

Health benefits of milk and functional dairy products

Abstract

Dairy products have so far been in the front line in the development of functional foods. Fermented dairy products have traditionally been considered to have health benefits and thus broadening the product range to other types of health-promoting products is quite natural for the dairy industry. Functional dairy products have recently been increasingly available in the daily-life which has gained increasing popularity in the past few years. Consumer's interest about personal health is reasons in establishing markets for functional dairy products. In the near future we will definitely see more products targeted for special consumer groups. This mini-review provides the reader with a brief overview of the field. It consists of two parts giving state-of-truth information about the following topics: Milk and its health benefits and functional dairy products. This article should be of benefit to everyone involved with food science and nutrition, research on functional dairy product, and food product development.

Keywords: milk, yogurt, health benefit, probiotics, dairy, functional products

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Introduction

Milk is considered as a nearly complete food since it is a good source of protein, fat and major minerals. Also, milk and milk products are main constituents of the daily diet, especially for vulnerable groups such as infant's school age children and old age.^{1,2} Several studies have reported the distribution and occurrence of the essential components in various animal milks³ Milk is one of the most important nutrition food sources besides breast milk for infants and babies. In fact, consumption of dairy products has recently been linked to health benefits that are the direct antitheses of diseases and complexity that related to overweight and obesity. For example, individuals that consume dairy products are more likely to have lower weight,⁴ lower blood pressure,^{5,6} and decreased risk of stroke, colon cancer⁷⁻⁹ and osteoporosis.^{10,11} There is a wide range of functional foods that were developed recently and many of them are being produced in all over the world including probiotic, prebiotic and synbiotic foods as well as foods enriched with fat-reduced, salt-reduced foods or sugar-reduced foods, antioxidants and phytosterols as shown in Figure 1.

Among these foods, probiotic functional food has exerted positive effects on the overall health. We can divide it in both probiotic dairy foods and probiotic non-dairy foods. The market of probiotic dairy foods is increasing annually. An increased demand for dairy probiotic products comes from health promotion effects of probiotic bacteria which are originally initiated from milk products, bioactive compounds of fermented dairy products and prevention of lactose intolerance. Therefore, development of these products is a key research priority for food design and a challenge for both industry and science sectors.¹² This mini-review is an attempt to show some advances that have been made connecting milk and functional dairy product.

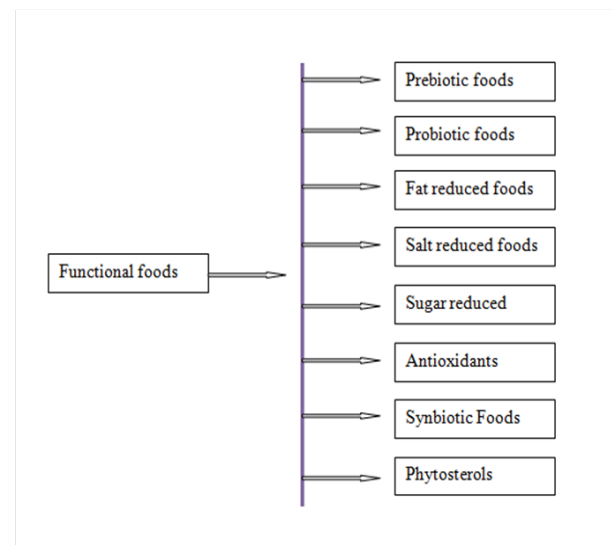


Figure 1 Most of the functional foods that being produced in all over the world.

Milk and its health benefits

Milk is a composite physiological fluid that facilitates postnatal adaptation of baby through digestive maturation simultaneously by providing the bioactive components and nutrients. It supports lymphoid tissues development and establishment of symbiotic micro flora. The importance, potency and the quantity of milk bioactive compounds are possibly more than old consideration.^{12,13} They comprise certain specific organic acids, vitamin A, B12, D, riboflavin

calcium, carbohydrates, phosphorous, selenium, magnesium, zinc, proteins, bioactive peptides and oligosaccharides. They mostly emerge during fermentation or digestive processes while in some cases these are components of fresh milk. The possible mechanisms for cholesterol decreasing or removal by probiotic bacteria and fermented dairy products include inhibition of intestinal cholesterol absorption. FAs having medium chain whey proteins and other minerals may add positive result of dairy products on body mass. The dairy proteins play a vital role in food intake regulation, satiety and metabolic distracts relating to obesity. Blood pressure may be affected by lactic acid bacteria, milk proteins, peptides and calcium. Milk fat contains certain components having the functional significance. Antimicrobial effects are exerted by sphingolipids and their active metabolites either directly or upon their digestion. They were studied as a medicine as well as an aphrodisiac and skin balm during the Middle Age. Whey proteins, i.e. α -lactalbumin, lactoferrin, lactoperoxidase, serum albumin and β -lactoglobulin acquire important biological and nutritional properties particularly regarding disease prevention. Immunostimulatory, anticarcinogenic and antimicrobial are other whey protein activities that promote health. Milk products and their components take part in regulating the body mass through satiety signals. Therefore, whey proteins include physiological milk components for individuals with metabolic syndrome and obesity. Whey protein in high protein milk products may improve insulin sensitivity and reduce fat deposition. The bioavailability of trace elements and minerals i.e. manganese, calcium, magnesium, iron, selenium and zinc is also improved by milk proteins and peptides.¹³

The health benefits of milk and dairy products are known to humanity and may be attributed to the biologically active compounds that are existing in milk. Beside the modification of several milk components, probiotics may also act directly as preventive agents, or in therapy of some severe disease. The functional role of fermented dairy products is either directly through interaction with consumed microorganisms or, indirectly, as a result of action of microbial metabolites like nutrients, generated during the fermentation process. The health promoting mechanisms of probiotic action are mostly based on the positive effect they exert on the immunity response.¹⁴

Milk facilitates the maturation of digestive tube and cell growth of a baby in gastrointestinal tract (GIT). Donovan¹⁵ reported that milk is a complex combination of nutrients such as particular bioactive saccharides, lipids and proteins content which assist to regulate the development of GIT by representing the important signals. On the other hand, Morrow et al.¹⁶ & Newburg et al.¹⁷ concluded that milk is a source of communication in case of mother and the newborn child that influences the role of mucosal immunity and minimizes the risk of infection. Milk has a wide various biologically active substances for instance, enzymes, immunoglobulins, oligosaccharides, antimicrobial peptides, hormones, cytokines, and the growth factors besides the basic saccharides, proteins and lipids as reported by Pouliot.¹⁸ Milk components are particular parts of immune system of newborn and they assist to stimulate and sustain the baby immune homeostasis. Neutrophils, macrophages and T-lymphocytes as the heterogeneous population of milk cells play an important role in the defense against pathogenic bacteria.

So far, more than 60 different enzymes are recognized in milk and during the heat treatment the most of those enzymes will destroy and become inactive. The heat processing at high level of temperatures causes not only digestion enzymes denaturation

(amylases, proteinases, phosphatases, lipases) but also digestion those enzymes having antioxidant and antimicrobial characteristics. These special characteristics are essential in milk stability as well as in the defense against pathogens; catalase, oxidoreductase, xanthine, lysozyme, dismutase, superoxide, lactoperoxidase, ribonuclease and myeloperoxidase. Milk antimicrobial agents have been shown bactericidal and even bacteriostatic behavior. They are transmitted to progeny where they protect the progeny from highly contagious disorders. Lactoperoxidase, xanthine, oxidoreductase and lysozyme are the other best protecting factors in additions to immunoglobulin.^{19,20} Lactoperoxidase assists in milk storage as well as it inhibits the propagation of psychrotropic bacteria. According to²¹ it positively affects the Gram negative catalysed coliform bacteria, pseudomonads, shigella and salmonella. Seifu et al.²² has reported that lactoperoxidase assembly is utilized as a natural preservation agent in dairy manufacturing in different regions especially tropical areas. The xanthine oxidoreductase has bactericidal effects and reduces the rate of NO_2 and results in cytotoxic nitric oxide production. It results in the production of hydrogen peroxide that acts as substrate for NADPH oxidase, and lactoperoxidase (component of proficient anti microbial systems).

Functional dairy products

Dairy products are prominent as natural healthy products that contain the most crucial elements of the balanced diet. In additions to nutritional benefits milk plays a significant role in the control of chronic diseases, example blood pressure was being 'treated' with dairy products. It may not seem obvious to discuss blood pressure in relation to weight management, but the link between dairy components and weight management was initially derived from blood pressure studies.

In Europe, dairy products are the major contributors in the functional food market by contributing approximately 60% of the total functional food spellings.²³ They are the second well-liked class of functional foodstuff in the US and the consumers spend almost \$5.0 billion on dairy functional products in 2004.²⁴ The Australian functional foods market is in its early life and is presently expected at \$57.0million where probiotic yogurt is being the head in this zone that is growing at 22% and the soy yogurt resides at second. FAO/WHO standards describe the yogurt as 'lactic acid fermentation by the activity of *Lactobacillus delbrueckii* and *Streptococcus thermophilus* (*St. thermophilus*) to produce a coagulated milk.'²⁵ Food Standards Australia and New Zealand (2006) defined low fat yogurt as 'the yogurt synthesized by culturing low fat or skim cow's milk that results in a thickened yogurt and does not have flavoring or fruit. It has 0.3% fat and 6.6% protein on average. Dairy probiotic products can be produced by incorporation of probiotic bacteria in both of fermented and unfermented mix as reported by Homayouni et al.¹² The work done on the dairy probiotic products is summarized in Table 1.

Shah³¹ quoted that fermented milk is a prepared through mixed starter fermentation by using a culture comprising of *St. thermophilus* and *L. delbrueckii*. In Australia, lactic acid bacteria are allowed to employ as a starter cultures. Consequently, some yoghurt manufacturer use *L. jugurti* and *L. helveticus* for producing of yoghurt. Conversely, the standards in US do not allow any starter culture to be used other than *St. thermophilus* and *Lactobacillus delbrueckii*. The supplementation of different fruit provision in fermented milk products further endorse the healthy image of fermented milk that

incorporate the fruits benefits. They provide antioxidants and fibre as described by O Rell.³² Recently, corn milk³³ soy milk^{34–36} and peanut milk³⁷ depending on fermented milk products are being synthesized as an alternate of vegetarian bovine milk fermented products that also overcome the allergenicity of milk protein. Furthermore, to enhance functionality of fermented milk that by addition of plant extracts such as antioxidative and tea catechin is also significantly considered.³⁸

Various essential nutrients and different components are provided by fermented milk that regulates various body functions in an optimistic way. It is confirmed by various scientific evidences that chronic disorders i.e. coronary heart disease, osteoporosis, hypertension and cancer can be controlled by the ordinary utilization of probiotic or prebiotic supplemented fermented milk. Therefore the fermented milks meet with the functional food standards.

Table 1 A summary table for dairy probiotic products

Dairy probiotic foods	Probiotic strains	Characteristics	References
Probiotic ice cream	<i>Lactobacillus casei</i> (Lc01) and <i>Bifidobacterium lactis</i> (Bb12)	Highest resistance to simulated acidic, alkaline and ice cream conditions	26, 27
Petit-suisse cheese	Bifidobacteria and lactobacilli	The presence of the prebiotics insulin and oligofructose can promote growth rates besides increased lactate and short chain fatty acids production	28sa
Conventional yoghurt	<i>L. acidophilus</i> and <i>B. bifidum</i>	Add extra nutritional and physiological values	12
Bio-yoghurt	<i>L. acidophilus</i> and <i>B. bifidum</i>	Have to retain viability and activity in yoghurt as a probiotic at consumption time.	29
Probiotic milk	<i>Lactobacillus acidophilus</i>	Remained viable in sweet acidophilus milk over 28days at 7°C	30

Conclusion

This paper reviewed and discussed some of the findings regarding the role of milk health and dairy products as functional foods. In general, dairy products provide a solid nutritional base for losing weight. Dairy's dietary minerals may play an important role by influences adipocyte metabolism through calcitrophic hormone, and decrease the energy available from fat in food products by forming undigestible complexes. The functional dairy components significantly contribute to the prevention of several diseases like hypertension, obesity, cancer, diabetes, and some transmissible diseases. On another hand, there is much kind of applications of these bioactive dairy components such as phosphopeptides are currently used as both dietary and pharmaceutical supplements. Many of the components found in milk may have a protective effect against the onset of disease that occurs as a result of overweight, As well as several components found in milk could be sort and use in especial applications for individuals that do not consume dairy or may be lactose intolerant.

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Conflict of interest

The author declares no conflict of interest.

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