

The role of Yogurt in improving the quality of the American diet and meeting dietary guidelines

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The Dietary Guidelines for Americans (DGA) recommend three daily servings of low- or nonfat dairy products, yet two-thirds of individuals in the United States do not meet that goal. Including low- or nonfat yogurt as part of an overall healthful diet can be a positive step toward meeting the DGA recommendations. Yogurt naturally contains calcium and potassium, and some products are fortified with vitamin D. All of these nutrients were identified in the DGA as “nutrients of concern,” because typical intake falls far short of recommended intakes. Yogurt can also be an excellent source of high-quality protein, which promotes satiety, helps in maintaining a healthy body weight, and aids muscle and bone growth. In addition, yogurt is low in sodium and contributes 1.0% or less of added sugars to the diets of most individuals in the United States; however, 90% of children and adults consume less than 8 ounces (1 cup) of yogurt per week. Thus, consuming 1 serving of yogurt per day would help to meet the DGA-recommended dairy servings and would provide nutrients of concern.

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INTRODUCTION

Despite consistent recommendations from health professionals and government agencies for Americans to consume more nutrient-dense foods that are low in energy, sodium, saturated fat, and cholesterol, and to become more physically active, few individuals in the United States meet current diet and physical activity goals.^{1–4} The 2010 US Dietary Guidelines for Americans (DGA) contain specific guidelines for creating a healthful, nutrient-dense diet. Additionally, the Health and Human Services Healthy People 2020 goals and objectives promote good health, the reduction of chronic disease risk and achievement, and maintenance of healthy body weight through the consumption of healthful diets.⁵ Saturated fats and added sugars, which provide most of the nonessential energy and few nutrients in the diet, are believed to be major contributors to imbalance in US diets.⁶ The 2010 DGA recommend that intakes of added

sugars and saturated fats be reduced significantly,³ but many individuals in the United States continue to exceed these recommendations.⁷

The DGA recommend that Americans consume three servings of low- and nonfat milk and milk products per day. Yet, according to the USDA Center for Nutrition Policy and Promotion, and the DGA, less than one-third of the population meets the dietary recommendations for servings of dairy (milk, cheese, yogurt),⁸ averaging only 52% of the recommended intake.⁶ Young adults have the greatest tendency for insufficient intakes.¹ An analysis of the 2001–2004 National Health and Nutrition Examination Survey (NHANES) data found that over 90% of women aged 19–20 years had usual dairy intakes below the recommendations.¹

The 2010 DGA identified several “nutrients of concern,” i.e., those nutrients that fall short of recommended intakes among both adults and children for a substantial percentage of the population; these include

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potassium, dietary fiber, calcium, vitamin D, iron, folate, and vitamin B₁₂.³ NHANES data from 2003–2008 reveal that a significant portion of the US population falls short of the estimated average requirement (EAR) intakes for one or more of the above nutrients, even when supplements are taken into consideration; for example, 70–94% of the population were below the EAR for vitamin D^{9–11} and between 38% and 50% were below the EAR for calcium.^{9,11} Average potassium intake for adults 20 years and older is between 51% and 67% of the adequate intake (AI) level of 4,700 mg that is recommended by the Institute of Medicine (IOM).^{12,13} For some nutrients, dietary intakes are inadequate only for certain segments of the population, such as vitamin B₆ for adult females and older adults, folate for adult and pregnant females, phosphorus for teen girls, zinc for adults 70 years and older and for teen girls 14–18 years, and iron for pregnant females and older adults.

The Healthy Eating Index, a measure of healthful eating developed by the USDA's Center for Nutrition Policy and Promotion to assess the US diet, has shown that approximately 74% of the population needs to improve their diets.¹⁴ Only 10% of the population reportedly have good diets and 16% were characterized as having poor diets.⁸ The poor quality of the US diet is further evidenced by the prevalence of overweight and obesity among all age groups. The most recent data show that 68% of adults in the United States are either overweight or obese,¹⁵ almost 36% are obese,¹⁶ and almost 6% are extremely obese.¹⁵ Among children ages 2–5 years, more than 12% are overweight; among children ages 6–11 years, 17% are overweight; and almost 18% of adolescents between the ages of 12 and 19 years are overweight.¹⁵ Among all children and adolescents ages 2–19 years, almost 17% are obese.¹⁵ This has led to a much higher risk of premature death and many serious disorders, including type 2 diabetes, hypertension, dyslipidemia, cardiovascular disease (CVD), stroke, gallbladder disease, sleep apnea, osteoarthritis, and certain kinds of cancer.⁶ Heart disease, stroke, T2D, and certain types of cancer are among the leading causes of preventable death.¹⁷

The negative effects of the poor-quality diets in the United States are compounded by a generally sedentary lifestyle. These two factors interact to increase the risks of premature death, coronary artery disease, hypertension, type 2 diabetes, overweight and obesity, osteoporosis, certain types of cancer, depression and decreased quality of life, and reduced musculoskeletal fitness.⁴ According to the National Center for Health Statistics, almost 50% of adults 18 years of age and older fail to meet 2008 Physical Activity Guidelines for Adults.^{4,18,19} A recent prediction model estimated that if no changes are made to diet and physical activity levels in the United States, obesity among

adults will increase 33% and severe obesity 130% over the next two decades.²⁰ A recent analysis of the economic impact of obesity on healthcare costs estimated the national medical costs of obesity-related illness in adults to be \$210 billion.²¹

MAJOR CONTRIBUTORS TO POOR-QUALITY DIETS IN THE UNITED STATES

Added sugar

In its 2002 report *Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids*,²² the IOM recommended a maximum intake of 25% of total calories from added sugars. Added sugars are refined sugars and syrups that are added to foods or beverages during processing or preparation to enhance flavor, improve the texture and color of baked goods, and thicken, firm, or preserve foods such as puddings, jams, and jellies. Added sugars do not include innate sugars, such as those in milk products and fruits.⁶ The maximum 25% of caloric intake recommendation is based on dietary intake survey data showing that people with diets at or above this level of added sugars were more likely to have poor intakes of important essential nutrients.²³ Although the percentage of daily calories derived from added sugars declined between 1999 and 2000 and between 2007 and 2008,⁷ consumption of added sugars remains high in the United States. The 2010 Dietary Guidelines Advisory Committee (DGAC) recommended that consumption of saturated fats and added sugar account for between 5% and 15% of energy intakes. However, saturated fats and added sugars contribute approximately 35% of energy to the typical diet in the United States.⁶

The government faces unique regulatory challenges with regard to added sugars in foods.²⁴ Federal agencies have differing roles and responsibilities related to research, food safety, food assistance, and labeling, which are sometimes at odds with one another. While government agencies recommend limiting foods with added sugar, the IOM 2007 report on *Competitive Foods in Schools*²⁵ recommended that a specific exception be made regarding the sugar content of dairy products. Specifically, the report states the following: “To avoid elimination of these dairy products [e.g., fruit-flavored yogurt] on the basis of their sugar content, the committee has made an exception to the added sugars limit.” Other measures of nutrient density have taken a similar approach by weighing the amount of nutrients to encourage relative to the amount of nutrients to limit for each food.²⁶ The sugar content of individual foods should be weighed against the food's overall nutrient content.

Saturated fat

The composition of fat in the US diet is also a critical health issue. Consumption of saturated fatty acids (SFA) and *trans* fatty acids are associated with poor circulating lipid/lipoprotein profiles and increased risk of CVD.⁶ The average SFA content of the US diet is 11–12% of energy (above the recommended 10%) and has remained unchanged for the past 15 years.⁶ The 2010 DGAC recommended that the percentage of calories from saturated fat be lowered to 7% of calories (approximately 15.5 g in a diet providing 2,000 calories a day), to reduce the risk of CVD. In the United States, the top sources of saturated fat in the diet include full-fat cheese, pizza, grain-based desserts, dairy desserts, chicken and chicken mixed dishes, sausage, and franks.³ Nonfat yogurts provide less than 0.3 g of saturated fat, and lowfat yogurts no more than 2.1 g of saturated fat per 8 ounces, respectively.²⁷ A portion of the saturated fat is present as stearic acid, a saturated fatty acid that has not been found to have a negative effect on lipoprotein levels and is not considered to be atherogenic.^{6,28,29}

Sodium

Excessive sodium intake, especially when accompanied by inadequate potassium intake, raises blood pressure, which is a well-accepted risk factor for stroke, coronary heart disease, and kidney disease.⁶ Sodium-potassium ratios can be improved by lowering sodium intake, by raising potassium intake, or both.²⁹ More than 90% of middle-aged and elderly adults in the United States will develop hypertension in their lifetime.^{6,30} The American Heart Association recommends a ceiling of 1,500 mg of sodium per day.³¹ In 2005, the DGAC recommended a daily sodium intake of less than 2,300 mg for the general adult population and stated that hypertensive individuals, African Americans, and middle-aged and older adults may benefit from reducing their sodium intake even further.⁶ Because these latter groups together comprise nearly 70% of the US adult population, the goal should be 1,500 mg per day, in conjunction with other dietary changes, including increasing potassium intake, for the general population. In the United States, milk and cheese together provide almost 10% of the sodium in the diet³²; nonfat and lowfat yogurts provide between 131 and 175 mg of sodium per 8 oz serving.²⁷

WHAT IS A NUTRIENT-DENSE DIET?

Both the 2005 and 2010 DGA placed an emphasis on the consumption of nutrient-dense diets.^{3,33} Though there is no generally accepted evidence-based standard, the 2010 DGA defined nutrient-dense foods as those in which

nutrients and other beneficial substances have not been diluted by the addition of calories from added solid fats, sugars, or refined starches, or by the solid fats naturally present in foods. The Academy of Nutrition and Dietetics defined nutrient-dense foods as foods that provide substantial amounts of nutrients for relatively few calories.³⁴ Examples of nutrient-dense foods include vegetables, fruits, high-fiber whole grains, non- or lowfat fluid milk and milk products, seafood, lean meat and poultry, eggs, soy products, nuts, and seeds.³ Inadequate intakes of nutrient-dense foods from the basic food groups place individuals at risk for lower-than-recommended levels of specific nutrients, namely vitamin D, calcium, potassium, and dietary fiber.⁶

Non- or lowfat yogurt is a nutrient-dense food and contains nutrients that are insufficient in the US diet, including calcium, vitamin D, and potassium. Though the micronutrient composition of yogurt and milk are similar, yogurt is a more concentrated source of riboflavin, vitamin B₁₂, calcium, magnesium, potassium, and others.³⁵ For example, lowfat yogurt contains approximately 25% more potassium, calcium, and magnesium per 8 oz serving compared with an equal serving of lowfat milk.²⁷ Based on data from 2004 NHANES, 90% of all children and adults in the United States averaged less than one 8 oz serving of yogurt per week, with less than 5% having more than 8 oz per week.³⁶ Selecting foods from the “food groups to encourage,” such as low- or nonfat milk and yogurt, is an effective way to put the concept of nutrient density into practice.³⁵

NUTRIENT CONTRIBUTION OF BREAKFAST AND SNACKS

Breakfast

Breakfast as a meal, as well as the foods typically consumed at breakfast, are important contributors of energy and nutrient intake for children, yet it has been estimated from NHANES data that 20% of children and 31.5% of adolescents do not regularly consume breakfast.³⁷ USDA researchers have found that students who consume breakfast, either at school or at home, have significantly higher Healthy Eating Index scores compared to those who do not eat breakfast, especially among children in low-income households.³⁸ A higher percentage of children who skip breakfast have reduced intakes of many nutrients, such as vitamins A, E, C, B₆, B₁₂, folate, iron, calcium, phosphorus, magnesium, potassium, and dietary fiber.³⁷ It follows then that those who skip breakfast tend to have poorer nutritional status.³⁹ They also have more trouble concentrating and performing well in school.³⁹ The most recent analysis of NHANES 2009–2010 data

found that, for all age groups, 15–22% of a day’s total calories come from breakfast.¹³ Among children between the ages of 2 and 11 years, 19–20% of calories come from breakfast. Paradoxically, children and adolescents who are breakfast skippers have higher body mass indexes for their age, a higher waist circumference, and a greater prevalence of obesity.³⁷ A nutrient-dense breakfast was recognized by the DGAC as an aid in weight management.⁶

Nutrient-dense lowfat and nonfat milk products are required at breakfast and lunch as part of the most recent USDA Nutrition Standards for School Meals.⁴⁰ USDA has, for many years, included yogurt as a meat alternate in the National School Lunch and Breakfast Program and Greek yogurt is also being offered in a pilot program.⁴¹ The breakfast meal offers an opportunity for children to obtain a serving of dairy as part of a nutrient-dense meal.

Snacks

Over the last 30 years, the percentage of US adults snacking on any given day has risen from 59% to 90% and the average number of snacks consumed per day has doubled.¹⁰ From 2003–2006 alone, snacking prevalence increased significantly from 71% to 97%.⁴² Nearly one in six adults (16%) obtains over 40% of their total daily calories from foods and beverages they report being consumed as snacks.¹⁰ Young children get the largest percentage of their calories from snacks (between 25% and 29% of calories for children 6–11 years of age).¹³ Not only has snacking increased over time, the types of snack foods being consumed have changed. Major shifts toward increased intakes of salty snacks, chips, and nuts have occurred along with smaller shifts toward reduced amounts of dairy products and fruit.^{42,10} Snacks are also a major source of sugars (both innate and added) in the diet. For all age groups, 29–42% of all sugars come from snacks.¹³ While higher snacking frequency is associated with higher total calorie intake, snacking frequency is similar among normal-weight, overweight, and obese individuals, suggesting that the quality, not the quantity, of snacking is important.¹⁰ Lowfat and nonfat dairy products, such as yogurt, fulfill the DGA recommendations for nutrient-dense snacks.

ROLE OF DAIRY IN THE DIET

The Dietary Guidelines for Americans recommended that individuals choose foods that provide more calcium, vitamin D, potassium, and dietary fiber; and increase intake of nonfat or lowfat milk and milk products, such as milk, yogurt, cheese, or fortified soy beverages. The DGAC

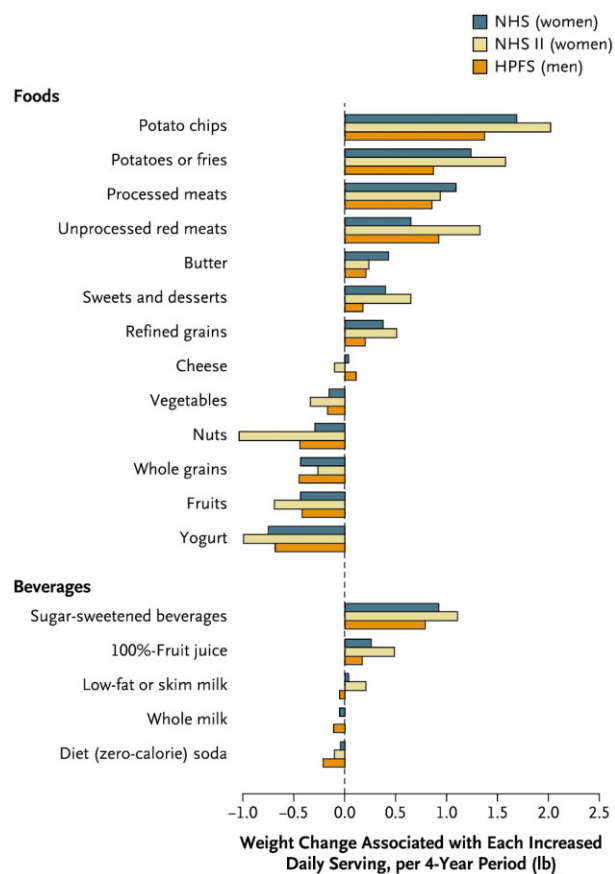


Figure 1 Relationship between changes in food and beverage consumption and weight changes every 4 years.

Associations between routine dietary consumption and weight gain over time in individuals from three large epidemiological data sets are illustrated. Weight changes are reported for each increase in the daily serving of the food or beverage; decreased intake would be associated with the inverse weight changes. Yogurt consumption was associated with less weight gain over time, even after adjusting for age, baseline body-mass index, sleep duration, and changes in smoking status, physical activity, television watching, and alcohol use in a multivariate analysis. The study population included women ($n = 50,422$) in the Nurses’ Health Study followed for 20 years (1986–2006); women ($n = 47,898$) in the Nurses’ Health Study II followed for 12 years (1991–2003); and men ($n = 22,557$) in the Health Professionals Follow-up Study followed for 20 years (1986–2006). Reproduced with permission from Mozaffarian et al. (2011).⁸²

also recommended eating less solid fats, added sugars, refined grains, sodium, and saturated fat (Figure 1).

Dairy plays a role in building a more nutrient-dense diet. Not only does dairy consumption increase calcium intake and improve bone and muscle function, three daily servings of lowfat or fat-free milk and milk products, such as milk, yogurt, and cheese help improve overall nutrient

intake, which can contribute to a reduction in the risk of several chronic diseases.³ Without adequate consumption of dairy foods, several important nutrients may fall short, even in otherwise healthful diets. According to the 2010 DGA, if recommendations for three servings of lowfat and nonfat milk and milk products daily are followed, the servings would provide 70% of the calcium and vitamin D (assuming vitamin D-fortified milk and milk products is consumed), 30–40% of the phosphorus, vitamin A, riboflavin, and vitamin B₁₂, and 20–30% of the protein, potassium, zinc, and choline in the diet, while providing only 12% of total calories. Interestingly, only about 10% of older children, men, women, and pregnant women have usual intakes of choline at or above the adequate intake (AI) level.⁴³ In the Nurses' Health Study, dairy foods, along with meat and eggs, were found to be among the greatest contributors of choline to the diet.⁴⁴

The DGA also recommend that consumers choose nonfat or lowfat milk or yogurt more often than cheese, which contributes much more sodium and saturated fat to the diet. In addition, the American Diabetes Association,⁴⁵ the American Heart Association,⁴⁶ and the DASH Diet (Dietary Approaches to Stop Hypertension)⁴⁷ all recommend consumption of lowfat or nonfat milk and milk products for health. However, as many as 98% in some age groups fall short of the recommended intake for dairy.¹

Of the milk and dairy products consumed in the United States, most are not lowfat or nonfat alternatives. Among dairy foods, full-fat cheese is the single largest contributor of saturated fat (8.5%) to the diet, accounting for more than sausage, franks, bacon, ribs and French-fried potatoes combined (6.9%).³ Consumption of lowfat or nonfat yogurt remains low when compared to consumption of full-fat cheese, with an estimated average of 8 oz per week.⁴⁸ A study of a French population found that rebalancing the intake of milk-based products in favor of the least energy-dense one (i.e., yogurt and milk) would help individuals reach nutritional adequacy.⁴⁹

The 2010 DGA state that moderate evidence links increasing intake of dairy products to improved bone health, reduced risk of cardiovascular disease, T2D, and lower blood pressure in adults. A systematic review of the literature, published in 2011, concluded that the evidence from 19 prospective cohort studies was suggestive of a protective effect of dairy consumption on the risk of overweight and obesity.⁵⁰ Most recently, a prospective study of more than 33,000 women in Sweden found an inverse association between total dairy food intake and risk of myocardial infarction,⁵¹ and a recent review concluded that the preponderance of evidence indicates dairy foods are beneficially associated with lower blood pressure.⁵² Another recent meta-analysis of seven cohort studies showed the overall positive role of dairy consumption on

the risk of T2D, and a subgroup analysis suggested that milk and yogurt consumption were most strongly associated with overall risk reduction compared to high-fat dairy.⁵³ In contrast, low-level dairy consumption, for example in the case of self-perceived lactose intolerance, results in lower intakes of calcium and other nutrients and is associated with hypertension and diabetes in adults.⁵³

YOGURT CONSUMPTION AND IMPROVED NUTRIENT ADEQUACY

Consumption of all milk products by the U.S. population is only about half of what is recommended. However, for some segments of the population, the situation is worse. Only 16.1% and 10.7% of adults between the ages of 19 and 50 years or 51 years and older, respectively, consume the recommended number of dairy servings per day.⁵⁴ Even more worrisome is that women and girls have the lowest intake levels; 90% of girls and women age 14 and older consume less than the recommended amount of dairy servings (milk, yogurt, and cheese combined).⁵⁵

A recent analysis of five cycles of NHANES data (1999–2000, 2001–2002, 2003–2004, 2005–2006, and 2007–2008) found that yogurt consumption on a given day had increased from 3.7% of adults in 1999–2000 to 6.7% in 2007–2008. Yogurt consumption was associated with greater average intakes of calcium, potassium, and fiber, which are three of the four nutrients highlighted by the 2010 DGA as nutrients of concern.⁵⁶ In a survey of adult men in the military, frequent consumption of lowfat yogurt was associated with decreased intake of both total and saturated fat.⁵⁷ Thus, if substituted for more energy-dense foods, yogurt could lead to more nutrient-dense diets and provide more of several of the shortfall nutrients identified by the 2010 DGAC.⁶

Protein of high quality

The nutritional value of a protein differs substantially, depending on its essential amino acid composition and digestibility. The PDCAAS rating (Protein Digestibility Corrected Amino Acid Score) was adopted by the Food and Drug Administration (FDA), the Food and Agriculture Organization (FAO), and the World Health Organization (WHO) in 1993 as the preferred method to determine protein quality. With a PDCAAS score of 1, the highest possible, dairy proteins share first place, along with egg white and soy proteins. However, the FAO recently recommended that the DIAAS (Digestible Indispensable Amino Acid Score) replace the PDCAAS rating system as the preferred method for measuring protein quality.⁵⁸ For example, the DIAAS score for dairy protein in the form of milk, which provides all nine essential amino acids, is 1.22, compared to 0.64 for peas and 0.40 for wheat.

The recommended dietary allowance (RDA) for both men and women (19 years and older) is 0.80 g per kilogram of body weight per day of good-quality protein, like that found in yogurt.²² Protein RDAs for children are higher on a gram-per-body-weight basis than for adults, i.e., ages 1–3 years, 1.05 g/kg/day; ages 4–13 years, 0.95 g/kg/day; ages 14–18 years, 0.85 g/kg/day. RDAs for protein also increase for women who are pregnant (1.1 g/kg/day) and lactating (1.3 g/kg/day).

The IOM established an acceptable macronutrient distribution range (AMDR) for protein as 5–20% of total calories for children between the ages of 1 and 3 years, 10–30% of total calories for children between the ages of 4 and 18 years, and 10–35% of total calories for adults older than 18 years²²; the AMDR reflects the percent composition of the diet that provides adequate energy and nutrients. For men and women, protein typically provides about 15% of total calories,^{13,22} which is well within the AMDR. Even the 95th percentile of protein intake does not approach the highest AMDR distribution range of 35% for an age/sex group. Higher intakes of high-quality protein, such as that found in yogurt, could safely be recommended⁵⁹ and may provide benefits related to weight management, bone health, and sarcopenia, as well as other health outcomes.⁵⁹

Dietary protein has been shown to contribute to satiety, which may help in weight management.⁶⁰ Whey protein and casein, the two major types of proteins in yogurt, may increase satiety more than other proteins.^{61–63} The effect appears to be dose dependent, with higher protein intakes resulting in greater appetite suppression.^{64,65} Increases in appetite-regulating hormones, such as pancreatic polypeptide (PP), that may result from increased intake of protein⁶⁵ and increased intakes of dairy⁶⁶ have been suggested as the mechanism for the satiety stimulating effects.

Dietary guidance has recommended reductions in the intake of foods high in saturated fats, cholesterol, and sodium. Many sources of high-quality animal protein are high in all three. Nonfat dairy products, such as nonfat yogurt, are virtually devoid of saturated fats, low in cholesterol and sodium, but still contain high-quality protein, calcium, and the other nutrients found in dairy products.

Calcium and vitamin D

Adequate calcium and vitamin D throughout life as part of a well-balanced diet may reduce the risk of osteoporosis and a recent study suggests that yogurt may have superior bone-building benefits.⁶⁷ Recommended calcium intake ranges from 800 to 1,300 mg per day, depending on the age and gender of the individual.⁶⁸ Dairy products, including milk, yogurt, and cheese, provide the major share of calcium from foods. In the United States; an estimated 72%

of calcium in the diet comes from milk, cheese, and yogurt and from foods to which dairy products have been added (pizza, lasagna, dairy desserts).⁶⁹ Estimates from NHANES 2009–2010 indicate calcium intakes from food alone range from 813 to 1,029 mg per day.¹³ The average total intake of calcium from all sources in the US population ranges from 918 to 1,296 mg/day, depending on the life stage.⁶⁸ Three to four servings from the milk group would ensure adequate intakes of calcium for everyone over the age of 9 years and, in turn, would also increase intake of other nutrients in foods within the milk groups, including potassium, magnesium, phosphorus, and vitamins D, A, B₁₂, riboflavin, and niacin.⁷⁰ One 8-oz serving of nonfat or lowfat yogurt provides up to 80% more calcium than an equal serving of milk (Table 1). Results from the ongoing Framingham Heart Study Offspring Cohort discovered that consuming more than four servings of yogurt a week, but not milk or cheese, was associated with a protective trend against hip fracture and greater bone mineral density in the trochanter, as compared to consuming fewer servings of yogurt a week.⁶⁷

Among the US population, about 43% of all persons, and almost 70% of older women, report calcium intake from supplements.⁶⁹ Although supplemental calcium use is highest among older women, it is still not sufficient to meet recommended calcium intakes.⁷¹ While results of studies on the bioavailability of calcium supplements are highly variable, few studies have directly compared the bioavailability of calcium from dietary and supplemental sources.⁶⁵ However, one study compared the effects of dietary calcium versus supplemental calcium (form not specified) on estrogen levels among healthy postmenopausal women and suggested that, compared to supplemental calcium, dairy sources of calcium had a positive effect on estrogen levels, and, in turn, may have contributed to greater bone densities. Subjects consuming dietary calcium had greater bone mass densities despite a lower average total daily calcium intake than the calcium supplement group.⁷² Calcium supplements are not nutritionally equivalent substitutes for dairy foods, such as milk or yogurt, which provide a unique combination of nine essential nutrients and may be more beneficial for bone health.^{72,73} If calcium supplements are used, care must be taken to ensure that other essential nutrients provided by dairy foods are met from other food sources or supplements.⁷³

Potassium

Increasing potassium intake can lessen the blood-pressure-raising effects of excess dietary sodium.⁶ Conversely, inadequate potassium intake may increase the risk of kidney stones and perhaps osteoporosis.⁶ After reviewing the evidence, the DGAC recommended that

Table 1 Comparison of the nutrient content of nonfat milk and nonfat plain, fruit-flavored, and Greek yogurts.^a

Nutrient content	Nonfat milk with vitamins A and D (100 g)	Nonfat milk with vitamins A and D (8 oz RACC)	Nonfat yogurt, plain (100 g)	Nonfat yogurt, plain (8 oz RACC)	Nonfat yogurt, fruit-flavored with vitamin A (100 g)	Nonfat yogurt, fruit-flavored with vitamin A (8 oz RACC)
Water (g)	90.84	226.74	85.23	193.47	75.4	171.16
Energy (kcal)	34	85	56	127	95	216
Protein (g)	3.37	8.41	5.73	13.01	4.4	9.99
Fat (g)	0.08	0.20	0.18	0.41	0.20	0.45
Carbohydrate (g)	5.09	12.70	7.68	17.43	19	43.13
Calcium (mg)	122	305	199	451	152	345
Magnesium (mg)	11	27	19	43	14	32
Phosphorus (mg)	101	252	157	356	119	270
Potassium (mg)	156	389	255	579	194	440
Sodium (mg)	42	105	77	175	58	132
Iron (mg)	0.03	0.07	0.09	0.20	0.07	0.16
Zinc (mg)	0.42	1.05	0.97	2.2	0.74	1.68
Vitamin A (IU)	204	509	7	16	12	27
Vitamin C (mg)	0	0	0.9	2.04	0.7	1.59
Vitamin D (IU)	47	117	0	0	52	118
B ₆ (mg)	0.037	0.092	0.053	0.12	0.040	0.091
B ₁₂ (μg)	0.50	1.248	0.61	1.38	0.47	1.07
Folate (μg)	5	12	12	27	9	20
Niacin (mg)	0.094	0.235	0.124	0.281	0.100	0.227
Riboflavin (mg)	0.182	0.454	0.234	0.531	0.180	0.409
Thiamin (mg)	0.045	0.112	0.048	0.109	0.04	0.091

^a Data obtained from the USDA National Nutrient Database.²⁸

Americans increase their intake of potassium. The Food and Nutrition Board currently recommends a potassium intake of 4,700 mg a day for adults to reduce the risk of hypertension. Most individuals in the United States fall far short of that, with men consuming, on average, less than 3,200 mg per day and women less than 2,400 mg per day.⁶ Among the foods rich in potassium and low in sodium highlighted in the National Heart, Lung and Blood Institute's guide to the DASH diet are broccoli, kale, sweet potatoes, and tomatoes.⁷⁴ Most lowfat and nonfat yogurts are low in sodium and are a good source of potassium. A single 8-oz serving of yogurt provides 6–14% of the recommended daily intake for potassium; however, only about 1% of the current potassium intake of the US population comes from yogurt.¹²

In analyzing the data from the Framingham Heart Study Offspring Cohort, Wang et al.³⁶ found that yogurt consumers had higher potassium intakes (+120 mg/day) than non-consumers. Compared to non-consumers, yogurt consumers are not only likely to have higher potassium intakes; they are also less likely to have inadequate intakes of riboflavin and vitamin B₁₂, calcium, magnesium, and zinc.³⁶

Yogurt and lactose intolerance

The National Institutes of Health identified self-restriction of dairy foods, associated with self-diagnosis of

lactose intolerance, as a public health problem.⁷⁵ For those who are lactose intolerant, milk avoidance is a major obstacle to obtaining adequate calcium and vitamin D in the diet.⁷⁶ In both children and adolescents, restriction of dairy foods because of perceived milk or lactose intolerance is associated with lower bone mineral content.^{77–79} Cheese is often recommended as a low-lactose dairy that contains many of the same nutrients as milk. However, cheese may contain higher amounts of sodium and saturated fat than milk, which are recommended in the DGA as nutrients to limit, particularly for children.⁸⁰ Yogurt offers a more easily digestible dairy alternative to milk for lactose intolerant individuals, both because it contains approximately 31% less lactose per serving and because of the presence of lactase-producing bacteria.⁸¹ For those who suffer from lactose intolerance, yogurt offers a nutrient-dense, more easily digestible alternative to milk and other milk products.

ASSOCIATION BETWEEN YOGURT CONSUMPTION AND WEIGHT MANAGEMENT, REDUCED HYPERGLYCEMIA, AND REDUCED HYPERTENSION

Yogurt consumption may also aid weight management. A prospective study of three separate cohorts of more than 120,000 women and men in the United States, followed every 4 years for 20 years, showed that consumption of

yogurt, fruits, vegetables, and whole grains was associated with less weight gain over time, with yogurt showing the greatest impact (Figure 1).⁸² No such association was found with nonfat or lowfat milk, whereas, whole milk and cheese consumption was associated with weight gain over the two decades.⁸²

Using a similar approach with a different cohort of 3,285 subjects followed over 17 years (Framingham Heart Study Offspring Cohort 1991–2008), Wang et al.³⁶ found that yogurt consumption (at 4% of daily calories) was associated with less change of annualized weight and waist circumference over time and healthier levels of circulating glucose.³⁶ In addition, from the same cohort data, yogurt consumption was associated with maintaining blood pressure values in the normal range. While observational studies cannot infer causality, the comparable findings of these independent studies suggest that regular yogurt consumption contributes to a balanced diet, and is associated with less long-term weight gain and improved health outcomes. The mechanism(s) are unclear, though it has been suggested that changes in colonic bacteria influence weight gain.⁸³ Yogurt is an excellent source of high-quality protein, which helps maintain satiety better than fat or carbohydrates,^{84,85} and provides less than 1.0% of the intake of added sugars in the diet for the vast majority of individuals.⁸⁶ Thus, increasing intake to one serving a day, yogurt would still contribute a small percentage of added sugar to the US diet.

CONCLUSION

The DGA, the Academy of Nutrition and Dietetics, the American Heart Association, and the Dietary Approaches to Stop Hypertension (DASH) diet program all recommend the inclusion of three servings of lowfat or nonfat dairy a day in the diet. Lowfat and nonfat yogurts are suggested as low-sodium, lowfat dairy options. Additionally, the 2010 DGA recommendations include the following suggestions: 1) consider the nutrients and other healthful properties of food and beverages, as well as their calories, when selecting an eating pattern for optimal health; 2) eat a nutrient-dense breakfast; 3) reduce intake of calories from solid fats and added sugars; and 4) increase intake of dietary potassium from vegetables, fruits, and milk and milk products. Choosing nutrient-dense foods, based on their complete nutrient content, can help both children and adults meet their nutrient requirements, without consuming excessive amounts of saturated fat, sodium, and calories.

Lowfat and nonfat yogurts can play a role in each of these recommendations to achieve a more nutrient-dense diet, to help manage weight, to improve nutritional status, and to improve the overall health of the US population.

Currently, individuals in the United States consume, on average, only about 0.1 of a serving of yogurt a day, which is less than one-quarter of the recommended serving from the milk group.²⁷ Consuming one 8 oz serving of yogurt every day would bring the average consumption of milk and milk products from 52% of the current recommendation to 85%, and provide 30% of the daily value for calcium, thus helping to close the calcium gap as well as providing other important nutrients, such as, potassium, B vitamins, vitamin D, and high-quality protein. Yogurt is a nutrient-dense food that is nutritionally distinct from other dairy products. When consumed daily, yogurt contributes to the DGA-recommended three servings-a-day of dairy and can easily be incorporated as part of several meals throughout the day, including breakfast, lunch, and dinner, as well as snacks.

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