The Pharma Innovation Journal 2022; SP-11(6): 908-914

www.ThePharmaJournal.com

The Pharma Innovation

**ISSN (E): 2277-7695**
**ISSN (P): 2349-8242**
**NAAS Rating: 5.23**
TPI 2022; SP-11(6): 908-914

www.thepharmajournal.com
Received: 16-03-2022
Accepted: 25-04-2022

**Arishdeep Kour**
School of Agriculture, Lovely Professional University, Phagwara, Punjab, India

**Corresponding Author**
**Arishdeep Kour**
School of Agriculture, Lovely Professional University, Phagwara, Punjab, India

# Study on the different types of fortification techniques of curd (dahi)

## Arishdeep Kour

**Abstract**
One of the most important ways to improve the quality and quantity of nutrients in food is to strengthen the diet. It has the potential to be a low-cost health intervention. Because dairy products, such as curd, are widely used, fortifying these foods will reduce or prevent the disturbances associated with malnutrition. The main focus of this review is to examine the technical elements involved in the manufacturing of various varieties of fortified curds, and their role in preventing illness and remediation. In this study, fortification is described and the main reasons for performing this procedure are provided, followed by a brief discussion of the fortification of curd with minerals, vitamins, and fruits and vegetables utilized in the process. As a result, it has the potential to deliver healthy nutrients to the human diet.

**Keywords:** Fortification, deficiencies, yogurt, functional, additives

## Introduction
Considering the significance of food safety and quality, consumers' health is receiving greater attention (Grunert, 2005) [8]. However, because of nutritional inadequacies in human cultures, particularly throughout specific stages of development, acceptance, importation, and consumption of fortified foods are rising (Preedy *et al.*, 2013) [31]. The process of adding vitamins and minerals to a diet consumed during digestion to improve your nutrition is known as dietary supplement. It is a tried and true, safe, and inexpensive way to improve your diet and prevent and control micronutrient deficiency. The Copenhagen Consensus listed food consolidation as one of the least expensive development policies in 2008 and 2012 (Horton *et al.*, 2008) [15]. Nutritionists have stated that fortifying food items with natural resources (fruits, grains, etc.) is one of the greatest strategies to enhance total nutritional consumption with minimal adverse effects (Pimentel *et al.*, 2013) [33]. However, compliance notes on the manufacture of fortified foods to protect customers' health and ensure the absence of toxicity as a result of the use of this material appear to be essential. Fermentation has been used for thousands of years to extend the shelf life of perishable food and to enhance the taste and aroma of processed foods. Ripe food has been produced since the Neolithic period. Wine, bread, and cheese are the Neolithic era. Wine, bread, and cheese are well-known foods. Curd and other fermented dairy products (such as kefir and kumys), traditional alcoholic beverages, vinegar, and pickles are also known in Central Asian countries (Prajapati *et al.*, 2003) [32]. Fermentation is a chemical process that breaks down living organisms into smaller ones using enzymes. Fermentation produces highly digestible, stable, and nutritious food. Fungus, yeast, and bacteria are responsible for fermentation. Raw foods are accidentally produced during the growth of these bacteria (Yousef *et al.*, 2003) [39]. *Streptococcus thermophilus* and *Lactobacillus delbrueckii* spp. *bulgaricus* ferment milk to create curd. Curd manufacturing as a fermented milk product began in the Middle East and has since expanded around the world. Curd is more nutritious than milk and is a good source of protein, calcium, phosphorus, riboflavin, thiamin, vitamin B12, folate, niacin, magnesium, and zinc. Lactose intolerant persons can drink curd because the lactose in milk is transformed to lactic acid during fermentation and because lactose fermenting bacteria are present in curd. In addition, consuming fermented milk products lowers the pH of the stomach, which in turn reduces the risk of pathogen transmission and the consequences of lower gastric juice output (O'connell *et al.*, 2005) [29]. Because fermented milk products are among the most popular foods in the world, they are used to provide nutritious portions of human food. Furthermore, fortification of certain goods, such as curd, is an effective approach to increase nutritional consumption in everyday foods (Grunert, 2005) [8].

Mineral and protein deficiencies caused by inadequate consumption or absorption of minerals such as calcium, iron, and zinc have been linked to a variety of human health issues such as stunted development in children, weak bones, and immune system diseases. Dietary supplementation may play a key role in solving health problems. Curd has acquired widespread public appeal because it is viewed as a nutritious food abundant in nutrients such as calcium and high-quality proteins (Mckinley, 2005) [22]. However, like other dairy products, the level of iron and zinc is very low (Minj *et al.*, 2020) [24]. Curd, because of its nature and widespread usage, may be an appropriate carrier for these minerals.

**Food fortification**

Diet supplementation is one of the most effective ways to reduce malnutrition among public health interventions. Dietary supplementation in the United States has been instrumental in eradicating goiter, rickets, beriberi, and pellagra (Bishai and Nalubola, 2002) [3].

Diet supplementation is defined as the addition of one or more essential nutrients to a diet, whether nutrients are present in the diet, intended to prevent or correct the marked deficiency of one or more nutrients in individuals or groups of individuals. Food fortification is a larger notion that may be done for a variety of reasons. It restores nutrients lost during food preparation through enrichment. In this situation, the amount of nutrients provided is about equivalent to the natural content of the food before processing. Additionally, foods can be fortified with nutrients that aren't naturally present, a process called fortification. In this situation, the amount of nutrition provided may be more than that which existed before processing. Additionally, fortification standardizes the quantities of nutrients with varying concentrations (Gunasekara *et al.*, 2011) [10].

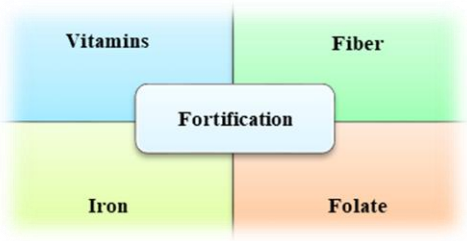


**Fig 1:** Micronutrient Deficiencies of Public Health Significance in India. (Gunasekara *et al.*, 2011) [10].

Diet supplementation is often recognized as an inexpensive long-term strategy to reduce the incidence of iron deficiency. This can take the form of "bulk drugs" in the form of fortified foods such as cereals, milk, salt, and condiments, which are consumed by both high-risk groups and those with little or no need for extra iron. The intended consolidation program, in which the food product used especially for vulnerable people is strengthened, can also be tested (Hurrell, 1997) [16].

**Definition of food fortification**

The process of introducing nutrients to foods is known by a variety of terms, including fortification, restoration, enrichment, standardization, and supplementation.

*Standardization* is the introduction of nutrients to meals to adjust for a natural fluctuation to obtain a standard amount is known as standardization. Standardization is a key step in ensuring that the end product has a constant, uniform quality.

*Restoration* is the addition of a nutrient to food in order to regain its original nutritional composition. The adding of nutrients to meals in conformity with a standard of identity as prescribed by food standards is referred to as enrichment. In both restoration and enrichment programmer, nutrients that are naturally accessible or present in the food product are commonly included.

*Supplementation* is the introduction of nutrients to meals that aren't ordinarily present or are only present in trace amounts. It is possible to include more than one nutrient, as well as large amounts of each.

*Fortification* is unique from restoration and standardization in that the nutrient given and the food selected as a carrier have met certain criteria, assuring that the fortified product will be a good source of the nutrient for a particular demographic. Nutrients introduced to fortify food may or may not have been present in the food carrier at the time of manufacture (Wirakartakusumah *et al.*, 1998) [37].

**Classical food fortification**

The basic foods, spices, and condiments can be fortified to increase the number of critical micronutrients like vitamins and minerals, hence increasing nutritional consumption. Incorporating synthetic micronutrients into meals is one approach to strengthen them. The most extensively utilized in many poor nations is fortification vehicles are among the most often used. Foods include oils and fats, milk, sugar, salt, rice, wheat, or maize flour. Some aspects of food fortification, like the amount of iron in the diet, are important to consider fortification, fortificant bioavailability and fortified quantity. The food we eat has a huge impact on our health. Food intake improves the micronutrient status of people quickly and at low cost, especially if existing technologies and local services are considered the benefits of communication. Food intake improves the micronutrient status of the people quickly and at the right cost, especially when existing technologies and regional distribution channels gain momentum. Fortification of rice has the potential to assist almost half of the global total. In terms of population intervention, rice may be considered one of the leading sources of basic food security for food security in less developed countries. Nutritional supplements may be well incorporated into flour, fortifying flour is much easier. As a result, rice flour was suggested as a good fortification. To combat vitamin A deficiency and iron deficiency, long-term interventions have been used, including fortifying cotton oil with vitamin A and iron-rich wheat flour, zinc, folic acid and vitamin B. Because various micronutrient deficits coexist in many situations, multiple micronutrient fortification looks to be more advantageous and should be investigated. This is why many fortification efforts concentrate on multi-micronutrients and vehicles that are best suited to the target group's acceptance of fortified meals. Food fortification can take many different forms, with various methodologies and procedures (Chadare *et al.*, 2019) [5].

**Historical learning and influence of food fortification**

Micronutrient deficiency is a major global problem that could affect people of any age in both developed and underdeveloped countries. Deficiency of many micronutrients was common in poor rural communities and cities in developed countries for nearly a century. They were mostly eradicated when the economic situation improved, due to a healthier lifestyle that included micronutrient-fortified meals and increased availability of animal-based foods. However, most deficiencies, such as iron and iodine, have continued, whereas others, like folic acid, B12, calcium, and vitamin D,

have emerged or resurfaced. Micronutrient deficits are significantly more severe in underdeveloped nations than in advanced nations, and they represent a serious hindrance to many countries' future growth. Iron, iodine, vitamin A, and zinc deficiencies affect around 2 million individuals worldwide, mostly women and children in undeveloped countries. Decreased brain development and cognition, as well as diminished immunity to infection, poor pregnancy rates, growth retardation, decreased work capacity, eyesight, and sometimes even death, are all consequences of these abnormalities. Nutritional deficiencies are common in the same person and are caused by a regular intake of plant-based diet plans with no or little animal source meals, and, in a particular instance of iodine and selenium inadequacies, low nutrient levels of these micronutrients due to low levels in plant and animal foods. Micronutrient intake can be increased in a number of ways. They include the fortification of basic foods, sauces, infant feeds, and some industrial goods; plant breeding strategies for biofortification of food staples; dietary variety; and pharmaceutical dosage augmentation. If micronutrient status is to be improved in underdeveloped nations, further public health measures like infection control, better sanitation and hygiene, and encouragement of breast-feeding may be required. Nutritional diversity is simpler for substantial communities that can access animal source products, while biofortification is the most favorable for low-income populations in underdeveloped countries that eat mostly locally cultivated foods and have limited or no access to processed foods. The primary goal of these food-based therapies is to avoid micronutrient deficiencies. Regular supplements with capsules and tablets providing pharmacological dosages of micronutrients could be used to prevent or treat deficiencies and have been used to deliver more vitamin A, iron, and folic acid (Mannar and Hurrell 2018) [23].

**History of curd**

Most regulatory authorities across the globe regard curd (sometimes spelled "curd" or “dahi") to be a fermented milk product that delivers digested lactose and especially specified, *Streptococcus thermophilus* and *Lactobacillus bulgaricus* are two viable bacterial strains. It is a good source of protein, calcium, potassium, phosphorus, and vitamins B2 and B12. It also acts as a stabilizing vehicle (Fisberg and Machado 2015) [6]. Dairy products are thought to have entered the human diet around 10,000-5000 BC, following the domestication of dairy animals (cattle, sheep, and goats, as well as buffalo, and camels) (Moren *et al.*, 2013) [28]. Milk, on the other hand, is rapidly deteriorating, making it unusable. Middle Eastern shepherds carried milk in bags made of internal intestines at that time. It was found that placing milk in the digestive tract caused it to thicken and sour, preserve and allow the dairy products to be stored longer (McGee *et al.*, 2004) [27]. The health advantages of fermented milk products are mentioned in Indian Ayurvedic texts going back to around 6000 BC. In Indian cuisine nowadays, there are over 700 curd and cheese items. Other than drying milk, producing curd was the only known safe technique of preserving milk for millennia. The curd is widely known throughout the Greek and Roman empires, and the Greeks were the first to describe it by writing texts around 100 BC, highlighting the corrupt use of curd. Abraham attributed his life to curdling in the Bible (the Book of Job), and refers to “the Land of Milk and Honey,” which many historians have come to understand as a reference to curd (Batmanglij 2007) [4]. The term "curd" is said to stem from the Turkish word "yog urmak," which meaning "to thicken, coagulate, or curdle". Researchers did not explain the health advantages linked with curd intake until the twentieth century. *Bacillus bulgaricus* (*L. bulgaricus*), a lactic acid bacterium utilised in curd cultures today, was identified in 1905 by Stamen Grigorov, a Bulgarian medical student (McGee, 2004) [27]. Curd is usually fermented and acidic milk with organic and well-defined bacteria, resulting in a thick, tasty product and a long shelf life. It is a stabilizing vehicle and combines essential nutrients (additional probiotics, fibers, vitamins, and minerals). Sweeteners, fruits, and flavors can all be used to change the consistency and aroma. Rice, soy, and almonds may all be used to make curd (Bodot, 2013).

**Curd consumption and health effects**

It’s the most widely consumed fermented milk product in the world, and it is frequently recognized as a healthy food. It's a nutrient-dense dish since its high in a variety of nutrients compared to the number of calories and fat it contains. Curd, for instance, may provide the body with significant amounts of calcium in a bioavailable form. Curd contains a few health benefits in addition to providing a basic diet, which includes high lactose tolerance, potential role in weight loss and fat loss, and a list of health benefits associated with probiotic microbes (Mckinley, 2005) [22]. Curd is made by fermenting milk with lactic acid and introducing the first culture of *Streptococcus thermophilus* and *Lactobacillus delbrueckii* ssp. *bulgaricus* in the mixture. In some areas, rare viruses such as *Lactobacillus helveticus* and *Lactobacillus delbrueckii* ssp. lactis is added to the original culture. Curd and other fermented milk products were created to retain nutrients in milk; however, it was quickly discovered that by fermenting with different bacteria, a range of flavors, textures, consistency, and, more recently, health features could be formed (Saubade *et al.*, 2017) [35].

Dahi is excellent in promoting health and wellbeing, according to traditional Indian medicine (Ayurveda), because of its antimicrobial property against pathogenic germs and improved nutritional digestion. As a consequence, in the current study, traditionally manufactured Indian fermented milk curd was evaluated as a probiotic for its health benefits. Since ancient times, dahi has been prescribed for the treatment of diarrhea and other acute/chronic gastrointestinal diseases. Lactic acid bacteria, which are renowned for their probiotic ability and good health impacts on individuals, are found in traditionally produced fermented milk curd. Probiotics are living microorganisms that are beneficial to humans when consumed in appropriate quantities; they are naturally found in fermented foods. Probiotic microorganisms have a long history of interaction with milk products, which provide a convenient probiotic delivery system, especially curd and fermented milk receiving the most focus as live probiotic culture carriers (Kore *et al*., 2012) [19].

Lactose intolerance is caused by a deficiency of the enzyme lactase, which inhibits lactose disaccharide in digestion. If lactose enters the large intestine without being digested, it can be digested by colonic bacteria. Constipation, diarrhea, and abdominal discomfort may all have side effects. People who are lactose intolerant are said to tolerate curd. There is no difference in the tolerance of heat-treated against fresh curds containing live bacteria, according to various studies (Mckinley, 2005) [22].

**Table 1:** Nutritional composition of curd (per 100 g)

| Component | Whole milk curd |
|---|---|
| Energy | 79 kcal |
| Carbohydrate | 7.8 g |
| Protein | 5.7 g |
| Fat | 3.0 g |
| Vitamin D | 0 |
| Calcium | 200 mg |
| Potassium | 280 mg |
| Phosphorus | 170 mg |
| Vitamin B1 (Thiamin) | 0.06 mg |
| Vitamin B3 (Niacin) | 0.2 mg |
| Vitamin B2 (Riboflavin) | 0.27 mg |
| Carotene | 21 µg |
| Folate | 18 µg |

**Source:** The Dairy Council, 2017

**Beneficial effects and uses of LAB**

Lactic acid bacteria are a kind of bacterium that aids in the production of lactic acid during the fermentation process. Due to the creation of numerous chemicals, these bacteria are utilized in the making of curd and are responsible for the flavor, color, and texture. Lactic acid bacteria create antimicrobial chemicals that can fight diseases and microorganisms that destroy food. Lactic acid bacteria have been found to have a positive impact on humans, such as aiding in the control of a variety of diseases. A sufficient amount of curd in one's regular diet can help with the following problems.

1. It protects against Helicobacter pylori and boosts immunity.
2. It improves digestion, especially in the stomach, lowers blood pressure and bad cholesterol levels, and reduces the risk of coronary heart disease.
3. It aids in the prevention of infections, osteoporosis, and problems with the female reproductive system.
4. Lactic acid produces antimicrobial compounds such as organic acids, bacteriocins, diacetyl, and hydrogen peroxide, which function as preservatives and stop hazardous putrefactive microbes from growing (Kaur *et al.*, 2017) [20].

**Fortification of micronutrients through the curd**

Curd has now been enhanced with several micronutrients to satisfy the needs of humans. One way of improving the quality and quantity of curd is to fortify it with nutrients such as minerals, vitamins, and functional additives. Furthermore, fortified yogurt improves nutritional content and helps to avoid illnesses caused by malnutrition (Gahruie *et al.*, 2015) [9].

**Fortification of dry matter**

Curd's total solids content affects its physical and rheological properties. The MSNF percentage for milk is the normal solids level for skim milk curd manufacturing; however, several varieties of concentrated curd milk bases may include more than 20% dry matter. Because of the enrichment of the basic milk, the dry matter percentage of most commercial curds is between 13 and 17 percent (Agarwal *et al.*, 2015) [1]. Enrichment can be achieved by concentrating the milk foundation or adding nonfat dry milk or additional components to the base, such as whey or casein-based protein powders. The technique of choice is governed by process constraints and ultimate product quality. The total protein concentration in curd base, regardless of the kind of protein added, is important to the rheological and physical characteristics of curd gels. The fermented gel strength increases as the protein level rise, and water mobility decreases. High amounts of whey protein, on the other hand, might influence flavor by adding to bitterness. As a result, large whey-to-casein ratios should be avoided (Agarwal *et al.*, 2015) [1].

**Vitamins fortification**

Vitamins are organic compounds that work as cofactors in the body. Fermented milk products, such as curd, provide vitamins. However, various vitamin contents in curds exist owing to the capacity of certain starters to synthesize vitamin B, which is required for their growth. As a result, depending on the starter used, curd and fermented milk products made by strains may have various vitamins (Öztürk *et al.*, 2018) [30]. Vitamin assessment is also more challenging since procedures such as heat treatment, incubation period, temperature, and storage conditions alter the vitamin content of curd, Vitamin content of full fat and nonfat curds, as well as a comparison of whole milk.

**Vitamin D fortification**

In nearly every part of the world, low vitamin D levels have become one of the most common health problems affecting people of all ages and stages of life (Zhou *et al.*, 2015) [40]. There is growing evidence that vitamin D insufficiency is not only linked to reduce calcium resorption in the gut but also to the genesis of several metabolic diseases (Avastano *et al.*, 2017) [2]. Vitamin D is a fat-soluble vitamin with a function of hormones that are widely known to regulate calcium, phosphorus, and bone metabolism. Vitamin D is essential in the prevention of insulin resistance, obesity, pre-diabetes, metabolic syndrome, cardiovascular risk, and oxidative stress (Morvaridzadeh *et al.*, 2021) [25]. As a result, by addressing specific metabolic abnormalities, this vitamin can help decrease systemic inflammation. Furthermore, data suggests that blood vitamin D concentrations in persons with NAFLD are lower than in healthy people. So yet, no research has looked at the effects of vitamin D and probiotics on persons with NAFLD. Most studies utilize nutritional supplements to assess the nutrients on illnesses, curd as a nutrient carrier to assess its act on NAFLD. Curd is a popular dairy product among Iranians (Jafari *et al.*, 2016) [18], therefore we fortified it with vitamin D and assessed the effect of the vitamin D and probiotic fortified curd on patients with NAFLD.

Low-fat dairy products that have not been fortified with vitamins A and C are poor suppliers of these nutrients. Vitamin A is often added to low-fat milk and other dairy products, but not vitamin C. Vitamin-enriched fruit juices have become very popular among health-conscious consumers as they are marketed as nutritious beverages. Enhancing milk production with vitamins A and C increases nutritional quality and, as a result, is acceptable. An empty or flavored curd is an example of a dairy product that can benefit from the strengthening of vitamins A and C. It contains less than 2% of the US RDA for both vitamins per serving (227 g), its acidity will promote vitamin C stability (Ilic *et al.*, 1988) [17], and is considered a healthy diet. The main goal is to strengthen curd-flavored curd with vitamins A and C, separately and collectively, under real production conditions at levels that provide at least 100 percent of the US recommending daily intake of both 227 grams of vitamins used during normal storage. We also investigated the effect of

vitamin supplementation on pH, acidity, and neurological features of curd throughout its normal shelf life.

**Calcium fortification**

Milk and dairy products are the most prevalent calcium sources in the diet, with 10% to 40% dietary calcium absorption. Milk and dairy products contribute around 32% of calcium absorption. A lack of calcium in the Polish people has prompted the promotion of a growing variety of calcium-fortified foods, particularly enhanced fruit drinks and dairy products (Szajnar *et al.,* 2017) [36]. During acid gel formation, milk proteins, caseins, and whey proteins create a network that forms the curd gel is formed. Changes in the balance of calcium in milk and the effect of hydrophobic interactions between milk proteins cause the gel to grow. Heat treatment of milk produces whey protein complexes and whey protein-casein complexes by denaturing the whey proteins - lactoglobulin and -lactalbumin and subsequent protein-protein interactions via disulfide bonding. Acid supplementation involves changes in the milk calcium network, resulting in the dissolution of colloidal calcium phosphate (CCP) within micelles, a decrease in the stability of your structure in both the micellar structure, and the accumulation of micelles to produce a gel network. As a result, the process of acid gelation is strongly influenced by the calcium content of milk and its distribution throughout the milk system. Calcium is found in milk in two ways: soluble (10 mM) and colloidal (20 mM), which is partially soluble (2 mM) possibly ionic (Ramasubramanian *et al.,* 2008) [34]. The elimination of colloidal calcium by filtration or acidification alters micelle structure, while the addition of a modest amount of calcium salt reduces hydration of casein micelles while increasing micellar density. Calcium extraction via ion exchange lowers Ca2+, leading to such a commensurate drop in overall calcium content of dairy and micellar breakdown once more than 50% of total calcium is removed. Lowering the pH and the concentration of calcium ions promote heat denaturation of β-lactoglobulin with preferred adherence to the casein micelle membrane during milk high-temperature treatment (Ramasubramanian *et al.,* 2008) [34]. Calcium is essential for the efficiency of many functions, and its inclusion inside the food is required for the adult system to function normally. In addition to being an essential component of skeletons, calcium, aids in the maintenance of cell organelle structure and controls internal and extracellular space equilibrium. Components include physiological situations and aspects like pregnancies, adolescence, menstruation, old age, hormonal, development factors related to calcium metabolism, disorders that impede calcium absorption, and gut microbiota. Although the supply of calcium in the body is genetic and varies from person to person, external influences can influence its composition and quality. External influences include dietary changes with specific nutrients and pharmaceutical therapy. Adequate calcium levels maintain the bones and help to avoid osteoporosis, a condition characterized by inadequate mineral bone density (Wawrzyniak and Sulibursk, 2021) [38].

**Fiber fortification**

Dietary fiber has good physical benefits such as relaxation, lowering blood cholesterol, and lowering blood sugar (AACC 2001). Milk and most dairy products have low dietary fiber. The growth of consumer knowledge about the physiological benefits of dietary fiber, as well as readily available dietary fiber preparations, has led to the successful creation of many dietary fiber-enhanced dairy products worldwide (Guggisberg *et al.,* 2009) [11]. The addition of dietary fiber to curd can give the food a variety of health advantages to the customer. Previous research has found that the source of dietary fiber influences both the sensory and textual properties of enhanced dairy products. The cell walls of fruits, vegetables, and grains contain fiber. Researchers have studied the effect of dietary fiber on curd quality. The addition of 1.32% oat fiber improved the body and texture of the curd and reduced the overall taste quality. With fiber growth, the pH increases but syneresis decreases (1.5, 3.0, and 4.5 percent by weight). Natural bran has a greater effect on balance than roasted bran, whereas pina colada flavor has a higher viscosity than pine-flavored curd (Staffolo *et al.,* (2004). Impact of commercial fiber found in apple, wheat, bamboo or Inulin investigated for sensory and rheological properties of curd. Although some rheological properties were altered, the enhanced curds were well received by customers (Hashim *et al.,* 2009) [12]. Fibers in the diet total of seven fibers were tested. Table 1 lists their origins, qualities, and supplier, as well as the label we utilized throughout the research.

**Table 2:** Characteristics, origin, and trade name of fibres that can be used for fortification. (SDF = soluble dietary fibre, IDF = insoluble dietary fibre, TDF = total dietary fibre, WHC = water-holding capacity)

| Fiber name | Commercial name | SDF (%) | IDF (%) | TDF (%) | WHC (%) |
|---|---|---|---|---|---|
| Corn | Nu 20085 Ultrafine corn bran dietary fiber | 2 | 86 | 88 | 200 |
| Sugar beet | Fibrex 585 Sugar beet fiber | 24 | 50 | 74 | 550 |
| Oat | Snowite Fine oat fiber | 2 | 88 | 90 | 310 |
| Rice | Protex 20-S Rice fiber | 22 | 20 | - | 65 |
| Soy | Tu 20070 Ultrafine soy dietary fiber | 10 | 65 | 75 | 200 |

From Angelino Reconstituted skim milk and pasteurized, homogenized whole milk standardized to 12 percent solids-non-fat and 1 percent fat is used to make curds in 1000-ml stainless steel containers. 4 percent sugar was added to all of the curds Fiber was added at a rate of 1.32 percent. The mixture was homogenised for 30 minutes in a Stomacher at 85 °C, then chilled to 42 °C before being inoculated with 0.04 percent of a concentrated frozen starting culture comprising *Lactobacillus delbrueckii* subsp. *bulgaricus* and *Streptococcus thermophilus* (1:1), and incubated at 42 °C to a final pH of 4.4 (7-8 hours). The coagulum was then broken, and the curd was mixed before being transferred aseptically to plastic cups and kept at 4 °C.

**Iron fortification**

Iron is an important micronutrient in human nutrition. It is a heme component of hemoglobin and myoglobin, and it plays a crucial role in the transport, storage, and consumption of oxygen. Iron deficiency causes anemia, changes mental development, lowers immunity, reduces cognitive scores in children, and harms reproductive outcomes (Hosseinnejad *et al.,* 2017) [13].

Curd is a great source of calcium and protein, but it has relatively little iron, as do many dairy products. Iron fortification of curd might assist achieve this dietary need. One advantage of utilizing dairy foods as a vehicle for iron supCurd is a wonderful source of calcium and protein;

however, it has very little iron, as do all dairy products. Iron fortification of curd might assist achieve this dietary need. Another benefit of using dairy foods as a form of iron supplement is that people who eat low-iron foods tend to consume more dairy products; those with high iron diets tend to consume very few dairy products (USDA, 1982). In addition, iron-containing dairy products have high iron bioavailability. It has been established that people who eat low-fat foods tend to consume more dairy products; those with high iron diets tend to consume very few dairy products. In addition, iron-containing dairy products have high iron bioavailability. However, before making any such reinforcement, the effects of iron supplementation on microbial physiology during curd production and shelf life, oxidation of milk fat, and the effect of iron on the taste and acceptance of strong curd should be determined (Hekmat *et al.*, 1997) [14]. Research on iron reinforcement in curd has been done. It is widely known that two basic flavors may be associated with strong dairy products: an oxidized flavor from iron-catalyzed lipid oxidation and a metallic flavor from iron salts. There was no evidence of oxidative rancidity in fresh bio-curd or during storage samples, although Mehanna *et al*. found it (Mehanna *et al.*, 2000) [26]. Determined iron concentration appears to have a minor effect on fresh curd enriched with iron from various sources. It was noted that the sensory quality of iron-rich dairy products varies with the type of iron used, the amount of iron supplied, and the qualifications of fortified dairy products (El-Kholy *et al.*, 2011).

**Fruits and vegetable fortification**

Fruits, vegetables, and dairy products have long been recognized as healthy diet components, as indicated by their inclusion in national dietary guides and nutritional standards across the world. It has recently been proposed that whole plant-based meals, probiotics, and prebiotics can modify the microbiota, resulting in improved heart health (Fernandez *et al.*, 2017) and (Painter J, Rah JH, Lee YK. 2002) [7, ]. Individually, fruits and curd have been recognized as indications of good eating habits. Fruits have a low energy density and a high concentration of antioxidants, prebiotic fibres and polyphenols, all of which can benefit digestive health. Curd, on the other hand, is a nutrient-dense meal that is high in dairy protein, calcium, magnesium, vitamin B-12, conjugated linoleic acid, and other essential fatty acids. It also includes helpful bacterial cultures, making it a possible source of probiotics (Fernandez, 2017) [7].

The addition of natural antioxidant components to curd is a simple technique to promote public health and/or minimize illness risk. Carrot and cantaloupe juice were used to create a curd structure with various concentrations. Milk acid mixing time combined with various concentrations of juice to achieve pH 5.2 and 4.6. The apparent viscosity was also determined. As carrot juice content grew, so did the first stress of carrot curd. During cold storage, the total carotenoid concentration of all curd samples decreased gradually. Curd kept its activity as an antioxidant through storage. The depletion of β-carotene in curd did not impede its ability to absorb peroxyl radicals, especially when low oxygen content. Curd made with carrot juice is a highly fermented milk formula that brings healthy carotenoids to the consumer. While the body has its defenses against oxidative stress by using this new product these defenses are thought to become less effective with aging as oxidative stress becomes greater (Kumari *et al.*, 2021) [21].

**Conclusion**

Curd is one of the world's most popular healthy and nutritious foods. As a result, it has the potential to deliver healthy nutrients to the human diet. According to research, the majority of people in undeveloped or underdeveloped nations suffer from micronutrient insufficiency, and enhanced food items can significantly reduce nutritional disorders. It included a list of various nutritional components and how they are used in dairy products, as well as the impact of rich foods on disease prevention or treatment. This research demonstrates that dietary enrichment can prevent or treat the majority of illnesses, particularly in young children, and has a considerable influence on community health.

**References**


1. Agarwal S, Beausire RL, Patel S, Patel H. Innovative uses of milk protein concentrates in product development. Journal of food science. 2015;80(S1):A23-A29.
2. Avastano S, Barrea L, Savanelli MC, Nappi F, Di Somma C, Orio F, *et al*. Low vitamin D status and obesity: Role of nutritionist. Reviews in Endocrine & Metabolic Disorders. 2017;18(2):215-225.
3. Bishai D, Nalubola R. The history of food fortification in the United States: its relevance for current fortification efforts in developing countries. Economic Development and Cultural Change. 2002;51(1):37-53.
4. Batmanglij N. A Taste of Persia: An Introduction to Persian Cooking. Washington, DC: Mage Publishers, 2007.
5. Chadare FJ, Idohou R, Nago E, Affonfere M, Agossadou J, Fassinou TK, *et al*. Conventional and food- to- food fortification: An appraisal of past practices and lessons learned. Food science and nutrition. 2019;7(9):2781-2795.
6. Fisberg M, Machado R. History of yogurt and current patterns of consumption. Nutrition reviews. 2015;73(1):4-7.
7. Fernandez MA, Marette A. Potential health benefits of combining yogurt and fruits based on their probiotic and prebiotic properties. Advances in Nutrition. 2017;8(1):155S-164S.
8. Grunert KG. Food quality and safety: Consumer perception and demand. European Review of Agricultural Economics. 2005;32:369-391. http://dx.doi.org/10.1093/eurrag/jbi011
9. Gahruie HH, Eskandari MH, Mesbahi G, Hanifpour MA. Scientific and technical aspects of yogurt fortification: A review. Food Science and Human Wellness. 2015;4(1):1-8.
10. Gunasekara P, Hettiarachchi M, Liyanage C, Lekamwasam S. Effects of zinc and multimineral vitamin supplementation on glycemic and lipid control in adult diabetes. Diabetes, metabolic syndrome and obesity: targets and therapy. 2011;4:53.
11. Guggisberg D, Cuthbert-Steven J, Piccinali P, Bütikofer U, Eberhard P. Rheological, microstructural and sensory characterization of low-fat and whole milk set yoghurt as influenced by inulin addition. International Dairy Journal. 2009;19(2):107-115.
12. Hashim IB, Khalil AH, Afifi HS. Quality characteristics and consumer acceptance of yogurt fortified with date fiber. Journal of dairy science. 2009;92(11):5403-5407.
13. Hosseinnejad M, Jafari SM, Ganje M. Modeling of

Changes in Physicochemical, Textural and Sensory Properties of Fortified Yoghurt with Zinc and Iron by Artificial Neural Networks. Research and Innovation in Food Science and Technology. 2017;5(4):325-336.
14. Hekmat S, Mcmahon DJ. Manufacture and quality of iron-fortified yogurt. Journal of dairy science. 1997;80(12):3114-3122.
15. Horton S, Alderman H, Rivera JA. The challenge of hunger and malnutrition. Copenhagen consensus, 2008, 3-4.
16. Hurrell RF. Preventing iron deficiency through food fortification. Nutrition Reviews. 1997;55(6):210-222.
17. Ilic DB, Ashoor SH. Stability of vitamins A and C in fortified yogurt. Journal of dairy science. 1988;71(6):1492-1498.
18. Jafari T, Faghihimani E, Feizi A, Iraj B, Javanmard SH, Esmaillzadeh A, *et al*. Effects of vitamin D-fortified low fat yogurt on glycemic status, anthropometric indexes, inflammation, and bone turnover in diabetic postmenopausal women: a randomised controlled clinical trial. Clinical nutrition. 2016;35(1):67-76.
19. Kore KB, Pattanaik AK, Sharma K, Mirajkar PP. Effect of feeding traditionally prepared fermented milk dahi (curd) as a probiotics on nutritional status, hindgut health and haematology in dogs, 2012.
20. Kaur R, Kaur G, Mishra SK, Panwar H, Mishra KK, Brar GS. Yogurt: A nature's wonder for mankind. International Journal of Fermented Foods. 2017;6(1):57-69.
21. Kumari S, Kumari R, Chaurasia SK, Jha AK, Bharti BK. Fortified yoghurt: A new and effective method to utilize probiotics benefits. 2021.
22. Mckinley MC. The nutrition and health benefits of yoghurt. International journal of dairy technology. 2005;58(1):1-12.
23. Mannar MV, Hurrell RF. (Eds.). Food fortification in a globalized world. Academic Press, 2018.
24. Minj J, Dogra S. Significance of fortification of beneficial natural ingredients in milk and milk products. In dairy processing: Advanced research to applications Springer, Singapore, 2020, 87-118p.
25. Morvaridzadeh M, Nachvak SM, Mohammadi R, Moradi S, Mostafai R, Pizarro AB, *et al*. Probiotic yogurt fortified with vitamin D Can improve glycemic status in non-alcoholic fatty liver disease patients: A randomized clinical trial. Clinical nutrition research. 2021;10(1):36.
26. Mehanna NM, Thanaa MS, Awatif SM, El-Asfory SMA. Composition and some properties of zabady made from iron-fortified buffalo's milk. Egyptian Journal of Dairy Science. 2000;28(2):183-194.
27. McGee H. Fresh fermented milks and creams. In: Dorfman P Greene J McGee A, eds. Food and Cooking: The Science and Lore of the Kitchen. New York: Scribner, 2004, 44-51.
28. Moreno Aznar LA, Cervera Ral P, Ortega Anta RM, Díaz Martín JJ, Baladia E, Basulto J, *et al*. Evidencia científica sobre el papel del yogur y otras leches fermentadas en la alimentación saludable de la población española. Nutrición Hospitalaria. 2013;28(6):2039-2089.
29. O'Connell JM, Sweeney T, Callan JJ, O'Doherty JV. The effect of cereal type and exogenous enzyme supplementation in pig diets on nutrient digestibility, intestinal microflora, volatile fatty acid concentration and manure ammonia emissions from finisher pigs. Animal Science. 2005;81(3):357-364.
30. Öztürk Hİ, Aydın S, Sözeri D, Demirci T, Sert D, Akın N. Fortification of set-type yoghurts with *Elaeagnus angustifolia* L. flours: Effects on physicochemical, textural, and microstructural characteristics. LWT. 2018;90:620-626.
31. Preedy VR, Srirajaskanthan R, Patel VB. Handbook of food fortification and health. From Concepts to Public Health Applications, 2013.
32. Prajapati JB, Nair BM. The history of fermented foods. Handbook of fermented functional foods, 2003, 1-25.
33. Pimentel TC, Cruz AG, Prudencio SH. Influence of long-chain inulin and *Lactobacillus paracasei* subspecies *paracasei* on the sensory profile and acceptance of a traditional yogurt. Journal of Dairy Science. 2013;96(10):6233-6241.
34. Ramasubramanian L, Restuccia C, Deeth HC. Effect of calcium on the physical properties of stirred probiotic yogurt. Journal of Dairy Science. 2008;91(11):4164-4175.
35. Saubade F, Hemery YM, Guyot JP, Humblot C. Lactic acid fermentation as a tool for increasing the folate content of foods. Critical Reviews in Food Science and Nutrition. 2017;57(18):3894-3910.
36. Szajnar K, Znamirowska A, Kalicka D, Zaguła G. Fortification of yoghurts with calcium compounds. Journal of Elementology, 2017, 22(3).
37. Wirakartakusumah MA, Hariyadi P. Technical aspects of food fortification. Food and nutrition bulletin. 1998;19(2):101-108.
38. Wawrzyniak, N, Suliburska J. Nutritional and health factors affecting the bioavailability of calcium: a narrative review. Nutrition Reviews. 2021;79(12):1307-1320.
39. Yousef AE, Courtney PD. Basics of stress adaptation and implications in new-generation foods. Microbial stress adaptation and food safety. 2003;1:1-30.
40. Zhou SS, Da Li NNC, Zhou Y. Vitamin paradox in obesity: Deficiency or excess. World journal of diabetes. 2015;6(10):1158.