

Indicators of Diet Quality, Nutrition, and Health for Americans by Program Participation Status, 2011–2016: SNAP Report



Final Report

December 2021



Indicators of Diet Quality, Nutrition, and Health for Americans by Program Participation Status, 2011–2016: SNAP Report

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This report was prepared by Insight Policy Research, Inc., under Contract No. GS-10F-0136X with the U.S. Department of Agriculture.

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Suggested Citation

Gleason, S., Hansen, D., & Wakar, B. (2021). *Indicators of diet quality, nutrition, and health for Americans by program participation status, 2011–2016: SNAP report*. Prepared by Insight Policy Research, Contract No. AG-GS-10F-0136X. Alexandria, VA: U.S. Department of Agriculture, Food and Nutrition Service, Office of Policy Support, Project Officer: Michael Burke. www.fns.usda.gov/research-and-analysis

Acknowledgements

This report was prepared by Insight Policy Research (Insight) under Contract Number AG-GS-10F-0136X from the U.S. Department of Agriculture, Food and Nutrition Service. It represents a team effort in which many individuals made key contributions in addition to the authors. We gratefully acknowledge their assistance. In particular, we recognize our Project Officer, Michael Burke, for his leadership and guidance. This report also benefited from thoughtful review and critique by Mehreen Ismail, Kathryn Law, Donna Johnson-Bailey, and Anita Singh.

The authors also gratefully acknowledge the numerous individuals from Insight who provided valuable assistance throughout this study and Susan Gross, a consultant to Insight, for her review of the study plan. In particular, at Insight, we thank Elaine Wilcox-Cook and Josh Rozen for their SAS coding expertise and assistance. We also thank Lizzie Nelson for providing quality control by reviewing SAS output, report tables, and text. Carole Trippe and Betsy Thorn provided useful suggestions on the content of this report. We also thank our publications team for editing and formatting support.

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Abbreviations and Acronyms

AHA	American Heart Association
AI	adequate intake level
AMDR	acceptable macronutrient distribution range
ARS	Agricultural Research Service
CDC	Centers for Disease Control and Prevention
CDRR	chronic disease risk reduction level
DCCPS	Division of Cancer Control & Population Sciences
DGA	Dietary Guidelines for Americans
DGAC	Dietary Guidelines Advisory Committee
DQA	Diet Quality of Americans
DRI	Dietary Reference Intake
EAR	estimated average requirement
FNDDS	Food and Nutrient Database for Dietary Studies
FNS	Food and Nutrition Service
FPED	Food Patterns Equivalents Database
FY	fiscal year
HDL	high-density lipoprotein
HEI	Healthy Eating Index
HHS	U.S. Department of Health and Human Services
IOM	Institute of Medicine
LDL	low-density lipoprotein
MEC	Mobile Examination Center
MUFA	monounsaturated fatty acid
NASEM	National Academies of Science, Engineering, and Medicine

NCHS	National Center for Health Statistics
NFS	not further specified
NHANES	National Health and Nutrition Examination Survey
NHLBI	National Heart, Lung, and Blood Institute
NIH	National Institutes of Health
ODS	Office of Dietary Supplements
oz	ounce
PUFA	polyunsaturated fatty acid
SFA	saturated fatty acid
SNAP	Supplemental Nutrition Assistance Program
SNAP-Ed	SNAP Nutrition Education and Obesity Prevention Grant Program
TG	triglycerides
USDA	U.S. Department of Agriculture
WHtR	waist-to-height ratio

Executive Summary

The Food and Nutrition Service (FNS) of the U.S. Department of Agriculture (USDA) administers 15 nutrition assistance programs with the overarching goal of increasing food security and reducing hunger through access to affordable, healthy food and nutrition education. The Supplemental Nutrition Assistance Program (SNAP), the focus of this report, is the largest domestic food and nutrition assistance program administered by FNS. The aim of SNAP is to increase food security and ensure low-income households have access to nutritious food.

This study is the fourth in a series that uses the National Health and Nutrition Examination Survey (NHANES) data to examine the relationship between SNAP participation and indicators of diet quality, nutrition, and health (Centers for Disease Control and Prevention, National Center for Health Statistics, 2020a; see table ES.1). This research was not designed to assess the impact of SNAP or infer causality. Rather, the study results contribute to the evidence base needed to inform SNAP policy and practices and, in turn, improve the diet quality, nutrition and health outcomes of SNAP participants.

Table ES.1. Indicators of Diet Quality, Nutrition, and Health Examined in the Study

Outcome	Measures
Chapter 2. Overall Diet Quality	
Diet quality	- Healthy Eating Index (HEI)-2015 total score - HEI-2015 component score
Chapter 3. Indicators of Nutrition and Health	
Weight status	Percentages of individuals with a body mass index (BMI) classified as underweight, normal weight, overweight, or obese
Waist circumference	Percentages of individuals with waist circumference classified as normal or high risk
Disease risk	Percentages of individuals with normal, increased, high, very high, or extremely high risk of disease based on BMI and waist circumference classifications
Waist-to-height ratio (WHtR)	- Mean WHtRs - Distribution of WHtRs
Blood pressure	Percentages of individuals with normal blood pressure, elevated blood pressure, stage 1 hypertension, stage 2 hypertension, or hypertensive crisis
Biochemical indicators ^a	Percentages of individuals in each indicator-specific reference category
Blood biomarkers ^b	Percentage of individuals with normal/adequate or low/inadequate levels
Chapter 4. Food Consumption Patterns	
Consumption of food classified into supermarket aisle food groups	- Percentage of individuals who consumed foods from supermarket aisle food groups and subgroups on a given day - Mean amounts (in U.S. Department of Agriculture Food Pattern equivalents and in grams) of foods from supermarket aisle food groups and subgroups consumed on a given day among the total population and among only consumers

Outcome	Measures
Chapter 5. Usual Energy and Macronutrient Intakes	
Usual macronutrient intakes ^c	■ Mean usual intake ■ Distributions of usual intake ■ Percentages of individuals with usual intakes below, within, or above the acceptable macronutrient distribution ranges
Usual energy intakes	■ Mean usual intake (in calories) ■ Distributions of usual intake
Consumption of calories from saturated fats, added sugars, and alcohol	■ Percentage of total calories consumed from saturated fats, added sugars, and alcohol
Chapter 6. Usual Micronutrient Intakes	
Usual micronutrient intakes	■ Mean usual intake ■ Distributions of usual intake ■ Percentages of individuals with usual intakes that met or exceeded the estimated average requirement^d ■ Percentages of individuals with usual intakes that met the adequate intake level^e ■ Percentages of individuals with usual intakes that exceeded the chronic disease risk reduction level^f

^a High-density lipoprotein cholesterol, low-density lipoprotein cholesterol, triglycerides, blood glucose, and hemoglobin

^b Serum vitamin B12, serum vitamin D, and urinary iodine

^c Total fat, protein, carbohydrates, linoleic and linolenic fatty acids, and fiber

^d For vitamins A, B6, B12, C, D, and E; copper; selenium; folate; niacin; riboflavin; thiamin; calcium; iron; magnesium; phosphorus; and zinc

^e For potassium, sodium, and choline

^f For sodium

A. Introduction

1. SNAP Overview

SNAP provides benefits via electronic benefit transfer cards that can be used at authorized retailers to purchase food. Households with a gross income of less than 130 percent of the relevant Federal Poverty Guidelines and a net income of less than 100 percent of the relevant Federal Poverty Guidelines are eligible to participate. More than 80 percent of SNAP households lived in poverty in fiscal year 2018 (USDA FNS, 2019). More than 40 percent of SNAP households included a child, 26 percent included an older individual, and 21 percent included an individual with a disability. To improve the likelihood individuals eligible for SNAP will make nutritious food choices within a limited budget and choose physically active lifestyles consistent with the current (2015–2020) Dietary Guidelines for Americans (DGA; U.S. Department of Health and Human Services & USDA, 2015), each State¹ delivers interventions through SNAP Education (SNAP-Ed), the nutrition education and obesity prevention component of SNAP, that are targeted to meet the needs of its population.

2. Approach

The primary sources of data for this study were three cycles of NHANES data (2011–2012, 2013–2014, and 2015–2016). The NHANES is designed to assess the health and nutritional status of adults and children in the United States; the survey examines a nationally representative sample of about 5,000

¹ SNAP is administered at the State level by the 50 States, the District of Columbia, Guam, and the U.S. Virgin Islands.

individuals each year. The NHANES includes interviews, physical examination components, and laboratory tests (CDC NCHS, 2017). Several additional data resources, including the Food Patterns Equivalents Database (FPED) (USDA Agricultural Research Service [ARS], 2019), were used to complete the analyses. Using these data, the study team conducted two main types of analyses:

- ▶ **Descriptive analyses** provided data on measures of diet quality, nutrition, and health among SNAP participants² compared with two groups of nonparticipants: individuals who were income-eligible for SNAP but reported they did not participate in the program recently (income-eligible nonparticipants), and individuals with higher incomes who were not eligible for SNAP (higher income nonparticipants).
- ▶ **Matched analyses** compared selected diet quality, nutrition, and health measures of interest between matched SNAP participants and income-eligible nonparticipants. Propensity score matching was used to generate matched comparison groups that were similar based on an array of individual characteristics related to both SNAP participation and diet quality.

Both analyses provided tabulations by participant group for all individuals and separately for three age groups—children (1–18 years old), adults (19–59 years old), and older adults (aged 60 and older)—and by gender.

The study team conducted two types of supplemental analyses. Using propensity score matching, the study team compared selected measures of interest between matched SNAP participants, SNAP plus the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) participants or SNAP plus National School Lunch Program (NSLP) participants, and income-eligible nonparticipants. The study team also used multivariable regression analyses to examine differences between SNAP participants and nonparticipants while controlling for other factors. Because they were not the primary focus of the report, results of these supplemental analyses are presented in report appendices.

B. Findings

This section presents key findings with a focus on the significant differences between SNAP participants and both groups of nonparticipants for each chapter. Not all significant differences are discussed in this section. As noted previously, this research was not designed to measure the impact of SNAP participation on diet quality, nutrition, and health. Therefore, significant differences that appear between SNAP participants and nonparticipants cannot be attributed to participation in SNAP. Similarly, the absence of a significant difference cannot be interpreted as evidence participation in SNAP has no effect. The accurate assessment of SNAP impacts would require specially designed and costly studies.

Chapter 2. Overall Diet Quality

Overall diet quality was examined using the Healthy Eating Index (HEI)-2015, which assesses adherence to the 2015–2020 DGA recommendations.

The HEI-2015 has 13 components: 9 adequacy components representing dietary elements that are encouraged and 4 moderation components representing dietary elements for which limited consumption is recommended. The maximum score for each component ranges from 5 to 10 points (see

² SNAP program participation was determined by the NHANES survey question, “[Do you/Does any member of your household] currently receive SNAP or Food Stamp benefits?”

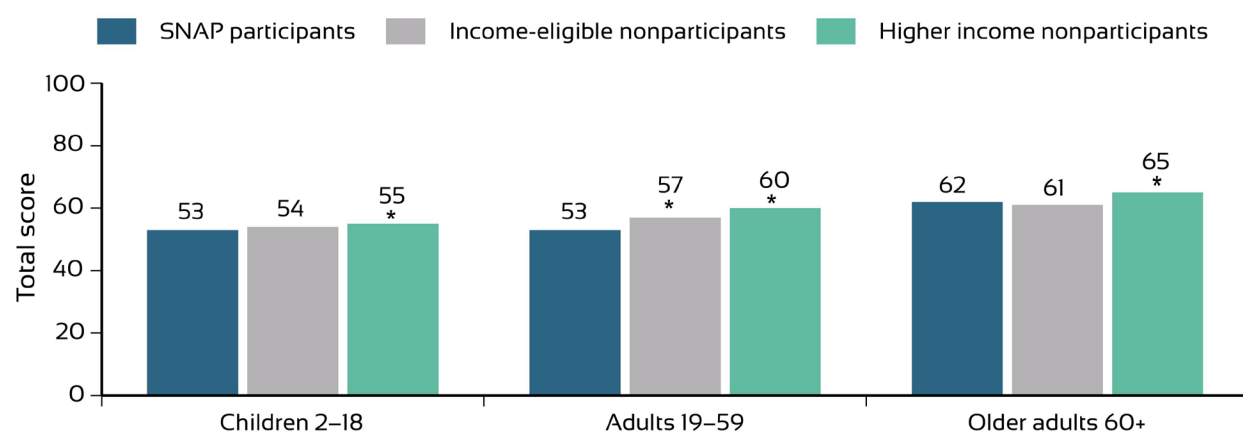
text box). Scores for each of the 13 components are summed to create a total HEI-2015 score with a range from 0 to 100. A higher HEI score—for each component and in total—indicates a diet that aligns more closely with the DGA. Key findings related to overall diet quality follow:

- ▶ Based on a mean total HEI score of 59, the overall diet quality of Americans does not align well with the DGA. On average, SNAP participants had lower total HEI scores than income-eligible and higher income nonparticipants (55 versus 57 and 60 points, respectively). However, little is known about the magnitude of change or difference in HEI scores needed to observe differences in health outcomes. Thus, the observed differences may not reflect meaningful differences between the groups.
- ▶ By age group, SNAP participants consistently had lower total HEI scores than higher income nonparticipants (see figure ES.1).
- ▶ Compared with both groups of nonparticipants, SNAP participants tended to score lower (worse) for total fruits, whole fruits, total vegetables, and added sugars components. SNAP participants tended to score higher (better) than either group of nonparticipants for the sodium component. Among older adults, however, there were no differences in the total HEI and component scores between SNAP participants and income-eligible nonparticipants.

HEI-2015 Components and Maximum Points for Each Component

- **Adequacy components:** Total fruits (5), whole fruits (5), total vegetables (5), greens and beans (5), whole grains (10), dairy (10), total protein foods (5), seafood and plant proteins (5), and fatty acids (10)
- **Moderation components:** Refined grains (10), sodium (10), added sugars (10), and saturated fats (10)

Figure ES.1. Mean Total HEI-2015 Scores Among Individuals Aged 2 and Older by Age and Program Participation



Note: Estimates are based on the day 1 dietary recall. Scores are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Significant differences in scores are noted by * $p < .05$. Differences were tested comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that reported receiving SNAP benefits at the time of data collection.

HEI = Healthy Eating Index

Sources: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls; Food Patterns Equivalents Database 2011–2012, 2013–2014, and 2015–2016. Sample includes NHANES respondents aged 2 and older with complete day 1 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

Chapter 3. Indicators of Nutrition and Health

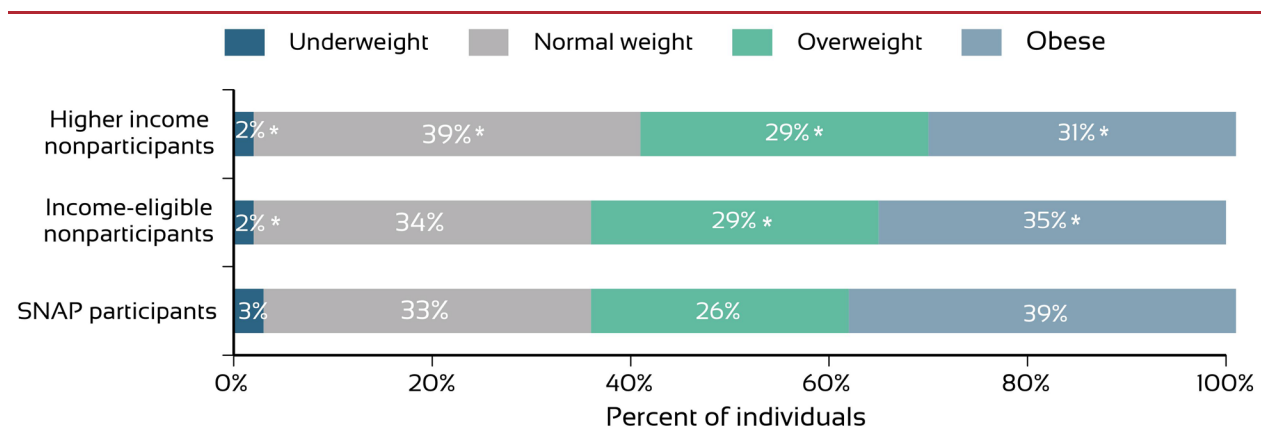
NHANES anthropometric and biochemical data were used to examine body mass index (BMI), measures of abdominal obesity, disease risk, blood pressure, and additional blood biomarkers and biochemical indicators of nutrition and health.

Weight status

BMI, or the ratio of an individual's weight to height squared, is used as an indicator of body fatness. BMI was assessed for individuals aged 2 and older.³ See chapter 3, table 3.2 for reference values. Key findings related to BMI follow:

- ▶ Among all individuals, 29 percent were overweight and 33 percent were obese. SNAP participants had a higher prevalence of obesity than either income-eligible or higher income nonparticipants (39 versus 35 and 31 percent, respectively; see figure ES.2), but results varied by age and gender group.
- ▶ Boys participating in SNAP had a considerably lower prevalence of obesity than income-eligible nonparticipants (19 versus 26 percent). However, adult men participating in SNAP had a higher prevalence of obesity than income-eligible nonparticipants (37 versus 32 percent).
- ▶ Girls participating in SNAP had a higher prevalence of obesity than higher income nonparticipants (21 versus 13 percent), and more than half (52 percent) of adult women participating in SNAP were obese compared with 40 percent of income-eligible nonparticipants and 35 percent of higher income nonparticipants.

Figure ES.2. Percentage of Individuals Aged 2 and Older Who Were Underweight, Normal Weight, Overweight, or Obese by Program Participation



Note: Significant differences in estimates are noted by * $p < .05$. Differences were tested using two-sample t -tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants.

Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 body measures data. Sample includes NHANES respondents aged 2 and older with complete day 1 dietary recall data and weight and height data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

³ BMI-for-age percentiles were used for children 2–18 years old.

Abdominal obesity

Abdominal obesity is detrimental to health because it increases the risk of developing type 2 diabetes, high blood pressure, and coronary artery disease. The study team used waist circumference and waist-to-height ratio (WHtR) to assess abdominal obesity and associated disease risk among all adults aged 19 and older. See chapter 3, table 3.2 for reference values. Key findings related to abdominal obesity follow:

- ▶ Overall, a higher percentage of SNAP participants had a high-risk waist circumference compared with higher income nonparticipants (57 versus 53 percent).
- ▶ A higher percentage of women participating in SNAP had a high-risk waist circumference than higher income nonparticipants (70 versus 60 percent). By contrast, a lower percentage of men participating in SNAP had a high-risk waist circumference compared with higher income nonparticipants (43 versus 46 percent).
- ▶ Overall, the mean WHtR for all adults was 0.59, which exceeded the 0.50 threshold for increased health risk. SNAP participants had a higher mean WHtR than either income-eligible or higher income nonparticipants (0.61 versus 0.59 and 0.58, respectively).

Disease risk

Disease risk was determined based on BMI and waist circumference categories; individuals aged 19 and older were categorized as having normal, increased, high, very high, or extremely high disease risk. See chapter 3, table 3.3 for reference values. Key findings related to disease risk follow:

- ▶ Overall, a higher percentage of SNAP participants than either income-eligible or higher income nonparticipants had very high or extremely high disease risk (31 versus 27 and 27 percent and 11 versus 8 and 7 percent, respectively).
- ▶ A lower percentage of men participating in SNAP had increased or high disease risk compared with either group of nonparticipants, while a higher percentage of women who participated in SNAP had very high, or extremely high disease risk compared with either nonparticipant group.

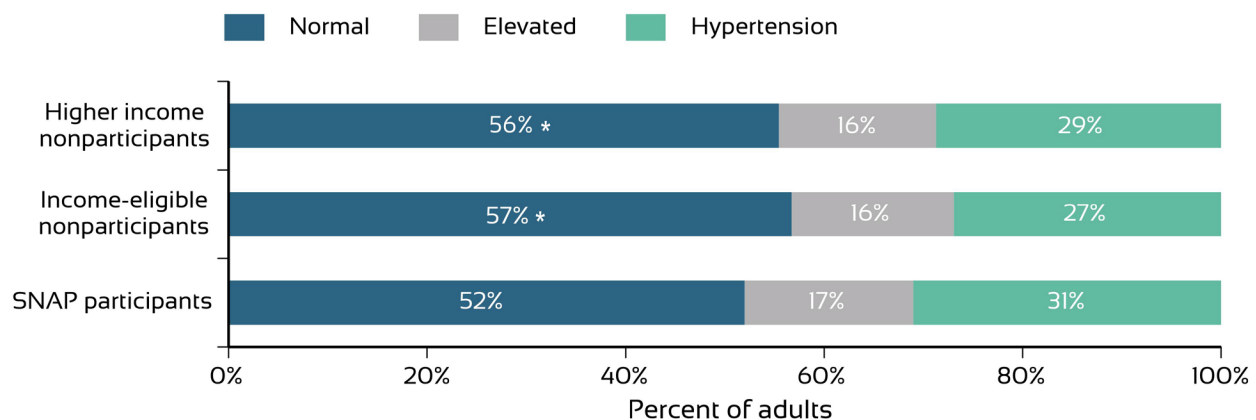
Blood pressure

Blood pressure was analyzed for individuals aged 8 and older based on the American Heart Association's (2017) definition of blood pressure levels and the age- and gender-specific recommendations for children developed by the National Heart, Lung, and Blood Institute of the National Institutes of Health (NIH) (2012, pp. 82–89). See chapter 3, table 3.4 for reference values. Key findings related to blood pressure follow:

- ▶ Overall, SNAP participants had a higher prevalence of stage 2 hypertension or hypertensive crisis than either group of nonparticipants (14 versus 12 and 12 percent and 1.1 versus 0.7 and 0.4 percent, respectively).
- ▶ Children participating in SNAP had a higher prevalence of elevated blood pressure compared with higher income nonparticipant children (9 versus 7 percent).

- ▶ A lower percentage of adults aged 19 to 59 participating in SNAP had normal blood pressure compared with either group of nonparticipants (see figure ES.3).
- ▶ Among adults aged 19–59, 64 percent of adult women and 46 percent of adult men had normal blood pressure; differences between gender groups were not tested.

Figure ES.3. Percentage of Adults Aged 19–59 With Blood Pressure That Was Normal, Elevated, or Classified as Hypertension by Program Participation



Note: Significant differences in estimates are noted by * $p < .05$. Differences were tested using two-sample t -tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants.

Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 blood pressure data. Sample includes NHANES respondents 19–59 years old with complete day 1 dietary recall data and blood pressure data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

Blood biomarkers

The study team examined several blood biomarkers indicative of health and influenced by diet quality: high-density lipoprotein (HDL) cholesterol, low-density lipoprotein (LDL) cholesterol, triglycerides (TG), blood glucose, and hemoglobin. Measures for each biomarker were evaluated relative to reference standards for age groups and gender. See chapter 3, table 3.5 for reference values. Key findings related to blood biomarkers follow:

- ▶ A higher percentage of SNAP participants aged 6 and older had lower than recommended HDL levels compared with income-eligible and higher income nonparticipants (40 versus 35 and 30 percent, respectively).
- ▶ SNAP participants aged 12 and older had a higher prevalence of diabetes than higher income nonparticipants (13 versus 8 percent).
- ▶ A lower percentage of SNAP participants aged 12 and older had normal TG concentrations compared with higher income nonparticipants (73 versus 77 percent).

Biochemical indicators

The study team used three biochemical indicators of health drawn from CDC’s study to assess the U.S. population’s nutritional status as of 2012 (CDC, n.d.): serum vitamin B12, serum vitamin D (25-

hydroxyvitamin D), and iodine. See chapter 3, table 3.6 for reference values. Key findings related to biochemical indicators follow:

- ▶ A lower percentage of SNAP participants aged 1 and older had adequate serum vitamin D concentrations than either income-eligible or higher income nonparticipants (65 versus 71 and 82 percent, respectively).
- ▶ A higher percentage of SNAP participants aged 6 and older had adequate iodine concentrations compared with higher income nonparticipants (66 versus 60 percent).

Chapter 4. Food Consumption Patterns

The study team examined the food consumption patterns of SNAP participants and nonparticipants on a given day by estimating (1) the proportion of individuals consuming foods from supermarket aisle food groups and subgroups and (2) the average amounts consumed. The supermarket aisle approach categorizes foods into 1 of 10 food groups (see text box) and then into more than 150 subgroups (Cole & Fox, 2008a). All the supermarket aisle food groups and subgroups reflect foods consumed as *discrete* items. Key findings related to food consumption patterns follow:

Supermarket Aisle Food Groups

- Grains
- Vegetables
- Fruit and 100 percent fruit juice
- Milk and milk products
- Meat and meat alternatives
- Mixed dishes
- Other beverages
- Sweets and desserts
- Salty snacks
- Added fats and oils

- ▶ At the food group level, SNAP participants and income-eligible nonparticipants had similar consumption patterns on a given day, but a lower percentage of SNAP participants reported consuming items from the fruit and 100 percent fruit juice food group. Compared with higher income nonparticipants, a lower percentage of SNAP participants reported consuming food from most food groups but reported similar consumption of salty snacks and meat and meat alternatives.
- ▶ At the subgroup level, a lower percentage of SNAP participants than higher income nonparticipants reported consuming whole grains and sugar-free soda on a given day, but a higher percentage reported consuming refined grains, cooked potatoes, 100 percent fruit juice, beans, and regular soda. Compared with either group of nonparticipants, a lower percentage of SNAP participants reported consuming whole fruit, skim milk, yogurt, and plain water, and a higher percentage reported consuming whole milk and noncarbonated sweetened drinks.

Chapter 5. Usual Energy and Macronutrient Intakes

Dietary recall data were used to assess total energy and macronutrient intakes relative to the Dietary Reference Intakes (DRIs) and the 2015–2020 DGA.⁴ The DRIs provide guidelines on appropriate nutrient intakes for healthy individuals based on age, gender, and life stage (Institute of Medicine, 1997; 1998; 2000; 2001; 2005; 2006; 2011; National Academies of Science, Engineering, and Medicine [NASEM], 2019) and are the most up-to-date scientific standards for determining if dietary patterns are

⁴ Two nonsequential dietary recalls were used to assess usual intakes. One dietary recall was used to assess the mean percentage of calories from saturated fats, added sugars, and alcohol.

nutritionally adequate. Table ES.2 summarizes the applicable DRIs. The DGA provides evidence-based recommendations for food and beverage intakes and is published every 5 years.

Table ES.2. DRI Standards Used to Assess Macronutrient and Energy Intakes

Nutrient(s)	Standard	Description of Standard
Total fat, protein, and carbohydrate; linoleic and linolenic fatty acids	AMDR	Reflects a range of usual intakes that are associated with a reduced risk of chronic disease and that also provide adequate intakes of essential nutrients; defined as the percentage of total calorie intake from macronutrients and essential fatty acids (linoleic acid and linolenic acid)
Fiber	AI	Defined when insufficient data are available to establish an estimated average requirement; groups with mean usual intakes at or above AI levels are assumed to have nutrient adequacy, but no firm conclusions can be drawn when mean usual intakes fall below the AI

AI = adequate intake; AMDR = acceptable macronutrient distribution range; DRI = Dietary Reference Intake

Energy intakes

The study team estimated total usual energy intakes (in calories)⁵ and percentage of energy from saturated fat, added sugars, and alcohol and compared these findings with the 2015–2020 DGA recommendations.⁶ Key findings related to energy intakes follow:

- ▶ Compared with higher income nonparticipants, SNAP participants consumed a smaller percentage of calories from saturated fats on a given day (10.9 versus 11.3 percent of calories) and a higher percentage of SNAP participants met the dietary guidelines for saturated fat consumption (31 versus 23 percent of individuals).
- ▶ SNAP participants consumed a greater percentage of calories from added sugars on a given day compared with either income-eligible or higher income nonparticipants on average (15.5 versus 13.4 and 12.5 percent, respectively). Adult women participating in SNAP had the highest added sugar consumption at a mean of 17 percent of calories on a given day.

Macronutrient intakes

The study team also compared the usual intakes of fat, protein, carbohydrates, linoleic acid, and linolenic acid with the acceptable macronutrient distribution ranges (AMDRs) and usual intakes of fiber with the adequate intake level (AI). Key findings related to macronutrient and fiber intakes follow:

- ▶ A higher percentage of SNAP participants had usual intakes of fat and carbohydrates within the AMDRs compared with higher income nonparticipants (69 versus 56 percent and 83 versus 70 percent, respectively).
- ▶ SNAP participants had a lower mean usual intake of fiber than either income-eligible or higher income nonparticipants (7.5 versus 8.3 and 8.5 grams per 1,000 calories, respectively).

⁵ Energy is measured in units of kilocalories; however, for brevity throughout the report, the more common term—calories—is used.

⁶ The 2015–2020 DGA recommends consuming less than 10 percent of calories from saturated fats or added sugars.

Chapter 6. Usual Micronutrient Intakes

The National Cancer Institute (NCI) method (NIH NCI, n.d.a) was used to estimate mean usual intakes of vitamins and minerals, intake distributions, and the percentage of individuals with usual intakes consistent with DRI standards.⁷ Table ES.3 summarizes the applicable DRIs.

Table ES.3. DRI Standards Used to Assess Usual Micronutrient Intakes

Nutrient(s)	Standard	Description of Standard
Vitamins A, B6, B12, C, D, and E; copper; selenium; folate; niacin; riboflavin; thiamin; calcium; iron; magnesium; phosphorus; and zinc	EAR	Average daily nutrient intake level estimated to meet the requirements for half of the healthy individuals in a life stage or gender group; the proportion of a group with usual intakes equal to or greater than the EAR is an estimate of the prevalence of adequate usual intakes in that group
Potassium, sodium, and choline	AI	Defined when insufficient data are available to establish an EAR; groups with mean usual intakes at or above AI levels are assumed to have nutrient adequacy, but no firm conclusions can be drawn when mean usual intakes fall below the AI
Sodium	CDRR	The intake above which intake reduction is expected to reduce chronic disease risk within an apparently healthy population

AI = adequate intake; CDRR = chronic disease risk reduction; DRI = Dietary Reference Intake; EAR = estimated average requirement

Estimated average requirement

Usual intakes of 10 vitamins and 7 minerals were assessed relative to the estimated average requirements (EARs). Key findings follow:

- ▶ There were several differences between SNAP participants and higher income nonparticipants in the prevalence of adequate usual intakes. A lower percentage of SNAP participants than higher income nonparticipants met or exceeded the EARs for all vitamins and minerals included in the analysis, except vitamin B12, vitamin D, iron, and selenium, for which there were no differences.
- ▶ In contrast, there were very few differences between SNAP participants and income-eligible nonparticipants in the prevalence of adequate usual intakes. A lower percentage of SNAP participants than income-eligible nonparticipants met or exceeded the EARs for copper and magnesium. There were no differences between SNAP participants and income-eligible nonparticipants for any vitamins or other minerals.

Adequate intake level and chronic disease risk reduction level

Usual intakes of choline, potassium, and sodium were compared with the adequate intake levels (AIs). Mean usual sodium intake was also compared with the chronic disease risk reduction level (CDRR). Key findings follow:

- ▶ SNAP participants had lower mean usual intakes of potassium than both income-eligible and higher income nonparticipants (84 versus 87 and 92 percent of AI, respectively).

⁷ See appendix A for a detailed description of the NCI method.

- ▶ A lower percentage of SNAP participants than higher income nonparticipants had mean usual intakes of sodium that exceeded the CDRR (87 versus 92 percent).

Chapter 7. Matched Participant Group Findings

The matched analyses focused on a subset of outcomes examined in chapters 2 through 6 (see text box). A propensity score-matching model was employed to minimize observable differences between SNAP participants and income-eligible nonparticipants (see appendix A for a more detailed description of the approach). Differences between SNAP participants and a matched sample of income-eligible nonparticipants were calculated for each outcome and for children, adults, and older adults, separately. Compared with findings from descriptive analyses, which did not control for important demographic and contextual factors, findings from the matched analyses indicate the groups differ on fewer outcomes, particularly at the subgroup level; they also help confirm that SNAP children and men have better outcomes for several key indicators.

Key findings related to the matched analysis follow:

- ▶ Adults participating in SNAP had lower total HEI scores than matched income-eligible nonparticipants (52 versus 56 points).
- ▶ Children participating in SNAP had a lower prevalence of obesity than matched income-eligible nonparticipants (20 versus 25 percent). Conversely, adults participating in SNAP had a higher prevalence of obesity than matched income-eligible nonparticipants (44 versus 38 percent). This difference was driven by women participating in SNAP, who had a significantly higher prevalence of obesity than matched income-eligible nonparticipants (55 versus 42 percent).
- ▶ A higher percentage of SNAP participants had low HDL levels and hemoglobin compared with matched income-eligible nonparticipants (42 versus 37 percent and 12 versus 9 percent, respectively).
- ▶ Children participating in SNAP had a lower prevalence of prediabetes than matched income-eligible nonparticipants (15 versus 29 percent). Among adults, prediabetes prevalence results varied by gender. Men participating in SNAP had a lower prevalence of prediabetes than matched income-eligible nonparticipants (29 versus 44 percent). Conversely, women participating in SNAP had a higher prevalence of prediabetes than matched income-eligible nonparticipants (30 versus 19 percent).
- ▶ SNAP participants consumed a higher percentage of calories from added sugars on a given day than matched income-eligible nonparticipants (16 versus 14 percent).

Matched Outcomes	
Overall diet quality	
■	Total HEI-2015 scores
■	Component HEI-2015 scores
Indicators of nutrition and health	
■	BMI
■	Blood pressure
■	HDL
■	LDL
■	TG concentrations
■	Blood glucose levels
■	Hemoglobin
■	Serum vitamin D concentrations
Nutrient and energy intakes	
■	Total calories
■	Calories from added sugars, added fats, and alcohol
■	Calcium
■	Vitamin D
■	Dietary fiber
■	Iron
■	Potassium
■	Sodium

C. Conclusions

Neither the descriptive nor the matched analysis was designed to assess the impact of SNAP or infer causality. Still, the results from this study highlight opportunities to improve the diet quality, nutrition, and health of Americans and SNAP participants in particular. Similar to the previous study, findings from this study indicate that SNAP participants had a higher prevalence of obesity and diverged from DGA recommendations more than nonparticipants, especially higher income nonparticipants. Women participating in SNAP had a particularly high prevalence of obesity.

In response to high obesity prevalence, policies and promotion efforts across programs should continue to emphasize physical activity, dietary patterns consistent with the DGA, and energy balance during each stage of life. To help SNAP participants better align their diets with the current DGA, nutrition messages and interventions targeted to individuals eligible for SNAP, such as those implemented through SNAP-Ed, should continue to encourage increased consumption of fruits and vegetables, low-fat milk, and whole grains and reduced consumption of refined grains, sodium, saturated fats, and added sugars—especially from sugar-sweetened beverages.

Chapter 1. Introduction

The Food and Nutrition Service (FNS) of the U.S. Department of Agriculture (USDA) administers 15 nutrition assistance programs with the overarching goal of increasing food security and reducing hunger through access to affordable, healthy food and nutrition education. These programs include the Supplemental Nutrition Assistance Program (SNAP); Special Supplemental Nutrition Program for Women, Infants, and Children (WIC); and National School Lunch Program (NSLP). SNAP, the focus of this report, is the largest domestic food and nutrition assistance program administered by FNS. The aim of SNAP is to ensure low-income households have access to nutritious food. This study is the fourth in a series that uses National Health and Nutrition Examination Survey (NHANES) data to examine the relationship between participation in these programs, diet quality, and health outcomes; this series of reports was initially funded by USDA's Economic Research Service (Fox & Cole, 2004a, 2004b; Cole & Fox, 2004a, 2004b) and continued by USDA FNS (Cole & Fox, 2008a, 2008b, 2008c; Condon et al., 2015a, 2015b, 2015c). The objectives of this study are as follows:

- ▶ For all Americans, assess overall diet quality and compare selected measures of nutrition and health with recommended values.
- ▶ Compare the overall diet quality, nutrition, and health of SNAP participants with those of income-eligible and higher income nonparticipants (these two groups are described later in this section).
- ▶ Compare selected measures of overall diet quality, nutrition, and health between SNAP participants and matched income-eligible nonparticipants.

To address the study objectives, the study team measured overall diet quality using the Healthy Eating Index (HEI)-2015 and assessed the adequacy of usual nutrient intakes relative to current Dietary Reference Intake (DRI) and Dietary Guidelines for Americans (DGA) standards (Institute of Medicine [IOM], 1997; 1998; 2000; 2001; 2005; 2006; 2011; NASEM, 2019; U.S. Department of Health and Human Services [HHS] & USDA, 2015). The study team assessed nutrition and health using various indicators that included anthropometric measures (e.g., body mass index [BMI], waist circumference) and blood biomarkers (e.g., high-density lipoprotein [HDL] cholesterol, blood glucose). This report also presents data on usual energy intakes; consumption of calories from saturated fats, added sugars, and alcohol; and food consumption patterns as both the proportion of individuals who consumed foods from each food group and the average amounts consumed.

The study team conducted both descriptive and matched analyses. For the descriptive analyses, information is presented for SNAP participants and two groups of nonparticipants: individuals who were income-eligible for SNAP but reported they did not participate in the program currently (income-eligible nonparticipants) and individuals with higher incomes who were not eligible for SNAP (higher income nonparticipants). Information is also presented on outcomes for all individuals and separately for three age groups—children (1–18 years old), adults (19–59 years old), and older adults (aged 60 and older)—and by gender. For the matched analysis, the team compared a subset of outcomes between SNAP participants and income-eligible nonparticipants selected into the matched comparison group based on their similarity to SNAP participants on an array of individual characteristics related to both SNAP participation and diet quality.

Given the descriptive nature of core study analyses, it was not possible to evaluate the causal effects of program participation on outcomes of interest. This research was not designed to assess the impact of

SNAP or attribute differences observed between SNAP participants and nonparticipants to an effect of the program. However, this study does contribute to the evidence base needed to inform SNAP policy and practices and, in turn, improve the diet quality, nutrition and health outcomes of SNAP participants.

The remainder of this chapter provides an overview of SNAP and more detail on the data and methods used in the study. Findings from the descriptive analyses are presented in chapters 2–6, and the matched participant group findings are provided in chapter 7. Key findings and conclusions are discussed in chapter 8. The study team provides supporting information for the data and documentation of the analytic methods in appendix A. Appendices B through F present detailed data tables. Appendix G provides additional data tables for the comparison of matched SNAP participants and income-eligible nonparticipants. Appendices H through J present findings from supplemental analyses that are described later in this chapter.

A. SNAP Overview

In fiscal year (FY) 2018, SNAP provided benefits to 40.7 million participants in more than 20 million households per month on average (USDA FNS, 2020). For these Americans, SNAP provided more than \$60 billion in benefits to support participants in purchasing groceries. On average, households received \$251 in SNAP benefits per month for groceries (or \$125 per person; USDA FNS, 2019).

During the same year, most SNAP households (81 percent) included a child, older individual, or individual with a disability (USDA FNS, 2019). Similarly, more than two-thirds of SNAP participants were children, older individuals, or individuals with a disability; almost half (44 percent) were younger than 18 years old. Households with children received an average benefit of \$387 per month, and more than half (61 percent) were single-adult households. Among households with older individuals, most (82 percent) consisted of older individuals living alone. More than 80 percent of SNAP households lived in poverty in FY 2018 (USDA FNS, 2019).

1. SNAP Eligibility and Benefits

Eligibility for SNAP benefits can be determined in two ways: (1) meeting Federal income and resource tests, or (2) being automatically “categorically” eligible based on eligibility for certain other low-income assistance programs.⁸ To be eligible, households must have a monthly net income (gross income minus certain deductions) of less than 100 percent of the relevant Federal Poverty Guidelines (\$2,092 for a four-person household in FY 2019; Aussenberg & Falk, 2019). Households without an older or disabled member must also have a monthly gross income of less than 130 percent of the relevant Federal Poverty Guidelines (\$2,720 for a four-person household in FY 2019). Households must also have liquid assets with a value below a specific threshold.⁹ In FY 2019, this level was \$2,250, or \$3,500 for households with an older or disabled member.

Traditional categorical eligibility for SNAP is based on receipt of cash assistance from Supplemental Security Income, the Temporary Assistance for Needy Families block grant, or State-run General Assistance programs. Another form of categorical eligibility—broad-based categorical eligibility—makes all households with incomes below the State-determined income threshold eligible for SNAP. Under

⁸ Many State agencies use policy options, which allow States to deviate from these standard Federal requirements and tailor their SNAP programs to meet the needs of eligible households (USDA, 2018).

⁹ Countable resources include most assets easily converted to cash but exclude homes and most vehicles.

broad-based categorical eligibility, States can use gross income eligibility thresholds up to 200 percent of Federal Poverty Guidelines and can eliminate asset tests.

2. Nutrition Education

SNAP-Education (SNAP-Ed), the nutrition education and obesity prevention component of SNAP, seeks to improve the likelihood that persons eligible for SNAP will make healthy food choices within a limited budget and choose physically active lifestyles consistent with the current 2015–2020 DGA and USDA food guidance (USDA FNS, n.d.).

The provision of nutrition education through SNAP was authorized in 1981 and began in 1990 with a handful of participating States. Since then, SNAP-Ed has grown and is now implemented in all 50 States, the District of Columbia, Guam, and the U.S. Virgin Islands. SNAP-Ed was restructured following the enactment of the 2010 Child Nutrition Act (Public Law 111-296). The statute, signed December 13, 2010, amended the Food and Nutrition Act of 2008, Section 2, to establish a nutrition education and obesity prevention grant program with the aim of improving SNAP-Ed programmatic operations and effectiveness and easing administrative burden. The statute emphasized obesity prevention, in addition to nutrition education, and sought to foster a more effective and comprehensive SNAP-Ed program to address the critical problem of obesity, especially its effects on low-income Americans. The scope of activities was expanded to include public health approaches, and income eligibility for SNAP-Ed was set at less than 185 percent of the Federal Poverty Guidelines to more closely align with other FNS means-tested nutrition assistance programs.

B. Methods Summary

This section provides a high-level overview of the data sources, sample, and analytic approaches employed for this study. Additional details on the study methods are provided in appendix A.

1. Data Sources

The study team used 6 years of survey data from the NHANES 2011–2016 as the main data source for this study (Centers for Disease Control and Prevention [CDC], National Center for Health Statistics [NCHS], 2020a), and other data sources such as the Food Patterns Equivalents Database (FPED) were also incorporated.

NHANES

The NHANES, conducted by CDC NCHS, is designed to assess the health and nutritional status of adults and children in the United States; the survey examines a nationally representative sample of about 5,000 individuals each year.¹⁰ The NHANES includes interviews and physical examinations. The interview includes demographic, socioeconomic, dietary, and health-related questions. The examination component consists of medical, dental, and physiological measurements and laboratory tests (CDC NCHS, 2017).

This study team relied primarily on data from the dietary interview but also utilized data collected through the household interview, survey questionnaires, and physical examination for the analysis.

¹⁰ For more information on the NHANES, see https://www.cdc.gov/nchs/nhanes/about_nhanes.htm

Dietary interview. This NHANES component consisted of two 24-hour dietary recall interviews that quantified foods and beverages consumed during the preceding 24 hours for 2 separate days (day 1 and day 2 dietary recalls). The dietary recalls were conducted using the USDA automated multiple-pass method instrument. Respondents were provided with measurement aids to help them estimate the portion sizes of foods they consumed. The first dietary interview was conducted in person in the NHANES Mobile Examination Center (MEC), and the second dietary interview was conducted by telephone 3 to 10 days after the day 1 dietary recall. The day 2 dietary recall was used to control for within-person variance in nutrient intakes when estimating usual nutrient intakes. For children younger than 6 years old, the dietary recall interviews were conducted with a proxy, generally the person most knowledgeable about the child's dietary intake. For children 6 to 11 years old, the interviews were conducted jointly with the child and the proxy. For the 2011–2016 NHANES, 86 percent of respondents with complete day 1 dietary recall also had complete day 2 dietary recall. The dietary interview component of the NHANES, referred to as What We Eat in America, was conducted as a partnership between USDA and HHS.

Household interview, survey questionnaires, and examination data. These NHANES components gathered information on respondents' characteristics (e.g., SNAP participation, age, sex); anthropometry (e.g., height, weight); and laboratory values (e.g., low-density lipoprotein [LDL], hemoglobin; see table 1.3).

Other data sources

In addition to the NHANES, the study team used several additional data sources and programs to support the analysis. To analyze food consumption patterns, the team used 6 years (2011–2012, 2013–2014, and 2015–2016) of FPED data (USDA Agricultural Research Service [ARS], 2019). FPED converts the foods and beverages in USDA's Food and Nutrient Database for Dietary Studies (FNDDS) to the 37 USDA Food Patterns components in both Food Patterns units (e.g., cup equivalents of fruit, ounce equivalents of protein foods) and per 100 grams. FNDDS nutrient values are updated for every 2-year release cycle for What We Eat in America (USDA, ARS, 2020). The team linked each unique food reported in the NHANES 2011–2016 food-level files to the appropriate FPED source and computed the average amounts of each Food Patterns component consumed based on the amount of food reported in individuals' day 1 dietary recall.

The team also used HEI-2010 and HEI-2015 SAS program and support files (National Institutes of Health [NIH], National Cancer Institute [NCI], Division of Cancer Control & Population Sciences [DCCPS], 2020a); CDC growth charts (CDC, 2018); NCI Usual Dietary Intakes SAS macros v2.1 (NIH NCI DCCPS, 2020b); and U.S. Census Bureau (n.d.). population counts from 2010 in the analysis.

2. Analytic Sample

This section describes the methods the study team used to identify and categorize the analytic sample and provides characteristics for the sample.

Sample definitions

This report contains tabulations of dietary measures for SNAP participants and nonparticipants. The study team identified SNAP participants through their affirmative responses to the NHANES survey question, "{Do you/Does any member of your household} currently receive SNAP or Food Stamp benefits?" (CDC NCHS, 2020c). The team categorized those who did not report currently receiving SNAP

benefits as nonparticipants. Income-eligible nonparticipants were defined as individuals from households with monthly family income less than or equal to 130 percent of the relevant Federal Poverty Guidelines, and higher income nonparticipants were individuals from households with monthly income greater than 130 percent of the relevant Federal Poverty Guidelines.

All the analyses described in this report were restricted to NHANES respondents with complete day 1 dietary recall data; some analyses had additional sample restrictions. To compute most dietary measures, the study team used only day 1 dietary recall data. For the usual nutrient intake analysis, both day 1 and day 2 dietary recall data were used to control for within-person day-to-day variance in nutrient intakes. The team excluded infants and pregnant or breastfeeding women 20–44 years old from the analytic sample; pregnant and breastfeeding women outside these age ranges could not be identified in the data. These groups were excluded because the dietary reference standards were different for pregnant and breastfeeding women.

This report provides tabulations of SNAP participants, income-eligible nonparticipants, and higher income nonparticipants for all individuals and separately for three age groups: children (1–18 years old),¹¹ adults (19–59 years old), and older adults (aged 60 and older). Most of the tabulations included in the appendices provide separate estimates by these age groups and by gender. Table 1.1 shows the sample sizes and weighted population counts for SNAP participants and both groups of nonparticipants. Sampling weights are discussed in appendix A.

Table 1.1. Sample Sizes of 2011–2016 NHANES Respondents With Complete Day 1 Dietary Recalls by Age Group and Gender

Subgroup	All Individuals	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
Sample Sizes				
All individuals	24,281	6,093	4,551	12,244
Men and boys	12,123	2,890	2,291	6,235
Women and girls	12,158	3,203	2,260	6,009
Children 1–18 years old	9,260	3,076	1,709	4,023
Boys	4,682	1,545	865	2,044
Girls	4,578	1,531	844	1,979
Adults 19–59 years old	10,269	2,215	1,994	5,473
Men	5,094	997	1,012	2,776
Women	5,175	1,218	982	2,697
Older adults aged 60+	4,752	802	848	2,748
Men	2,347	348	414	1,415
Women	2,405	454	434	1,333

¹¹ The study team excluded infants younger than 1 year old because many of the dietary measures used for this report did not apply to infants.

Subgroup	All Individuals	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
Weighted Population Counts				
All individuals	302,711,121	52,095,403	45,218,787	190,851,062
Men and boys	150,832,232	24,439,373	22,054,970	96,925,405
Women and girls	151,878,889	27,656,030	23,163,817	93,925,657
Children 1–18 years old	73,150,420	18,629,495	11,495,208	40,102,021
Boys	37,189,234	9,454,292	5,689,529	20,605,701
Girls	35,961,186	9,175,204	5,805,679	19,496,320
Adults 19–59 years old	167,939,375	27,650,870	25,966,312	106,395,545
Men	85,349,600	12,717,556	13,112,103	55,171,411
Women	82,589,775	14,933,314	12,854,209	51,224,134
Older adults aged 60+	61,621,325	5,815,037	7,757,268	44,353,497
Men	28,293,398	2,267,525	3,253,338	21,148,293
Women	33,327,927	3,547,512	4,503,929	23,205,203

Note: “All individuals” includes respondents with missing SNAP participation or income. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits. Weighted population counts are based on National Health and Nutrition Examination Survey (NHANES) day 1 dietary sample weights to adjust for nonresponse in the day 1 dietary recall and the differential allocation by day of the week for the dietary intake data collection.

Source: NHANES 2011–2016 dietary recalls and demographic data. Sample includes NHANES respondents aged 1 and older with complete day 1 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

Characteristics of SNAP participants and nonparticipants

Table 1.2 presents demographic data for SNAP participants, income-eligible nonparticipants, and higher income nonparticipants.¹² Compared with higher income nonparticipants, a lower percentage of SNAP participants were non-Hispanic White and a higher percentage were Mexican American, other Hispanic, or non-Hispanic Black. A higher percentage of SNAP participants than income-eligible nonparticipants were non-Hispanic Black. A higher percentage of adults participating in SNAP compared with higher income nonparticipants had less than a high school education and a lower percentage than either group of nonparticipants were married.

In comparing estimates for SNAP participants and nonparticipants, it is important to consider differences in the age composition of these groups. SNAP participants generally tend to be younger than either nonparticipant group. Thirty-six percent of SNAP participants were aged 19 and older compared with 44 and 45 percent of income-eligible and higher-income nonparticipants, respectively. Therefore, the study team age-adjusted estimates to eliminate between-group differences that resulted solely from differences in the age distributions of the groups.¹³

¹² It may be of interest that 9.5 percent and 7.1 percent of SNAP participants in the sample also participate in WIC and NSLP, respectively.

¹³ Age standardization was applied to estimates for the following age groups: 1–3 years old, 4–8 years old, 9–13 years old, 14–18 years old, 19–30 years old, 31–50 years old, 51–59 years old, 60–70 years old, and aged 71 and older. Data for children, adults, older adults, and all individuals were “built up” from estimates for smaller age groups, standardized according to the age distribution of the U.S. population based on the 2010 census (U.S. Census Bureau, n.d.).

Table 1.2. Demographic Characteristics of SNAP Participants and Nonparticipants, All Ages

Demographic Characteristic By Subgroup	All Individuals			SNAP Participants			Income-Eligible Nonparticipants			Higher Income Nonparticipants		
	Percent	Note	Standard Error	Percent	Note	Standard Error	Percent	Note	Standard Error	Percent	Note	Standard Error
Race/Ethnicity												
All individuals												
Mexican American	10.5		(1.31)	16.2		(2.29)	18.5		(2.23)	6.5 ***		(0.94)
Other Hispanic	6.5		(0.69)	10.7		(1.68)	9.9		(1.08)	4.4 ***		(0.53)
Non-Hispanic White	62.2		(2.27)	40.5		(3.19)	49.4		(3.27)	72.4 ***		(1.83)
Non-Hispanic Black	12.1		(1.28)	25.6		(2.45)	12.9 ***		(2.05)	7.9 ***		(0.89)
Other race, multiracial	8.7		(0.63)	7.0		(0.88)	9.3		(0.86)	8.9		(0.67)
Children 1–18 years old												
Mexican American	15.8		(1.95)	22.6		(3.02)	24.7		(2.85)	9.3 ***		(1.51)
Other Hispanic	8.2		(0.84)	11.3		(1.70)	11.7		(1.69)	5.6 **		(0.68)
Non-Hispanic White	52.2		(3.08)	31.8		(3.65)	40.0		(3.78)	66.5 ***		(2.78)
Non-Hispanic Black	14.2		(1.68)	27.9		(2.98)	13.2 ***		(2.06)	7.9 ***		(1.17)
Other race, multiracial	9.6		(0.76)	6.4		(0.78)	10.4 *		(1.47)	10.6 **		(1.10)
Adults 19–59 years old												
Mexican American	10.6		(1.29)	13.5		(2.01)	18.4		(2.46)	7.2 **		(1.03)
Other Hispanic	6.8		(0.75)	10.2		(1.79)	10.3		(1.15)	4.8 **		(0.67)
Non-Hispanic White	61.0		(2.22)	45.1		(3.39)	48.1		(3.53)	69.7 ***		(1.88)
Non-Hispanic Black	12.4		(1.28)	24.2		(2.41)	14.0 **		(2.33)	8.7 ***		(0.92)
Other race, multiracial	9.2		(0.69)	7.1		(1.16)	9.3		(0.94)	9.5		(0.70)
Older adults aged 60+												
Mexican American	4.1		(0.81)	8.9 u		(3.10)	9.6		(1.82)	2.4 *		(0.43)
Other Hispanic	3.7		(0.58)	11.5		(2.56)	6.1 *		(1.02)	2.1 ***		(0.32)
Non-Hispanic White	77.2		(1.76)	46.4		(4.34)	67.8 ***		(3.13)	84.0 ***		(1.43)
Non-Hispanic Black	8.6		(1.01)	25.1		(2.86)	8.8 ***		(1.58)	6.0 ***		(0.77)
Other race, multiracial	6.4		(0.73)	8.1		(1.45)	7.7		(1.56)	5.6		(0.74)

Demographic Characteristic By Subgroup	All Individuals			SNAP Participants			Income-Eligible Nonparticipants			Higher Income Nonparticipants		
	Percent	Note	Standard Error	Percent	Note	Standard Error	Percent	Note	Standard Error	Percent	Note	Standard Error
Education (All Adults Aged 19+)												
All adults aged 19+												
Less than high school	15.1		(0.95)	32.0		(1.28)	27.1		(2.57)	7.9 ***		(0.66)
High school diploma or GED	21.5		(0.81)	30.9		(1.31)	24.2 **		(1.55)	18.6 ***		(0.92)
More than high school	63.4		(1.40)	37.2		(1.41)	48.7 **		(3.37)	73.5 ***		(1.26)
Adults 19–59 years old												
Less than high school	14.3		(0.99)	30.1		(1.25)	24.7		(2.68)	6.8 ***		(0.73)
High school diploma or GED	21.2		(0.95)	32.3		(1.49)	23.6 ***		(1.86)	17.6 ***		(0.98)
More than high school	64.5		(1.57)	37.7		(1.58)	51.6 ***		(3.71)	75.6 ***		(1.39)
Older adults aged 60+												
Less than high school	17.1		(1.21)	41.0		(3.20)	35.1		(3.17)	10.5 ***		(0.82)
High school diploma or GED	22.5		(1.07)	24.2		(1.76)	26.1		(1.97)	21.0		(1.43)
More than high school	60.3		(1.41)	34.8		(2.98)	38.9		(3.22)	68.5 ***		(1.47)
Marital Status (All Adults Aged 20+)												
All adults aged 20+												
Married	53.0		(1.17)	27.5		(1.55)	38.6 ***		(1.94)	61.9 ***		(1.13)
Widowed, divorced, separated	18.9		(0.63)	30.3		(1.58)	21.7 ***		(1.55)	15.9 ***		(0.71)
Never married	19.7		(1.08)	28.5		(1.48)	27.6		(3.01)	15.9 ***		(0.88)
Cohabiting	8.4		(0.47)	13.7		(1.09)	12.1		(1.29)	6.3 ***		(0.54)
Adults 20–59 years old												
Married	49.9		(1.29)	26.8		(1.62)	37.0 ***		(2.44)	59.1 ***		(1.25)
Widowed, divorced, separated	14.2		(0.70)	25.1		(1.79)	14.3 ***		(1.26)	11.5 ***		(0.79)
Never married	25.3		(1.29)	32.1		(1.77)	34.4		(3.39)	21.1 ***		(1.06)
Cohabiting	10.6		(0.61)	16.0		(1.26)	14.3		(1.51)	8.3 ***		(0.74)

Demographic Characteristic By Subgroup	All Individuals			SNAP Participants			Income-Eligible Nonparticipants			Higher Income Nonparticipants		
	Percent	Note	Standard Error	Percent	Note	Standard Error	Percent	Note	Standard Error	Percent	Note	Standard Error
Older adults aged 60+												
Married	61.3		(1.31)	30.8		(3.38)	43.7 **		(3.05)	68.5 ***		(1.32)
Widowed, divorced, separated	31.4		(1.15)	54.3		(3.18)	45.2 *		(2.64)	26.1 ***		(1.16)
Never married	4.8		(0.42)	11.6		(1.43)	6.0 **		(1.07)	3.5 ***		(0.52)
Cohabiting	2.6		(0.36)	3.3		(0.89)	5.1		(1.42)	1.8		(0.39)

Note: "All individuals" includes respondents with missing SNAP participation or income. Education is reported for individuals aged 6 and older but is displayed for individuals 19 and older to capture high school completion. Marital status is reported only for individuals aged 20 and older in the NHANES 2011–2016. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$, ** $p < .01$, or *** $p < .001$. Differences were tested using two-sample t -tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits.

u Indicates individual estimates did not meet the standards of reliability or precision because of large coefficient of variation

Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls and demographic data. Sample includes NHANES respondents aged 1 and older with complete day 1 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

3. Data Analysis

This report describes differences between SNAP participants and nonparticipants in their nutrient intakes, food consumption patterns, overall diet quality, and other indicators of nutrition and health (e.g., BMI, blood pressure). The primary and supplemental analytic approaches used to examine and describe these differences are discussed in the subsections below. Table 1.3 summarizes the outcomes and measures examined in this study and the relevant ages for each outcome or measure.

Additional information about the analytic approach, including the use of NHANES sampling weights, calculation of standard errors, and age standardization, is provided in appendix A. The study team also identified individual point estimates that did not meet the standards of reliability or precision because of large coefficients of variation. In keeping with NHANES reporting guidelines, such estimates are reported in detailed tables but are flagged with a “u” for unreliable. In some cases, between-group differences may be statistically significant even when one point estimate is unreliable. Unreliable differences are not discussed in this report.

As noted previously, this research was not designed to measure the impact of SNAP participation on diet quality. Therefore, significant differences between SNAP participants and nonparticipants cannot be attributed to participation in SNAP. Similarly, the absence of a significant difference cannot be interpreted as evidence that participation in SNAP has no effect. The accurate assessment of SNAP impacts requires specially designed studies or, at minimum, complex analytical models that require a variety of measures, some of which are not available in NHANES data.

Analytic Approaches	
Primary (presented in report)	
■	Descriptive analyses comparing SNAP participants with income-eligible and higher income nonparticipants (see chapters 2–6)
■	Matched analyses comparing matched SNAP participants with income-eligible nonparticipants (see chapter 7)
Supplemental (presented in appendices)	
■	Matched analyses comparing matched SNAP participants, SNAP plus WIC or SNAP plus NSLP participants, and income-eligible nonparticipants (see appendices H and I)
■	Multivariable regression analyses examining differences between SNAP participants and income-eligible nonparticipants (see appendix J)

Table 1.3. Summary of Outcomes and Measures for Descriptive Analyses

Outcome	Measures	Ages
Chapter 2. Overall Diet Quality		
HEI-2015 scores ^a	■ HEI-2015 total score ■ HEI-2015 component score	2+
Chapter 3. Indicators of Nutrition and Health		
Weight status	■ Percentages of individuals who were underweight, normal weight, overweight, or obese ^b	2+
Waist circumference	■ Percentages of individuals with normal or high-risk waist circumference measurements	19+
Disease risk	■ Percentages of individuals with normal, increased, high, very high, or extremely high risk of disease based on BMI and waist circumference	19+
WHtR	■ Mean WHtRs ■ Distribution of WHtRs	19+

Outcome	Measures	Ages
Blood pressure	■ Percentages of individuals with normal blood pressure, elevated blood pressure, stage 1 hypertension, stage 2 hypertension, and hypertensive crisis	8+
HDL cholesterol	■ Percentages of individuals with normal or below recommended HDL levels	6+
LDL cholesterol	■ Percentages of individuals with normal or above recommended LDL levels	12+
TG	■ Percentages of individuals with normal, borderline high, or high TG concentrations	12+
Glucose	■ Percentages of individuals with normal glucose levels, prediabetes, or diabetes	12+
Hemoglobin	■ Percentages of individuals with normal or low hemoglobin concentrations	1+
Serum vitamin B12 concentration	■ Percentages of individuals with normal or low serum vitamin B12 concentrations	19+
Serum vitamin D concentration	■ Percentages of individuals with normal or low serum vitamin D concentrations	1+
Urinary iodine concentration	■ Percentages of individuals with normal or low iodine concentrations	6+
Chapter 4. Food Consumption Patterns		
Consumption of specific food groups and discrete food items	■ Proportion of individuals consuming foods from supermarket aisle food groups in a given day ■ Proportion of individuals consuming foods from supermarket aisle subgroups, among those consuming the food group ■ Mean amounts (in Food Patterns units and in grams) of foods from supermarket aisle food groups and subgroups consumed in a day, among those consuming the food group	1+
Chapter 5. Usual Energy and Macronutrient Intakes		
Consumption of calories from saturated fats, added sugars, and alcohol	■ Percentage of total calories contributed by calories from saturated fats, added sugars, and alcohol on a given day	2+
Usual energy intakes	■ Mean usual intakes (in calories)^c ■ Distributions of usual intake	1+
Usual macronutrient intakes	■ Mean usual intakes ■ Distributions of usual intakes ■ Usual intakes compared with DRIs (AMDR and AI) and percentages of individuals meeting DRIs	1+
Chapter 6. Usual Micronutrient Intakes		
Usual nutrient intakes	■ Mean usual intakes ■ Distributions of usual intakes ■ Usual intakes compared with DRIs (EAR, AI, and CDRR) and percentages of individuals meeting DRIs	1+

AI = adequate intake; AMDR = acceptable macronutrient distribution range; BMI = body mass index; CDRR = chronic disease risk reduction; DRI = Dietary Reference Intake; EAR = estimated average requirement; HDL = high-density lipoprotein; HEI = Healthy Eating Index; LDL = low-density lipoprotein; TG = triglyceride; WHtR = waist-to-height ratio

^a HEI-2010 scores are presented in appendix B to facilitate comparisons with the 2007–2010 Diet Quality of Americans study.

^b For adults, obesity is further classified into three severity levels: level I is BMI 30.0 to < 35, level II is BMI 35.0 to < 40.0, and level III is BMI 40+.

^c Energy is measured in units of kilocalories; however, for brevity throughout the report, the more common term—calories—is used.

Descriptive analyses

Descriptive analyses provided data on measures of diet quality, nutrition, and health among SNAP participants compared with income-eligible nonparticipants and higher income nonparticipants. The study team tested the statistical significance of differences between SNAP participants and both groups of nonparticipants using *t*-tests. Detailed tables showing all results are provided in appendices B through G. Statistically significant differences are noted throughout this report with asterisks. Because of the large number of *t*-tests conducted, caution should be used in interpreting results; a proportion of these tests are expected to be significant by chance. Throughout the report, the discussion focuses on the differences between SNAP participants and one or both groups of nonparticipants but also references other between-group differences—children versus adults or men versus women—when the differences are noteworthy. The team did not test the statistical significance of these secondary comparisons because these comparisons are not the focus of this report.

Matched analyses

Matched analyses compared selected diet quality, nutrition, and health measures of interest between matched SNAP participants and income-eligible nonparticipants. The study team used propensity score matching to conduct two-group matched analyses between SNAP participants and income-eligible nonparticipants to minimize the confounding influence of unobservable differences between groups. See appendix A for additional detail. After constructing a comparison group of income-eligible nonparticipants that minimized differences with SNAP participants in the NHANES 2011–2016, the team calculated *t*-tests for differences in mean outcomes between SNAP participants and matched nonparticipants (see table 1.4). Findings for the matched analyses are presented in chapter 7 and appendix G.

Table 1.4. Summary of Outcomes and Measures for Matched Analyses

Outcome	Measures	Age
Overall Diet Quality		
HEI-2015 scores	■ HEI-2015 total score ■ HEI-2015 component scores	2+
Indicators of Nutrition and Health		
Weight Status	■ Percentage of individuals who were underweight, normal weight, overweight, or obese	2+
Select blood biomarkers	■ Percentages of individuals with normal or below recommended HDL levels	6+
	■ Percentages of individuals with normal or above recommended LDL levels	12+
	■ Percentages of individuals with normal, borderline high, or high TG concentrations	12+
	■ Percentages of individuals with normal glucose levels, prediabetes, or diabetes	12+
	■ Percentages of individuals with normal or low hemoglobin concentrations	1+

Outcome	Measures	Age
Energy Intakes		
Usual energy intakes	■ Mean usual intakes (in calories)	1+
Consumption of calories from saturated fats, added sugars, and alcohol	■ Percentage of calories contributed by calories from saturated fats, added sugars, and alcohol on a given day	2+

BMI = body mass index; HDL = high-density lipoprotein; HEI = Healthy Eating Index; LDL = low-density lipoprotein; TG = triglyceride

Supplemental analyses

The study team conducted two supplemental analyses to further inform FNS’s understanding of the diet quality, nutrition, and health of SNAP participants compared with other groups. First, the study team compared selected measures of interest (see table 1.4) between matched SNAP participants and income-eligible nonparticipants. The study team used propensity score matching to conduct three-group matched analyses between SNAP participants, SNAP plus WIC participants or SNAP plus NSLP participants, and income-eligible nonparticipants to minimize the confounding influence of unobservable differences between these groups. See appendix A for additional detail. After constructing a comparison group of income-eligible nonparticipants that minimized differences with SNAP participants in the NHANES 2011–2016, the team calculated *t*-tests for differences in mean outcomes between SNAP participants and matched nonparticipants (see table 1.4). Findings from the SNAP plus WIC matched analyses are presented in appendix H, and findings from the SNAP plus NSLP analyses are presented in appendix I.

Second, the study team conducted multivariable regression analyses to examine associations between program participation and selected measures of interest. The regressions provided slightly greater power to detect differences by program participation and potentially reduced bias because, compared with the above-described matched analyses, more of the sample could be retained. For the matched analyses, nonparticipants without a comparable SNAP match were dropped. Findings from the multivariable regression analyses are presented in appendix J.

Chapter 2. Overall Diet Quality

Key Takeaways

Total HEI-2015 scores serve as a measure of overall diet quality. Among all individuals, mean total HEI-2015 scores sit well below the maximum possible score of 100 points, suggesting on average, Americans fall short of meeting the 2015–2020 DGA recommendations. Although generally true for SNAP participants overall, the study also found—

- Compared with one or both nonparticipant groups, **SNAP participants'** consumption of refined grains, sodium, and saturated fats **aligned better** with the 2015–2020 DGA.
- SNAP older adults aged **60 and older** had higher HEI scores than adults 19–59 and children aged 2–18. The diets of **SNAP older adults** also **aligned better** with the 2015–2020 DGA than the diets of income-eligible nonparticipants.



This chapter examines the diet quality of SNAP participants and nonparticipants using the HEI. The HEI is a measure of diet quality that assesses adherence to key DGA nutrition recommendations (USDA & HHS, 2010).

Section A provides background information on the HEI. Section B presents results on total HEI-2015 scores, and section C presents results on HEI-2015 component scores. This chapter discusses only statistically significant differences between SNAP participants and nonparticipants; detailed results of the HEI-2015 analysis are presented in appendix B. Findings based on the HEI-2010 are also presented in appendix B to facilitate comparisons with the 2007–2010 DQA study (Condon et al., 2015a).

A. Healthy Eating Index Background

The HEI has been adopted by USDA as a tool to monitor the nutritional quality of foods consumed by the U.S. population and monitor progress toward healthier eating habits among nutrition assistance program participants (Guenther et al., 2008). The HEI was first created in 1995 by USDA's Center for Nutrition Policy and Promotion; it is updated with each iteration of the DGA. It was revised in 2006 to reflect the 2005 DGA (HEI-2005), updated in 2012 to reflect the 2010 DGA (HEI-2010), and updated again in 2018 to reflect the 2015–2020 DGA (HEI-2015; Krebs-Smith et al., 2018). Although the NHANES 2011–2016 data spanned both the HEI-2010 and HEI-2015, this chapter presents HEI-2015 findings because they provide a measure of diet quality relative to the *current* DGA recommendations (see appendix B for HEI-2010 results).¹⁴ HEI scores are estimated at the population level using the population ratio method.¹⁵

¹⁴ The main difference between the HEI-2010 and HEI-2015 is in the empty calories construct. In the HEI-2015, the empty calories component (i.e., calories from solid fats, alcohol, and added sugars) was replaced with two discrete components for saturated fats and added sugars. With this change, saturated fats replaced solid fats, and alcohol was removed as an item that contributes to a specific component. For a full comparison of HEI-2005, HEI-2010, and HEI-2015, see <https://epi.grants.cancer.gov/he/comparing.html>

¹⁵ This method involves calculating mean intakes of relevant food groups, nutrients, and calories for the population, then calculating the ratios of the means with calories in the denominator and comparing with HEI standards for scoring.

Table 2.1 outlines the 13 HEI-2015 components, maximum points that can be earned for each, and standards for achieving the minimum and maximum number of points for each component. The standards used to assign HEI-2015 component scores are expressed on a density basis (i.e., amounts per 1,000 calories or as a percentage of calories) rather than absolute amounts of foods consumed; this reflects the recommendation individuals should strive to meet nutritional guidelines while maintaining energy balance.

Each component of the HEI-2015 reflects a key aspect of diet quality. Adequacy components are dietary elements that are encouraged; higher scores for adequacy components reflect greater consumption. The nine adequacy components are total fruits, whole fruits, total vegetables, greens and beans, whole grains, dairy, total protein foods, seafood and plant proteins, and fatty acids. By contrast, moderation components are dietary elements recommended for limited consumption; higher scores for moderation components reflect lower consumption. The four moderation components are refined grains, sodium, added sugars, and saturated fats. Scores for intakes between the minimum and maximum standards are scored proportionately; the minimum score for each component is zero. Scores for each of the 13 components are summed to create a total HEI-2015 score with a range from 0 to 100. A higher HEI-2015 score indicates a diet that better aligns with the corresponding 2015–2020 DGA. When interpreting HEI scores, a difference of 5 to 6 points between groups may be meaningful (Kirkpatrick et al., 2018).

Table 2.1. HEI-2015 Component Points and Standards for Scoring

Component	Maximum Score	Standard for Maximum Score	Standard for Minimum Score of Zero
Adequacy Components			
Total fruits	5	≥ 0.8 cup equiv. per 1,000 calories	No fruit
Whole fruits	5	≥ 0.4 cup equiv. per 1,000 calories	No whole fruit
Total vegetables	5	≥ 1.1 cup equiv. per 1,000 calories	No vegetables
Greens and beans	5	≥ 0.2 cup equiv. per 1,000 calories	No dark green vegetables or legumes
Whole grains	10	≥ 1.5 oz. equiv. per 1,000 calories	No whole grains
Dairy	10	≥ 1.3 cup equiv. per 1,000 calories	No dairy
Total protein foods	5	≥ 2.5 oz. equiv. per 1,000 calories	No protein foods
Seafood and plant proteins	5	≥ 0.8 oz. equiv. per 1,000 calories	No seafood or plant proteins
Fatty acids	10	(PUFAs + MUFAs)/SFAs ≥ 2.5	(PUFAs + MUFAs)/SFAs ≤ 1.2
Moderation Components			
Refined grains	10	≤ 1.8 oz. equiv. per 1,000 calories	≥ 4.3 oz. equiv. per 1,000 calories
Sodium	10	≤ 1.1 grams per 1,000 calories	≥ 2.0 grams per 1,000 calories
Added sugars	10	≤ 6.5 percent of calories	≥ 26 percent of calories
Saturated fats	10	≤ 8 percent of calories	≥ 16 percent of calories
Total HEI score	100		

Note: Intakes between the minimum and maximum standards are scored proportionately. Total fruits include 100 percent fruit juice; whole fruits include all forms except juice. Total vegetables include greens and beans; total protein foods include legumes (beans and peas). Dairy includes all cow's milk products, such as fluid milk, yogurt, and cheese, and fortified soy beverages. Seafood and plant proteins include seafood, nuts, seeds, soy products (other than beverages), and legumes. Fatty acids are measured by the ratio of PUFAs and MUFAs to SFAs.

calories = kilocalories; equiv. = equivalent; MUFA = monounsaturated fatty acid; PUFA = polyunsaturated fatty acid; SFA = saturated fatty acid

Table 2.2 provides a synopsis of the data sources, sample, and measures examined in this chapter. Children younger than 2 years old were excluded from all HEI analyses because the 2015–2020 DGA did not apply to them.

Table 2.2. Data, Sample, and Measures Used to Assess HEI-2015 Scores

Data	Sample	Measures
NHANES 2011–2016 <i>Single 24-hour dietary recall per person</i> FPED 2011–2012, 2013–2014, 2015–2016	 Individuals aged 2 and older	 HEI-2015 total score HEI-2015 component scores

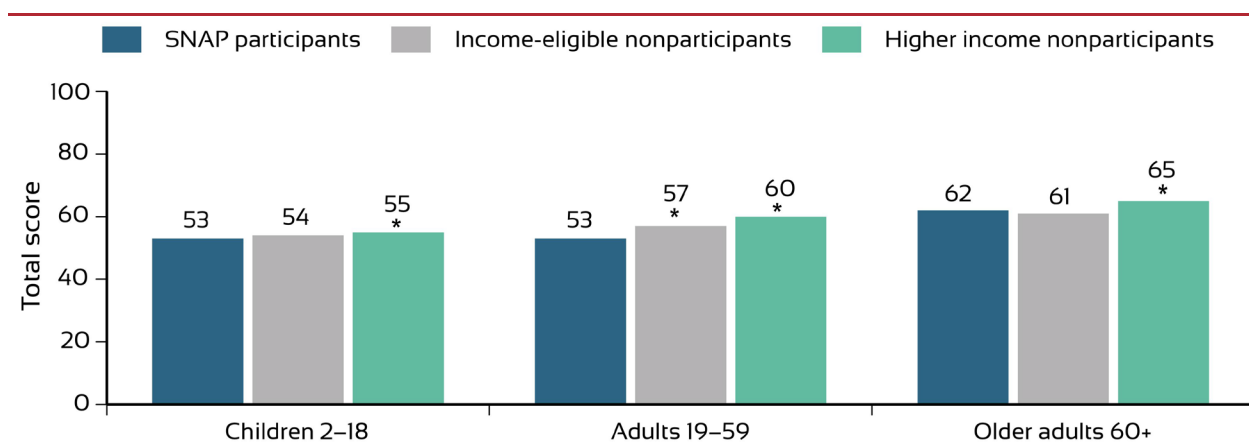
FPED = Food Patterns Equivalents Database; HEI = Healthy Eating Index; NHANES = National Health and Nutrition Examination Survey

B. HEI-2015 Total Scores

The average total HEI-2015 score for all individuals was 59 out of 100 possible points (see appendix table B.1). By gender, women and girls had a higher average total HEI-2015 score overall than men and boys (60 versus 57 points for all individuals). By age group, children had the lowest average total score of 54 points, and older adults had the highest average total score of 65 points. Within each age group, women or girls consistently had higher average scores than men or boys. Low total HEI-2015 scores suggest, on average, Americans fall short of meeting the 2015–2020 DGA recommendations.

Overall, SNAP participants had lower total HEI-2015 scores than income-eligible and higher income nonparticipants on average (55 versus 57 and 60 points, respectively; see appendix table B.1). Across all age groups, SNAP participants had lower average total scores than higher income nonparticipants. Among adults, SNAP participants also had significantly lower average total scores than income-eligible nonparticipants (see figure 2.1).

Figure 2.1. Mean Total HEI-2015 Scores for Individuals Aged 2 and Older by Age and Program Participation



Note: Estimates are based on the day 1 dietary recall. Scores are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in percentages are noted by * $p < .05$. Differences were tested using two-sample t -tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits.

HEI = Healthy Eating Index

Sources: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls; Food Patterns Equivalents Database 2011–2012, 2013–2014, and 2015–2016. Sample includes NHANES respondents aged 2 and older with complete day 1 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

C. HEI-2015 Component Scores

This section discusses significant findings related to HEI-2015 component scores overall and by age group. See appendix B for detailed results by gender.

1. All Individuals

Among all individuals, the maximum score was not achieved for any HEI-2015 components on average (see table 2.3). The mean score was closest to the maximum for the total protein foods component overall (4.9 out of 5 points). Mean scores were particularly low for the whole grains (2.9 out of 10 points), fatty acids (4.3 out of 10 points), and sodium (4.0 out of 10 points) components.

Compared with income-eligible nonparticipants, SNAP participants scored lower for the total fruits, whole fruits, total vegetables, and added sugars components and higher for the refined grains and sodium components on average (see table 2.3). SNAP participants scored lower than higher income nonparticipants for 9 of the 13 components—including 3 moderation components—but scored higher for the sodium and saturated fats components on average (see table 2.3).

Table 2.3. Mean HEI-2015 Component Scores for All Individuals Aged 2 and Older by Program Participation

Components	Maximum Score	All Individuals	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
Sample size	–	23,691	5,866	4,460	12,001
Adequacy Components					
Total fruits	5	2.9	2.6	3.0 ***	3.0 ***
Whole fruits	5	4.0	3.1	3.8 ***	4.2 ***
Total vegetables	5	3.3	2.9	3.3 ***	3.4 ***
Greens and beans	5	3.0	2.6	2.9	3.1 ***
Whole grains	10	2.9	2.3	2.5	3.1 ***
Dairy	10	6.4	6.2	6.1	6.5 *
Total protein foods	5	4.9	4.9	4.9	4.9 *
Seafood and plant Proteins	5	4.5	4.2	4.3	4.5 **
Fatty acids	10	4.3	4.1	4.3	4.3
Moderation Components					
Refined grains	10	6.2	5.9	5.4 ***	6.4 ***
Sodium	10	4.0	4.3	3.8 **	3.9 **
Added sugars	10	6.5	5.3	6.4 ***	6.8 ***
Saturated fats	10	5.7	6.0	6.0	5.5 ***
Total HEI-2015 score	100	58.6	54.5	56.7 **	59.9 ***

Note: “All individuals” includes respondents with missing SNAP participation or income. Estimates are based on the day 1 dietary recall. Scores are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Mean component scores may not sum to total score because of rounding. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$, ** $p < .01$, or *** $p < .001$.

Differences were tested using two-sample *t*-tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits.

HEI = Healthy Eating Index

– Denotes not applicable

Sources: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls; Food Patterns Equivalents Database 2011–2012, 2013–2014, and 2015–2016. Sample includes NHANES respondents aged 2 and older with complete day 1 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

2. Children

Children 2–18 years old had mean component scores that came close to achieving maximum scores for the whole fruits (4.3 out of 5 points) and dairy (8.5 out of 10 points) components (see table 2.4). Mean scores were lowest for the greens and beans (1.7 out of 5 points), whole grains (2.9 out of 10 points), and fatty acids (3.0 out of 10 points) components. Mean scores for total vegetables, sodium, and refined grains were also below 50 percent of the maximum score. In general, children’s scores for moderation components were low and highlighted areas in which children’s diets diverged from the 2015–2020 DGA recommendations.

Among children, mean component scores were similar for SNAP participants and income-eligible nonparticipants with a few exceptions: SNAP participants scored lower for total fruits, whole fruits, and added sugar consumption on average (see table 2.4). Compared with higher income nonparticipants,

children participating in SNAP scored lower for the total fruits, whole fruits, whole grains, dairy, refined grains, and sodium components but higher for the total vegetables, greens and beans, total protein foods, fatty acids, and saturated fats components on average.

Table 2.4. Mean HEI-2015 Component Scores for Children Aged 2–18 by Program Participation

Components	Maximum Score	All Children	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
<i>Sample size</i>	–	8,670	2,849	1,618	3,780
Adequacy Components					
Total fruits	5	3.5	3.1	3.5 *	3.7 ***
Whole fruits	5	4.3	3.7	4.2 *	4.5 ***
Total vegetables	5	2.3	2.4	2.5	2.2 *
Greens and beans	5	1.7	1.9	1.9	1.5 *
Whole grains	10	2.9	2.5	2.6	3.2 ***
Dairy	10	8.5	8.2	8.3	8.6 *
Total protein foods	5	4.5	4.6	4.5	4.4 *
Seafood and plant proteins	5	3.1	2.9	2.9	3.2
Fatty acids	10	3.0	3.3	3.2	2.8 **
Moderation Components					
Refined grains	10	4.8	4.6	4.4	5.0 *
Sodium	10	4.6	4.4	4.4	4.8 *
Added sugars	10	6.0	5.7	6.2 *	6.0
Saturated fats	10	5.1	5.3	5.4	4.9 *
Total HEI-2015 score	100	54.3	52.7	54.1	54.8 **

Note: “All children” includes respondents with missing SNAP participation or income. Estimates are based on the day 1 dietary recall. Scores are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Mean component scores may not sum to total score because of rounding. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$, ** $p < .01$, or *** $p < .001$. Differences were tested using two-sample *t*-tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits.

HEI = Healthy Eating Index

– Denotes not applicable

Sources: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls; Food Patterns Equivalents Database 2011–2012, 2013–2014, and 2015–2016. Sample includes NHANES respondents 2–18 years old with complete day 1 dietary recall data.

3. Adults Aged 19 to 59

Adults achieved the maximum score for the total protein foods component on average (5 out of 5 points; see table 2.5). By contrast, adults’ mean scores for the whole grains and sodium components were below 50 percent of the maximum score.

Adults participating in SNAP scored lower than income-eligible nonparticipants for seven components but higher for the sodium and refined grains components on average (see table 2.5). Compared with higher income nonparticipants, SNAP participants scored lower for most components but higher for the sodium and saturated fat components on average.

Table 2.5. Mean HEI-2015 Component Scores for Adults Aged 19–59 by Program Participation

Components	Maximum Score	All Adults	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
Sample size	–	10,269	2,215	1,994	5,473
Adequacy Components					
Total fruits	5	2.5	2.1	2.6 **	2.6 ***
Whole fruits	5	3.6	2.4	3.4 ***	3.9 ***
Total vegetables	5	3.5	2.8	3.5 ***	3.6 ***
Greens and beans	5	3.4	2.4	3.2 **	3.6 ***
Whole grains	10	2.6	1.9	2.3 **	2.8 ***
Dairy	10	5.7	5.5	5.2	5.8 *
Total protein foods	5	5.0	5.0	5.0	5.0
Seafood and plant proteins	5	4.9	4.5	4.7	4.9 *
Fatty acids	10	4.7	4.3	4.8 *	4.7 *
Moderation Components					
Refined grains	10	6.5	6.4	5.3 ***	6.7
Sodium	10	3.8	4.7	3.8 **	3.6 ***
Added sugars	10	6.4	4.5	6.2 ***	7.0 ***
Saturated fats	10	6.0	6.3	6.3	5.8 **
Total HEI-2015 score	100	58.4	52.8	56.5 ***	60.2 ***

Note: “All adults” includes respondents with missing SNAP participation or income. Estimates are based on the day 1 dietary recall. Scores are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Mean component scores may not sum to total score because of rounding. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$, ** $p < .01$, or *** $p < .001$. Differences were tested using two-sample *t*-tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits.

HEI = Healthy Eating Index

– Denotes not applicable

Sources: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls; Food Patterns Equivalents Database 2011–2012, 2013–2014, and 2015–2016. Sample includes NHANES respondents 19–59 years old with complete day 1 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

4. Older Adults Aged 60+

Overall, older adults had mean component scores that reached the maximum score for the total protein foods and seafood and plant proteins components (5 out of 5 points; see table 2.6). Older adults achieved less than 50 percent of the maximum scores for the whole grains, fatty acids, and sodium components on average.

Older adults participating in SNAP and income-eligible nonparticipants had similar HEI-2015 component scores on average (see table 2.6). Compared with higher income nonparticipants, SNAP participants had a lower total HEI score and scored lower for the refined grains component on average.

Table 2.6. Mean HEI-2015 Component Scores for Older Adults Aged 60 and Older by Program Participation

Components	Maximum Score	All Older Adults	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
Sample size	–	4,752	802	848	2,748
Adequacy Components					
Total fruits	5	3.5	3.5	3.4	3.4
Whole fruits	5	4.7	4.4	4.5	4.7
Total vegetables	5	4.1	3.8	3.8	4.2
Greens and beans	5	3.6	3.7	3.0	3.7
Whole grains	10	3.8	3.4	3.1	4.0
Dairy	10	5.8	5.8	5.9	5.8
Total protein foods	5	5.0	5.0	5.0	5.0
Seafood and plant proteins	5	5.0	4.7	4.9	5.0
Fatty acids	10	4.9	4.7	4.2	5.0
Moderation Components					
Refined grains	10	7.1	6.3	6.6	7.3 ***
Sodium	10	3.9	3.4	3.3	4.0
Added sugars	10	7.4	7.3	7.1	7.4
Saturated fats	10	5.6	6.0	5.6	5.6
Total HEI-2015 score	100	64.5	62.1	60.5	65.2 *

Note: “All older adults” includes respondents with missing SNAP participation or income. Estimates are based on the day 1 dietary recall. Scores are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Mean component scores may not sum to total score because of rounding. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$, ** $p < .01$, or *** $p < .001$.

Differences were tested using two-sample *t*-tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits.

HEI = Healthy Eating Index

– Denotes not applicable

Sources: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls; Food Patterns Equivalents Database 2011–2012, 2013–2014, and 2015–2016. Sample includes NHANES respondents aged 60 and older with complete day 1 dietary recall data.

Chapter 3. Indicators of Nutrition and Health

Key Takeaways

Indicators of nutrition and health such as body mass index (BMI), waist circumference, blood pressure, high-density lipoprotein (HDL), and low-density lipoprotein (LDL) suggest that Americans, on average, have elevated chronic disease risk. The study also found—

- A higher percentage of **older adult** SNAP participants had a **normal** waist circumference compared to higher income nonparticipants, and **normal** disease risk compared to income-eligible nonparticipants.
- A higher percentage of **men and boys** participating in SNAP had **normal** blood glucose and LDL levels compared to one or both nonparticipant groups, and boys participating in SNAP had a considerably **lower** prevalence of obesity than income-eligible nonparticipants.
- **SNAP participants** had a higher prevalence of lower than recommended HDL levels and hypertension than either nonparticipant group. A **higher** percentage of **women** participating in SNAP had high disease risk or greater compared with either nonparticipant group.



This chapter examines numerous measures of nutrition and health available through the NHANES MEC examination and laboratory analysis. The MEC examination includes anthropometric measurements, blood pressure, and other measures. The laboratory analysis collects biological specimens (e.g., blood, urine) that provide information about participants' health and nutritional status. Eligibility for specific laboratory tests is based on a survey participant's gender and age at the time of screening. In this chapter, data from the MEC and laboratory analysis are used to examine BMI; waist circumference; disease risk; waist-to-height ratio (WHtR); blood pressure; and additional indicators of nutrition, including high-density lipoprotein (HDL) and low-density lipoprotein (LDL) cholesterol, triglycerides (TG), blood glucose, hemoglobin, and blood or urine concentrations of iodine and vitamins B12 and D.

This chapter discusses only statistically significant differences between SNAP participants and nonparticipants. Detailed results are presented in appendix C. Table 3.1 provides a synopsis of the data sources, sample, and measures examined in this chapter.

Table 3.1. Data, Sample, and Measures Used to Assess Indicators of Nutrition and Health

Data	Sample	Measures
NHANES 2011–2016 MEC examination and laboratory data	Individuals aged 1 and older (hemoglobin and vitamin D blood serum concentrations) Individuals aged 2 and older (BMI) Individuals aged 6 and older (serum HDL cholesterol and urinary iodine concentrations) Individuals aged 8 and older (blood pressure) Individuals aged 12 and older (blood LDL cholesterol, TG, and glucose) Individuals aged 19 and older (waist circumference, WHtRs, disease risk, vitamin B12 blood serum concentrations)	Mean and distribution of WHtRs Percentages of individuals within various reference levels for each outcome

BMI = body mass index; HDL = high-density lipoprotein; LDL = low-density lipoprotein; MEC = mobile examination center; TG = triglyceride; WHtR = waist-to-height ratio

A. Anthropometric and Disease Risk Measures

This study examined BMI for adults and BMI-for-age percentiles¹⁶ for children aged 2–18. BMI is a ratio of an individual’s weight to height¹⁷ and is used as an indicator of body fatness. Being overweight or obese significantly increases the chances of developing many diseases, including type 2 diabetes, high blood pressure, coronary heart disease, stroke, gallbladder disease, respiratory problems, osteoarthritis, sleep apnea, and some types of cancer (HHS, Office of Disease Prevention and Health Promotion, n.d.).

This study also examined waist circumference and WHtR for adults; both measures reflect abdominal obesity. Accounting for distribution of body fat is important because visceral fat (i.e., fat stored between the internal organs) is more detrimental to health than subcutaneous fat (i.e., fat stored under the skin; Hamdy et al., 2006). Visceral fat and resulting abdominal obesity increase the risk of developing type 2 diabetes, high blood pressure, and coronary artery disease. Although waist circumference on its own is an indicator of health risk for adults, WHtR takes both waist circumference and height into account. Research suggests WHtR is more useful than BMI in assessing health status because of its ability to differentiate between visceral and subcutaneous fat accumulation (Ashwell et al., 2012; Schneider et al., 2010; Lee et al., 2008). Disease risk is another measure examined in this study that accounts for abdominal obesity by linking BMI and waist circumference (see table 3.3).

Table 3.2 outlines the BMI, waist circumference, and WHtR reference values and recommendations for adults. BMI-for-age is the only anthropometric measure examined for children because the other measures do not have established cutoffs for children’s growth patterns. Because men and women are

¹⁶ Children’s weight status is determined by using BMI-for-age percentiles that consider a child’s age and gender. BMI-for-age percentiles are evaluated relative to CDC (2018) growth charts.

¹⁷ $BMI = \frac{\text{weight (kilograms)}}{\text{height (meters}^2\text{)}}$

metabolically different and have some different anthropometric measure cutoffs, the following sections are divided by gender.

Table 3.2. Reference Values and Recommendations for Anthropometric Measures for All Adults Aged 19+

Measure	Reference Values and Recommendations
Weight status ^a	For adults, BMI cutoffs are defined as follows: ■ Underweight if BMI < 18.5 ■ Normal weight if BMI 18.5 to < 25.0 ■ Overweight if BMI 25.0 to < 30.0 ■ Obese if BMI 30.0 or higher — Class I if BMI 30.0 to < 35.0 — Class II if BMI 35.0 to < 40.0 — Class III if BMI 40.0 or higher
Waist circumference ^a	For men, waist circumference categories are defined as follows: ■ Normal if waist circumference ≤ 40 inches ■ High risk if waist circumference > 40 inches For women, waist circumference categories are defined as follows: ■ Normal if waist circumference ≤ 35 inches ■ High risk if waist circumference > 35 inches
WHtR ^b	For men and women, waist-to-height ratio categories are defined as follows: ■ Normal if WHtR < 0.5 ■ Increased risk if WHtR ≥ 0.5

BMI = body mass index; WHtR = waist-to-height ratio

^a CDC, 2015

^b Ashwell & Gibson, 2016

Table 3.3. Disease Risk

BMI Category	Waist Circumference Category	
	Normal	High Risk
Underweight	Normal risk	Normal risk
Normal weight	Normal risk	Normal risk
Overweight	Increased risk	High risk
Class I obesity	High risk	Very high risk
Class II obesity	Very high risk	Very high risk
Class III obesity	Extremely high risk	Extremely high risk

BMI = body mass index

Source: NIH, National Heart, Lung, and Blood Institute, n.d.a

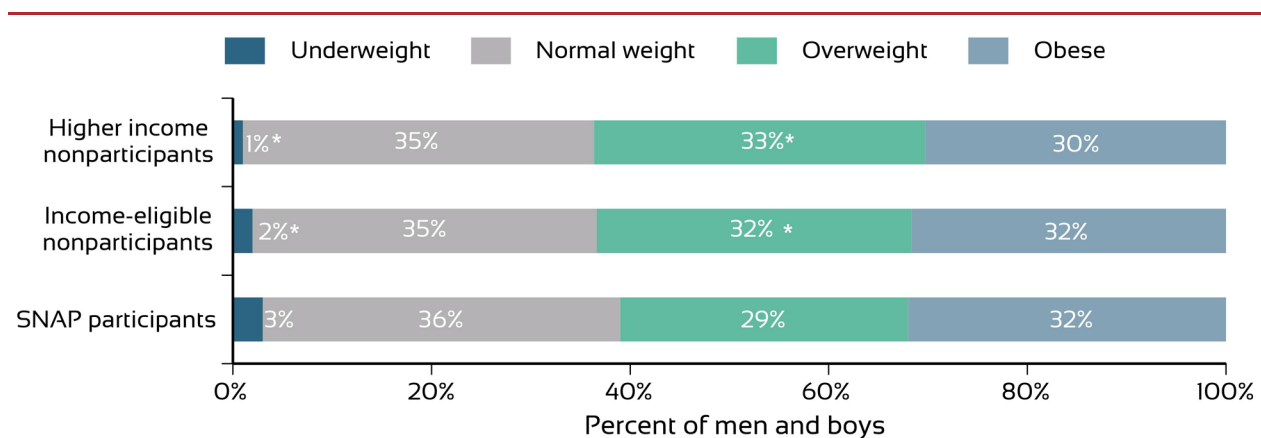
1. Body Mass Index

Among all individuals in the NHANES 2011–2016 survey sample, the prevalence of overweight was 29 percent and the prevalence of obesity was 33 percent (see appendix table C.1). Although they had a lower prevalence of overweight, SNAP participants had a higher prevalence of obesity than either income-eligible or higher income nonparticipants (39 versus 35 and 31 percent, respectively).

Men and boys

Among all men and boys, the prevalence of overweight was 32 percent and prevalence of obesity was 31 percent (see appendix table C.1). Men and boys participating in SNAP had a lower prevalence of overweight than either income-eligible or higher income nonparticipants (29 versus 32 and 33 percent, respectively; see figure 3.1). Men and boys participating in SNAP also had a higher prevalence of underweight than either income-eligible or higher income nonparticipants (3 versus 2 and 1 percent, respectively).

Figure 3.1. Percentage of Men and Boys Aged 2 and Older in Each Body Mass Index Category by Program Participation

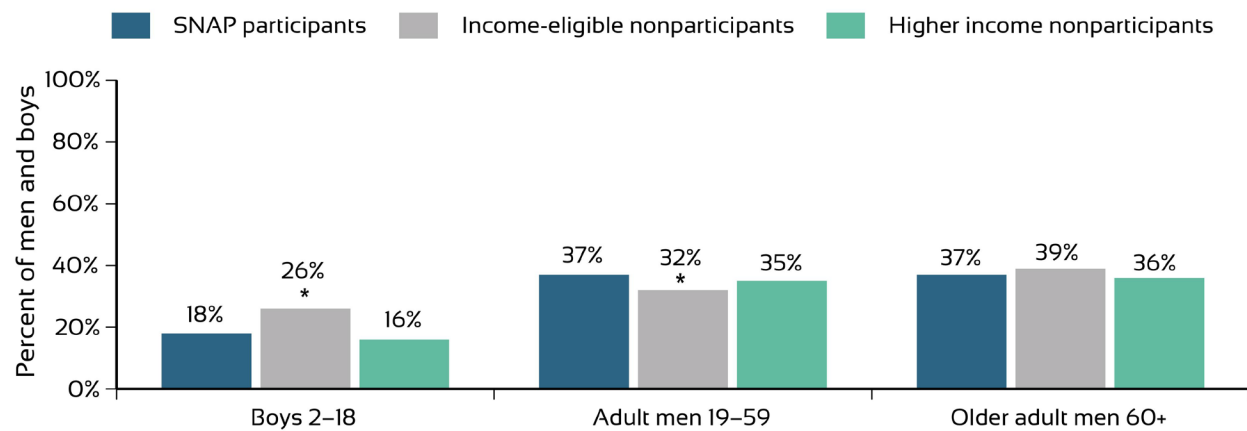


Note: Values are age adjusted to account for the different age distributions of SNAP participants and nonparticipants; values are also weighted based on NHANES sample weights. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Percentages may not sum to 100 percent because of rounding. Significant differences in estimates are noted by * $p < .05$. Differences were tested using two-sample t -tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits.

Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 body measures data. Sample includes male NHANES respondents aged 2 and older with complete day 1 dietary recall data and weight and height data.

In general, the prevalence of obesity was lower among boys than among adult men and older adult men (18 versus 35 and 36 percent, respectively; see appendix table C.1). Boys participating in SNAP had a considerably lower prevalence of obesity than income-eligible nonparticipants (18 versus 26 percent; see figure 3.2). However, adult men participating in SNAP had a higher prevalence of obesity than income-eligible nonparticipants (37 versus 32 percent; see figure 3.2). There was no difference in the prevalence of obesity by program participation among older adult men. Despite the prevalence of obesity among men, adult and older adult men also had a higher prevalence of underweight than either nonparticipant group.

Figure 3.2. Percentage of Men and Boys Aged 2 and Older With Obesity by Age and Program Participation



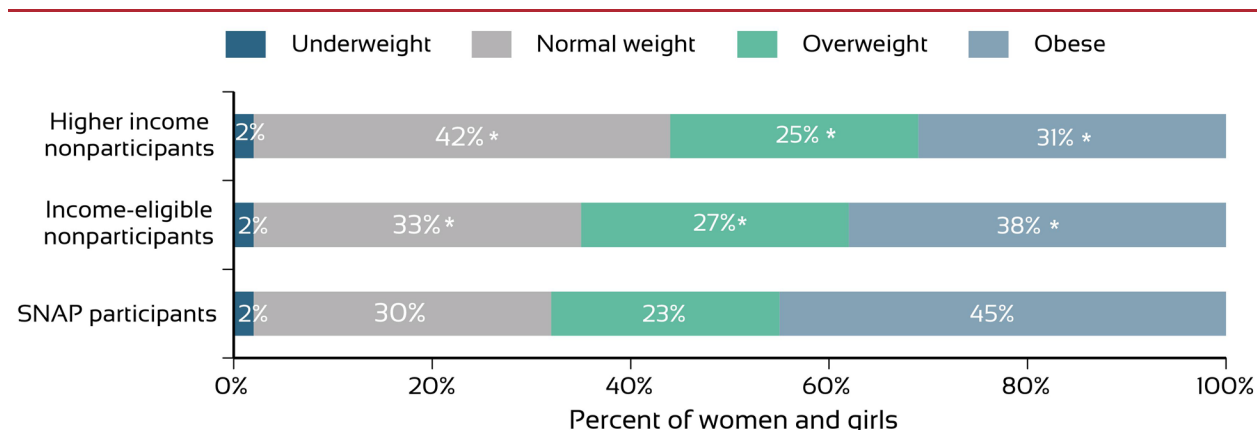
Note: Values are age adjusted to account for the different age distributions of SNAP participants and nonparticipants; values are also weighted based on National Health and Nutrition Examination Survey (NHANES) sample weights. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$. Differences were tested using two-sample t -tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits.

Source: NHANES 2011–2016 body measures data. Sample includes male NHANES respondents aged 2 and older with complete day 1 dietary recall data and weight and height data.

Women and girls

Among all women and girls, one-quarter (25 percent) were overweight, and the prevalence of obesity was 34 percent (see appendix table C.1). Women and girls participating in SNAP had a higher prevalence of obesity than either group of nonparticipants (see figure 3.3).

Figure 3.3. Percentage of Women and Girls Aged 2 and Older in Each Body Mass Index Category by Program Participation

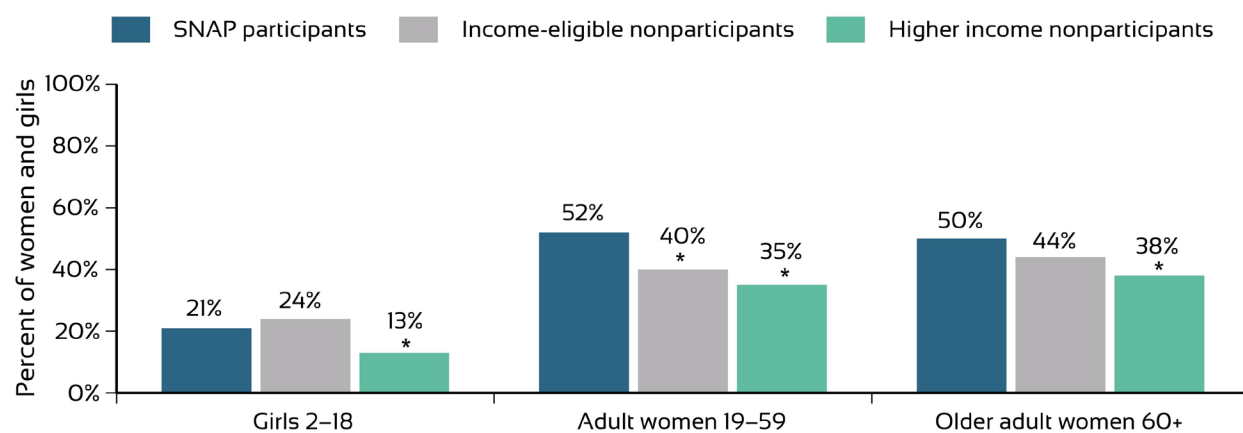


Note: Values are age adjusted to account for the different age distributions of SNAP participants and nonparticipants; values are also weighted based on National Health and Nutrition Examination Survey (NHANES) sample weights. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$. Differences were tested using two-sample t -tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits.

Source: NHANES 2011–2016 body measures data. Sample includes female NHANES respondents aged 2 and older with complete day 1 dietary recall data and weight and height data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

In general, girls had a lower prevalence of obesity than adult and older adult women (see appendix table C.1). Girls participating in SNAP had a higher prevalence of obesity than higher income nonparticipants (21 versus 13 percent; see figure 3.4). Compared with income-eligible and higher income nonparticipant women, adult women participating in SNAP had a higher prevalence of obesity (52 versus 40 and 35 percent, respectively). Older adult women participating in SNAP had a higher prevalence of obesity than higher income nonparticipants (50 versus 38 percent).

Figure 3.4. Percentage of Women and Girls Aged 2 and Older With Obesity by Age and Program Participation



Note: Values are age adjusted to account for the different age distributions of SNAP participants and nonparticipants; values are also weighted based on National Health and Nutrition Examination Survey (NHANES) sample weights. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$. Differences were tested using two-sample t -tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits.

Source: NHANES 2011–2016 body measures data. Sample includes female NHANES respondents aged 2 and older with complete day 1 dietary recall data and weight and height data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

2. Waist Circumference

Overall, 54 percent of all adults aged 19 and older had a high-risk waist circumference (see appendix table C.2).¹⁸ A higher percentage of SNAP participants had a high-risk waist circumference compared with higher income nonparticipants (57 versus 53 percent).

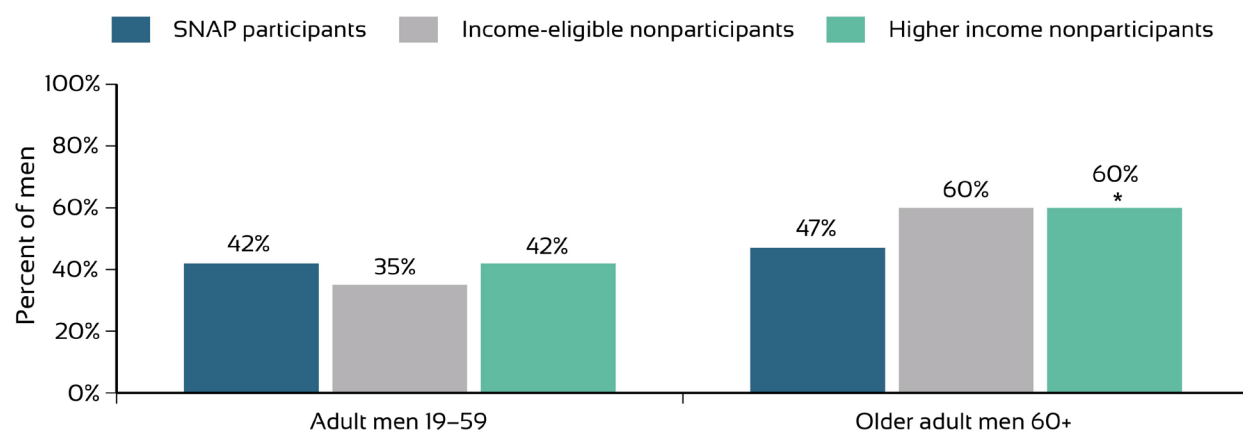
Men

Forty-five percent of all men had a high-risk waist circumference (see appendix table C.2). A lower percentage of men participating in SNAP had a high-risk waist circumference compared with higher income nonparticipants (43 versus 46 percent).

Among adult men, 41 percent had a high-risk waist circumference (see appendix table C.2). Among older adult men, 59 percent had a high-risk waist circumference. A lower percentage of older adult men participating in SNAP had a high-risk waist circumference than higher income nonparticipants (47 versus 60 percent; see figure 3.5).

¹⁸ High risk refers to increased risk of heart disease and type 2 diabetes.

Figure 3.5. Percentage of Men Aged 19 and Older With High-Risk Waist Circumference by Age and Program Participation



Note: Values are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$. Differences were tested using two-sample t -tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits.

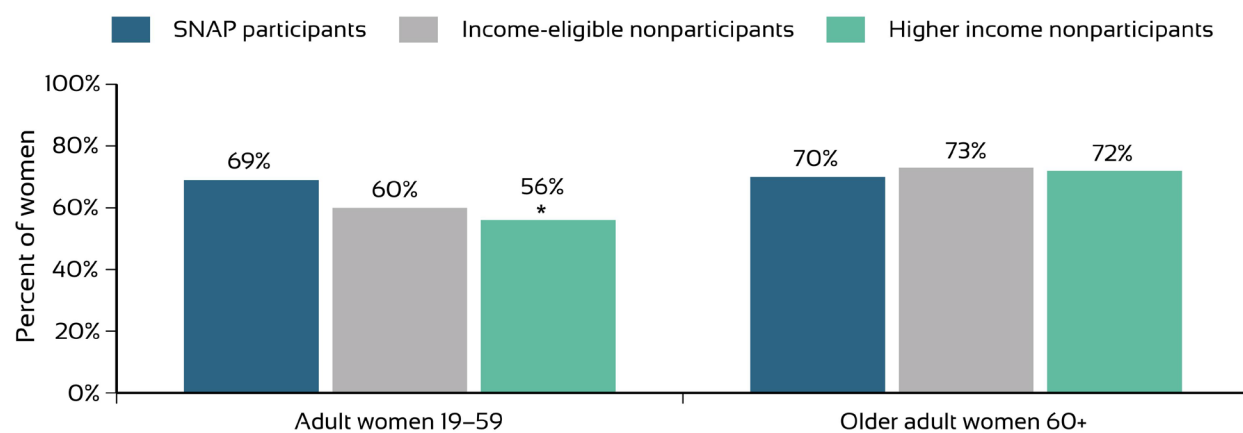
Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 body measures data. Sample includes male NHANES respondents aged 19 and older with complete day 1 dietary recall data and waist circumference data.

Women

Most women (63 percent) had a high-risk waist circumference (see appendix table C.2). A higher percentage of adult women participating in SNAP had a high-risk waist circumference compared with higher income nonparticipants (70 versus 60 percent).

Among adults, 59 percent of women had a high-risk based waist circumference (see appendix table C.2). A higher percentage of adult women participating in SNAP than higher income nonparticipants had a high-risk waist circumference (69 versus 56 percent; see figure 3.6). Most older adult women (72 percent) had a high-risk waist circumference, and results were similar across participant groups.

Figure 3.6. Percentage of Women Aged 19 and Older With High-Risk Waist Circumference by Age and Program Participation



Note: Values are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$. Differences were tested using two-sample t -tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits.

Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 body measures data. Sample includes female NHANES respondents aged 19 and older with complete day 1 dietary recall data and waist circumference data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

3. Waist-to-Height Ratios

Overall, the mean WHtR for adults was 0.59, which exceeded the 0.5 threshold for increased health risk (see appendix table C.3). SNAP participants had a higher mean WHtR than either income-eligible or higher income nonparticipants (0.61 versus 0.59 and 0.58, respectively).

Men

For all men, the mean WHtR was 0.58 (see appendix table C.3). For adult men aged 19 to 59, the mean WHtR was 0.57, and men participating in SNAP had a higher mean WHtR compared with either nonparticipant group. For older adult men, the mean WHtR was 0.61, and men participating in SNAP had a lower mean WHtR compared with income-eligible nonparticipants.

Women

For all women, the mean WHtR was 0.60 (see appendix table C.3). For adult women, the mean WHtR was 0.59, and for older adult women, the mean WHtR was 0.63. For both age groups, SNAP participants had a higher mean WHtR than either nonparticipant group (see appendix table C.3). Women also tended to have a higher WHtR than men overall and within the same age group.

4. Disease Risk

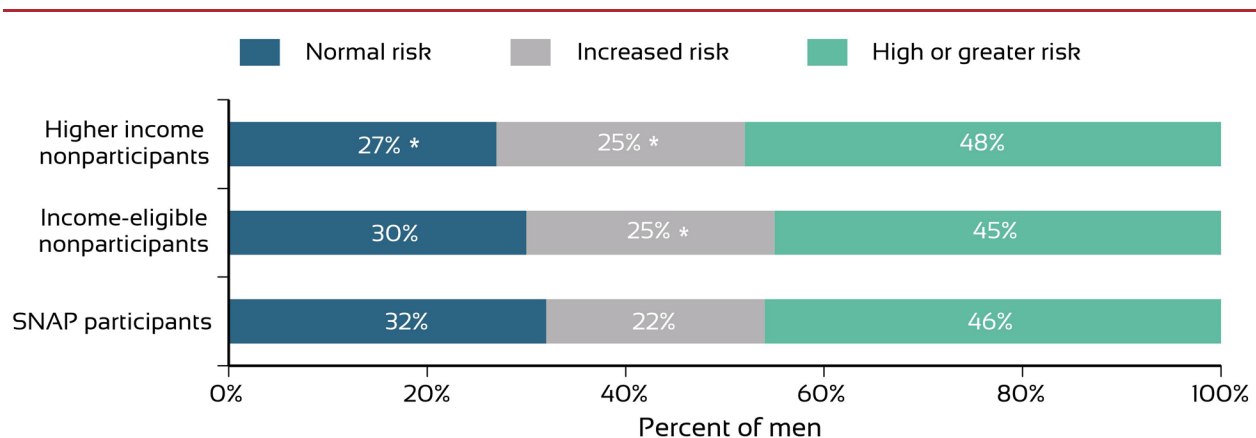
More than half of all adults (54 percent) had high or greater disease risk (i.e., high risk, very high risk, or extremely high risk) based on the classification for BMI and waist circumference developed by NIH's National Heart, Lung, and Blood Institute (NHLBI), n.d.a; see table 3.3 and appendix table C.4). Overall, a lower percentage of SNAP participants had normal disease risk compared with higher income nonparticipants (28 versus 32 percent).

Men

Almost half of men (48 percent) were at high or greater disease risk (see appendix table C.4). A higher percentage of men participating in SNAP had normal disease risk than higher income nonparticipants (32 versus 27 percent; see figure 3.7)

Among adult men, a higher percentage of SNAP participants had normal disease risk compared with higher income nonparticipants (33 versus 28 percent; see appendix table C.4). Among older adult men, a higher percentage of SNAP participants had normal disease risk than either nonparticipant group.

Figure 3.7. Percentage of Men Aged 19 and Older Within Each Disease Risk Category by Program Participation



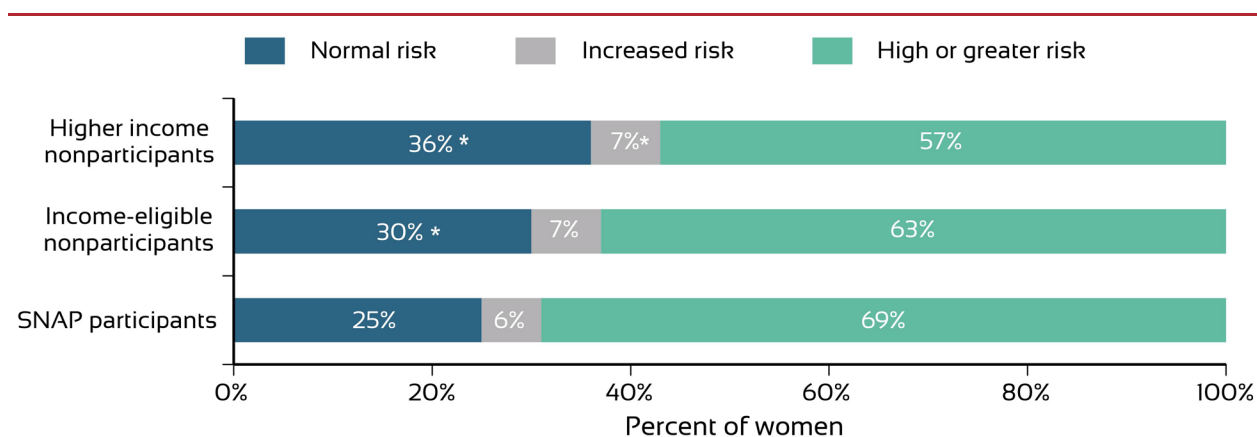
Note: Values are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$. Significance not calculated for combined groups (i.e., high or greater risk); see appendix table C.4. Differences were tested using two-sample t -tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits. Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 body measures data. Sample includes male NHANES respondents aged 19 and older with complete day 1 dietary recall data and height, weight, and waist circumference data.

Women

Sixty percent of women were at high or greater disease risk (see appendix table C.4). A lower percentage of women who participated in SNAP fell within the normal risk category than either nonparticipant group (25 versus 30 and 36 percent, respectively; see figure 3.8).

Among adult women, a lower percentage of SNAP participants had normal disease risk than either group of nonparticipants (see appendix table C.4). A higher percentage of adult women SNAP participants also had very high or extremely high disease risk compared with either nonparticipant group. Among older adult women, a higher percentage of SNAP participants had extremely high disease risk than higher income nonparticipants (14 versus 6 percent).

Figure 3.8. Percentage of Women Aged 19 and Older Within Each Disease Risk Category by Program Participation



Note: Values are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$. Significance not calculated for combined groups (i.e., those with high or greater risk); see appendix table C.4. Differences were tested using two-sample t -tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits.

Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 body measures data. Sample includes female NHANES respondents aged 19 and older with complete day 1 dietary recall data and height, weight, and waist circumference data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

B. Blood Pressure

A potential adverse effect of excess sodium intake is the development of high blood pressure (NASEM, 2019). High blood pressure can lead to heart attack, stroke, or kidney disease. The risk of developing high blood pressure can be controlled by eating a healthy diet, increasing physical activity, and maintaining a healthy weight. The NHANES includes blood pressure measures (systolic and diastolic) on all respondents aged 8 and older in the MEC exam sample. The American Heart Association (AHA) defines blood pressure levels as normal, elevated, stage 1 hypertension, stage 2 hypertension, and hypertensive crisis (AHA, 2017). NIH NHLBI (2012, pp. 82–89) provides age- and gender-specific blood pressure recommendations for children.

In this section, stage 1 hypertension, stage 2 hypertension, and hypertensive crisis are generally combined and discussed simply as “hypertension.” For more detailed results by stage of hypertension, see appendix C. Table 3.4 presents reference values by age group.

Table 3.4. Reference Values and Recommendations for Blood Pressure

Age Group	Reference Values and Recommendations
Children 1–12 years old ^a	■ Normal if blood pressure for age-sex-height < 90th percentile ■ Elevated blood pressure if blood pressure for age-sex-height ≥ 90th percentile and < 95th percentile or 120/80 mmHg to < 95th percentile (whichever is lower) ■ Stage 1 HTN if blood pressure for age-sex-height ≥ 95th percentile to < 95th percentile +12 mmHg, or 130/80 mmHg to 139/89 mmHg (whichever is lower) ■ Stage 2 HTN if blood pressure for age-sex-height ≥ 95th percentile +12 mmHg, or 140/90 mmHg (whichever is lower)
Children aged 13 and older and adults ^{a, b}	■ Normal if systolic < 120 mmHg, diastolic < 80 mmHg ■ Elevated if systolic 120–129 mmHg, diastolic < 80 mmHg ■ Stage 1 HTN if systolic 130–139 mmHg, diastolic 80–89 mmHg ■ Stage 2 HTN if systolic ≥ 140 mmHg, diastolic ≥ 90 mmHg ■ Hypertensive crisis if systolic > 180 mmHg, diastolic > 120 mmHg

HTN = hypertension; mmHg = millimeters of mercury

^a Flynn et al., 2017

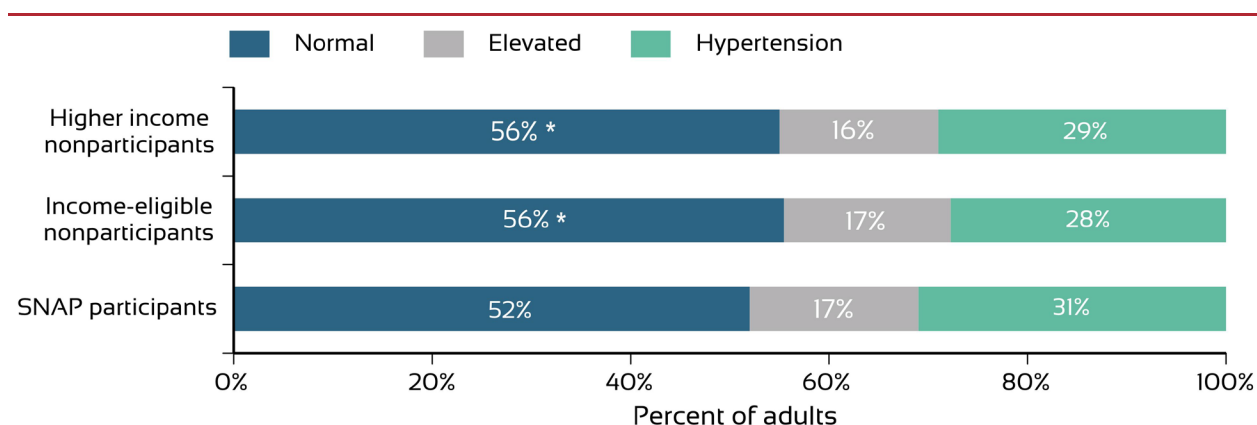
^b AHA, 2017

Among all individuals aged 8 and older, 55 percent had normal blood pressure, 15 percent had elevated blood pressure, and 30 percent had hypertension (see appendix table C.5). A lower percentage of SNAP participants had normal blood pressure than either group of nonparticipants.

The majority (88 percent) of children aged 8–18 had normal blood pressure. Of the remainder, 8 percent had elevated blood pressure, and 4 percent had hypertension (see appendix table C.5). A lower percentage of children participating in SNAP had normal blood pressure compared with higher income nonparticipants (86 versus 89 percent), which may be driven by the lower percentage of girls participating in SNAP with normal blood pressure compared with higher income nonparticipants (88 versus 93 percent). Among all children, a greater proportion of girls (91 percent) had normal blood pressure than boys (85 percent).

Among adults, 55 percent had normal blood pressure, 16 percent had elevated blood pressure, and 29 percent had hypertension (see appendix table C.5). A lower percentage of adults participating in SNAP had normal blood pressure than either group of nonparticipants (see figure 3.9). Fewer than half (46 percent) of adult men had normal blood pressure, almost one-fifth (19 percent) had elevated blood pressure, and more than one-third (35 percent) had hypertension (see appendix table C.5). A lower percentage of men participating in SNAP had normal blood pressure than either group of nonparticipants. About two-thirds (64 percent) of adult women had normal blood pressure, 13 percent had elevated blood pressure, and almost a quarter (23 percent) had hypertension (see appendix table C.5). Compared with adult men, the prevalence of elevated blood pressure and hypertension was lower among adult women. There were no differences by participant group for adult women.

Figure 3.9. Percentage of Adults Aged 19–59 With Blood Pressure Classified as Normal, Elevated, or Hypertension by Program Participation



Note: Values are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Percentages may not sum to 100 percent because of rounding. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$. Significance not calculated for combined groups (i.e., hypertension); see appendix table C.5. Differences were tested using two-sample t -tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits. Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 blood pressure data. Sample includes NHANES respondents 19–59 years old with complete day 1 dietary recall data and blood pressure data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

Fewer than one-third (27 percent) of all older adults had normal blood pressure, 20 percent had elevated blood pressure, and the majority (53 percent) had hypertension (see appendix table C.5). Among all older adults, there were no differences in blood pressure status by participant group. A greater proportion of older adult men (29 percent) had normal blood pressure than older adult women (26 percent).

C. Blood Biomarkers

This section examines several blood biomarkers that are indicators of health and may be influenced by diet quality: HDL and LDL cholesterol, TG, blood glucose, and hemoglobin. Low HDL cholesterol and elevated LDL cholesterol and TG are linked to heart disease; high blood glucose levels can result in type 2 diabetes; and low hemoglobin may indicate iron deficiency, iron deficiency anemia, or anemia. Measures for each of these blood biomarkers are evaluated relative to reference standards for age groups by gender (see table 3.5). Blood biomarkers are available from NHANES' laboratory analysis. Because eligibility for specific laboratory tests is based on a survey participant's gender and age at the time of screening, some measures are not available for all age groups.

Table 3.5. Reference Values and Recommendations for Blood Biomarkers

Measure	Reference Values and Recommendations	
	Adults	Children
HDL cholesterol ^{a, b}	For men, HDL levels are defined as: ■ Normal if HDL > 40 mg/dL ■ Lower than recommended if HDL ≤ 40 mg/dL For women, HDL levels are defined as: ■ Normal if HDL > 50 mg/dL ■ Lower than recommended if HDL ≤ 50 mg/dL	For children 6–19 years old, HDL levels are defined as: ■ Normal if HDL > 45 mg/dL ■ Borderline low if HDL 40–45 mg/dL ■ Lower than recommended if HDL < 40 mg/dL
LDL cholesterol ^{a, b}	LDL levels are defined as: ■ Normal if LDL < 100 mg/dL ■ Higher than recommended if LDL ≥ 100 mg/dL	For children 12–18 years old, LDL levels are defined as: ■ Normal if LDL < 110 mg/dL ■ Borderline high if LDL 110–129 ■ Higher than recommended if LDL ≥ 130 mg/dL
TG ^{b, c}	TG concentrations are defined as: ■ Normal if TG < 150 mg/dL ■ Borderline high if TG 150–199 mg/dL ■ High if TG ≥ 200 mg/dL	For children 12–18 years old, TG concentrations are defined as: ■ Normal if TG < 90 mg/dL ■ Borderline high if TG 90–129 mg/dL ■ High if TG ≥ 130 mg/dL
Glucose ^d	Fasting plasma glucose levels are defined as: ■ Normal if < 100 mg/dL ■ Prediabetes if 100–125 mg/dL ■ Diabetes if > 125 mg/dL	Same as adults
Hemoglobin ^e	For nonpregnant females aged 15 and older, hemoglobin levels are defined as: ■ Normal if ≥ 120 g/L ■ Low if < 120 g/L For males aged 15 and older, hemoglobin levels are defined as: ■ Normal if ≥ 130 g/L ■ Low if < 130 g/L	For children 6–59 months old, hemoglobin levels are defined as: ■ Normal if ≥ 110 g/L ■ Low if < 110 g/L For children 5–11 years old, hemoglobin levels are defined as: ■ Normal if ≥ 115 g/L ■ Low if < 115 g/L For children 12–14 years old, hemoglobin levels are defined as: ■ Normal if ≥ 120 g/L ■ Low if < 120 g/L

g/L = grams per liter; HDL = high-density lipoprotein; LDL = low-density lipoprotein; mg/dL = milligrams per deciliter; TG = triglycerides

^a For adults: NIH, U.S. National Library of Medicine, 2020

^b For children: NIH NHLBI, 2012, pp. 98

^c For adults: NIH, U.S. National Library of Medicine, 2017

^d CDC, 2019

^e These reference levels are used for the nonsmoking population residing at sea level. Adjustments are made for smokers and those residing at 1,000 or more meters above sea level based on World Health Organization (2011) recommendations.

1. HDL Cholesterol

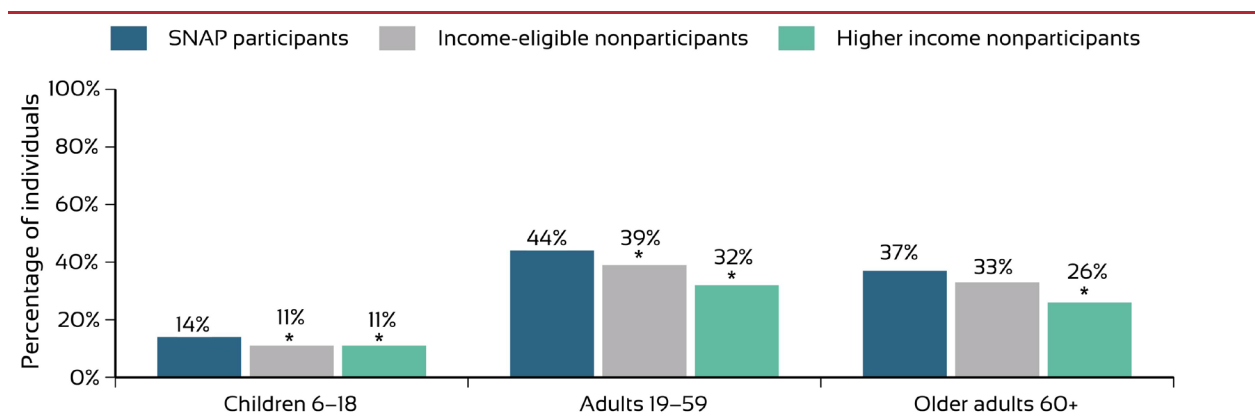
About one-third (32 percent) of all individuals aged 6 and older had lower than recommended HDL levels (see appendix table C.6).¹⁹ A higher percentage of SNAP participants had low HDL than either group of nonparticipants.

Among children 6–18 years old, 16 percent had borderline low HDL and 12 percent had lower than recommended levels (see appendix table C.6). A higher percentage of SNAP participants had lower than recommended HDL levels compared with income-eligible or higher income nonparticipants (14 versus 11 and 11 percent, respectively).

Among adults aged 19–59, more than one-third (35 percent) had low HDL levels (see appendix table C.6). A higher percentage of SNAP participants had low HDL levels than either group of nonparticipants (44 versus 39 and 32 percent, respectively; see figure 3.10). By gender, a higher percentage of men participating in SNAP had low HDL compared with higher income nonparticipants, and a lower percentage of women participating in SNAP had low HDL than either group of nonparticipants. A greater percentage of adult women had low HDL levels than adult men (37 versus 33 percent).

Among older adults, 28 percent had low HDL levels (see appendix table C.6). A higher percentage of older adults participating in SNAP had low HDL compared with higher income nonparticipants (37 versus 26 percent; see figure 3.10). A lower percentage of older adult men who participated in SNAP had normal HDL compared with income-eligible or higher income nonparticipants, and a lower percentage of older adult women who participated in SNAP had normal HDL than higher income nonparticipants.

Figure 3.10. Percentage of Individuals Aged 6 and Older With Lower Than Recommended HDL Levels by Age and Program Participation



Note: Values are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$. Differences were tested using two-sample t -tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits.

HDL = high-density lipoproteins

Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 blood biomarker data. Sample includes NHANES respondents aged 6 and older with complete day 1 dietary recall data and blood biomarker data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

¹⁹ When discussing all individuals, “lower than recommended” includes both “borderline low” and “lower than recommended” categories for children.

2. LDL Cholesterol

Among all individuals aged 12 and older, 57 percent had higher than recommended LDL levels, and there were no differences by participant group (see appendix table C.7).²⁰ Among all men and boys, a lower percentage of SNAP participants had higher than recommended LDL compared with income-eligible nonparticipants (54 versus 59 percent). There were no differences by participant group among women and girls.

Twelve percent of children aged 12–18 had borderline high LDL, and 5 percent had higher than recommended LDL levels (see appendix table C.7). Compared with income-eligible nonparticipants, a lower percentage of children participating in SNAP had higher than recommended LDL levels (4 versus 10 percent).

Among adults, almost two-thirds (64 percent) had higher than recommended LDL levels, and there were no differences by participant group (see appendix table C.7). A higher percentage of adult men had higher than recommended LDL (66 percent) levels compared with women (61 percent).

Among older adults, 58 percent had higher than recommended LDL levels (see appendix table C.7). There were no differences by participant group among all older adults, older adult men, and older adult women. Unlike the pattern observed for adults, a higher percentage of older adult women (64 percent) had higher than recommended LDL levels compared with older adult men (51 percent).

3. Triglycerides

About three-quarters of all individuals aged 12 and older (76 percent) had normal TG, 13 percent had borderline high TG, and 12 percent had high TG (see appendix table C.8). A smaller proportion of SNAP participants had normal TG than higher income nonparticipants (73 versus 77 percent).

Among children 12–18 years old, 75 percent had normal TG (see appendix table C.8). A lower percentage of SNAP participants had normal TG than higher income nonparticipants (13 versus 7 percent).

Among adults, 76 percent had normal TG, 12 percent had borderline high TG, and 12 percent had high TG (see appendix table C.8). A lower percentage of SNAP participants had normal TG than higher income nonparticipants (74 versus 77 percent).

Three-quarters (75 percent) of older adults had high TG, 15 percent had borderline high TG, and 10 percent had high TG (see appendix table C.8). Older adult SNAP participants had a lower prevalence of high TG compared with income-eligible nonparticipants (9 versus 15 percent).

4. Glucose

Of all individuals aged 12 and older, more than half (54 percent) had normal blood glucose levels, more than one-third (37 percent) had levels indicative of prediabetes, and 9 percent had levels indicative of diabetes (see appendix table C.9). SNAP participants had a higher prevalence of diabetes than higher income nonparticipants (13 versus 8 percent; see figure 3.11).

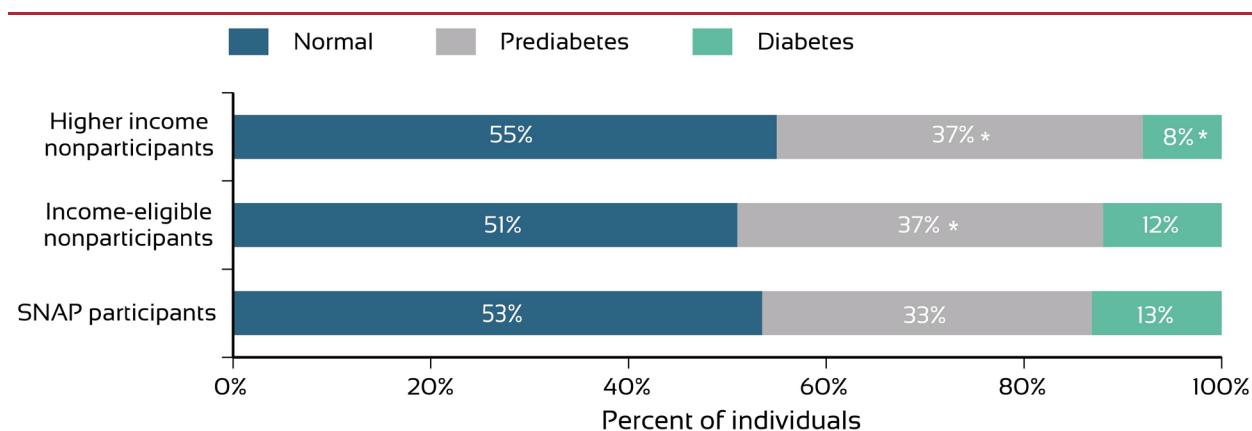
²⁰ When discussing all individuals, “higher than recommended” includes both “borderline high” and “higher than recommended” categories for children.

Among children 12–18 years old, the majority (78 percent) had normal blood glucose, 21 percent had prediabetes, and 1 percent had diabetes (see appendix table C.9). Children participating in SNAP had a lower prevalence of prediabetes than income-eligible nonparticipants (17 versus 27 percent).

Among adults, 57 percent had normal blood glucose, 36 percent had prediabetes, and 7 percent had diabetes (see appendix table C.9). Adults participating in SNAP had a higher prevalence of diabetes than higher income nonparticipants (10 versus 6 percent).

About one-third (32 percent) of older adults had normal blood glucose, almost one-half (47 percent) had prediabetes, and more than one-fifth (21 percent) had diabetes (see appendix table C.9). Consistent with the trend observed for other age groups, older adults participating in SNAP had a higher prevalence of diabetes than higher income nonparticipants (30 versus 19 percent).

Figure 3.11. Percentage of Individuals Aged 12 and Older With Normal Blood Glucose Levels, Prediabetes, and Diabetes by Age and Program Participation



Note: Values are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Percentages may not sum to 100 percent because of rounding. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$. Differences were tested using two-sample t -tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits. Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 blood biomarker data. Sample includes NHANES respondents aged 12 and older with complete day 1 dietary recall data and blood biomarker data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

5. Hemoglobin

Most individuals (93 percent) had normal hemoglobin levels, and 7 percent had low hemoglobin (see appendix table C.10). A higher percentage of SNAP participants had low hemoglobin than either income-eligible or higher income nonparticipants (11 versus 8 and 5 percent, respectively); this pattern held for SNAP participants overall and men and women separately.

Nearly all (95 percent) children aged 1 and older had normal hemoglobin, and 5 percent had low hemoglobin (see appendix table C.10). A higher percentage of children participating in SNAP had low hemoglobin than either income-eligible or higher income nonparticipants (7 versus 5 and 3 percent, respectively). A greater proportion of girls had low hemoglobin than boys (6 versus 3 percent).

The vast majority (93 percent) of adults had normal hemoglobin, and 7 percent had low hemoglobin (see appendix table C.10). A higher percentage of adults participating in SNAP had low hemoglobin compared with either income-eligible or higher income nonparticipants (11 versus 9 and 5 percent, respectively). A greater percentage of women had low hemoglobin than men (11 versus 3 percent).

Among older adults, 90 percent had normal hemoglobin, and 10 percent had low hemoglobin (see appendix table C.10). Consistent with the pattern observed for other age groups, a higher percentage of older SNAP participants had low hemoglobin than either income-eligible or higher income nonparticipants (19 versus 12 and 8 percent, respectively).

D. Biochemical Indicators

This section examines three biochemical indicators that may be influenced by diet quality: serum vitamin B12, serum vitamin D (25-hydroxyvitamin D), and iodine.²¹ These nutrients each play a unique role in health; vitamin B12 contributes to nerve function, red blood cell formation, and DNA synthesis (NIH, Office of Dietary Supplements [ODS], 2019a); vitamin D is essential for bone health (NIH ODS, 2019b); and iodine is important for thyroid function (NIH ODS, 2020b).

This section assesses the concentrations of each indicator against normal ranges among SNAP participants and nonparticipants. Table 3.6 provides reference values for the biochemical indicators discussed in this section. Intakes of vitamin B12 and D are presented in chapter 6 and noted in this chapter to provide additional context; iodine intake data is not available from NHANES.

Table 3.6. Reference Values for Biochemical Indicators

Measure	Reference Values and Recommendations
Serum vitamin B12 ^a	Vitamin B12 concentrations are defined as follows for all adults aged 19 and older: ■ Normal if ≥ 200 pg/mL ■ Low if < 200 pg/mL
Serum vitamin D ^b	Serum 25-hydroxyvitamin D concentrations are defined as follows for both children and adults: ■ Normal if ≥ 50 and < 125 nmol/L ■ Inadequate if ≥ 30 to < 50 nmol/L ■ Associated with deficiency if < 30 nmol/L
Urinary iodine ^c	Urinary iodine concentrations are defined as follows for both children and adults: ■ Adequate if 100–199 mcg/L ■ Insufficient if < 100 mcg/L ■ Severe deficiency if < 20 mcg/L

mcg/L = micrograms per liter; nmol/L = nanomoles per liter; pg/mL = picogram per milliliter

^a IOM, 1998

^b IOM, 2011

^c World Health Organization, 2007

²¹ These indicators of health were identified from a CDC report that assessed the U.S. population's nutritional status as of 2012 (CDC, n.d.).

1. Serum Vitamin B12

Almost all adults aged 19 and older (98 percent) had adequate serum B12 concentrations (see appendix table C.11). There were no differences in B12 adequacy overall by gender or participant group. Almost all adults (99 percent) had adequate B12 concentrations; similarly, almost all older adults (97 percent) had adequate B12 concentrations. Among older adult women, a smaller percentage of SNAP participants had adequate B12 concentrations compared with income-eligible nonparticipants (96 versus 99 percent).

These results are consistent with the intake-based findings in chapter 6, which show 96 and 94 percent of adults and older adults, respectively, had intakes of vitamin B12 from food that met or exceeded the estimated average requirement (EAR).

2. Serum Vitamin D

Among all individuals aged 1 and older, 77 percent had adequate serum vitamin D concentrations, 18 percent had inadequate concentrations, and 5 percent had levels associated with deficiency (see appendix table C.12). A lower percentage of SNAP participants had adequate serum vitamin D concentrations than either income-eligible or higher income nonparticipants (65 versus 71 and 82 percent, respectively); this pattern was true for all individuals and both men and boys as well as women and girls separately.

Eighty-three percent of children had adequate serum vitamin D levels, 15 percent had inadequate concentrations, and 3 percent had concentrations associated with deficiency (see appendix table C.12). A lower percentage of children who participated in SNAP had adequate vitamin D concentrations compared with higher income nonparticipants (75 versus 88 percent).

Among adults, 71 percent had adequate serum vitamin D concentrations, 22 percent had inadequate levels, and 7 percent had levels associated with deficiency (see appendix table C.12). A lower percentage of SNAP participants had adequate vitamin D concentrations than either income-eligible or higher income nonparticipants (58 versus 65 and 77 percent, respectively).

Eighty-six percent of older adults had adequate serum vitamin D concentrations, 12 percent had inadequate levels, and 3 percent had concentrations associated with deficiency (see appendix table C.12). Consistent with the pattern observed for adults, a lower percentage of older SNAP participants had adequate vitamin D concentrations than either income-eligible or higher income nonparticipants (74 versus 81 and 88 percent, respectively).

These findings diverge from the intake-based findings in chapter 6 (only 6 percent of individuals had intakes of vitamin D that met or exceeded the EAR) because very few foods contain vitamin D unless they are fortified (e.g., milk); vitamin D can be synthesized by the skin through sun exposure (NIH ODS, 2019b).

3. Iodine

Among all individuals aged 6 and older, 62 percent had adequate iodine concentrations (see appendix table C.13). A higher percentage of SNAP participants had adequate iodine concentrations compared with higher income nonparticipants (66 versus 60 percent). Overall, a greater proportion of men and boys (66 percent) had adequate iodine concentrations than women and girls (58 percent).

Fewer than three-quarters (71 percent) of children had adequate iodine concentrations, and there were no differences by participant group overall or among boys and girls, separately (see appendix table C.13). A higher percentage of boys (75 percent) had adequate iodine concentrations than girls (68 percent). Among adults, 56 percent had adequate iodine concentrations. For adults overall and adult women, a higher percentage of SNAP participants had adequate iodine concentrations than higher income nonparticipants. Among older adults, 70 percent had adequate iodine concentrations. Results were similar for participants and nonparticipants.

Chapter 4. Food Consumption Patterns

Key Takeaways

Food consumption patterns reflect food groups and subgroups consumed on a given day. Overall, percentages of individuals consuming each food group were similar for SNAP participants and income-eligible nonparticipants. The study also found—

- A **lower** percentage of **SNAP participants** reported consuming sweets and desserts or added fats and oils than higher income nonparticipants.
- A **lower** percentage of **SNAP participants** reported consuming fruit and 100 percent fruit juice than income-eligible nonparticipants. A **higher** percentage of SNAP participants reported consuming noncarbonated sweetened drinks than income-eligible nonparticipants.



This chapter examines the food consumption patterns of SNAP participants and nonparticipants by estimating the following:

- ▶ **Proportion of individuals consuming foods from supermarket aisle food groups and subgroups on a given day.** The percentages reported for the supermarket aisle food groups reflect the proportion of individuals who consumed one or more foods from a given food group, in any amount, on the day covered in the dietary recall.
- ▶ **Consumption of specific supermarket aisle food subgroups.** The percentages reported for supermarket aisle food subgroups reflect the proportion of individuals who consumed one or more foods in a given food subgroup, among those consuming any food from a given food group, on the day covered in the dietary recall. This approach allowed the study team to compare food choices of SNAP participants and nonparticipants while controlling for overall levels of consumption at the food group level.
- ▶ **Average amounts of food consumed from supermarket aisle food groups and subgroups on a given day.** The amounts reported reflect the average amounts consumed among those consuming any food from a given food group or subgroup, on the day covered in the dietary recall. Average amounts are reported in Food Patterns units of cup or ounce equivalents and/or in grams, depending on which unit is appropriate for the food group.

The food groups and subgroups used in the analysis are defined using the “supermarket aisle” approach (Cole & Fox, 2008a). This approach categorizes foods into 1 of 10 food groups and then into subgroups. For example, whole milk, 2 percent milk, cheese, and yogurt are subgroups in the milk and milk products group. Table 4.1 presents the complete list of food groups and subgroups used for the supermarket aisle approach. All the supermarket aisle food groups and subgroups reflect foods consumed as *discrete* items. This means combination items—such as sandwiches, Mexican entrees, green salads, and soups—reported in the dietary recall as individual components are counted as one item (e.g., a sandwich reported as a beef patty, cheese, and a roll is counted as one item and included in the “cheeseburger/hamburger” subgroup).

Table 4.1. Supermarket Aisle Food Groups and Subgroups Used to Classify Types of Foods Consumed

Food Group	Subgroups		
Grains	■ Bread ■ Rolls ■ English muffins ■ Bagels ■ Biscuits, scones, croissants ■ Muffins	■ Cornbread ■ Corn tortillas ■ Flour tortillas ■ Taco shells ■ Crackers ■ Breakfast/granola bars	■ Pancakes, waffles, French toast ■ Cold cereal ■ Hot cereal ■ Rice ■ Pasta
Vegetables	■ Raw lettuce/greens ■ Raw carrots ■ Raw tomatoes ■ Raw cabbage/coleslaw ■ Other raw ■ Salad (w/ greens) ■ Cooked green beans ■ Cooked corn	■ Cooked peas ■ Cooked carrots ■ Cooked broccoli ■ Cooked tomatoes ■ Cooked mixed ■ Cooked starchy ■ Other cooked deep yellow ■ Other cooked dark green	■ Other cooked ■ Other fried ■ Cooked potatoes, not fried ■ Cooked potatoes, fried ■ Vegetable juice
Fruit and 100 percent fruit juice	■ Fresh orange ■ Fresh other citrus ■ Fresh apple ■ Fresh banana ■ Fresh melon ■ Fresh watermelon ■ Fresh grapes	■ Fresh peach/nectarine ■ Fresh pear ■ Fresh berries ■ Other fresh fruit ■ Avocado/Guacamole ■ Lemon/lime—any form ■ Canned/frozen peaches	■ Applesauce, canned/frozen apples ■ Canned/frozen pineapple ■ Other canned/frozen ■ Noncitrus juice ■ Citrus juice ■ Dried fruit
Milk and milk products	■ Unflavored whole milk ■ Unflavored 2 percent milk ■ Unflavored 1 percent milk ■ Unflavored skim milk ■ Unflavored milk—percent fat NFS	■ Flavored whole milk ■ Flavored 2 percent milk ■ Flavored 1 percent milk ■ Flavored skim milk ■ Flavored milk—percent fat NFS	■ Dry or evaporated milk ■ Yogurt ■ Cheese
Meat and meat alternatives	■ Beef ■ Ground beef ■ Pork ■ Ham ■ Lamb and misc. meats ■ Chicken ■ Organ meats ■ Turkey	■ Cold cuts ■ Fish ■ Shellfish ■ Bacon/sausage ■ Eggs ■ Beans ■ Baked/refried beans ■ Soy products	■ Protein/meal enhancement ■ Nuts ■ Peanut/almond butter ■ Seeds
Mixed dishes	■ Tomato sauce and meat (no pasta) ■ Chili con carne ■ Meat mixtures with red meat ■ Meat mixtures with chicken/turkey ■ Meat mixtures with fish ■ Hamburgers/Cheeseburgers	■ Hot dogs ■ Luncheon meat sandwich ■ Beef/pork/ham sandwich ■ Chicken/turkey sandwich ■ Cheese (no meat) sandwich ■ Fish sandwich ■ Peanut butter sandwich ■ Breakfast sandwich ■ Mexican entrees	■ Pizza (no meat) ■ Pizza with meat ■ Macaroni and cheese ■ Pasta dishes ■ Rice dishes ■ Other grain mixtures ■ Soups/Stews ■ Vegetable mixtures ■ Entrée salads
Other beverages ^a	■ Coffee ■ Tea ■ Beer ■ Wine ■ Liquor	■ Energy drinks ■ Water (plain) ■ Regular soda ■ Sugar-free soda ■ Plant-based beverages	■ Noncarbonated sweetened drinks ■ Noncarbonated low-calorie/sugar-free drinks

Food Group	Subgroups		
Sweets and desserts	- Sugar and sugar substitutes - Syrups/Sweet toppings - Jelly - Gelatin dessert	- Ice cream - Pudding - Flavored ice - Sweet rolls - Cake/Cupcakes	- Cookies - Pie/Cobblers - Pastries - Doughnuts - Candy
Salty snacks	- Corn-based salty snacks - Pretzels/Party mix	- Popcorn - Potato chips	
Added fats and oils	- Butter - Margarine - Other added oils	- Salad dressing - Mayonnaise - Gravy	- Cream cheese - Cream/Sour cream

Note: "Other raw" and "Other cooked" vegetables include all vegetables not categorized separately.

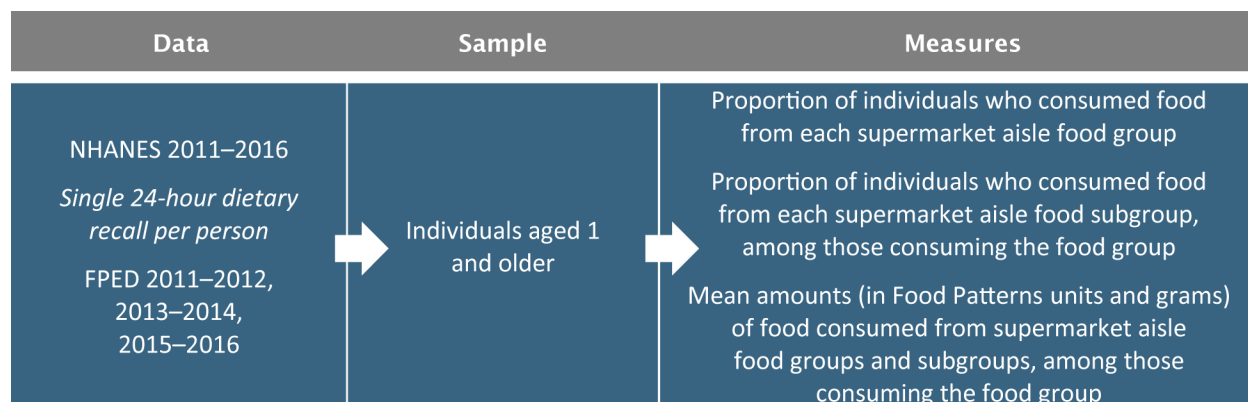
NFS = not further specified

^a "Other beverages" food group excludes milk and 100 percent fruit juice but includes water.

This chapter discusses only statistically significant and reliable differences between SNAP participants and nonparticipants.²² Appendix D includes results for every food group and subgroup defined in the supermarket aisle approach.

Table 4.2 provides a synopsis of the data sources, sample, and measures examined in this chapter. Findings in this chapter are used to compare reported intakes between SNAP participants and nonparticipants; these findings should not be construed as representing total intakes of FPED food groups or compared with recommendations for these food groups. Importantly, these analyses are based on 1 day of dietary recall data (specifically, the day 1 dietary recall). These findings represent intakes on a given day and should not be interpreted as usual intakes of food groups or subgroups.

Table 4.2. Data, Sample, and Measures Used to Assess Food Consumption Patterns

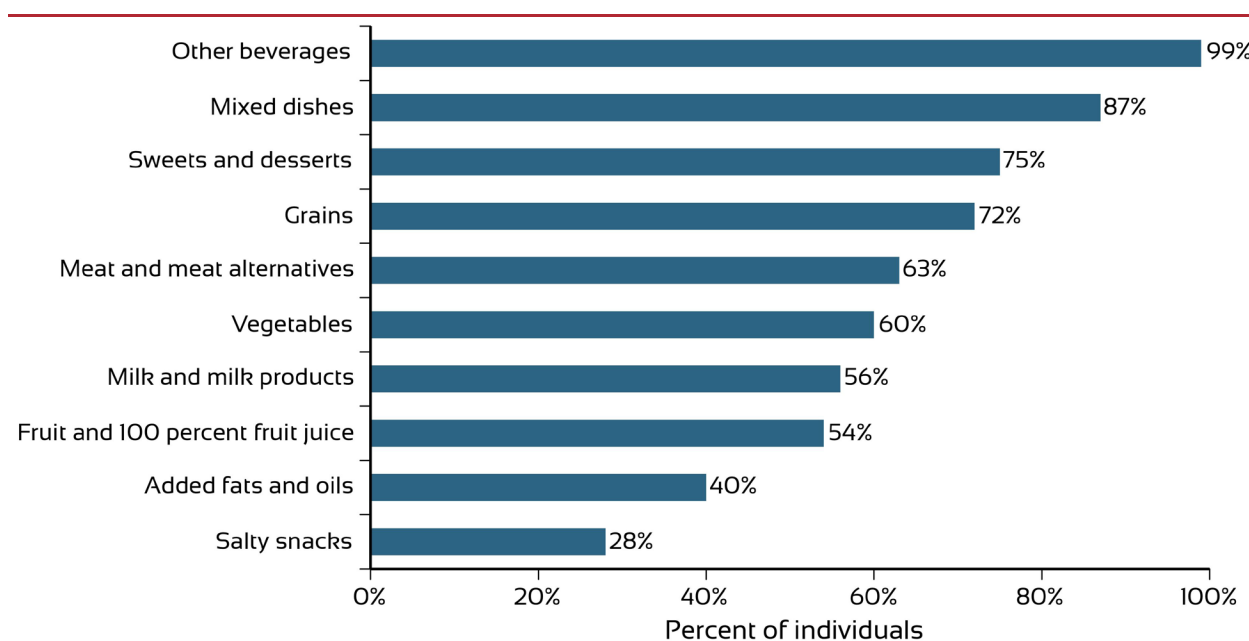


FPED = Food Patterns Equivalents Database; NHANES = National Health and Nutrition Examination Survey

²² In some cases, between-group differences may be statistically significant even when one point estimate is unreliable. This report does not discuss results determined to be unreliable or comparisons for which either estimate in the comparison was determined to be unreliable.

Overall, most individuals (75 percent or more) consumed discrete food items from the other beverages, mixed dishes, and sweets and desserts supermarket aisle food groups on the day covered in the dietary recall (see figure 4.1). Percentages of individuals consuming each food group were generally similar for SNAP participants and income-eligible nonparticipants, but a lower percentage of SNAP participants consumed fruit and 100 percent fruit juice. A lower percentage of SNAP participants than higher income nonparticipants consumed discrete items from all food groups, except salty snacks and meat and meat alternatives, for which consumption was similar (see table 4.3). Sections A through J discuss consumption patterns for each supermarket aisle food group separately.

Figure 4.1. Percentage of Individuals Aged 1 and Older Consuming Any Discrete Food Items From 10 Supermarket Aisle Food Groups on a Given Day



Note: The “Other beverages” food group excludes milk and 100 percent fruit juice but includes water. Estimates reflect foods consumed as discrete items. Combination items, like sandwiches, reported in the dietary recall as individual components were counted as one food choice. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population.

Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls. Sample includes NHANES respondents 1 year old and older with complete day 1 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

Table 4.3. Percentage of Individuals Aged 1 and Older Consuming Any Discrete Food Items From 10 Supermarket Aisle Food Groups on a Given Day by Program Participation

Food Group	All Individuals	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
Grains	72.1	67.6	70.6	73.8 ***
Vegetables	59.8	55.1	56.1	61.6 ***
Fruit and 100 percent fruit juice	54.2	45.6	52.4 ***	57.1 ***
Milk and milk products	55.5	53.3	52.3	56.6 **
Meat and meat alternatives	62.7	61.5	60.0	63.2
Mixed dishes	86.9	84.3	85.4	87.9 ***
Other beverages ^a	99.2	98.6	99.0	99.4 ***
Sweets and desserts	74.5	71.6	72.1	75.9 ***
Salty snacks	27.9	26.5	25.0	28.7
Added fats and oils	40.4	34.9	35.7	43.2 ***

Note: “All individuals” includes respondents with missing SNAP participation or income. Estimates are based on a day 1 dietary recall per person. Food choices reflect individual foods consumed except when foods were reported to be eaten in “combination” (i.e., mixed dishes category). In these cases, the foods reported in combination were counted as one food choice. Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$, ** $p < .01$, or *** $p < .001$. Differences were tested using two-sample t-tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits.

^a The “Other beverages” food group excludes milk and 100 percent fruit juice but includes water.

Sources: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls; Food Patterns Equivalents Database 2011–2012, 2013–2014, and 2015–2016. Sample includes NHANES respondents 1 year old and older with complete day 1 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

A. Consumption of Grains as Discrete Food Items

This section discusses significant findings related to the percentages of individuals consuming grains as a discrete food item, the consumption of specific grain items, and the average amounts of grains consumed on a given day.

1. Percentage of Individuals

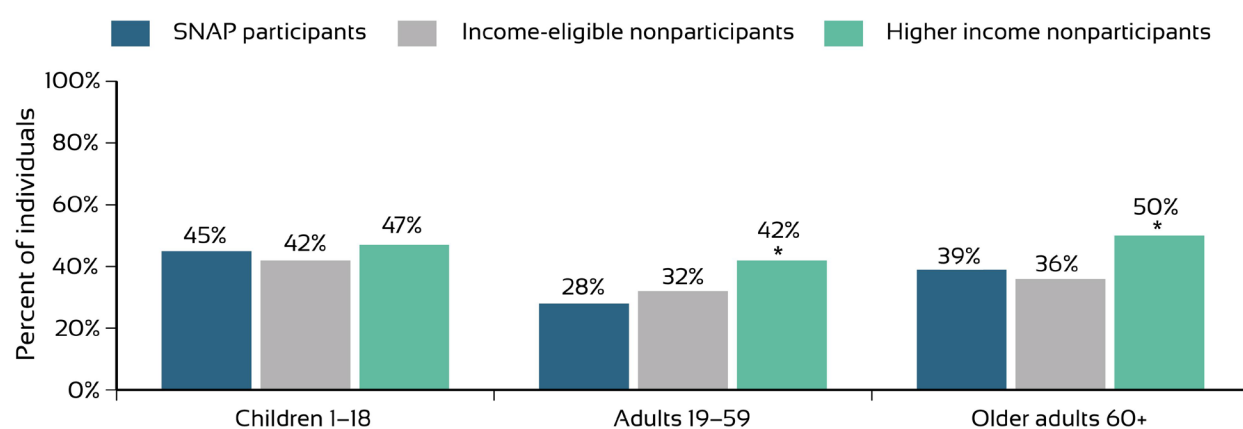
Almost three-quarters of individuals (72 percent) consumed a discrete grain or grain-based item on the day covered in the dietary recall (see figure 4.1). This category excludes grains and grain-based foods included in mixed dishes like sandwiches. A lower percentage of SNAP participants reported consuming discrete items in the grains food group compared with higher income nonparticipants (see table 4.3). Among individuals who consumed at least one discrete grain item, refined grain consumption was reported by 81 percent of individuals, and whole grain consumption was reported by almost half (42 percent) of individuals (see appendix table D.1). Overall, a lower percentage of SNAP participants consumed whole grains than higher income nonparticipants (34 versus 45 percent), and a higher percentage consumed refined grains (85 versus 79 percent).

More than three-quarters (78 percent) of children consumed a discrete grain item, and a lower percentage of children participating in SNAP consumed a discrete grain item compared with higher income nonparticipant children on a given day (see appendix table D.1). Among children consuming at

least one discrete grain item, most (80 percent) consumed a refined grain, and almost half (45 percent; see figure 4.2) consumed a whole grain. There were no differences in consumption of whole grains and refined grains by children’s participant group.

Among adults, 67 percent consumed a discrete grain item; most of these adults (81 percent) consumed a refined grain, and more than one-third (38 percent) consumed a whole grain on a given day (see appendix table D.1). A lower percentage of adults participating in SNAP consumed a discrete grain item than either nonparticipant group. Among older adults, most (81 percent) consumed a discrete grain item; among these individuals, most (79 percent) consumed a refined grain and 48 percent consumed a whole grain (see figure 4.2). There were no differences in overall grain consumption among older adults by participant group. A higher percentage of both adults and older adults participating in SNAP consumed a refined grain, and a lower percentage consumed a whole grain compared with higher income nonparticipants of the same age groups.

Figure 4.2. Percentage of Individuals Aged 1 and Older Consuming Whole Grains Among Those Consuming Any Discrete Grains on a Given Day by Age and Program Participation



Note: Grains are classified as whole grains if at least 50 percent of the total grains are whole grain. The Food Patterns Equivalents Database (FPED) data sources listed in the table were used to classify grains. Estimates are based on a day 1 dietary recall per person. Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$. Differences were tested using two-sample t -tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits.

Sources: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls; FPED 2011–2012, 2013–2014, and 2015–2016. Sample includes NHANES respondents 1 year old and older with complete day 1 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

2. Consumption of Specific Grain Items

Among all individuals eating at least one discrete grain item, cold cereal was the most commonly consumed item on a given day (33 percent of individuals; see table 4.4), and bread was the second most commonly consumed item (29 percent of individuals). Among children, cold cereal was the most commonly consumed item (46 percent), followed by bread and crackers (22 percent each). Bread and cold cereal were the most commonly consumed items by adults and older adults.

Table 4.4. Top Five Most Commonly Consumed Discrete Grains Among Individuals Aged 1 and Older With Any Grain Consumption on a Given Day by Age and Program Participation

Discrete Grain	All Individuals	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
All Individuals				
Cold cereal	32.9	33.4	30.4	32.5
Bread	29.3	29.7	30.5	29.4
Crackers	19.5	16.5	17.5	21.1 ***
Rice	14.9	18.3	16.4	13.6 **
Breakfast/granola bar	9.9	4.9	6.0	12.3 ***
Children 1–18 Years Old				
Cold cereal	46.3	51.5	50.5	43.0 ***
Crackers	22.2	18.1	17.8	25.9 ***
Bread	21.7	17.9	23.6 *	22.7 **
Pancakes, waffles, French toast	15.8	12.6	15.1	17.8 **
Rice	12.2	13.0	11.6	11.7
Adults 19–59 Years Old				
Bread	29.0	30.5	30.6	28.5
Cold cereal	27.1	27.9	23.0 *	27.6
Crackers	17.4	15.3	15.4	18.8 *
Rice	17.1	19.6	19.3	15.7
Breakfast/granola bar	11.3	4.9	7.4	14.0 ***
Older Adults Aged 60 and Older				
Bread	40.3	42.7	39.3	41.0
Cold cereal	32.7	26.6	26.5	33.7 *
Crackers	22.4	18.4	23.5	21.6
Hot cereal	13.8	15.3	16.5	13.1
Rice	11.8	21.1	14.1 *	9.9 ***

Note: “All individuals” includes respondents with missing SNAP participation or income. Estimates are based on a day 1 dietary recall per person. Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$, ** $p < .01$, or *** $p < .001$. Differences were tested using two-sample t -tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits.

Sources: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls; Food Patterns Equivalents Database 2011–2012, 2013–2014, and 2015–2016. Sample includes NHANES respondents 1 year old and older with complete day 1 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

3. Average Amounts

Among individuals who consumed a discrete grain item on the day covered in the dietary recall, the average consumption was 3.0 ounces (see appendix table D.3). Individuals consumed 1.6 ounces of whole grains and 2.8 ounces of refined grains. Relative to income-eligible nonparticipants, SNAP participants consumed fewer total ounces of discrete grain items on average (3.0 versus 3.2 ounces). SNAP participants also consumed fewer ounces of whole grains than higher income nonparticipants on average (1.4 versus 1.6 ounces).

Children who reported eating grain items consumed 2.6 ounces of grains on the day covered in the dietary recall (see appendix table D.3). Children participating in SNAP consumed smaller quantities of whole grains (1.1 versus 1.2 ounces) than higher income nonparticipants on average. Adults who reported eating grain items consumed an average of 3.2 ounces of grains per day. Adults participating in SNAP consumed larger quantities of total discrete grain items (3.5 versus 3.0 ounces) and refined grains (3.3 versus 2.9 ounces) than higher income nonparticipants on a given day. Older adults who reported eating grain items consumed an average of 2.9 ounces of grains on a given day. Older adult SNAP participants reported consuming larger quantities of refined grains than higher income nonparticipants (2.9 versus 2.5 ounces).

B. Consumption of Vegetables as Discrete Food Items

This section discusses significant findings related to the percentage of individuals consuming vegetables as a discrete food item, the consumption of specific vegetable items, and the average amounts of vegetables consumed on a given day.

1. Percentage of Individuals

Sixty percent of individuals consumed a discrete vegetable on the day covered in the dietary recall (see figure 4.1). This included raw vegetables; cooked vegetables except for potatoes (hereafter referred to as cooked vegetables); and cooked potatoes reported as discrete food items. Compared with higher income nonparticipants, a lower percentage of SNAP participants consumed a discrete vegetable (55 versus 62 percent; see table 4.3). Overall, 58 percent of individuals consumed cooked vegetables, 46 percent consumed cooked potatoes, and 34 percent consumed raw vegetables (see appendix table D.1). A similar percentage of SNAP participants consumed cooked vegetables, and a higher percentage consumed cooked potatoes compared with higher income nonparticipants. A lower percentage of SNAP participants than either nonparticipant group consumed raw vegetables.

More than half of children (55 percent) consumed a discrete vegetable, and there were no differences in the percentage of children consuming vegetables by participant group on a given day (see appendix table D.1). Fifty-nine percent of all children consumed cooked vegetables, 49 percent consumed cooked potatoes, and 27 percent consumed raw vegetables.

Sixty percent of adults consumed a discrete vegetable on the day covered in the dietary recall (see appendix table D.1). A lower percentage of adults participating in SNAP reported consuming a discrete vegetable than higher income nonparticipants (54 versus 62 percent). Fifty-eight percent of adults consumed cooked vegetables, about half (47 percent) consumed cooked potatoes, and one-third (33 percent) consumed raw vegetables. A similar percentage of adult SNAP participants consumed cooked vegetables, and a higher percentage consumed cooked potatoes compared with higher income nonparticipants. A lower percentage of adult SNAP participants than either nonparticipant group consumed raw vegetables.

More than two-thirds (66 percent) of older adults consumed a discrete vegetable on the day covered in the dietary recall (see appendix table D.1). A lower percentage of older adults participating in SNAP reported consuming vegetables overall compared with higher income nonparticipants (61 versus 69 percent). More than half of older adults (57 percent) consumed cooked vegetables, 40 percent consumed cooked potatoes, and 43 percent consumed raw vegetables. There were no differences by participant group in the percentage of older adults consuming these vegetable subgroups.

2. Consumption of Specific Vegetables

Among individuals eating at least one discrete vegetable, fried potatoes were the most commonly consumed vegetable on a given day (28 percent of individuals; see table 4.5). Fried potatoes were the most commonly consumed vegetable for all age groups except for older adults, who most frequently reported consuming salad with greens. Cooked tomatoes were also among the top five most commonly consumed vegetables for all age groups.

Table 4.5. Top Five Most Commonly Consumed Discrete Vegetables Among Individuals Aged 1 and Older With Any Vegetable Consumption on a Given Day by Age and Program Participation

Discrete Vegetable	All Individuals	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
All Individuals				
Cooked potatoes, fried	27.8	29.5	30.0	26.8
Cooked tomatoes	23.4	23.6	25.7	22.8
Salads (w/ greens)	20.4	15.6	18.6	21.6 ***
Cooked potatoes, not fried	19.8	22.6	20.4	19.1 *
Other cooked	10.1	7.7	7.8	11.3 **
Children 1–18 Years Old				
Cooked potatoes, fried	33.2	37.7	34.7	31.1 **
Cooked tomatoes	27.4	27.9	29.9	26.9
Cooked potatoes, not fried	16.7	17.8	18.4	15.8
Salads (w/ greens)	12.6	10.7	11.9	13.6
Cooked corn	10.1	10.6	10.7	10.0
Adults 19–59 Years Old				
Cooked potatoes, fried	29.0	30.8	30.0	28.1
Cooked tomatoes	24.7	24.9	25.7	24.1
Salads (w/ greens)	21.5	14.8	22.0 **	22.5 ***
Cooked potatoes, not fried	19.6	23.2	19.7	18.9
Other cooked	11.2	7.3	8.5	12.8 ***
Older Adults Aged 60 and Older				
Salads (w/ greens)	27.3	24.5	16.9	29.1
Cooked potatoes, not fried	24.4	26.8	25.4	24.0
Cooked potatoes, fried	17.5	14.7	23.8 *	17.5
Cooked tomatoes	14.5	13.9	20.1	13.6
Other cooked	13.9	14.1	11.8	14.3

Note: “Other cooked vegetables” includes all vegetables not categorized separately. “All individuals” includes respondents with missing SNAP participation or income. Estimates are based on a day 1 dietary recall per person. Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$, ** $p < .01$, or *** $p < .001$. Differences were tested using two-sample t-tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits.

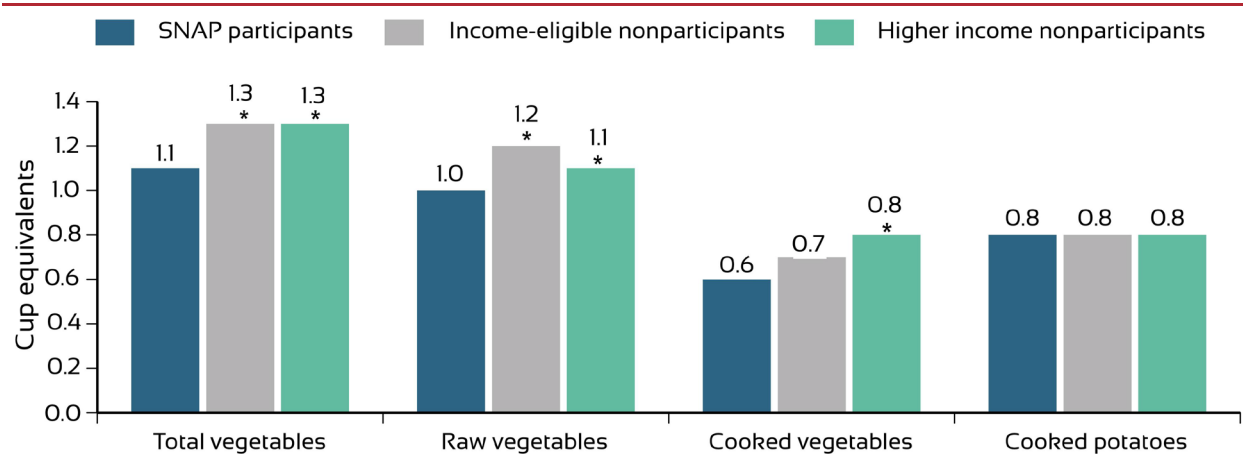
Sources: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls; Food Patterns Equivalents Database 2011–2012, 2013–2014, and 2015–2016. Sample includes NHANES respondents 1 year old and older with complete day 1 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

3. Average Amounts

Among individuals who consumed a discrete vegetable on the day covered in the dietary recall, average reported consumption was 1.3 cup equivalents (see appendix table D.3). Overall, SNAP participants reported consuming smaller quantities of discrete vegetables than both income-eligible nonparticipants and higher income nonparticipants on average (1.1 versus 1.3 and 1.3 cup equivalents, respectively; see figure 4.3). There were no differences in the average consumption of cooked potatoes across the participant groups.

Among children, average vegetable consumption was 0.8 cup equivalents, and the average quantity consumed was similar across participant groups on a given day (see appendix table D.3). Adults consumed an average of 1.4 cup equivalents of vegetables. Adults participating in SNAP reported consuming smaller quantities of vegetables than either group of nonparticipants on average. Among older adults, average vegetable consumption was 1.5 cup equivalents. There were no differences in the average total vegetable consumption among older adults by participant group.

Figure 4.3. Average Amounts of Discrete Vegetables Consumed Among Individuals Aged 1 and Older With Any Vegetable Consumption on a Given Day by Program Participation



Note: The cooked vegetables subcategory excludes potatoes. The cooked potatoes category includes fried potatoes. Estimates are based on a day 1 dietary recall per person. Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$. Differences were tested using two-sample t -tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits.

Sources: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls; Food Patterns Equivalents Database 2011–2012, 2013–2014, and 2015–2016. Sample includes NHANES respondents 1 year old and older with complete day 1 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

C. Consumption of Fruit and 100 Percent Fruit Juice as Discrete Food Items

This section discusses significant findings related to the percentages of individuals consuming fruit and 100 percent fruit juice (hereafter referred to as fruit juice) as discrete food items, the consumption of specific fruit and fruit juice items, and the average amounts of fruit and fruit juice consumed on a given day.

1. Percentage of Individuals

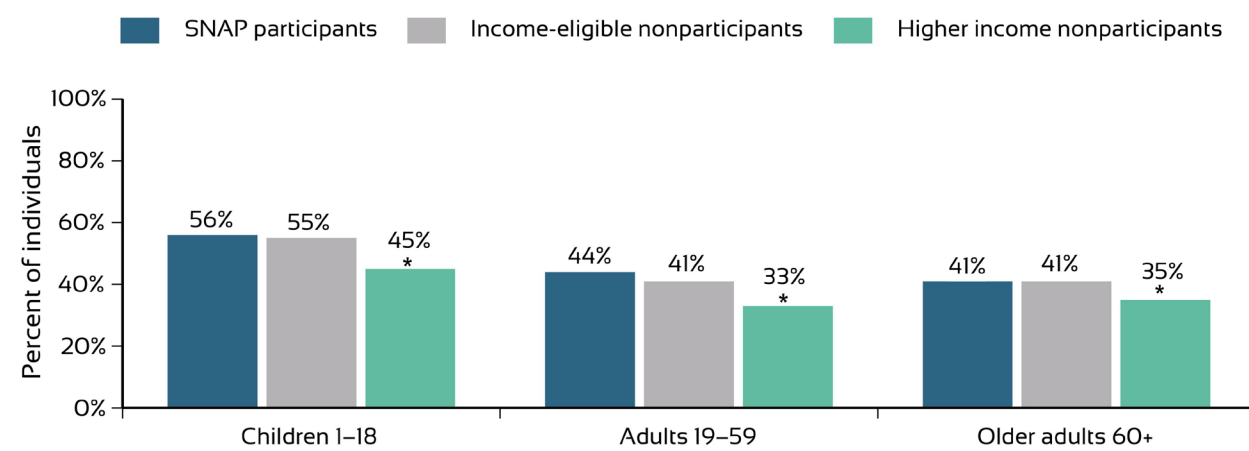
More than half (54 percent) of individuals consumed a discrete fruit or fruit juice on the day covered in the dietary recall (see figure 4.1). Among these individuals, most (82 percent) consumed whole fruit, and more than one-third (39 percent) consumed fruit juice (see appendix table D.1). Compared with either group of nonparticipants, a lower percentage of SNAP participants reported consuming fruit and fruit juice overall (see table 4.3). Specifically, a lower percentage of SNAP participants consumed whole fruit than either nonparticipant group, and a higher percentage consumed fruit juice than higher income nonparticipants.

Almost two-thirds (64 percent) of children consumed a discrete fruit or fruit juice on a given day (see appendix table D.1). Most of these children (80 percent) consumed whole fruit, and half (49 percent) consumed fruit juice. A lower percentage of children participating in SNAP consumed fruit and fruit juice overall and whole fruit specifically compared with higher income nonparticipants. A higher percentage of children participating in SNAP consumed fruit juice than higher income nonparticipants (see figure 4.4).

About half (47 percent) of adults consumed a discrete fruit or fruit juice on the day covered in the dietary recall (see appendix table D.1). Most of these adults consumed whole fruit (81 percent), and more than one-third (36 percent) consumed fruit juice. A lower percentage of adults participating in SNAP than either nonparticipant group consumed fruit and fruit juice overall and whole fruit specifically. A higher percentage of adult SNAP participants specifically consumed fruit juice than higher income nonparticipants (see figure 4.4).

Fewer than two-thirds (62 percent) of older adults reported consuming a discrete fruit or fruit juice on a given day (see appendix table D.1). Among these older adults, 87 percent consumed whole fruit, and 36 percent consumed fruit juice. The percentage of older adults consuming fruit and fruit juice was similar across participant groups. Patterns of consumption for this age group were like those for other age groups, however. A lower percentage of older SNAP participants consumed whole fruit and a higher percentage consumed fruit compared with higher income nonparticipants (see appendix table D.1).

Figure 4.4. Percentage of Individuals Aged 1 and Older Consuming 100 Percent Fruit Juice Among Those Consuming Any Fruit or 100 Percent Fruit Juice on a Given Day by Age and Program Participation



Note: Estimates are based on a day 1 dietary recall per person. Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$. Differences were tested using two-sample t-tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits. Sources: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls; Food Patterns Equivalents Database 2011–2012, 2013–2014, and 2015–2016. Sample includes NHANES respondents 1 year old and older with complete day 1 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

2. Consumption of Specific Fruit and 100 Percent Fruit Juices

Among individuals consuming at least one discrete fruit or fruit juice on a given day, citrus juice and fresh banana were the most commonly consumed items overall (25 percent for both; see table 4.6). A higher percentage of SNAP participants consumed citrus juice, and a lower percentage consumed fresh banana than higher income nonparticipants. Consumption of fresh berries varied considerably by participant group; near double the percentage of higher income nonparticipants consumed fresh berries than SNAP participants and income-eligible nonparticipants.

Among children, noncitrus juice and fresh apples were the most commonly consumed items (see table 4.6). Fresh bananas and citrus juice were the most commonly consumed items by both adults and older adults. A lower percentage of fresh fruit in general was consumed by children and adults participating in SNAP compared with higher income nonparticipants.

Table 4.6. Top Five Most Commonly Consumed Discrete Fruits and 100 Percent Fruit Juices Among Individuals Aged 1 and Older With Any Fruit or Fruit Juice Consumption on a Given Day by Age and Program Participation

Discrete Fruit and 100 Percent Fruit Juice	All Individuals	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
All Individuals				
Fresh banana	24.6	21.3	23.6	25.3 **
Citrus juice	24.5	28.1	26.7	22.8 **
Fresh apple	20.5	19.4	20.8	20.6
Noncitrus juice	16.7	21.1	20.1	15.0 ***
Fresh berries	12.7	6.2	10.7 **	14.8 ***
Children 1–18 Years Old				
Noncitrus juice	31.0	34.1	34.4	28.9 *
Fresh apple	24.3	23.9	26.1	23.9
Citrus juice	21.3	26.0	24.5	19.0 **
Fresh banana	17.9	15.7	19.8	18.2
Canned or frozen fruit, no syrup	13.9	12.5	11.4	15.9
Adults 19–59 Years Old				
Fresh banana	26.1	21.3	23.6	27.5 **
Citrus juice	25.2	29.2	27.4	23.2 *
Fresh apple	20.0	18.0	20.3	20.4
Noncitrus juice	12.4	17.5	15.6	10.7 ***
Fresh berries	11.5	5.8	11.4 **	12.8 ***
Older Adults Aged 60 and Older				
Fresh banana	28.9	28.6	28.6	28.0
Citrus juice	26.5	27.4	27.3	26.5
Fresh apple	16.9	18.0	15.4	17.0
Fresh berries	15.0	6.5 ^u	10.4	17.1 ***
Fresh orange	11.4	15.4	13.4	10.8

Note: “Canned or frozen fruit, no syrup” includes canned/frozen peaches, pineapple, and other fruit. “All individuals” includes respondents with missing SNAP participation or income. Estimates are based on a day 1 dietary recall per person. Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$, ** $p < .01$, or *** $p < .001$. Differences were tested using two-sample t -tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits.

^u Indicates individual estimates did not meet the standards of reliability or precision because of large coefficient of variation

Sources: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls; Food Patterns Equivalents Database 2011–2012, 2013–2014, and 2015–2016. Sample includes NHANES respondents 1 year old and older with complete day 1 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

3. Average Amounts

Among individuals who consumed a discrete fruit or fruit juice on the day covered in the dietary recall, the average consumption was 1.6 cup equivalents (see appendix table D.3). Average consumption of whole fruit was 1.3 cups, and average consumption of fruit juice was 1.1 cups. Quantities of fruit and fruit juice consumed were similar across participant groups, but SNAP participants consumed more fruit juice than higher income nonparticipants on average (1.2 versus 1.0 cup equivalents).

Children consumed an average of 1.5 cup equivalents of fruit or fruit juice on a given day (see appendix table D.3). Among those consuming any fruit or fruit juice, average consumption was 1.2 cups of whole fruit and 1.1 cups of fruit juice. Children participating in SNAP consumed less fruit or fruit juice overall than income-eligible nonparticipants on average (1.5 versus 1.6 cup equivalents).

Adults consumed an average of 1.6 cup equivalents of fruit and fruit juice on a given day (see appendix table D.3). Among those consuming any fruit or fruit juice, adults participating in SNAP consumed larger quantities of fruit and fruit juice than higher income nonparticipants on average (1.8 versus 1.6 cup equivalents). Older adults participating in SNAP consumed an average of 1.5 cup equivalents of fruit and fruit juice. Consumption was similar across participant groups.

D. Consumption of Milk and Milk Products as Discrete Food Items

This section discusses significant findings related to the percentages of individuals consuming milk and milk products (e.g., yogurt, cheese) as discrete food items; the consumption of specific milk and milk product items; and the average amounts of milk and milk products consumed on a given day. Plant-based beverages are categorized in the “other beverages” food group.

1. Percentage of Individuals

More than half (56 percent) of individuals reported consuming a discrete milk or milk product on the day covered in the dietary recall (see figure 4.1). Among those consuming any milk or milk products, 74 percent consumed cow’s milk. Compared with higher income nonparticipants, a lower percentage of SNAP participants consumed milk or milk products overall (53 versus 57 percent; see table 4.3).

Three-quarters (73 percent) of children consumed discrete milk or milk products on the day covered in the dietary recall (see appendix table D.1). Among children consuming any milk or milk products on a given day, most (89 percent) consumed cow’s milk. There were no differences among children by participant group in overall milk or milk product consumption. Compared with higher income nonparticipants, a higher percentage of children participating in SNAP consumed cow’s milk (87 versus 93 percent).

Fewer than half (47 percent) of adults reported consuming discrete milk or milk products on a given day (see appendix table D.1). Among those adults consuming any milk or milk products, fewer than three-quarters (68 percent) consumed cow’s milk. Compared with higher income nonparticipants, a lower percentage of adults participating in SNAP consumed milk or milk products overall (43 versus 48 percent). A higher percentage of adult SNAP participants than higher nonparticipants consumed cow’s milk (73 versus 66 percent).

Fifty-nine percent of older adults consumed discrete milk or milk products on the day covered in the dietary recall (see appendix table D.1). Among those consuming any milk or milk products, about three-quarters (73 percent) consumed cow's milk. There were no differences among older adults by participant group in overall milk or milk product consumption. Compared with higher income nonparticipants, a higher percentage of older adults participating in SNAP consumed cow's milk (71 versus 81 percent).

2. Consumption of Specific Milk and Milk Products

Among individuals consuming at least one discrete milk or milk product on the day covered in the dietary recall, cheese and 2 percent unflavored milk were the most commonly consumed items (33 and 30 percent, respectively; see table 4.7). Overall, unflavored 2 percent milk was the most commonly consumed type of milk for all participant groups; figure 4.5 shows the consumption of whole, 2 percent, 1 percent, and skim unflavored milk by participant group.

Among children, 2 percent unflavored milk was the most commonly consumed item (39 percent) on a given day, followed by cheese (26 percent) and unflavored whole milk (22 percent; see table 4.7). A lower percentage of children participating in SNAP consumed cheese compared with higher income nonparticipant children (24 versus 30 percent). A higher percentage of children participating in SNAP consumed unflavored whole milk than either group of nonparticipant children (see figure 4.5). Among adults and older adults, cheese and 2 percent unflavored milk were the most commonly consumed items. A lower percentage of adults and older adults participating in SNAP consumed cheese than higher income nonparticipants.

Table 4.7. Top Five Most Commonly Consumed Discrete Milk and Milk Products Among Individuals Aged 1 and Older With Any Milk and Milk Product Consumption on a Given Day by Age and Program Participation

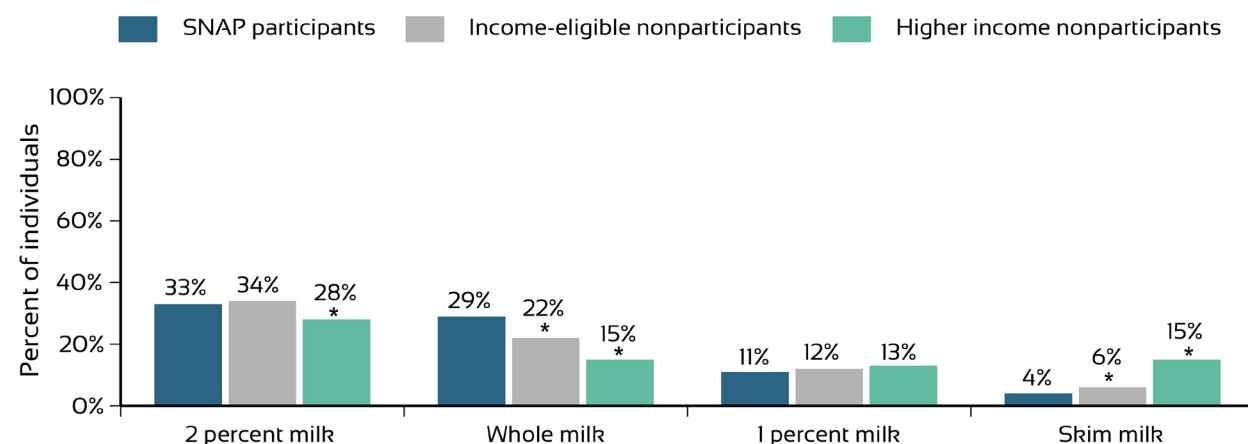
Discrete Milk and Milk Product	All Individuals	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
All Individuals				
Cheese	33.1	27.3	30.9	35.4 ***
2 percent milk, unflavored	30.3	32.6	34.2	28.4 *
Unflavored whole milk	18.6	29.4	22.2 **	15.2 ***
Yogurt	15.2	8.3	11.7 **	17.8 ***
1 percent milk, unflavored	12.4	11.1	11.7	12.7
Children 1–18 Years Old				
2 percent milk, unflavored	38.8	38.4	40.8	38.4
Cheese	26.1	21.4	22.8	29.5 ***
Unflavored whole milk	22.2	31.3	23.5 **	17.9 ***
1 percent milk, unflavored	16.5	15.6	17.7	16.7
Flavored milk, fat not specified	12.8	14.4	13.2	12.0
Adults 19–59 Years Old				
Cheese	35.9	31.1	33.5	37.9 *
2 percent milk, unflavored	27.3	30.9	32.9	24.8 *
Unflavored whole milk	17.8	28.6	19.8 **	14.6 ***
Yogurt	15.9	7.8	12.1 *	18.7 ***
Skim milk, unflavored	11.6	2.5	7.0 **	14.9 ***

Discrete Milk and Milk Product	All Individuals	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
Older Adults Aged 60 and Older				
Cheese	33.5	23.3	33.4 *	35.3 ***
2 percent milk, unflavored	28.0	30.3	29.6	26.4
Yogurt	16.7	10.2	12.6	18.5 **
Unflavored whole milk	16.3	29.0	27.5	13.6 ***
Skim milk, unflavored	16.0	6.9	6.0	19.0 ***

Note: "All individuals" includes respondents with missing SNAP participation or income. Estimates are based on a day 1 dietary recall per person. Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$, ** $p < .01$, or *** $p < .001$. Differences were tested using two-sample t-tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits.

Sources: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls; Food Patterns Equivalents Database 2011–2012, 2013–2014, and 2015–2016. Sample includes NHANES respondents 1 year old and older with complete day 1 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

Figure 4.5. Percentage of Individuals Aged 1 and Older Consuming Each Type of Unflavored Milk Among Those Consuming Milk and Milk Products on a Given Day by Program Participation



Note: Estimates are based on a day 1 dietary recall per person. Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$. Differences were tested using two-sample t-tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits.

Sources: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls; Food Patterns Equivalents Database 2011–2012, 2013–2014, and 2015–2016. Sample includes NHANES respondents 1 year old and older with complete day 1 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

3. Average Amounts

Among individuals who consumed a discrete milk or milk product on the day covered in the dietary recall, average consumption was 1.4 cup equivalents (see appendix table D.3). Average consumption was 1.4 cup equivalents of cow's milk, 0.8 cup equivalents of cheese, and 0.6 cup equivalents of yogurt. Average consumption of cow's milk was higher among SNAP participants than either group of

nonparticipants. There were no differences in average quantities of cheese or yogurt consumed by participant group.

Among children who consumed a discrete milk or milk product on the day covered in the dietary recall, average consumption was 1.7 cup equivalents (see appendix table D.3). Average consumption was 1.6 cup equivalents of cow's milk, 0.8 cup equivalents of cheese, and 0.5 cup equivalents of yogurt. Total consumption of cow's milk was lower among children participating in SNAP than higher income nonparticipants on average (1.5 versus 1.6 cup equivalents).

Among adults who consumed a discrete milk or milk product, average consumption was 1.3 cup equivalents (see appendix table D.3). Consumption was 1.3 cup equivalents of cow's milk, 0.9 cup equivalents of cheese, and 0.7 cup equivalents of yogurt on a given day. Consumption of milk and milk products overall was higher among adults participating in SNAP than income-eligible nonparticipants on average (1.5 versus 1.3 cup equivalents). Average consumption of cow's milk specifically was higher among adults participating in SNAP than either group of nonparticipants. Among older adults who consumed a discrete milk or milk product, average consumption was 1.2 cup equivalents. Average consumption was 1.2 cup equivalents of cow's milk, 0.7 cup equivalents of cheese, and 0.7 cup equivalents of yogurt; consumption was similar among older adults across participant groups.

E. Consumption of Meat and Meat Alternatives as Discrete Food Items

This section discusses significant findings related to the percentages of individuals consuming meat and meat alternatives as discrete food items, the consumption of specific meat and meat alternative items, and the average amounts of meat and meat alternatives consumed on a given day.

1. Percentage of Individuals

About two-thirds (63 percent) of individuals reported consuming a discrete meat or meat alternative on the day covered in the dietary recall (see figure 4.1). Fifty-seven percent of children, 63 percent of adults, and 69 percent of older adults consumed a discrete meat or meat alternative. There were no differences in meat consumption by participant group among any of the age groups (see appendix table D.1).

2. Consumption of Specific Meat and Meat Alternatives

Among individuals consuming at least one discrete meat or meat alternative, chicken and eggs were the most commonly reported items on a given day (30 and 26 percent of individuals, respectively; see table 4.8). A higher percentage of SNAP participants consumed chicken than either nonparticipant group. Nuts were the third most commonly consumed meat and meat alternative overall (15 percent), but consumption varied considerably by participant group. Nuts were consumed more often by higher income nonparticipants (18 percent) and income-eligible nonparticipants (12 percent) than SNAP participants (7 percent).

Among children, chicken was the most commonly consumed item (38 percent; see table 4.8). Chicken was also the most commonly consumed item by adults (30 percent). By contrast, eggs were the most commonly consumed meat and meat alternative among older adults (29 percent).

Table 4.8. Top Five Most Commonly Consumed Discrete Meat and Meat Alternatives Among Individuals Aged 1 and Older With Any Meat and Meat Alternate Consumption on a Given Day by Age and Program Participation

Discrete Meat and Meat Alternative	All Individuals	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
All Individuals				
Chicken	30.0	35.4	30.6 *	28.1 ***
Eggs	26.3	27.0	27.8	26.3
Nuts	15.5	7.3	11.6 ***	18.2 ***
Bacon/sausage	15.2	15.8	14.9	15.1
Beef	13.0	12.5	13.2	13.0
Children 1–18 Years Old				
Chicken	37.5	42.7	36.9 *	35.2 **
Eggs	24.0	22.7	28.8 *	23.0
Bacon/sausage	15.7	15.1	16.1	15.3
Beef	11.2	11.4	11.3	11.3
Beans	8.9	10.6	11.6	7.0 *
Adults 19–59 Years Old				
Chicken	29.8	33.6	31.1	28.0 *
Eggs	26.6	27.3	25.2	27.2
Nuts	16.7	6.7	13.3 ***	19.8 ***
Bacon/sausage	14.5	15.4	13.5	14.4
Beef	14.1	14.0	15.1	14.1
Older Adults Aged 60 and Older				
Eggs	28.6	32.1	34.5	27.7
Nuts	23.6	12.8	14.9	26.2 ***
Chicken	20.8	31.4	20.9 **	19.2 ***
Bacon/sausage	16.8	17.9	17.7	17.0
Fish	11.9	9.4	9.3	12.8

Note: “All individuals” includes respondents with missing SNAP participation or income. Estimates are based on a day 1 dietary recall per person. Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$, ** $p < .01$, or *** $p < .001$. Differences were tested using two-sample t -tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits.

Sources: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls; Food Patterns Equivalents Database 2011–2012, 2013–2014, and 2015–2016. Sample includes NHANES respondents 1 year old and older with complete day 1 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

3. Average Amounts

Among individuals who consumed a discrete meat or meal alternative on the day covered in the dietary recall, average consumption was 5.0 ounces (see appendix table D.3). Consumption was similar across participant groups. On average, children consumed 3.4 ounces, adults consumed 5.7 ounces, and older adults consumed 4.6 ounces of meat and meat alternatives. There were no differences in consumption by participant group among any of the age groups.

F. Consumption of Mixed Dishes

This section discusses significant findings related to the percentages of individuals consuming mixed dishes, the consumption of specific mixed-dish items, and the average amounts of mixed dishes consumed on a given day.

1. Percentage of Individuals

Most individuals (87 percent) consumed a discrete mixed dish on the day covered in the dietary recall (see figure 4.1). A lower percentage of SNAP participants reported consuming a mixed dish than higher income nonparticipants (84 versus 88 percent; see table 4.3).

Most children (88 percent), adults (87 percent), and older adults (84 percent) consumed a discrete mixed dish (see appendix table D.1). A lower percentage of adults and older adults participating in SNAP reported consuming a mixed dish compared with higher income nonparticipants of the same age group.

2. Consumption of Specific Mixed Dishes

Among individuals consuming at least one discrete mixed dish, Mexican entrees and soups/stews were the most commonly consumed items on the day covered in the dietary recall (see table 4.9). Both children and adults reported consuming Mexican entrees most commonly, and there were no differences in consumption of Mexican entrees by participant group for either age group. Older adults most commonly reported consuming soups/stews and sandwiches with luncheon meat. A higher percentage of older adults participating in SNAP consumed soups/stews than either group of nonparticipants.

Table 4.9. Top Five Most Commonly Consumed Discrete Mixed Dishes Among Individuals Aged 1 and Older With Any Mixed Dish Consumption on a Given Day by Age and Program Participation

Discrete Mixed Dish	All Individuals	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
All Individuals				
Mexican entrees	18.0	17.4	21.1	17.4
Soups/stews	13.7	14.4	15.0	12.9
Luncheon meat sandwich	13.4	13.8	13.2	13.4
Cheese sandwich (no meat)	12.8	12.0	13.1	13.1
Pasta dishes	11.6	10.5	11.2	11.8
Children 1–18 Years Old				
Mexican entrees	19.1	19.6	22.3	18.1
Pizza w/meat	14.2	17.0	16.7	12.2 **
Cheese sandwich (no meat)	13.1	11.6	11.5	14.1 *
Luncheon meat sandwich	12.8	14.2	12.2	12.8
Pasta dishes	12.5	14.0	11.5	11.9

Discrete Mixed Dish	All Individuals	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
Adults 19–59 Years Old				
Mexican entrees	20.0	18.4	23.0	19.6
Soups/stews	13.3	12.1	14.9	12.9
Luncheon meat sandwich	13.0	12.4	12.7	13.3
Cheese sandwich (no meat)	12.5	11.3	14.2	12.5
Rice dishes	11.4	10.6	11.7	11.4
Older Adults Aged 60 and Older				
Soups/stews	18.3	23.9	16.5 *	17.8 *
Luncheon meat sandwich	15.2	17.2	16.1	14.5
Cheese sandwich (no meat)	13.6	14.8	11.9	13.7
Vegetable mixtures	12.2	8.1	8.6	13.0 *
Pasta dishes	10.9	7.7	10.7	11.3 *

Note: “All individuals” includes respondents with missing SNAP participation or income. Estimates are based on a day 1 dietary recall per person. Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$, ** $p < .01$, or *** $p < .001$. Differences were tested using two-sample t -tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits.

Sources: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls; Food Patterns Equivalents Database 2011–2012, 2013–2014, and 2015–2016. Sample includes NHANES respondents 1 year old and older with complete day 1 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

3. Average Amounts

Among individuals who consumed a discrete mixed dish on the day covered in the dietary recall, average consumption was 435 grams (see appendix table D.5). SNAP participants consumed smaller quantities of mixed dishes than income-eligible nonparticipants on average (416 versus 466 grams).

Among children who consumed a discrete mixed dish, average consumption was 340 grams (see appendix table D.5). There were no differences in quantity of mixed dishes consumed by children’s participant group. Among adults who consumed a discrete mixed dish, average consumption was 490 grams. Adults participating in SNAP consumed smaller quantities of mixed dishes than income-eligible nonparticipants (470 versus 533 grams). Among older adults who consumed a discrete mixed dish, average consumption was 390 grams. Consumption was similar among older adults across participant groups.

G. Consumption of Beverages Other Than Milk and 100 Percent Fruit Juice

This section discusses significant findings related to the percentages of individuals consuming beverages other than milk and 100 percent fruit juice as a discrete food item (hereafter referred to as beverages), the consumption of specific beverages, and the average amounts of beverages consumed on a given day.

1. Percentage of Individuals

Almost all individuals (99 percent) consumed a discrete beverage on the day covered in the dietary recall (see figure 4.1). Most children (97 percent) consumed a discrete beverage (see appendix table D.1). More than 99 percent of adults and older adults reported consuming a discrete beverage.

2. Consumption of Specific Beverages Other Than Milk and 100 Percent Fruit Juice

Among individuals consuming at least one discrete beverage, water was the most commonly consumed beverage on a given day (83 percent of individuals; see table 4.10). Forty-one percent of individuals reported consuming coffee, and about one-third (31 percent) consumed regular soda. Overall, a lower percentage of SNAP participants reported consuming water than either nonparticipant group. A higher percentage of SNAP participants also consumed regular soda compared with higher income nonparticipants (40 versus 28 percent), and a higher percentage consumed noncarbonated sweetened drinks (e.g., juice drinks that were not 100 percent fruit juice) than either group of nonparticipants.

Among children, water and noncarbonated sweetened drinks were the most commonly consumed beverages (see table 4.10). About one-third of children (32 percent) reported consuming regular soda on the day covered in the dietary recall (see figure 4.6). A lower percentage of children participating in SNAP reported consuming water than either group of nonparticipants. Compared with higher income nonparticipants, a higher percentage of children participating in SNAP reported consuming noncarbonated sweetened drinks and regular soda (see table 4.10).

The most commonly consumed beverages for adults were water (83 percent), coffee (47 percent), and regular soda (35 percent; see table 4.10). Compared with either group of nonparticipants, a lower percentage of adults participating in SNAP consumed water or coffee and a higher percentage consumed regular soda on the day covered in the dietary recall (see figure 4.6).

For older adults, water (84 percent), coffee (68 percent), and tea (31 percent) were the most commonly consumed beverages. Compared with higher income nonparticipants, a lower percentage of older adults participating in SNAP consumed coffee, tea, or sugar-free soda and a higher percentage consumed regular soda (see table 4.10 and figure 4.6).

Table 4.10. Top Five Most Commonly Consumed Discrete Beverages Other Than Milk and 100 Percent Fruit Juice Among Individuals Aged 1 and Older With Any Beverage Consumption on a Given Day by Age and Program Participation

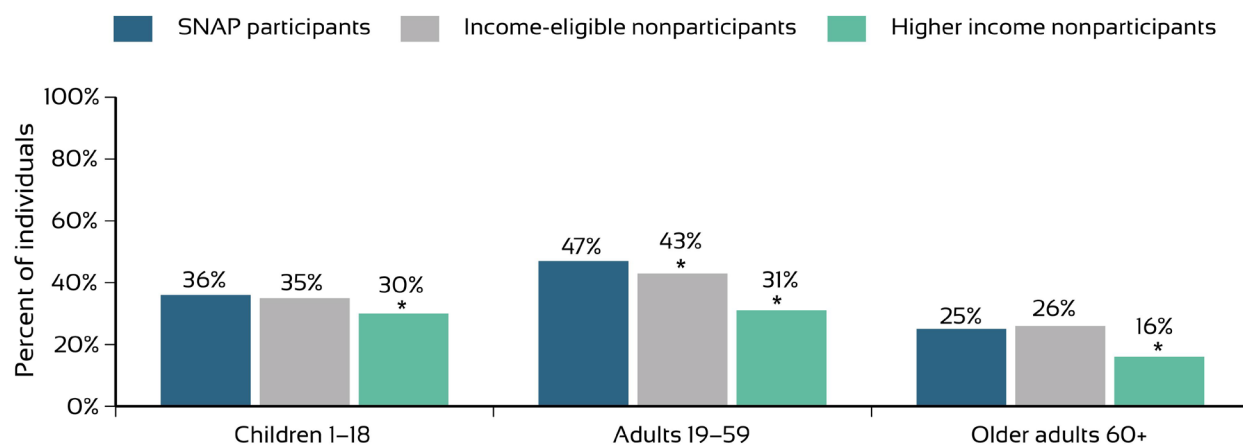
Discrete Beverage	All Individuals	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
All Individuals				
Water (plain)	83.3	75.4	82.9 ***	85.9 ***
Coffee	40.6	34.9	38.6	42.4 ***
Soda, regular	31.2	40.1	37.6	27.6 ***
Noncarbonated, sweetened drinks	25.0	28.1	24.6 *	23.7 ***
Tea	23.1	21.0	20.0	24.4 *

Discrete Beverage	All Individuals	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
Children 1–18 Years Old				
Water (plain)	82.8	75.3	82.1 ***	86.3 ***
Noncarbonated, sweetened drinks	35.8	40.3	36.4	33.5 **
Soda, regular	32.1	36.0	34.9	29.5 **
Tea	13.1	13.6	11.7	13.3
Noncarbonated, low-calorie/sugar-free drinks	10.5	9.7	9.4	11.1
Adults 19–59 Years Old				
Water (plain)	83.4	73.6	83.4 ***	86.1 ***
Coffee	47.1	39.1	44.7 *	49.8 ***
Soda, regular	35.0	46.7	42.5 *	30.5 ***
Tea	24.8	22.9	21.5	26.3 *
Noncarbonated, sweetened drinks	23.4	26.8	23.1	22.1 **
Older Adults Aged 60 and Older				
Water (plain)	83.8	81.2	82.4	84.5
Coffee	68.2	61.0	63.6	70.4 **
Tea	31.1	24.7	26.3	33.3 **
Soda, sugar-free	19.2	13.5	17.1	20.8 **
Soda, regular	18.5	25.4	26.3	16.1 ***

Note: “All individuals” includes respondents with missing SNAP participation or income. Estimates are based on a day 1 dietary recall per person. Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$, ** $p < .01$, or *** $p < .001$. Differences were tested using two-sample *t*-tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits.

Sources: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls; Food Patterns Equivalents Database 2011–2012, 2013–2014, and 2015–2016. Sample includes NHANES respondents 1 year old and older with complete day 1 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

Figure 4.6. Percentage of Individuals Aged 1 and Older Consuming Regular Soda Among Those Consuming Beverages Other Than Milk and 100 Percent Fruit Juice on a Given Day by Age and Program Participation



Note: Estimates are based on a day 1 dietary recall per person. Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$. Differences were tested using two-sample t -tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits. Sources: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls; Food Patterns Equivalents Database 2011–2012, 2013–2014, and 2015–2016. Sample includes NHANES respondents 1 year old and older with complete day 1 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

3. Average Amounts

Among individuals who consumed a discrete beverage on the day covered in the dietary recall, average consumption was 2,161 grams (see appendix table D.5). SNAP participants consumed smaller quantities of beverages than income-eligible and higher income nonparticipants on average. Specifically, SNAP participants consumed smaller quantities of plain water than either group of nonparticipants and larger quantities of regular soda than higher income nonparticipants on average (see appendix table D.5). By age group, children consumed 1,059 grams, adults consumed 2,648 grams, and older adults consumed 2,027 grams of discrete beverages on average.

H. Consumption of Sweets and Desserts

This section discusses significant findings related to the percentages of individuals consuming sweets and desserts as a discrete food item, the consumption of specific sweets and desserts, and the average amounts of sweets and desserts consumed on a given day. Sugar-sweetened beverages are not included in the sweets and desserts but rather in the beverages other than milk and 100 percent fruit juice category, discussed in section G of this chapter.

1. Percentage of Individuals

Three-quarters of individuals (75 percent) consumed a discrete sweet or dessert on the day covered in the dietary recall (see figure 4.1). Overall, a lower percentage of SNAP participants reported consuming sweets and desserts than higher income nonparticipants (72 versus 76 percent; see table 4.3).

Most children (76 percent) consumed a sweet or dessert on the day covered in the dietary recall (see appendix table D.1). A lower percentage of children participating in SNAP consumed a sweet or dessert than higher income nonparticipants (74 versus 78 percent). About three-quarters of adults (72 percent) consumed a sweet or dessert; consistent with the pattern observed for children, a lower percentage of adults participating in SNAP consumed a sweet or dessert than higher income nonparticipants (69 versus 73 percent). Compared with children and adults, a higher percentage of older adults reported consuming a sweet or dessert (81 percent), but consumption was similar for older adults across participant groups.

2. Consumption of Specific Sweets and Desserts

Among individuals eating at least one discrete sweet or dessert, candy was the most commonly consumed item overall (33 percent of individuals; see table 4.11). Among children, candy was the most commonly consumed item, followed by cookies. Sugar and sugar substitutes (e.g., brown sugar, liquid stevia) were the most commonly consumed items by adults and older adults (39 and 42 percent, respectively). For older adults, a higher percentage of SNAP participants consumed sugar and sugar substitutes than higher income nonparticipants.

Table 4.11. Top Five Most Commonly Consumed Discrete Sweets and Desserts Among Individuals Aged 1 and Older With Any Sweet or Dessert Consumption on a Given Day by Age and Program Participation

Discrete Sweet and Dessert	All Individuals	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
All Individuals				
Candy	32.7	30.6	30.4	33.5 *
Sugar and sugar substitutes	32.3	36.5	34.1	30.8 **
Cookies	31.1	29.2	31.4	31.5
Ice cream	21.5	19.3	18.3	22.9 *
Syrups/sweet toppings	13.2	11.8	11.3	14.3 **
Children 1–18 Years Old				
Candy	38.8	39.7	36.5	39.2
Cookies	38.7	37.3	36.2	40.3
Ice cream	25.4	21.9	23.7	27.8 **
Syrups/sweet toppings	17.5	14.8	13.8	19.9 **
Cake/cupcakes	9.5	9.1	8.8	9.9

Discrete Sweet and Dessert	All Individuals	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
Adults 19–59 Years Old				
Sugar and sugar substitutes	39.0	42.0	41.2	37.5
Candy	31.5	30.2	28.4	32.4
Cookies	27.4	25.3	29.6 *	27.1
Ice cream	19.3	17.8	14.1	20.7
Syrups/sweet toppings	11.5	11.1	9.9	12.0
Older Adults Aged 60 and Older				
Sugar and sugar substitutes	43.8	53.2	45.3	41.7 ***
Cookies	32.7	30.2	30.6	33.5
Candy	28.1	19.9	28.3 **	29.7 ***
Ice cream	23.2	20.6	24.0	23.4
Syrups/sweet toppings	13.0	9.9	12.4	13.8 *

Note: “All individuals” includes respondents with missing SNAP participation or income. Estimates are based on a day 1 dietary recall per person. Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$, ** $p < .01$, or *** $p < .001$. Differences were tested using two-sample *t*-tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits.

Sources: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls; Food Patterns Equivalents Database 2011–2012, 2013–2014, and 2015–2016. Sample includes NHANES respondents 1 year old and older with complete day 1 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

3. Average Amounts

Among individuals who consumed a discrete sweet or dessert on the day covered in the dietary recall, average consumption was 113 grams (see appendix table D.5). Comparable quantities were consumed across participant groups. Children consumed an average of 116 grams of sweets and desserts. Children participating in SNAP consumed smaller quantities of sweets and desserts than higher income nonparticipants on average (101 versus 126 grams). Adults consumed an average of 109 grams, and older adults consumed an average of 117 grams.

I. Consumption of Salty Snacks

This section discusses significant findings related to the percentages of individuals consuming salty snacks as a discrete food item, the average amounts of salty snacks consumed, and the consumption of specific salty snack items on a given day. Salty snacks were divided into four categories: corn-based salty snacks, pretzels/party mix, popcorn, and potato chips.

1. Percentage of Individuals

Fewer than one-third (28 percent) of individuals consumed a discrete salty snack on the day covered in the dietary recall (see figure 4.1). Overall, there were no differences in salty snack consumption by participant group (see table 4.3).

One-third (34 percent) of children consumed a discrete salty snack (see appendix table D.1). There were no differences in the percentage of children consuming salty snacks by participant group. Twenty-seven percent of adults reported consuming a discrete salty snack, and there were no differences by participant group. Twenty-two percent of older adults consumed a discrete salty snack. A lower percentage of older adults participating in SNAP consumed salty snacks than higher income nonparticipants (15 versus 23 percent).

2. Consumption of Specific Salty Snack Items

Among individuals eating at least one discrete salty snack, corn-based salty snacks and potato chips were the most commonly reported items overall (38 and 36 percent of individuals, respectively; see appendix table D.1). Overall, a higher percentage of SNAP participants consumed potato chips compared with higher income nonparticipants, and a lower percentage consumed pretzels/party mix. Corn-based salty snacks were the most commonly consumed discrete salty snack among both children and adults. Among older adults, however, potato chips were the most commonly reported salty snack (39 percent).

3. Average Amounts

Among individuals who consumed a discrete salty snack on the day covered in the dietary recall, the average consumption was 41 grams (see appendix table D.5). Children consumed an average of 38 grams of salty snacks. Adults and older adults consumed an average of 44 grams and 34 grams, respectively. There were no differences in average quantity of salty snacks consumed by participant group among all individuals or by age group.

J. Consumption of Added Fats and Oils

This section discusses significant findings related to the percentages of individuals consuming added fats and oils as a discrete food item, the consumption of specific added fats and oils, and the average amounts of added fats and oils consumed on a given day.

1. Percentage of Individuals

Forty percent of individuals consumed a discrete added fat or oil on the day covered in the dietary recall (see figure 4.1). A lower percentage of SNAP participants consumed an added fat or oil than higher income nonparticipants (35 versus 43 percent; see table 4.3). Approximately one-quarter (23 percent) of children consumed a discrete added fat or oil (see appendix table D.1). Fewer than half (43 percent) of adults consumed a discrete added fat or oil. More than half (55 percent) of older adults consumed a discrete added fat or oil.

2. Consumption of Specific Added Fats and Oils

Among individuals consuming at least one discrete added fat or oil, cream/sour cream was the most commonly reported item on a given day (47 percent of individuals; see table 4.12). Margarine and butter were also commonly consumed (24 and 17 percent of individuals, respectively). A lower percentage of SNAP participants consumed butter than higher income nonparticipants (20 versus 25 percent). Among children, butter was the most commonly reported added fat (32 percent). Cream/sour cream, butter, and margarine were the most commonly consumed added fats by adults and older adults.

Table 4.12. Top Five Most Commonly Consumed Added Fats and Oils Among Individuals Aged 1 and Older With Any Fat or Oil Consumption on a Given Day by Age and Program Participation

Discrete Fat or Oil	All Individuals	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
All Individuals				
Cream/sour cream	47.1	47.1	46.8	47.6
Butter	24.0	19.7	20.7	25.4 ***
Margarine	16.8	16.0	17.2	17.3
Salad dressing	8.8	9.3	9.3	8.4
Gravy	7.8	10.1	7.8	7.1 *
Children 1–18 Years Old				
Butter	31.9	23.6	25.4	35.9 ***
Cream/sour cream	20.1	22.4	21.1	19.8
Margarine	17.0	10.7	16.9 *	18.7 **
Salad dressing	15.1	19.6	18.7	13.1 *
Gravy	10.5	16.6	8.2 *	8.8 **
Adults 19–59 Years Old				
Cream/sour cream	56.6	57.2	56.0	57.2
Butter	19.3	16.6	17.0	19.8
Margarine	13.8	14.9	14.1	14.0
Salad dressing	7.8	6.7	7.5	8.0
Other added fats	7.2	6.7	6.0	7.4
Older Adults Aged 60 and Older				
Cream/sour cream	53.8	48.9	52.6	55.1
Butter	27.6	24.2	26.0	28.4
Margarine	25.8	26.6	27.0	25.7
Gravy	6.6	8.1	8.9 u	6.5
Other added fats	4.7	5.1 u	1.9 u	4.9

Note: “All individuals” includes respondents with missing SNAP participation or income. Estimates are based on a day 1 dietary recall per person. Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$, ** $p < .01$, or *** $p < .001$. Differences were tested using two-sample t-tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits.

u Indicates individual estimates did not meet the standards of reliability or precision because of large coefficient of variation
Sources: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls; Food Patterns Equivalents Database 2011–2012, 2013–2014, and 2015–2016. Sample includes NHANES respondents 1 year old and older with complete day 1 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

3. Average Amounts

Among individuals who consumed a discrete added fat or oil on the day covered in the dietary recall, the average consumption was 36 grams (see appendix table D.5). Children consumed an average of 28 grams of discrete added fats and oils. Adults and older adults consumed 40 and 33 grams on average, respectively.

Chapter 5. Usual Energy and Macronutrient Intakes

Key Takeaways

Usual intakes of macronutrients and fiber were compared to the acceptable macronutrient distribution ranges (AMDR) and adequate intake level (AI), respectively. Percentages of calories consumed from saturated fats, added sugars, and alcohol on a given day were compared to 2015–2020 DGA recommendations. Generally, macronutrient intakes were within the AMDRs, but percentages of calories from saturated fats and added sugars exceeded 2015–2020 DGA recommendations. The study also found—

- A **higher** percentage of **SNAP participants** had usual intakes of fat and carbohydrates within the AMDRs than higher income nonparticipants.
- **SNAP participants** consumed a **smaller** percentage of calories from saturated fats and a **higher** percentage of SNAP participants met the 2015–2020 DGA recommendations for saturated fat than higher income nonparticipants.
- **SNAP participants** consumed a **greater** percentage of calories from added sugars and lower fiber intakes than both nonparticipant groups. Adult women participating in SNAP had the **highest** added sugar consumption.



This chapter examines the adequacy of energy and nutrient intakes among SNAP participants and nonparticipants by estimating usual intakes of total calories and macronutrients. Macronutrients are dietary components that contribute to energy intake and include fat, protein, carbohydrates, and alcohol (HHS & USDA, 2015). The chapter also examines usual intakes of essential fatty acids and fiber, which are categorized as fats and carbohydrates, respectively. Essential fatty acids (i.e., linoleic and linolenic acid) are fats the body is unable to synthesize and, therefore, must be consumed in the diet to maintain health (NIH ODS, 2018). Fiber, a nondigestible carbohydrate found in plants, promotes satiety, regulates blood sugar, and supports cardiovascular and gastrointestinal health.

The study team compared the usual intakes of total fat, protein, carbohydrates, linolenic and linoleic fatty acids, and fiber with the DRIs established by NASEM's, formerly IOM,²³ Food and Nutrition Board. The DRIs provide guidelines on appropriate intake amounts for healthy individuals based on age, gender, and life stage (IOM, 1997; 1998; 2000; 2001; 2005; 2006; 2011; NASEM, 2019) and are the most up-to-date scientific standards for determining if dietary patterns are nutritionally adequate. The DRIs used in this report include acceptable macronutrient distribution range (AMDR), estimated average requirement (EAR), adequate intake level (AI), and chronic disease risk reduction level (CDRR). AMDR and AI are used to assess intakes in this chapter (see table 5.1); EAR, AI, and CDRR are used to assess micronutrient intakes in chapter 6.

²³ Now known as the Health and Medicine Division of the National Academies of Sciences, Engineering, and Medicine

Table 5.1. DRIs Used to Assess Macronutrient Intakes

Nutrient(s)	Standard	Description of Standard
Total fat, protein, and carbohydrate; linoleic and linolenic fatty acids	AMDR	Reflects a range of usual intakes that are associated with a reduced risk of chronic disease and that also provide adequate intakes of essential nutrients; defined as the percentage of total calorie intake from macronutrients and essential fatty acids (linoleic acid and linolenic acid)
Fiber	AI	Defined when insufficient data are available to establish an EAR; groups with mean usual intakes at or above AI levels are assumed to have nutrient adequacy, but no firm conclusions can be drawn when mean usual intakes fall below the AI

AI = adequate intake; AMDR = acceptable macronutrient distribution range; DRI = Dietary Reference Intake; EAR = estimated average requirement

The team also compared intakes of saturated fats, added sugars, and alcohol to the 2015–2020 DGA. The DGA provides evidence-based recommendations for food and beverage intakes and is published every 5 years. Although alcohol is considered a macronutrient because it provides calories, it is nonessential and provides limited nutrients. Added sugars and saturated fats are similar in that they contribute to total energy intake but provided limited nutrients. The 2015–2020 DGA describes calories from these sources, along with refined grains and any other excess calories, as “calories for other uses.” Because of challenges with estimating calories in excess of individuals’ energy requirements, this study did not examine “calories for other uses” as defined in the 2015–2020 DGA. Instead, the study team estimated the individual contribution of saturated fats, alcohol, and added sugars to total energy intake among SNAP participants and nonparticipants and compared these estimates with thresholds recommended in the 2015–2020 DGA (see table 5.2).²⁴

Table 5.2. 2015–2020 DGA Recommendations for the Consumption of Saturated Fats, Added Sugars, and Alcohol

DGA Recommendation	2015–2020 DGA
Saturated fats ^a	Consume less than 10 percent of calories per day from saturated fats
Added sugars ^b	Consume less than 10 percent of calories per day from added sugars
Alcohol ^c	If alcohol is consumed, it should be consumed in moderation—up to one drink per day for women and up to two drinks per day for men—and only by adults of legal drinking age

DGA = Dietary Guidelines for Americans

^a Fatty acids that have no double bonds; fats high in saturated fatty acids are usually solid at room temperature.

^b Added sugars are energy sweeteners added to foods during processing or preparation or consumed separately.

^c One drink is defined as 12 fluid ounces of regular beer (5 percent alcohol), 5 fluid ounces of wine (12 percent alcohol), or 1.5 fluid ounces of 80-proof distilled spirits (40 percent alcohol). One drink contains 0.6 fluid ounces of alcohol.

The study team used the method developed by NCI to estimate the usual intake distributions, the mean intakes, and the percentage of individuals in each group with usual intakes consistent with DRI standards. These estimates reflect nutrient intakes from foods and beverages. Estimates do not include nutrient contributions from dietary supplements. Detailed descriptions of the NCI method and DRI standards are provided in appendix A.

²⁴ With the exception of alcohol; the DGA does not express its recommendation for the consumption of alcohol as a percentage of total calories

Only statistically significant and reliable differences in intakes between SNAP participants and nonparticipants are discussed in this chapter.²⁵ Detailed results appear in appendix E. Table 5.3 provides a synopsis of the data sources, sample, and measures examined in this chapter.

Table 5.3. Data, Sample, and Measures Used to Assess Intakes of Macronutrients and Calories

Data	Sample	Measures
NHANES 2011–2016 Day 1 and day 2 dietary recalls	Individuals aged 1 and older	Mean usual intakes Distribution of usual intakes Percentages of individuals with usual intakes above, below, or within AMDRs
NHANES 2011–2016 Day 1 dietary recall	Individuals aged 2 and older	Percentage of AI Percentage of total calories from saturated fats, added sugars, and alcohol Percentages of individuals with saturated fat, added sugar, and alcohol intakes consistent with 2015–2020 DGA

AI = adequate intake; AMDR = acceptable macronutrient distribution range; DGA = Dietary Guidelines for Americans; NHANES = National Health and Nutrition Examination Survey

A. Usual Energy Intakes

This section discusses the significant findings on usual energy intakes (in calories) overall and for each age and gender group. The total number of calories an individual needs each day to maintain energy balance varies by age, gender, height, weight, and level of physical activity. Table 5.4 presents the estimated calories needed to maintain energy balance for individuals aged 2 and older at three levels of physical activity; the DGA does not estimate calorie needs for children younger than 2 years old.

Table 5.4. Estimated Daily Energy Needs by Age, Gender, and Physical Activity Level

Age and Gender Group ^a	Estimated Daily Energy Needs ^a		
	Sedentary ^b	Moderately Active ^c	Active ^d
Women and Girls			
2–3 years old	1,000	1,000–1,400	1,000–1,400
4–8 years old	1,200–1,400	1,400–1,600	1,400–1,800
9–13 years old	1,400–1,600	1,600–2,000	1,800–2,200
14–18 years old	1,800	2,000	2,400
19–30 years old	1,800–2,000	2,000–2,200	2,400
31–50 years old	1,800	2,000	2,200
51+ years old	1,600	1,800	2,000–2,200

²⁵ In some cases, between-group differences may be statistically significant even when one point estimate is unreliable. This report does not discuss results determined to be unreliable or comparisons for which either estimate in the comparison was determined to be unreliable.

Age and Gender Group ^e	Estimated Daily Energy Needs ^a		
	Sedentary ^b	Moderately Active ^c	Active ^d
Men and Boys			
2–3 years old	1,000	1,000–1,400	1,000–1,400
4–8 years old	1,200–1,400	1,400–1,600	1,600–2,000
9–13 years old	1,600–2,000	1,800–2,200	2,000–2,600
14–18 years old	2,000–2,400	2,400–2,800	2,800–3,200
19–30 years old	2,400–2,600	2,600–2,800	3,000
31–50 years old	2,200–2,400	2,400–2,600	2,800–3,000
51+ years old	2,000–2,200	2,200–2,400	2,400–2,800

Note: Energy is measured in units of kilocalories; however, for brevity throughout the report, the more common term—calories—is used.

^a Estimates are based on estimated energy requirement equations using reference heights (average) and reference weights (healthy) for each age/gender group. For children and adolescents, reference height and weight vary. For adults, the reference man is 5 feet 10 inches tall and weighs 154 pounds. The reference woman is 5 feet 4 inches tall and weighs 126 pounds. An individual's calorie needs may be more or less than these average estimates.

^b Sedentary means a lifestyle that includes only the physical activity of independent living.

^c Moderately active means a lifestyle that includes physical activity equivalent to walking about 1.5 to 3 miles per day at 3 to 4 miles per hour in addition to the activities of independent living.

^d Active means a lifestyle that includes physical activity equivalent to walking more than 3 miles per day at 3 to 4 miles per hour in addition to the activities of independent living.

^e The calorie ranges shown are to accommodate the needs of different ages within the group. For children and adolescents, more calories are needed at older ages. For adults, fewer calories are needed at older ages.

^f Estimates for women do not include women who are pregnant or breastfeeding.

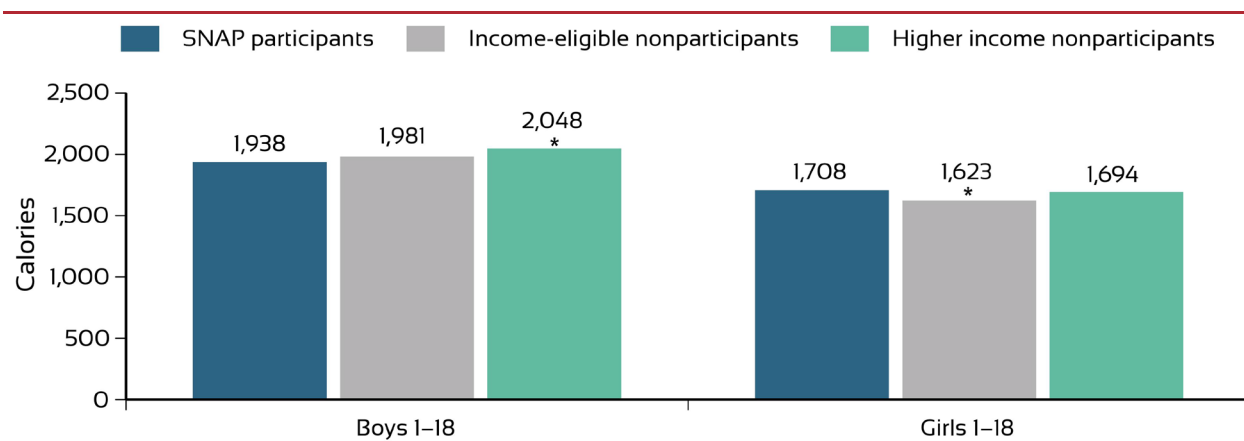
Source: IOM, 2005

It is difficult to use self-reported dietary intakes to assess whether intake is consistent with calorie needs because social desirability, among other factors, contributes to underreporting of intake (Tooze et al., 2004). Certain groups are more likely to underreport dietary intake, including women and individuals who are overweight or obese (Moshfegh et al., 2008; Tooze et al., 2004). Individuals with lower socioeconomic status, education, and literacy levels are also more likely to underreport dietary intake (Briefel et al., 1997). The findings on usual calorie intakes should, therefore, be interpreted with caution. Because long-term imbalances between calorie intake and expenditure result in weight change, BMI is recommended for assessing the appropriateness of usual calorie intakes (for children aged 2 and older; IOM, 2005). See chapter 3 for a discussion of BMI and other anthropometric measures.

1. Children

Children consumed an average of 1,851 calories per day (see appendix table E.17). Boys consumed more calories than girls on average, consistent with their greater calorie needs (see table 5.4). Average daily energy intake was 2,014 calories for boys and 1,681 calories for girls. Among boys, SNAP participants had lower average daily energy intakes than higher income nonparticipants (see figure 5.1). Among girls, SNAP participants had higher average daily energy intakes than income-eligible nonparticipants.

Figure 5.1. Mean Daily Energy Intakes Among Children Aged 1–18 by Gender and Program Participation



Note: Estimates are based on two dietary recalls per person. Usual intake was estimated using the National Cancer Institute method. Values are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$. Differences were tested using two-sample t -tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits. Standard errors were estimated using balanced repeated replication to account for complex survey design.

Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls. Sample includes NHANES respondents 1–18 years old with complete day 1 and day 2 dietary recall data.

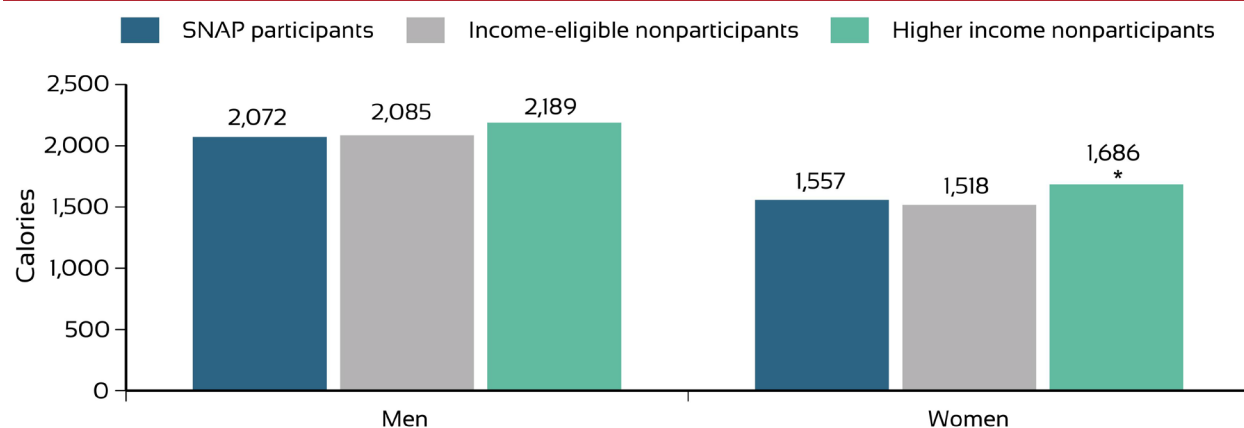
2. Adults

Among adults, the mean daily calorie intake was 2,251 calories (see appendix table E.17). Men consumed 2,624 calories per day, and women consumed 1,882 calories per day, on average. Calorie intakes were similar for men and women across participant groups.

3. Older Adults

Older adults consumed 1,873 calories per day on average (see appendix table E.17). The mean daily intakes were 2,156 calories for men and 1,646 calories for women. There were no differences in energy intake by participant group for older adult men. Among older adult women, SNAP participants had lower daily energy intakes than higher income nonparticipants on average (see figure 5.2).

Figure 5.2. Mean Daily Energy Intakes Among Older Adults Aged 60 and Older by Gender and Program Participation



Note: Estimates are based on two dietary recalls per person. Usual intake was estimated using the National Cancer Institute method. Values are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$. Differences were tested using two-sample t -tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits. Standard errors were estimated using balanced repeated replication to account for complex survey design.

Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls. Sample includes NHANES respondents aged 60 and older with complete day 1 and day 2 dietary recall data.

B. Usual Intakes of Macronutrients

AMDR

- AMDRs are defined for macronutrients and essential fatty acids. The AMDR is the intake range associated with reduced risk of chronic disease and provides adequate intakes of essential nutrients.
- This section discusses AMDRs for total fat, protein, carbohydrate, and linoleic and linolenic fatty acids. The mean usual percentage of calories from each macronutrient is compared with the AMDRs and discussed as falling above, within, or below these ranges.
- AMDR ranges are defined in appendix A.

AI

- The AI is used when insufficient evidence is available to establish an EAR. The AI is expected to fall above the unknown EAR value and meet or exceed the nutritional needs of almost all members of a healthy population
- This section discusses AI for fiber. Mean usual intake of fiber is expressed as a percentage of the AI.
- Unlike the EAR, the AI level cannot be used to calculate the prevalence of adequate nutrient intakes for a group.

This section discusses the significant findings overall and by age group for intakes of total fat, protein, carbohydrate, and essential fatty acids (i.e., linoleic and linolenic acid) relative to the AMDRs (see text box and appendix A). This section also discusses usual intakes of fiber. The study team assessed mean usual intakes of fiber as both a percentage of the AI and on a gram-per-calorie basis; the standard used to establish the AI for fiber was 14 grams per 1,000 calories (IOM, 2005).^{26, 27} The 2015 Dietary Guidelines Advisory Committee (DGAC) classified fiber as a nutrient of public

²⁶ Based on the median calorie intakes for each age and gender group as reported in the 1994–1996, 1998 Continuing Survey of Food Intakes by Individuals (USDA ARS, 2016).

²⁷ Estimated intakes of fiber include dietary fiber only, but AIs are established for total fiber; estimated intakes do not account for functional fiber (i.e., isolated fiber added to a food or supplement).

health concern; its underconsumption has been linked to adverse health outcomes in the scientific literature (DGAC, 2015). To increase intake of fiber, the DGA recommends making the nutritional shift to eating more vegetables, fruits, and whole grains. Nutrients of public health concern are further discussed in chapter 6.

1. All Individuals

A majority (59 percent) of all individuals had usual intakes of total fat consistent with the AMDR (see table 5.5). Usual intakes of linoleic and linolenic acid were within the AMDRs for 91 and 76 percent, respectively, of all individuals (see appendix tables E.13 and E.15). Virtually all individuals (99 percent) had usual intakes of protein consistent with the AMDR, and almost three-quarters (74 percent) had usual intakes of carbohydrate consistent with the AMDR.

Individuals with usual intakes of total fat inconsistent with the AMDR tended to have intakes above than below the recommended range; about one-third of all individuals exceeded the AMDR for total fat (see table 5.5). By contrast, individuals whose usual carbohydrate intakes did not fall within the AMDR range tended to have intakes below than above the recommended range. A higher percentage of SNAP participants than higher income nonparticipants had usual intakes of total fat and carbohydrate consistent with the AMDRs.

Table 5.5. Percentages of Individuals Aged 1 and Older With Macronutrient Intakes Below, Within, and Above the AMDR by Program Participation

Standard	All Individuals	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
Total Fat				
Below the AMDR	1.2	1.1	2.1 *	1.3
Within the AMDR	59.2	69.0	65.6	55.9 ***
Above the AMDR	39.6	29.9	32.4	42.8 ***
Protein				
Below the AMDR	1.0	1.4 u	1.8	0.6 u
Within the AMDR	98.9	98.6	98.1	99.2
Above the AMDR	0.1 u	0.0 u	0.1 *u	0.2 **
Carbohydrate				
Below the AMDR	25.7	16.0	18.6	29.0 ***
Within the AMDR	73.6	83.0	80.4	70.4 ***
Above the AMDR	0.7	1.0	1.0	0.5

Note: "All individuals" includes respondents with missing SNAP participation or income. Usual intake was estimated using the National Cancer Institute method. Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$, ** $p < .01$, or *** $p < .001$. Differences were tested using two-sample t-tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits. Standard errors were estimated using balanced repeated replication to account for complex survey design.

AMDR = acceptable macronutrient distribution range

u Indicates individual estimates did not meet the standards of reliability or precision because of large coefficient of variation

Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls. Sample includes NHANES respondents aged 1 and older with complete day 1 and day 2 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

Among all individuals, mean usual intakes of fiber were 60 percent of the AI (see appendix table E.8). SNAP participants had lower mean usual intakes of fiber than either income-eligible or higher income nonparticipants (53 versus 58 and 62 percent of AI, respectively). On a gram-per-1,000 calorie basis, the mean usual intakes of fiber for all individuals were about 8.3 grams—slightly more than half of the 14-gram standard used to set the AI (see appendix table E.9). Because these values were less than 100 percent of the AI, no conclusions could be drawn about adequate usual intakes of fiber or relative adequacy between groups.

2. Children

More than two-thirds (69 percent) of children had usual intakes of total fat consistent with the AMDR (see table 5.6). Most children (90 percent) had usual intakes of linoleic acid within the AMDR, and 62 percent of children had intakes of linolenic acid within the AMDR (see appendix tables E.13 and E.15). Almost all children had usual intakes of protein (99 percent) and carbohydrates (97 percent) consistent with the AMDRs.

The percentages of children with usual intakes of total fat and protein within the AMDRs were comparable for SNAP participants and both groups of nonparticipants (see table 5.6). A higher percentage of children participating in SNAP had carbohydrate intake within the AMDR than income-eligible nonparticipants. Children with total fat intakes outside the AMDR tended to exceed this range rather than fall below it.

Table 5.6. Percentages of Children Aged 1–18 With Macronutrient Intakes Below, Within, and Above the AMDR by Program Participation

Standard	All Children	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
Total Fat				
Below the AMDR	4.5	3.3	6.1	4.8
Within the AMDR	69.0	74.3	72.3	67.7
Above the AMDR	26.5	22.4 u	21.5	27.5
Protein				
Below the AMDR	0.7 u	0.8 u	0.6 u	0.7 u
Within the AMDR	99.0	99.2	98.9	98.7
Above the AMDR	0.3 u	0.1 u	0.5 *u	0.6 **

Standard	All Children	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
Carbohydrate				
Below the AMDR	3.0	1.1 u	5.0 *	2.9
Within the AMDR	96.5	98.7	93.3 **	96.6
Above the AMDR	0.5	0.2 u	1.7 **	0.6 u

Note: "All children" includes children with missing SNAP participation or income. Usual intake was estimated using the National Cancer Institute method. Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$, ** $p < .01$, or *** $p < .001$. Differences were tested using two-sample t -tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits. Standard errors were estimated using balanced repeated replication to account for complex survey design.

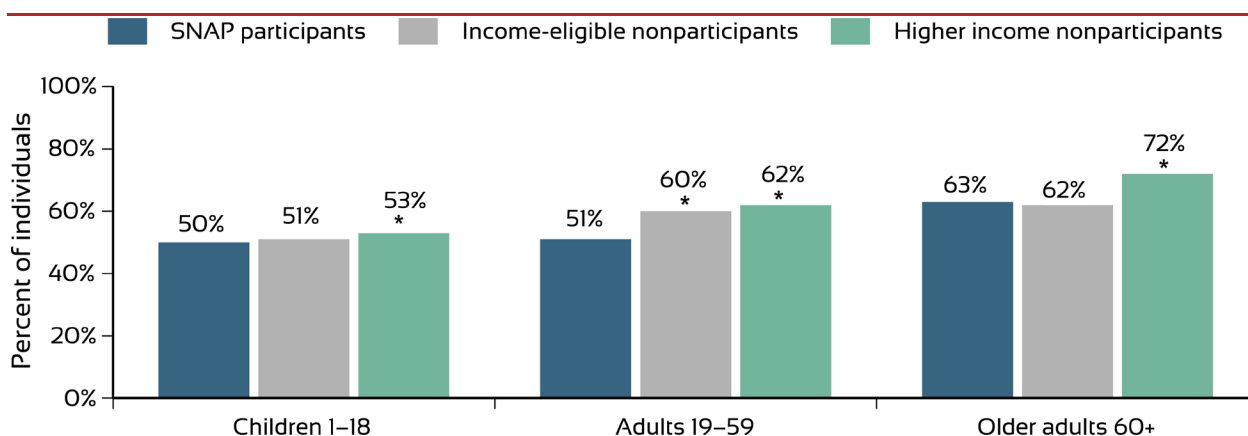
AMDR = acceptable macronutrient distribution range

u Indicates individual estimates did not meet the standards of reliability or precision because of large coefficient of variation

Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls. Sample includes NHANES respondents 1–18 years old with complete day 1 and day 2 dietary recall data.

The mean usual intakes of fiber for children were 52 percent of the AI (see appendix table E.8). Children participating in SNAP were slightly further from achieving the AI than higher income nonparticipants (see figure 5.3). On a gram-per-calorie basis, mean usual fiber intakes were 7.7 grams per 1,000 calories for children. SNAP participants had a lower gram-per-calorie fiber intake than either group of nonparticipants on average (7.4 versus 7.8 and 7.8 grams per 1,000 calories; see appendix table E.9).

Figure 5.3. Mean Usual Fiber Intakes as a Percentage of the Adequate Intake Among Individuals Aged 1 and Older by Age and Program Participation



Note: Estimates are based on two dietary recalls per person. Usual intake was estimated using the National Cancer Institute method. Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$. Differences were tested using two-sample t -tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits. Standard errors were estimated using balanced repeated replication to account for complex survey design.

Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls. Sample includes NHANES respondents aged 1 and older with complete day 1 and day 2 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

3. Adults

More than half of adults had fat intakes within the AMDR (58 percent; see table 5.7). Among adults, 92 and 81 percent had usual intakes of linoleic and linolenic acid within the AMDR, respectively (see appendix tables E.13 and E.15). Almost all adults (99 percent) had protein intakes within the AMDR, and about two-thirds of adults (65 percent) had carbohydrate intakes within the AMDR.

Among adults, a higher percentage of SNAP participants than higher income nonparticipants had usual intakes of total fat consistent with the AMDR (69 versus 54 percent; see table 5.7). A higher percentage of SNAP participants compared with higher income nonparticipants also had usual intakes of carbohydrate consistent with the AMDR (79 versus 61 percent).

Table 5.7. Percentages of Adults Aged 19–59 With Macronutrient Intakes Below, Within, and Above the AMDR by Program Participation

Standard	All Adults	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
Total Fat				
Below the AMDR	0.1 u	0.3 u	0.5 u	0.1 u
Within the AMDR	57.9	69.1	65.4	53.9 ***
Above the AMDR	42.0	30.6	34.1	46.0 ***
Protein				
Below the AMDR	1.5	2.1 u	2.6	0.7 u
Within the AMDR	98.5	97.9	97.4	99.3
Above the AMDR	0.0 u	0.0 u	0.0 u	0.0 u
Carbohydrate				
Below the AMDR	33.9	20.3	23.3	38.7 ***
Within the AMDR	65.4	78.5	75.9	60.9 ***
Above the AMDR	0.7	1.2 u	0.8 u	0.5

Note: “All adults” includes respondents with missing SNAP participation or income. Usual intake was estimated using the National Cancer Institute method. Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$, ** $p < .01$, or *** $p < .001$. Differences were tested using two-sample *t*-tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits. Standard errors were estimated using balanced repeated replication to account for complex survey design.

AMDR = acceptable macronutrient distribution range

u Indicates individual estimates did not meet the standards of reliability or precision because of large coefficient of variation

Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls. Sample includes NHANES respondents 19–59 years old with complete day 1 and day 2 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

Average fiber intakes for adults were 60 percent of the AI (see appendix table E.8). SNAP participants in this age group were further from achieving the AI than either nonparticipant group (see figure 5.3). On a gram-per-calorie basis, mean usual fiber intakes were 8.2 grams per 1,000 calories for adults (see appendix table E.9). SNAP participants also had lower gram-per-calorie fiber intakes than both income-eligible nonparticipants and higher income nonparticipants on average.

4. Older Adults

Half of older adults had usual intakes of fat consistent with the AMDR (see table 5.8). Almost all older adults whose intakes of total fat were not consistent with the AMDR had intakes above the recommended range. Most older adults had usual intakes of linoleic and linolenic acid within the AMDR (91 and 82 percent, respectively; see appendix tables E.13 and E.15). Essentially all older adults (100 percent) had usual intakes of protein within the AMDR, and more than two-thirds (69 percent) had usual intakes of carbohydrate within the AMDR. Most older adults whose usual intakes of carbohydrate were not consistent with the AMDR had intakes below the recommended range.

Among older adults, a higher percentage of SNAP participants than higher income nonparticipants had total fat intakes within the AMDR (see table 5.8). A higher percentage of SNAP participants than higher income nonparticipants also had carbohydrate intakes within the AMDR.

Table 5.8. Percentages of Older Adults Aged 60 and Older With Macronutrient Intakes Below, Within, and Above the AMDR by Program Participation

Standard	All Older Adults	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
Total Fat				
Below the AMDR	0.4 u	0.8 u	1.5 u	0.2 u
Within the AMDR	50.4	61.7	57.3	46.6 **
Above the AMDR	49.3	37.5	41.3	53.1 ***
Protein				
Below the AMDR	0.2 u	0.3 u	0.7 u	0.2 u
Within the AMDR	99.8	99.7	99.3	99.8
Above the AMDR	0.0	0.0	0.0 u	0.0 u
Carbohydrate				
Below the AMDR	30.9	22.5	22.1 u	34.1 **
Within the AMDR	68.5	76.3	77.1	65.3 *
Above the AMDR	0.7	1.2 u	0.8 u	0.6 u

Note: "All older adults" includes respondents with missing SNAP participation or income. Usual intake was estimated using the National Cancer Institute method. Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$, ** $p < .01$, or *** $p < .001$. Differences were tested using two-sample t -tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits. Standard errors were estimated using balanced repeated replication to account for complex survey design.

AMDR = acceptable macronutrient distribution range

u Indicates individual estimates did not meet the standards of reliability or precision because of large coefficient of variation

Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls. Sample includes NHANES respondents aged 60 and older with complete day 1 and day 2 dietary recall data.

Compared with children and adults, older adults had the highest mean usual intakes of fiber (69 percent of AI and 9.4 grams per 1,000 calories; see appendix tables E.8 and E.9). SNAP participants in this age group were further from meeting the AI than higher income nonparticipants (see figure 5.3).

C. Intakes of Saturated Fats, Added Sugars, and Alcohol on a Given Day

This section discusses the significant findings overall and by age group for the percentage of total energy contributed by saturated fats, added sugars, and alcohol on a given day (based on day 1 dietary recall) and the percentage of individuals meeting the 2015-2020 DGA for saturated fat (based on day 1 dietary recall).

1. All Individuals

Among individuals aged 2 and older, saturated fats accounted for 11 percent of total calories consumed on a given day (see table 5.9 and appendix table E.18). Compared with higher income nonparticipants, SNAP participants consumed a slightly smaller but statistically significant percentage of calories from saturated fats (11.4 versus 10.9 percent, respectively).

Fewer than one-third of individuals (27 percent) met the DGA recommendation of less than 10 percent of calories from saturated fat on a given day (see appendix table E.11). A higher percentage of SNAP participants than higher income nonparticipants had usual intakes of saturated fat consistent with the DGA recommendation (31 versus 23 percent; see appendix table E.11).

On a given day, 13 percent of calories consumed by individuals of all ages came from added sugars, which exceeded the DGA recommendation of 10 percent (see table 5.9). SNAP participants consumed a greater percentage of calories from added sugar than both groups of nonparticipants on a given day. Among all individuals on a given day, alcohol contributed 1 percent of total calories. No differences were observed between SNAP participants and nonparticipants in the average percentage of total calories from alcohol.

Table 5.9. Percentage of Total Energy From Saturated Fats, Added Sugars, and Alcohol on a Given Day Among Individuals Aged 2 and Older by Program Participation

Source of Calories	All Individuals	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
Saturated fat	11.2	10.9	11.0	11.4 ***
Added sugars	13.1	15.5	13.4 ***	12.5 ***
Alcohol	1.1	1.0	1.0	1.1

Note: "All individuals" includes respondents with missing SNAP participation or income. Estimates are based on day 1 dietary recalls. Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$, ** $p < .01$, or *** $p < .001$. Differences were tested using two-sample t-tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits.

Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls. Sample includes NHANES respondents ages 2 and older with complete day 1 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

2. Children

On a given day, children consumed 12 percent of calories from saturated fat (see table 5.10 and appendix table E.18), and only 18 percent met the DGA recommendation (see appendix table E.11). Compared with adults and older adults, children had the highest average saturated fat consumption and

the lowest percentage meeting the DGA (see figure 5.4). There were no differences in the percentage of calories from saturated fat or the percentage of children meeting the DGA by participant group.

Children consumed 14 percent of calories from added sugars on a given day, which exceeded the DGA recommendation (see table 5.10). Small but significant differences were observed in the average percentage of calories SNAP participants consumed from added sugars compared with income-eligible and higher income nonparticipants (15 versus 14 percent of calories for both nonparticipant groups).

Alcohol intake among children was uncommon (0 percent of calories for all children), and only children over 15 reported consuming alcohol (see table 5.10). Although based on unreliable estimates, the contribution of alcohol to total calories among children on a given day appears to be negligible. However, because alcohol consumption is not legal for this age group, it is likely consumption is underreported.

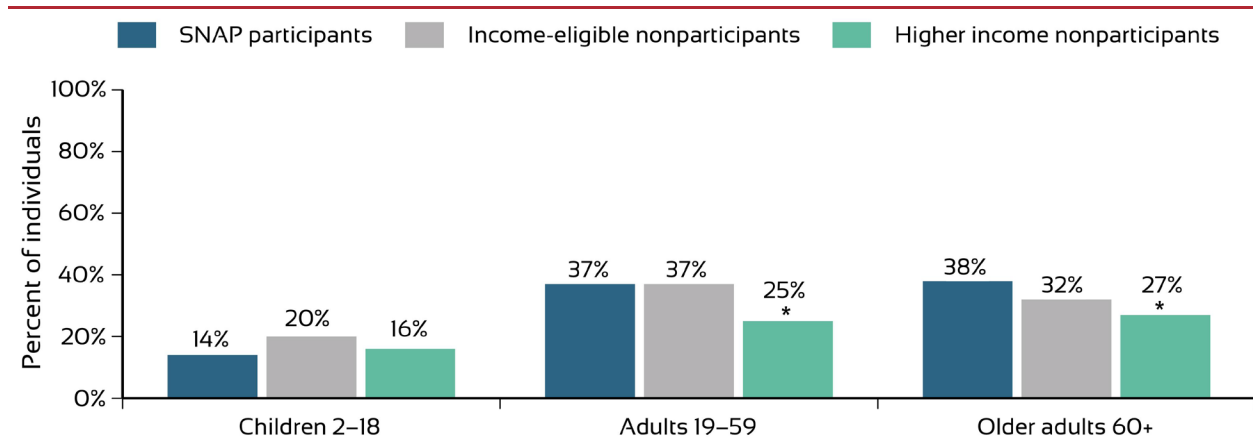
Table 5.10. Percentage of Total Energy From Saturated Fats, Added Sugars, and Alcohol on a Given Day Among Children Aged 2–18 by Program Participation

Source of Calories	All Children	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
Saturated fat	11.7	11.5	11.4	11.8
Added sugars	14.3	14.9	13.8 **	14.1 *
Alcohol	0.0	0.0 u	0.0 * u	0.0 u

Note: “All children” includes children with missing SNAP participation or income. Estimates are based on day 1 dietary recalls. Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$, ** $p < .01$, or *** $p < .001$. Differences were tested using two-sample t -tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits.

u Indicates individual estimates did not meet the standards of reliability or precision because of large coefficient of variation. Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls. Sample includes NHANES respondents 2–18 years old with complete day 1 dietary recall data.

Figure 5.4. Percentages of Individuals Aged 2 and Older With Intakes That Met the Dietary Guidelines for Americans Recommendation for Saturated Fat on a Given Day by Age and Program Participation



Note: Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$. Differences were tested using two-sample t -tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits.

Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls. Sample includes NHANES respondents aged 2 and older with complete day 1 and day 2 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

3. Adults

Adults consumed an average of 11 percent of calories from saturated fat (see table 5.11 and appendix table E.18) on a given day, and fewer than one-third of adults (30 percent) met the DGA recommendation (see appendix table E.11). Compared with higher income nonparticipants, SNAP participants consumed a smaller percentage of calories from saturated fat on average, and a higher percentage had saturated fat intakes that met the DGA recommendation (see figure 5.4).

On a given day, added sugar intakes among SNAP participants represented 13 percent of calories (see table 5.11 and appendix table E.18), which exceeded the DGA recommendation (see appendix table E.11). SNAP participants consumed a greater percentage of calories from added sugar than income-eligible and higher income nonparticipants on average. On a given day, adults consumed 1.5 percent of calories from alcohol.

Table 5.11. Average Percentage of Total Energy From Saturated Fats, Added Sugars, and Alcohol on a Given Day Among Adults Aged 19–59 by Program Participation

Source of Calories	All Adults	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
Saturated fat	11.0	10.7	10.7	11.2 **
Added sugars	13.2	16.8	13.7 ***	12.2 ***
Alcohol	1.5	1.4	1.5	1.6

Note: “All adults” includes respondents with missing SNAP participation or income. Estimates are based on day 1 dietary recalls. Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$, ** $p < .01$, or *** $p < .001$. Differences were tested using two-sample t-tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits.

Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls. Sample includes NHANES respondents 19–59 years old with complete day 1 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

4. Older Adults

Older adults consumed 11 percent of calories from saturated fat on a given day (see table 5.12 and appendix table E.18), and fewer than one-third (29 percent) of older adults met the DGA recommendation for saturated fat (see appendix table E.11). A higher percentage of SNAP participants met the DGA for saturated fat and tended to consume fewer calories from saturated fat than higher income nonparticipants (see figure 5.4).

Average added sugar intakes were 11 percent of calories and similar across participant groups (see table 5.12). Relative to adults and children, older adults consumed the smallest percentage of calories from added sugars. On a given day, older adults consumed less than 1 percent of calories from alcohol; there were no differences by participant group.

Table 5.12. Average Percentage of Total Energy From Saturated Fats, Added Sugars, and Alcohol on a Given Day Among Older Adults Aged 60 and Older by Program Participation

Source of Calories	All Older Adults	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
Saturated fat	11.3	10.8	11.2	11.4 *
Added sugars	11.3	11.5	12.0	11.1
Alcohol	0.9	0.8	0.8	0.9

Note: “All older adults” includes respondents with missing SNAP participation or income. Estimates are based on day 1 dietary recalls. Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$, ** $p < .01$, or *** $p < .001$. Differences were tested using two-sample t-tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits.

Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls. Sample includes NHANES respondents aged 60 and older with complete day 1 dietary recall data.

Chapter 6. Usual Micronutrient Intakes

Key Takeaways

Usual intakes of 10 vitamins and 7 minerals were assessed relative to the estimated average requirement (EAR). Usual intakes sodium, potassium, and choline were compared to the adequate intake (AI) level; sodium intakes were also compared to the chronic disease risk reduction (CDRR) level. In general, a similar percentage of SNAP participants and income-eligible nonparticipants met the dietary reference intakes.

The study also found—

- A **similar** percentage of **children participating in SNAP** and either group of nonparticipants had adequate usual intakes of most vitamins and minerals.
- A **higher** percentage of **children participating in SNAP** than income-eligible nonparticipants had adequate usual intakes of vitamin B6 and a **higher** percentage than both nonparticipant groups had adequate usual intakes of B12.
- Among **all individuals**, a **lower** percentage of SNAP participants had adequate usual intakes of copper and magnesium than income-eligible nonparticipants.



This chapter examines the prevalence of adequate micronutrient intakes among SNAP participants and nonparticipants by estimating the usual intakes of vitamins and minerals. Consistent with chapter 5, the study team used the NCI method to estimate the usual intake distributions, the mean intakes, and the percentage of individuals in each group with usual intakes consistent with DRI standards. The EAR, AI level, and CDRR are used to assess micronutrient intakes in this chapter (see table 6.1). These estimates reflect micronutrient intakes from foods and beverages; they do not include intakes from dietary supplements. Detailed descriptions of the NCI method and DRI standards are provided in appendix A.

Table 6.1. DRIs Used to Assess Usual Micronutrient Intakes

Nutrient(s)	Standard	Description of Standard
Vitamins A, B6, B12, C, D, and E; copper; selenium; folate; niacin; riboflavin; thiamin; calcium; iron; magnesium; phosphorus; and zinc	EAR	Average daily nutrient intake level estimated to meet the requirements for half of the healthy individuals in a life stage or gender group. The proportion of a group with usual intakes equal to or greater than the EAR is an estimate of the prevalence of adequate usual intakes in that group
Potassium, sodium, and choline	AI	Defined when insufficient data are available to establish an EAR. Groups with mean usual intakes at or above AI levels are assumed to have nutrient adequacy, but no firm conclusions can be drawn when mean usual intakes fall below the AI
Sodium	CDRR	The intake above which intake reduction is expected to reduce chronic disease risk within an apparently healthy population

AI = adequate intake; CDRR = chronic disease risk reduction; DRI = Dietary Reference Intake; EAR = estimated average requirement

Only statistically significant and reliable differences in usual micronutrient intakes between SNAP participants and nonparticipants are discussed in this chapter.²⁸ Full tabulations of the results presented in this chapter are provided in appendix F. Table 6.2 provides a synopsis of the data sources, sample, and measures examined in this chapter.

Table 6.2. Data, Sample, and Measures Used to Assess Nutrient Intakes



AI = adequate intake; CDRR = chronic disease risk reduction; EAR = estimated average requirement; NHANES = National Health and Nutrition Examination Survey

The low mean usual intakes of some micronutrients discussed in this chapter do not necessarily hold public health significance. Findings on the prevalence of adequate usual intakes should be interpreted with caution. DGAC identified nutrients of public health concern as follows:

- ▶ Underconsumed relative to the EAR or AI
- ▶ Evidence of underconsumption based on biochemical indicators of nutritional status
- ▶ Evidence of direct relation between nutrient inadequacy and a specific health condition

By these standards, DGAC did not classify vitamins A, C, or E as nutrients of public health concern for the U.S. population because the underconsumption of these vitamins had not been linked to adverse health outcomes in the scientific literature. Micronutrients of public health concern included calcium, vitamin D, and potassium. To increase intakes of these nutrients, DGAC recommended making the nutritional shift to eating more vegetables, fruits, whole grains, and dairy. Although DGAC classified vitamin D as a

²⁸ In some cases, between-group differences may be statistically significant even when one point estimate is unreliable. This report does not discuss results determined to be unreliable or comparisons for which either estimate in the comparison was determined to be unreliable.

nutrient of public health concern, it can be obtained through one's diet and synthesized endogenously through skin exposure to sunlight—making it unique among nutrients. The findings related to vitamin D status based on a biochemical indicator, 25-hydroxyvitamin D, are presented in chapter 3. DGAC also identified sodium and saturated fat as nutrients that were overconsumed and might pose health risks; findings related to saturated fat intake are presented in chapter 5.

A. Usual Intakes of Vitamins and Minerals With Defined EARs

This section discusses significant findings overall and by age group (i.e., children, adults, and older adults) for vitamins and minerals with defined EARs (see text box). The proportion of individuals in a life stage or gender group with usual intakes greater than or equal to the EAR is an estimate of the prevalence of adequate intakes in that population group.

1. All Individuals

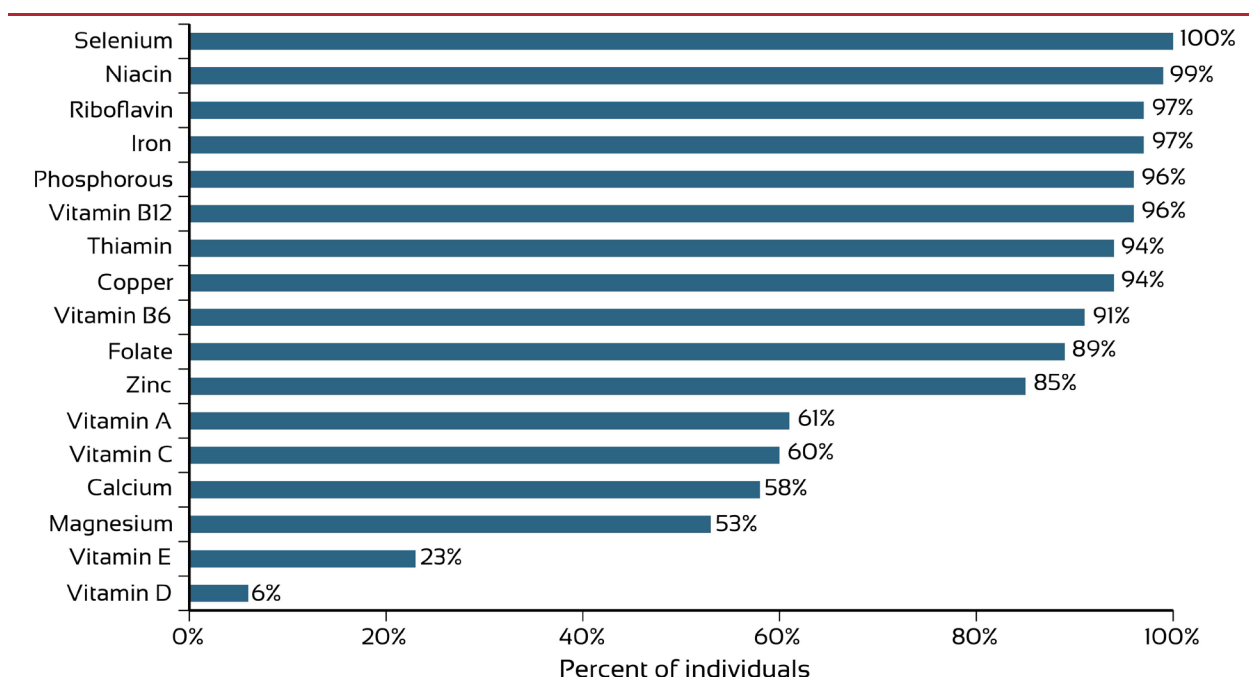
Almost all individuals (85 percent or more) had adequate usual intakes of vitamin B12, vitamin B6, copper, folate, iron, niacin, phosphorous, riboflavin, selenium, thiamin, and zinc based on age and gender (see figure 6.1). The prevalence of adequate usual intakes was lower for vitamin A, vitamin C, calcium, and magnesium, ranging from 53 to 61 percent. The prevalence was very low for vitamin E (23 percent) and vitamin D (6 percent).

Among all individuals, a lower percentage of SNAP participants than higher income nonparticipants had adequate usual intakes of all vitamins and minerals included in the analysis except vitamin B12, vitamin D, iron, and selenium, and a lower percentage than income-eligible nonparticipants had adequate usual intakes of copper and magnesium (see table 6.3).

EAR

- The EAR is the average daily nutrient intake level estimated to meet the requirement for half of the healthy individuals in a life stage or gender group.
- This section discusses EARs for vitamins A, B6, B12, C, D, and E; copper; selenium; folate; niacin; riboflavin; thiamin; calcium; iron; magnesium; phosphorus; and zinc. Mean usual intake is expressed as the percentage of individuals with intakes equal to or greater than the EAR.
- The proportion of a group with usual intakes equal to or greater than the EAR is an estimate of the prevalence of adequate usual intakes in the group.

Figure 6.1. Percentage of Individuals Aged 1 and Older With Usual Intakes of Vitamins and Minerals That Met or Exceeded the Estimated Average Requirements



Note: Includes respondents with missing SNAP participation or income. Estimates are based on two dietary recalls per person. Usual intake was estimated using the National Cancer Institute method. Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits. Standard errors were estimated using balanced repeated replication to account for complex survey design.

EAR = estimated average requirement

Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls. Sample includes NHANES respondents aged 1 and older with complete day 1 and day 2 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

Table 6.3. Percentage of Individuals Aged 1 and Older With Usual Intakes of Vitamins and Minerals That Met or Exceeded the EARs by Program Participation

Vitamins and Minerals	All Individuals	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
Vitamins				
Vitamin A	61.2	51.1	51.4	65.5 ***
Vitamin B6	91.4	86.1	86.9	93.0 ***
Vitamin B12	95.9	94.5	94.0	96.0
Vitamin C	60.1	55.0	59.6	61.2 ***
Vitamin D	5.8	5.5	4.1	6.4
Vitamin E	23.1	15.2	17.1	25.8 ***
Folate	89.4	85.8	86.9	90.3 **
Niacin	98.8	97.4	97.8	99.0 **
Riboflavin	97.4	94.8	95.4	98.2 ***
Thiamin	94.2	91.2	92.7	94.9 ***

Vitamins and Minerals	All Individuals	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
Minerals				
Calcium	57.6	52.7	52.5	60.5 ***
Copper	93.5	87.6	90.2 *	95.7 ***
Iron	97.1	96.1	95.8	97.3
Magnesium	53.1	42.0	47.2 **	57.4 ***
Phosphorous	96.1	95.1	94.5	96.8 **
Selenium	99.6	99.2	99.5	99.7
Zinc	85.3	79.8	79.7	87.8 ***

Note: "All individuals" includes respondents with missing SNAP participation or income. Estimates are based on two dietary recalls per person. Usual intake was estimated using the National Cancer Institute method. Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$, ** $p < .01$, or *** $p < .001$. Differences were tested using two-sample *t*-tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits. Standard errors were estimated using balanced repeated replication to account for complex survey design.

EAR = estimated average requirement

Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls. Sample includes NHANES respondents aged 1 and older with complete day 1 and day 2 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

2. Children

The prevalence of adequate usual intakes among children was above 85 percent for vitamin B6, vitamin B12, copper, folate, iron, niacin, phosphorous, riboflavin, selenium, thiamin, and zinc (see table 6.4). The prevalence was lower for vitamin C (82 percent) and even lower for vitamin A, calcium, and magnesium (58 to 79 percent). Consistent with the pattern observed for all individuals and other age groups, the prevalence of adequate usual intakes among children was lowest for vitamin D (8 percent) and vitamin E (31 percent). Relative to adults and older adults, the prevalence of adequate usual intakes was consistently higher among children for all vitamins and minerals except calcium, iron, and phosphorus.

Children participating in SNAP had similar results as either group of nonparticipants for adequate usual intakes of most vitamins and minerals included in the analysis (see table 6.4). However, a higher percentage of children participating in SNAP than income-eligible nonparticipants had adequate usual intakes of vitamin B6, and a higher percentage than both nonparticipant groups had adequate usual intakes of vitamin B12. Among children, a lower percentage of SNAP participants had adequate usual intakes of vitamin A (75 versus 81 percent), vitamin E (28 versus 34 percent), calcium (55 versus 61 percent), and magnesium (64 versus 72 percent) compared with higher income nonparticipants.

Table 6.4. Percentage of Children Aged 1–18 With Usual Intakes of Vitamins and Minerals That Met or Exceeded the EARs by Program Participation

Vitamins and Minerals	All Children	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
Vitamins				
Vitamin A	79.0	75.3	74.9	80.9 *
Vitamin B6	97.7	99.0	95.8 *	98.0
Vitamin B12	98.6	99.8	97.8 **	98.4 *
Vitamin C	81.9	80.7	89.8	81.3
Vitamin D	7.9	6.1	8.5	8.5
Vitamin E	31.1	27.6	24.6	33.8 *
Folate	95.7	96.8	93.2	95.5
Niacin	99.4	99.7	98.7	99.5
Riboflavin	98.7	99.2	98.0	98.9
Thiamin	97.9	98.8	97.5	97.9
Minerals				
Calcium	58.3	54.7	54.3	61.3 *
Copper	95.5	94.0	94.0	96.6
Iron	98.0	98.2	97.0	98.0
Magnesium	69.1	64.1	67.0	71.9 ***
Phosphorous	86.4	85.6	84.1	88.4
Selenium	99.8	99.8	99.9	99.8
Zinc	91.2	91.6	88.7	92.1

Note: “All children” includes respondents with missing SNAP participation or income. Estimates are based on two dietary recalls per person. Usual intake was estimated using the National Cancer Institute method. Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$, ** $p < .01$, or *** $p < .001$. Differences were tested using two-sample t -tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits. Standard errors were estimated using balanced repeated replication to account for complex survey design.

EAR = estimated average requirement

Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls. Sample includes NHANES respondents 1–18 years old with complete day 1 and day 2 dietary recall data.

3. Adults

For adults, the prevalence of adequate usual intakes was above 85 percent for vitamin B6, vitamin B12, copper, folate, iron, niacin, phosphorous, riboflavin, selenium, thiamin, and zinc (see table 6.5). The prevalence of adequate usual intakes was lower for vitamin A, vitamin C, calcium, and magnesium (51 to 65 percent). Consistent with the pattern observed for all individuals and other age groups, the prevalence of adequate intakes among adults was lowest for vitamin D (5 percent) and vitamin E (22 percent).

Among adults, there were many differences in prevalence of adequate intakes between SNAP participants and higher income nonparticipants. A lower percentage of SNAP participants than higher income nonparticipants to have adequate usual intakes of all vitamins and minerals examined except

vitamin B12, vitamin D, iron, and selenium (see table 6.5). The magnitudes of the differences between the two groups were greatest for vitamin A (42 versus 59 percent) and magnesium (36 versus 56 percent).

Table 6.5. Percentage of Adults Aged 19–59 With Usual Intakes of Vitamins and Minerals That Met or Exceeded the EARs by Program Participation

Vitamins and Minerals	All Adults	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
Vitamins				
Vitamin A	53.7	42.4	43.3	59.3 ***
Vitamin B6	92.7	85.5	89.3	94.7 ***
Vitamin B12	95.5	93.9	93.8	95.6
Vitamin C	52.8	45.8	51.1	54.5 ***
Vitamin D	5.4	5.3	2.4 * u	6.0
Vitamin E	22.4	13.0	16.5	25.5 ***
Folate	89.0	84.0	87.3	90.3 **
Niacin	98.9	97.4	98.5	99.2 *
Riboflavin	97.2	94.4	95.3	98.1 ***
Thiamin	93.9	89.9	92.2	94.8 **
Minerals				
Calcium	64.8	58.5	58.5	68.2 ***
Copper	93.1	86.1	90.0 *	95.8 ***
Iron	96.0	94.4	94.3	96.4
Magnesium	50.9	36.4	44.9 ***	56.2 ***
Phosphorous	99.5	98.6	98.7	99.7 *
Selenium	99.6	99.3	99.6	99.7
Zinc	86.1	79.1	80.1	89.2 ***

Note: “All adults” includes respondents with missing SNAP participation or income. Estimates are based on two dietary recalls per person. Usual intake was estimated using the National Cancer Institute method. Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$, ** $p < .01$, or *** $p < .001$. Differences were tested using two-sample t -tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits. Standard errors were estimated using balanced repeated replication to account for complex survey design.

EAR = estimated average requirement

u Indicates individual estimates did not meet the standards of reliability or precision because of large coefficient of variation

Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls. Sample includes NHANES respondents 19–59 years old with complete day 1 and day 2 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

4. Older Adults

The prevalence of adequate usual intakes among older adults was above 85 percent for vitamin B12, copper, iron, niacin, phosphorous, riboflavin, selenium, and thiamin (see table 6.6). The prevalence of adequate usual intakes was lower for folate, vitamin B6, and zinc (75 to 82 percent). More than half of older adults had adequate usual intakes of vitamin A and vitamin C (60 and 54 percent, respectively), and more than one-third had adequate usual intakes of magnesium and calcium (39 and 35 percent,

respectively). Consistent with the pattern observed for all individuals and other age groups, the prevalence of adequate usual intakes among older adults was lowest for vitamin E (15 percent) and vitamin D (5 percent). Relative to children and adults, the prevalence of adequate usual intakes among older adults was lowest for all vitamins and minerals examined except vitamin A, vitamin C, phosphorus, and iron.

For older adults, the prevalence of adequate usual intakes was comparable for SNAP participants and income-eligible nonparticipants. However, a lower percentage of SNAP participants in this age group than higher income nonparticipants had adequate usual intakes of vitamin A, vitamin B6, vitamin E, riboflavin, copper, magnesium, and zinc (see table 6.6). The differences between SNAP participants and higher income nonparticipants were greatest for vitamin A (46 versus 64 percent), vitamin E (6 versus 16 percent), zinc (66 versus 78 percent), and magnesium (30 versus 42 percent).

Table 6.6. Percentage of Older Adults Aged 60 and Older With Usual Intakes of Vitamins and Minerals That Met or Exceeded the EARs by Program Participation

Vitamins and Minerals	All Older Adults	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
Vitamins				
Vitamin A	60.4	45.8	45.5	64.2 ***
Vitamin B6	79.1	71.0	68.1	81.0 *
Vitamin B12	93.8	89.5	89.4	94.4
Vitamin C	53.7	48.8	45.9	55.2
Vitamin D	4.6	5.3 u	3.5	4.8
Vitamin E	14.5	5.7 u	9.0	16.4 ***
Folate	82.4	76.9	77.6	83.4
Niacin	97.7	94.4	94.6	97.9
Riboflavin	96.6	90.2	92.6	97.5 ***
Thiamin	90.4	85.3	88.1	91.4
Minerals				
Calcium	34.8	32.8	31.7	36.1
Copper	92.2	83.8	85.9	94.0 ***
Iron	99.1	98.4	98.6	99.1
Magnesium	38.8	30.2	28.2	42.2 ***
Phosphorous	98.6	96.6	95.7	99.1
Selenium	99.2	97.9	98.7	99.4
Zinc	75.3	66.3	66.8	78.0 **

Note: "All older adults" includes respondents with missing SNAP participation or income. Estimates are based on two dietary recalls per person. Usual intake was estimated using the National Cancer Institute method. Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$, ** $p < .01$, or *** $p < .001$. Differences were tested using two-sample t-tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits. Standard errors were estimated using balanced repeated replication to account for complex survey design.

EAR = estimated average requirement

u Indicates individual estimates did not meet the standards of reliability or precision because of large coefficient of variation

Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls. Sample includes NHANES respondents aged 60 and older with complete day 1 and day 2 dietary recall data.

B. Usual Intakes of Micronutrients Assessed Using AI and CDRR Levels

This section discusses significant findings on intakes of micronutrients that do not have assigned EARs. Intakes of these nutrients (choline, potassium, and sodium; see text box) are compared with AI levels. Populations with mean usual intakes that meet or exceed AI levels can be assumed to have high levels of nutrient adequacy. When mean usual intakes fall below the AI, however, no firm conclusions can be drawn about the prevalence of adequate usual intakes.

This section also includes a discussion of mean usual sodium intakes compared with the CDRR (see text box).

AI

- The AI is used when insufficient evidence is available to establish an EAR. The AI is expected to fall above the unknown EAR value and meet or exceed the nutritional needs of almost all members of a healthy population.
- This section discusses the AIs for potassium, sodium, and choline. Mean usual intake is expressed as a percentage of the AI.
- Unlike the EAR, the AI level cannot be used to calculate the prevalence of adequate nutrient intakes for a group.

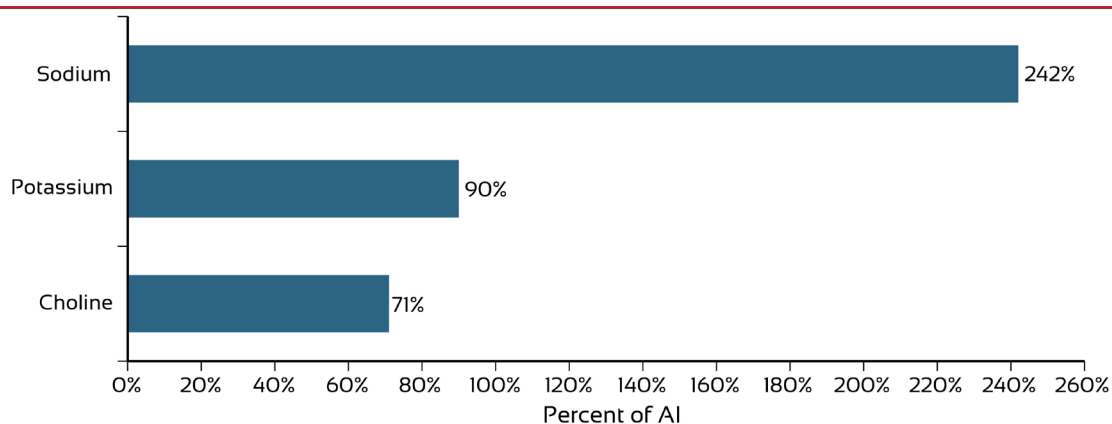
CDRR

- The CDRR is the intake above which intake reduction is expected to reduce chronic disease risk within an apparently healthy population.
- This section discusses the CDRR for sodium. Mean usual intake is presented as the percentage of individuals with an intake that exceeded the CDRR.

1. All Individuals

The mean usual intakes of potassium were 90 percent of the AI (see figure 6.2). SNAP participants had lower mean usual intakes of potassium than both income-eligible and higher income nonparticipants (84 versus 87 and 92 percent of AI, respectively) and lower mean usual intakes of choline and sodium than higher income nonparticipants (see table 6.7). Because these values were less than 100 percent of the AIs, no conclusions could be drawn about adequate usual intakes of potassium or choline.

Figure 6.2. Mean Usual Nutrient Intakes Among Individuals Aged 1 and Older as a Percentage of AI



Note: Includes respondents with missing SNAP participation or income. Estimates are based on two dietary recalls per person. Usual intake was estimated using the National Cancer Institute method. Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population.

AI = adequate intake

Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls. Sample includes NHANES respondents aged 1 and older with complete day 1 and day 2 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

For the total population, the mean usual intakes of sodium were more than twice the AI (242 percent; see appendix table F.19). Because this value exceeded the AI, the prevalence of inadequate sodium intakes was likely to be low. Most (90 percent) of the individuals had usual sodium intakes that exceeded the CDRR (see table 6.7). A lower percentage of SNAP participants than higher income nonparticipants had mean usual intakes of sodium that exceeded the CDRR (87 versus 92 percent).

Table 6.7. Percentage of AI and Percentage of Intakes That Exceeded the CDRR Among Individuals Aged 1 and Older by Program Participation

Nutrient	All Individuals	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
Mean Percent of AI				
Choline	71.2	69.6	69.0	72.1 **
Potassium	90.0	83.9	87.2 **	92.0 ***
Sodium	241.8	235.2	237.8	243.9 ***
Mean Percent of Individuals With Intakes That Exceeded the CDRR				
Sodium	90.1	87.2	85.8	91.5 ***

Note: "All individuals" includes respondents with missing SNAP participation or income. Estimates are based on two dietary recalls per person. Usual intake was estimated using the National Cancer Institute method. Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$, ** $p < .01$, or *** $p < .001$. Differences were tested using two-sample t -tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits. Standard errors were estimated using balanced repeated replication to account for complex survey design.

AI = adequate intake; CDRR = chronic disease risk reduction

Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls. Sample includes NHANES respondents aged 1 and older with complete day 1 and day 2 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

2. Children

The mean usual intakes of choline were 78 percent of the AI among children. Children's mean usual intakes of potassium were 90 percent of the AI (see table 6.8). Among children, SNAP participants had lower mean intakes of potassium than higher income nonparticipants (88 versus 91 percent of AI). Because mean usual intakes for choline and potassium fell below 100 percent of the AI, no conclusions could be drawn about nutrition adequacy. For sodium, 95 percent of children had mean usual intakes that exceeded the CDRR and results were similar by participant group (see figure 6.3).

Table 6.8. Percentage of AI and Percentage of Intakes That Exceeded the CDRR Among Children Aged 1–18 by Program Participation

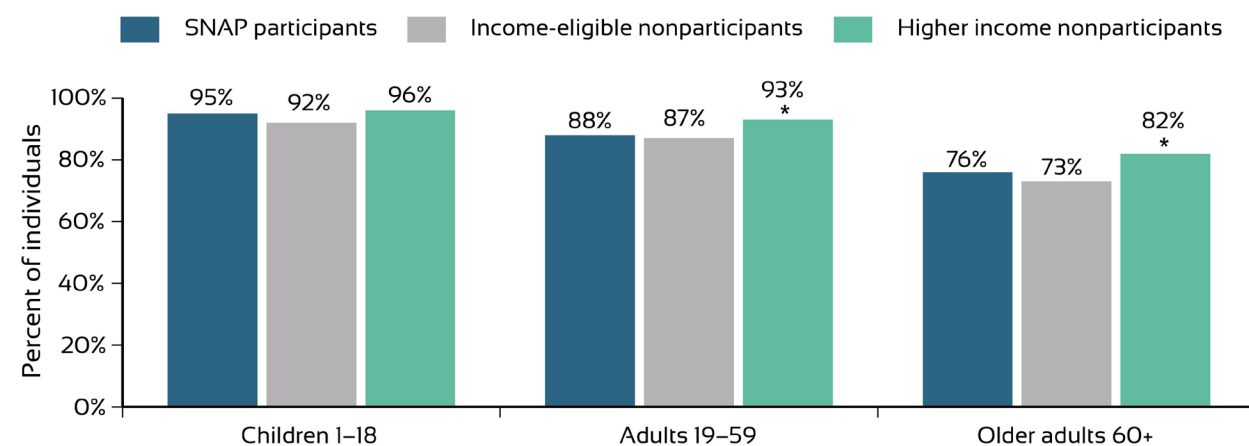
Nutrient	All Children	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
Mean Percent of AI				
Choline	77.5	76.4	78.4	77.7
Potassium	90.0	87.8	90.3	91.0 *
Sodium	252.6	253.3	247.7	253.4
Mean Percent of Individuals With Intakes That Exceeded the CDRR				
Sodium	94.6	94.9	91.8	95.5

Note: “All children” includes respondents with missing SNAP participation or income. Estimates are based on two dietary recalls per person. Usual intake was estimated using the National Cancer Institute method. Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$, ** $p < .01$, or *** $p < .001$. Differences were tested using two-sample t -tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits. Standard errors were estimated using balanced repeated replication to account for complex survey design.

AI = adequate intake ; CDRR = chronic disease risk reduction

Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls. Sample includes NHANES respondents 1–18 years old with complete day 1 and day 2 dietary recall data.

Figure 6.3. Percentage of Individuals Aged 1 and Older With Usual Sodium Intakes That Exceeded the CDRR by Age and Program Participation



Note: Estimates are based on two dietary recalls per person. Data do not include sodium intake from table salt. Usual intake was estimated using the National Cancer Institute method. Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$. Differences were tested using two-sample t -tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits. Standard errors were estimated using balanced repeated replication to account for complex survey design.

CDRR = chronic disease risk reduction

Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls. Sample includes NHANES respondents aged 1 and older with complete day 1 and day 2 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

3. Adults

For adults, mean usual choline intakes were 71 percent of the AI. SNAP participants had lower mean usual intakes of choline than higher income nonparticipants (68 versus 72 percent). Mean usual potassium intakes were 91 percent of the AI (see table 6.9). SNAP participants had lower mean usual intakes of potassium than both income-eligible and higher income nonparticipants (83 versus 88 and 93 percent of AI, respectively). Because the mean usual intakes for potassium and choline fell below 100 percent of the AI, no conclusions could be drawn about nutrient adequacy. Mean usual sodium intakes were 249 percent of the AI, and 91 percent of adults had intakes that exceeded the CDRR. SNAP participants had lower mean usual intakes of sodium than higher income nonparticipants (see figure 6.3 and table 6.9).

Table 6.9. Percentage of AI and Percentage of Intakes That Exceeded the CDRR Among Adults Aged 19–59 by Program Participation

Nutrient	All Adults	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
Mean Percent of AI				
Choline	70.8	68.7	67.7	71.9 **
Potassium	90.5	83.0	87.6 **	92.9 ***
Sodium	248.8	238.6	245.4	251.5 ***
Mean Percent of Individuals With Intakes That Exceeded the CDRR				
Sodium	91.4	87.6	87.4	92.8 **

Note: “All adults” includes respondents with missing SNAP participation or income. Estimates are based on two dietary recalls per person. Usual intake was estimated using the National Cancer Institute method. Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$, ** $p < .01$, or *** $p < .001$. Differences were tested using two-sample *t*-tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits. Standard errors were estimated using balanced repeated replication to account for complex survey design.

AI = adequate intake; CDRR = chronic disease risk reduction

Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls. Sample includes NHANES respondents 19–59 years old with complete day 1 and day 2 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

4. Older Adults

Among older adults, mean usual intakes of choline were 64 percent of the AI and comparable for participants and nonparticipants. SNAP participants had lower mean usual intakes of potassium compared with higher income nonparticipants (82 versus 91 percent of AI; see table 6.10). Because mean usual intakes for potassium and choline fell below 100 percent of the AI, no conclusions could be drawn about nutrient adequacy. For sodium, a lower percentage of SNAP participants than higher income nonparticipants had sodium intakes that exceeded the CDRR (76 versus 82 percent; see figure 6.3).

Table 6.10. Percentage of AI and Percentage of Intakes That Exceeded the CDRR Among Older Adults Aged 60 and Older by Program Participation

Nutrient	All Older Adults	SNAP Participants	Income-Eligible Nonparticipants	Higher Income Nonparticipants
Mean Percent of AI				
Choline	64.4	63.5	60.7	65.6
Potassium	88.5	81.5	81.7	90.8 ***
Sodium	206.2	200.8	201.7	208.6
Mean Percent of Individuals With Intakes That Exceeded the CDRR				
Sodium	80.1	75.8	72.9	82.4 *

Note: "All older adults" includes respondents with missing SNAP participation or income. Estimates are based on two dietary recalls per person. Usual intake was estimated using the National Cancer Institute method. Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$, ** $p < .01$, or *** $p < .001$. Differences were tested using two-sample *t*-tests comparing SNAP participants with income-eligible nonparticipants or higher income nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits. Standard errors were estimated using balanced repeated replication to account for complex survey design.

AI = adequate intake; CDRR = chronic disease risk reduction

Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls. Sample includes NHANES respondents aged 60 and older with complete day 1 and day 2 dietary recall data.

Chapter 7. Matched Participant Group Findings

Key Takeaways

Compared with findings from descriptive analyses that did not control for important demographic and contextual factors, findings from the matched analyses indicate that the groups differ on relatively few outcomes. The study also found—

- **Children participating in SNAP** had a **lower** prevalence of obesity and prediabetes than matched income-eligible nonparticipants.
- **Men participating in SNAP** had a **lower** prevalence of prediabetes, but **women** had a **higher** prevalence of prediabetes and obesity than matched income-eligible nonparticipants.
- A higher percentage of **SNAP adults** had lower than recommended HDL levels and low hemoglobin levels and consumed a **greater percentage** of calories from added sugars than their matched income-eligible nonparticipants.



This chapter presents findings using matched samples to examine differences in outcomes between SNAP participants and a matched sample of income-eligible nonparticipants.

The matched analyses focus on a subset of outcomes examined elsewhere in this report: HEI-2015 scores, selected indicators of nutrition and health, and calories and selected nutrients (see text box). Differences between SNAP participants and a matched sample of income-eligible nonparticipants were calculated for each outcome and for children and adults, separately. Only selected results are discussed in the following sections; detailed results of matched comparison analyses are presented in appendix G.

A. Matched Comparison of SNAP Participants With Income-Eligible Nonparticipants

A propensity score-matching model was employed to minimize observable differences between SNAP participants and income-eligible nonparticipants, thereby reducing the potential for selection bias because of factors associated with both SNAP participation and the outcomes of interest (see appendix A for a more detailed description of the approach).²⁹ Table 7.1 shows summary statistics for SNAP participants and income-eligible nonparticipants included in the matched analysis sample; mean characteristics are shown for continuous variables, and sample distributions are presented for categorical variables.

Compared with matched income-eligible nonparticipants, SNAP participants were younger, experienced higher levels of poverty, spent more money at supermarkets, and spent less money on eating out and on nonfood items (see table 7.1). A higher percentage of SNAP participants were Black than matched income-eligible nonparticipants, but a lower percentage were any other race/ethnicity. A higher percentage of SNAP participants were female, were U.S. citizens, had larger households, had less than a ninth-grade education, and received Supplemental Security Income or cash assistance than matched income-eligible nonparticipants.

Matched Outcomes

Overall diet quality

- Total HEI-2015 scores
- Component HEI-2015 scores

Indicators of nutrition and health

- BMI
- Blood pressure
- HDL
- LDL
- TG concentrations
- Blood glucose levels
- Hemoglobin
- Vitamin D concentrations

Nutrient and energy intakes

- Total calories
- Calories from added sugars, added fats, and alcohol
- Calcium
- Vitamin D
- Dietary fiber
- Iron
- Potassium
- Sodium

²⁹ In other words, a propensity score was calculated for each SNAP participant and income-eligible nonparticipant, which quantified the probability of the respondent participating in SNAP. Each SNAP participant was then matched to an income-eligible nonparticipant with a similar probability of participating in SNAP. Any income-eligible nonparticipants who were not identified as matches for SNAP participants were dropped from the matched analysis.

Table 7.1. Characteristics of Matched Analysis Sample: Continuous and Categorical Variables

Characteristic	SNAP Participants		Matched Income-Eligible Nonparticipants	
	Mean or Percent	Standard Error	Mean or Percent	Standard Error
Continuous Variables				
Sample size (n)	2,983	—	1301	—
Age in years	24.17	(0.40)	32.26 ***	(0.63)
Family poverty–annual income ratio	0.70	(0.01)	0.97 ***	(0.01)
Monthly spending (dollars)				
At supermarket/grocery store	469.29	(5.20)	395.38 ***	(7.92)
On nonfood items	26.19	(1.20)	32.31 **	(1.78)
On food at other stores	79.58	(2.59)	74.36	(4.12)
Eating out	67.44	(2.01)	103.27 ***	(3.92)
On carryout/delivered foods	17.80	(0.86)	19.51	(1.52)
Categorical Variables				
Sample size (n)	2,983	—	1,301	—
Female	51.9	(0.91)	48.5 *	(1.39)
Race/ethnicity				
Mexican American	18.8	(0.72)	26.1 ***	(1.22)
Other Hispanic	11.2	(0.58)	11.8 ***	(0.90)
Non-Hispanic White	26.1	(0.80)	31.5 ***	(1.29)
Non-Hispanic Black	36.8	(0.88)	18.5 ***	(1.08)
Non-Hispanic Asian	2.6	(0.29)	8.4 ***	(0.77)
Other race, multiracial	4.4	(0.38)	3.7 ***	(0.52)
U.S. citizen	92.7	(0.48)	76.9 ***	(1.17)
Number of people in household				
1–2	17.1	(0.69)	25.7 ***	(1.21)
3–4	31.1	(0.85)	36.8 ***	(1.34)
5–6	35.7	(0.88)	29.1 ***	(1.26)
7 or more	16	(0.67)	8.4 ***	(0.77)
Education				
Less than ninth grade	54.9	(0.91)	37.9 ***	(1.35)
Some high school	17.6	(0.70)	18.7 ***	(1.08)
High school diploma/GED or equivalent	13.6	(0.63)	15.2 ***	(1.00)
Some college or more	13.8	(0.63)	28.2 ***	(1.25)
Total savings/cash assets for the family				
Less than \$500	93.5	(0.45)	82.1 ***	(1.06)
\$501–\$1,000	3.7	(0.35)	7.6 ***	(0.74)
\$1,001+	2.8	(0.30)	10.3 ***	(0.84)
Receives Supplemental Security Income	19.8	(0.73)	6.6 ***	(0.69)
Receives cash assistance	19.2	(0.72)	3.2 ***	(0.49)

Characteristic	SNAP Participants		Matched Income-Eligible Nonparticipants	
	Mean or Percent	Standard Error	Mean or Percent	Standard Error
Monthly family income				
\$0–\$799	27.6	(0.82)	15.4 ***	(1.00)
\$800–\$1,649	45.7	(0.91)	42.4 ***	(1.37)
\$1,650+	26.7	(0.81)	42.3 ***	(1.37)

Note: Education is reported starting at age 6 but is displayed for individuals 19 and older to capture high school completion. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$, ** $p < .01$, or *** $p < .001$. Differences in continuous variables were tested using two-sample *t*-tests comparing SNAP participants with matched income-eligible nonparticipants. Differences in categorical variables were tested using chi-squared tests comparing SNAP participants with matched income-eligible nonparticipants, and significance is noted for all levels of a categorical variable with a significant chi-squared test result. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits.

Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls and demographic data. Sample includes matched NHANES respondents aged 1 and older with complete day 1 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

B. Overall Diet Quality

Among all individuals, total HEI scores were similar for SNAP participants (54 points) and matched income-eligible nonparticipants (56 points; see appendix table G.1). Among adults, SNAP participants had lower total HEI scores than matched income-eligible nonparticipants (53 versus 56 points). There were no differences in HEI score by matched participant group for children and older adults. These matched findings by age group are consistent with the findings in chapter 2.

Among children, SNAP participants scored higher than matched income-eligible nonparticipants for the greens and beans component but lower for the saturated fat component (see appendix table G.1); this difference was nonsignificant in chapter 2. Among adults, SNAP participants scored higher than matched income-eligible nonparticipants for the refined grains component but lower for the whole fruits, total vegetables, greens and beans, and added sugars components; this finding is consistent with the findings in chapter 2. Among older adults, SNAP participants scored higher than matched income-eligible nonparticipants for the sodium component but lower for the added sugars component; these differences were nonsignificant in chapter 2.

C. Selected Indicators of Health and Nutrition

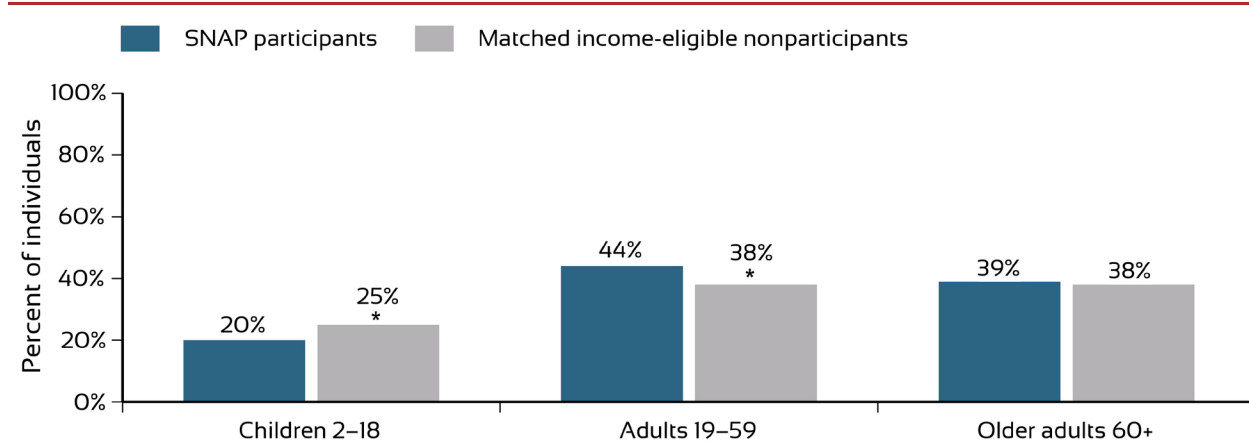
This section discusses findings for selected indicators of nutrition and health, including BMI, blood pressure, high-density lipoprotein (HDL) and low-density lipoprotein (LDL) cholesterol, triglycerides (TG), blood glucose, hemoglobin, and vitamin D levels.

1. Body Mass Index

Among all individuals aged 2 and older, similar proportions of SNAP participants and matched income-eligible nonparticipants were in each BMI category (see appendix table G.2). Children participating in SNAP had a lower prevalence of obesity than matched income-eligible nonparticipants (20 versus 25 percent; see figure 7.1). Conversely, adults participating in SNAP had a higher prevalence of obesity than matched income-eligible nonparticipants; this difference was driven by women participating in SNAP,

who had a significantly higher prevalence of obesity than matched income-eligible nonparticipants (55 versus 42 percent). There were no significant differences in overweight or obesity among older adults, but older adult men participating in SNAP had a higher prevalence of underweight than matched nonparticipants (10 versus 2 percent). These matched findings by age group are similar to the findings in chapter 3, although the unmatched analysis found that among all individuals aged 2 and older, SNAP participants overall had a higher prevalence of obesity than income-eligible nonparticipants.

Figure 7.1. Percentage of Individuals Aged 2 and Older With Obesity by Age and Matched Program Participation



Note: Values are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Significant differences in estimates are noted by * $p < .05$ and based on a t -test for difference in proportions between SNAP participants and matched income-eligible nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits.

Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 body measures data. Sample includes NHANES respondents aged 2 and older with complete day 1 dietary recall data and weight and height data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

2. Blood Pressure

Among all individuals aged 8 and older, almost half of both SNAP participants and matched income-eligible nonparticipants had elevated blood pressure or hypertension (see appendix table G.3). Children participating in SNAP had a higher prevalence of elevated blood pressure than matched income-eligible nonparticipants (10 versus 6 percent). About half of adults participating in SNAP and matched nonparticipants had elevated blood pressure or hypertension, and almost three-quarters of older adults had elevated blood pressure or hypertension. This matched analysis reflects similar prevalence of elevated blood pressure and hypertension as the unmatched analysis in chapter 3. But in the unmatched analysis, children participating in SNAP and income-eligible nonparticipants had similar prevalence of elevated blood pressure. However, a lower percentage of adults participating in SNAP had normal blood pressure levels compared with income-eligible nonparticipants. Results for older adults were nonsignificant.

3. HDL Cholesterol

Among all individuals aged 6 and older, a higher percentage of SNAP participants had lower than recommended HDL than matched income-eligible nonparticipants (42 versus 37 percent; see appendix table G.4). Children had similar HDL levels, but a higher percentage of adults participating in SNAP than

matched income-eligible nonparticipants had low HDL levels (48 versus 41 percent). Older adults had similar HDL levels by matched participant group. These results are consistent with the unmatched findings in chapter 3.

4. LDL Cholesterol

Among all individuals aged 12 and older, 54 percent of SNAP participants and 56 percent of matched income-eligible nonparticipants had higher than recommended LDL levels (see appendix table G.5). There were few differences by age or participant group, but a higher percentage of children participating in SNAP had borderline high LDL levels (19 versus 9 percent), and a higher percentage of adult men participating in SNAP had normal LDL levels compared with matched income-eligible nonparticipants (44 versus 31 percent). These results are similar to those for the unmatched analysis in chapter 3: A higher percentage of men and boys aged 12 and older participating in SNAP had normal LDL levels compared with income-eligible nonparticipants.

5. Triglycerides

Among all individuals aged 12 and older, 71 percent of SNAP participants and 73 percent of matched income-eligible nonparticipants had normal TG concentrations (see appendix table G.6). Among children, a lower percentage of boys participating in SNAP had normal TG concentrations than matched income-eligible nonparticipants (61 versus 78 percent). There were no differences in TG concentrations among adults and older adults. The unmatched analysis in chapter 3 found no differences in TG concentrations overall or by age group.

6. Blood Glucose Levels

Among all individuals aged 12 and older, 59 percent of SNAP participants and 56 percent of matched income-eligible nonparticipants had normal blood glucose levels (see appendix table G.7). A higher percentage of children participating in SNAP had normal blood glucose levels than matched income-eligible nonparticipants (85 versus 71 percent). Notably, 77 percent of boys participating in SNAP but only 58 percent of matched income-eligible nonparticipants had normal blood glucose levels. Similarly, among adult men, 63 percent of SNAP participants but fewer than half (47 percent) of matched income-eligible nonparticipants had normal blood glucose levels. The opposite was true for adult women: 59 percent of SNAP participants had normal blood glucose levels, while a higher proportion (73 percent) of matched income-eligible nonparticipants had normal blood glucose levels. Among older adults, 40 percent of SNAP participants versus 35 percent of matched income-eligible nonparticipants had normal levels; there were no differences by gender or participant group. These results are similar to unmatched findings in chapter 3.

7. Hemoglobin

Among all individuals aged 1 and older, a higher percentage of SNAP participants had low hemoglobin levels compared with matched income-eligible nonparticipants (12 versus 9 percent; see appendix table G.8). A higher percentage of children participating in SNAP had low hemoglobin levels than matched income-eligible nonparticipants (7 versus 5 percent). Among adults, a higher percentage of men participating in SNAP had low hemoglobin levels compared with matched counterparts. Twenty-one percent of older adult SNAP participants and 16 percent of matched income-eligible nonparticipants had low hemoglobin levels; these differences were nonsignificant. These results are consistent with unmatched chapter 3 findings, with the exception of findings for older adults; a lower percentage of

SNAP participants in this age group had normal hemoglobin levels than income-eligible nonparticipants in the unmatched analysis.

8. Serum Vitamin D Levels

Among all individuals aged 1 and older, 66 percent of SNAP participants had adequate serum vitamin D levels, and 69 percent of matched income-eligible nonparticipants had adequate levels (see appendix table G.9). More than three-quarters of children participating in SNAP and matched nonparticipants had adequate serum vitamin D levels. Among adults, a smaller proportion of SNAP participants had adequate serum vitamin D levels than matched income-eligible nonparticipants (58 versus 64 percent). Three-quarters of older adults participating in SNAP and matched nonparticipants had adequate serum vitamin D levels; there were no differences by participant group. The unmatched analysis discussed in chapter 3 found smaller proportions of SNAP participants overall, adults, and older adults had adequate vitamin D levels compared with income-eligible nonparticipants.

D. Usual Intakes of Energy and Selected Nutrients

This section discusses findings for total energy intakes and calories from saturated fats, added sugars, and alcohol. This section also includes a brief discussion of findings for selected nutrients: calcium, vitamin D, fiber, iron, potassium, and sodium. These nutrients were selected for the matched analysis because DGAC identified them as nutrients of public health concern (discussed in chapter 6).

1. Total Calories

Children participating in SNAP had a mean usual intake of 1,880 calories, and matched income-eligible nonparticipants had a mean usual intake of 1,793 calories (see appendix table G.10). Adults participating in SNAP had a mean intake of 2,368 calories, and matched income-eligible nonparticipants had a mean intake of 2,347 calories. Older adults participating in SNAP had a mean intake of 1,714 calories, and matched income-eligible nonparticipants had a mean intake of 1,772 calories. Across all age groups, there were no significant differences in energy intake by participant group; see appendix G for mean energy intake by gender. The unmatched analysis discussed in chapter 5 also found no differences between SNAP participants and income-eligible nonparticipants overall or by age group.

2. Calories From Saturated Fats, Added Sugars, and Alcohol

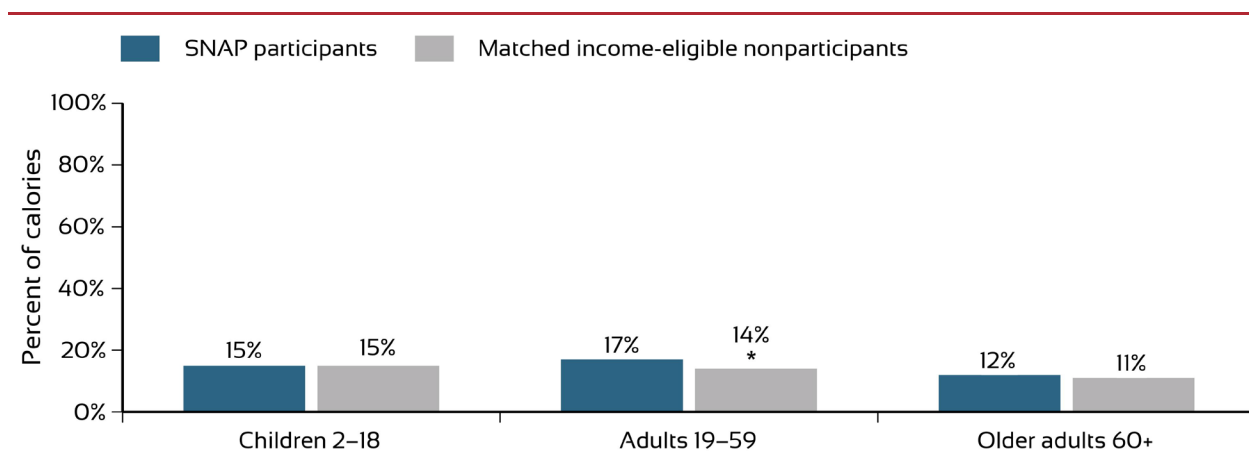
Among all individuals, both SNAP participants and matched income-eligible nonparticipants consumed 11 percent of calories from saturated fats on average, which exceeded the DGA recommendation of less than 10 percent of calories from saturated fat (see appendix table G.11). Women and girls participating in SNAP consumed a greater percentage of calories from saturated fats than matched income-eligible nonparticipants on average (11 versus 10 percent). The unmatched analysis discussed in chapter 5 found no differences in saturated fat consumption between SNAP participants and income-eligible nonparticipants by age or gender.

Mean added sugar consumption also exceeded the DGA recommendation of 10 percent of calories; SNAP participants consumed a greater percentage of calories from added sugars (16 percent) than matched income-eligible nonparticipants on average (14 percent; see appendix table G.11). By age group, there were significant differences in mean added sugar intake among adults only. Adults participating in SNAP consumed a greater mean percentage of calories from added sugar than matched income-eligible nonparticipants (17 versus 14 percent; see figure 7.1). These findings are similar to the

unmatched findings in chapter 5, but the unmatched analysis found children participating in SNAP also consumed a greater percentage of calories from added sugar than income-eligible nonparticipants on average.

Alcohol contributed a small percentage of calories for all individuals. Both SNAP participants and matched income-eligible nonparticipants consumed about 1 percent of calories from alcohol (see appendix table G.11). There were no significant differences in the percentage of calories from alcohol. These findings are consistent with the unmatched results in chapter 5.

Figure 7.2. Mean Percentage of Calories From Added Sugars Among Individuals Aged 2 and Older by Age and Matched Program Participation



Note: Estimates are based on day 1 dietary recalls. Percentages are age adjusted to account for the different age distributions of SNAP participants and nonparticipants. Estimates are weighted to account for differential probabilities of selection, nonresponse to survey instruments, and differences between the final sample and the U.S. civilian noninstitutionalized population. Significant differences in estimates are noted by * $p < .05$ and based on a t -test for difference in means between SNAP participants and matched income-eligible nonparticipants. SNAP participants consist of individuals in households that at the time of data collection reported receiving SNAP benefits.

Source: National Health and Nutrition Examination Survey (NHANES) 2011–2016 dietary recalls. Sample includes NHANES respondents aged 2 and older with complete day 1 dietary recall data. Sample excludes pregnant and breastfeeding women 20–44 years old; pregnant and breastfeeding women outside of these age ranges could not be identified in the data.

3. Selected Nutrients

A higher percentage of SNAP participants met the EAR for vitamin D than matched income-eligible nonparticipants (7 versus 4 percent; see appendix table G.13). There were no differences in the percentage of SNAP participants or matched income-eligible nonparticipants meeting the EAR for calcium or iron (see appendix tables G.12 and G.15). SNAP participants consumed a smaller percentage of the AI for fiber and potassium compared with matched income-eligible nonparticipants on average (see appendix table G.14 and G.16). Mean usual intake of sodium was similar for SNAP participants and matched nonparticipants, but a higher percentage of boys participating in SNAP exceeded the CDRR for sodium compared with matched income-eligible nonparticipants (99 versus 94 percent; see appendix table G.17). These findings differ slightly from those for the unmatched analysis discussed in chapter 6; this analysis found no differences in vitamin D consumption and similar sodium consumption between SNAP participants and unmatched income-eligible nonparticipants.

Chapter 8. Conclusions

This study analyzed 2011–2016 NHANES data to assess and compare the diet quality, nutrition, and health of SNAP participants and nonparticipants. The remainder of this chapter summarizes key study findings and implications.

A. Descriptive Analyses

The study team used descriptive analyses to assess the differences in diet quality, nutrition, and health among SNAP participants compared with income-eligible nonparticipants and higher income nonparticipants. The team recommends using caution when interpreting these results; this research was not designed to measure the impact of SNAP participation on diet quality, and a proportion of these results are expected to be significant by chance.

1. Overall Diet Quality

- ▶ The overall diet quality of Americans does not align well with the DGA. On average, SNAP participants overall and by age group had lower total HEI scores than nonparticipants. However, because little is known about the magnitude of change or difference in HEI scores needed to observe differences in health outcomes, the observed differences may not reflect meaningful differences between the groups.
- ▶ SNAP participants tended to score lower than both groups of nonparticipants for total fruits, whole fruits, total vegetables, and added sugars components. SNAP participants tended to score higher (i.e., better) than either group of nonparticipants for the sodium component. Among older adults, there were no differences in the total HEI and component scores between SNAP participants and income-eligible nonparticipants.

2. Indicators of Nutrition and Health

- ▶ Overall, the prevalence of obesity was higher among SNAP participants than among income-eligible or higher income nonparticipants. However, compared with income-eligible nonparticipants, SNAP children, and boys in particular, had a lower prevalence of obesity, and SNAP older adults had a similar prevalence of obesity.
- ▶ SNAP participants had similar levels of disease risk compared with income-eligible nonparticipants and higher levels of disease risk compared with higher income nonparticipants based on several measures that accounted for abdominal obesity.
- ▶ Overall, more SNAP participants had risk factors for cardiovascular disease compared with nonparticipants. A higher percentage of SNAP participants had low HDL, and a lower percentage had normal TG.
- ▶ A lower percentage of SNAP participants than either group of nonparticipants had normal blood pressure. When examined by age group, this trend prevailed among children and adults; however, a similar percentage of SNAP older adults had normal blood pressure compared with both nonparticipant groups.
- ▶ A higher percentage of SNAP participants than either group of nonparticipants had low hemoglobin; this trend was observed across all age groups.

- ▶ Compared with higher income nonparticipants, SNAP participants had a higher prevalence of diabetes. Children participating in SNAP, however, had a lower prevalence of prediabetes than income-eligible nonparticipants.
- ▶ A lower percentage of SNAP participants had adequate serum vitamin D levels than either income-eligible or higher income nonparticipants.

3. Food Consumption Patterns

- ▶ The percentages of individuals consuming discrete portions of each food group were generally similar for SNAP participants and income-eligible nonparticipants. By contrast, SNAP participants' and higher income nonparticipants' consumption patterns differed for most food groups; these differences were especially pronounced for grains, vegetables, and fruit and 100 percent fruit juice, with a substantially lower percentage of SNAP participants consuming discrete portions from these groups. These differences in food choices likely contributed to the lower intakes of most vitamins, minerals, and fiber observed among some SNAP participants in relation to higher income nonparticipants.
- ▶ Compared with either group of nonparticipants, a lower percentage of SNAP participants reported consuming discrete portions of raw vegetables, fruit and fruit juice (and fresh fruit in particular), unflavored skim milk, and water and a higher percentage reported consuming noncarbonated sweetened drinks (e.g., juice drinks that were not 100 percent fruit juice) and unflavored whole milk.
- ▶ Compared with higher income nonparticipants only, a lower percentage of SNAP participants reported consuming discrete portions of whole grains; a higher percentage reported consuming regular soda.

4. Usual Macronutrient and Calorie Intakes

- ▶ A higher percentage of SNAP participants than higher income nonparticipants had usual intakes of total fat and carbohydrate consistent with the AMDRs and intakes of saturated fat consistent with the DGA recommendation.
- ▶ Usual fiber intakes were below the AI for SNAP participants and both groups of nonparticipants.

5. Usual Micronutrient Intakes

- ▶ In general, SNAP participants and income-eligible nonparticipants had similar usual intakes of vitamins and minerals. Compared with higher income nonparticipants, however, a lower percentage of SNAP participants had adequate usual intakes of all the vitamins and minerals included in the analysis, except vitamin B12, vitamin D, iron, and selenium.
- ▶ Average choline and potassium intakes were below the AI for SNAP participants and both groups of nonparticipants.
- ▶ A lower percentage of SNAP participants than higher income nonparticipants had mean usual intakes of sodium that exceeded the CDRR.

B. Matched Comparative Analyses

The matched analyses focused on a subset of outcomes examined elsewhere in the report. These included HEI-2015 scores, intakes of energy and selected nutrients, and selected indicators of nutrition and health. Differences between SNAP participants and a matched sample of income-eligible nonparticipants were calculated for each outcome and for children, adults, and older adults, separately. Compared with findings from descriptive analyses, which did not control for important demographic and contextual factors, findings from the matched analyses indicate the groups differ on relatively few outcomes; they also help confirm that SNAP children and men have better outcomes for several key indicators. Key findings related to the matched analysis follow:

- ▶ Overall, total HEI scores were similar for SNAP participants and matched income-eligible nonparticipants. Adults participating in SNAP, however, had lower total HEI scores than matched income-eligible nonparticipants.
- ▶ Children participating in SNAP had a lower prevalence of obesity than matched income-eligible nonparticipants. Conversely, adults participating in SNAP had a higher prevalence of obesity than matched income-eligible nonparticipants; this result was driven by women participating in SNAP, who had a significantly higher prevalence of obesity than matched income-eligible nonparticipants.
- ▶ SNAP participants had a higher prevalence of elevated or high blood pressure, lower than recommended HDL levels, and low hemoglobin levels compared with matched income-eligible nonparticipants.
- ▶ A higher percentage of children participating in SNAP had normal blood glucose levels than matched income-eligible nonparticipants. A higher percentage of boys and adult men participating in SNAP had normal blood glucose levels than matched income-eligible nonparticipants. Conversely, a lower percentage of adult women participating in SNAP had normal blood glucose levels than matched income-eligible nonparticipants.
- ▶ Among all individuals, saturated fat and added sugar intakes on a given day exceeded the DGA. SNAP participants consumed a greater percentage of calories from added sugars than matched income-eligible nonparticipants.

C. Implications

Neither the descriptive nor matched analyses were designed to assess the impact of SNAP or infer causality. Still, the results from this study highlight opportunities to improve the diet quality, nutrition, and health of Americans and SNAP participants in particular. Similar to the previous study, findings from this study indicate SNAP participants had a higher prevalence of obesity and diverged from 2015–2020 DGA recommendations more than nonparticipants, especially higher income nonparticipants. Women participating in SNAP had a particularly high prevalence of obesity. Several studies have documented the association between SNAP participation and obesity, particularly among women, and attempted to unpack the paradoxical relationship between obesity and food insecurity (Papan & Clow, 2015; Ploeg & Ralston, 2008; Leung & Villamor, 2010). Although there is no easy answer to this problem, policies and promotion efforts across FNS programs should continue to emphasize physical activity, dietary patterns consistent with the DGA, and energy balance during each stage of life.

FNS reaches millions of children and low-income individuals each day through the nutrition assistance programs it administers nationwide (USDA FNS, 2013). These programs provide not only access to food resources but also nutrition education to assist families in making healthier choices. The FNS core nutrition messages were designed to reach and resonate with mothers and children served by SNAP, WIC, and other Federal nutrition assistance programs. To help SNAP participants better align their diets with the current DGA, FNS core nutrition messages should continue to encourage increased consumption of fruits and vegetables, low-fat milk, and whole grains. Although not currently part of FNS's core messaging, reduced consumption of refined grains, sodium, saturated fats, and added sugars—especially from sugar-sweetened beverages—might also be important to emphasize.

Restructured in 2010 following the enactment of the 2010 Child Nutrition Act (Pub. L. 111–296),³⁰ SNAP-Ed emphasizes obesity prevention in addition to nutrition education. Many SNAP-Ed interventions target low-income children and their families to promote FNS's core nutrition messages and address motivational mediators and intervening factors relevant to low-income mothers and children. These interventions, along with evidence-based interventions that directly target low-income women and aim to improve environmental supports for nutrition and physical activity, could help address the critical issue of obesity.

³⁰ The Act amended section 2 of the Food and Nutrition Act of 2008 to establish a nutrition education and obesity prevention grant program.

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