of C-reactive protein (CRP), TNF- α , IL-6, and monocyte chemotactic protein 1 and increased adiponectin levels [73]. A cross-sectional study carried out with 412 Portuguese adolescents found an inverse association between the total number of dairy products and milk ingested and serum concentrations of IL-6 among adolescents who were not overweight [75].

A recent review published in the journal *Nutrients* pointed out that among food groups of animal origin, dairy products demonstrated the best benefits in inflammation biomarkers, with a significant association between dairy intake and adoption of the DASH (Dietary Approaches to Stop Hypertension) diet trial - which recommends the consumption of low-fat dairy products) and reduction of CRP levels. Some mechanisms of action presented to justify the results include the action of medium-chain fatty acids from dairy products, which can positively regulate genes related to the citric acid cycle and oxidative phosphorylation and negatively regulate genes related to the complement system and inflammation; the presence of branched-chain fatty acids (BCFAs) that are associated with a reduction in NF- κ B, TLR-4 and CRP; and the supply of bioactive peptides that act to reduce the inflammatory response, interrupting NF- κ B signaling and the production of cytokines, exerting antioxidant activity and reducing reactive oxygen species (ROS). The authors point out that more studies are needed to better elucidate the potential effects of bioactive peptides in *in vivo* environments [76].

The evidence on the inflammatory process associated with cow's milk only concerns CMPA. It is defined as an adverse reaction mediated by an immunological mechanism, involving immunoglobulin E (IgE) or not, but also mixed mechanisms [77]. IgE-mediated reactions are the most common reactions, often occurring quickly, usually within minutes to 2 hours after ingesting small amounts of cow's milk. There is only a worsening of respiratory conditions with increased mucus production and asthma if the individual is a carrier of CMPA. In this case, one of the affected systems is the respiratory tract, with a degree of intensity ranging from mild to severe, life-threatening

changes (anaphylaxis and laryngeal edema) [78].

4) Is the consumption of cow's milk associated with a greater risk of developing lactose intolerance? Should patients diagnosed with this condition completely exclude milk from their daily lives?

No. The consumption of cow's milk is not associated with an increased risk of developing lactose intolerance. What exists is an inverse relationship: the greater the milk consumption, the lower the risk of developing lactose intolerance. The exclusion of milk due to self-perceived intolerance, which in most cases is not confirmed by clinical diagnosis, undoubtedly constitutes a nutritional loss. Furthermore, even for patients diagnosed with intolerance, generally, 12 g of lactose is tolerated without symptoms.

Discussion

There are two forms of lactase deficiency: primary and secondary. The primary may be adult alactasia and hypolactasia. The secondary can be permanent or transitory. Alactasia is a rare autosomal recessive disorder associated with the absence of lactase expression in newborns. Adult hypolactasia is the condition resulting from the progressive and physiological decline in the activity of the lactase enzyme that typically occurs during childhood and progresses into adulthood. On the other hand, secondary lactase deficiency is induced by disease or injury to the small intestine and may be permanent or transient. Permanent disease occurs due to Celiac disease, Crohn's disease, and ulcerative colitis. Transient infections due to parasites, gastroenteritis, rotavirus, and in these cases lactose intolerance are temporary [79].

The relationship between milk intake and lactose intolerance is inverse. Epidemiological studies show that populations that in their early days depended on livestock farming much more than on agriculture, and were large consumers of milk and dairy products in general, have a lower prevalence of lactose intolerance compared to those who depended more on agriculture for food survive [80].

Clinical diagnosis is extremely important, with an evaluation of the manifestation of one or more of the following symptoms: distension, abdominal pain and cramping, nausea, borborygmus, flatus, and diarrhea. We must remember that there are other carbohydrates widely distributed in foods for which poor digestion can cause symptoms similar to lactose intolerance. This occurs because humans do not have the enzyme α -

galactosidase that breaks down raffinose and stachyose found in beans, broccoli, potatoes, cauliflower, onions, fiber and fiber supplements, and also in alcohols derived from carbohydrates (sucralose, mannitol, and sorbitol) [81] and which can be erroneously associated with lactose intolerance.

Even in cases where there is no definitive diagnosis, patients may assume or believe that they are lactose intolerant and modify their diet accordingly, often eliminating much of their dairy intake and therefore also eliminating the benefits nutrients arising from its intake [82]. Avoiding dairy products can lead to deficiencies in essential nutrients, which is why the National Institutes of Health has identified self-restriction of dairy foods associated with selfdiagnosis of lactose intolerance as a public health problem. In their 2013 joint consensus statement on lactose intolerance, the National Medical Association (NMA) and the National Hispanic Medical Association (NHMA) recommended that healthcare professionals encourage patients to keep dairy foods in their diet, even if they are lactose intolerant lactose [82].

It is worth noting that there is confusion between CMPA and lactose intolerance, leading to the hasty withdrawal of milk from the diet, which should only be removed when CMPA is diagnosed. Lactose intolerance is dose-dependent, that is, the individual manifests symptoms after a certain amount of lactose, therefore tolerating smaller amounts. Therefore, the amount of lactose that does not determine clinical manifestation must be found, which varies between individuals. This is because the severity of symptoms after lactose ingestion depends on several factors such as the amount of lactose ingested, intestinal transit time, expression of residual lactase, variability of the intestinal microbiota, individual sensitivity, and psychological factors [83]. Some intolerants do not need to completely exclude milk that contains 8 to 10 g of lactose in 200 mL (one glass). Generally, 12 g of lactose is tolerated without symptoms [84-86].

The NMA and NHMA have encouraged healthcare professionals to help patients employ strategies to help them achieve recommended levels of dairy food intake and improve tolerance to milk, which includes fractional milk intake (taking in small portions of milk). portions throughout the day); combine milk intake with foods with a higher concentration of fat to delay gastric emptying; prefer hot foods because they are better tolerated; and ingest milk with foods that contain soluble fiber [82].

Also, lactose-free milk and dairy products are an option to provide the essential nutrients present in common dairy products for those who are not able to digest lactose. In recent years, the quality and variety

of products in the lactose-free dairy segment have increased significantly, giving consumers more attractive products to choose from [87]. Another option includes exogenous replacement of the lactase enzyme, which breaks down lactose into glucose and galactose to allow for better absorption. Finally, studies suggest that altering the gut microbiota through probiotic supplementation in lactose-intolerant patients can help alleviate symptoms [88].

5) What types of cow's milk are available

The main types of milk available on the market can be differentiated by the fat content present (whole, semi-skimmed, and skimmed), addition/exclusion of specific nutrients, or heat treatment used in its manufacture (pasteurized, ultra-high temperature – UHT). It should be noted that the indication for each type of milk must be evaluated individually.

Discussion

Resolutions from the Ministry of Agriculture, Livestock, and Supply (MAPA) establish technical standards for food standardization and quality criteria for food production, processing, and marketing. According to lipid content, milk is classified into:

- Whole milk: fat content greater than or equal to 3% of its content.
- Semi-skimmed or partially skimmed milk: intermediate fat content, that is, from 0.6 to 2.9% of its content.
- Skimmed milk: total milk fat content less than 0.5% of its content.

The indication of products such as semi-skimmed, partially skimmed, or skimmed milk are usually recommended as a suitable option for a healthy diet, aimed at reducing saturated fat intake, especially in populations at greater risk of cardiovascular diseases [89-92]. Milk with added nutrients follows specific legislation [93].

Concerning lactose content, according to ANVISA RDC nº135, of 02/08/17, which regulates foods for special purposes, foods for lactose-restricted diets that contain a quantity of lactose are considered lactose-free equal to or less than 100 (one hundred) milligrams per 100 (one hundred) grams or milliliters of ready-to-eat food, following the manufacturer's preparation instructions. Permitted declaration on packaging: "lactosefree", "zero lactose", "0% lactose", "lactose-free" or "does not contain lactose" [94].

Foods for lactose-restricted diets that contain a quantity of lactose greater than 100 (one hundred) milligrams per 100 (one hundred) grams or milliliters

and equal to or less than 1 (one) gram per 100 (one hundred) will be considered low in lactose grams or milliliters of ready-to-eat food, according to the manufacturer's preparation instructions". Permitted declaration on packaging: "low lactose content" or "low in lactose" [94].

According to the processing used, milk can also be divided into:

- Refrigerated raw milk: produced on rural properties, refrigerated, and destined for milk and dairy establishments under official inspection service. Concerning lipid content, refrigerated raw milk must have a minimum content of 3.0 g of fat/100 g [91].
- Pasteurized milk: fluid milk subjected to one of the pasteurization processes provided for in current legislation, automatically packaged in a closed circuit and intended for direct human consumption [91].
- UHT Milk (Ultra High Temperature): homogenized milk that has been subjected, for 2 to 4 seconds, to a temperature between 130°C and 150°C, through a continuous flow thermal process, immediately cooled to a temperature below 32°C and packaged under aseptic conditions in sterile, hermetically sealed packaging [92].

More recently, the commercialization of type A2A2 milk began to be carried out in Brazil. This milk is taken from a herd with animals that contain only the A2A2 genes, responsible for producing the A2 β -casein protein instead of A1 β -casein. This small difference is quite relevant, as A1 β -casein may be responsible for gastrointestinal discomfort when consuming cow's milk not associated with lactose [95,96].

The literature documents that A1 β -casein favors the release of the opioid peptide β -casomorphin-7 (BCM-7) during its gastrointestinal digestion. Regarding the effects of BCM7, the European Food Safety Authority confirmed that there was no definitive evidence of an association between the consumption of A1 milk and an increase in the occurrence of type 1 diabetes, heart disease, and autism, which are suggested to result from exposure to BCM- 7. However, the document recognizes that BCM-7 can exert biological activities such as interfering with gastrointestinal motility and gastric and pancreatic secretions [97]. There is no consensus in the scientific community or among regulatory bodies on the effects of A1 β -casein on health. In addition to this factor, there is a possibility that there are individuals who are more susceptible than others to the BCM-7 peptide [98].

It is reasonable to postulate that the longer gastrointestinal transit time as observed by the effect of BCM-7 may lead to increased susceptibility to

fermentation of lactose and other dietary components such as FOODMAPS (oligosaccharides, disaccharides, monosaccharides, and polyols) that represent food constituents that can cause intestinal discomfort because they are more fermentable because they are not digested by the human digestive tract [99].

Thus, people who experience discomfort after ingesting conventional milk (with A1 β -casein) not related to lactose intolerance, can benefit from consuming A2A2 milk, with better digestion and a reduction in gastrointestinal symptoms [100].

6) Is drinking UHT cow's milk safe?

Yes. UHT milk has gone through a highly safe and validated process since the mid-20th century. Heat treatment followed by cooling and packaging in aseptic packaging ("long life") guarantees a longer shelf life of the food, without the need for refrigeration before the product is opened, in addition to maintaining the quality of the milk and its microbiological safety. Thus, we have microbiologically and nutritionally safe milk.

Discussion

The UHT method is approved by international and national health bodies and regulated by MAPA Ordinance 370 of September 1997, through the RTIQ – Technical Regulation of Identity and Quality of UHT milk [92].

The procedure aims to eliminate and/or inactivate microorganisms that could cause changes in the quality of the product [101]. It is a method widely used in the conservation of milk and milk-based products, because it allows the population better access to the products, as it guarantees the preservation of nutritional characteristics, microbiological safety, and an increase in shelf life.

As a joint report by the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO) attests, the ultrapasteurization (UHT) process preserves the nutritional qualities of milk. Compared to pasteurized milk, it is equal to it not only in terms of nutritional value but also in terms of color and flavor [101]. Regarding the nutritional profile of processed milk, particularly those subjected to the ultra-pasteurization process, scientific literature indicates that any change in proteins that may occur as a result of UHT heat treatment or pasteurization has no nutritional importance. According to the International Dairy Federation [102,103], much research indicates that UHT milk has the same protein quality as raw milk.

After heating and cooling, the milk is packaged in controlled/aseptic environments, in carton packages known as "long life". These packages are made up of six

layers. From the inside out, two layers of polyethylene prevent any contact between the milk and the other protective layers of the packaging. Then there is an aluminum coating, whose function is to prevent the passage of oxygen, light, and microorganisms.

The fourth layer of polyethylene is an adhesion layer. The fifth layer, a paper covering, provides stability and resistance to the packaging structure and, finally, a sixth layer of polyethylene provides the final finish and protects against external humidity [104]. The result is high-quality packaging that prevents the entry of light, air, water, and microorganisms, and at the same time, prevents the loss of aroma and inhibits oxidation, which negatively affects the quality of food.

The combination of heat treatment and packaging in aseptic packaging, in addition to allowing the milk to be stored at room temperature until consumption in a completely safe way [102,103], makes it unnecessary to use any preservatives to extend its shelf life. In addition to not being necessary, Brazilian legislation prohibits the addition of these substances to milk, and it is considered a criminal practice of fraud if it occurs. The only substances that can be added to milk in this process are stabilizers to prevent phase separation, ensuring a homogeneous product, and guaranteeing the stability of proteins during the ultra-pasteurization process. The use of these stabilizers is regulated by MAPA and all stabilizers permitted by law undergo rigorous studies and research to ensure their safety (MAPA, 1997) [92].

Finally, "long-life" packaging is produced from renewable resources and has a small environmental impact in terms of CO₂. Around 75% of carton packaging is made from cardboard, which offers a positive characteristic concerning the sustainable environmental profile. It offers the possibility of extensive recycling of its components. Recycling takes place in two stages: removing the paper and processing the polyethylene/aluminum. The remaining two components are reused for various purposes [105].

7) When and to which audience should I advise the consumption of cow's milk?

Milk consumption is important at all stages of life, in childhood, adolescence, pregnancy, and for adults and the elderly, due to its nutritional quality. Milk and dairy products are recommended in different international guidelines and national and international dietary guides, and the inclusion of the food in Brazilians' dietary routine, when there is no contraindication, should be encouraged by health professionals.

Discussion

According to the Nutrient Rich Foods Index – NRFI [106], which classifies foods by their nutritional density and their price, using the Nutrient Rich Foods (NRF) and data from the United States Department of Agriculture [107], milk stands out for being the lowest-cost source of calcium, being among the lowest-cost protein-source foods and for having a more favorable nutrient-to-price ratio, even, than vegetables and fruits. As already presented, milk, as well as its derivatives, provides important nutrients for good health, three of which are of public health interest: calcium, potassium, and vitamin D.

In Brazil, calcium intake is far below values considered ideal; It varies, on average, from 500 to 600 mg per day [108], which represents, on average, only 50% of the daily calcium requirement of the adult population. Generally, dairy products contribute about 2/3 of dietary calcium, with vegetables, fruits, and grains supplying practically the remainder [109].

Due to this entire set of aspects, milk is part of practically all national and international food guides [110]. In Brazil, the dietary guide recommends the use of milk in the context of a healthy diet [111]; American and Canadian dietary guides suggest 3 servings per day; in Sweden, the recommendation is 500 mL of milk per day, with a preference for semi-skimmed milk; in Denmark, the suggestion is 250 mL per day for adults [110]. Medical societies also have their position.

For children, the pyramid of the Brazilian Society of Pediatrics [112] recommends 3 daily servings of dairy products after weaning and until adulthood and the European Society (ES-PGHAN) recommends milk and suggests a maximum of 500 mL per day [113]. Health authorities such as the American Diabetes Association (ADA), the American Heart Association (AHA), the National Medical Association (NMA), and the National Hispanic Medical Association (NHMA) recommend three servings of low-fat dairy products per day as a means of closing the nutrient intake gap [82].

In 2021, the American Heart Association released the Dietary Guidance to Improve Cardiovascular Health, which recommends choosing healthy protein food sources and includes low-fat or fat-free milk and dairy products among the suggested food groups. Scientific evidence indicates that dietary patterns with daily consumption of low-fat or fat-free dairy products are associated with a lower risk of all-cause mortality, cardiovascular disease, overweight, and obesity. Similarly, the Dietary Approaches to Stop Hypertension (DASH) recommends the consumption of low-fat or fat-free milk and dairy products as part of a healthy diet aimed at preventing/controlling systemic arterial hypertension [114].

In the nutritional approach, it is important to investigate the adequacy of energy and nutrient consumption as the first step to establish a nutritional diagnosis and propose interventions aimed at ensuring health and disease prevention. Due to food fads that suggest the removal of milk from the diet, the health professional must include in their anamnesis questioning the reasons why the patient does not consume milk and dairy products. Including in the approach the investigation into the justifications for lower-than-recommended consumption of nutrients, in general, contributes to the subsequent definition of strategies to be used in nutritional education as a tool for modifying eating behavior.

Encouraging the consumption of milk and dairy products, due to their nutritional quality, is an integral part of the nutritional guidance process. The types and quantities to be recommended must be appropriate to the different stages of life. Milk and dairy products should preferably be skimmed for adults, and whole for children, adolescents, and pregnant women [110].

Conclusion

- Milk is a food historically consumed by humans, which has adapted from an
- evolutionary point of view to consume it as a relevant nutritional source;
- Dairy products are a source of various nutrients with a structural, metabolic, and functional profile. Calcium is its main source in milk, in particular, which makes this food essential for preventing bone and dental diseases;
- Milk consumption is associated with several health benefits, including favorable effects on the prevention of chronic and cardiovascular diseases, osteoporosis, and cognitive performance, among others;
- Milk may eventually have an "inflammatory" profile in patients with CMPA. In non-allergic people, dairy intake may improve inflammatory biomarkers in adults;
- Lactose intolerant patients, depending on the degree of involvement (mild, moderate, or severe) can consume milk in the amount they feel comfortable with. Additionally, they can opt for lactose-free milk or use the lactase enzyme orally when drinking milk;
- Milk is considered a safe food and is present in practically all dietary guides. Individual intolerances and allergies exist and must be taken into account;
- The UHT (Ultra High Temperature) method is regulated and approved by international and national health bodies and guarantees the microbiological quality of the milk, without altering the nutritional characteristics. Associated with conservation in aseptic

packaging, it allows for longer shelf life and even greater microbiological safety;

- Breast milk must be offered exclusively to the baby until the sixth month of life and, in a supplementary form, for up to two years or more;
- The consumption of cow's milk is recommended for children from one year of age (if breastfeeding is impossible) and throughout their lives;

It is important to remember that dietary guidelines must always be personalized, taking into account individual nutritional needs and health conditions, which reinforces the importance of the health professional in carrying out an appropriate intervention.

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Data Sharing Statement

No additional data are available.

Conflict of Interest

Given the relevance of the topic today and the nutritional aspects involved in the consumption of cow's milk, and in response to a request for clarification made by the Brazilian Association of the Long-Life Dairy Industry (ABLV), the Brazilian Association of Nutrology (ABRAN) and the Brazilian Society for Food and Nutrition (SBAN) agreed to seek clarification on the topic, which is presented in the form of this consensus, helping to clarify the main doubts that exist on the subject based on robust and current scientific evidence.

Similarity Check

It was applied by Ithenticate®.

Peer Review Process

It was performed.

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