



PROTEIN IN THE U.S. DIET AND THE CONTRIBUTION OF DAIRY FOODS

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HIGHLIGHTS

- Protein in the U.S. diet comes primarily from protein* foods, dairy products and grains.
- At an average of 1.8 servings of dairy products per day, dairy provides one-fifth of daily protein.
- Average protein intake in all age groups meets or exceeds the RDA. Protein accounts for just 14-16% of total calories, which falls toward the lower end of the Acceptable Macronutrient Distribution Range (AMDR).
- Protein intake is typically higher at lunch and dinner than at breakfast. A higher protein diet can help modulate appetite and slow age-related muscle loss.
- Dairy products contain high quality protein that can help consumers meet their daily protein needs.

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Protein plays a vital role in growth and development, immunity, the health of bones, skin, and nerves, and much more. A growing body of research indicates that a higher protein diet may help modulate appetite and satiety (1), help dieters retain more muscle and lose more fat during periods of weight loss (1, 2), and help older adults slow the loss of skeletal muscle that occurs with age (sarcopenia) (3). Consumers are becoming more aware of protein's many benefits and seeking ways to increase protein in the diet.

To better understand how much protein Americans consume each day and which foods contribute to daily protein intakes, the National Dairy Council (NDC) examined dietary data from *What We Eat in America*, the dietary component of the National Health and Nutrition Examination Survey (NHANES) (4).

Food Sources of Protein

Where do Americans get their protein? Protein foods* and food mixtures†, some of which include dairy foods as ingredients, provide nearly two-thirds (63%) of the protein in the diet (Figure 1). Milk and other dairy foods provide one-fifth (20%) of total daily protein intake. This includes 13% from dairy foods consumed as individual food items‡ and about another 7% from dairy foods that are used as ingredients in food mixtures. Grain foods provide only a modest amount of protein (10%).

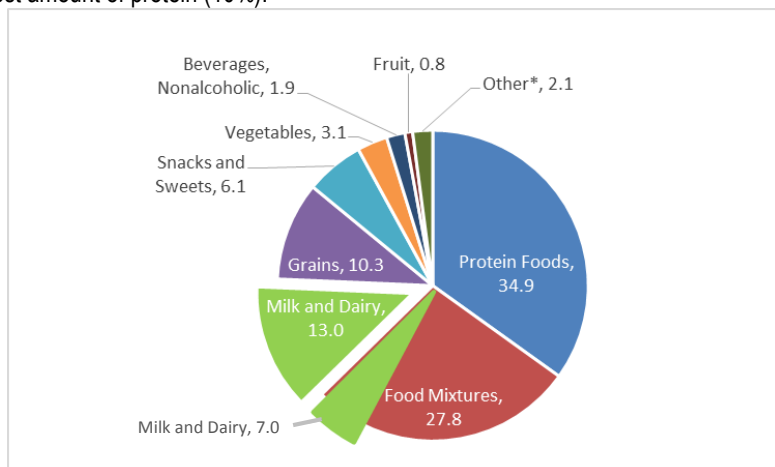


Figure 1. Food sources of protein in the diet of Americans ages 2 years and older; percentage of the total daily protein intake (NHANES 2007-2010).

*Protein foods: meat; poultry; fish; eggs; beans, peas, legumes; nuts and seeds; processed soy products.

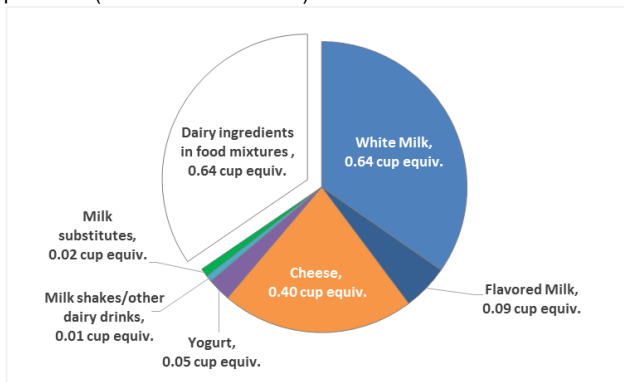
†Food mixtures using dairy products as ingredients include casseroles, pizza, sandwiches with cheese, and smoothies.

‡ Individual food items include a glass of milk, a serving yogurt, or cheese (e.g., string cheese).

Dairy Food Consumption

Americans ages 2 years and older consume an average of 1.8 cup equivalent servings of dairy products per day – with about two-thirds of this consumed as individual food items and one-third used as ingredients in food mixtures (Figure 2).

Figure 2. Average daily servings (cup equivalents) of dairy products (NHANES 2009-2010).



One cup equivalent serving = 1 cup milk, 1 cup yogurt, 1.5 ounces natural cheese, or 2 ounces processed cheese.

The average amount of milk, cheese and yogurt consumed daily differs as do the proportions consumed as individual food items and used as ingredients in food mixtures:

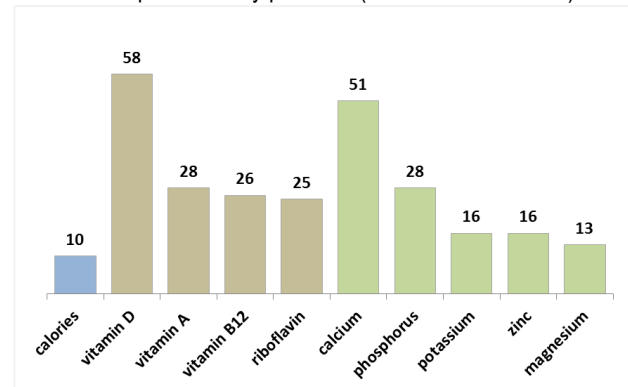
- Milk: 1 cup equivalent per day (includes white and flavored milk, buttermilk, evaporated milk, and milk substitutes). About three-fourths (76%) of milk consumption is as a beverage and the other fourth (24%) is used in food mixtures.
- Cheese: 0.8 cup equivalents per day (includes natural and processed cheese, cottage cheese and ricotta cheese). Half of daily cheese consumption (49%) is as an ingredient in food mixtures.
- Yogurt: less than one-tenth of a cup equivalent (0.06 cup equivalents) per day (includes plain, flavored and frozen yogurt). Less than 20 percent of yogurt is used as an ingredient in food mixtures.

Children tend to consume more dairy products than adults, and males generally consume more than females (see page 5).

Contributions of Dairy Foods to Nutrient Intakes

While dairy products make up about one-fifth of the day's protein, they contribute only 10% of daily calories plus more than 20% of the daily intakes of calcium, vitamin D, vitamin A, vitamin B12, riboflavin and phosphorus from foods consumed by Americans 2 years and older (Figure 3) (5).

Figure 3. Percentage of daily calories, vitamins and minerals from consumption of dairy products (NHANES 2003-2006).



Dairy is High Quality Protein

The main types of proteins in dairy foods – whey and casein - are high quality proteins, meaning they contain all of the 9 essential amino acids (building blocks of protein) in proportions that support protein synthesis in muscles and other tissues (6, 7).

How much protein in a serving?

Milk, whole, 1 cup	8 g
Cheese, natural, 1.5 ounces ^a	10 g
Cheese, processed, 2 ounces	10 g
Cottage cheese, low-fat, ½ cup	13 g
Yogurt, plain, low-fat, 1 cup	12 g
Yogurt, Greek, plain, non-fat, 6 ounces	17 g
Whey-based protein powder, 2 tbs	9 g

^a Examples are cheddar, Swiss and muenster.

Source: USDA National Nutrient Database for Standard Reference, Release 26.

About Protein Quality...

Amino acids are the building blocks of protein. Nine are considered “essential” and must be obtained from the diet. High quality proteins contain all 9 essential amino acids in the proportions that cells need for protein synthesis. Lower quality proteins are missing or low in one or more essential amino acids. In addition to the amino acid profile, the digestibility of protein factors into its quality. Animal foods generally contain higher quality protein than plant foods.

There are several methods for rating protein quality. One widely used method is the Protein Digestibility-Corrected Amino Acid Score (PDCAAS), which rates proteins from 0 to 1 (0 represents the lowest quality and 1 represents the highest) (6). With this method, whole wheat has a score of 0.42, soybeans 0.91, beef 0.92 and cow's milk 1.0. The high PDCAAS score for milk indicates its proteins are well-digested and its mix of amino acids supports efficient protein synthesis.

Protein Intake in Grams

The Recommended Dietary Allowance (RDA) for protein ranges from 13 to 34 grams per day for children, depending on age (Table 1) (8). For girls and boys ages 14-18 years, the RDA is 46 grams and 52 grams, respectively, and for women and men 19 years and older, the RDA is 46 grams and 56 grams, respectively.

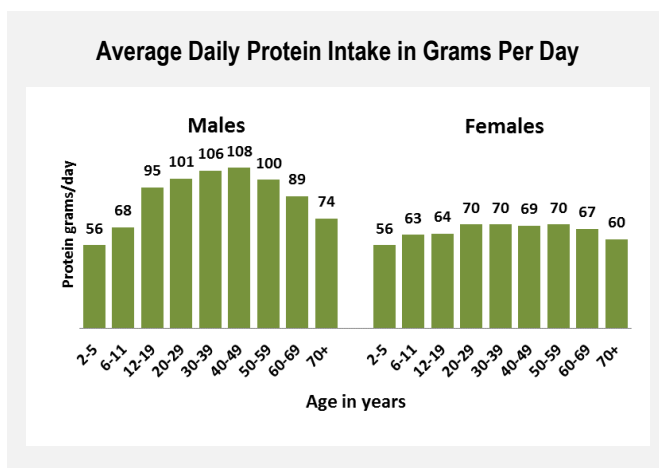
Table 1. The Recommended Dietary Allowance (RDA) for Protein (grams per day) (8).

Children age 1-3	13 g
Children age 4-8	19 g
Children age 9-13	34 g
Girls age 14-18	46 g
Boys age 14-18	52 g
Women age 19-70+	46 g
Men age 19-70+	56 g
Pregnant/lactating women	71 g

The average daily protein intake meets or exceeds the RDA (Figure 4). Among boys and men, average protein intake ranges from 56 to 108 grams per day, depending on age. Protein intake increases from childhood through midlife, peaking at age 40-49 years. Men's protein intake declines after age 50, but the average doesn't dip below the RDA.

Among girls and women, protein intake doesn't vary as much by age as it does in males. Average protein intake across age groups ranges from 56 to 70 grams per day. Intake changes very little from age 20 to 59 years. Women's protein intake declines somewhat after age 60, but similarly, the average doesn't dip below the RDA.

Figure 4. Average daily protein intake in grams per day, by age and sex (USDA What We Eat In America, NHANES 2009-2010).



... and as a Percentage of Calories

The recommended daily protein intake also can be looked at in terms of calories provided by protein. The Institute of Medicine (IOM) has set Acceptable Macronutrient Distribution Ranges (AMDR) for protein, fat and carbohydrate (macronutrients are nutrients that provide energy, or calories) (Table 2) (8).

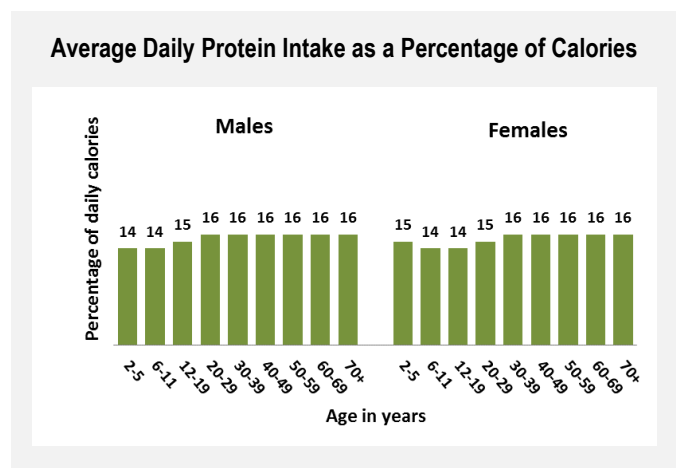
Table 2. Acceptable Protein Macronutrient Distribution Range (AMDR; % of daily calories) (8).

Children age 1-3	5-20%
Children age 4-8	10-30%
Children age 9-13	10-30%
Girls age 14-18	10-30%
Boys age 14-18	10-30%
Women age 19-70+	10-35%
Men age 19-70+	10-35%
Pregnant/lactating women	10-35%

The AMDRs represent ranges of intake associated with reduced risk for chronic disease. The IOM recommends that adults obtain 10 to 35 percent of daily calories from protein with recommendations for children differing only slightly. The lower end of this range is set at a level that provides approximately the RDA for protein.

How does actual protein consumption in the United States compare to the AMDR? In males and females, the percentage of daily calories from protein ranges from 14 to 16 percent across age groups (Figure 5). These values fall towards the lower end of the AMDR, indicating that many Americans have room to increase the protein in their diet.

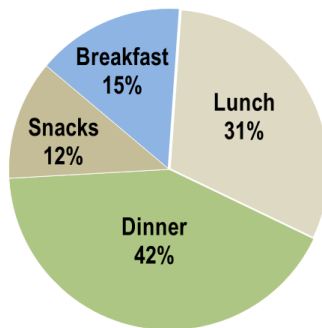
Figure 5. Average daily protein intake as a percentage of calories, by age and sex (USDA What We Eat In America, NHANES 2009-2010).



Protein Intake at Meals & Snacks

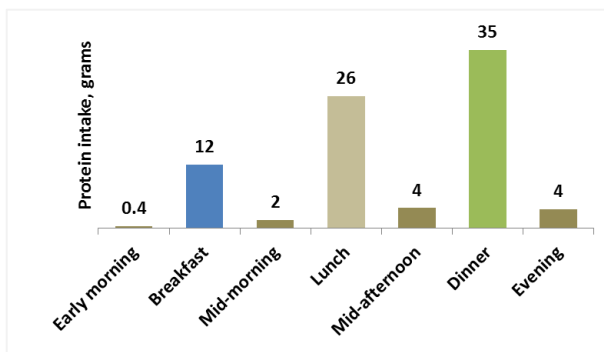
How is protein intake distributed throughout the day? The smallest proportion of total daily protein is consumed at breakfast with the largest proportion consumed at dinner (Figure 6). This pattern is seen in both males and females and across all race/ethnicity groups (data not shown).

Figure 6. Average percentage of daily protein intake from meals and snacks, U.S. population 2 years old and older (NHANES 2001-2008).



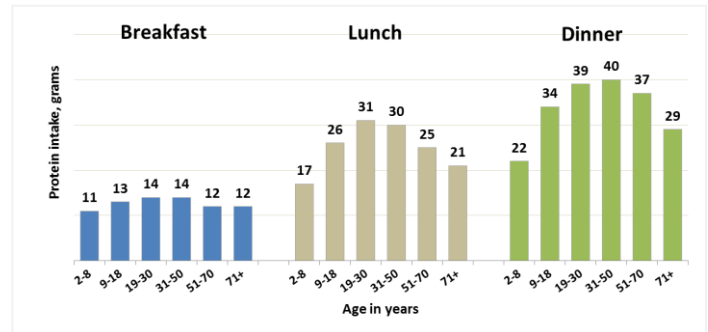
Breakfast provides an average of 12 grams, lunch 26 grams, and dinner 35 grams of protein (Figure 7). Snacks, which are eaten intermittently throughout the day, provide an additional 10 grams. The number of snacks consumed each day varies by age and whether 1, 2 or 3 meals are typically eaten (See data from [USDA WWEIA Data Tables Meals and Snacks](#)).

Figure 7. Average amount of protein consumed at meals and snacks (U.S. population 2 years and older; NHANES 2001-2008).



Americans tend to consume more protein at lunch and dinner than at breakfast, particularly individuals who are 9 years and older (Figure 8). Protein intake at breakfast is similar across all age groups.

Figure 8. Average amount of protein consumed at meals by age group (NHANES 2001-2008).



Protein Intake Throughout the Day

Current patterns of protein intake are characterized by average daily intakes of 14-16% of calories, which are distributed unevenly across breakfast, lunch and dinner. Average intakes of protein are less than 15 grams at breakfast and snacks and more than 30 grams at dinner. Higher protein intakes (20-30% of calories) when following a reduced-calorie diet can help curb hunger and retain muscle during weight loss (1, 2). Evidence continues to mount that consuming a moderate amount of high-quality protein, about 30 grams, at each meal can maximally stimulate muscle protein synthesis in healthy adults and may slow age-related loss of muscle mass in older adults (3, 9-11).

Moderately higher daily intakes of protein along with modifications to eating patterns to achieve similar protein intakes at breakfast, lunch and dinner may be a strategy to help consumers more consistently experience the benefits of a protein-rich diet.

Dairy foods naturally contain high-quality protein. Milk, flavored milk, cheese, cottage cheese, yogurt and Greek-style yogurt all can help individuals achieve higher protein intakes and a more balanced pattern of protein intake across the three main meals of the day.

Dairy Consumption Declines with Age and is Lower in Females than Males

Consumption of dairy products falls as individuals get older with males generally consuming more servings of dairy foods, on average, than females (Figures 9A and 9B). Importantly, Americans ages 9 and older are not consuming three daily servings of dairy as recommended in the *2010 Dietary Guidelines for Americans* (12).

Table 3. Recommended daily servings of low-fat or fat-free milk and milk products.

Age Group	Servings (cup equivalents)
2-3 years	2
4-8 years	2 ½
9+ years	3

Source: *2010 Dietary Guidelines for Americans* (12).

While the average daily consumption of dairy products for individuals 2 years and older is 1.8 cup equivalent servings, males consume more dairy products than do females (2.1 vs. 1.6 servings per day).

Boys in the 2-8 year old age group consume 2.3 servings per day, while older boys (ages 9-18 years) consume 2.6 cup equivalent servings per day. Daily consumption of dairy products subsequently decreases in adulthood to 2.1 daily servings in 19-50 year old men and 1.8 servings per day in men 51 years of age and older.

In females, average dairy consumption is highest at 2.3 cup equivalent servings per day for girls, ages 2-8 years. Dairy product consumption by older girls, ages 9-18 years, drops to 1.9 servings per day. Adult women consume only half of the recommended 3 daily servings at 1.6 cup equivalent servings per day by women 19 to 50 years old and 1.4 servings by women 51 years and older.

Children, ages 2-18 years, consume a half cup equivalent serving of dairy products more per day than adults, ages 19 years and older. Similarly, boys ages 2-18 years and adult men consume a half cup equivalent serving more per day more than girls 2-18 years old and adult women, respectively.

Figure 9A. Average daily servings of dairy products by males across age groups (NHANES 2009-2010).

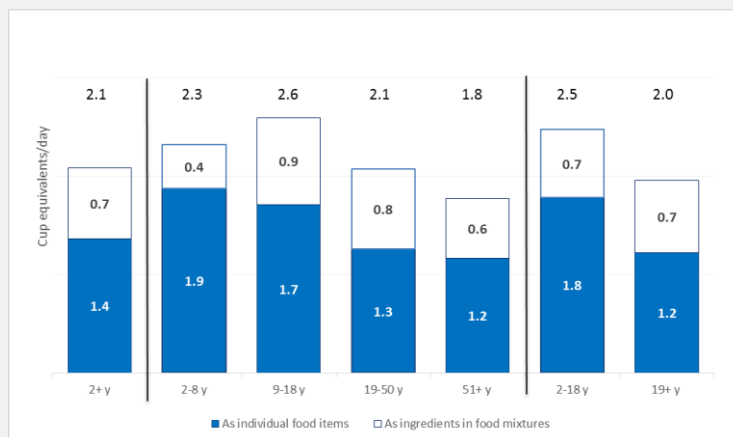
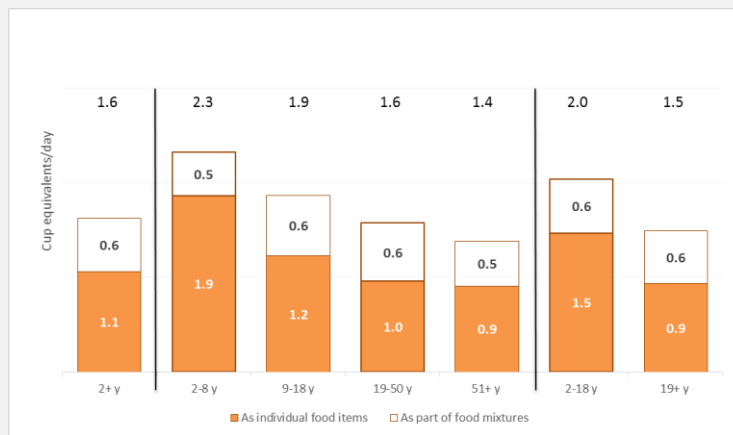


Figure 9B. Average daily servings of dairy products by females across age groups (NHANES 2009-2010).



Figures 9A and 9B. Values shown above each bar represent the total daily intakes of dairy products (cup equivalents per day) for each age group of Americans (NHANES 2009-2010).

Achieving recommended intakes

Consuming the recommended daily amounts of dairy can help close nutrient gaps and potentially displace other less nutritious options in the diet. Moreover, moderate evidence shows that intake of milk and milk products is linked to improved bone health, especially in children and adolescents. Moderate evidence also indicates that intake of milk and milk products is associated with a reduced risk of cardiovascular disease and type 2 diabetes and with lower blood pressure in adults (12-14).

One approach to increase dairy consumption is to establish the habit of drinking milk in young children, as children who consume milk at an early age are more likely to do so as adults (12). Adding just one more serving of dairy each day can help achieve recommended intakes.



Did You Know?

Whey protein powder is a convenient source of high quality protein

Whey protein contains all the essential amino acids and is one of the best sources of branched-chain amino acids, such as leucine, which stimulate muscle synthesis (15).

Whey offers a simple way to boost protein intake. Twenty to 40 grams of whey protein is needed to maximize muscle protein synthesis in young to older adults. One-quarter cup of whey-based protein powder contains approximately 18 grams of protein. It can be added to smoothies, blended coffee beverages, yogurt, puddings, and baked goods such as muffins and pancakes.

Average protein consumption in the U.S. diet meets important benchmarks, but there is room to increase protein intake.

- The average protein intake for all age groups meets or exceeds the Recommended Dietary Allowance (RDA) for protein. However, protein contributes only 14-16 percent of total calories, a level that falls towards the low end of the Acceptable Macronutrient Distribution Range (AMDR). In addition, protein intake decreases in older age groups.
- NHANES data for 2007-2010 show that dairy contributes about one-fifth (20 percent) of the daily protein intake by Americans. Average dairy consumption is 1.8 servings per day. Analysis by age groups indicates that dairy consumption, especially milk consumption, steadily declines with age.
- Moderately higher daily intakes of protein along with altering eating patterns to achieve similar protein intakes at breakfast, lunch and dinner may help consumers achieve the benefits of a protein-rich diet. Benefits for older adults and people managing their weight, in particular, may include support for muscle synthesis, slower age-related muscle loss, and improved meal satiety.
- Many Americans have room to increase the protein in their diet. Dairy products are versatile, convenient sources of high quality protein that can help individuals meet their protein goals.

References

1. Westerterp-Plantenga MS, Lemmens SG, Westerterp KR. Dietary protein - its role in satiety, energetics, weight loss and health. *Br J Nutr* 2012;108 Suppl 2:S105-12.
2. Soenen S, Martens EA, Hochstenbach-Waelen A, Lemmens SG, Westerterp-Plantenga MS. Normal protein intake is required for body weight loss and weight maintenance, and elevated protein intake for additional preservation of resting energy expenditure and fat free mass. *J Nutr* 2013;143(5):591-6.
3. Mamerow MM, Mettler JA, English KL, Casperson SL, Arentson-Lantz E, Sheffield-Moore M, et al. Dietary protein distribution positively influences 24-h muscle protein synthesis in healthy adults. *J Nutr* 2014;144(6):876-80.
4. U.S. Department of Agriculture ARS, Beltsville Human Nutrition Research Center, Food Surveys Research Group; U.S. Department of Health and Human Services. Centers for Disease Control and Prevention, National Center for Health Statistics. *What We Eat In America, NHANES 2001-2008; 2003-2006; 2007-2010; 2009-2010.*
5. Miller GD, Auestad N. Towards a sustainable dairy sector: Leadership in sustainable nutrition. *International Journal of Dairy Technology* 2013;66(3):307-316.
6. Schaafsma G. The protein digestibility-corrected amino acid score. *J Nutr* 2000;130(7):1865s-7s.
7. Schaafsma G. Advantages and limitations of the protein digestibility-corrected amino acid score (PDCAAS) as a method for evaluating protein quality in human diets. *Br J Nutr* 2012;108 Suppl 2:S333-6.
8. Institute of Medicine (IOM). *Dietary carbohydrates: sugars and starches.* In: Spears GE. *Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids.* Washington, DC: National Academies Press; 2002/20015
9. Paddon-Jones D, Rasmussen BB. Dietary protein recommendations and the prevention of sarcopenia. *Curr Opin Clin Nutr Metab Care* 2009;12(1):86-90.
10. Paddon-Jones D, Leidy H. Dietary protein and muscle in older persons. *Curr Opin Clin Nutr Metab Care* 2014;17(1):5-11.
11. Pennings B, Groen B, de Lange A, Gijsen AP, Zorenc AH, Senden JM, et al. Amino acid absorption and subsequent muscle protein accretion following graded intakes of whey protein in elderly men. *Am J Physiol Endocrinol Metab* 2012;302(8):E992-9.
12. U.S. Department of Agriculture and U.S. Department of Health and Human Services. *Dietary Guidelines for Americans, 2010. 7th Edition,* Washington, D.C.: U.S. Government Printing Office, December 2010.
13. Rice BH. Dairy and Cardiovascular Disease: A Review of Recent Observational Research. *Curr Nutr Rep* 2014;3:130-138.
14. Rice BH, Quann EE, Miller GD. Meeting and exceeding dairy recommendations: effects of dairy consumption on nutrient intakes and risk of chronic disease. *Nutr Rev* 2013;71(4):209-23.
15. Blomstrand E, Eliasson J, Karlsson HK, Kohnke R. Branched-chain amino acids activate key enzymes in protein synthesis after physical exercise. *J Nutr* 2006;136(1 Suppl):269s-73s.

Definitions

Dietary Reference Intakes are nutrient reference values developed by the Institute of Medicine of The National Academies of Science. They are intended to serve as a guide for good nutrition and provide the scientific basis for the development of food guidelines in both the United States and Canada. These nutrient reference values are specified on the basis of age, gender and lifestage and cover more than 40 nutrient substances.

- **Recommended Dietary Allowances (RDAs)** are set to meet the needs of almost all (97 to 98 percent) individuals in a group
- **Acceptable Macronutrient Distribution Range (AMDR).** A range of intakes for a particular energy source (e.g., protein) that is associated with reduced risk of chronic diseases while providing adequate intakes of essential nutrients
Source: [Dietary Reference Intakes Tables and Application ...](#)

Milk and Milk Products or alternately, **Dairy Products**, includes milk, cheese, yogurt

- **Milk** includes fluid milk, buttermilk, evaporated milk, dry milk, and milk substitutes (e.g., calcium-fortified soy beverage)
- **Cheese** includes natural cheese, soft cheese, processed cheese, cheese food, cottage cheese, ricotta cheese and fat-free cream cheese
- **Yogurt** includes plain yogurt, flavored yogurt, fruit yogurt and frozen yogurt

Dairy's Contribution to Protein Intakes

The total contribution of dairy to protein intake includes the contribution of dairy products consumed in the form of individual food items plus that from dairy products used as ingredients in food mixtures

- **As individual food items.** Examples include fluid milk (white or flavored), cheese snacks (e.g., cheese and crackers, string cheese), and yogurt (plain, flavored, or fruit) or frozen yogurt
- **In food mixtures.** Examples of food mixtures that contain milk, cheese or yogurt as an ingredient include egg dishes, casseroles, sandwiches with cheese, pizza, and smoothies

Source: [ARS, USDA Food Patterns Equivalent Database](#)

Methods

Estimates in this report are based on one day of dietary intake data collected in *What We Eat In America*, the dietary intake interview component of the National Health and Nutrition Examination Survey (NHANES) in 2007-2010. Data on the consumption of milk and milk products and their contributions to nutrient intakes are based on day 1 dietary intake data from NHANES 2007-2008 and 2009-2010 for 8,442 and 8,944 individuals, respectively, ages 2 years and older with complete and reliable intakes, excluding breastfed infants. Sample weights were applied in all analyses to produce nationally representative estimates.

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