



FUNCTIONAL DAIRY FOODS: MAKING HEALTHY EATING EASIER

SUMMARY

Functional foods are generally described as foods and beverages that provide health benefits beyond their inherent nutritional value. An increasing variety of functional dairy products are appearing in the dairy case. Some examples include milks, yogurts, and cheeses enriched with omega-3 fatty acids or plant stanols/sterols to help reduce the risk of heart disease, and dairy products with probiotics (“friendly” bacteria) and prebiotics to enhance digestive health.

Increased understanding of the cardioprotective effects of omega-3 fatty acids, particularly eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) derived from microalgae, fatty fish, and fish oils has led to their inclusion in various foods including dairy products. Based on the level of evidence, the Food and Drug Administration (FDA) permits some foods and beverages to display the following “qualified health claim” on their label, “supportive but not conclusive research shows that consumption of EPA and DHA omega-3 fatty acids may reduce the risk of coronary heart disease.” Some dairy products enriched with omega-3 fatty

acids may also carry structure/function claims, such as “omega-3 fats help reduce triglyceride levels,” which do not require prior FDA approval.

Plant stanols or sterols, when consumed in sufficient amounts, reduce blood cholesterol levels. Sufficient data of their efficacy and safety exist so that the FDA permits food manufacturers to display a health claim for plant stanols, or their esters in reducing the risk of coronary heart disease on product

labels. Some recent studies demonstrate that adding plant sterols to low-fat milk has beneficial effects on blood lipid levels.

A number of dairy products, particularly yogurts and kefir as well as some cheeses, are enriched with probiotics and/or prebiotics to enhance digestive health. Probiotics are live microorganisms (e.g., strains of different species of *Lactobacillus* or *Bifidobacterium*) that when consumed in adequate amounts confer a health benefit. A prebiotic is a nondigestible food ingredient (e.g., inulin) that stimulates the growth and/or activity of health-supporting bacteria such as bifidobacteria.

Research findings demonstrate that specific probiotics and/or prebiotics have beneficial effects on various intestinal functions (e.g., intestinal transit time, lactose digestion) and disorders (e.g., constipation, diarrhea, irritable bowel syndrome, inflammatory bowel syndrome). However, the positive effects of probiotics depend on the specific strain, species, and genera of the bacteria used and its dose. FDA has not approved any health claims for probiotics or prebiotics. However, structure-function claims (e.g., “promotes a healthy digestive system”) can be made if such claims are supported by an appropriate amount of science, are truthful, and are not misleading.

To help consumers make informed choices, some manufacturers provide information about the specific probiotic(s) and its dose on the product label and a web site where published studies documenting efficacy can be found.

Enhancing the already healthful attributes of dairy products with physiologically active components provides an option for individuals to help meet their specific health needs. D

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INTRODUCTION

Increased consumer interest in improving overall health and reducing risk for specific diseases has fueled the demand for foods and beverages that provide health benefits beyond their traditional nutritional value (i.e., so-called functional foods) (1,2). Although most Americans (80%) rate their health as “excellent,” “very good,” or “good,” significantly fewer (59%) are satisfied with their health status, according to the 2008 International Food Information Council (IFIC)'s survey on *Consumer Attitudes Toward Food, Nutrition & Health* (2). This gap indicates that even though many Americans consider themselves to be healthy, they also believe that there is room for improvement (1). In fact, more Americans today (67%) are making changes to improve the healthfulness of their diet than in 2006 (57%) (1).

Consistent with consumers' efforts to improve the healthfulness of their diets, there is growing interest in consuming functional foods or beverages to improve heart health, digestive/gastrointestinal health, immune function, and overall health and wellness, among other benefits (1).

According to a 2007 IFIC survey on functional foods/foods for health, more than 80% of survey participants said that they are currently consuming or would be interested in consuming foods or beverages with added health benefits (1). When asked to name the top functional foods that they would be interested in consuming for desired health benefits, consumers ranked milk third (1).

The dairy industry has responded to consumers' awareness of and interest in functional foods by enhancing the already healthful attributes of milk, yogurt, and cheese with specific physiologically active components (3-5). Examples include omega-3 fatty acids and plant sterols/stanols for cardiovascular health and probiotics and prebiotics for digestive health. An increasing number of value added dairy products tailored to meet the needs of specific age groups from young childhood to older adulthood are available in the U.S. dairy case (4).

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This *Digest* discusses functional foods for health in general, and value added dairy foods designed to protect heart health, improve digestive/gastrointestinal health, and provide other health benefits. Several value added dairy products are identified as examples only and are not intended to be an endorsement.

FUNCTIONAL FOODS

Although undefined under current U.S. food regulations, functional foods are generally considered to be foods or beverages that provide health benefits beyond their inherent nutritional value (6). Conventional foods marketed for specific health benefits (i.e., functional foods) are subject to the same regulatory requirements of any other food (6,7). The U.S. Food and Drug Administration (FDA) regulates food products according to their intended use and the nature of claims made on the package (6). Health-related statements or claims allowed on foods containing functional components for health include nutrient content claims, structure-function claims, qualified health claims, and health claims (7). For information on these types of claims, readers are referred to FDA's updated *Guidance for Industry. A Food Labeling Guide* (7).

In its position statement on functional foods, the American Dietetic Association (ADA) states that functional foods “have a potentially beneficial effect on health when consumed as part of a varied diet on a regular basis, at effective levels” (6). The ADA recommends that functional foods be regulated to ensure that products are safe, that good manufacturing practices have been followed, and that all label claims are truthful, not misleading, and based on significant scientific agreement (6).

FUNCTIONAL DAIRY FOODS FOR HEART HEALTH

Heart-related and circulatory conditions (e.g., general heart health, blood pressure, high cholesterol) are top health concerns, reported by more than half (53%) of consumers, according to a recent IFIC survey (1). The number of Americans concerned about their blood cholesterol

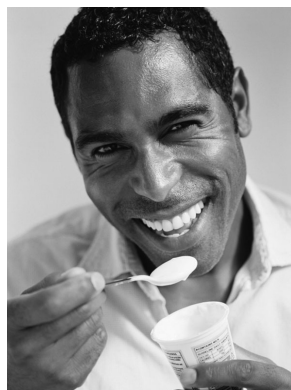
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levels has doubled since 2000, climbing from 5% in 2000 to 13% in 2007 (1). Cardiovascular disease is the leading cause of morbidity and mortality in the U.S. (8).

The dairy industry has introduced a number of functional dairy foods targeted to consumers concerned about heart health (5). Research linking omega-3 fatty acids, particularly eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), and plant stanols/sterols with heart health has led to their inclusion in a variety of dairy foods. For example, Omega Farms has introduced a full line of dairy products containing 75 mg of EPA and DHA omega-3 fatty acids per serving – milks (1% low fat white, 1% low fat chocolate), cheese (mild Cheddar, Monterey Jack), and yogurt (www.megsomegafarms.com). Kemps Plus Healthy Lifestyle milk (www.kemps.com), Farmland Dairies Special Request 1% Plus milks (www.farmlanddairies.com), and Horizon Organic DHA Omega-3 milk (www.horizonorganic.com) are other dairy products containing omega-3 fatty acids. Kroger's Active Lifestyle in-house brand fat-free milk is an example of a cholesterol-reducing milk containing plant sterols (www.kroger.com). Also, Lifeline Food Company has introduced Lifetime cholesterol-reducing low fat cheeses containing plant sterols (www.lifetimecheese.com).

Omega-3 Fatty Acids. Omega-3 fatty acids are highly unsaturated fatty acids including alpha-linolenic acid (ALA) from plant sources (e.g., flaxseed, soybeans, walnuts, and canola and soybean oils), and EPA and DHA from fatty fish (e.g., mackerel, salmon, tuna, trout), fish oils, and microalgae (9). The most compelling evidence for the cardioprotective effects of omega-3s is attributed to EPA and DHA which are readily absorbed. Although the body can metabolically convert ALA into EPA and DHA, this conversion is inefficient and variable (9). For this reason, preformed DHA and EPA are preferred for heart health.

Accumulating scientific evidence indicates that omega-3 fatty acids, particularly EPA and DHA, have beneficial effects on many cardiovascular disease end-points, including stroke, ischemia, cardiac arrhythmias, sudden cardiac death, and all-cause mortality (10-12). The long chain omega-3



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fatty acids EPA and DHA have been demonstrated to reduce blood triglyceride levels, blood pressure, and inflammation, and stabilize heart rhythm (10,13-20). Double-blind, randomized controlled studies in hypertriglyceridemic men at increased risk for cardiovascular disease showed that intake of 3 g/day of DHA reduced concentrations of some atherogenic lipids and lipoproteins and increased concentrations of some cardioprotective lipids (19,20).

To help prevent coronary heart disease, health professional organizations recommend two servings of fatty fish per week (approximately 8 ounces total), which provide about 500 mg of EPA and DHA per day (8,9,21,22). The American Heart Association recommends 1 g/day of DHA plus EPA for adults with coronary heart disease and 2 to 4 g/day for patients who need to lower triglyceride levels (22). Intake of more than 3 g of omega-3 fatty acids from supplements should be done only under a physician's care (22).

For individuals who do not eat fish and/or need to increase their intake of omega-3 fatty acids, functional dairy foods with DHA and EPA can help increase intake. FDA has authorized a qualified health claim for DHA and EPA omega-3 fatty acids and risk of heart disease (7). For products that meet the qualifying criteria, the label may state, "Supportive but not conclusive research shows that the consumption of DHA and EPA omega-3 fatty acids may reduce the risk of coronary heart disease," followed by the amount of DHA and EPA in the product.

Plant Stanols/Sterols. There is significant scientific agreement that plant stanols/sterols can lower low density lipoprotein (LDL) cholesterol when consumed in sufficient quantities (~ 2 g per day) (8,23,24). For people with elevated blood cholesterol levels, the American Heart Association and the National Cholesterol Education Program's Adult Treatment Panel III recommend plant and sterol-containing foods with meals every day as part of a heart-healthy diet (8,23). Sufficient data supporting the efficacy and safety of plant sterols or stanols or their esters led the FDA to authorize a health claim related to their intake in reducing the risk of coronary heart disease on qualifying products such as

fat-free milk with plant sterols or stanols (6,7).

Although margarines and spreads are the first and predominant product category to add stanols/sterols, some dairy products are now being enriched with these functional ingredients. Recent studies have shown that adding plant sterols to milk has beneficial effects on blood lipid levels (25,26). A randomized blind trial found that consumption of phytosterol-enriched milk (2 g/day) for 15 days reduced plasma levels of total and LDL cholesterol in both healthy and hypercholesterolemic adults (25).

FUNCTIONAL DAIRY FOODS TO IMPROVE DIGESTIVE HEALTH

Digestive health is positioned to become the largest segment of the functional foods market worldwide (27). In Europe and Asia and more recently in the U.S., probiotics and prebiotics are being added to an increasing number of foods, particularly dairy foods, to improve digestive/gastrointestinal health and provide other health benefits.

Some examples include Dannon's Activia lowfat yogurt containing its proprietary culture, *Bifidus Regularis* (scientifically known as *Bifidus animalis* DN-173 010), with the claim that it "helps regulate the digestive system when eaten daily for two weeks" (www.activia.com); Dannon's DanActive probiotic-cultured dairy drink containing 10^{10} *Lactobacillus casei* Immunitas (scientifically known as *Lactobacillus casei* DN-114 001) per serving that claims to "help strengthen the body's defenses" and "go to work directly in the digestive tract, where about 70% of the immune system is located" (www.danactive.com); Dannon's Danimals drinkable yogurt with *Lactobacillus* GG probiotic targeted to kids to enhance their digestive and immune health (www.danimals.com); and Yoplait's Yo-Plus, a lowfat yogurt with a unique blend of probiotic bacteria (*Bifidobacterium lactis* BB-12) and a prebiotic (i.e., inulin) to "help naturally regulate digestive health" (www.Yo-Plus.com).



Based on research findings, specific probiotics (health-promoting bacteria) are being added to dairy products to improve digestive health. However, the beneficial effects of probiotics depend on the particular probiotic used and its dose.

Some cheeses with probiotics or prebiotics are also available to improve digestive health. For example, Kraft has launched LiveActive natural cheese snacks, cubes, and sticks with the probiotic culture, *Bifidobacterium lactis*, and cottage cheese with 3 g of the prebiotic fiber inulin in each 4-oz cup for digestive health (www.LiveActiveFoods.com).

Probiotics and Prebiotics.

Although there is no regulatory definition, probiotics are generally described as live microorganisms (e.g., specific species and strains of *Lactobacillus* or *Bifidobacterium*), that when consumed in adequate numbers, confer a health benefit to the host (28). Prebiotics are nondigestible food ingredients (e.g., fructans such as inulin and galacto-oligosaccharides found naturally in small amounts in onions, bananas, wheat, and other whole foods) that stimulate the growth and/or activity of health-promoting bacteria such as certain species and strains of bifidobacteria and lactobacilli (28-30). Symbiotics are a combination of prebiotics and probiotics.

Fermented dairy foods such as yogurt, kefir, and cheese are the most common conventional foods marketed with probiotics. In fact, dairy products are ideal delivery vehicles for probiotics because they contain nutrients important to the survival of probiotic species and help buffer stomach acid which increases the chance that the bacteria will survive into the intestine (28). The refrigerated storage of dairy products also helps maintain probiotic and prebiotic stability (28).

Most health effects of probiotics and prebiotics are related directly or indirectly (i.e., via the immune system) to sites of action in the gastrointestinal tract (29). Numerous research studies suggest that specific probiotics have beneficial effects on different intestinal functions (e.g., intestinal transit, immune function) and disorders (e.g., constipation, bacterial infections, diarrhea, irritable bowel syndrome, inflammatory bowel disease) (28,29,31-34). Findings from a meta-analysis of data from

34 randomized placebo-controlled trials evaluating the effectiveness of specific strains of probiotic bacteria on different types of acute diarrhea found that they reduced antibiotic-associated diarrhea by 52%, travelers' diarrhea by 8%, and acute diarrhea of diverse causes by 34% (33). The protective effect of these probiotic bacteria against acute diarrhea was greater for children than for adults (33). For more information on the health benefits of probiotics, readers may refer to www.usprobiotics.org.

Consuming yogurts with the live, active starter cultures, *Lactobacillus bulgaricus* and *Streptococcus thermophilus*, has been shown to help lessen symptoms of lactose intolerance (31). The presence of the National Yogurt Association's "Live Active Cultures" seal (www.aboutyogurt.com) on yogurts provides consumers with assurance that the product contains a certain number of starter culture bacteria at the time of manufacture. In addition to the above starter cultures, probiotic bacteria such as *L. acidophilus* and bifidobacteria may be added to yogurts, but their benefit is less consistent than that achieved for yogurt starter cultures (31). Although the "Live Active Cultures" seal does not include information on these added probiotics, some yogurt manufacturers may provide this information.

The health effects of probiotics depend on the specific strain, species, and genera of the bacteria used (e.g., for the strain *Lactobacillus rhamnosus* GG, the genus is *Lactobacillus*, the species is *rhamnosus*, and the strain designation is GG) and its potency (number of viable bacteria per dose) (28). At present, there are no FDA approved health claims for probiotics or prebiotics (35). However, structure-function claims (e.g., "promotes a healthy digestive system"), which do not require pre-approval by FDA, can be made if such claims are supported by consistent results from well-designed, placebo controlled studies, are truthful, and are not misleading (7).

To help consumers and health professionals choose among the



Incorporating functional dairy products into a varied diet is an option to help individuals improve their nutritional status, reduce the risk of specific diseases/disorders, and achieve overall health.

increasing number of food products containing probiotics, some manufacturers provide information on their product labels or web sites (e.g., www.activia.com, www.danactive.com). This information may include the specific probiotic(s) used, the amount of viable microbes in a serving of the product through the end of its shelf life, and published studies that substantiate the benefits claimed for the product. For example, Dannon provides web sites with information from studies demonstrating that its *Bifidus Regularis* (www.activia.com) reduces transit time through the gastrointestinal tract in older adults in a dose-dependent fashion (36-38) and that its *Lactobacillus casei* Immunitas (www.danactive.com) reduces the incidence and severity of diarrhea (39-42) and increases resistance to infections (43). In the absence of a web site, some manufacturers may provide a toll-free number which consumers are encouraged to call to obtain information about the product.

OTHER HEALTH BENEFITS

Research findings suggest that long chain omega-3 fatty acids, particularly DHA, play a role in neural and visual health throughout life (11,44-54). Brain and retina tissues are especially rich in DHA (44). Based on DHA's essentiality for normal neural development, food products including dairy products containing DHA have been introduced. Some examples of these products include Stonyfield Farms YoMommy yogurt which provides 32 mg of DHA per 4 ounce serving (www.stonyfield.com) and General Mills Yoplait Kids yogurt which contains 16 mg of naturally sourced DHA per serving (www.yoplaitkids.com). Emerging research suggests that DHA may reduce the risk of neuropsychiatric disorders (e.g., depression, dementia including Alzheimer's disease) in adult years (44,46,52-54).

Although dairy products (i.e., milk, yogurt, and cheese) are recognized as an important source of calcium, vitamin D, potassium, and other nutrients for bone health (21), additional calcium, as well

as vitamin D and the prebiotic inulin which both increase calcium absorption, are being added to some dairy products to help optimize bone health.

CONCLUSION

The increased availability of value added dairy foods is consistent with consumers' needs and desires for products to meet their specific health needs such as reduced risk of heart disease or improved digestive health. The growth in functional dairy products creates both opportunities and challenges for health professionals.

Given consumers' interest in functional foods for health (1), nutrition and health professionals have a window of opportunity to communicate how value added dairy foods can be part of an overall healthful diet that meets an individual's specific health needs. Dairy foods are naturally nutrient rich and can be tailored to meet specific health needs through the addition of functional ingredients. **D**

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RELATED RESOURCES

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■ National Dairy Council's *Quick Reference Guide: Nutrition Claims on Dairy Products*

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■ Understanding Nutrition Claims on Food Labels. *Dairy Council Digest* 78(1), 2007.

■ Probiotics: Considerations for Human Health. *Dairy Council Digest* 76(1), 2005.

■ Functional Foods: An Overview. *Dairy Council Digest* 70(6), 1999.

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