



## DAIRY'S ROLE IN CHILDREN'S HEALTH & WELLNESS

### SUMMARY

Dairy products are not only important for children's growth and development, but these foods also have beneficial roles in a variety of chronic diseases. The 2005 Dietary Guidelines for Americans recommends 3 cups/day of fat-free or low-fat milk or equivalent milk products (e.g., cheese, yogurt) as part of a healthful diet for children 9 years of age and older and for some younger children who are physically active.

Milk, cheese, and yogurt are naturally nutrient-rich foods providing calcium, potassium, other minerals, vitamins, and protein essential for children's growth and development. Studies in children and adolescents demonstrate that intake of dairy products improves the overall nutritional quality of the diet.

Findings from numerous investigations indicate that consuming recommended servings of dairy foods or dairy food nutrients such as calcium in childhood and adolescence helps to achieve genetically determined peak bone mass, reduce the

risk of bone fractures during growth, and protect against osteoporosis and related fractures in later adult years. Intake of vitamin D-fortified milk and milk products may help reduce the risk of rickets and vitamin D insufficiency.

Childhood overweight is currently at its highest prevalence. Epidemiological studies have examined the relationship between dairy/calcium intake and body weight/fat in children. However, the findings are inconsistent due to failure to control for confounding variables (e.g., calorie intake), among other factors. Based on evidence to-date, consuming recommended amounts of dairy foods does not cause unhealthy weight gain in children and adolescents.

Excess body weight is a risk factor for type 2 diabetes, hypertension, and metabolic syndrome. Preventing childhood overweight is therefore a public health priority. A new study found that intake of a diet rich in dairy products, fruits and vegetables during the preschool years has a favorable effect on blood pressure throughout childhood and early adolescence. Further research is needed to determine dairy's effect on children's body weight/fat and its role in obesity-related co-morbidities.

In addition to overweight, many children are undernourished. Concern about children's insufficient intake of essential nutrients such as calcium and their declining intake of calcium-rich dairy foods such as milk has led to efforts to increase their consumption of dairy products. Such efforts include improving the look, temperature, taste, and availability of milk in schools and encouraging parents and other care providers to be positive role models by consuming dairy foods themselves and by making these foods readily available. **D**



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## INTRODUCTION

The 2005 Dietary Guidelines for Americans (1) recommends 3 cups/day of fat-free or low-fat milk or equivalent milk products (e.g., cheese, yogurt) as part of a healthful diet for children 9 years and older and for some younger children who are physically active. For sedentary children ages 2 through 8 years, the recommendation is 2 cups of fat-free or low-fat milk or equivalent milk products per day (1).

Milk, cheese, and yogurt are naturally nutrient-rich foods providing calcium, potassium, other minerals, vitamins, and protein essential for children's growth and development (2,3). Studies in children and adolescents demonstrate that intake of dairy products improves the overall nutritional quality of the diet (4). Also, consuming dairy foods has a beneficial role in a variety of chronic diseases (5,6). Intake of recommended servings of calcium or calcium-rich foods such as dairy foods in childhood and adolescence helps to achieve genetically determined peak bone mass, reduce the risk of bone fractures during growth, and protect against osteoporosis and related fractures in later adult years (6).

Childhood overweight has reached epidemic proportions in the U.S. (7,8). Yet, despite the growing girth of American youth, many children are undernourished (9). Children's and adolescents' failure to consume recommended servings from the major food groups, in particular from the vegetable, fruit, and dairy groups (9), contributes to nutrient shortages such as vitamins D and E, folate, potassium, magnesium, and, most significantly, calcium (1,10,11).

Overweight children are at increased risk of being overweight or obese as adults (7). Also, overweight increases risk of chronic diseases during childhood as well as in adulthood (7,12,13). Many overweight children and adolescents have impaired glucose tolerance, a condition that precedes the development of type 2 diabetes (14,15), and approximately 30% of overweight children have hypertension (16). Overweight and high blood pressure are also components of metabolic syndrome (also called insulin resistance syndrome), a condition in which multiple risk factors for




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*Studies have shown that intake of dairy foods can increase the nutritional quality of children's diets without adverse effects on body weight/fat.*

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cardiovascular disease and type 2 diabetes cluster in the same individual (12,17,18). The prevalence of metabolic syndrome in adolescence is approximately 4% overall, but it reaches 30% to 50% in overweight adolescents (12).

As a result of the dramatic increase in the prevalence of overweight in children and adolescents and its co-morbidities, and findings that this population has low intakes of several essential nutrients, particularly calcium, attention has focused on promoting a healthy weight in children and youth and improving their nutrient intake (7,13,19-21).

This *Digest* reviews dairy's role in children's nutrient intake, bone health, body weight/fatness, blood pressure, and metabolic syndrome. In addition, it identifies some efforts to increase children's dairy food intake.

## DAIRY PRODUCTS' ROLE IN CHILDREN'S HEALTH AND WELLNESS

**Nutrient Intake.** Milk, cheese, and yogurt are naturally nutrient-dense foods providing a high concentration of essential nutrients such as calcium, vitamin D (if fortified), riboflavin, phosphorus, protein, potassium, vitamin A, vitamin B<sub>12</sub>, and niacin, in relation to their energy value (2,4,22,23). Studies in children and adolescents demonstrate that consumption of dairy products such as unflavored and flavored milk increases calcium intake and improves the overall nutritional quality of their diets (4,24-28). Moreover, intake of dairy foods has been shown to increase the nutritional quality of the diets of children and adolescents without adverse effects on body weight/fat (29-32).

When school-aged children included milk as part of their noon meal, intakes of calcium, vitamins A and E, and zinc increased (24). Intake of flavored milk positively affects children's calcium intake and overall diet quality (25,26). An investigation of the dietary intake of more than 3,000 children ages 6 to 17 years found that those who consumed more flavored dairy products such as flavored milk and yogurt were more likely to get at least 2 to 3 servings of dairy foods a day and consume more calcium,

less added sugar, and lower amounts of saturated fat overall than children who drank more than 16 to 25 ounces of sodas and sweetened fruit drinks every day (26).

As children increase in age, they tend to decrease their milk consumption and increase their intake of less nutritious beverages such as carbonated soft drinks and fruit drinks (5,27,28,33-35). This trend is of concern, especially in light of the substantial proportion of U.S. children with suboptimal calcium intakes and/or who are overweight (5,25,36,37).

Based on data from the Bogalusa Heart Study, the quality of children's diets decreases from childhood to young adulthood (35). When researchers examined food group consumption patterns and dietary intake from childhood (10 years of age) to young adulthood (19 to 28 years), they found that, despite an increase in total food consumption, intake of low-quality foods (e.g., fats/oils, candy, sweetened beverages, salty snacks) increased twofold, whereas intake of nutrient-dense foods (e.g., dairy, fruits, vegetables, breads/grains, meats) decreased by 10% (35). At age 10, only 50% of children consumed a food from each of the five nutrient-dense food groups and this decreased to only 19% by young adulthood (35).

When researchers surveyed parents of 645 children ages 1 to 5 years regarding their children's food and beverage intakes, they found that dairy food intake improved children's diet quality and that children with higher intakes of milk and calcium were less likely to consume nutrient-void beverages (38). According to an analysis of data collected among 1,548 ten-year old children enrolled in the Bogalusa Heart Study and followed for 21 years, milk consumption was significantly lower in those who consumed medium to high amounts of sweetened beverages compared to those with lower or no intake of sweetened beverages (39). Based on these findings, the researchers concluded, "Consumption of milk should be encouraged, particularly if increased soft drink consumption begins to replace milk consumption" (39).

**Bone Health.** Optimizing peak bone mass, reached sometime between 15 and 30 years of age, and reducing the rate of

bone loss in later adult years are the major factors influencing risk of osteoporosis (6). Because much of genetically determined peak bone mass is accumulated during the first two decades of life, childhood and adolescence are critical times to optimize skeletal health (40,41). Scientific evidence supports a beneficial role for dairy foods and dairy food nutrients such as calcium in bone health (6,40). Health professional organizations such as the American Academy of Pediatrics (41), the American Dietetic Association (42), and the U.S. Surgeon General (6) recognize the importance of calcium and calcium-rich foods such as milk, cheese, and yogurt for children's and adolescents' bone health.

Research carried out at Ohio State University provides support for a positive effect of calcium and dairy products on bone mineral density in adolescent girls aged 10 years and followed for seven years (43,44). To learn more about nutritional influences on peak bone mass, the researchers conducted a long-term randomized clinical trial comparing calcium supplements (1,000 mg/day plus 881 mg/day dietary calcium) with a placebo (785 mg dietary calcium) (43). In addition, a group of girls participated in an observational study in which calcium intake (1,213 mg/day) was provided by dairy products (43). Both calcium and dairy products improved bone mass accrual, leading to a higher peak bone mass (43). While calcium supplementation and dairy products had a positive influence on bone mineral density of the hip and forearm, dairy products were also associated with a higher bone mineral density of the spine (43). Calcium influenced volumetric bone density, but dairy products had an additional impact on bone growth and bone expansion, perhaps due to the calcium and protein content of dairy products (43). In the randomized clinical trial, calcium supplementation had a significant beneficial effect on bone density during the pubertal growth spurt (ages 8-13), a time during which approximately 37% of the entire adult skeletal mass is accumulated (44).

A study of 80 British adolescent girls found that bone mineral density and bone mineral content were greater in those who increased their milk intake by an additional 1 cup/day

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*The 2005 Dietary Guidelines for Americans states that "the consumption of milk products is especially important for children and adolescents who are building their peak bone mass and developing lifelong habits."*

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(and increased their calcium intake from 739 mg/day to 1,125 mg/day) for 18 months compared to girls who consumed about 1/2 cup of milk/day (703 mg calcium/day) (29). Studies in Chinese children in Asia demonstrate that increasing milk intake during childhood and adolescence increases total bone mineral content, bone mineral density, and indicators of bone strength (45-48). In addition, the finding that bone mineral density and content were greater in Chinese girls receiving calcium- and vitamin D-fortified milk than calcium-fortified milk supports the role of vitamin D in promoting bone mineralization (48).

Prolonged avoidance of milk has been shown to compromise children's bone health and increase their risk of bone fractures during childhood (49-51). When the fracture histories of 50 children ages 3 to 13 years who had avoided milk for prolonged periods were compared to fractures in a group of children born at the same time in the same city, the milk avoiders experienced more fractures, especially of the forearm (50). Also, many of the milk avoiders were overweight (50). Another study of young children with a history of avoiding milk found that reduced bone mass, height reduction, and overweight persisted over two years of follow-up (51). Further support for a beneficial effect of milk intake during childhood and adolescence on bone health and protection against fractures in later years comes from retrospective investigations in adults (52,53).

Consuming a sufficient intake of vitamin D-fortified milk and milk products (e.g., some yogurts, cheeses) is important to help protect against osteoporosis in later years and to prevent rickets (i.e., a disease characterized by soft and deformed bones) and vitamin D insufficiency in children and adolescents. While voluntary, nearly all milk sold in the U.S. is fortified with vitamin D to obtain a standardized amount of 400 I.U. per quart (40). Two cups of vitamin D-fortified milk contains 200 I.U. of vitamin D, the amount recommended for children and adolescents (40). Rickets has recently made an unexpected




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*A new study has found that diets high in dairy foods, fruits and vegetables help children maintain a healthy blood pressure as they grow.*

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comeback among young children in the U.S. (54) and subclinical vitamin D deficiency has been identified in otherwise healthy adolescents (55,56). Rickets and vitamin D insufficiency are attributed in part to low intake of vitamin D-fortified milk (57).

In addition to calcium and vitamin D, other nutrients in dairy foods such as phosphorus, protein, magnesium, and zinc support children's bone health (58). For this reason, children are encouraged to consume a varied diet consisting of nutrient dense foods – such as recommended servings of dairy foods – to support bone health (1,58).

**Body Weight/Fatness.** Considering the high prevalence of pediatric overweight and its implications for the development of serious diseases, both during childhood and later in adulthood, there is an urgent need to identify effective dietary and behavioral approaches. Although inconclusive, some evidence suggests that the increasing intake of high-sugar and nutrient-poor beverages relative to the decrease in milk intake may increase children's energy consumption, potentially increasing their risk for overweight (18,37,59).

Compared to studies in adults, relatively little research has examined the relationship between calcium or dairy intake and body weight/fat in children and adolescents (18). Nearly all studies in children and adolescents are epidemiological investigations. In general, findings from these studies have shown either a beneficial or neutral relationship between calcium or dairy food intake and body weight/fat in children (18). Inconsistencies in the findings may be explained by confounding factors (e.g., energy intake, physical activity), among other variables (18).

Based on the evidence to-date, there is no scientific basis for children or adolescents who are concerned about their body weight or body fat to avoid dairy products (1,60). Considering that dairy food intake is relatively low for most American children (9) and that some evidence suggests that low intake of dairy foods may have an adverse effect on

children's body weight/fat (18,49,51,61-63), there is a critical need for more research to examine the effects of a wide range of dairy intakes on body weight/composition.

**High Blood Pressure.** Overweight in childhood and adolescence is strongly associated with high blood pressure in youth (16,64). In addition, other lifestyle factors including dietary intake likely influence children's blood pressure (64). Low intake of dairy products may be a contributing factor to high blood pressure in childhood (65). In the first study to analyze the effect of food intake on blood pressure levels in children, researchers found that preschool-aged children who consistently consumed more dairy products (2 or more servings/day) with or without more servings of fruits and vegetables (4 or more servings/day) during the preschool years had smaller yearly gains in systolic blood pressure throughout childhood compared to children consuming lower amounts of these foods (65).

Although the exact mechanism for the blood pressure lowering effect of these foods is not completely understood, the researchers suggest that specific nutrients and other food components may be responsible (66). Dairy food nutrients such as calcium, magnesium, and potassium, as well as peptides from milk proteins, have been demonstrated to lower blood pressure (66-68).

**Metabolic Syndrome.** Overweight and high blood pressure are components of metabolic syndrome, a condition of multiple risk factors for cardiovascular disease as well as type 2 diabetes (12,16-18). The prevalence of metabolic syndrome is high among overweight children and adolescents and it increases directly with the degree of overweight (69).

Among overweight young adults in the CARDIA (Coronary Artery Risk Development in Young Adults) study, consumption of dairy foods was inversely associated with the incidence of all components of the metabolic syndrome over 10 years, independent of other factors (70). Also, young adults

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*To improve children's nutritional status and health, schools, parents, and others can take steps to help increase children's intake of naturally nutrient-dense foods such as dairy foods.*

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participating in the Bogalusa Heart Study who had no risk factors for metabolic syndrome consumed more low-fat dairy products than those who had one or more risk factors associated with metabolic syndrome (71). Thus, it may be that dairy intake has a beneficial effect on metabolic syndrome in children and adolescents. However, more research is needed to determine dairy's protective effect (18).

## CONCLUSION

Considering the nutritional and health benefits of milk and other dairy foods such as cheese and yogurt, efforts are being made to increase children's and adolescents' dairy product consumption (5). These include increasing children's participation in school meals, creating healthy school nutrition environments supportive of healthy food consumption, including dairy food intake, and improving the look, temperature, and taste of school milk (5). A School Milk Pilot Test sponsored by National Dairy Council and the American School Food Service Association found that children drink more milk when schools offer it in plastic, re-sealable containers in different sizes, various flavors, merchandising locations (vending or a la carte) and ice-cold refrigeration (72). Steps are being taken to implement these changes in schools nationwide, a measure that could greatly improve children's health and wellness (73).

The family and social environment strongly influence a child's food intake, nutrition, and attitudes about food and eating (74). Parents, by making dairy foods available and consuming these foods themselves, can play a positive role in shaping their children's dietary habits, including their intake of dairy products (75).

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