



HEALTH BENEFITS OF DAIRY FOODS: AN UPDATE

SUMMARY

Numerous studies published within the past year or so add to the accumulating body of evidence suggesting that dairy products may help reduce the risk of osteoporosis and hypertension, achieve and maintain a healthy body weight, and have a beneficial role in cardiovascular disease, type 2 diabetes, and the metabolic syndrome (also called insulin resistance syndrome).

The bone health advantage of food sources of calcium (primarily dairy products) compared to calcium supplements was recently demonstrated in a cross-sectional study of healthy postmenopausal women. Other recent studies support a favorable effect of dairy products on bone health. Researchers attribute this beneficial effect to many nutrients in milk (e.g., calcium, vitamin D, protein, phosphorus, magnesium, potassium, zinc, vitamins A, C, and K) that support bone health. A number of government and health professional organizations encourage three daily servings of dairy products for bone health.



New observational studies demonstrate the blood pressure-lowering effect of dairy products and support findings from the previous landmark DASH (Dietary Approaches to Stop Hypertension) trial. The American Heart Association, in its recent guidelines to prevent and treat hypertension, supports the DASH dietary pattern which includes three servings of low-fat dairy foods.

Some new epidemiological studies add to the emerging scientific

evidence indicating that calcium intake, and particularly consumption of dairy products, may result in small beneficial shifts in body weight and body fatness, which in turn may help achieve and maintain a healthy body weight. For example, a study demonstrated that young, normal weight women who consumed at least three servings of dairy foods a day gained less body fat over 18 months than those who ate fewer than three servings a day.

Recent investigations suggest that consuming dairy foods or dairy food nutrients such as calcium and vitamin D may protect against cardiovascular disease, particularly by their effect on risk factors (e.g., hypertension, obesity, high blood cholesterol levels). The American Heart Association, in its recent healthy lifestyle recommendations for the general population and in its guidelines for cardiovascular disease prevention in women, encourages consumption of low-fat and fat-free dairy products as part of a heart-healthy diet.

According to a recent review and meta-analysis of observational and clinical trials, consuming adequate amounts of calcium, vitamin D, and dairy products may help prevent type 2 diabetes. Emerging epidemiological findings also link higher intake of dairy products with reduced risk of the metabolic syndrome, a risk factor for cardiovascular disease and type 2 diabetes.

Low-fat and fat-free milk and milk products are one of the 2005 Dietary Guidelines' "Food Groups to Encourage." This is not surprising given the high nutrient density of dairy products, their emerging beneficial role in health promotion and disease prevention, and many Americans' low dairy food intake.



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INTRODUCTION

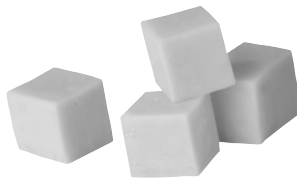
Milk and other dairy products such as cheese and yogurt are naturally nutrient-rich foods, supplying a high concentration of many nutrients in relation to their energy (caloric) content (1). Consuming dairy products is associated with overall diet quality and adequacy of intake of many nutrients, including calcium, potassium, magnesium, zinc, iron, riboflavin, vitamin A, folate, and vitamin D (2,3). The 2005 Dietary Guidelines for Americans identifies seven nutrients low in the diets of children and adults (2). Dairy foods, such as milk, cheese, and yogurt, supply four (i.e., calcium, potassium, magnesium, and vitamin A) of these seven nutrients for adults, and three (i.e., calcium, magnesium, and potassium) for children. Moreover, low-fat and fat-free milk and other dairy products are one of the “Food Groups to Encourage” identified in the Dietary Guidelines to help consumers meet nutrients lacking or low in their diets (2).

Each year, findings from new scientific studies add to the accumulating body of evidence supporting the health benefits of dairy foods. This past year has been no exception. Numerous studies have demonstrated that consuming dairy products or dairy nutrients (e.g., calcium, vitamin D) helps to reduce the risk of osteoporosis and hypertension, achieve and maintain a healthy body weight, and may have a beneficial role in the prevention of cardiovascular disease, type 2 diabetes, and the metabolic syndrome.

This *Digest* highlights some new scientific studies supporting a beneficial role for dairy foods in health promotion and disease prevention. Recent dietary guidance supporting consumption of dairy foods is also identified. For more information, particularly including previous studies, readers are referred to recent comprehensive reviews (4,5).

DAIRY'S HEALTH BENEFITS: A LOOK AT NEW STUDIES

Bone Health & Osteoporosis Prevention. Adequate intake of calcium-rich foods such as milk and other dairy products throughout life helps to



Calcium from food, primarily dairy products, is associated with greater bone mineral density than calcium from supplements, according to a study in postmenopausal women.



reduce the risk for osteoporosis (6). This bone-thinning disease affects 44 million adults over the age of 50 (6). Although 80% of adults with osteoporosis are women, the disease also affects men and occurs in all races and ethnic groups (6). Calcium and vitamin D have long been known to be beneficial for bone health. This is understandable considering that 99% of the body's calcium is stored in bones and vitamin D increases calcium absorption. In addition to calcium and vitamin D, other nutrients in dairy foods such as protein, phosphorus, magnesium, potassium, zinc, and vitamins A, C, and K support bone health (6,7). Based on studies demonstrating the constructive interaction of protein and calcium on bone, the balance (and amounts) of protein and calcium in dairy foods appears to be ideal for skeletal health (8).

Food sources of calcium compared to calcium supplements may have a bone health advantage, as recently demonstrated in a cross-sectional study of 168 healthy postmenopausal women (9). One-week diet records were used to divide the subjects into three groups based on their major source of calcium intake: diet (primarily dairy foods), supplements, or a combination of diet and supplements (9). Women in the dietary calcium group not only had a greater bone mineral density, but they also experienced a bone-favorable shift in their estrogen metabolism compared to women who obtained their calcium from supplements. Interestingly, these advantages of dietary calcium occurred despite a lower average daily calcium intake compared to the supplement group (9). The researchers suggest that calcium-rich foods should be encouraged for those at risk of bone loss (9).

Other recent studies support a favorable effect of dairy products on bone health (10,11). Researchers in Greece reported beneficial changes in pelvis, total spine, and total body bone mineral density in postmenopausal women who consumed recommended intakes of calcium and vitamin D from fortified dairy products for one year (10). Further, these changes were more favorable than those observed in women who increased their calcium intake from supplements. The researchers

attributed the beneficial effect of dairy foods not only to calcium and vitamin D, but also to other nutrients in dairy foods important for bone metabolism, such as potassium, magnesium, and vitamin A (10).

Avoiding or restricting intake of dairy foods has been shown to adversely affect bone health (12,13). In an investigation in the U.S., restricting intake of dairy foods due to perceived milk intolerance in girls as young as 10 years was associated with a lower intake of dietary calcium and milk and a significantly lower spinal bone mineral content than in girls without perceived milk intolerance (13). Interestingly, when girls who reported perceived milk intolerance completed a breath hydrogen test, more than half (55%) were not lactose maldigesters (13).

Recognition of Americans' low intake of calcium and dairy foods (14-16), as well as the importance of dairy foods and dairy food nutrients in bone health (6), has led government and health professional organizations (e.g., the 2005 Dietary Guidelines, the 2004 Surgeon General's report on Bone Health and Osteoporosis, the National Medical Association, the American Academy of Pediatrics) to recommend consumption of at least three servings of low-fat or fat-free dairy foods such as milk, cheese, and/or yogurt a day (2,6,17,18). Recently, the American Menopause Society, in an updated position statement, states "The best source of calcium is food, and the best food source is dairy products" (19). This position statement encourages postmenopausal women to consume 3 cups of milk or equivalent milk products daily as the best way to meet their Dietary Reference Intake of 1,200 mg of calcium/day (19,20).

Blood Pressure Reduction & Prevention of Hypertension.

Hypertension or uncontrolled high blood pressure, which increases the risk for cardiovascular disease and stroke, affects at least 65 million U.S. adults (21). The importance of dairy foods and dairy food nutrients such as calcium, potassium, and magnesium in the prevention and treatment of hypertension has received widespread attention since the landmark DASH (Dietary Approaches to Stop Hypertension) trial (22).



Consuming recommended servings of low-fat or fat-free dairy foods may help reduce the risk of hypertension, promote a healthy body weight, have a beneficial effect on cardiovascular disease risk factors, and lower the risk of type 2 diabetes.



This multi-center, government sponsored feeding trial showed that a low fat diet rich in low-fat dairy foods (three servings/day) and fruits and vegetables (eight to ten servings/day) (i.e., the so-called DASH diet) was more effective in reducing systolic and diastolic blood pressure than a diet rich in fruits and vegetables alone (22). Moreover, the reduction in blood pressure associated with the DASH diet was particularly effective for individuals with hypertension and matched that achieved with some antihypertensive medications (22).

Recent observational studies add to the evidence indicating that dairy foods and dairy food nutrients such as calcium help to maintain normal blood pressure (23,24). A cross-sectional study among 4,797 adults enrolled in the National Heart, Lung, and Blood Institute Family Heart Study found that consuming three or more servings of dairy foods a day was associated with a significantly lower systolic blood pressure and prevalence of high blood pressure when compared to consuming less than one-half serving of dairy foods a day (23).

Dairy products and dietary calcium were both significantly and independently associated with lower levels of systolic blood pressure in a cross-sectional survey of 912 middle-aged French men enrolled in a multi-center study of cardiovascular disease risk factors (24). The systolic blood pressure-lowering effect was enhanced when intakes of both calcium and dairy products were increased. Recent investigations that have examined the effect of dairy product consumption on the metabolic syndrome and its components report a beneficial effect of dairy products on blood pressure (25,26). Also, researchers in the United Kingdom found that blood pressure was reduced in women who consumed a dietary pattern that included low-fat dairy foods, fruits, and vegetables (i.e., similar to the DASH diet) (27).

The role of the DASH diet (which includes dairy foods) in blood pressure control is supported by government and health professional organizations (2,28-30). For example, the American Heart Association, both in its 2006 guidelines to prevent and treat hypertension (29) and in its 2006 diet and healthy lifestyle recommendations to

prevent heart disease (30), reinforces the benefits of the DASH dietary pattern.

Achieving and Maintaining a Healthy Body Weight.

The prevalence of obesity and overweight in the U.S. has increased dramatically over the past three decades. An estimated 75% of adults and nearly 24% of children and adolescents will be overweight or obese by 2015 if the current rate of increase continues (31). It therefore is not surprising that efforts are underway to reverse this trend.

In a recent study, researchers from Purdue University found that young, normal weight women ages 18 to 30 years who consumed at least three servings of dairy foods a day (1,000 to 1,400mg of dairy calcium) gained less body fat over 18 months than young, normal weight women who ate fewer than three servings of dairy foods a day (32). This follow-up study of the effect of a one-year dairy product intervention on fat mass found that the women continued to consume higher amounts of calcium-rich dairy foods for at least six months once they had established this dietary habit during the previous year. The researchers suggest that, while the short-term effect on body composition in normal weight women may be small, maintenance of higher dairy calcium intakes may lead to prevention of slow age-related fat mass gain (32). Other studies suggest that increasing intake of dairy foods or dairy food nutrients such as calcium and vitamin D may help prevent weight gain or be beneficial for weight maintenance (33-35).

Additional studies report a favorable effect of dairy foods or calcium consumption on body composition and weight loss (36-38). For example, in a secondary analysis of data from a study involving 259 overweight diabetic patients, a higher intake of low-fat dairy products in patients on a calorie-restricted diet enhanced weight loss over a six-month period (38). The researchers concluded that "a diet rich in low-fat dairy products seems highly appropriate for weight loss among diabetic patients" (38).



Consuming adequate amounts of milk and other dairy foods is emerging as a potential strategy to prevent the metabolic syndrome and its components. Individuals with the metabolic syndrome are at increased risk for cardiovascular disease and type 2 diabetes.



Cardiovascular Disease. Dairy products have been alleged to contribute to cardiovascular disease because they are sources of cholesterol and saturated fat. However, there is little scientific evidence that dairy products consumed in recommended amounts increase the risk of cardiovascular disease (39). In fact, some studies suggest that consuming dairy foods or dairy food nutrients/components such as calcium, vitamin D, bioactive peptides, and conjugated linoleic acid may have a protective effect (40-43). A case-control study in Greece involving 848 patients with a first, non-fatal event of an acute coronary syndrome and 1,078 controls found that consumption of dairy products was associated with a significantly lower risk of acute coronary events, even after controlling for several confounding factors (40). In another study in Greece, an osteoporosis prevention intervention including three servings of fortified, low-fat dairy products a day and a biweekly nutrition education program for five months had a beneficial effect on cardiovascular disease risk factors (e.g., body mass index, systolic blood pressure, total and LDL cholesterol levels) in women (41).

Other recent studies suggest that dairy food nutrients such as calcium and vitamin D may reduce cardiovascular disease risk by their beneficial effect on blood lipid levels (42,43). In 63 overweight or obese women with initially low calcium intakes (<800mg/day), increased calcium and vitamin D intake improved blood lipid and lipoprotein profiles during a 15-week weight loss intervention, with some of these changes being independent of changes in body composition (42). Another investigation in 19 moderately overweight men aged 18 to 50 years found that a high intake of calcium from dairy products (milk and low-fat yogurt) was more effective than calcium supplements in lowering the amount of fat released into the bloodstream after a high-fat (39% of calories) meal (43). Based on their findings, the researchers suggested that a long-term intake of calcium from dairy products may have beneficial effects on

the blood lipid profile, thereby reducing the risk of cardiovascular disease (43).

Low-fat and fat-free milk and other dairy products should be included in a heart-healthy diet, according to the American Heart Association's 2006 diet and lifestyle recommendations for the general population (30) and its 2007 guidelines for cardiovascular disease prevention in women (44).

Type 2 Diabetes. Recent epidemiological studies link dairy foods and/or calcium consumption with reduced risk of type 2 diabetes (45-48). A 10-year prospective study of more than 37,000 middle-aged women without diabetes who participated in the U.S. Women's Health Study found that women with the highest dairy intake (>2.9 servings/day) had a 21% lower risk for type 2 diabetes than those who consumed less than 0.85 servings/day after adjusting for potential confounding factors (46). Every extra daily serving of dairy foods was associated with a 4% lower risk of type 2 diabetes. This inverse association was mainly attributed to intake of low-fat dairy foods (46). Similar findings have been reported in men (47). Each additional serving of dairy foods reduced men's risk of diabetes by 9% (47).

Although the mechanism(s) remains to be elucidated, dairy products contain a number of components that may support the inverse relationship between dairy consumption and type 2 diabetes (45,49-51). A recent review and meta-analysis of observational and clinical trials of calcium and vitamin D and glucose homeostasis in adults suggests that consuming adequate intakes of calcium, vitamin D, and dairy products may help prevent type 2 diabetes possibly by promoting beta cell function or improving insulin response (45). Other nutrients in dairy foods such as magnesium and bioactive peptides with insulin-stimulating properties may also contribute to the inverse association between dairy food consumption and type 2 diabetes (50,51).

The Metabolic Syndrome.

Emerging epidemiological findings

New studies add to an accumulating body of scientific evidence supporting the recommendation to consume at least 3 cups of low-fat or fat-free milk or equivalent milk products (cheese, yogurt) each day as part of a healthful diet.



indicate that consuming adequate amounts of dairy products may reduce the risk of the metabolic syndrome (also called insulin resistance syndrome), a risk factor for cardiovascular disease and type 2 diabetes. The metabolic syndrome is described as a cluster of metabolic disorders including two or three of the following: abdominal obesity, atherogenic dyslipidemia (high blood triglyceride and low HDL cholesterol levels), high blood pressure, insulin resistance, a proinflammatory state, and a prothrombotic state (52). The recent increase in this syndrome has drawn attention to identifying strategies to prevent and treat this disorder (52,53).

A prospective study of 2,375 men in the United Kingdom found that regular consumption of milk (2 cups or more/day) was associated with a 62% risk reduction in the metabolic syndrome, while regular consumption of other dairy products such as yogurt and cheese reduced the risk by 56% (54). This study supports earlier findings in middle-aged and older women and in overweight young adults (55,56).

According to a recent cross-sectional, population-based survey of 912 middle-aged men in France, a dietary pattern consisting of high intakes of dairy products, fish, and cereal grains was associated with a low risk of the metabolic syndrome (57). The combination of these foods reduced the risk of the metabolic syndrome more than did each of these foods separately.

The potentially favorable role of dairy products in the metabolic syndrome is not surprising given findings from a number of studies indicating a beneficial effect of dairy products and dairy nutrients on individual components of the metabolic syndrome (26,45,55,56, 58-60). As reviewed by researchers in Germany (26,58), several nutrients in dairy foods such as calcium, magnesium, potassium, whey proteins, bioactive peptides, and medium-chain fatty acids contribute to dairy foods' beneficial effect on the metabolic syndrome by their impact on blood pressure, blood cholesterol levels, body weight, and insulin sensitivity (26,58). The DASH

November | December 2007

dietary pattern, which includes three servings of low-fat dairy products, is recognized as a “successful approach to tackle several disorders of the metabolic syndrome” (26). Although more research (particularly clinical trials) is needed to confirm the beneficial role of dairy foods in the metabolic syndrome, the findings to date are promising.

CONCLUSION

The 2005 Dietary Guidelines for Americans (2) recommends 3 cups of low-fat or fat-free milk or equivalent milk products (cheese, yogurt) a day as part of a healthful diet. Unfortunately, many Americans fail to consume recommended intakes of dairy foods and dairy food nutrients such as calcium (14-16). Dairy foods are naturally nutrient-rich foods which can improve the nutrient adequacy of the diet (1-4). Also, new research findings add to the accumulating body of scientific evidence supporting dairy foods' role in health promotion and disease prevention. For these reasons, milk and other dairy foods are clearly a “food group to encourage.”

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