

What Is a Snack, Why Do We Snack, and How Can We Choose Better Snacks? A Review of the Definitions of Snacking, Motivations to Snack, Contributions to Dietary Intake, and Recommendations for Improvement^{1,2}

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ABSTRACT

Around the world, adults consume energy outside of traditional meals such as breakfast, lunch, and dinner. However, because there is no consistent definition of a “snack,” it is unclear whether those extra eating occasions represent additional meals or snacks. The manner in which an eating occasion is labeled (e.g., as a meal or a snack) may influence other food choices an individual makes on the same day and satiety after consumption. Therefore, a clear distinction between “meals” and “snacks” is important. This review aims to assess the definition of extra eating occasions, to understand why eating is initiated at these occasions, and to determine what food choices are common at these eating occasions in order to identify areas for dietary intervention and improvement. Part I of this review discusses how snacking is defined and the social, environmental, and individual influences on the desire to snack and choice of snack. The section concludes with a brief discussion of the associations of snacking with cardiometabolic health markers, especially lipid profiles and weight. Part II addresses popular snack choices, overall snacking frequencies, and the demographic characteristics of frequent snackers in several different countries. This review concludes with a recommendation for nutrition policymakers to encourage specific health-promoting snacks that address nutrient insufficiencies and excesses. *Adv Nutr* 2016;7:466–75.

Keywords: appetite regulation, childhood obesity, eating behavior, food intake and appetite regulation, nutritional assessment

Introduction

Because of the difficulty involved in defining “snacks” and “snacking,” there is discrepancy in the literature about whether snacking prevalence has increased or remained static and whether snacking contributes to energy imbalance and weight gain (1, 2) or facilitates weight maintenance and a lower BMI (3–5). Yet, we know that individuals are consuming energy outside of meals (2, 6–21), regardless of the overall prevalence of snacking or its impact on health. This review discusses the definitions and presentation of snacking in the current literature and snacking patterns in several areas of the world. Part I of this review discusses how snacking is defined and the social, environmental, and individual influences on the desire to snack and choice

of snack. This section concludes with a brief discussion of the associations of snacking with cardiometabolic health markers, including plasma lipid concentrations and BMI. On the basis of information from part I as well as cross-sectional data and government dietary guidelines, part II of this review evaluates popular snack choices in several different countries and how the nutrition science community can promote nutrient-dense snack options and choices. Given that snacking is still an eating occasion during which people consume energy and nutrients (2, 6–21), even if the impact of frequent eating on health remains largely unknown, choosing healthful snacks could help mitigate the potential negative effects of snacking and contribute to promoting and facilitating nutrient-dense and health-promoting diets (22).

Although several different definitions have been proposed in the literature, in this review “snacks” will refer to eating foods or consuming caloric beverages between regular

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meals (7, 11, 14, 17, 21, 23, 24). “Snack foods” will designate energy-dense, nutrient-poor foods high in sodium, sugar, and/or fat such as cookies, cakes, sugar-sweetened beverages, and chips (12, 13, 19, 21, 25, 26). “Snacking” refers to the act of eating a snack, regardless of whether healthful choices or “snack foods” are consumed (2, 9, 13, 16, 18, 19, 21, 26–28).

Part I: Definitions of Snacks, Influences on Snacking, and the Effect of Snacking on Metabolic and Cardiovascular Health

What is a “snack”?

How an eating occasion is labeled influences other food choices an individual makes on the same day and may even affect satiety after eating (19, 29–33). In addition, the delineation of different eating occasions affects data collection on eating patterns and their interpretation and is important for the research community to consider in order to collect accurate information (33). Despite its potential to influence daily eating patterns of an individual as well as how data are collected and interpreted, the term “snack” does not have a static definition (33). Several publications in the literature even commented on the definitional variation and difficulty of distinguishing meals from snacks (23, 26, 33). Some current definitions of “snack” in the literature are based on the time of day of an eating occasion (5, 11, 13, 14, 16, 17, 20), type of food consumed (12), amount of food consumed, location of food consumption, or a combination of several of these factors (17, 21, 23, 34). Furthermore, some studies relied on study participants to label their eating occasions, sometimes with (1, 2, 5–10, 14, 15, 17–19, 24, 27, 32, 35) and sometimes without (12) providing them with a list of examples or controlled, defined labels. Provided labels, however, still varied by study. Several studies allowed participants to categorize eating occasions as either meals or snacks (1, 5, 6, 15, 19), whereas others separated specific meals (i.e., breakfast, brunch/lunch, dinner, small meal, main meal) from snacks (2, 8, 10, 17, 18, 32). Some studies further differentiated between snacks on the basis of time of day (i.e., morning, afternoon, and evening snacks) (7, 14, 24, 27).

In other studies, research teams or interviewers classified eating occasions for participants after reporting of food intake (5, 13, 16, 20, 21, 23, 34). Some studies that used cross-sectional data, especially from multiple studies, even reclassified participant-defined eating occasions (1, 2, 5, 9, 11, 18, 24, 35). To reclassify, some research teams collapsed 2 eating occasions, such as breakfast and brunch, into a single occasion (32) or combined all eating occasions within 15 (1, 2, 5, 9, 18, 35) or 30 (20) min of each other into 1 eating occasion. However, some studies did not specify how food intake data were separated by eating occasion (11).

Having participants define eating occasions without any designated parameters could introduce considerable variety into snacking data. Although this phenomenon has not been studied extensively, a few surveys specifically assessed inter-individual variations in the definition of “snacks” (36–38). Two surveys were conducted on American college campuses

(36, 37). Undergraduate students associated snacks with the following cues: eating alone, short eating periods (10 min), disposable utensils, lower food and nutrition quality, and most importantly, standing while eating (36). Generally, respondents perceived snacks to be small portions of packaged, inexpensive, and nutrient-poor foods and defined “snacks” as a specific set of foods (36). The second survey of college students found that the time of day and location of consumption also factored into whether an eating occasion was considered a meal or a snack (37). A third survey conducted in England found that respondents ($n = 121$) defined snacks, snacking, and snack foods differently (38). University students and staff were mailed surveys and asked to define 1 term (snack, snacking, or snack foods) and describe (including food, location, company, and time of day) the last time they had eaten a snack, snacked, or eaten snack foods (38). All of the questions were open-ended. This survey was followed with a second survey ($n = 86$) on the other 2 terms. Although the differences between the definitions of “snacks,” “snacking,” and “snack foods” were not significant, the data did suggest “conceptually consistent differences in usage” among the terms on the basis of location of food consumption, food choice, and time of day (38). For instance, “snack food” was more likely to be eaten later in the day (after 1800 h), whereas a “snack” was more likely to be consumed early in the day (38). However, in the conclusion of this study, the authors expressed hesitance about defining any of these terms and suggested that due to the considerable variation among participant responses, the root word “snack” should be avoided in research questionnaires (38). The participants in all 3 of these surveys were part of very specific populations and therefore the results cannot be widely extrapolated. Nonetheless, the variation in the definition of “snack” from this very limited audience alone suggests the possibility of even greater disparity in “snack” definitions in populations of greater age, ethnic, and cultural diversity.

As an example, secondary analyses of data from the NHANES in the United States, which relies on participant definitions of eating occasions, are intended to represent the entire American population (39). NHANES data do show some differences in snack definition, most notably that some respondents “defined foods eaten at the same time as both a snack and a meal” (2, 9, 18). These respondents may define snacks by type of food consumed (i.e., snack foods) rather than by the time of day they are consumed. Although researchers can recode eating episodes by time of consumption, the presence of these single eating occasions with multiple codes suggests that participants of NHANES define snacks differently. Researchers cannot feasibly account for all of the variations.

Although the semantics of eating occasion labels may seem trivial, an individual’s definition of an eating occasion as a snack or as a meal may influence their food selection (28, 30, 32, 33, 36). An analysis of NHANES data from 1988 to 1994 found that individuals who reported skipping a meal but eating several snacks had less healthful overall

nutrient intakes than did individuals who ate 3 meals, with or without snacks (32). Diet quality was assessed by macro- and micronutrient intake, including cholesterol, vitamins B-6 and C, folic acid, calcium, magnesium, iron, sodium, potassium, and fiber (32). Individuals who ate all 3 meals as well as snacks had the “highest intakes of all micronutrients examined, except cholesterol, vitamin B-6, and sodium” (32). Persons who skipped breakfast but ate 2 snacks had the “lowest intake of all micronutrients except sodium” (32). In this study, individuals who classified their eating occasions as meals therefore seemed to choose more nutrient-dense foods.

In addition to affecting micronutrient intake, defining eating occasions as meals instead of snacks influences food choices later in the same day (30). An intervention study in 138 undergraduate students showed that individuals report feeling less satiated by a “snack” than a “meal,” even when the 2 eating occasions are isocaloric (30). Individuals also tend to consume more calories at an eating occasion after a “snack” than after a “meal.” (30) Previous food diary (19) and intervention (28, 31, 40) studies also indicated that eating between meals does not affect the amount of calories eaten at the next meal. The results of these studies (19, 30–32) suggest that simply the way in which an eating occasion is labeled may influence choice of food, satiety, and daily caloric intake.

To clarify data in the literature, especially data from large epidemiologic studies, it may be prudent to avoid the word “snack” on forms and interview questions to minimize confusion about what it means to eat a “snack” (38). Instead, participants could be asked to simply record meals and food or caloric beverage items consumed between meals.

Defining snacks: nutrition policy

Government-issued dietary guidelines could also benefit from the use of a clear and consistent definition of snack and snack food or the elimination of these terms altogether. On the basis of the literature discussed in this section, consumers seem to define “snacks” and “snack foods” differently (36–38). Yet, neither of these terms have a clear definition in some government-issued dietary guidelines (41–46). The 2010 Dietary Guidelines for Americans (DGA), for instance, encourages decreasing the consumption of “snack foods” but also provides few suggestions for “snacks.” Although their intended meaning may not seem difficult to discern, the plethora of “snack” definitions among the American public may complicate the interpretation of these guidelines by some sectors of the general public, the intended audience for these guidelines (42). To clarify recommendations, dietary guidelines need to provide definitions of “snack” and “snack foods,” especially because the label applied to an eating occasion can influence nutrient intake, satiety, and food quality (19, 28–33, 36).

Motivations to snack

Similar to the definitions of snacking, the desire to snack depends on several different factors. The motivations to snack

discussed in this review include hunger (26, 28, 47), location (37, 48–50), social/food culture and environment (26, 51–57), cognitive factors (58–62), and hedonic eating (63–66).

Hunger. Although snacking when hungry tends to be associated with the consumption of health-promoting foods, snacking in the absence of hunger leads to the consumption of fat, sugar, and sodium-rich foods (26). Unnecessary snacking promotes “weight gain and poor nutrition” (26), and the results of studies by Chapelot et al. (28, 47) support this hypothesis. In one study, habitual nonsnackers were offered a snack between lunch and dinner (47). Although all of the participants consumed ≥ 1 food item offered as a snack, the researchers found no evidence of a biological cue (hunger score change, decrease in insulin or glucose concentrations) prompting a desire to eat (28). Chapelot et al. concluded that these participants ate because food was available even in the absence of biological cues, an example of unnecessary snacking. However, the control group of regular snackers did adjust the timing and size of their next meal after consuming a snack (28). According to these studies, nonhabitual snackers lack a biological motivation to eat snacks and, for these “nonsnackers,” snacking without hunger leads to increased energy consumption, which can cause eventual weight gain.

Location. Location may affect food selection for snacks (37, 49, 50) as well as portion size (48). Although eating at home or at work is associated with more healthful food choices for snacks, eating at other locations is associated with larger snack sizes (48) and higher fat and lower fiber content (49, 50). One survey asked British and Australian college students to “construct a ‘typical’ lunch, dinner, or snack for 11 specific locations” using a list of 51 foods (37). Locations ranged from eating while watching television (TV) at home to eating in an airplane or on a camping trip (37). This study used cluster analysis to group foods by location and eating occasion and found that, although participants grouped some foods by eating occasion, the foods selected as appropriate for each eating occasion more often depended on the location of food consumption (37).

The results of 3 cross-sectional studies also showed an impact of eating location on food choice. A recent cross-sectional study of snacking habits of Norwegian adults ($n = 1787$) found that snacks eaten in the workplace had the most favorable nutrient profile and generally consisted of less energy and added sugars but more protein than snacks consumed at home, at restaurants, or while traveling (49). Another cross-sectional study in Irish adults ($n = 958$) assessed the nutrient contributions of foods in their daily diets by location of consumption (50). This study did not distinguish between eating occasions, but the results showed that foods eaten outside the home generally had more fat, less fiber, and fewer micronutrients than foods eaten at home (50). Finally, a study in 115 Northern Irish children ages 5–8 y found that the snacks children ate outside the home tended to be larger than snacks eaten in the home (48).

However, for this group, the foods selected for snacks were similar both in and outside the home, which may be due to parents bringing snacks from the home for their children to eat outside the home (48). Although not all of these studies looked specifically at snacks, where individuals eat may influence the nutrient profile and portion size of the foods they choose at different eating occasions, including snacks (44–46).

Social and food culture and environment. Snacking can also be influenced by social culture, food culture, and socioeconomic status (26). Although a comprehensive discussion on the plethora of environmental factors that influence eating is beyond the scope of this review, some factors relevant to snacking, including social modeling and food insecurity, will be addressed.

Several studies have shown that the amount of food consumed by eating companions affects portion size, an effect referred to as “social modeling” (51, 52). According to a recent review (67), this effect has primarily been studied in the context of snack food consumption. If eating companions consume a large portion of food, the person eating with them also tends to eat more. The converse is true with small amounts of food. Even if an eating companion is not present, environmental cues about earlier individuals’ food intake and choices, such as empty food wrappers, can influence intake (51, 68). The enhanced influence of eating companions during snack times may be due to the lack of an “eating routine” or “script” for snacking as an eating occasion (52, 53), whereas meals tend to be more constrained by certain behaviors or places.

Snack consumption may also be initiated because of celebratory social occasions as well as the availability of or desire for tempting food. One research team developed a “Reasons to Snack” inventory with 35 different options and used this inventory in a study in 1544 adults (54). This inventory was specifically developed to assess individuals’ reasons to consume unhealthy snacks that contain large amounts of fat or sugar and found that the most common reasons for consuming unhealthy snacks included celebrating at a party or special occasion or craving a tasty food (54). Another study asked 55 adults to keep a diet diary for 5 d and rate their reasons for eating with the use of a similar scale with only 13 items (55). In this study, the most common reason for consuming unhealthy snacks was that “they looked or smelled so tempting” (55% of snacking occasions), followed by “hunger” (49%) and “needing energy” (23%) (55).

However, in some countries, including France (19, 28), the Philippines (24), and Mexico (14, 24, 69), a fourth “meal” or snack is part of a traditional meal pattern. The French have an eating occasion called *goûter* between lunch and dinner (26). A small meal between lunch and dinner, *merienda*, is customary in the Philippines (24). In Mexico, a midmorning meal (*almuerzo*) is relatively common (14, 69). In these countries, therefore, tradition may motivate snacking.

In food-insecure populations, however, snacking may be adopted as a strategy to skip meals (56). Food-insecure individuals have limited or uncertain “access at all times to enough food for an active, healthful life” (56, 57). NHANES collects food security data on individuals through a Food Security Survey Module (56, 57, 70). Recently published studies on snacking and food security (56, 57) used information from the 1999–2002 Food Security Survey Module, which divides individuals into 4 groups: food secure, marginally food secure, food secure without hunger, and food secure with hunger (57). These studies found that individuals who are food insecure without hunger snack more often, eat larger meals, and may consume more calories from snacks than food-secure individuals (56). Food-insecure women without hunger consumed more energy at snacks, and food-insecure men without hunger consumed more energy at meals than their food-secure counterparts (56). Because the major energy source for snacks among food-insecure adults was “sugar, sweets, and beverages,” this trend toward increased snacking indicates that snacks may serve different roles in the diet and have different health effects based on socioeconomic status (56, 57).

Distracted eating. Other motivations to consume snacks include distracted eating and the association of eating with certain activities. Several articles have been published on how eating while distracted affects the amount of food individuals choose to consume later in the day (58–60). For instance, eating lunch while watching TV or playing video games tends to increase the amount of snacks people eat later (58–60). However, as stated in a recent meta-analysis and systematic review, this finding has been replicated primarily in relatively homogenous populations with healthy BMIs and an age range of 20–47 y (58).

In addition to affecting later memory of food consumed, watching TV has also been associated with the number of snacks consumed per day (61). In Canadian college students ($n = 613$), “medium” to “high” viewers of TV (where “high” was ≥ 4 h of TV viewing daily and “medium” was between 1 and 4 h of TV viewing) snacked more frequently than did “low” TV viewers (61). Snacking frequency was assessed by using a 5-point Likert scale that asked participants to rate how often they snacked while watching TV (“never” to “every day”) (61). The results of this study suggest that individuals who watch TV frequently perceive themselves as snacking more frequently while watching TV.

The reasons for greater snack consumption while watching TV have not been fully explained in the literature, but 1 research team assessed the impact of different types of TV programs (“boring” or “engaging”) on food intake in normal-weight college-aged female participants ($n = 18$) (62). After a 4-h fast, participants had free access to both chocolate candies and grapes while either watching TV or reading for 30 min. A “nonengaging” text for reading was used as a control. Participants consumed significantly more snacks (by mass) during both the boring TV condition ($P = 0.009$) and the text condition ($P = 0.05$) relative to the engaging TV

condition. However, participants ate significantly more grapes than chocolate candies in all of the conditions ($P = 0.006$). Although the study population was limited to young women and most of the snacks eaten were fruit, boredom did seem to contribute to the decision to snack.

These studies suggest that eating while distracted may contribute to reduced satiety and increase consumption at the next eating occasion. “Boring” distractions may increase snack intake even more. If individuals are “multitasking” while snacking, they may eat more of a snack or consume more food at their next meal. More research is needed in this area with more diverse study populations over longer time periods to determine how distracted eating affects intake and body weight.

Hedonic eating. In addition to being motivated by distraction, snacking may also be motivated by the rewarding properties of food, or “hedonic eating.” One personality model, reinforcement sensitivity theory, asserts that the regulation of food intake may be driven by an individual’s sensitivity to reward (63). The initial study assessing connections between reward sensitivity and eating behaviors surveyed female college students ($n = 99$) with questionnaires about food cravings and their sensitivity to punishment and reward (63). Women who were more sensitive to reward had higher BMIs and higher food craving scores ($P < 0.05$) (63). Similarly, a cross-sectional study in 1104 adolescents found that 14- to 16-y-olds who were “sensitive to reward” consumed more energy-dense snacks and sugar-sweetened beverages than did individuals who were less “sensitive to reward” (64).

Yet, in another study, initiation of eating in the absence of hunger was not significantly correlated with sensitivity to reward (65). This study provided 50 adults with a “snack taste test” of chocolate candies, which participants were instructed to consume until satiation. Immediately after the first test, participants were given a second, unanticipated, and voluntary opportunity to consume a different kind of chocolate candy. Not all of the adults accepted the second taste test. However, the only significant difference between the adults who chose to participate in the second taste test and those who did not was that the adults who participated had significantly higher inhibitory control scores than the adults who declined ($P = 0.03$). There were no significant differences in BMI, impulsivity, hunger, or food reward sensitivity between the 2 groups.

Therefore, although 2 cross-sectional studies (63, 64) showed significant associations between reward sensitivity, BMI, food cravings, and snack food consumption, the results of an intervention study did not support these findings. This difference may be due to the different populations assessed in each study. However, this area of study is relatively new, and the connections between sensitivity to reward and eating habits, especially snacking habits, merit further investigation.

Snacking, heart health, and weight

Whether snacking is initiated because of hunger, regular eating patterns, or other psychological or physiological cues may

be predictive of its effect on weight (5, 26, 28, 47, 63). The health impact of eating frequency may depend on how an individual defines an eating occasion (a snack compared with a meal) as well as their motivation to eat, food choice, age, sex, and socioeconomic group (11, 14, 18, 20, 21, 28).

Heart health. The only consistent link between snacking and a health outcome appears to be its association with improved cardiovascular health markers, including lipid profile (cholesterol and TG concentrations) and blood pressure (10, 71, 72). Frequent eating may improve lipid profiles and decrease the risk of cardiovascular disease (10, 72). A review article assessing the effects of feasting (1 large meal daily) compared with “nibbling” (3, 6, 9, 12, or 17 small meals daily) found that the “nibbling” pattern was associated with lower total- and LDL cholesterol concentrations and blood pressure (72). An additional study found that more frequent meal consumption (>1 –2 meals/d) resulted in lower total and LDL cholesterol (71). Although the results of this review and study assess a pattern of “frequent eating” rather than “snacking,” they both suggest that consuming food more often throughout the day, an eating pattern that could be due to snacking, improves lipid concentrations and blood pressure.

Weight. As several current reviews indicate, the effects of eating frequency on weight are not well understood (4, 26, 28, 73, 74). “Snacking” specifically does not have any unambiguous correlations with weight and has been associated with healthy weight maintenance and weight gain as well as both high diet quality and low diet quality (27, 35). Reviews on the associations between snacking and weight in both adults (73) and children (75) reported inverse correlations between snacking and adiposity. However, one of these reviews also noted that the correlation becomes positive when adjusted for underreporting (73).

A recent cross-sectional study in adults ($n = 10,092$) in England reported a helpful nuance to these different associations between weight and eating frequency (25). In this study, snacking was inversely associated with body fat in normal-weight individuals [BMI (in kg/m^2) <25] but was positively associated with waist circumference and subcutaneous fat thickness in overweight and obese men and women (25). Choice of snack also mitigated these associations. Overweight and obese participants tended to eat more snack foods such as “crisps, chocolates, ice cream, and sweets” and less “yogurt and nuts” than the normal-weight participants (25). On the basis of this study’s results, pre-existing health status may influence snack choice and the effect of snacking on weight.

Part II: Current Snack Choices, Snacker Demographics, and Recommendations for Change

The remainder of this review focuses on the foods and beverages that people choose to consume for snacks, the demographic profile of snackers, and suggestions for how the nutrition science community can recommend snack choices

to better fulfill nutrient insufficiencies and avoid nutritional excesses. Information from several countries will be addressed, but due to the authors' language proficiencies, data for part II were limited to countries for which government-issued dietary guidelines were available in English or French and at least 1 study on snacking habits was available in English. Language presents an important limitation to this worldview of snacking, because it is not possible to know whether data on other countries are missing due to language barriers or a lack of data. In addition, the data discussed in this section are limited by the study populations assessed. Nationwide survey data on snacking patterns were not available for all countries and therefore some information used in this section relies on data from small, homogenous populations.

Foods for snacks. Food preferences for snacks are similar in several areas of the world. In the United States, "salty snacks, desserts, candy, and sweetened beverages" are popular snack choices (21), and salty snacks have become especially popular since 1977 (18). In 2006, salty snacks including chips and nuts comprised 14.3% of total snacks consumed (18). Salty snacks, including crackers, popcorn, and pretzels, are also popular among Canadian youth (16). From 1977 to 2006, the preference for sweet snacks in the United States decreased overall, but in 2006 desserts still comprised 19.6% of snacks (18). Milk/dairy and fruit/juices have also become less popular snacks in the United States as well (18). Yet, although fruit and sweets have declined slightly as snack selections in the United States, they are very popular snacks in Mexico, Brazil, China, Oman, and France (13, 14, 19, 21, 76). Fruit is the most common snack food in Mexico (14), and one of the most popular snack items in Brazil (13). Other popular snack items in Brazil are other sweets, desserts, and "*salgados* (fried/baked dough with meat/cheese/vegetable)" (13). Similarly, among Greek adults, 2 of the most popular snack items are desserts (chocolates, cakes, and ice cream) and savory pies (6). In China, both fruit and grain-based foods are popular snacks (21). Snacks in France also tend to include sugary grain-based foods, including "sweets, cereal bars, [and] biscuits" (19), and Canadian children tend to also choose sweet grain-based products (16). In Finland, however, the same foods are consumed at snacks and meals (20). With the exception of fruit, many of these snacks fit the profile of "snack foods" and are relatively nutrient-poor and energy-dense. Therefore, on the basis of cross-sectional data, the choice of foods eaten for snacks is an area of concern for public health.

Beverages as snacks. The increased consumption of caloric beverages as snacks also merits concern, because sweetened beverages provide energy and few, if any, other nutrients. In the United States, the energy density of beverages consumed as snacks has been increasing since 1977 (18). From 1977 to 2006, the "percentage of snacks that consisted of beverages only" increased by 4%, and beverages now comprise ~100 kcal/d in the diets of American adults (9, 18). Beverages

TABLE 1 Recommendations on snacks and snacking in the dietary guidelines of several countries and regions¹

Country	Snacking recommendation
Australia	The Australian Dietary Guidelines rely on a definition of snacks as a category of discretionary foods ("snack foods") to be consumed in limited amounts. The guidelines mention that "legumes, nuts, and seeds can be eaten as snacks" (43).
Brazil	Brazil's Dietary Guidelines discourage snacking between meals but suggest that individuals with higher energy needs consume small meals of fruit or "milk, yogurt, or nuts" (80).
Canada	Canada's Food Guide recommends limiting salty snacks and eating vegetables and fruit for snacks. For women of childbearing age, their guide encourages fruit and yogurt for snacks (44).
England	England's National Health Service recommends snacking on dried fruit in the evening as a way to eat more fruit and also recommends nuts and fresh fruit as snacks. The National Health Service website has a page listing several low-calorie snack suggestions (81).
France	Le Guide Alimentaire Pour Tous recommends consuming a regular snack instead of eating mindlessly or snacking continuously. For snack foods, this guide recommends yogurt, milk, fruit, fruit juice, vegetables, or some bread with butter or jam (82).
Greece	This guide recommends a few foods (nuts, seeds, and fruit) as snacks as long as energy intake does not exceed energy expenditure (83).
Greenland	Greenland's guide recommends limiting snack foods to 1/wk but does recommend eating small healthful snacks such as "a piece of fruit or a vegetable, crisp bread, or dried fish" between meals (45).
Nordic countries	The Nordic Nutrition Recommendations only discuss "snack foods" and recommend limiting them due to their high salt, fat, and sugar content (81).
Oman	The Omani Guide to Healthy Eating suggests choosing snacks wisely and recommends choosing low-calorie and nutrient-dense foods. "Snack foods" are discussed as a major source of fats (41).
Sweden	The Swedish Nutrition Recommendations state that 2–3 snacks may be included each day as part of a healthful diet (84).
Switzerland	Switzerland provides an entire page of healthy snack ideas, which includes fruit, vegetables, whole-grain breads, cheese, yogurt, milk, and nuts but advises against sweets and fatty, salty snacks (85).
United States	The 2010 Dietary Guidelines for Americans recommend "raw, cut-up vegetables" and fruit as snacks (42). The 2015 Scientific Report of the Dietary Guidelines Advisory Committee recommends decreasing snack food intake, because snacks are a high contributor to energy, sugar, and saturated fat intake, and expresses concern over how snacks tend to be less nutrient dense than actual meals. It also suggests choosing "smart" snacks (46).

¹ Data for this table include countries with dietary guidelines in English that contain a direct reference to snacking or best snacking choices.

are also popular snacks among American children (77). In Mexico, beverages (milk, soda, coffee, and tea) were among the top 5 snacks for all age groups (14). Sweetened coffee and tea and sugar-sweetened beverages were 2 of the top 5 snacks in Brazil (13), and beverages overall are a popular snack category in China (21). Coffee is 1 of the top 3 favorite snacks in Greece (6), soda is a snack in France (19), and tea is a popular snack among Omani girls (76).

Snacking demographic characteristics. “Snacker demographics” were evaluated for the following countries: Australia, Brazil, Canada, China, England, Finland, France, Greece, Mexico, Sweden, Switzerland, the United Arab Emirates, and the United States, and snacking occasions were respondent-defined. Although a large proportion of adults and children in several of these countries consume snacks, recommendations for snack choices could be further directed toward sectors of the population, such as women and young adults, who snack frequently in certain regions.

In some countries, including Brazil, Mexico, Canada, the United States, Greece, and France, snacking contributes significantly to daily energy intake. In both Brazil and Mexico, national survey data show that approximately three-quarters of the population (74% in Brazil, 73% in Mexico) consume an average of 1.6 snacks/d (13, 14). However, snacks contribute a more substantial amount to daily energy intake of Brazilians (21% of daily intake) than of Mexicans (12% of daily intake). (13, 14) “Heavy snackers” (≥ 3 snacks/d) from Brazil receive $\sim 35\%$ of their daily energy intake from snacks (13). In both Canada and the United States, snacks comprise almost one-quarter of the daily energy intake for adults: 23% of energy intake for Canadians and 24% for Americans (17, 18). In Greece, a small cross-sectional study ($n = 200$) showed that snacks comprise 33.5% of daily energy intake, or 628 kcal, for adults (6). Eighty-seven percent of the adults surveyed for the Greek study consumed snacks (6). In a dietary intake study in 54 French adults, snacks provided an average of 18.5% of their daily energy

intake, and these adults ate snacks on 20 of the 28 d they were asked to keep a food diary (19).

In the countries for which snack data were available by sex and age, women tended to snack more often than men, but there were no discernable global trends by group. Small meals and snacks are common among women in Australia, China, Switzerland, Sweden, the United Arab Emirates, and the United States (7, 9–11, 18, 21, 78, 79). More men are “snackers” in Finland, however (20), and in Greece, the snacking habits of men and women are similar (6). In terms of age, Brazilian adults >60 y consume more energy from snacks than do younger adults (13), but Canadian adults over the age of 71 y consumed the lowest portion of their daily energy intake from snacks (16%) (17). Adult snackers in the United States and Mexico, by contrast, tend to be between the ages of 19 and 39 y (14, 18). In Canada, adolescents aged 14–18 y consume the most energy from snacks, with males in this range consuming $\sim 30\%$ of their daily calories from snacks and females consuming $\sim 28\%$ (17). Similarly, American children receive $\sim 27\%$ of their daily energy intake from snacks (77); and in both China and Mexico, children snack more frequently than adults (14, 21). In the United Arab Emirates, women snack more than children, but data on Emirati men’s snacking habits were not available for comparison (11).

Snack recommendations: nutrition policy and nutrient insufficiencies. Although the dietary guidelines of several countries mention snacks or snack foods (Table 1), some of them (41, 43, 44, 46, 80, 86) caution against consuming sweet, savory, or salty snacks but provide few, if any, suggestions for health-promoting alternatives. For instance, the Nordic Nutrition Recommendations, the Omani Guide to Healthy Eating, and the Australian Eat for Health Guide recommend limiting “snack foods” as well as sugary and “savory snacks” because of their high salt, fat, and sugar content (41, 43, 86). However, the Nordic recommendations list no options for healthy snacks (86), the Omani guide recommends

TABLE 2 Nutrients of public health concern around the world

Country	Nutrients of public health concern	Source
Australia	Folic acid, iodine, iron, vitamin D	Australian Institute of Health and Welfare (89)
Brazil	Fiber, vitamin A	FAO: Nutrition Country Profiles (90)
Canada	Calcium, iron, potassium, vitamin D	Health Canada (91)
China	Energy, iodine, iron, vitamin A	FAO: Nutrition Country Profiles (92)
France	Calcium	Agence Française de Sécurité Sanitaire des Aliments (82)
Greece	Calcium, folic acid, iodine, iron	Ministry of Health and Welfare, Supreme Scientific Health Council (83)
Mexico	Iodine, iron, vitamin A	FAO: Nutrition Country Profiles (93)
Nordic countries	Folic acid, iodine, iron, vitamin D	Nordic Council of Ministers (86)
Oman	Calcium, fiber, folic acid, iron, vitamin D, zinc	Department of Nutrition, Ministry of Health of Oman (41)
Persian Gulf countries	Calcium, iodine, iron, vitamin A, vitamin D	Arab Center for Nutrition, Nutrition and Health Studies Unit of Bahrain (94, 95)
Switzerland	Folic acid, iron, vitamin D	Federal Office of Public Health (96)
United Kingdom	Folic acid, iron, magnesium, selenium, vitamin C, vitamin D, zinc	Proprietary Association of Great Britain (97)
United States	Calcium, fiber, iron, potassium, vitamin D	Scientific Report of the 2015 Dietary Guidelines Advisory Committee (46)

simply choosing snacks “wisely” (41), and the Australian guidelines suggest only “legumes, nuts, and seeds” for snacks (43). The snack suggestions in the Brazilian dietary guidelines similarly list few foods as appropriate “snacks”—milk, yogurt, and nuts (80). The 2015 Scientific Report of the DGA Advisory Committee recommends selecting “healthy” and “smart snacks” (46) but does not list “healthy” snacks or define “smart” snacks. In addition to clarifying a definition of snacks and snack foods, these dietary guidelines should offer suggestions of health-promoting snack options.

A few countries, Greenland, Sweden, France, and Switzerland (45, 81–83, 85), already provide specific suggestions for snacks that include more options than dairy or nuts. In Greenland, snacks are recommended as an eating occasion, and snacking specifically on “a piece of fruit or a vegetable, crisp bread or dried fish” is recommended (45). The Swedish Nutrition Recommendations suggests sandwiches of bread and margarine, fruit, milk, and occasional sweets as snacks (84), and *Le Guide Alimentaire Pour Tous* from France makes specific snack suggestions, including fruit, bread with butter and jam, and raw vegetables, for individuals who prefer to eat frequently (82). With a 2-page document on healthy snack choices for morning and afternoon snacks that includes fruit and vegetables listed by season as well as nuts and grain and dairy products, Switzerland provides the most comprehensive list of snack suggestions (85). Although these guides also do not distinguish clearly between “snacks” and “snack foods,” these guidelines could serve as models for other countries in developing snack recommendations.

The nutrient insufficiencies and excesses of certain countries could also be used to develop snack recommendations and even formulate specific snack foods. Although few countries recommend specific foods for snacks, countries with official dietary guidelines do tend to have population-level recommendations regarding the inclusion of certain nutrients or foods in the diet. Snack foods rich in important nutrients that rely on the pre-existing snack preferences of different populations could contribute to facilitating nutrient-dense and health-promoting diets.

For example, the 2010 DGA identifies potassium, dietary fiber, calcium, and vitamin D as “nutrients of concern” because their intake is low enough to be of concern for public health (42). The DGA therefore recommends that Americans consume more vegetables, fruit, whole grains, milk and milk products, and seafood to address these insufficiencies (42). These recommendations, in conjunction with current snack food preferences, could be used to develop recommendations for health-promoting snacks that are rich in the nutrients of concern (22).

Nutrients of concern could also be used to guide the development of new snack foods. This strategy has been implemented in rural India, where one food company introduced beverages and snacks formulated to address specific nutrient needs, including water, iron, and folic acid, in 2011 (87). One of these snacks, made from extruded grains, contains 25% of the daily iron needs of adolescent girls as well as 50% of their recommended dietary allowances of thiamin,

vitamin B-12, and folic acid (88). This snack is primarily intended to address the nutrient insufficiencies of adolescent females at risk of developing anemia due to low dietary iron intake (87), and full nutrient data on this snack were not readily available to assess its overall nutrient profile. The development of health-promoting snacks could be an important area for collaboration between food companies and nutritionists, and this strategy of developing or recommending snacks that target specific insufficiencies and certain populations could be adopted in other countries for which similar data are available (Table 2).

Limitations. The lack of a consistent definition of “snack” in the literature affected the collection and interpretation of information for this review. Research articles for this review were identified via database searches with the use of the term “snack” and from the bibliographies of relevant articles. However, snacking can also be discussed in articles about eating frequency, eating occasions, dietary habits, dietary patterns, frequent eating, and small meals. Evaluating information on all of these topics was beyond the scope of this review.

Furthermore, the information on snack preferences and demographic characteristics relies on limited amounts of data to draw conclusions about extremely large and diverse populations, and not all of these data are recent. Some of the data used for this review have not been updated for >10 y. Because other studies suggest that a shift in eating behaviors has occurred since that time (18), some of these data are likely no longer accurate.

Conclusions. Snacks, snacking, and snack foods are difficult to define and study. The definition of and motivation to snack depend on external factors such as the time of day, type of food, food availability, and location, among others. Yet, the impact of frequent eating occasions on health outcomes, including weight gain, remains largely unknown. The literature suggests that the consumption of nutrient-poor snacks may be associated with high BMI, eating in the absence of hunger, eating away from home or work, social modeling, and food insecurity. Even though these factors may be associated with poor dietary choices in some populations, the motivation to snack as well as the health impact of snacking are subject to considerable interindividual variation, which merits further investigation. Because heavily salted, sweetened, and high-fat foods such as chips, desserts, and sugar-sweetened beverages are still the most popular snacks in several countries, dietary guidelines could reimagine “snack foods” to prevent “snack time” from becoming an occasion for overeating nutrient-poor foods.

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