

Part D. Chapter 7: Portion Size

Introduction

Dietary patterns that include a variety of nutrient-dense foods with appropriate calories are integral to health promotion and disease prevention. The *Dietary Guidelines for Americans, 2020–2025* encourages Americans to monitor portion size and to consider reducing portions to accommodate a variety of food choices that can fit within their calorie needs. Portion size refers to the amount of food or beverage served at a given time during a singular eating occasion and includes pre-portioned, self-served, and packaged foods and beverages. Portion size differs from serving size, which has often been used to refer to the customary or standard amount of a particular food or beverage consumed for the purpose of evaluating nutritional content or providing dietary guidance.

The *Dietary Guidelines* has provided guidance on portion size since 2005, and such guidance has evolved throughout the past 2 decades in response to the rising U.S. prevalence and profound health consequences of obesity.¹ Hill and Peters' landmark 1999 paper in *Science* was among the first to call out environmental contributions to obesity, citing potential contributing effects of an “unlimited supply of convenient, relatively inexpensive, highly palatable, energy-dense foods.”² Those and other scientific observations of environmental contributions spurred a new direction of scientific research, which moved beyond diet-health relationships to consider external factors that influence what and how much people eat. Understanding how portion sizes influence selection and consumption of food is critical for identifying strategies to help individuals follow a healthy dietary pattern with appropriate calories to achieve or maintain a healthy weight.³

This chapter describes the Committee's examination of evidence on relationships between food and beverage portion sizes and 1) growth, body composition, and risk of obesity; and 2) energy intake. The chapter also discusses the results of those systematic reviews and provides the Committee's advice to the Departments for developing the *Dietary Guidelines for Americans, 2025-2030*.

Setting the Review Criteria

The Committee conducted systematic reviews across life stages from young children to older adults, including individuals during pregnancy and postpartum. Given general public interest in identifying strategies that support healthy dietary patterns as well as a healthy weight, the Committee's work evaluated scientific literature on portion size that considered energy density, nutrient density, and/or the quality or type of food/beverage served. As the Committee synthesized evidence on portion size and growth, body composition, and risk of obesity, it considered studies of food and beverage portion size that provided 1) pre-portioned or pre-packaged foods at snacks and meals; 2) education on portion control as a behavioral strategy; and 3) tools or aids to facilitate portion control, such as graduated or smaller tableware (i.e., bowls, glasses, plates), smaller serving utensils and dishware, and technology/software aids for portion control. During synthesis of the evidence for portion size and energy intake, the Committee delineated effects of portion size and energy density (i.e., amount of energy per weight (g) of food or drink) by separately evaluating foods low in energy density (e.g., vegetables) vs. foods high in energy density

(e.g., macaroni and cheese). The Committee also separately evaluated studies that provided pre-portioned foods given their relevance for translatable portion size strategies, such as batch cooking, meal prepping, and pre-packaged point-of-purchase meals.

The Committee examined several key confounders when interpreting results of its systematic reviews, including variables it prioritized in consideration of health equity such as sex, age, race and/or ethnicity, and socioeconomic position. Given interests in the implications of portion size for energy balance and weight maintenance, the Committee identified energy intake and anthropometry at baseline as important potential confounders of relationships between portion size and 1) growth, body composition, and risk of obesity; and 2) energy intake outcomes. Consistent with the Committee's other reviews involving growth, body composition, and risk of obesity outcomes, it distinguished favorable growth and body composition outcomes from unfavorable growth and body composition outcomes, a distinction that was extended to the examination of the relationship between portion size and energy intake as well. Favorable growth and body composition outcomes were increases in or greater height (children and adolescents only) or lean body mass, and reductions in or lower weight-for-age, BMI-for-age, fat mass, or waist circumference. Unfavorable growth and body composition outcomes were increases in or greater weight-for-age, BMI-for-age, fat mass, or waist circumference, and lower height (for children and adolescents only) or reductions in lean body mass. For the relationship between portion size and energy intake, energy intake as an outcome was examined within a singular eating occasion as well as over longer time periods (depending on what was measured in the study).

Expansion of Previous Reviews

Numerous narrative reviews have examined the body of empirical studies on portion size that has accumulated between 2000 and 2023.⁴⁻⁶ Review topics include studies of portion size effects on food intake among children and adults,^{7,8} potential mechanisms of effects on behaviors,^{9,10,11} and the role of portion size in development of obesity and in weight management.^{3,12-15} Surprisingly few systematic reviews, however, have been conducted to rigorously evaluate the scientific evidence on portion size. A 2015 meta-analysis of 58 studies of children and adults found a small to moderate effect of portion size, package size, and/or tableware size on food consumption at meals and snacks.¹⁶ A 2023 systematic review and meta-analysis of 14 short-term studies of children and adults found moderate to large effects of offering small vs. large portion sizes on daily energy intake over different periods of exposure (1 to 11 days in 12 studies and 1 to 6 months in 2 studies).¹⁷

These findings provide robust scientific rationale for the Committee's consideration of portion size as a potential strategy for reducing excessive energy intake and risk of obesity. However, prior research lacks explicit consideration of certain parameters, such as energy density, that are important for evaluating portion size as a population-based strategy for achieving healthy dietary patterns and achieving or maintaining a healthy weight.^{3,15} Therefore, the Committee prioritized integrating the concepts of food type, portion size, and energy density in its comprehensive review of the evidence on portion size in order to identify specific evidence-based strategies that individuals can use to achieve the *Dietary Guidelines* recommendations.

List of Questions

1. What is the relationship between portion size and growth, body composition, and risk of obesity?¹⁸
2. What is the relationship between portion size and energy intake?¹⁹

Conclusion Statements

Question 1. What is the relationship between portion size and growth, body composition, and risk of obesity?

Approach to Answering Question: Systematic Review

Young Children, Children, and Adolescents

A conclusion statement cannot be drawn about the relationship between portion sizes consumed by young children, children, and adolescents and growth, body composition, and risk of obesity because there is not enough evidence available. (Grade: Grade Not Assignable)

Adults and Older Adults

A conclusion statement cannot be drawn about the relationship between portion sizes consumed by adults and older adults and body composition or risk of obesity because of inconsistency in the interventions, comparators, and outcomes in the body of evidence. (Grade: Grade Not Assignable)

Individuals During Pregnancy

A conclusion statement cannot be drawn about the relationship between portion sizes consumed during pregnancy and gestational weight gain because there is not enough evidence available. (Grade: Grade Not Assignable)

Individuals During Postpartum

A conclusion statement cannot be drawn about the relationship between portion sizes consumed during postpartum and postpartum weight change because there is no evidence available. (Grade: Grade Not Assignable)



View the full systematic review, including details on the methodology and the evidence underlying these conclusion statements, at https://nesr.usda.gov/2025-dietary-guidelines-advisory-committee-systematic-reviews/portion-size_growth-obesity

Question 2. What is the relationship between portion size and energy intake?

Approach to Answering Question: Systematic Review

Young Children, Children, and Adolescents

Serving larger portions of energy dense foods increases energy intake in children. This conclusion statement is based on evidence graded as strong. (Grade: Strong)

Serving larger portions of vegetables and fruits increases intake of those foods without increasing energy intake in children. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

A conclusion statement cannot be drawn about the relationship between portion size and energy intake in young children and adolescents because there is no evidence available. (Grade: Grade Not Assignable)

A conclusion statement cannot be drawn about the relationship between pre-portioned foods by young children, children, and adolescents and energy intake because there is not enough evidence available. (Grade: Grade Not Assignable)

Adults and Older Adults

Serving larger portions of foods increases food and energy intake in adults and older adults. This conclusion statement is based on evidence graded as strong. (Grade: Strong)

Portion size and energy density are independent and additive in their effects on energy intake in adults and older adults. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

Serving foods as smaller pre-portioned amounts decreases energy intake in adults and older adults. This conclusion statement is based on evidence graded as moderate. (Grade: Moderate)

Individuals During Pregnancy

A conclusion statement cannot be drawn about the relationship between portion size and energy intake during pregnancy because there is no evidence available. (Grade: Grade Not Assignable)

A conclusion statement cannot be drawn about the relationship between pre-portioned foods and energy intake during pregnancy because there is no evidence available. (Grade: Grade Not Assignable)

Individuals During Postpartum

A conclusion statement cannot be drawn about the relationship between portion size and energy intake during postpartum because there is no evidence available. (Grade: Grade Not Assignable)

A conclusion statement cannot be drawn about the relationship between pre-portioned foods and energy intake during postpartum because there is no evidence available. (Grade: Grade Not Assignable)



View the full systematic review, including details on the methodology and the evidence underlying these conclusion statements, at <https://nesr.usda.gov/2025-dietary-guidelines-advisory-committee-systematic-reviews/portion-size-energy-intake>

Integration

The Committee developed scientific questions to comprehensively examine the effects of food and beverage portion size on 1) growth, body composition, and risk of obesity; and 2) energy intake consumed to support the development of graded, population-level, food-based recommendations that could be used to achieve healthy dietary patterns and healthy weight. Given the focus of guidelines on life stage, the evidence was synthesized separately across life stages. Although only 2 broad questions on portion size were developed, the evidence base for portion size and growth, body composition, and risk of obesity contained fewer studies, therefore conclusion statements could not be developed for this question. The evidence base for portion size and energy intake was large enough to organize the evidence such that separate conclusion statements could be developed for portion size and types of foods consumed (energy-dense foods, vegetables and fruits, and pre-portioned foods). When conclusions could be drawn from the Committee's review of evidence on portion size and energy intake, they included favorable (i.e., reduction in energy intake), unfavorable (i.e., increase in energy intake), and no association (i.e., no change in energy intake) relationships.^{18,19} All conclusion statements were graded as moderate or strong, pointing to the potential for portion size to be used as a favorable strategy to manage energy intake.

Portion Size and Growth, Body Composition, and Risk of Obesity Outcomes for Which Conclusions Could Not Be Drawn

No conclusions could be drawn from the Committee's review of the evidence on portion size and growth, body composition, and risk of obesity. For young children, children, adolescents, and individuals during pregnancy and during postpartum, not enough evidence was available to draw a conclusion. For adults and older adults, inconsistency in the interventions, comparators, and outcomes within the evidence prevented the ability to draw a conclusion.¹⁸ The inability to draw conclusions regarding food and beverage portion size in relation to growth, body composition, and risk of obesity highlights the need for more research in this area. This is important because consuming less energy-dense foods over time may help prevent obesity.

Favorable Relationships Between Portion Size and Energy Intake

Two conclusion statements about portion size and energy intake found favorable outcomes. Among children, serving larger portions of vegetables and fruits was not related to greater energy intake, due to the low energy density of these foods, which is favorable and consistent with recommendations to consume more vegetables and fruits.¹⁹ Among adults and older adults, the use of pre-portioned foods decreases energy intake.

Unfavorable Relationships Between Portion Size and Energy Intake

Three conclusion statements about portion size and energy intake found unfavorable outcomes. Among children, larger portions of energy-dense foods were related to greater energy intake. Among adults and older adults, larger portions of food were related to greater energy intake, and among adults and older adults, portion size and energy density of foods independently and additively increased energy intake.^{19,20}

Portion Size and Energy Intake Relationships for Which Conclusions Could Not Be Drawn

No conclusions could be drawn for portion size and energy intake among young children and adolescents because no evidence was available. In addition, no conclusions could be drawn for pre-portioned foods and energy intake among young children, children, or adolescents because the body of evidence was too small and included only 1 RCT. In addition, no conclusions could be drawn for portion size or pre-portioned foods and energy intake among individuals during pregnancy or postpartum because no evidence was available.¹⁹

Summary

The conclusion statements for relationships between portion size and energy intake indicate that serving larger portion sizes increases food and beverage intake, but the impact of portion size on energy intake depends on the energy density of the food or beverage consumed. In general, for both children and adults, larger portion sizes increase intake, and if the larger portion is an energy-dense food, energy intake increases. If the larger portion is of lower energy-dense foods or beverages, energy intake may not change even though food intake increases, particularly among children. Pre-portioned foods, which generally are foods that have been portioned as a recommended standard serving size or as a smaller portion, reduces energy intake in adults and older adults. Thus, consuming smaller portions of energy-dense foods or beverages, which could be achieved by using pre-portioned foods, may be related to reduced energy intake. Although the body of evidence considered demonstrates robust influences of food and beverage portion size on intake among children and adults, evidence is lacking with regard to the relationship between portion size and energy intake in young children, adolescents, and individuals during pregnancy and during postpartum. Evidence is also lacking with regard to the role of portion size in achieving or maintaining a healthy weight and growth, body composition, and risk of obesity overall. The scientific literature has noted that the relationships described in the conclusion statements have been found to be consistent 1) across participant characteristics, such as age and body mass index, and 2) across many types of foods, such as unit foods (e.g., sandwiches) and amorphous entrees (e.g., macaroni and cheese).²⁰

Discussion

Comparison to Previous Dietary Guidelines Advisory Committee Findings

This Committee's systematic reviews build on a narrative review of the evidence conducted by the 2005 Committee on portion size and energy intake and a systematic review conducted by the 2010 Committee's review on portion size and body weight, both of which considered much smaller and narrower bodies of evidence than the current review.^{21,22}

The 2005 Committee indicated that, based on the findings of 6 short-term feeding studies, 1 longitudinal study, and 3 observational studies, "The amount of food offered to a person influences how much he or she eats; and, in general, more calories are consumed when a large portion is served rather

than a small one.” The 2005 Committee also called out the importance of limiting portions of energy-dense foods.

The current Committee’s conclusions generally agree with the 2005 findings and extend it in several important ways.¹⁹ First, the Committee evaluated the evidence separately for children and adults and concluded that strong evidence demonstrates that intake of larger portions of energy-dense foods promote higher energy intake. This conclusion points to an opportunity to develop food-based guidance on portion size across the lifespan that is sensitive to life stage considerations and energy density of foods and beverages. Second, the Committee concluded that for children, increasing the portion sizes of vegetables and fruits offered was not related to greater energy intake, which may have beneficial effects on children’s vegetable and fruit consumption with negligible effects on energy intake. This conclusion highlights the potential strategic use of portion size to promote consumption of foods aligned with the *Dietary Guidelines*. Third, the Committee found sufficient evidence among adults and older adults to conclude that effects of portion size on energy intake are independent and additive to those of energy density. This conclusion underscores the need to jointly consider portion size and energy density in food-based guidance for dietary patterns that can be used to achieve or maintain a healthy weight. Fourth, the Committee concluded that among adults and older adults, pre-portioned meals are associated with reduced energy intakes, providing direct evidence in support of strategies that promote portion control, such as meal planning and prepping for several days.

The 2010 Committee was the first to review evidence on portion size and body weight, as part of that Committee’s charge to comprehensively review the science on environmental drivers of dietary intake and weight. The 2010 Committee concluded that, based on the findings of 3 randomized controlled trials and 1 case-control study, “Strong evidence documents a positive relationship between portion size and body weight.” In contrast, the current Committee judged the evidence insufficient to draw meaningful conclusions about the association between portion size and growth, body composition, and risk of obesity outcomes during childhood, adulthood, pregnancy, and the postpartum life stages.¹⁸ The difference in conclusions stemmed from a lack of evidence noted by this Committee for specific life stages of pregnancy, postpartum, childhood, and adolescence as well as inconsistencies in interventions, comparators, and outcomes in the body of evidence among adults and older adults. Importantly, few studies considered portion sizes in the context of energy density, which likely contributed to inconsistencies in findings.

Comparison to Other Systematic Reviews and Meta-Analyses

The Committee’s conclusions for portion size and energy intake generally agree with the findings of 2 previous systematic reviews. A 2015 Cochrane review evaluated the effects of portion, package, and tableware size on food selection and consumption among children and adults.¹⁶ This meta-analysis of 58 studies found small to moderate effects of portion, package, or tableware size on food consumption among children and adults. The authors projected that this effect size, if sustained across the entire diet, would translate to a 12 to 16 percent increase in average daily energy intake. Although the findings are generally aligned with the Committee’s conclusions, it is notable that the Cochrane review focused on food

consumption and did not explicitly focus on energy intake or growth, body composition, and risk of obesity outcomes.

The Committee's findings on portion size and energy intake are also aligned with those of a 2023 systematic review and meta-analysis that focused on prevention of weight gain.¹⁷ The 2023 effort included 14 experimental studies (12 in adults and 2 in children) that evaluated effects of reducing portion size on daily energy intake during time periods that ranged from 1 day to 6 months.¹⁷ Investigators found a moderate to large reduction in energy intake when smaller vs. larger portions were offered. Adjustments in consumption of non-portion-manipulated foods were not sufficient to fill the energy gap, such that a 10 percent reduction in portion sizes served was associated with a 1.6 percent reduction in daily energy intake. Larger effects were seen in studies that manipulated portion sizes at most meals compared to studies that manipulated portions at 1 to 2 meals. In a subset of 4 studies that measured body weight, being served smaller vs. larger portion sizes was associated with less weight gain.¹⁷ The authors concluded that reducing portion sizes may be an effective strategy for preventing weight gain, but because their review did not explicitly evaluate the role of food type or energy density, their conclusion differs from the Committee's finding that the body of evidence on portion size and growth, body composition, and risk of obesity is insufficient to draw conclusions. These differences are likely due to the Committee's stringent inclusion and exclusion criteria, its rigorous evaluation of the quality of evidence, and its consideration of energy density.

Neither of the reviews discussed above evaluated evidence by life stage, although both included studies of children and adults.^{17,23} The Committee's interest in evaluating the evidence by life stage represents an important contribution given questions in early studies as to whether young children might be less susceptible to portion size effects than adults.^{6,24} The body of evidence reviewed by the Committee (and examined in previous systematic reviews) demonstrates that the relationship between large portion sizes and increased energy intake extends to children. The Committee's conclusions collectively highlight the importance of offering developmentally appropriate portion sizes to promote healthy growth and prevent obesity during childhood. However, little empirical evidence directly addresses this possibility as the Committee found only 1 study of this relationship during childhood.

In addition, neither of the reviews explicitly evaluated the role of food type or energy density.^{18,19} Nonetheless, the Committee's conclusions with regard to independent and additive effects of portion size and energy density among adults and older adults align with 2 recent systematic reviews and a host of other narrative reviews.^{12,25} A 2022 systematic review and meta-analysis of 38 within-subjects randomized controlled trials evaluated effects of food energy density on energy intake among children and adults. It found that consuming lower energy-dense foods, compared to higher energy-dense foods, resulted in significantly reduced energy intake. Further, energy density was not associated with food intake (weight/volume consumed) but showed a positive linear relationship with energy intake.²⁶ Another systematic review and meta-analysis of 31 experimental studies (27 studies of adults, 4 studies of children) similarly demonstrated a large effect of energy density on daily energy intake.²⁷ Collectively, these studies suggest that reducing food energy density may promote weight management by allowing individuals to eat satiating quantities of food while consuming less energy. Taken together with the Committee's findings,

these reviews suggest that targeting portion size as a population-based strategy for healthy dietary patterns and achieving or maintaining a healthy weight will require explicit consideration of energy density.

The Committee reviewed studies of portion size tools and determined that evidence in this area was insufficient to develop specific conclusions about consumer-oriented strategies for portion control. A 2021 meta-analysis focused specifically on the effect of portion size tools on portion size awareness, selection, and intake found that most studies (n=28) compared standard size plates, bowls, and spoons to those of smaller diameter and/or volume and used calibrated tableware with printed indicators or indented segments to aid portion control.²⁸ Findings supported an overall beneficial effect of portion control tools on consumption. Effects differed by type of tools, with effects seen for bowls and spoons—but not plates—on the amount of foods served and consumed. These findings point to the need for future consideration of tools designed to provide visual cues and promote portion control.

Summary

The Committee's comprehensive examination of the evidence and resulting conclusions extend previous Committees' systematic reviews and conclusions for the influence of portion size on 1) growth, body composition, and risk of obesity; and 2) energy intake outcomes across life stages. The body of evidence on portion size is predominated by robust randomized controlled trials. Large portions, particularly of energy-dense foods and beverages, promote energy intake among both adults and children. Portion size effects have been observed across a variety of different types of foods, participant characteristics, and packaging types and sizes, suggesting that larger portion sizes may have universal effects to promote food consumption. The implications of portion size for energy intake, however, may depend on food type. Among adults and older adults, portion size and energy density have independent and additive effects on energy intake. Among children, larger portion sizes of low energy-dense foods such as vegetables and fruits promote consumption of those foods without appreciable effects on energy intake. Strategies to promote portion control include selection of smaller package sizes and use of pre-portioned meals for energy-dense foods and beverages.

Committee's Advice to the Departments

The Committee's advice to the Departments as they develop the *Dietary Guidelines for Americans, 2025-2030* is to recommend that adults and children consume smaller portions of foods and beverages that are high in energy density and low in nutrient density. The recommendation to consume smaller portions does not apply to vegetables and fruits in children, as evidence indicates that larger portions of these healthy foods were not related to greater energy intake despite increased intake of vegetables and fruits. Among adults and older adults, consuming smaller portions of energy-dense, nutrient-poor foods and beverages could be achieved by using pre-portioned foods. Among young children, children, adolescents, and pregnancy and postpartum the evidence was not clear about use of pre-portioned foods. Although the concept for portion size is already included in the *Dietary Guidelines for Americans, 2020-2025*, more emphasis could be made on use of pre-portioned foods among adults and older adults to achieve lower intakes of energy-dense foods and beverages.

In summary, the Committee recommends that the Departments include the following concepts in the next edition of the *Dietary Guidelines*:

- For children and adults, consume smaller portions of energy-dense foods to stay within energy requirements.
- Use portion size strategically to promote children’s intake of vegetables and fruits, some of which are sources of some of the nutrients of public health concern (calcium, potassium, and fiber)
- For adults, use pre-portioned foods to help reduce intake of energy-dense foods. This could include:
 - For foods prepared in the home, consider meal planning; and when prepping food for multiple meals in the home, store energy-dense foods in pre-portioned sizes.
 - For foods consumed away from home, such as in commercial, non-commercial, and retail and food service establishments, choose energy-dense foods in smaller, pre-portioned packages as a default.
- For foods available in retail stores and food service establishments, offer choices so that energy-dense foods can be purchased in smaller, pre-portioned packages. In parallel, strategies to decrease packaging chemical exposures and increase sustainability should be considered, which can include repackaging bulk- or value-sized foods at home into smaller portions using sustainable options.
- Prioritize, support, and fund research that examines relationships between pre-portioned foods and energy intake among young children, children, and adolescents; and that examines food portion size in relation to growth, body composition, and risk of obesity among all age groups and life stages.

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