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Therapeutic Importance of Cheese: A Review

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ABSTRACT: Cheese contains a high concentration of essential nutrients relative to its energy level. The fats contribute flavor and texture of cheese. Among the milk proteins, caseins are the main protein in cheese; these are nutritionally rich due to the high supply of essential amino acids, phosphate, and calcium. They also act as a good source of energy in the human diet. One of the most important minerals in cheese is calcium. Besides calcium, cheese is also a good source of phosphorus and zinc, and magnesium is also worth mentioning. Chewing cheese stimulates saliva flow. The alkaline nature of saliva buffers the acids formed in plaque. There is also an increased rate of sugar clearance due to the diluting action of cheese-stimulated saliva. High calcium content in cheese helps to achieve healthier bone density. Consumption of cheese with probiotic bacteria has various health-enhancing effects such as increasing the saliva secretion rate and thereby enhancing oral health by reducing hypo-salivation and mouth dryness. Cheese consumption may be associated with a lower risk for T2D. Further study is needed to understand the links between cheese and its health benefits.

Keywords: Cheese, Nutritional value, health aspects, probiotic cheese.

INTRODUCTION

India's milk production has gone up to 210 million tonnes from 146 million tonnes in 2014, which is an increase of 44 percent. The annual growth rate of milk production is about 6 percent as compared to 2 percent production growth at the global level. In 2021-22, milk production increased by 5.8 percent compared to the previous year. The per capita availability of milk was 407 grams per day in 2019-20. In milk products, Cheese is one of the most versatile food products available nowadays, and suitable for all age groups. Cheese consumption and production have continued to increase over the past decades. The popularity of cheese is attributed to its great taste, availability of new and different varieties, convenience and versatility of use, and nutritional value. World cheese production is continually growing at a 4 percent rate (Kumar *et al*., 2017). Also, the proportion of milk converted into cheese is increasing and is currently over 30 percent. This is ascribed to increased milk production and greater demand for cheese. The Cheese industry has been and is playing its part in the development of this demand in all countries of the world. India is one of the growing markets for cheese. During the last few years, The Indian cheese market has grown steadily at 10 to 12 percent per annum in terms of volume and 16-17% per year in value terms (Jana, 2015). Per capita consumption of cheese in India is a mere 200 grams per year in contrast to the global average of 7 kg per annum.

Cheese is made mostly from the milk of cows, buffaloes, sheep, or goats. Goat milk has a high nutritional content. It is a rich source of calcium, phosphorous, chlorine, and vitamins (Yedatkar *et al*., 2022). Cheese is a classic example of fermentation technology. Cheese provides a valuable alternative to fermented milk and yogurts as a food vehicle for probiotic delivery, for certain potential advantages. Cheese may be a rich source of other essential nutrients it contains a rich amount of proteins in easily assailable form and essential minerals in more absorbable form besides being the only concentrated and balanced milk food for lactose intolerant. For people with lactose intolerance (LI), cheese can be a source of dairy nutrients with minimal lactose vitamins, and also short-chain fatty acids, and certain transfatty acids which will be considered part of a healthy diet. For vegetarians, cheese and other dairy foods are important sources of high-quality protein. During cheese ripening, casein is hydrolyzed into an outsized sort of peptide by proteases and peptidases from milk, rennet, starter culture, and secondary microbial flora. Some of these peptides are structurally almost like endogenous peptides that play an important role within the organism as hormones or antibiotics. Cheese has been well-proven to have therapeutic, anti-cholesterolemic, anti-carcinogenic, and anti-cariogenic properties beyond their basic nutritive value. It can be overcome by the production of cheese with low fat or cholesterol removal and by the addition of certain functional living materials, such as probiotic bacteria. They contribute a variety to our gustative desire in terms of nutritional and intrinsic health attributes, as the micro-flora present produce simple compounds like lactic acid, amino acids, and free fatty acids that are easily assailable. Thus, it plays a really important role within the diet of humans; however, it suffers from adverse nutritional image for the presence of saturated carboxylic acid, cholesterol, and salt content Besides this, cheese is also a good source of vitamins, riboflavin, minerals and some of the cheese flora inhibits the growth of certain toxin producing bacteria in the gastrointestinal tract (GIT). Certain biologically active lipids, such as conjugated fatty acid (CLA) and milk fat globule membrane (MFGM), present in cheeses are also found to be health beneficial. Hence, cheeses have come under the as perfect food category. The high concentration of essential amino acids in cheese contributes to the growth and development of the physical body. Despite the presence of a notable amount of saturated and trans-fatty acids, there is no clear evidence relating the consumption of cheese to any disease. Conjugated linolic acid and sphingolipids present in cheese may have anti-carcinogenic properties. The high concentration of calcium in cheese is documented to contribute to the formation and maintenance of strong bones and teeth, but also shows a positive effect on the vital sign and helps in losing weight in combination with lower energy diets. Cheese is a crucial foodstuff and an integral part of a healthful diet for its substantial contribution to human health. In recent times, diet has been linked to varied diseases like diabetes, obesity, disorder, osteoporosis, and cancer, and therefore the focus of nutrition research has shifted towards specific food ingredients contributing to nutrition and health.

Nutritional value of cheese: Cheese contains a high concentration of essential nutrients relative to its energy level. Its precise nutrient content is influenced by the type of milk used, the manufacturing process, and the ripening time. The water-insoluble nutrients are retained within the cheese curd whereas the water-soluble milk constituents remain within the whey (Walther *et al.*, 2008). Most of the lactose from milk is lost in whey during cheese manufacture and therefore the residual lactose in cheese curd is typically fermented to carboxylic acid by the starter bacteria. Expect fresh cheeses, most cheeses are lactose-free or contain only trace amounts. Thus, cheeses can be consumed without ill effects by lactose-intolerant people. Dairy foods like cheese are foundational foods in healthy dietary patterns. Healthy dietary patterns, which include low-fat and fat-free dairy foods, are associated with lower risk for both CVD and T2D. (Science summary and health 2021) Eating dairy foods is also linked to improved bone health, especially in children and adolescents (Kouvelioti *et al.*, 2017); (de Lamas, 2018). Limited evidence also indicates that eating cheese daily is linked to a protective effect on bone health in adults as well (Ong *et al*., 2020).

Fat: Fat content is essential in cheese and it varies based on the milk content and the process involved in the production of cheese. The fats contribute flavor and texture to the cheese and the types of fats involved in cheese are triglycerides, saturated fatty acids, and unsaturated fatty acids including mono and polyunsaturated fatty acids. The fatty acids contents of milk vary with the species of animals Cheese fat generally contains approximately 66 % saturated (SFA) (57.4 % palmitic, 21.6 % myristic, and 17.6 % stearic), 30 % monounsaturated (MUFA), and 4 % polyunsaturated fatty acids (PUFA). Thus, cheese represents a significant dietary source of both total fat and SFA. The knowledge of these physiological functions of SFA together with the results from new epidemiological studies indicates that we have to differentiate between individual saturated fatty acids and no longer treat them as a whole. If a reduction of the total SFA intake is sought it should not be done by reducing the consumption of dairy products (in Switzerland they represent 43% of total SFA intake) SFAs have a poor image because there's some evidence of a negative influence on blood lipids. However, individual SFAs influence blood cholesterol levels differently (Legrand and Rioux 2010). Total plasma cholesterol-raising effects of SFAs are generally greater with medium chain lengths (lauric C12:0, myristic C14:0, and palmitic C16:0) than for those with longer chain lengths (stearic acid C18:0) (German and Dillard 2006). In addition, stearic acid, which is an important component of the SFAs in cheese, is rapidly converted to the MUFA oleic acid C18:1, which is considered to be one of the healthier sources of fat in the diet and is not related to cardiovascular risk (Jakobsen *et al.*, 2009). In addition, it is known that butyric acid may play a role in cancer prevention (German, 1999); Caprylic and capric acids have antiviral activities (Thormar *et al.*, 1994) and lauric acid may have antiviral, antibacterial, and anticariogenic properties (Thormar and Hilmarsson 2007). The cholesterol content of cheese is a function of its fat content and ranges from approximately 10 to 100 mg/100 g depending on the variety. Despite considerable consumer confusion, dietary cholesterol has much less influence on blood cholesterol levels than dietary saturated fat (Keys, 1984). Dietary cholesterol does not serve as a metabolic fuel. Instead, it's employed by the body as a precursor for cell membranes, bile salts, and steroid hormones that are essential at all times. Studies show that healthy people's response to 100 $mg.day^{-1}$ of dietary cholesterol is minimal and elevates total plasma cholesterol very slightly (Parodi, 2004). Trans-fatty acids, especially those of industrial origin, have been accused of enhancing the risk of coronary heart disease (Willett, 2006). A special trans-fatty acid in milk fat is conjugated linoleic acid (CLA), which is typical of ruminant fat. In cheese, the content varies between 0.1 and 2.5 $g \cdot kg^{-1}$ fat. A Comparison of milk from the lowlands with milk from the highlands showed a threefold increase in the concentration of CLA in the fat from the highlands. These differences could be explained by breed and fodder. Several animal studies report various beneficial effects of CLA but only a few could also be demonstrated in humans. There is a demand for low–fat cheeses owing to the greater incidence of obesity and other diseases among people. Strains of exo-polysaccharide (EPS) producing lactic acid bacteria have been used successfully to manufacture low-fat mozzarella cheeses with improved moisture retention and functional properties (Petersen *et al.*, 2000).

Protein: The major milk proteins include caseins, β-lacto globulin, lacto-ferrin, serum albumin, and immunoglobulin, which exert various biological activities as a whole protein or peptides. Among the milk proteins, caseins are the main protein in cheese; which exist in the form of aggregates after combination with colloidal calcium phosphate known as casein micelles (Farrell *et al.*, 2004). Caseins in cheese are nutritionally rich due to the high supply of essential amino acids, phosphate, and calcium. They also act as a good source of energy in the human diet. The nutrition value of cheese protein was slightly lower than the milk protein due to the loss of sulfur-containing protein in whey during cheese making process. However, the use of certain techniques in cheese preparation, such as ultra-filtration for a concentration of milk and the addition of whey proteins in milk, prevent the loss of biologically active protein. The digestibility of cheese protein was higher than the source milk and this greatly increased during the curing process of cheese. Cheese protein is almost 100 % digestible, as the ripening phase of cheese manufacture involves a progressive breakdown of casein to water-soluble peptides and free amino acids. Between those peptides, some bioactive peptides have been found. These peptides are only active after they have been released from their parent protein by proteolysis and can exert a wide range of activities such as hypertensive, antioxidant, antimicrobial, and immune modulator between others (Tidona *et al.*, 2009). Among the amino acid content in cheese, it is important to highlight the high lysine content. Lysine has a high bioavailability in cheese due to the absence of Maillard reactions (de la Fuente and Juárez 2001).

Pre-digestion step was commonly referred to as the curing process of cheese and this process enhances the conversion of proteins to smaller peptides and amino acids. The water-insoluble casein in cheese is mostly converted to water-soluble nitrogenous compounds during the curing process. Thus, cheeses provide a good source of peptides and amino acids from casein and thereby prevent the dismantling of vital proteins in our body. Lactoferrin is the multi-functional glycoprotein that existed in the cheese at the range of 672$\mu g\ g^{-1}$ (soft cheese) to 1218 $\mu g\ g^{-1}$ (semi-hard cheese) (Dupont *et al.*, 2006). These proteins have various physiological roles which include host defense against a variety of microorganisms, iron homeostasis, anticancer, antiviral, and anti-inflammatory activity (Elbarbary *et al.*, 2010). It possesses two metal-binding sites which can able to bind iron and thereby have an antimicrobial effect against a wide range of microorganisms including yeast (Steijns *et al.*, 2000). The enzymes, such as pepsin, chymosin, cathepsin, and other natural milk enzymes have a potential proteolytic effect on lactoferrin in cheese. It also leads to the generation of peptides, such as lactoferricin and lactoferrin, which also exhibit antimicrobial activity. Cheese flavor and texture are mostly contributed by the proteolysis of cheese protein which leads to the generation of various biologically and nutritionally rich peptides and amino acids. In general, β-casein is degraded less extensively in Parmesan, Emmental, and Tilsit, than αs1-casein, with higher retaining of γ1-casein and γ2-casein. However, in Roquefort cheese, β-casein is almost degraded. The plasmin action in cheese can be determined by the presence of less γ1-casein and more γ2-casein. These peptides are of great interest beyond the nutritional and sensory value due to the production of biologically active peptides (BPs). A wide range of biological activities has been described, including opioid, blood pressure-lowering, mineral binding, antimicrobial, immunomodulating, cell-modulating, anti-carcinogenic, anti-cariogenic, anti-thrombotic, anti-inflammatory, and cholesterol-lowering activities (Bachmann *et al.*, 2003). Cheese contains a high content of biologically valuable protein which ranges between 4 % (cream cheese) and 40 % (Parmesan) depending upon the variety. The nutritional value of cheese proteins does not change during cheese manufacturing and the content tends to vary inversely with the fat content (O'Brien and O'Connor 2004).

Vitamins and minerals: Vitamin and Mineral concentration in cheese varies with the type of cheese, manufacturing procedure, coagulation method, and the amount of salt added to the cheese. Milk and dairy products contain all vitamins and minerals in different quantities (Sieber *et al.*, 2001). One of the most important minerals in dairy products and especially in cheese is calcium. Semi-hard and hard cheese contains about 6 to 11 $g \cdot kg^{-1}$ cheese. The content of soft cheese is lower due to the acidification of the vat of milk. One portion (50 g) of semi-hard or hard cheese supplies one-third to half of the recommended daily intake of 1200 mg of calcium. In Switzerland, 71% of the daily calcium intake is consumed in the form of milk and dairy products and about 20% as semi-hard and hard cheese (Eichholzer *et al.*, 2005). Besides calcium, cheese is also a good source of phosphorus and zinc, and magnesium is also worth mentioning. As cheese is a concentrated source of bio-available Ca, increasing the amount consumed in the daily diet together with a good source of vitamin D has the potential to safeguard against osteoporosis in the future, particularly in those that consume inadequate quantities of Ca at a young age (Ash and Wilbey 2010). The relatively high content of salt has often been discussed about hypertension. But other ingredients in cheese such as calcium and certain bioactive peptides have been shown to neutralize a possible negative effect. Cheese calcium is particularly well absorbed and bio-available. In addition, some research studies have found that the interaction of high-in-calcium milk products with other constituents like proteins, vitamins, fats, etc. gives it specific health effects. The calcium content for 100 g of cheese: pressed cooked cheeses from 900 to 1000 mg; processed and blue-veined cheese from 500 to 700 mg; soft cheese with washed rind from 400 to 800 mg; surface-ripened cheese from 100 to 300 mg; cream cheese from 60 to 100 mg. Cheese's absorption coefficient of calcium can be compared to that of milk (~33%). Its bioavailability is promoted by the simultaneous intake of phosphorous in good proportions and by the presence of peptides. Phosphopeptides from enzymatic hydrolysis of caseins seem to facilitate the placing and keeping of the calcium in solution (a large number of these peptides (+ than 45) have been identified as transporters of calcium). The nutritional value of cheese varies widely. Cottage cheese may consist of 4% fat and 11% protein while some whey cheeses are 15% fat and 11% protein, and triple-crème cheeses are 36% fat and 7% protein. In general, cheese is a rich source of calcium, protein, phosphorus, sodium, and saturated fat. A 28-gram serving of cheddar cheese contains about 7 grams of protein and 202 milligrams of calcium. Nutritionally, cheese is essentially concentrated milk, but altered by the culturing and aging processes.

CHEESE AND HEALTHASPECTS

Cheese is a rich source of bio-available calcium. The following discussion of the health aspect of cheese mainly focuses on the role played by this specific mineral, but at the same time, specific roles played by other ingredients such as protein, bioactive peptides, CLA, and sphingolipids cannot be ignored.

Protection against dentalcaries: Chewing cheese stimulates saliva flow. The alkaline nature of saliva buffers the acids formed in plaque. There is also an increased rate of sugar clearance due to the diluting action of cheese-stimulated saliva. Research has also suggested that chewing cheese may reduce the levels of carcinogenic bacteria (Herod, 1991). This may be secondary to the reduced incidence of caries as conditions within a carious lesion tend to promote the growth of these organisms. The high calcium and phosphorus content seems to be another factor in the cariostatic mechanism of cheese. Both casein and whey protein seem to be involved in the reduction of enamel demineralization. Casein phosphopeptides may also be responsible for some anti-carcinogenicity by concentrating calcium and phosphate in plaque. Dental caries is due to the breakdown of tooth enamel by acids which are formed during the fermentation of sugars and starches by plaque bacteria. Cheese consumption helps to prevent tooth caries by enhancing remineralization and reducing the demineralization process (Kashket and De Paola 2002). According to different studies the anti-cariogenic effect of cheese products is based on various components. On the one hand, calcium and phosphorus seem to minimize the drop in plaque pH, which means that acid production after dairy consumption is reduced (Jenkins and Ferguson 1966). Chewing a piece of cheese after a sugary food brings plaque pH rapidly back to neutrality (Rugg-Gunn *et al.*, 1975). Jensen *et al.* (1984) realized that not all types of cheese are equally potent in inhibiting the drop in plaque pH. Aged cheese seems to protect better than young and fresh cheese. One explanation for the protection could be a buffering effect by the stimulation of saliva flow by cheese. Saliva contains calcium and phosphate ions at super saturation which leads to mineralization of the enamel in a neutral environment (Ashley *et al.*, 1991). Studies in humans have shown that cheese has a protective role in the prevention of caries, the action of cheese being independent of sugar intake. Its richness in calcium and phosphorous contribute to healthy teeth: it protects against the acidity in the mouth and facilitates the fixing of fluorine and its proteins reinforce the protective effect of the saliva which stimulates the production (from chewing). Moynihan *et al.* (1999) measured the calcium concentration of the plaque after a meal containing cheese and a meal without cheese. The meal with cheese increased the calcium concentration of the plaque significantly more than the control meal Cheese was found to decrease the dental caries coefficient. Casein also plays an important role. Casein phosphopeptides react with high concentrations of calcium and phosphate to form calcium phosphate complexes. These complexes lead to remineralization of the enamel and today are incorporated in toothpaste, gels, and chewing gum (Braun and Nimmagudda 2005).

Weight reduction or anti-obese effects: Obesity is an established health hazard, increasing the risk of coronary heart disease, hypertension, diabetes, and some cancers, as well as other metabolic abnormalities (Nammi *et al.*, 2004). The main causes of this epidemic disease, *i.e.* poor nutrition, minimal physical activity, and social and cultural or other lifestyle factors. The recommended nutritional interventions for weight reduction vary among low-fat, low-carbohydrate, and other models. When the low-fat approach is argued, milk, dairy products, and especially (full-fat) cheese are usually condemned because of their high-fat content. Therefore, dairy products are often omitted by people trying to lose weight. Overweight women seem to benefit most from the intake of cheese: regular intake ($\geq$ 1 serving.d^{-1}) of whole milk, sour milk, or cheese was inversely associated with weight gain. No association was seen between a regular intake of less than 1 serving.d^{-1} or an increase or decrease in the intake of dairy products. When adjusted for BMI, the findings remained significant for cheese and whole milk, and sour milk for normal-weight women only. Thus, Rosell *et al.* (2006) concluded that the association between the intake of dairy products and weight change differed according to the type of dairy product and body mass status. Calcium in food seems to play an important role in this relationship. Zemel *et al.* (2000) found an unexpected side effect in a study in which they investigated the effect of calcium on blood pressure. Not only was there a significant decrease in blood pressure after increasing calcium intake from 400 to 1000 mg, but there was also a significant reduction in body fat by 4.9 kg. These findings were confirmed in some further studies, but not in all (Snijder, 2007). In western countries, hypertension is a major risk factor for both coronary heart disease and stroke. In several studies, dairy products have shown a beneficial effect on blood pressure, especially in mildly hypertensive subjects. Two main components seem to be relevant in this situation: calcium and bioactive peptides. A diet with (low-fat) dairy products seems to reduce the incidence of hypertension with a significant effect on the primary prevention of cardiovascular diseases (McCarron *et al.*, 2002). Besides calcium, potassium, magnesium also seems to have a beneficial effect on blood pressure. This is another reason why dairy products, as a good source of all three minerals, are recommended to reach the recommended daily allowance (RDA) of calcium (Massey, 2001). Cheese is a rich source of bioactive peptides. Among these peptides, one of the most interesting and investigated biological functions is the angiotensin-converting enzyme (ACE)-inhibitory effect. ACE is a key enzyme in the regulation of blood pressure because it enables the conversion of angiotensin-I into the highly potent vasoconstrictor angiotensin-II and in activate the depressing action of bradykinin. By inhibiting the effect of ACE, these peptides have a positive influence on hypertension, although their effect is less pronounced than what has been observed with drugs based on the same principle. ACE-inhibiting peptides have been found in several food proteins (Li *et al.*, 2004). Meisel *et al.* (2006) list over 200 amino acid sequences derived from milk, animal (non milk), plant, and miscellaneous protein sources with an ACE-inhibitory effect. The chain length varies from 2 to 20 amino acids and the potency of these peptides is also extremely different. In cheese, these peptides are produced during secondary proteolysis through the action of proteinases and peptidases. Studies have found that blue cheese consumption helps with managing levels of visceral fat around the abdominal area and maintaining gut health. The calcium in blue cheese may also be linked to anti-obesity mechanisms that reduce body weight from fat Excessive levels of visceral fat have been associated with higher mortality rates.

Beneficial for bone health: Because of its high calcium content, cheese can help people achieve healthier bone density. Over time, regular consumption of calcium-rich foods such as cheese protects bone health and helps reduce the risk of developing osteoporosis. As discussed above, cheese can provide a significant amount of calcium, especially in the diet of lactose-intolerant individuals. Female adolescents, limiting the intake of dairy products because of self-perceived milk intolerance, have a significantly lower intake of calcium as well as a significantly lower spinal bone mineral content than female adolescents without perceived milk intolerance (Malik *et al.*, 2007). It could even show, in their experiments with rats, that milk calcium taken with cheese is even better absorbed than milk calcium taken without the cheese (Kato *et al.*, 2002). And as a consequence, the bone mineral density of the rats fed milk calcium with cheese was significantly higher than in the control group. Cheng *et al.* (2005) supported the results of Kato *et al.* (2002) in their study with 10-to 12-year-old children. Calcium supplementation with cheese resulted in a higher change in cortical thickness of the tibiathan the placebo, or treatment with calcium supplementation in the form of pills with or without vitamin D. Cheese was significantly better than placebo treatment for whole-body bone mineral density. Besides calcium other cheese compounds such as magnesium and vitamin D also play an important role in building up bone mineral density and reducing bone loss. However, phosphorus has a hypo calciuric effect, so the consumption of cheese with its remarkable amount of phosphorus might harm bone mineral density. Bizik *et al.* (1996) could not confirm this hypothesis with their study, in which they doubled the consumption of phosphorus in healthy young men with the addition of cheese and milk. High phosphorus intake does not promote bone resorption if the calcium-to-phosphorus ratio is < 1:1.5, which is the cheese case. Besides calcium other cheese compounds such as magnesium and vitamin D and even some bioactive peptides also play an important role in building up bone mineral density and reducing bone loss. Recent clinical studies suggest that several anti-hypertensive drugs, especially ACE inhibitors, reduced bone fractures, because angiotensin-II, a potent vasoconstrictor, also affects bone by activating osteoblasts (Shimizu *et al.*, 2008). VPP, a small peptide, formed during the fermentation of milk with *L. helveticus*, has been shown to possess ACE-inhibitory activity. In an animal study with ovary ectomized rats, the group fed with *L. helveticus* fermented milk significantly prevented bone loss by decreasing bone turnover and increasing bone mineral density (Narva *et al.*, 2007). VPP in water could not prevent bone loss and the authors concluded that this might be due to the poor bioavailability of the bioactive peptide in water. It is not clear whether the preventive effect of fermented milk is due to VPP. Because VPP is known to have a lowering effect on blood pressure, these results show an interesting connection to a study by Metz *et al.* (1999). They investigated the relationship between blood pressure, dietary calcium, and bone mass. The findings show that blood pressure was negatively related to the bone mineral density and bone mineral content independent of age, BMI and calcium intake. The observational nature of the study precluded causality, which is supported by experimental data associating hypertension with calcium metabolism. Therefore, it is hypothesized that hypertension may be related to the risk of osteoporosis. At any rate, in females with primary hypertension, bone strength, although fitting for chronological age and body height, was lower than expected for body weight (Pludowski *et al.*, 2008).

Anti-carcinogenic effect: The World Cancer Research Fund and the American Institute for Cancer Research (2007) have recently examined the literature on food and cancer. Cheese consumption was related to colorectal and prostate cancer. Eleven cohort studies and 25 case-control studies exist, showing a correlation between colorectal cancer and cheese. Due to the inconsistency of the results, they declared that the evidence for cheese consumption as a cause of colorectal cancer was limited. Prostate cancer was discussed because of numerous associations between the dairy product and calcium (dietary and supplemental) consumption in epidemiological studies. The report mentioned above evaluated 9 cohort studies,12 case-control studies, and 2 ecological studies for the relation between dietary calcium and prostate cancer. A dose-response relationship was apparent from the cohort but not from case-control data. However, a coherence of prostate cancer and calcium only correlates with diets very high in calcium (1.5 $g.d^{-1}$ or more). Diets high in calcium are a probable cause of prostate cancer. According to the panel there is, however, limited evidence that high consumption of milk and dairy products is a cause of prostate cancer. These findings could be explained by the presence of anti-carcinogenic compounds such as CLA and sphingolipids in cheese. Almost 20 years ago an initial study suggested an anti-mutagenic 400 B. Walther *et al.* activity of CLA. Since then, considerable in vitro experiments and animal trials have been carried out concerning CLA inhibition of carcinogenesis. It is assumed that CLA is involved in various steps in all three stages of carcinogenesis, exerting its effect by modulation of cell proliferation and apoptosis, regulation of gene expression, influence on eicosanoid synthesis and metabolism, and anti-oxidative mechanisms (Belury *et al*., 2002). Further studies will have to provide information on possible anti-carcinogenic effects in humans. Experiments have shown that the CLA concentration in blood can be enhanced by the consumption of CLA-rich cheese (Huang *et al.*, 2005). Another interesting group of lipids relating to the prevention of cancer is the sphingolipids. No human trials or epidemiological studies are evaluating a protective effect on the development and progression of colon cancer. Based on the fact that sphingolipids reduce markers of colon cancer in animal trials and that their metabolites induce spontaneous cell death in human cancer cells, it is highly probable that sphingolipids also have anti-carcinogenic properties in humans (Vesper *et al.*, 1999). Besides soybeans (189 $mg.kg^{-1}$), the best sources of these lipids are milk, full cream, butter, and cheese, containing 115, 490, 710, and 995 $mg.kg^{-1}$, respectively. They provide about one-third of the total intake in countries with high dairy product consumption, such as Switzerland. Because of their amphiphile character and their distribution in the milk fat globule membrane, quantitative determination in milk products is very difficult (Wehrmüller, 2007).

Probiotic cheese help in the gastrointestinal tract: Probiotic is the term used for the administration of living microorganisms in food that exert certain health-enhancing function in our body. The various health-enhancing functions of probiotic bacteria include enhancing the immune system, reducing bad cholesterol, being anti-carcinogenic, and so on. Some LAB such as *Pediococcus, and Lactobacillus* inhibits the growth of toxigenic mold by the production of certain antimetabolites such as hydroxyl fatty acids, and hydrogen peroxide (Dalie *et al.*, 2010). Cheese act as a good source for the delivery of probiotic organisms since it acts as a buffer and creates a highly acidic environment which is favorable for the survival of probiotic throughout GIT (Cruz *et al.*, 2009). Consumption of cheese with probiotic bacteria has various health-enhancing effects such as increasing the saliva secretion rate and thereby enhancing oral health by reducing hypo-salivation and mouth dryness (Hatakka *et al.*, 2007). The consumption of cheese with *L. rhamnosus* HN001 and *L. acidophilus* is found to increase the immune response of healthy elderly people. Some of the age-related deterioration of the immune system can also be reduced by the consumption of cheese. Cheese with certain LAB species can also able to reduce the growth of certain toxigenic microbes by the production of certain metabolites. Some of the cheese LAB species show antigenotoxic properties and antimutagenic properties (Hsieh *et al.*, 2006), thereby it may reduce the risk of cancer Massi *et al.* (2004). Among the LAB species, *Lactobacilli casei* isolated from traditional Italian ewe cheeses show microbial antigenotoxic–antimutagenic properties (Caldini *et al*, 2008; Corsetti *et al.*, 2008). Thus, cheese also serves as an alternative function with the implementation of certain beneficial bacteria, and further research also should be focused to enhance the value of these functional cheeses based on the disease-specific. The incorporation of probiotic bacteria in cheeses could improve the health status and quality of probiotic products. Cheeses are advantageous as a delivery system for viable probiotic over fermentation products such as yogurt due to their higher pH, higher buffering capacity, solid consistency, and higher fat content (Vinderola *et al.*, 2002; Ong *et al.*, 2006), which offer protection to the probiotic microorganisms during storage and passage through the GI tract (Stavros *et al.*, 2012). However, these four unique features of cheeses may fail as distinctive features during food progression in the GI tract**,** and their effectiveness may vary greatly depending on the type of cheese and production technology. Probiotic bacteria in cheese-making are members of the genera Lactobacillus and Bifido bacterium. In addition, probiotic properties have recently been demonstrated for bacteria that belong to the genus *Propionibacterium* as well as for the genus *Enterococcus*, in cheeses (Stavros *et al.*, 2012). As in the case of any probiotic food, to exert their health benefits on the consumer's body, probiotic bacteria incorporated in cheese must be able to grow and/or proliferate in the human intestine and therefore should be able to survive during the passage through the gastro-intestinal tract (GIT), which involves exposure to hydrochloric acid in the stomach and bile in the small intestine (Stanton *et al.*, 2003). Clinical benefits both for animals and for human have been reported for the ingestion of probiotic cheeses. Ahola *et al.* (2002) studied the effect of probiotic Edam cheese containing *Lactobacillus rhamnosus* LC705 and *L. rhamnosus* GG ATCC53103 (LGG) on the risk of dental caries. During the study, no significant difference was found for *Streptococcus mutans* populations between the control group and the group who ingested probiotic cheese. Probiotic are associated with the modulation of immunity, lowering of cholesterol, treatment of rheumatoid arthritis, prevention of cancer, an improvement of lactose intolerance, and reducing the effect of atopic dermatitis, Crohn's disease, diarrhea, constipation, as well as urinary tract infection and candidiasis (Kisan, 2019).

Cheese for lactose intolerant patients: There are many lactose-free kinds of cheese available on the market. These cheeses are produced by incubating the cheese milk with lactase before renneting. This technique is useful mainly for young and fresh cheeses that contain a significant amount of lactose. Throughout the cheese-making process, the milk is thickened, and the curds (the solid parts) are isolated from the whey (the liquid part where most of the lactoseis). Whey is drained off before the cheese is made, so quite a bit of lactose is removed. The curds used to produce hard cheeses have less moisture (whey) than the curds used to make softer cheeses; therefore, soft cheeses possess more lactose than hard ones (Dekker *et al.*, 2019; Silanikove *et al.*, 2015). More extra moisture is lost as cheese ages. Moreover, during the aging process, in hard and matured cheeses, lactic acid bacteria consume all the lactose present in the cheese, so no lactase incubation is needed. The long era cheese has matured, the less lactose remains in the final product; therefore, the lactose concentration in hard-matured (long-ripened) cheeses is usually very low and can be easily tolerated by most individuals suffering from primary LI. For those with LI, avoiding dairy foods can lead to inadequate consumption of shortfall nutrients like calcium (Silberman and Jin 2019). Eating small amounts of aged, hard cheeses such as Parmesan, Cheddar, and Swiss, which contain minimal lactose, may be an effective approach to managing LI and still consuming important dairy nutrients (Silberman and Jin 2019; Dekker *et al.*, 2019).

Reducing the risk of Type 2 Diabetics and Cardiovascular disease: Eating cheese has also been linked with health benefits. Systematic reviews found that moderate-quality evidence indicates eating cheese may be associated with a lower risk for T2D (Drouin-Chartier, 2016; Alvarez-Bueno *et al.*, 2019). Evidence from a meta-analysis also supports a link between eating cheese and a 10 percent lower risk for stroke, with the largest risk reductions observed with daily consumption of about 40 grams (~1½ ounce) of cheese (Chen *et al.*, 2017). Another study found that the risk of developing T2D may depend on the types and food sources of saturated fatty acids (SFA) (Liu *et al.*, 2019). While there was no relationship between overall SFA intake and the risk of developing T2D, consumption of SFA commonly found in cheese was related to a lower risk of developing T2D (Liu *et al.*, 2019). Links between cheese consumption and CVD risk differ from what would be expected based on the SFA content of cheese. A systematic review found that high-quality evidence from two meta-analyses and a prospective study indicated no association between cheese consumption and CVD risk (Drouin-Chartier, 2016). Several additional studies concluded that eating cheese was linked to a lower risk of CVD, including stroke (Johansson *et al.*, 2019). This difference in the expected versus observed health impacts of cheese may be due to the unique physical structure, or matrix, of protein, vitamins, and minerals in cheese (Thorning *et al.*, 2017). More research is needed to understand if the links between cheese and T2D and CVD are due to the amount of SFA in cheese, nutrients such as calcium, or the physical structure of the cheese.

CONCLUSION

Cheese has a long history in the human diet to which it contributes a substantial amount of important nutrients; in particular, proteins, bioactive peptides, amino acids, fat, fatty acids, vitamins, and minerals. Cheese can be considered an important component of an equilibrated diet from a nutritional point of view. It is an excellent source of protein and minerals, especially calcium in a highly bioavailable form Research today is concentrated more and more on the influence of nutrition on human health. Calcium, which is present in large quantities in cheese, has been shown to have a positive effect on various disorders (hypertension, osteoporosis, obesity, and dental caries). Besides calcium, other constituents with potentially positive effects on health are found, e.g. bioactive peptides, which also decrease hypertension. In humans, the possible anti-carcinogenic effects of specific lipids (CLA, sphingolipids) have not yet been investigated but animal studies suggest a certain potential. Cheese still has a negative image because of its fatty acid composition. However, research has uncovered even more details, whereby these old convictions have started to waver. Further studies are needed both to confirm earlier results and clarify their mechanism as well as to discover further interesting cheese constituents and their effects. Besides all this scientific research, the inseparable tradition and enjoyment of cheese should not be forgotten. Cheese is more than the sum of its constituents.

FUTURE SCOPE

Cheese has also been linked with health benefits. Systematic reviews found that moderate-quality evidence indicates eating cheese may be associated with a lower risk for T2D.More research is needed to understand if the links between cheese and T2D and CVD are due to the amount of SFA in cheese, nutrients such as calcium, or the physical structure of the cheese.

Conflict of Interest. None.

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