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Assessing the Nutrient Intakes of Vulnerable Subgroups

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Abstract

This study is a comprehensive analysis of the nutrient adequacy of segments of the population at risk of inadequate nutrient intake, excessive intake, or dietary imbalances, based on the Continuing Survey of Food Intakes by Individuals conducted in 1994-96 and 1998. The segments include adolescent females, older adults, children and adults at risk of overweight, individuals living in food-insufficient households, low-income individuals, and individuals targeted by and participating in food and nutrition assistance programs. The study adds to a growing literature that uses current, improved knowledge of nutrient requirements and recommended nutrient assessment methods to analyze nutrient intakes. The study indicates generally inadequate intakes of key micronutrients, especially magnesium, calcium, folate, and vitamin E; energy intakes less than recommended energy requirements for adults; and consumption of too much food energy from fat and not enough from carbohydrates; and inadequate intakes of fiber. In addition, diet adequacy deteriorates as individuals get older. Children—especially infants and young children—have diets that are more nutritionally adequate than those of adolescents and adults.

Food Assistance and Nutrition Research Program

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I. INTRODUCTION

In recent years, concerns about the nutritional adequacy of the diets of certain population subgroups have arisen. The prevalence of obesity and overweight among children, adolescents, and adults has steadily increased over the past four decades (Kuczmarski et al. 1994; Ogden et al. 2002; and Flegal et al. 2002). Despite increases in overweight, food insecurity persists among some subgroups of the population (Nord et al. 2004), and poor diet quality—especially the consumption of high-fat, energy-dense foods—characterize other subgroups (Kant 2000, 2003).

Subgroups of particular concern include adolescent females, older adults, overweight and obese children and adults, individuals living in food-insecure or food–insufficient households, low-income individuals, and individuals targeted by and participating in food and nutrition assistance programs. This report presents detailed analysis findings from a study assessing the diets of these subgroups using the set of dietary reference standards developed by the Institute of Medicine over the past decade. Assessing the diets of these subgroups focuses on the risk of either inadequate or excessive nutrient intakes, as well as other dietary imbalances.

The study uses data from the 1994-1996 and 1998 Continuing Survey of Food Intakes by Individuals to address two primary research questions:

1. What are the characteristics of the distributions of usual nutrient intake for these subgroups?
   - What proportion of the subgroup has inadequate nutrient intake?
   - What proportion of the subgroup is at risk of excessive nutrient intake?
   - How variable are usual nutrient intakes?
2. Does the day-to-day variation (within-person standard deviation) in nutrient intake vary across population subgroups? For example,
   - Do individuals living in food-insecure households have more or less day-to-day variation in nutrient intake than other individuals?

- Do teenage females have greater or smaller day-to-day variation in nutrient intakes relative to other population subgroups?

This report focuses on the first question related to assessing nutrient adequacy, while a separate report examines the second question on the day-to-day variation in nutrient intake. The remainder of this chapter provides some background information on the nutritional adequacy of the diets of specific population subgroups, presents an overview of the study, and describes the report organization and important study considerations. Chapter II describes the outcomes examined and methods used to address the main research questions. Chapter III presents the results from analyses of the usual nutrient intakes. The concluding chapter summarizes the main findings and their implications. An appendix presents tables with usual intake distributions of selected subgroups.

A. BACKGROUND

As knowledge of the relationship between diet and long-term health has increased, so have concerns about the diets of certain population subgroups. Areas of concern include the increasing prevalence of overweight and obesity, the well-established links between chronic disease and dietary practices, and the persistence of hunger and food insecurity. Several groups appear at risk of nutrient deficiencies, dietary imbalances, or excessive intake. In some cases, these assessments were based on inappropriate methods; new assessments using methods proposed by the Institute of Medicine are needed to confirm these concerns.

Adolescent Females. Adolescence is a unique period of growth and development. In addition to maturing physically, teenagers begin to make a greater number of independent decisions about food consumption. Dietary concerns include thinness and overweight, inadequate intakes of micronutrients, meal-skipping, frequent dieting, and eating disorders.

Adolescent females, particularly low-income ones, appear to have low intakes of several micronutrients—iron, calcium, folate, magnesium, phosphorus, zinc, and vitamins A, C, and E (Herbert 1991; Eck and Hackett-Penner 1992; Life Sciences Research Office 1995; Suitor and Gleason 2002; and Stang and Bayerl 2002). At the same time, the prevalence of overweight and obesity among adolescent females has increased over time (Ogden et al. 2002), and intakes of fat and saturated fat exceed levels recommended by the Dietary Guidelines (Life Sciences Research Office 1995; Munoz et al. 1997; Troiano et al. 2000; and Gleason and Suitor 2001). Adolescent females also are more likely to skip breakfast (Devaney and Stuart 1998; and Gleason and Suitor 2001).

Older Adults. Demographic trends document an increasing proportion of the population that are older Americans. The challenges that older people face in their living arrangements, as well as physical and emotional health, income, and means of transportation, can profoundly influence eating patterns, nutrient intake, and health. Diet-related health problems among older adults include obesity, hypercholesterolemia, and hypertension (Dwyer 1991).

Empirical evidence on the dietary status of older Americans suggest potential inadequacies in the intakes of calcium, magnesium, zinc, and vitamins D, B_6, and B_{12} (Munro et al. 1987; Ponza et al. 1994; Ryan et al. 1992; and Briefel et al. 2000). A substantial proportion also report skipping meals (Ryan et al. 1992).

Overweight and Obese Children, Adolescents, and Adults. Overweight and obesity are associated with a host of adverse diet-related health outcomes. In addition, analyses of data collected through the National Health, and Nutrition Examination Surveys over the past three decades document a substantial increase in the prevalence of overweight and obesity among many age and gender subgroups (Kuczmarski et al. 1994; Mei et al. 1998; Troiano 1995; Ogden et al. 2002; and Flegal et al. 2002). Moreover, the prevalence of obesity is highest among low-income and low-education population subgroups (Drewnowski and Specter 2004).

Empirical evidence shows that the consumption of energy-dense foods is associated with lower intakes of several micronutrients (Kant 2000, 2003), suggesting that overweight subgroups may show evidence of excess energy consumption at the same time as inadequate nutrient intake. Other studies also document the association between overweight and the consumption of energy-dense foods and soft drinks (Bandini et al. 1999; St-Onge et al. 2003; and Drewnowski and Specter 2004).

Food-Insecure Individuals. Although nutrient deficiency diseases are rare in the United States, some Americans do not have adequate access to enough food all the time. Food security, defined as access by all people at all times to enough food for an active and healthy life, continues to be important in assessing the adequacy of the diets of population subgroups (Andrews et al. 2000). Recent estimates suggest that 89 percent of U.S. households were food secure in 2001, and 11 percent were food insecure sometime during the year. About 3.5 percent of all U.S. households in 2001 experienced food insecurity with hunger (Nord et al. 2004).

Food-insecure subgroups are considered at nutritional risk for reasons other than the potential for overall low energy intake. Even if overall food energy intake is low, intake of specific key nutrients may or may not be low. In addition, if the fear or risk of not having enough to eat at all times leads to the consumption of energy-dense foods, food insecurity could also lead to overconsumption and overweight.

Existing research suggests that adult and elderly women living in households that sometimes or often do not have enough to eat (food insufficient) have lower nutrient intakes than other similar women (Rose et al. 1991; and Rose and Oliveira 1997). This relationship does not appear to hold for children (Cristofar and Basiotis 1992; and Rose and Oliveira 1997). A recent study finds that food-insufficient groups are less likely to have adequate zinc intakes but equally likely to have adequate intakes of other key nutrients (Gleason and Suitor 2001).

Low-Income Individuals. Poverty in the United States affects individuals of all ages, from all racial and ethnic groups, and from all regions of the country. Poverty puts individuals at risk for virtually all chronic diseases. Among the dietary concerns associated with low household income are some nutrient deficiencies, dietary excesses and imbalances, increased prevalence of overweight and obesity, and poor diet quality.

Despite overwhelming evidence documenting health disparities by income, including nutrition-related health disparities, evidence on the relationship between household income and nutrient intake levels is mixed, and that relationship has varied considerably over time (Adrian and Daniel 1976; Basiotis et al. 1983; Johnson et al. 1994; and Gleason and Suitor 2001). The third Nutrition Monitoring Report in the United States concludes that low-income adolescents and adults have lower mean intakes of the vitamins and minerals considered to be of public health concern—vitamin A, vitamin C, vitamin B_6, folate, calcium, iron, and zinc (Life Sciences Research Office 1995). In addition, tables prepared from tabulations from the 1994-1996 Continuing Survey of Food Intakes by Individuals show that the percentage of individuals with average intakes less than various cutoff levels decreases with income for some, but not all, nutrients (U.S. Department of Agriculture 1999).

Participants in USDA Food and Nutrition Assistance Programs. In the past four decades, a safety net of food and nutrition assistance programs has been created to help low-income individuals obtain nutritious diets. The largest of these programs are the Food Stamp Program (FSP), the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), the National School Lunch Program (NSLP), and the School Breakfast Program (SBP). Together, these programs affect the daily food consumption of millions of Americans.

A large body of literature exists on the dietary effects of food and nutrition assistance programs. Although the effects of these programs on nutrient intake vary by program, age, and over time, empirical evidence suggests a relationship between program participation and nutrient intakes (Basiotis et al. 1987; Gordon et al. 1995; Rossi 1998; Oliviera et al. 2000; Gleason and Suitor 2003; and Fox et al. 2004). Food and nutrition assistance programs also appear to mediate the effects of other risk factors for poor dietary outcomes. For example, results from one study indicates that girls 5 to 12 years of age from households with food insecurity are less likely to be at risk of obesity-related health problems if they participate in the FSP, NSLP, and SBP (Jones et al. 2003). However, concerns about the fat content of school meals and the increasing prevalence of overweight and obesity among low-income children have caused some to ask whether the food and nutrition assistance programs are meeting the nutritional needs of low-income individuals and school-age children (Besharov and Germanis 2001).

Summary. A large body of literature suggests that several population subgroups are at risk of inadequate or excessive nutrient intake levels. However, much of this literature is dated; many of the studies use old data sets and (even for the most recent analyses) inappropriate methods to assess nutrient adequacy. In particular, while the existing literature typically focuses on a comparison of mean nutrient intake levels across population subgroups, conclusions about the nutrient adequacy of diets (prevalence of either inadequate or excessive intake levels) cannot be based on mean intake levels. This report uses data from the 1994-1996 and 1998 Continuing Survey of Food Intakes by Individuals (CSFII) and methods proposed by the Institute of Medicine to update our knowledge of the nutrient adequacy of the diets of vulnerable population subgroups.

B. STUDY OVERVIEW

Despite a host of empirical studies analyzing the dietary status of the U.S. population and various subgroups, several factors suggest the need for updated research on the dietary status of vulnerable subgroups. First, over the past decade, knowledge of nutrient requirements has increased significantly, resulting in a set of new dietary reference standards called the Dietary Reference Intakes (DRIs) (Institute of Medicine 1997, 1998, 2000b, 2001, 2002). The DRIs replace the 1989 Recommended Dietary Allowances (RDAs) and are the appropriate standards to use in determining whether diets are nutritionally adequate without being excessive. The DRIs differ from the 1989 RDAs in several respects: (1) they are based on a reduction in the risk of chronic disease, rather than merely the absence of signs of deficiency; (2) when data are available, tolerable upper intake levels are established to avoid the risk of adverse effects from excess consumption; and (3) when data are available, reference values are provided for other non-nutrient food components.

Second, studies that assess nutrient adequacy of diets have typically compared mean intake levels to the RDAs. The RDAs, however, are not the appropriate standard for assessing nutrient adequacy of diets. In addition, mean intake levels should not be used to assess either the prevalence of inadequate intake levels or the risk of excessive intake levels (Institute of Medicine 2000a).

A third reason motivating this analysis is the importance of learning more about the variation in individual intake. Individuals vary considerably in the amount of food they eat from day to day; yet it is their usual intakes—not their intakes on a given day—that determine whether their diet is nutritionally adequate. As a result, dietary assessment studies should focus on the usual nutrient intakes of subgroups. An unexplored and interesting question, however, is how the day-to-day variation in individual intake varies across population subgroups.[1] For example, adolescent females—especially those at risk of eating disorders, such as binge eating or dieting—may exhibit greater day-to-day variation in their diets. Or it is possible that individuals living in food-insecure households may have much less variety in their diets, resulting in less day-to-day variation in intake levels. Recent research suggests that, even controlling for energy intakes, diet variety is related to aggregate measures of nutrient adequacy (Murphy et al. 2004).

1. Data Sources

The primary data set used in this analysis is the 1994-1996 and 1998 Continuing Survey of Food Intakes by Individuals (CSFII). The 1994-1996 CSFII provides information on food and nutrient intake over two non-consecutive days for 16,103 individuals of all ages and gender, and of a variety of income levels, racial and ethnic groups, and sociodemographic characteristics. The survey, conducted over three years, was designed so that the information collected on any one year would constitute a nationally representative sample of individuals of all ages. The samples were selected using stratified, clustered multi-stage sampling procedures, with an oversampling of low-income individuals. Food intake data were collected using 24-hour dietary recall questionnaires, which included information on the type and amounts of all foods consumed by individuals over two non-consecutive days. In addition, sociodemographic information, including income and participation in food assistance programs, is provided by the survey.

The 1998 Supplemental Children's Survey was designed to be a one-time supplement to the 1994-1996 CSFII, using the same design and survey methodology of the CSFII. Dietary intake data were collected from 5,559 infants and children aged 0 through 9 years over two non-

[1] As discussed above, the methods and results from the analysis of the day-to-day variation in nutrient intake are the focus of a companion report (Carriquiry et al. 2004).

consecutive days between November 1997 and October 1998. The sample was designed to be a stand-alone, nationally representative sample of children in that age range; also, however, it could be combined with the dietary information collected for infants and children up to nine years of age in the 1994-1996 CSFII. Combining the data from the Supplemental Children's Survey sample and the 1994-96 CSFII sample of children in the same age range (4,253 children) provides a large sample of children birth through age 9. This large sample of children is particularly useful in this study, since one of the high-risk subgroups is that of overweight and obese children.

One disadvantage of the CSFII is that it does not collect information on supplement intakes. The National Health and Nutrition Examination Survey (NHANES), however, does collect some information on supplement use. Using complex, multi-stage stratified clustered samples of the civilian, non-institutionalized population aged two months and older, NHANES III includes both a 24-hour dietary recall and a food frequency-like questionnaire to elicit from respondents information on the consumption of a large variety of vitamin, mineral, and herbal supplements, including usual dosage and brands. While the supplement intake data do not permit estimation of the day-to-day variability in intakes of nutrients from supplement sources (as individuals provided only a self-assessment of "usual" supplement intake), they can still be used, with some caution, to obtain an adjusted distribution of nutrient intakes from all sources.

NHANES III includes a second recall day for only a small subsample of the original sample. Of those who completed a 24-hour recall questionnaire during the first-day interview, a small self-selected sample equal to approximately 5 percent of the original sample received a second 24-hour recall questionnaire, on a non-consecutive day. The replicate sample, though small and non-random, permits estimation of the usual nutrient intake distributions using the methods proposed by the National Research Council (1986) or by Nusser et al. (1996). However, because of small samples for the replicate observations, NHANES III does not allow a full analysis of the subgroups defined and analyzed for this study. For a few subgroups, though, NHANES III data (intakes from foods, beverages, and supplements) are used to determine whether the analysis findings from the NHANES data differ from those based on CSFII data (intakes from foods and beverages, excluding supplements).

2. Analysis Subgroups

Table 1 lists the subgroups analyzed and the unweighted sample sizes for each subgroup. Nine subgroups are the focus of the analysis:

- ***Adolescent females*****:** Female individuals ages 14 to 18 years, excluding pregnant or lactating females
- ***Older adults*****:** Individuals age 60 and older
- ***Individuals at risk of overweight*****:** Individuals ages 20 and under with Body Mass Index (BMI) greater than or equal to the 85th percentile of national standards and individuals age 20 and older with BMI greater than or equal to 25
- ***Individuals in food-insufficient households*****:** Because data on food insecurity are not available from the CSFII data, this high-risk category was defined as individuals living in food-insufficient households. Households that reported (1) “enough of the kinds of food we want to eat” or (2) “enough but not always the kinds of food we want to eat” were defined as food sufficient. Households that reported (3) “sometimes not enough to eat” or (4) “often not enough to eat” were defined as food insufficient.
- ***Individuals in low-income households*****:** Individuals in households with income less than or equal to 185 percent of the federal poverty level (FPL).
- ***FSP participants*****:** Individuals in households who participated in the FSP.
- ***WIC participants*****:** Children under 4 who participated in the Special Supplemental Nutrition Program for Women, Infants, and Children.[2]

[2] Because the DRIs differ for children 1 to 3 years of age and children 4 to 8 years of age, the WIC analysis focuses on children 1 to 3 years of age, even though children 4 years of age are eligible for WIC.

TABLE 1
Analysis Subgroups

High-Risk Subgroup	Sample Size	Comparison Group	Sample Size
Adolescent Females			
14 to 18 years	449	na	na
Older Adults			
Males 60 to 70 years	914	na	na
Males 71 years and over	722	na	na
Females 60 to 70 years	844	na	na
Females 71 years and over	670	na	na
Risk of Overweight		**Nonoverweight**	
Kids 4 to 8 years	1,407	Kids 4 to 8 years	1,819
Kids 9 to 13 years	328	Kids 9 to 13 years	775
Males 14 to 18 years	114	Males 14 to 18 years	352
Males 19 to 30 years	411	Males 19 to 30 years	500
Males 31 to 50 years	1,167	Males 31 to 50 years	620
Males 51 to 70 years	1,131	Males 51 to 70 years	534
Males 71 years and over	357	Males 71 years and over	356
Females 14 to18 years	100	Females 14 to18 years	341
Females 19 to 30 years	290	Females 19 to 30 years	561
Females 31 to 50 years	792	Females 31 to 50 years	874
Females 51 to 70 years	904	Females 51 to 70 years	645
Females 71 years and over	324	Females 71 years and over	325
From Food Insufficient Households		**From Food Sufficient Households**	
Kids 4 to 13 years	173	Kids 4 to 13 years	4,949
Males 14 to 30 years	58	Males 14 to 30 years	1,317
Males 31 to 50 years	56	Males 31 to 50 years	1,741
Males 51 years and over	25	Males 51 years and over	2,361
Females 14 to 30 years	43	Females 14 to 30 years	1,286
Females 31 to 50 years	50	Females 31 to 50 years	1,674
Females 51 years and over	25	Females 51 years and over	2,222
Income below 185% FPL		**Income above 185% FPL**	
Kids 4 to 8 years	1,906	Kids 4 to 8 years	2,029
Kids 9 to 13 years	496	Kids 9 to 13 years	705
Males 14 to 18 years	188	Males 14 to 18 years	286
Males 19 to 30 years	366	Males 19 to 30 years	554
Males 31 to 50 years	523	Males 31 to 50 years	1,283
Males 51 to 70 years	488	Males 51 to 70 years	1,192
Males 71 years and over	309	Males 71 years and over	413
Female 14 to 18 years	181	Female 14 to 18 years	274
Females 19 to 30 years	378	Females 19 to 30 years	504
Females 31 to 50 years	559	Females 31 to 50 years	1,175
Females 51 to 70 years	548	Females 51 to 70 years	1,057
Females 71 years and over	346	Females 71 years and over	324

Table 1 *(continued)*

High-Risk Subgroup	Sample Size	Comparison Group	Sample Size
FSP participants		**Income-eligible FSP nonparticipants**	
Kids 4 to 8 years	745	Kids 4 to 8 years	706
Kids 9 to 13 years	187	Kids 9 to 13 years	158
Males 14 to 18 years	77	Males 14 to 18 years	66
Males 19 to 30 years	67	Males 19 to 30 years	188
Males 31 to 50 years	139	Males 31 to 50 years	226
Males 51 years and over	142	Males 51 years and over	389
Female 14 to 18 years	65	Female 14 to 18 years	68
Females 19 to 30 years	130	Females 19 to 30 years	179
Females 31 to 50 years	209	Females 31 to 50 years	198
Females 51 years and over	174	Females 51 years and over	426
WIC participants		**Income-eligible WIC nonparticipants**	
Kids under 1 year	618	Kids under 1 year	270
Kids 1 to 3 years[a]	883	Kids 1 to 3 years[a]	1,113
NSLP participants[b]		**NSLP nonparticipants**	
Kids 4 to 8 years	854	Kids 4 to 8 years	682
Kids 9 to 13 years	666	Kids 9 to 13 years	458
Males 14 to 18 years	212	Males 14 to 18 years	149
Females 14 to 18 years	163	Females 14 to 18 years	168
SBP participants[b]		**SBP nonparticipants**	
Kids 4 to 8 years	355	Kids 4 to 8 years	727
Kids 9 to 13 years	204	Kids 9 to 13 years	556
Males 14 to 18 years	40	Males 14 to 18 years	169
Females 14 to 18 years	20	Females 14 to 18 years	179

Source: 1994-1996 and 1998 Continuing Survey of Food Intakes by Individuals.

Note: FPL=federal poverty level; FSP=Food Stamp Program; WIC=Special Supplemental Nutrition Program for Women, Infants and Children; NSLP=National School Lunch Program; SBP=School Breakfast Program.

na = not applicable.

[a]Because the DRIs differ for children 1 to 3 years of age and children 4 years of age, this subgroup includes children 1 to 3 years of age only.

[b]Defined as usually participating 5 days per week.

- ***NSLP participants*:** Children and adolescents who reported that they usually participated in the NSLP five times per week
- ***SBP participants*:** Children and adolescents who reported that they usually participated in the SBP five times per week

For some of these subgroups, comparison groups also are examined: non-overweight individuals, individuals in food-sufficient households, higher-income individuals, and income-eligible nonparticipants. In addition, all subgroups are subdivided into age and gender groupings that typically correspond to the DRI age/gender groupings, resulting in 107 analysis subgroups.

3. Nutrients Examined

Because of the large number of high-risk subgroups and their comparison counterparts included in the analysis, it is necessary to focus the nutrient assessment on those nutrients and dietary components of public health significance. The following nutrients are the focus of the analysis and conducted in this report.

Nutrients Included in the Dietary Assessment

Micronutrients	
Vitamin C	Vitamin E
Folate	Calcium
Magnesium	Vitamin A
Iron	Zinc
Vitamin B_{12} (older adults only)	
Macronutrients and Other Dietary Components	
Food energy	Percent of food energy from
Carbohydrate	Fat
Protein	Carbohydrate
Fiber	Protein

II. ANALYSIS METHODS

This study uses the DRIs to assess the nutrient adequacy of the diets of population subgroups at risk of either inadequate or excessive intake levels. Nutrient adequacy involves determining whether the diets of the various subgroups meet their nutrient requirements without being excessive. This chapter first describes the DRIs, then presents the research questions and methods used to address them.

A. DIETARY REFERENCE INTAKES

The DRIs for micronutrients include four reference standards—the Estimated Average Requirement (EAR), the Recommended Dietary Allowance (RDA), the Adequate Intake (AI), and the Tolerable Upper Intake Level (UL) (see Table 2). When sufficient information is available on the distribution of nutrient requirements, a nutrient will have an EAR and an RDA. When information is not sufficient to determine an EAR (and, thus, an RDA), then an AI is set for the nutrient. In addition, many nutrients have a UL. For some nutrients, however, data are not sufficient to estimate the UL reliably. The absence of a UL does not imply that the nutrient does not have a tolerable upper intake level, but, rather, that the available evidence at this times does not permit its estimation.

Table 2: Dietary Reference Intakes

Estimated Average Requirement (EAR)**:** usual intake level that is estimated to meet the requirement of half the healthy individuals in a life stage and gender group. At this level of intake, the other half of the healthy individuals in the specified group would not have their needs met.

Recommended Dietary Allowance (RDA): usual intake level that is sufficient to meet the nutrient requirement of nearly all healthy individuals in a particular age and gender group (97.5 percent of the individuals in a group). If the distribution of requirements in the group is assumed to be normal, the RDA can be derived as the EAR plus two standard deviation of requirements.

Adequate Intake (AI): usual intake level based on experimentally derived intake levels or approximations of observed mean nutrient intakes by a group (or groups) of apparently healthy people who are maintaining a defined nutritional state or criterion of adequacy –used when an EAR and RDA cannot be determined.

Tolerable Upper Intake Level(UL): highest level of usual nutrient intake that is likely to pose no risks of adverse health effects to individuals in the specified life stage group. As intake increases above the UL, the risk of adverse effects increases.

Source: Institute of Medicine, *Dietary Reference Intakes: Applications in Dietary Assessment.* Washington, DC: National Academies Press, 2000a.

For macronutrients and fiber, a somewhat different set of DRIs have been developed (Institute of Medicine 2002). In the case of food energy, dietary requirements are expressed in terms of estimated energy requirements (EERs). An adult EER is defined as the dietary energy intake needed to maintain energy balance in a healthy adult of a given age, gender, weight, height, and level of physical activity. In children, the EER is defined as the sum of the dietary energy intake predicted to maintain energy balance for an individual's age, weight, height, and activity level, plus an allowance for normal growth and development. For fat, protein, and carbohydrate, the DRIs include Acceptable Macronutrient Distribution Ranges (AMDRs) for intakes as a percentage of energy intakes. In addition, the DRIs for carbohydrate and protein include an EAR and an RDA. For fiber, the DRI is expressed as an AI.

B. STUDY QUESTIONS AND METHODOLOGICAL APPROACH

Table 3 provides an overview of the main study questions and outcome measures used in the analysis. The following discussion provides additional detail on this table.

Table 3: Research Questions and Outcome Measures

Outcome Measures	Comments
What are the characteristics of the distribution of usual intake of the high-needs subgroups?	
Mean and median usual nutrient intake Percentiles of the usual nutrient intake distribution	For energy, mean usual intake will be compared with the mean EER for each age/gender subgroup. For nutrients with an AI, mean intake will be compared with the AI.
What proportion of the subgroup has inadequate usual intake?	
Percentage with usual intake < EAR Percentage with usual fat, protein, and carbohydrate intakes outside the AMDR	Measures cannot be used for nutrients for which an EAR has not been determined. For iron in women, prevalence of inadequacy must be estimated using the probability approach (NRC 1986).
What proportion of the subgroup is at risk of excessive intake levels?	
Percentage with usual intake > UL	Measure cannot be used for nutrients for which a UL has not yet been determined.
How does the day-to-day variation in nutrient intake vary across subgroups?	
Estimate of the within-person standard deviation in intake	Of particular interest are the differences in day-to-day variability in intakes across population subgroups

1. What Are the Characteristics of the Distribution of Usual Intake?

In order to describe the characteristics of the usual intake distribution, and to use the DRIs in assessing diets, it is important to have a good estimator for the distribution of usual nutrient intakes in the group. The usual intake of a nutrient is defined as the long-run average intake of the nutrient by the individual (National Research Council [NRC] 1986). Usual intake seldom, if ever, can be observed. Rather, dietary recalls provide data on observed nutrient intakes over some specified period of time. Observed daily intake measures individual usual intake with error. That is, nutrient intake varies from individual to individual in the group, but it also varies from day to day within an individual. The day-to-day variability is "noise," since what we are typically interested in is the individual-to-individual variability in usual nutrient intake. Because for most nutrients, the day-to-day variability in intakes can be larger than the individual-to-individual variability, it is very important to "remove" the effect of this additional variability when estimating the distribution of usual intakes (Beaton et al. 1979).

A simple additive measurement error model that permits adjusting the data for the presence of day-to-day variability was proposed by the NRC (1986). The model proposed by NRC simply posits that the observed daily intake for an individual can be written as a deviation from the individual's usual intake. That is:

$$X_{ij} = x_i + e_{ij},$$

where X_{ij} denotes the observed intake for individual *i* on day *j*, x_i denotes the usual intake of the nutrient by individual *i*, and e_{ij} is the measurement error associated with that individual on that day. In the NRC report, it was assumed that the mean of the distribution of measurement errors is zero, so that the expectation of the daily intakes (conditional on the individual) is equal to the individual's long-run average intake of the nutrient. More precisely, the assumption used in the NRC (1986) report is

$$e_{ij} \sim N(0, \sigma^2_e),$$

so that $E(X_{ij} \mid i) = x_i$ and $Var(X_{ij}) = \sigma^2_x + \sigma^2_e$, where σ^2_x denotes the individual-to-individual variance in nutrient intake.

Notice that under this simple model, the mean of a few days of observed intakes for an individual, denoted $Xbar_i$, is an unbiased estimator of the individual's usual intake. However, the distribution of the observed individual mean intakes over a few days is not an unbiased estimate of the distribution of usual intakes in the group. If we assume that daily intakes for a sample of individuals in a group are observed over *d* days for each individual, then the variance of the distribution of observed means *Xbar* is equal to $\sigma^2_x + (\sigma^2_e / d)$. This follows from the assumptions of the measurement error model above, and implies that unless the number of days of intake *d* available for each individual in the sample is very large, or unless the variance of the measurement error σ^2_e is very small, the distribution of individual observed means will have a spread that is too large relative to the distribution of usual intakes.

Researchers at Iowa State University (ISU) have developed and modified approaches that permit estimating the usual intake distributions with a higher degree of accuracy. The method proposed by Nusser et al. (1996) is known as the ISU method for estimating usual nutrient intake distributions, and is now widely used by the nutrition community (see, for example, Beaton 1994; Carriquiry 1999; and Institute of Medicine 2000a). Software packages are available, which produce estimates of the mean and variance of usual intake in the group, as well as of any percentile of interest (Carriquiry et al. 1995). Standard errors for all quantities that take into account the design of the survey that collected the data are also produced by the software.

2. What Proportion of the Subgroup Has Inadequate Usual Intake?

Assessing the prevalence of nutrient inadequacy in a group requires estimating the proportion of individuals in the group whose usual intakes of a nutrient do not meet requirements. To determine this prevalence accurately requires information on both usual intakes and nutrient requirements for each individual in the subgroup. With this information, determining how many individuals have usual intakes less than their requirements is straightforward: one could simply count them.

Direct observation of the prevalence of nutrient inadequacy is impractical, however, because neither the requirement for the nutrient nor the usual intake of an individual can be observed. Typically, the only nutrient intake information available for a sample of individuals in a group is the daily intake of a nutrient observed over a few days (which can be adjusted at the group level, as discussed above); but nothing is known about individual requirements for the nutrient.

It is possible to show, however, that the proportion of individuals in a group whose usual nutrient intakes do not meet requirements can be approximated if the EAR for the nutrient for the appropriate gender age group and a reliable estimate of the distribution of usual nutrient intakes in the group is available. Beaton (1994) proposed a method for assessing the prevalence of nutrient inadequacy in a group that consists of simply estimating the proportion in the group whose usual intakes do not meet the EAR. Carriquiry (1999) showed that the approach proposed by Beaton (1994) can produce a nearly unbiased estimate of the prevalence of nutrient inadequacy, and recent analyses suggest that this method should be used in assessing the nutrient adequacy of group diets (Institute of Medicine 2000a). The approach, known as the EAR cut-point method, produces a reliable estimate of the prevalence of nutrient inadequacy in a group when the following assumptions hold:

- The distribution of requirements in the group is symmetric around the EAR.
- The requirements for the nutrient and the usual nutrient intake are independent.
- The variance of the distribution of requirements is smaller than the variance of the distribution of usual intakes.

Given the available information about the distribution of requirements, it appears that the above assumptions hold for many nutrients, with notable exceptions being energy and iron in pre-menopausal women. In the case of energy, intakes and requirements are highly correlated as long as individuals in the group are maintaining body weight. In the case of iron requirements, it has been established that the distribution of requirements for some subgroups is skewed with a long tail to the right. While the EAR cut-point method generally cannot be used to assess the prevalence of iron inadequacy, it is still possible to assess iron inadequacy by using the probability approach that was proposed in the NRC report (1986). To use this approach, a probability model based on the requirement distribution for iron is used to estimate the probability of inadequacy at each level of usual intake.

The analysis for this study used the EAR cut-point method to estimate the prevalence of inadequacy for each of the nutrients with an EAR, except iron; to assess iron adequacy, the probability approach is used. Some nutrients have EARs that differ by characteristics such as smoking status (vitamin C) or weight (protein). In these cases, observed intakes are divided by the EAR for each individual, the resulting ratios are adjusted to get “usual” intake-EAR ratios, and the percentages with ratios less than one are estimates of the prevalence of inadequacy.

For micronutrients without an EAR—that is, for nutrients with an AI—usual intakes distributions are presented and mean intakes are compared with the AI. However, for nutrients with an AI, it is important to note that limited inferences can be made regarding the prevalence of inadequacy. If mean intake levels are equal to or exceed the AI, it is likely that the prevalence of inadequacy is low; but if mean intakes are less than the AI, no conclusions can be drawn about the prevalence of inadequacy (Institute of Medicine 2000a).

For food energy, neither the EAR cut-point method nor the probability approach is the approach to assessing energy adequacy. Energy requirements are expressed in terms of estimated energy requirements (EERs). Since populations in balance should have usual intake and EERs distributions with roughly equal mean values, we compare the mean usual intake of food energy to mean EER for each subgroup to assess energy adequacy. EERs are calculated based on the equations provided in the macronutrient report (Institute of Medicine 2002). For age and gender subgroups where the equations depend on an assumed level of physical activity, the low active level is assumed.

For fat, protein, and carbohydrate, tables present usual distributions of intake as a percentage of energy intake and the percentage outside the AMDR. In addition, usual intake distributions of protein and carbohydrate are presented along with percentage below the EAR.

3. What Proportion Is At Risk of Excessive Intake Levels?

To estimate the proportion of each subgroup at risk of excessive intake levels, we calculate the percentage with usual intake exceeding the UL. Because ULs have not been established for all nutrients, this research question can be addressed only for those nutrients with ULs. In addition, since some ULs refer to intakes from supplements, and since the CSFII data do not include intakes from supplements, those nutrients cannot be examined with respect to the percentage exceeding the UL.

4. How Does the Day-to-Day Variation in Nutrient Intake Vary Across Subgroups?

Daily nutrient intakes are more variable from day-to-day for an individual than they are across individuals in a group (Sempos et al. 1985; and Nusser et al. 1996). In addition, it has been argued that the day-to-day variability in intakes is not homogeneous across individuals in a group (Nusser et al. 1996; and Institute of Medicine 2000a). For example, it has been shown that the within-individual variance of daily intake is positively associated with individual mean intake, so that those individuals with higher daily consumption of a nutrient also tend to have a larger variability of intake. A companion report investigates whether the day-to-day variability in intakes of different subgroups is a function of such factors as food insufficiency, gender and age group, and other sociodemographic characteristics (Carriquiry et al. 2004).

C. IMPORTANT DATA AND METHODOLOGICAL CONSIDERATIONS

Some important issues need to be considered when interpreting the results presented in the following chapter. The first is that the CSFII data do not include intakes from food supplements. Although we conducted a limited analysis of supplement use using data from NHANES III, small sample sizes and methodological issues associated with combining supplement use and dietary recall data limit the usefulness of that analysis.

A second important data consideration is the accuracy of 24-hour dietary recalls, and how the accuracy may vary across subgroups. Many studies have documented the underestimation of energy intakes among adult subgroups, especially among overweight adults (Mertz et al. 1991; Johannsson et al. 1998; and Schoeller 2002). To the extent that lower reported energy intakes are related to lower nutrient intake levels, the prevalence of inadequacy is overestimated for subgroups that exhibit underreporting. In addition, some studies suggest that food and nutrient intakes are overreported for young children (Devaney et al. 2004). If this overreporting of energy intakes is associated with higher nutrient intakes, the prevalence of inadequacy for these subgroups would be underestimated.

Another data issue concerns folate intakes. The data used in this analysis are from the 1994-1996 and 1998 CSFII, which were collected prior to the mandatory folic acid fortification of the food supply. Thus, folate intakes in this analysis underestimate current folate intakes. In addition, folate intakes from the CSFII are not in Dietary Folate Equivalents, which are the form in which the folate DRIs are expressed.

In addition, usual fiber intake from the CSFII is the intake of dietary fiber, while fiber requirements are expressed as total fiber, defined as the sum of dietary fiber and functional fiber. Thus, intake of dietary fiber is less than total fiber intake. Estimates suggest that total fiber intakes are, on average, 5.1 grams higher than dietary fiber intakes (Institute of Medicine 2002).

Finally, in interpreting the nutrient adequacy results for NSLP and SBP participants, it is important to note that the NSLP and SBP programs underwent significant changes in the mid 1990s, with the design and implementation of the School Meals Initiative for Healthy Children. In particular, USDA regulations in June 1995 required school food authorities to prepare meals that met new nutrition standards for fat, saturated fat, and other key nutrients. These requirements were not imposed on most schools during the period covered by the 1994-1996 CSFII, so dietary intakes of NSLP and SBP participants surveyed during that time period may not accurately reflect current intakes of program participants.

III. ANALYSIS RESULTS

This study assessing the nutrient adequacy of the diets of vulnerable subgroups has yielded a comprehensive and very detailed set of analysis results on the usual intake distributions of the various subgroups and how intakes compare with requirements. This chapter presents these results. For each subgroup examined, four tables summarizing the usual nutrient intake distributions are presented: (1) micronutrient intake; (2) estimated energy requirements and usual energy intake; (3) macronutrient intake; and (4) dietary fiber intake. Because of small sample sizes for food-insufficient households, these results are presented in the appendix.

The analysis presented in this report is descriptive only. Some of the high-risk subgroups have data presented on comparison subgroups: overweight and non-overweight individuals, low-income and higher-income individuals, food assistance program participants and income-eligible nonparticipants, and school nutrition program participants and nonparticipants. These comparison subgroups are intended to provide a context for interpreting the nutrient adequacy of the diets of the high-risk subgroups and should not be interpreted as suggesting impacts of the factors or characteristics that distinguish the groups. The individual comparisons do not account for other factors affecting nutrient intake, or for potential selection bias affecting comparisons of program participants and nonparticipants who may differ in important and unobservable ways.

A. SUMMARY OF KEY ANALYSIS RESULTS

Overall, the empirical findings show inadequate intakes of key micronutrients, imbalances in fat and carbohydrate intake, and inadequate intake of fiber. In general, children have more nutritionally adequate diets than adults. Dietary intakes appear to be underreported for adults and overreported for children, and overweight females appear to have higher levels of underreporting than other subgroups. The following is a summary of the key empirical findings:

- ***Most adolescent and adult subgroups have inadequate intakes of micronutrients.*** All eight key micronutrients examined—vitamin C, vitamin E, folate, calcium, magnesium, vitamin A, iron, and zinc—have moderate to high proportions with inadequate usual intakes for male and female subgroups 14 years and older.

  - Magnesium, folate and vitamin E have very high proportions with inadequate intake. Estimates of the prevalence of inadequacy for these nutrients typically exceed 70 percent for the adult subgroups and are 90 percent or higher for adolescent females.
  - Although the adequacy of calcium intake cannot be determined, mean intakes of calcium are far below the AI.
  - The prevalence of inadequate iron intake is lower than for other micronutrients, yet some subgroups—adolescent females and women in the reproductive years—have substantial proportions (10 to 20 percent) not meeting iron requirements.
  - The prevalence of inadequate intakes is typically higher for low-income subgroups relative to higher-income subgroups, and for some (but not all) overweight subgroups relative to their non-overweight counterparts.

- ***Reported energy intakes are less than estimated energy requirements for most adolescent and adult subgroups.*** Mean usual intake of food energy is less than mean Estimated Energy Requirement (EER) for the vast majority of the adolescent and adult subgroups. The difference is so large that underreporting of foods consumed must be at least a partial explanation.

  - The difference between mean EER and mean energy intake is greater for the overweight subgroups, especially female overweight subgroups, suggesting that underreporting may be associated with being overweight.
  - The difference between mean EER and mean energy intake is less for male subgroups than for female subgroups. Some male subgroups—non-overweight males 19 to 50 years of age, for example—have mean energy intake close to mean EER.

- ***For almost all adult subgroups, high proportions have usual intakes of fat outside the AMDR.*** Of those with usual fat intakes outside the AMDR, most exceed the upper bound of the AMDR. More than a third of most adult subgroups have usual intakes of fat greater than 35 percent of food energy.

- ***Dietary fiber intakes of all subgroups are low.*** For every subgroup examined, mean intake of dietary fiber is less than the AI for total fiber. Even the 90th percentile of dietary fiber intake is less than the AI for total fiber, suggesting inadequate intake of total fiber.

- ***The nutrient adequacy of diets deteriorates as individuals age.*** Children 1 to 3 years have the most nutritionally adequate diets, and children 4 to 8 years and 9 to 13 years have more nutritionally adequate diets than the older subgroups.

- The prevalence of inadequate usual intake for micronutrients is less for children than for adolescents and adults, and differences by income and overweight status are less.
- In contrast to adults, children 1 to 3 years and 4 to 8 years have reported energy intakes that *exceed* energy requirements. At least part of this difference may be the result of overreporting of intakes by parents of young children, a finding reported in other studies of intakes of infants and toddlers (Devaney 2004).
- Similar to adults, a high proportion of children 4 to 8 years and 9 to 13 years have usual fat intakes exceeding the upper limit of the AMDR. In contrast, high proportions of very young children 1 to 3 years have usual fat intakes less than the lower bound of the AMDR, partly reflecting the difference in the AMDR by age.

B. DETAILED ANALYSIS RESULTS

Adolescent Females. Adolescent females have low intakes of all micronutrients examined. The prevalence of inadequacy—percentage with usual intake less than requirements—is high, ranging from 18.7 percent for zinc to more than 90 percent for vitamin E, folate, and magnesium (Table 4a). The prevalence of inadequate vitamin E intake is almost 100 percent. Although the prevalence of inadequate calcium intake cannot be estimated precisely, mean calcium intake is far below the AI, suggesting low calcium intakes for adolescent females.

Table 4a

Usual Nutrient Intake: Micronutrients, Adolescent Females

	Usual Intake Percentiles						Assessing Inadequacy	
	10th	25th	Median	Mean	75th	90th	EAR[a]	% Inadeq[b]
Vitamin C (mg/d)	39	56	81	91	115	155	56	28.9
Vitamin E (mg/d)	5	6	7	7	8	9	12	99.5
Folate (mcg/d)	130	163	208	218	262	320	330	91.6
Calcium (mg/d)	434	551	704	732	882	1,065	**1,300**	…
Magnesium (mg/d)	151	180	215	220	253	295	300	90.1
Vitamin A (mcg RAE)	286	389	539	593	737	966	485	41.3
Iron (mg/d)	8.7	10.6	12.9	13.6	15.8	19.3	7.9	12.3
Zinc (mg/d)	6.4	7.8	9.6	9.9	11.6	13.8	7.3	18.7

Source: 1994-1996 CSFII.

[a]EAR = Estimated Average Requirement. For vitamin C, the EAR is 35 mg/d higher for smokers. For calcium, the value is an AI = adequate intake.

[b]For most nutrients, the % Inadequate = % with usual intakes < EAR. For iron, the probability approach is used to estimate the % Inadequate.

Both the mean and median of usual energy intake of adolescent females, as well as the estimated percentiles of the usual energy intake distributions, are less than the comparable percentiles of the EER distributions (Table 4b). Of particular importance in assessing energy intakes is that mean energy intake of 1901 kilocalories (kcal) is approximately 200 kcal less than the mean EER. This difference between mean usual intake and mean energy requirement is most likely the result of underreporting of foods consumed, since a deficit of 200 kcal per day over a period of time would lead to weight loss of approximately 10 pounds per year (Butte and Ellis 2003). Recent studies document that not only is this not the case, but that, in fact, increasing proportions of adolescent females, as well as many subgroups, are overweight (Ogden et al. 2002). Weight gain, not weight loss, is the observed problem.

Table 4b

Estimated Energy Requirements And Usual Intake Of Food Energy: Adolescent Females

	Distribution Percentiles (kcal)					
	10th	25th	Median	Mean	75th	90th
Usual intake	1,365	1,594	1,872	1,901	2,177	2,473
EER[a]	1,833	1,943	2,077	2,107	2,214	2,407

Source: 1994-1996 CSFII
[a]EER = Estimated Energy Requirement.

The usual intake of macronutrients shows that a high percentage of adolescent females has usual intake of fat that falls outside the AMDR of 25 to 35 percent of food energy (Table 4c). Almost one third of female adolescents have usual fat intakes as a percent of food energy outside the AMDR—slightly more than one quarter have usual fat intakes greater than 35 percent of food energy and 5 percent have usual fat intakes as a percent of food energy less than 25 percent. The percentage outside the AMDR for carbohydrate and protein is low, and the prevalence of inadequate intake of carbohydrate and protein intake is also low.

Table 4c

Usual Nutrient Intake: Macronutrients, Adolescent Females

	Fat		Carbohydrate		Protein	
	% < AMDR[a]	%> AMDR	% Inadeq[b]	% < AMDR	% Inadeq	% outside AMDR
Females 14-18	4.8	25.9	< 1	3.4	5.5	< 1

Source: 1994-1996 CSFII.
[a]AMDR = Acceptable Macronutrient Distribution Range.
[b]% Inadequate = % with usual intakes < EAR (Estimated Average Requirement)

Usual intakes of dietary fiber for adolescent females are far below the AI set for total fiber (Table 4d). Mean usual dietary fiber intake is 13 grams per day, compared with an AI for total fiber of 26 grams. Even if the average difference between total and dietary fiber (5.1 grams) is added to usual intakes, mean intake will still be below the AI.

Table 4d

Usual Intake of Dietary Fiber: Adolescent Females

	Usual Intake Distributions (g/d)						
	AI[a]	10th	25th	Median	Mean	75th	90th
Females 14-18	26	9	10	12	13	15	17

Source: 1994-1999 CSFII.
[a]AI = Adequate Intake.

Older Adults. With the exception of iron and vitamin B_{12}, each of the four subgroups of older adults shows a high prevalence of inadequacy of the micronutrients examined (Table 5a). For vitamin E, more than 90 percent of older women and more than three-quarters of older men had usual intakes less than their requirement. Magnesium and folate intakes also indicate a high prevalence of inadequacy, ranging from about 70 to 85 percent. The prevalence of inadequacy is lower for vitamin C, vitamin A, and zinc, though a substantial proportion (from 21 to 43 percent)

Table 5a
Usual Nutrient Intake: Micronutrients, Older Adults

	Usual Intake Percentiles						Assessing Inadequacy	
	10th	25th	Median	Mean	75th	90th	EAR[a]	% Inadeq[b]
Vitamin C (mg/d)								
Males 60-70	38	59	91	104	135	186	75	42.7
Males 71+	32	53	88	102	135	190	75	42.8
Females 60-70	36	55	84	95	123	167	60	35.0
Females 71+	37	56	85	93	121	161	60	31.5
Vitamin E (mg/d)								
Males 60-70	5	7	9	9	12	15	12	78.2
Males 71+	4	6	8	9	10	14	12	83.2
Females 60-70	4	5	6	7	8	11	12	94.7
Females 71+	3	4	6	6	8	10	12	95.3
Folate (mcg/d)								
Males 60-70	158	205	269	290	351	448	320	67.1
Males 71+	140	189	260	283	352	456	320	67.6
Females 60-70	125	161	210	222	270	336	320	87.4
Females 71+	122	161	215	230	283	357	320	83.9
Calcium (mg/d)								
Males 60-70	435	568	750	794	971	1,210	**1,200**	…
Males 71+	398	526	700	741	911	1,137	**1,200**	…
Females 60-70	314	423	570	604	748	936	**1,200**	…
Females 71+	311	413	550	580	714	888	**1,200**	…
Magnesium (mg/d)								
Males 60-70	196	242	300	311	368	440	350	69.5
Males 71+	171	215	270	281	334	405	350	79.5
Females 60-70	149	184	226	232	273	323	265	71.6
Females 71+	136	171	216	222	267	318	265	74.4
Vitamin A (mcg RAE)								
Males 60-70	418	589	869	1,017	1,263	1,784	625	28.3
Males 71+	368	548	823	987	1,228	1,786	625	32.2
Females 60-70	309	434	631	726	905	1,245	500	33.7
Females 71+	349	488	709	828	1,024	1,445	500	26.3
Iron (mg/d)								
Males 60-70	10.5	13.1	16.3	17.3	20.4	25.3	6.0	<1
Males 71+	8.8	11.5	15.1	16.4	19.9	25.5	6.0	2.4
Females 60-70	7.5	9.4	11.8	12.4	14.8	18.1	5.0	2.8
Females 71+	7.1	9.1	11.7	12.4	14.9	18.5	5.0	3.2
Zinc (mg/d)								
Males 60-70	7.9	9.6	11.8	12.3	14.4	17.4	9.4	22.5
Males 71+	6.7	8.3	10.6	11.3	13.6	16.7	9.4	37.2
Females 60-70	5.4	6.6	8.2	8.5	10.0	12.1	6.8	27.5
Females 71+	5.2	6.4	8.0	8.3	9.8	11.9	6.8	30.6
Vitamin B12 (mcg/d)								
Males 60-70	2.3	3.3	5.2	7.1	8.3	13.6	2.0	2.5
Males 71+	2.2	3.1	4.6	5.9	7.1	10.5	2.0	4.7
Females 60-70	1.5	2.3	3.5	4.5	5.5	8.4	2.0	12.5
Females 71+	1.5	2.0	3.4	4.9	5.6	9.5	2.0	20.4

Source: 1994-1996 CSFII.

[a]EAR = Estimated Average Requirement. For vitamin C, the EAR is 35 mg/d higher for smokers. For calcium, the value is an AI = Adequate Intake.

[b]For most nutrients, the % Inadequate = % < EAR. For iron, the probability approach is used to estimate the % Inadequate.

still has usual intakes less than requirements. For vitamin B_{12}—a nutrient of concern among older adults—the prevalence of inadequacy is low for males (3 to 5 percent) and higher for females (13 to 20 percent). The prevalence of inadequacy for iron is low for all subgroups of older adults.

As with adolescent females, both the mean and median of usual energy intake of older adults, as well as the estimated percentiles of the usual energy intake distributions, are considerably less than the comparable percentiles of the EER distributions (Table 5b). Mean energy intakes are about 20 percent lower (about 500 kcal) than estimated EERs for older adult males and about 25 percent lower than estimated EERs for older adult females. This difference between mean usual intake and mean EER is even larger than for other subgroups examined and is most likely the result of either underreporting of foods consumed, since a deficit of 400-500 kcal per day over a period of time would lead to unsustainable weight losses. As with almost all U.S. population subgroups, the prevalence of overweight and obesity has increased for older results over the past four decades (Flegal et al. 2002; and Kuczmarski et al. 1994).

Table 5b

Estimated Energy Requirements And Usual Intake Of Food Energy: Older Adults

	Distribution Percentiles (kcal)					
	10th	25th	Median	Mean	75th	90th
Males 60-70						
Usual intake	1,397	1,681	2,018	2,066	2,397	2,794
EER[a]	2,136	2,328	2,540	2,544	2,767	2,962
Males 71+						
Usual intake	1,176	1,440	1,773	1,821	2,150	2,527
EER	1,899	2,118	2,336	2,330	2,556	2,738
Females 60-70						
Usual intake	1,022	1,218	1,451	1,481	1,710	1,979
EER	1,658	1,806	1,989	1,997	2,168	2,345
Females 71+						
Usual intake	952	1,134	1,356	1,381	1,602	1,842
EER	1,481	1,640	1,814	1,827	1,996	2,162

Source: 1994-1996 CSFII

[a]EER = Estimated Energy Requirement.

The usual intake of macronutrients shows a substantial proportion of older adults have usual intakes of fat and carbohydrate that fall outside the AMDRs (Table 5c). About one third of older females and about 40 percent of older males have usual fat intakes that exceed the upper value of the AMDR. In addition, the percent with usual intake less than the AMDR for carbohydrate is also high—12 to 16 percent of older females and between one fifth and one quarter of older males. The percent outside the AMDR for protein is low (less than 1 percent), though the prevalence of inadequate protein intake is about 20 percent for older females and 8 to 16 percent for older males.

Table 5c

Usual Nutrient Intake: Macronutrients, Older Adults

	Fat		Carbohydrate		Protein	
	% < AMDR[a]	% > AMDR	% Inadeq[b]	% < AMDR	% Inadeq	% outside AMDR
Males 60-70	1.4	40.5	< 1	26.2	8.0	< 1
Males 71+	1.5	36.6	1.6	20.6	15.6	< 1
Females 60-70	1.6	31.1	3.5	16.0	18.2	< 1
Females 71+	2.3	28.3	4.3	11.6	20.4	< 1

Source: 1994-1996 CSFII.
[a]AMDR = Acceptable Macronutrient Distribution Range.
[b]% Inadequate = % with usual intakes < EAR (Estimated Average Requirement).

For older adults, usual intakes of dietary fiber are far below the AI set for total fiber (Table 5d). Mean usual dietary fiber intake is 19 and 18 grams per day for older males ages 60 to 70 and 71 and older, respectively, compared with an AI for total fiber of 30 grams. For older females, mean dietary fiber intake is 14 grams, compared with an AI of 21 grams. For both older males and females, the 90th percentile of usual dietary fiber intake is less than or close to the AI.

Table 5d

Usual Intake of Dietary Fiber: Older Adults

	Usual Intake Distributions (g/d)						
	AI[a]	10th	25th	Median	Mean	75th	90th
Males 60-70	30	10	13	18	19	23	28
Males 71+	30	9	12	17	18	22	27
Females 60-70	21	8	11	14	14	18	22
Females 71+	21	8	10	14	14	17	21

Source: 1994-1999 CSFII.
[a]AI = Adequate Intake.

Overweight Individuals.[1] Overall, the adequacy of micronutrient intake does not differ by overweight status (Table 6a). For adolescents and adults, the prevalence of inadequate usual intakes of vitamin C, vitamin E, folate, magnesium, and vitamin A is generally high for both overweight and non-overweight individuals and for both male and female subgroups. There is a low prevalence of inadequacy for iron, while for zinc, the prevalence of inadequacy is low among children but increases with age.

Most differences between overweight and non-overweight subgroups in the percentage with inadequate intakes are small, with the following exceptions:

- Adolescent overweight males have a higher prevalence of inadequate vitamin C intakes than adolescent non-overweight males (34 percent versus 21 percent). The opposite pattern is observed for vitamin C intakes for the adolescent female subgroups (17 percent versus 29 percent).
- For folate, overweight children aged 9 to 13 years, overweight adolescent females, and overweight females aged 19 to 50 years have a higher prevalence of inadequate intakes compared with comparable age and gender groups who are not overweight.

[1] Overweight for children and adolescents means at risk of overweight and is defined as BMI greater than the 85th percentile for children up through age 20. For adults over 20 years of age, overweight is defined as BMI greater than 25.

Table 6a

Usual Nutrient Intake: Micronutrients, Overweight Status

	Usual Intake Percentiles						Assessing Inadequacy		Usual Intake Percentiles						Assessing Inadequacy	
	10th	25th	Median	Mean	75th	90th	EAR[a]	% Inadeq[b]	10th	25th	Median	Mean	75th	90th	EAR[a]	% Inadeq[b]
	Vitamin C (mg/d)								**Vitamin E (mg/d)**							
Kids 4 - 8, overweight	50	69	96	103	129	165	22	0.4	4	5	6	6	7	9	6	52.3
Kids 4 - 8, not overweight	48	65	90	97	121	154	22	0.4	4	5	6	6	7	9	6	49.6
Kids 9 - 13, overweight	44	61	84	91	114	147	39	6.6	5	6	7	7	8	10	9	83.5
Kids 9 - 13, not overweight	48	67	95	105	132	174	39	5.1	5	6	7	8	9	11	9	72.8
Males 14 - 18, overweight	35	55	86	102	132	187	63	33.8	6	7	9	9	11	13	12	83.7
Males 14 - 18, not overweight	51	74	109	124	158	216	63	20.7 *	6	7	9	9	11	13	12	85.1
Males 19 - 30, overweight	44	64	94	107	136	185	75	33.2	6	8	10	10	12	15	12	73.4
Males 19 - 30, not overweight	47	71	110	128	164	232	75	40.6	6	8	10	10	12	15	12	74.4
Males 31 - 50, overweight	37	57	90	104	136	190	75	45.8	7	8	10	10	12	15	12	73.9
Males 31 - 50, not overweight	43	64	96	108	138	188	75	43.2	6	8	10	11	s	16	12	70.4
Males 51 - 70, overweight	38	59	91	104	135	188	75	42.9	5	7	9	9	11	15	12	79.1
Males 51 - 70, not overweight	39	62	99	114	149	207	75	41.6	5	7	9	9	11	15	12	79.0
Males 71+, overweight	29	50	84	98	130	184	75	45.3	4	6	8	9	11	15	12	81.1
Males 71+, not overweight	35	57	92	106	139	194	75	39.9	4	6	7	8	10	13	12	87.0
Females 14 - 18, overweight	57	65	75	76	86	97	56	16.9	4	5	7	7	8	10	12	96.0
Females 14 - 18, not overweight	37	55	83	95	121	168	56	29.4 *	6	6	7	7	8	8	12	100.0
Females 19 - 30, overweight	45	61	84	91	114	147	60	36.4	5	6	7	7	8	9	12	99.8
Females 19 - 30, not overweight	38	55	81	90	115	154	60	34.9	4	6	7	8	9	11	12	93.1
Females 31 - 50, overweight	36	52	76	85	109	147	60	42.6	4	5	7	7	9	11	12	93.2
Females 31 - 50, not overweight	32	49	76	88	113	158	60	43.6	4	6	7	7	9	11	12	93.6
Females 51 - 70, overweight	38	56	83	93	120	162	60	34.3	4	5	7	7	8	10	12	95.6
Females 51 - 70, not overweight	35	55	86	96	125	170	60	36.7	4	5	7	7	8	11	12	95.1
Females 71+, overweight	43	62	88	96	122	158	60	25.8	4	5	6	6	8	10	12	96.7
Females 71+, not overweight	35	54	82	91	118	158	60	34.5	3	4	6	6	8	10	12	95.9
	Folate (mcg/d)								**Calcium (mg/d)**							
Kids 4 - 8, overweight	163	205	259	271	323	393	160	9.2	551	686	851	872	1,034	1,219	**800**	…
Kids 4 - 8, not overweight	161	205	262	272	326	395	160	9.6	582	711	874	896	1,057	1,240	**800**	…
Kids 9 - 13, overweight	149	187	239	251	301	369	250	55.3	633	751	898	917	1,062	1,225	**1,300**	…
Kids 9 - 13, not overweight	173	215	271	285	340	414	250	40.6 **	598	747	941	975	1,166	1,397	**1,300**	…
Males 14 - 18, overweight	162	204	263	281	338	422	330	73.0	641	830	1,093	1,168	1,424	1,790	**1,300**	…
Males 14 - 18, not overweight	170	226	306	329	406	519	330	57.1	645	841	1,108	1,175	1,436	1,790	**1,300**	…
Males 19 - 30, overweight	175	225	294	314	382	479	320	58.5	572	729	940	988	1,195	1,466	**1,000**	…
Males 19 - 30, not overweight	176	224	294	321	390	501	320	57.9	556	716	937	997	1,515	1,725	**1,000**	…
Males 31 - 50, overweight	162	209	274	294	357	450	320	65.1	469	626	850	922	1,139	1,467	**1,000**	…

	Usual Intake Percentiles						Assessing Inadequacy		Usual Intake Percentiles						Assessing Inadequacy	
	10th	25th	Median	Mean	75th	90th	EAR[a]	% Inadeq[b]	10th	25th	Median	Mean	75th	90th	EAR[a]	% Inadeq[b]
Males 31 - 50, not overweight	171	223	293	318	384	494	320	58.7	518	665	862	906	1,099	1,350	**1,000**	…
Males 51 - 70, overweight	156	203	267	289	349	447	320	67.6	435	567	748	794	971	1,212	**1,200**	…
Males 51 - 70, not overweight	156	206	275	293	361	455	320	64.6	402	539	728	776	961	1,213	**1,200**	…
Males 71+, overweight	138	187	256	278	345	445	320	69.1	373	502	683	733	909	1,158	**1,200**	…
Males 71+, not overweight	143	194	265	287	356	458	320	66.5	428	551	715	748	908	1,110	**1,200**	
Females 14 - 18, overweight	157	180	207	211	238	270	330	98.9	461	552	665	681	793	920	**1,300**	…
Females 14 - 18, not overweight	126	161	208	220	266	328	330	90.3 *	443	564	721	749	904	1,091	**1,300**	…
Females 19 - 30, overweight	135	164	202	209	246	292	320	94.7	376	480	617	644	779	948	**1,000**	…
Females 19 - 30, not overweight	129	168	222	236	289	362	320	82.8 **	408	523	677	707	858	1,046	**1,000**	…
Females 31 - 50, overweight	122	156	202	214	259	322	320	89.7	339	449	597	631	776	967	**1,000**	…
Females 31 - 50, not overweight	119	160	217	234	290	370	320	82.0 **	379	492	642	674	821	1,010	**1,000**	…
Females 51 - 70, overweight	123	158	203	217	261	327	320	89.0	322	428	570	601	740	919	**1,200**	…
Females 51 - 70, not overweight	126	163	215	229	279	351	320	85.0	352	453	589	621	755	932	**1,200**	…
Females 71+, overweight	122	159	210	223	273	341	320	86.6	296	393	527	564	695	879	**1,200**	…
Females 71+, not overweight	130	169	223	236	288	358	320	83.2	343	443	571	592	719	868	**1,200**	…
				Magnesium (mg/d)								**Vitamin A (mcg RAE)**				
Kids 4 - 8, overweight	155	182	215	220	252	290	110	0.9	419	526	667	702	838	1,027	275	1.1
Kids 4 - 8, not overweight	159	184	216	220	251	286	110	0.5	452	560	704	731	872	1,042	275	0.6
Kids 9 - 13, overweight	166	197	236	241	280	324	200	26.9	371	479	630	672	819	1,027	420	16.1
Kids 9 - 13, not overweight	178	209	246	253	289	335	200	20.0	471	592	752	788	945	1,149	420	5.7
Males 14 - 18, overweight	190	232	288	299	354	424	340	70.6	383	513	704	775	959	1,257	630	40.6
Males 14 - 18, not overweight	213	256	312	322	377	445	340	61.9	418	588	838	926	1,167	1,544	630	29.2
Males 19 - 30, overweight	214	265	329	344	405	491	330	50.4	360	493	689	762	950	1,255	625	42.1
Males 19 - 30, not overweight	196	246	313	328	394	481	330	56.2	384	510	693	758	934	1,213	625	40.8
Males 31 - 50, overweight	210	259	323	335	398	477	350	60.0	364	512	730	829	1,031	1,410	625	35.4
Males 31 - 50, not overweight	211	264	331	342	409	487	350	56.8	389	537	750	833	1,034	1,376	625	38.2
Males 51 - 70, overweight	197	244	301	311	367	438	350	69.7	389	544	791	921	1,153	1,596	625	27.6
Males 51 - 70, not overweight	189	241	307	319	385	465	350	65.0	427	597	881	995	1,263	1,682	625	33.6
Males 71+, overweight	170	213	270	282	339	410	350	78.1	377	559	850	999	1,271	1,802	625	33.7
Males 71+, not overweight	169	213	269	279	334	400	350	79.7	357	532	812	955	1,217	1,726	625	30.9
Females 14 - 18, overweight	142	166	197	202	231	267	300	96.3	367	461	587	618	741	907	485	29.7
Females 14 - 18, not overweight	151	182	219	223	260	301	300	89.7	271	374	525	578	723	952	485	43.6
Females 19 - 30, overweight	154	177	204	207	234	264	255	86.6	293	393	536	582	720	928	500	43.9
Females 19 - 30, not overweight	154	188	229	237	277	329	255	64.7 **	279	393	562	640	798	1,095	500	41.2
Females 31 - 50, overweight	148	179	218	225	262	311	265	76.1	321	428	577	628	769	994	500	37.6
Females 31 - 50, not overweight	156	195	242	250	295	352	265	62.0 **	296	415	587	653	816	1,092	500	37.1
Females 51 - 70, overweight	152	184	225	231	272	318	265	72.0	303	420	590	672	827	1,134	500	28.3
Females 51 - 70, not overweight	160	195	238	245	287	340	265	65.2	353	477	652	719	884	1,163	500	36.9
Females 71+, overweight	139	172	213	218	259	304	265	77.7	336	467	703	860	1,068	1,538	500	21.1

Table 6a

	Usual Intake Percentiles						Assessing Inadequacy		Usual Intake Percentiles						Assessing Inadequacy	
	10th	25th	Median	Mean	75th	90th	EAR[a]	% Inadeq[b]	10th	25th	Median	Mean	75th	90th	EAR[a]	% Inadeq[b]
Females 71+, not overweight	139	174	220	227	272	325	265	72.3	407	528	713	773	950	1,205	500	29.0
	Iron (mg/d)								**Zinc (mg/d)**							
Kids 4 - 8, overweight	9.4	11.1	13.4	14.0	16.2	19.5	4.1	<1	6.6	7.9	9.5	9.9	11.5	13.5	4.0	0.2
Kids 4 - 8, not overweight	9.5	11.2	13.4	14.0	16.2	19.0	4.1	<1	6.8	7.9	9.4	9.6	11.1	12.8	4.0	0.1
Kids 9 - 13, overweight	10.5	12.5	15.0	15.5	18.0	21.0	5.9/5.7	<1	7.7	9.0	10.8	11.1	12.9	15.1	7.0	5.5
Kids 9 - 13, not overweight	10.8	13.0	15.8	16.6	19.3	23.3	5.9/5.7	<1	7.8	9.2	11.1	11.4	13.2	15.5	7.0	4.7
Males 14 - 18, overweight	12.2	14.6	17.9	18.9	22.1	26.7	7.7	<1	10.0	11.7	13.8	14.2	16.3	18.9	8.5	2.7
Males 14 - 18, not overweight	12.7	15.6	19.4	20.5	24.2	29.6	7.7	<1	10.1	11.9	14.3	14.7	17.0	19.9	8.5	2.7
Males 19 - 30, overweight	12.7	15.3	18.4	19.3	22.3	26.9	6.0	<1	10.2	12.3	14.8	15.3	17.9	21.3	9.4	6.3
Males 19 - 30, not overweight	12.5	15.1	18.4	19.6	22.9	28.1	6.0	<1	9.3	11.3	13.9	14.5	17.0	20.6	9.4	10.7
Males 31 - 50, overweight	11.7	14.3	17.7	18.8	22.0	27.3	6.0	<1	9.1	11.1	13.7	14.4	16.9	20.3	9.4	11.9
Males 31 - 50, not overweight	11.6	14.2	18.0	19.3	23.0	28.7	6.0	<1	9.2	11.2	13.8	14.6	17.1	20.8	9.4	11.1
Males 51 - 70, overweight	10.5	12.9	16.1	17.2	20.2	25.2	6.0	<1	8.3	10.0	12.3	12.9	15.1	18.1	9.4	19.2
Males 51 - 70, not overweight	10.0	12.6	16.3	17.2	20.8	25.6	6.0	1.2	7.4	9.4	11.9	12.6	14.8	18.4	9.4	24.7
Males 71+, overweight	8.9	11.5	15.2	16.4	20.0	25.3	6.0	2.1	7.0	8.7	10.8	11.5	13.5	16.8	9.4	33.2
Males 71+, not overweight	8.5	11.2	15.0	16.3	20.0	25.7	6.0	3.2	6.5	8.3	10.5	11.1	13.2	16.5	9.4	37.7
Females 14 - 18, overweight	8.9	10.5	12.5	13.1	15.0	17.9	7.9	10.9	6.8	8.1	9.8	10.1	11.8	13.9	7.3	15.2
Females 14 - 18, not overweight	8.8	10.7	13.1	13.6	15.9	19.2	7.9	12.2	6.5	7.8	9.5	9.7	11.4	13.2	7.3	17.9
Females 19 - 30, overweight	8.9	10.4	12.3	12.6	14.5	16.7	8.1	15.2	6.5	7.6	8.9	9.1	10.4	11.9	6.8	13.3
Females 19 - 30, not overweight	8.4	10.3	12.9	13.6	16.1	19.8	8.1	15.7	6.4	7.6	9.2	9.6	11.2	13.2	6.8	14.2
Females 31 - 50, overweight	8.0	9.7	12.0	12.6	14.7	17.9	8.1	18.9	6.2	7.4	9.0	9.3	10.8	12.7	6.8	16.1
Females 31 - 50, not overweight	7.9	10.1	12.7	13.6	16.1	20.1	8.1	17.2	5.8	7.2	9.1	9.7	11.6	14.3	6.8	20.2
Females 51 - 70, overweight	7.7	9.4	11.6	12.2	14.3	17.4	5.0	2.2	5.7	6.9	8.3	8.6	10.0	11.9	6.8	23.6
Females 51 - 70, not overweight	8.0	9.8	12.2	12.8	15.1	18.3	5.0	1.5	5.9	7.0	8.4	8.7	10.1	11.9	6.8	21.9
Females 71+, overweight	7.4	9.2	11.6	12.2	14.5	17.6	5.0	2.7	5.7	6.8	8.2	8.4	9.8	11.5	6.8	25.5
Females 71+, not overweight	7.2	9.1	11.8	12.6	15.2	18.9	5.0	2.9	4.8	6.1	7.7	8.2	9.7	12.1	6.8	35.5

Source: 1994-1996, 1998 CSFII.

[a]EAR = Estimated Average Requirement. For Vitamin C, the EAR is 35 mg/d higher for smokers. For calcium, the value is an AI = Adequate Intake.

[b]For most nutrients, the % Inadequate = % < EAR. For iron, the probability approach is used to estimate the % Inadequate.

*(**): p-value for difference between overweight and non-overweight is < 0.05(0.01)

Table 6a

- Mean calcium intakes of overweight females are consistently less than mean calcium intakes of non-overweight females, although the differences are not statistically significant.
- For magnesium, overweight females generally have a higher prevalence of inadequacy than non-overweight females.

As observed for the adolescent and older adult subgroups, both the mean and median of usual energy intake of the adult subgroups, as well as the estimated percentiles of the usual energy intake distributions, are less than the comparable percentiles of the EER distributions (Table 6b). The difference between mean energy intake and mean EER is greater for the overweight subgroups, especially female overweight subgroups, a finding reported in previous studies (Briefel et al. 1997, 1995). For overweight females, mean energy intakes are about 40 percent lower (550 to 700 kcal) than mean EER for all age subgroups. As before, this difference between mean usual intake and mean EER is most likely the result of underreporting of foods consumed, since the reported deficit in energy intake is inconsistent with both overweight status and the increasing prevalence of overweight and obesity.

For the non-overweight subgroups, the difference between energy requirements and mean energy intakes is much less (Table 6b). In fact, for non-overweight adolescent males and adult males 19 to 50 years of age, mean energy intake and mean EERs are close in value.

For overweight and non-overweight children 4 to 8 years of age, mean energy intakes *exceed* mean EERs (Table 6b). Although the excess consumption of energy relative to energy requirements is consistent with the increasing prevalence of overweight and obesity, the magnitude of the difference—more than 200 kcal—would imply a weight gain in excess of what has been observed. For example, an excess of 200 kcal per day over a period of time implies a weight gain of approximately 10 pounds per year (Butte and Ellis 2003), which appears large even in the context of the increasing prevalence of overweight among children.

Table 6b

Estimated Energy Requirements and Usual Intake of Food Energy: Overweight Status

	Distribution Percentiles (kcal)					
	10th	25th	Median	Mean	75th	90th
Kids 4 - 8, overweight						
Usual intake	1,358	1,556	1,786	1,823	2,053	2,337
EER[a]	1,226	1,344	1,531	1,563	1,759	1,945
Kids 9 - 13, overweight						
Usual intake	1,444	1,703	2,027	2,073	2,394	2,763
EER	1,696	1,875	2,165	2,237	2,529	2,887
Males 14 - 18, overweight						
Usual intake	1,833	2,168	2,614	2,716	3,151	3,730
EER	2,857	3,089	3,282	3,343	3,582	3,937
Males 19 - 30, overweight						
Usual intake	1,852	2,231	2,711	2,784	3,258	3,812
EER	2,702	2,828	3,044	3,071	3,254	3,531
Males 31 - 50, overweight						
Usual intake	1,700	2,045	2,494	2,579	3,019	3,566
EER	2,519	2,702	2,886	2,909	3,107	3,311
Males 51 - 70, overweight						
Usual intake	1,459	1,747	2,103	2,148	2,501	2,895
EER	2,333	2,521	2,719	2,728	2,917	3,134
Males 71+, overweight						
Usual intake	1,178	1,435	1,771	1,836	2,167	2,579
EER	2,102	2,271	2,481	2,473	2,689	2,825
Females 14 - 18, overweight						
Usual intake	1,277	1,482	1,729	1,751	1,996	2,254
EER	2,124	2,232	2,371	2,416	2,546	2,755
Females 19 - 30, overweight						
Usual intake	1,244	1,469	1,750	1,789	2,067	2,384
EER	2,137	2,270	2,502	2,495	2,642	2,877
Females 31 - 50, overweight						
Usual intake	1,174	1,395	1,657	1,696	1,953	2,265
EER	2,028	2,170	2,352	2,379	2,538	2,746
Females 51 - 70, overweight						
Usual intake	1,039	1,247	1,502	1,532	1,785	2,063
EER	1,859	2,005	2,156	2,177	2,334	2,499
Females 71+, overweight						
Usual intake	973	1,161	1,386	1,405	1,629	1,861
EER	1,665	1,781	1,968	1,958	2,112	2,264

	Distribution Percentiles (kcal)					
	10th	25th	Median	Mean	75th	90th
Kids 4 - 8, not overweight						
Usual intake	1,364	1,542	1,751	1,772	1,979	2,207
EER	1,301	1,411	1,533	1,548	1,658	1,822
Kids 9 - 13, not overweight						
Usual intake	1,559	1,792	2,070	2,113	2,385	2,719
EER	1,608	1,770	1,942	1,982	2,153	2,402
Males 14 - 18, not overweight						
Usual intake	1,930	2,306	2,786	2,865	3,338	3,903
EER	2,375	2,595	2,816	2,815	3,070	3,249
Males 19 - 30, not overweight						
Usual intake	1,843	2,242	2,735	2,858	3,331	4,020
EER	2,401	2,571	2,786	2,759	2,954	3,083
Males 31 - 50, not overweight						
Usual intake	1,709	2,049	2,444	2,504	2,889	3,373
EER	2,268	2,411	2,607	2,618	2,812	2,985
Males 51 - 70, not overweight						
Usual intake	1,393	1,713	2,120	2,184	2,586	3,058
EER	2,027	2,214	2,410	2,411	2,612	2,799
Males 71+, not overweight						
Usual intake	1,193	1,456	1,775	1,805	2,121	2,455
EER	1,836	2,017	2,186	2,191	2,380	2,521
Females 14 - 18, not overweight						
Usual intake	1,421	1,662	1,922	1,948 *	2,203	2,504
EER	1,806	1,904	2,025	2,024	2,137	2,223
Females 19 - 30, not overweight						
Usual intake	1,308	1,545	1,829	1,854	2,136	2,431
EER	1,859	1,970	2,090	2,101	2,233	2,343
Females 31 - 50, not overweight						
Usual intake	1,181	1,410	1,677	1,715	1,980	2,297
EER	1,755	1,871	2,012	2,010	2,160	2,258
Females 51 - 70, not overweight						
Usual intake	1,098	1,281	1,507	1,533	1,757	2,003
EER	1,609	1,727	1,870	1,872	2,010	2,146
Females 71+, not overweight						
Usual intake	964	1,129	1,332	1,356	1,557	1,780
EER	1,426	1,540	1,711	1,696	1,857	1,957

Source: 1994-1996, 1998 CSFII.

[a]EER = Estimated Energy Requirement.

*: p-value for difference in mean intakes between overweight and non-overweight is < 0.05

The intake of macronutrients shows high percentages with usual intakes of fat and carbohydrate that fall outside the AMDRs (Table 6c). The percentage with usual fat intakes exceeding the upper bound of the AMDR is higher for overweight individuals than for non-overweight individuals in most age-gender groups. For carbohydrate, the percentage with usual intake below the lower bound of the AMDR does not differ much between overweight and non-overweight females, but is larger for overweight children and adult males than for non-overweight children and adult males. The percent outside the AMDR for protein is low (less than 1 percent), although the prevalence of inadequate protein intake is between 20 and 30 percent for the overweight adult female subgroups. For almost all age and gender subgroups, the percentage with inadequate usual intake is significantly higher for overweight than for non-overweight individuals, presumably reflecting the higher protein requirements for overweight individuals.

Usual intakes of dietary fiber for both the overweight and non-overweight subgroups are far below the AI set for total fiber (Table 6d). For all subgroups, mean usual dietary fiber intake is considerably less than the AI. For most subgroups, even the 90th percentile of usual dietary fiber intake is less than the AI.

Low-Income Individuals. As shown for other subgroups, the prevalence of inadequate usual intakes of folate, magnesium, vitamin A, and zinc for adolescent and adult subgroups is generally high for both low-income and higher-income individuals (Table 7a). However, the prevalence of inadequate intakes for these nutrients is usually higher for low-income subgroups, especially for low-income elderly subgroups compared with higher-income elderly subgroups. For calcium, a similar pattern is observed; mean usual intake of calcium for low-income age and gender subgroups is less than the mean usual intake for the higher-income age and gender

Table 6c
Usual Nutrient Intake: Macronutrients, Overweight Status

	Fat		Carbohydrate		Protein	
	% < AMDR[a]	% > AMDR	% Inadeq	% < AMDR	% Inadeq	% outside AMDR
Kids 4 - 8, overweight	1.4	25.0	<1	2.0	<1	<1
Kids 4 - 8, not overweight	2.0	19.5	<1	<1 *	<1	<1
Kids 9 - 13, overweight	<1	28.6	<1	1.9	4.6	<1
Kids 9 - 13, not overweight	<1	22.2	<1	<1	<1 **	<1
Males 14 - 18, overweight	<1	38.9	<1	8.4	13.3	<1
Males 14 - 18, not overweight	2.9	26.3	<1	<1 *	<1 **	<1
Males 19 - 30, overweight	<1	25.3	<1	21.8	4.4	<1
Males 19 - 30, not overweight	<1	27.3	<1	15.5	1.1 **	<1
Males 31 - 50, overweight	<1	42.4	<1	29.6	4.8	<1
Males 31 - 50, not overweight	<1	32.3 **	<1	19.3 **	1.1 **	<1
Males 51 - 70, overweight	<1	44.2	<1	31.7	9.9	<1
Males 51 - 70, not overweight	2.1	34.6 **	1.1	22.8 **	3.7 **	<1
Males 71+, overweight	<1	40.3	1.6	21.9	21.7	<1
Males 71+, not overweight	2.9	33.2	1.3	18.5	9.0 **	<1
Females 14 - 18, overweight	3.3	42.4	<1	4.4	19.3	<1
Females 14 - 18, not overweight	5.2	21.8 *	<1	2.6	2.7 *	1.1
Females 19 - 30, overweight	<1	35.9	<1	12.8	26.3	2.4
Females 19 - 30, not overweight	1.7	25.2	<1	10.3	3.0 **	2.0
Females 31 - 50, overweight	<1	38.5	1.7	18.6	23.9	<1
Females 31 - 50, not overweight	1.7	31.8 *	2.3	16.1	5.4 **	<1
Females 51 - 70, overweight	1.2	36.6	3.0	19.0	27.3	<1
Females 51 - 70, not overweight	2.7	25.4 **	2.0	15.0	4.1 **	<1
Females 71+, overweight	<1	30.1	4.1	11.2	30.1	<1
Females 71+, not overweight	3.9 **	25.4	2.8	9.4	11.0 **	<1

Source: 1994-1996, 1998 CSFII.
[a]AMDR = Acceptable Macronutrient Distribution Range.
[b]% Inadequate = % < EAR (Estimated Average Requirement).
*(**): p-value for difference between overweight and non-overweight is < .05(0.01)

Table 6d
Usual Intake of Dietary Fiber: Overweight Status

	Usual Intake Distributions (g/d)						
	AI[a]	10th	25th	Median	Mean	75th	90th
Kids 4 - 8, overweight	25	8	10	12	12	14	17
Kids 4 - 8, not overweight	25	9	10	12	12	14	16
Kids 9 - 13, overweight	31/26	9	11	13	14	16	19
Kids 9 - 13, not overweight	31/26	10	11	14	14	16	19
Males 14 - 18, overweight	38	10	13	16	17	20	24
Males 14 - 18, not overweight	38	12	14	17	18	21	25
Males 19 - 30, overweight	38	10	13	18	18	23	28
Males 19 - 30, not overweight	38	10	13	17	19	23	29
Males 31 - 50, overweight	38	11	14	18	19	22	27
Males 31 - 50, not overweight	38	11	14	19	20	24	29
Males 51 - 70, overweight	30	10	13	18	18	23	28
Males 51 - 70, not overweight	30	10	13	18	19	23	29
Males 71+, overweight	30	9	12	16	17	22	27
Males 71+, not overweight	30	9	12	17	18	22	27
Females 14 - 18, overweight	26	9	11	12	12	13	15
Females 14 - 18, not overweight	26	8	10	12	13	15	18
Females 19 - 30, overweight	25	8	10	12	12	14	17
Females 19 - 30, not overweight	25	8	10	13	14 *	16	20
Females 31 - 50, overweight	25	8	10	13	13	16	19
Females 31 - 50, not overweight	25	8	10	14	15 **	18	23
Females 51 - 70, overweight	21	8	11	14	14	17	21
Females 51 - 70, not overweight	21	9	11	14	15	18	22
Females 71+, overweight	21	8	10	13	14	17	21
Females 71+, not overweight	21	8	11	14	14	18	22

Source: 1994-1996, 1998 CSFII.
[a]AI = Adequate Intake.
*(**): p-value for difference in mean intakes between overweight and non-overweight is <0.05(0.01)

Table 7a

Usual Nutrient Intake: Micronutrients, Low-Income Individuals

	Usual Intake Percentiles						Assessing Inadequacy		Usual Intake Percentiles						Assessing Inadequacy	
	10th	25th	Median	Mean	75th	90th	EAR[a]	% Inadeq[b]	10th	25th	Median	Mean	75th	90th	EAR[a]	% Inadeq[b]
	Vitamin C (mg/d)								**Vitamin E (mg/d)**							
Kids 4 - 8, LE 185% FPL[b]	50	68	94	101	126	161	22	< 1	4	5	6	6	7	9	6	48.2
Kids 4 - 8, GT 185% FPL	50	67	92	100	124	159	22	< 1	4	5	6	6	7	9	6	51.0
Kids 9 - 13, LE 185% FPL	44	61	87	95	120	157	39	6.9	5	6	7	7	8	10	9	82.7
Kids 9 - 13, GT 185% FPL	49	68	96	105	132	173	39	4.5	5	6	7	8	9	11	9	73.1
Males 14 - 18, LE 185% FPL	43	65	98	112	144	197	63	28.1	6	8	9	9	10	12	12	90.5
Males 14 - 18, GT 185% FPL	49	72	108	125	158	220	63	20.5	6	7	9	9	11	14	12	80.5
Males 19 - 30, LE 185% FPL	50	71	102	114	144	192	75	35.1	6	8	10	10	12	15	12	75.2
Males 19 - 30, GT 185% FPL	43	66	102	120	154	218	75	37.9	6	8	10	10	12	15	12	74.7
Males 31 - 50, LE 185% FPL	38	60	95	111	144	205	75	47.4	5	7	9	10	12	16	12	74.4
Males 31 - 50, GT 185% FPL	40	60	91	104	134	186	75	44.0	6	8	10	10	12	16	12	73.0
Males 51 - 70, LE 185% FPL	31	52	85	101	133	192	75	50.7	4	6	8	8	10	13	12	86.3
Males 51 - 70, GT 185% FPL	40	62	95	109	141	195	75	40.4 **	6	7	9	10	12	15	12	76.3 *
Males 71+, LE 185% FPL	26	41	65	75	98	138	75	61.2	3	4	6	6	8	10	12	95.3
Males 71+, GT 185% FPL	39	63	101	115	151	208	75	34.4 **	5	6	9	10	12	16	12	76.8 **
Females 14 - 18, LE 185% FPL	46	62	84	91	113	145	56	23.5	4	5	6	7	8	10	12	96.1
Females 14 - 18, GT 185% FPL	37	54	79	89	114	155	56	30.5	5	6	7	7	8	10	12	98.6
Females 19 - 30, LE 185% FPL	37	56	84	94	122	165	60	36.2	4	5	6	7	8	10	12	96.8
Females 19 - 30, GT 185% FPL	40	57	80	88	111	147	60	36.2	5	6	7	7	9	10	12	96.1
Females 31 - 50, LE 185% FPL	34	50	76	86	110	151	60	46.4	4	5	6	7	8	10	12	96.1
Females 31 - 50, GT 185% FPL	33	50	76	87	111	154	60	42.1	4	6	7	8	9	11	12	92.2
Females 51 - 70, LE 185% FPL	32	46	68	77	98	132	60	48.1	4	5	6	6	7	9	12	98.0
Females 51 - 70, GT 185% FPL	39	60	90	100	130	175	60	31.3 **	4	5	7	7	9	11	12	93.5
Females 71+, LE 185% FPL	36	53	78	87	111	148	60	35.9	3	4	5	5	6	8	12	98.3
Females 71+, GT 185% FPL	40	60	90	99	128	169	60	27.6	4	5	7	7	9	11	12	92.9
	Folate (mcg/d)								**Calcium (mg/d)**							
Kids 4 - 8, LE 185% FPL	165	207	265	278	334	409	160	8.7	568	691	841	863	1,010	1,184	**800**	…
Kids 4 - 8, GT 185% FPL	163	207	262	271	324	388	160	9.2	581	714	881	903 *	1,067	1,252	**800**	…
Kids 9 - 13, LE 185% FPL	156	193	243	253	302	365	250	53.6	592	713	862	886	1,032	1,209	**1,300**	…
Kids 9 - 13, GT 185% FPL	171	213	271	286	343	421	250	40.8 *	623	774	969	1,001 **	1,193	1,420	**1,300**	…
Males 14 - 18, LE 185% FPL	173	218	278	294	353	434	330	68.5	609	785	1,024	1,081	1,315	1,627	**1,300**	…
Males 14 - 18, GT 185% FPL	166	223	305	333	412	534	330	57.0	677	872	1,141	1,214	1,476	1,844	**1,300**	…
Males 19 - 30, LE 185% FPL	201	245	304	316	373	446	320	56.6	598	747	947	992	1,187	1,444	**1,000**	…
Males 19 - 30, GT 185% FPL	161	213	289	317	390	509	320	58.9	530	696	927	992	1,217	1,538	**1,000**	…
Males 31 - 50, LE 185% FPL	159	207	271	287	350	436	320	66.7	439	602	837	914	1,141	1,488	**1,000**	…
Males 31 - 50, GT 185% FPL	164	213	282	305	372	474	320	61.9	502	652	858	911	1,112	1,389	**1,000**	…
Males 51 - 70, LE 185% FPL	136	180	245	266	329	424	320	73.0	378	500	668	712	875	1,101	**1,200**	…
Males 51 - 70, GT 185% FPL	159	205	275	297	363	460	320	64.2	441	576	761	806 **	987	1,229	**1,200**	…
Males 71+, LE 185% FPL	119	160	218	237	294	379	320	80.9	323	438	599	646	803	1,028	**1,200**	…

	Usual Intake Percentiles						Assessing Inadequacy		Usual Intake Percentiles						Assessing Inadequacy	
	10th	25th	Median	Mean	75th	90th	EAR[a]	% Inadeq[b]	10th	25th	Median	Mean	75th	90th	EAR[a]	% Inadeq[b]
Males 71+, GT 185% FPL	159	211	284	306	377	480	320	61.0 **	466	590	753	788 **	948	1,153	**1,200**	…
Females 14 - 18, LE 185% FPL	132	159	194	200	234	276	330	97.6	484	581	703	720	840	977	**1,300**	…
Females 14 - 18, GT 185% FPL	135	170	217	229	275	338	330	88.7 *	428	550	711	743	901	1,099	**1,300**	…
Females 19 - 30, LE 185% FPL	115	154	209	226	280	360	320	84.0	374	483	628	656	798	976	**1,000**	…
Females 19 - 30, GT 185% FPL	137	172	220	230	276	336	320	87.0	404	520	675	707	858	1,051	**1,000**	…
Females 31 - 50, LE 185% FPL	106	138	187	204	250	323	320	89.6	316	424	576	619	768	979	**1,000**	…
Females 31 - 50, GT 185% FPL	126	165	218	232	284	357	320	83.8	382	492	638	667	810	990	**1,000**	…
Females 51 - 70, LE 185% FPL	111	142	184	197	238	298	320	93.0	290	398	546	582	727	921	**1,200**	…
Females 51 - 70, GT 185% FPL	128	165	216	230	280	351	320	84.8 **	355	456	592	622	755	928	**1,200**	…
Females 71+, LE 185% FPL	117	151	198	212	258	324	320	89.4	298	391	512	534	653	799	**1,200**	…
Females 71+, GT 185% FPL	128	171	231	246	304	383	320	79.1 *	338	444	586	618 **	758	939	**1,200**	…
	Magnesium (mg/d)								**Vitamin A (mcg RAE)**							
Kids 4 - 8, LE 185% FPL	157	182	214	220	251	289	110	< 1	398	507	653	698	839	1,047	275	1.2
Kids 4 - 8, GT 185% FPL	159	185	218	221	254	289	110	< 1	439	553	700	732	876	1,064	275	< 1
Kids 9 - 13, LE 185% FPL	170	196	227	232	262	299	200	28.0	404	516	659	701	837	1,045	445/420	11.7
Kids 9 - 13, GT 185% FPL	179	212	252	259	299	348	200	18.7 *	449	574	743	783	949	1,168	445/420	7.5
Males 14 - 18, LE 185% FPL	202	240	290	297	346	403	340	72.8	439	571	755	809	987	1,247	630	33.0
Males 14 - 18, GT 185% FPL	206	252	314	328	388	467	340	60.0 *	411	580	833	930	1,172	1,570	630	30.0
Males 19 - 30, LE 185% FPL	212	261	324	336	398	474	330	52.2	365	474	623	661	807	1,007	625	50.4
Males 19 - 30, GT 185% FPL	199	250	315	333	397	490	330	55.3	365	507	719	825	1,020	1,406	625	39.3
Males 31 - 50, LE 185% FPL	187	241	310	328	400	495	350	62.5	286	414	636	743	954	1,322	625	48.9
Males 31 - 50, GT 185% FPL	218	266	328	339	400	475	350	58.5	410	558	771	857	1,056	1,406	625	32.9 **
Males 51 - 70, LE 185% FPL	169	215	273	285	341	415	350	77.4	355	527	783	946	1,177	1,729	625	34.6
Males 51 - 70, GT 185% FPL	202	250	310	320	378	452	350	66.0 **	422	578	824	933	1,161	1,564	625	30.0
Males 71+, LE 185% FPL	149	187	235	246	292	356	350	89.1	269	421	674	822	1,055	1,552	625	45.6
Males 71+, GT 185% FPL	187	231	288	298	355	423	350	73.6 **	456	639	919	1,046	1,309	1,787	625	23.8 **
Females 14 - 18, LE 185% FPL	166	187	212	214	239	265	300	97.9	335	419	532	558	669	814	485	39.5
Females 14 - 18, GT 185% FPL	141	173	214	221	262	310	300	87.7 *	282	390	551	613	766	1,020	485	40.1
Females 19 - 30, LE 185% FPL	138	171	213	220	262	311	255	72.2	256	357	501	558	692	926	500	49.8
Females 19 - 30, GT 185% FPL	158	188	225	230	266	309	255	69.4	297	414	590	659	827	1,107	500	37.5
Females 31 - 50, LE 185% FPL	133	166	211	220	263	318	265	75.7	286	382	518	572	700	920	500	46.8
Females 31 - 50, GT 185% FPL	159	195	237	244	285	336	265	65.8 **	326	445	614	673	833	1,091	500	33.2 *
Females 51 - 70, LE 185% FPL	138	168	206	213	250	298	265	80.9	258	366	528	610	756	1,053	500	45.9
Females 51 - 70, GT 185% FPL	165	198	239	246	286	334	265	65.1 **	354	475	647	715	875	1,155	500	28.6 **
Females 71+, LE 185% FPL	130	159	195	200	236	277	265	86.7	324	461	669	793	974	1,394	500	29.8
Females 71+, GT 185% FPL	145	185	235	242	291	346	265	64.5 **	415	542	742	817	1,009	1,301	500	19.7
	Iron (mg/d)								**Zinc (mg/d)**							
Kids 4 - 8, LE 185% FPL	9.5	11.2	13.5	14.0	16.2	19.3	4.1	<1	7.0	8.2	9.7	10.0	11.5	13.5	4.0	0.1
Kids 4 - 8, GT 185% FPL	9.5	11.2	13.4	13.9	16.1	18.8	4.1	<1	6.5	7.7	9.2	9.4	10.9	12.7	4.0	0.1
Kids 9 - 13, LE 185% FPL	10.7	12.6	14.8	15.3	17.5	20.5	5.9/5.7	<1	8.0	9.2	10.7	11.0	12.5	14.3	7.0	3.5
Kids 9 - 13, GT 185% FPL	10.6	12.9	15.9	16.6	19.5	23.5	5.9/5.7	1.2	7.7	9.2	11.1	11.5	13.4	15.9	7.0	5.7

Table 7a

	Usual Intake Percentiles						Assessing Inadequacy		Usual Intake Percentiles						Assessing Inadequacy	
	10th	25th	Median	Mean	75th	90th	EAR[a]	% Inadeq[b]	10th	25th	Median	Mean	75th	90th	EAR[a]	% Inadeq[b]
Males 14 - 18, LE 185% FPL	12.6	15.1	18.5	19.4	22.7	27.5	7.7	<1	9.1	11.2	14.0	14.5	17.2	20.7	8.5	6.9
Males 14 - 18, GT 185% FPL	12.4	15.4	19.5	20.7	24.7	30.6	7.7	<1	10.8	12.3	14.4	14.7	16.7	19.2	8.5	1.0
Males 19 - 30, LE 185% FPL	12.8	15.2	18.1	18.7	21.5	25.2	6.0	<1	9.9	12.0	14.6	15.2	17.7	21.1	9.4	7.4
Males 19 - 30, GT 185% FPL	12.5	15.1	18.6	19.8	23.1	28.5	6.0	<1	9.5	11.5	14.0	14.7	17.1	20.6	9.4	9.5
Males 31 - 50, LE 185% FPL	10.4	13.5	17.7	19.2	23.2	29.9	6.0	1.1	9.1	11.3	14.1	15.0	17.8	22.0	9.4	11.8
Males 31 - 50, GT 185% FPL	11.9	14.3	17.9	18.9	22.1	27.0	6.0	<1	9.2	11.0	13.6	14.2	16.7	20.2	9.4	11.6
Males 51 - 70, LE 185% FPL	9.2	11.9	15.2	16.1	19.3	24.1	6.0	2.2	7.7	9.4	11.4	11.9	13.9	16.6	9.4	25.6
Males 51 - 70, GT 185% FPL	10.7	13.3	16.5	17.5	20.6	25.5	6.0	<1	8.1	9.9	12.3	13.0	15.3	18.9	9.4	20.3
Males 71+, LE 185% FPL	7.7	9.8	13.0	14.1	17.1	21.9	6.0	4.0	5.7	7.1	9.1	9.5	11.4	13.9	9.4	53.9
Males 71+, GT 185% FPL	9.5	12.3	16.3	17.5	21.4	27.1	6.0	1.8	7.4	9.1	11.5	12.3	14.6	17.9	9.4	28.4 *
Females 14 - 18, LE 185% FPL	8.7	10.7	13.0	13.5	15.8	18.9	7.9	10.7	7.2	8.3	9.8	10.0	11.5	13.1	7.3	11.4
Females 14 - 18, GT 185% FPL	8.7	10.5	12.8	13.5	15.7	19.1	7.9	12.5	6.1	7.5	9.4	9.8	11.7	14.0	7.3	22.1
Females 19 - 30, LE 185% FPL	8.0	9.9	12.6	13.1	15.7	19.1	8.1	16.8	6.3	7.4	8.9	9.1	10.5	12.1	6.8	16.1
Females 19 - 30, GT 185% FPL	8.8	10.6	12.8	13.4	15.6	18.7	8.1	14.8	6.4	7.7	9.3	9.6	11.1	13.1	6.8	13.7
Females 31 - 50, LE 185% FPL	7.2	8.9	11.3	12.1	14.4	18.0	8.1	23.3	5.5	6.9	9.0	9.8	11.7	14.9	6.8	23.9
Females 31 - 50, GT 185% FPL	8.2	10.1	12.6	13.4	15.9	19.6	8.1	16.7	6.3	7.5	9.1	9.5	11.1	13.0	6.8	15.5 *
Females 51 - 70, LE 185% FPL	6.9	8.6	10.9	11.6	13.7	17.1	5.0	3.6	5.2	6.3	7.7	8.0	9.4	11.2	6.8	33.4
Females 51 - 70, GT 185% FPL	8.4	10.1	12.2	12.8	14.8	17.8	5.0	1.2	6.0	7.1	8.6	8.9	10.4	12.3	6.8	20.0 **
Females 71+, LE 185% FPL	6.4	8.1	10.5	11.2	13.5	16.9	5.0	5.2	4.5	5.5	6.9	7.3	8.7	10.5	6.8	47.9
Females 71+, GT 185% FPL	8.0	10.1	12.7	13.4	16.0	19.5	5.0	1.8	6.0	7.3	8.9	9.2	10.7	12.9	6.8	18.3 **

Source: 1994-1996, 1998 CSFII.

[a]EAR = Estimated Average Requirement. For Vitamin C, the EAR is 35 mg/d higher for smokers. For calcium, the value is an AI = Adequate Intake.

[b]For most nutrients, the % Inadequate = % < EAR. For iron, the probability approach is used to estimate the % Inadequate.

*(**): p-value for difference between LE 185% FPL and GT 185% FPL is < 0.05(0.01)

Table 7a

subgroups. For young children, the prevalence of inadequate usual intake is lower, and the differences between low-income and higher-income subgroups are less.

Both the mean and median of usual energy intake of the low-income and higher-income adult subgroups, as well as the estimated percentiles of the usual energy intake distributions, are considerably less than the comparable percentiles of the EER distributions (Table 7b). In contrast, for children 4 to 8 years and 9 to 13 years, mean energy intake exceeds the mean estimated energy requirement.

The usual intake of macronutrients shows results similar to those presented for overweight and non-overweight subgroups—high percentages with usual intakes of fat and carbohydrate and low percentages with usual protein intake that fall outside the AMDRs (Table 7c). For some low-income subgroups—children, males 19 to 30 years, and males 71 years and over—the percentage with usual fat intakes above the upper bound of the AMDR is higher than for their higher-income counterparts. In addition, low-income adult females have a higher prevalence of inadequate protein intakes compared with higher-income adult females.

Usual intakes of dietary fiber for low-income and higher-income subgroups are far below the AI set for total fiber (Table 7d). For all income subgroups, mean usual dietary fiber intake is considerably less than the AI.

FSP and WIC Participants. For FSP participants, all micronutrients show a high prevalence of inadequacy for adolescent and adult females; all except iron and zinc have a high prevalence of inadequacy for adolescent and adult males; and, with the exception of vitamin E, the prevalence of inadequate usual intakes of micronutrients is low for children 4 to 8 years of age (Table 8a). (Recall that some FSP participant subgroups—males 14 to 18 and 19 to 30 years and females 14 to 18 years—have small sample sizes, making estimates of the usual intake

Table 7b

Estimated Energy Requirements and Usual Intake of Food Energy: Low-Income Individuals

	Distribution Percentiles (kcal)					
	10th	25th	Median	Mean	75th	90th
Kids 4 - 8, LE 185% FPL[a]						
Usual intake	1,327	1,525	1,770	1,806	2,050	2,328
EER[b]	1,242	1,357	1,514	1,542	1,682	1,881
Kids 9 - 13, LE 185% FPL						
Usual intake	1,516	1,731	1,991	2,017	2,275	2,551
EER	1,591	1,777	1,971	2,027	2,223	2,529
Males 14 - 18, LE 185% FPL						
Usual intake	1,984	2,305	2,707	2,764	3,160	3,617
EER	2,384	2,647	2,897	2,933	3,189	3,517
Males 19 - 30, LE 185% FPL						
Usual intake	1,892	2,314	2,819	2,919	3,407	4,064
EER	2,407	2,665	2,873	2,901	3,109	3,414
Males 31 - 50, LE 185% FPL						
Usual intake	1,615	2,013	2,511	2,639	3,119	3,821
EER	2,382	2,520	2,739	2,783	3,018	3,222
Males 51 - 70, LE 185% FPL						
Usual intake	1,300	1,597	1,952	2,010	2,357	2,791
EER	2,105	2,329	2,554	2,558	2,799	2,984
Males 71+, LE 185% FPL						
Usual intake	1,013	1,254	1,543	1,608	1,885	2,281
EER	1,883	2,069	2,289	2,290	2,498	2,712
Females 14 - 18, LE 185% FPL						
Usual intake	1,500	1,709	1,936	1,959	2,181	2,442
EER	1,800	1,919	2,069	2,106	2,220	2,454
Females 19 - 30, LE 185% FPL						
Usual intake	1,213	1,459	1,760	1,792	2,090	2,413
EER	1,891	2,043	2,218	2,273	2,457	2,683
Females 31 - 50, LE 185% FPL						
Usual intake	1,122	1,357	1,645	1,694	1,976	2,328
EER	1,838	2,004	2,191	2,220	2,380	2,611
Females 51 - 70, LE 185% FPL						
Usual intake	955	1,152	1,397	1,427	1,669	1,939
EER	1,701	1,843	2,016	2,055	2,233	2,453
Females 71+, LE 185% FPL						
Usual intake	862	1,028	1,232	1,254	1,456	1,675
EER	1,481	1,671	1,822	1,841	2,013	2,139

	Distribution Percentiles (kcal)					
	10th	25th	Median	Mean	75th	90th
Kids 4 - 8, GT 185% FPL						
Usual intake	1,375	1,549	1,752	1,776	1,977	2,207
EER	1,286	1,402	1,543	1,561	1,703	1,860
Kids 9 - 13, GT 185% FPL						
Usual intake	1,518	1,770	2,076	2,130 *	2,428	2,808
EER	1,641	1,799	2,009	2,070	2,278	2,647
Males 14 - 18, GT 185% FPL						
Usual intake	1,850	2,245	2,766	2,876	3,387	4,044
EER	2,420	2,663	2,912	2,947	3,206	3,522
Males 19 - 30, GT 185% FPL						
Usual intake	1,838	2,211	2,669	2,763	3,207	3,802
EER	2,465	2,678	2,889	2,889	3,087	3,276
Males 31 - 50, GT 185% FPL						
Usual intake	1,723	2,053	2,466	2,524	2,932	3,398
EER	2,396	2,586	2,807	2,817	3,031	3,240
Males 51 - 70, GT 185% FPL						
Usual intake	1,468	1,768	2,144	2,194 **	2,565	2,985
EER	2,214	2,411	2,646	2,642	2,853	3,089
Males 71+, GT 185% FPL						
Usual intake	1,359	1,601	1,894	1,924 **	2,215	2,527
EER	1,918	2,132	2,359	2,351	2,587	2,759
Females 14 - 18, GT 185% FPL						
Usual intake	1,324	1,560	1,846	1,874	2,158	2,461
EER	1,847	1,943	2,084	2,107	2,214	2,398
Females 19 - 30, GT 185% FPL						
Usual intake	1,285	1,521	1,810	1,842	2,128	2,440
EER	1,891	2,026	2,161	2,211	2,349	2,587
Females 31 - 50, GT 185% FPL						
Usual intake	1,192	1,417	1,673	1,706	1,957	2,259
EER	1,812	1,952	2,132	2,162	2,343	2,562
Females 51 - 70, GT 185% FPL						
Usual intake	1,111	1,306	1,545	1,572 **	1,808	2,066
EER	1,688	1,852	2,034	2,039	2,207	2,397
Females 71+, GT 185% FPL						
Usual intake	1,071	1,250	1,467	1,488 **	1,704	1,934
EER	1,481	1,611	1,812	1,816	1,984	2,167

Source: 1994-1996, 1998 CSFII.

[a]FPL = Federal Poverty Level.

[b]EER = Estimated Energy Requirement.

*(**): p-value for difference in mean intakes between LE 185% FPL and GT 185% FPL < 0.05(0.01)

Table 7c
Usual Nutrient Intake: Macronutrients, Low-Income Individuals

	Fat		Carbohydrate		Protein	
	% < AMDR[a]	% > AMDR	% Inadeq[b]	% < AMDR	% Inadeq	% outside AMDR
Kids 4 - 8, LE 185% FPL[c]	< 1	32.9	< 1	2.5	< 1	< 1
Kids 4 - 8, GT 185% FPL	2.3	14.4 **	< 1	0.5 **	< 1	1.3
Kids 9 - 13, LE 185% FPL	< 1	33.4	< 1	1.9	1.5	< 1
Kids 9 - 13, GT 185% FPL	1.5	19.3 **	< 1	0.6	1.4	< 1
Males 14 - 18, LE 185% FPL	< 1	50.9	< 1	6.4	2.3	< 1
Males 14 - 18, GT 185% FPL	2.3	18.5 **	< 1	0.5	< 1	< 1
Males 19 - 30, LE 185% FPL	< 1	37.4	< 1	26.6	2.3	< 1
Males 19 - 30, GT 185% FPL	< 1	20.7 *	< 1	14.5 *	2.7	< 1
Males 31 - 50, LE 185% FPL	< 1	42.1	< 1	28.5	4.4	< 1
Males 31 - 50, GT 185% FPL	< 1	38.3	< 1	25.7	3.2	< 1
Males 51 - 70, LE 185% FPL	1.3	40.5	2.1	28.9	13.2	< 1
Males 51 - 70, GT 185% FPL	1.2	41.7	< 1	28.6	7.0 *	< 1
Males 71+, LE 185% FPL	1.4	41.3	3.6	25.8	25.2	< 1
Males 71+, GT 185% FPL	1.1	33.0	< 1	16.8 *	9.5 **	< 1
Females 14 - 18, LE 185% FPL	< 1	27.2	< 1	2.5	3.8	2.5
Females 14 - 18, GT 185% FPL	8.6 **	25.2	< 1	3.4	6.7	< 1
Females 19 - 30, LE 185% FPL	1.9	29.2	1.1	10.6	13.4	1.4
Females 19 - 30, GT 185% FPL	1.1	30.1	< 1	12.9	7.0 *	2.6
Females 31 - 50, LE 185% FPL	< 1	40.4	2.2	19.1	17.9	< 1
Females 31 - 50, GT 185% FPL	< 1	32.0 *	2.1	16.6	10.8 *	< 1
Females 51 - 70, LE 185% FPL	1.1	34.9	4.6	14.0	26.9	< 1
Females 51 - 70, GT 185% FPL	2.2	31.1	1.9	18.1	13.4 **	< 1
Females 71+, LE 185% FPL	2.0	26.3	6.8	10.9	31.9	< 1
Females 71+, GT 185% FPL	2.2	29.6	2.1	11.4	10.8 **	< 1

Source: 1994-1996, 1998 CSFII.
[a]AMDR = Acceptable Macronutrient Distribution Range.
[b]% Inadequate = % < EAR (Estimated Average Requirement).
[c]FPL = Federal Poverty Level.
*(**): p-value for difference between LE 185% FPL and GT 185% FPL is < 0.05(0.01)

Table 7d
Usual Intake of Dietary Fiber: Low-Income Individuals

	Usual Intake Distributions (g/d)						
	AI[a]	10th	25th	Median	Mean	75th	90th
Kids 4 - 8, LE 185% FPL[b]	25	8	10	12	12	14	17
Kids 4 - 8, GT 185% FPL	25	8	10	12	12	14	16
Kids 9 - 13, LE 185% FPL	31/26	8	10	13	13	15	19
Kids 9 - 13, GT 185% FPL	31/26	10	12	14	15 **	17	20
Males 14 - 18, LE 185% FPL	38	12	14	16	17	19	22
Males 14 - 18, GT 185% FPL	38	11	14	17	18	22	26
Males 19 - 30, LE 185% FPL	38	10	14	18	19	23	28
Males 19 - 30, GT 185% FPL	38	10	13	17	18	22	28
Males 31 - 50, LE 185% FPL	38	10	13	17	19	23	29
Males 31 - 50, GT 185% FPL	38	11	14	18	19	23	28
Males 51 - 70, LE 185% FPL	30	8	11	16	17	21	27
Males 51 - 70, GT 185% FPL	30	10	14	18	19 **	23	28
Males 71+, LE 185% FPL	30	8	11	14	15	18	22
Males 71+, GT 185% FPL	30	10	13	18	19 **	23	29
Females 14 - 18, LE 185% FPL	26	10	11	12	12	13	15
Females 14 - 18, GT 185% FPL	26	8	10	13	13	15	18
Females 19 - 30, LE 185% FPL	25	7	9	12	13	15	19
Females 19 - 30, GT 185% FPL	25	8	10	13	13	16	20
Females 31 - 50, LE 185% FPL	25	7	9	12	12	15	19
Females 31 - 50, GT 185% FPL	25	8	11	14	14 **	18	21
Females 51 - 70, LE 185% FPL	21	8	10	12	13	15	19
Females 51 - 70, GT 185% FPL	21	9	11	14	15 **	18	22
Females 71+, LE 185% FPL	21	7	9	12	13	15	19
Females 71+, GT 185% FPL	21	8	11	15	15 **	19	23

Source: 1994-1996, 1998 CSFII.
[a]AI = Adequate Intake.
[b]FPL = Federal Poverty Level.
*(**): p-value for difference in mean intakes between LE 185% FPL and GT 185% FPL is < 0.05(0.01)

Table 8a

Usual Nutrient Intake: Micronutrients, FSP and WIC Participants

	Usual Intake Percentiles						Assessing Inadequacy		Usual Intake Percentiles						Assessing Inadequacy	
	10th	25th	Median	Mean	75th	90th	EAR[a]	% Inadeq[b]	10th	25th	Median	Mean	75th	90th	EAR[a]	% Inadeq[b]
	Vitamin C (mg/d)								**Vitamin E (mg/d)**							
	FSP[c] participants and income-eligible nonparticipants								**FSP participants and income-eligible nonparticipants**							
Kids 4 - 8, FSP	57	76	101	107	132	165	22	< 1	4	5	6	7	8	9	6	42.0
Kids 4 - 8, not in FSP	49	67	91	98	122	155	22	< 1	4	5	6	6	7	8	6	57.4 **
Kids 9 - 13, FSP	45	61	83	89	110	140	39	6.0	5	6	7	7	8	10	9	84.7
Kids 9 - 13, not in FSP	48	66	91	100	124	162	39	4.8	4	5	6	7	8	10	9	87.0
Males 14 - 18, FSP	44	65	96	107	137	185	63	26.8	6	7	9	9	10	12	12	89.5
Males 14 - 18, not in FSP	51	70	99	110	138	183	63	18.8	6	7	8	9	10	12	12	88.7
Males 19 - 30, FSP	56	71	90	95	113	139	75	46.0	6	7	9	9	11	13	12	84.1
Males 19 - 30, not in FSP	59	81	113	125	155	205	75	20.7	6	8	10	11	13	15	12	70.0
Males 31 - 50, FSP	42	61	91	105	133	185	75	54.7	5	7	9	10	12	15	12	74.7
Males 31 - 50, not in FSP	37	58	92	109	142	202	75	37.9	5	7	9	9	11	14	12	80.6
Males 51+, FSP	28	49	84	106	139	210	75	52.4	4	5	7	7	9	11	12	94.9
Males 51+, not in FSP	25	42	70	84	110	161	75	54.2	4	5	6	7	8	11	12	94.0
Females 14 - 18, FSP	51	65	86	91	110	137	56	21.0	4	5	6	6	8	10	12	98.1
Females 14 - 18, not in FSP	36	48	67	74	91	120	56	35.5	4	5	7	7	9	11	12	94.8
Females 19 - 30, FSP	35	53	80	91	117	160	60	43.4	4	5	6	7	8	9	12	99.5
Females 19 - 30, not in FSP	44	62	90	100	126	169	60	22.8	4	5	7	7	8	10	12	95.2
Females 31 - 50, FSP	40	55	76	83	104	135	60	47.8	4	5	6	7	8	10	12	96.3
Females 31 - 50, not in FSP	32	48	71	80	103	139	60	38.4	4	5	6	6	7	9	12	99.5
Females 51+, FSP	33	47	67	74	93	123	60	49.9	3	4	6	6	7	9	12	99.0
Females 51+, not in FSP	35	51	77	87	111	151	60	33.5 *	3	4	5	5	6	8	12	98.7
	WIC[d] participants and income-eligible nonparticipants								**WIC participants and income-eligible nonparticipants**							
Infants < 1, WIC	46	69	96	107	134	182	…	…	4	8	10	10	13	17	…	…
Infants < 1, not in WIC	30	50	77	84	110	145	…	…	2	4	9	9	12	16	…	…
Toddlers 1 - 3, WIC	56	78	110	116	146	184	13	< 1	3	4	5	5	7	9	5	51.8
Toddlers 1 - 3, not in WIC	43	61	87	96	121	159	13	< 1	3	4	5	5	6	7	5	57.6
	Folate (mcg/d)								**Calcium (mg/d)**							
	FSP participants and income-eligible nonparticipants								**FSP participants and income-eligible nonparticipants**							
Kids 4 - 8, FSP	170	217	281	297	359	443	160	7.7	576	708	872	893	1,055	1,236	**800**	…
Kids 4 - 8, not in FSP	168	207	258	270	320	387	160	7.7	555	674	819	842	983	1,156	**800**	…
Kids 9 - 13, FSP	147	179	221	228	268	316	250	66.5	550	676	838	866	1,025	1,217	**1,300**	…
Kids 9 - 13, not in FSP	157	193	242	253	301	364	250	54.0	688	778	887	898	1,006	1,123	**1,300**	…
Males 14 - 18, FSP	189	220	259	265	304	349	330	85.0	649	798	990	1,023	1,212	1,438	**1,300**	…
Males 14 - 18, not in FSP	181	212	250	254	291	332	330	89.4	573	734	954	1,013	1,228	1,528	**1,300**	…
Males 19 - 30, FSP	181	217	264	274	321	380	320	74.7	440	584	770	800	984	1,199	**1,000**	…
Males 19 - 30, not in FSP	224	278	349	363	433	521	320	39.7 *	658	837	1,078	1,134 *	1,370	1,684	**1,000**	…
Males 31 - 50, FSP	161	196	243	255	303	366	320	80.2	454	621	865	953	1,188	1,562	**1,000**	…
Males 31 - 50, not in FSP	166	211	272	288	348	431	320	67.1	473	601	776	821	991	1,226	**1,000**	…
Males 51+, FSP	114	159	224	246	308	405	320	77.5	319	427	582	631	781	1,004	**1,200**	…

	Usual Intake Percentiles						Assessing Inadequacy		Usual Intake Percentiles						Assessing Inadequacy	
	10th	25th	Median	Mean	75th	90th	EAR[a]	% Inadeq[b]	10th	25th	Median	Mean	75th	90th	EAR[a]	% Inadeq[b]
Males 51+, not in FSP	127	167	224	241	296	377	320	80.7	338	455	617	663	822	1,047	**1,200**	…
Females 14 - 18, FSP	138	169	211	218	259	309	330	93.5	354	471	631	672	828	1,042	**1,300**	…
Females 14 - 18, not in FSP	132	156	188	193	224	261	330	98.8	477	575	695	709	829	959	**1,300**	…
Females 19 - 30, FSP	122	154	196	204	246	298	320	93.6	369	473	605	624	754	902	**1,000**	…
Females 19 - 30, not in FSP	133	174	231	249	305	388	320	78.7	406	515	657	685	825	999	**1,000**	…
Females 31 - 50, FSP	101	134	179	191	236	297	320	93.1	272	376	520	558	699	892	**1,000**	…
Females 31 - 50, not in FSP	110	141	185	196	238	297	320	93.3	318	428	581	623	772	982	**1,000**	…
Females 51+, FSP	112	139	176	185	220	269	320	96.5	271	356	472	499	613	763	**1,200**	…
Females 51+, not in FSP	111	144	191	205	250	316	320	90.6	277	376	509	539	670	840	**1,200**	…
	WIC participants and income-eligible nonparticipants								**WIC participants and income-eligible nonparticipants**							
Infants < 1, WIC	62	86	116	123	150	189	…	…	292	446	584	616	770	940	**210/270**	…
Infants < 1, not in WIC	32	68	99	107	140	184	…	…	141	358	548	601	813	1,090	**210/270**	…
Toddlers 1 - 3, WIC	128	168	221	234	286	357	120	7.7	484	630	819	850	1,036	1,257	**500**	…
Toddlers 1 - 3, not in WIC	127	162	210	221	267	329	120	7.8	446	586	766	805	981	1,212	**500**	…
	Magnesium (mg/d)								**Vitamin A (mcg RAE)**							
	FSP participants and income-eligible nonparticipants								**FSP participants and income-eligible nonparticipants**							
Kids 4 - 8, FSP	163	190	222	227	259	298	110	< 1	426	538	683	721	861	1,063	275	1.1
Kids 4 - 8, not in FSP	158	183	214	218	247	283	110	< 1	369	470	614	665	797	1,027	275	2.0
Kids 9 - 13, FSP	160	185	216	221	252	289	200	36.7	351	438	552	574	686	824	445/420	21.3
Kids 9 - 13, not in FSP	178	200	227	230	257	286	200	25.0	380	486	635	701	840	1,097	445/420	16.5
Males 14 - 18, FSP	212	245	285	290	330	374	340	79.4	513	597	705	726	832	964	630	32.4
Males 14 - 18, not in FSP	198	229	265	269	305	344	340	89.0	365	452	568	594	707	856	630	62.4
Males 19 - 30, FSP	209	246	292	299	344	397	330	69.1	370	455	566	585	694	825	625	62.7
Males 19 - 30, not in FSP	222	279	352	366	438	526	330	42.2 *	495	600	738	767	902	1,076	625	29.4
Males 31 - 50, FSP	163	219	294	312	385	483	350	66.6	321	458	669	759	959	1,309	625	45.1
Males 31 - 50, not in FSP	212	257	316	326	384	454	350	63.7	275	383	548	620	775	1,052	625	60.0
Males 51+, FSP	142	188	249	262	322	398	350	81.8	296	453	687	866	1,048	1,601	625	43.8
Males 51+, not in FSP	153	194	250	263	318	391	350	83.0	306	460	706	826	1,057	1,493	625	42.3
Females 14 - 18, FSP	152	178	209	212	243	277	300	95.5	286	387	526	563	699	886	485	42.7
Females 14 - 18, not in FSP	198	209	222	223	236	249	300	100.0	333	392	470	487	563	663	485	54.8
Females 19 - 30, FSP	139	168	203	207	242	280	255	81.2	203	301	446	494	634	847	500	58.4
Females 19 - 30, not in FSP	147	181	225	232	276	327	255	65.9	313	413	554	594	731	927	500	40.5
Females 31 - 50, FSP	129	165	210	220	263	323	265	75.9	268	363	500	543	676	872	500	49.9
Females 31 - 50, not in FSP	140	173	216	224	266	318	265	74.5	290	383	514	565	688	900	500	47.5
Females 51+, FSP	130	156	189	194	226	263	265	90.5	230	319	456	541	662	946	500	56.8
Females 51+, not in FSP	132	161	196	201	236	275	265	87.0	277	399	586	693	860	1,230	500	39.0 **
	WIC participants and income-eligible nonparticipants								**WIC participants and income-eligible nonparticipants**							
Infants < 1, WIC	41	60	85	93	118	154	…	…	373	475	626	658	806	1,017	…	…
Infants < 1, not in WIC	26	47	81	91	123	170	…	…	178	365	544	577	753	988	…	…
Toddlers 1 - 3, WIC	128	156	189	194	227	266	65	< 1	357	454	582	620	743	929	210	< 1
Toddlers 1 - 3, not in WIC	122	148	182	186	220	257	65	< 1	353	443	559	587	699	854	210	< 1

Table 8a

	Iron (mg/d): Usual Intake Percentiles						Iron: Assessing Inadequacy		Zinc (mg/d): Usual Intake Percentiles						Zinc: Assessing Inadequacy	
	10th	25th	Median	Mean	75th	90th	EAR[a]	% Inadeq[b]	10th	25th	Median	Mean	75th	90th	EAR[a]	% Inadeq[b]
FSP participants and income-eligible nonparticipants																
Kids 4 - 8, FSP	10.0	11.9	14.5	15.1	17.6	21.0	4.1	<1	7.4	8.6	10.2	10.5	12.0	13.9	4.0	< 1
Kids 4 - 8, not in FSP	9.4	10.9	12.9	13.4	15.3	18.0	4.1	<1	6.9	8.0	9.4	9.7	11.1	12.9	4.0	< 1
Kids 9 - 13, FSP	9.6	11.6	14.2	14.8	17.3	20.5	5.9/5.7	<1	7.1	8.6	10.6	11.0	12.9	15.3	7.0	9.4
Kids 9 - 13, not in FSP	10.2	11.7	13.7	14.0	15.9	18.1	5.9/5.7	<1	8.3	9.1	10.1	10.2	11.2	12.3	7.0	< 1
Males 14 - 18, FSP	14.2	15.8	17.8	18.0	20.0	22.1	7.7	<1	10.7	11.8	13.1	13.2	14.5	15.9	8.5	< 1
Males 14 - 18, not in FSP	10.1	12.6	15.9	16.5	19.8	23.9	7.7	4.1	7.6	9.7	12.5	13.2	16.0	19.7	8.5	15.5
Males 19 - 30, FSP	10.6	13.3	16.7	17.2	20.5	24.3	6.0	1.3	9.1	11.2	13.9	14.3	16.9	19.9	9.4	11.5
Males 19 - 30, not in FSP	13.8	16.3	19.4	20.0	23.1	27.1	6.0	<1	9.7	12.0	14.8	15.5	18.2	22.0	9.4	8.4
Males 31 - 50, FSP	11.0	14.2	18.9	20.5	25.3	32.4	6.0	<1	9.3	11.7	14.7	15.5	18.4	22.6	9.4	10.4
Males 31 - 50, not in FSP	11.2	13.5	16.5	17.4	20.3	24.7	6.0	<1	10.1	11.7	13.7	14.0	16.0	18.4	9.4	5.8
Males 51+, FSP	8.6	11.2	14.6	15.2	18.6	22.7	6.0	3.2	7.2	8.6	10.5	10.8	12.7	14.9	9.4	35.3
Males 51+, not in FSP	8.2	10.4	13.5	14.4	17.4	21.8	6.0	3.0	6.4	7.8	9.6	10.0	11.8	14.2	9.4	47.0
Females 14 - 18, FSP	7.9	10.1	13.0	13.5	16.4	19.8	7.9	15.3	6.3	7.8	9.6	9.9	11.8	13.9	7.3	19.5
Females 14 - 18, not in FSP	9.5	11.1	13.2	13.5	15.5	17.9	7.9	5.1	7.3	8.5	9.9	10.1	11.5	13.1	7.3	9.8
Females 19 - 30, FSP	7.8	9.8	12.5	12.9	15.6	18.8	8.1	18.8	5.9	7.3	9.1	9.4	11.2	13.3	6.8	18.7
Females 19 - 30, not in FSP	8.8	10.6	13.0	13.5	15.8	18.8	8.1	14.1	6.8	7.9	9.2	9.4	10.8	12.3	6.8	10.4
Females 31 - 50, FSP	7.1	9.1	11.8	12.4	15.0	18.4	8.1	22.2	5.3	6.7	8.9	9.6	11.5	14.6	6.8	25.6
Females 31 - 50, not in FSP	7.3	9.0	11.1	11.5	13.6	16.3	8.1	24.0	5.6	7.1	9.1	9.8	11.8	14.8	6.8	22.1
Females 51+, FSP	6.9	8.4	10.3	10.9	12.7	15.6	5.0	4.2	5.7	6.4	7.4	7.6	8.6	9.7	6.8	33.9
Females 51+, not in FSP	6.5	8.2	10.7	11.4	13.8	17.3	5.0	5.0	4.5	5.5	7.0	7.3	8.7	10.6	6.8	47.0
WIC participants and income-eligible nonparticipants																
Infants $\leq$ 6 months, WIC	5.9	9.3	12.6	13.5	16.6	22.1	…	…	2.8	4.3	5.9	6.0	7.4	8.9	…	…
Infants < 6 months, not in WIC	1.8	6.2	9.7	11.2	15.7	19.9	…	…	1.1	2.5	4.3	4.6	6.4	8.5	…	…
Infants 7 - 11 months, WIC	8.7	12.0	16.1	16.7	20.8	25.4	6.9	7.1	3.9	5.2	6.7	6.8	8.2	9.9	2.5	2.7
Infants 7 - months, not in WIC	5.5	8.7	13.6	15.4	20.2	27.7	6.9	17.2	2.9	4.4	6.2	6.3	8.0	9.7	2.5	7.0
Toddlers 1 - 3, WIC	7.1	9.1	11.8	12.4	15.0	18.5	3.0	1.1	5.2	6.3	7.8	8.2	9.7	11.6	2.5	< 1
Toddlers 1 - 3, not in WIC	6.7	8.3	10.4	11.1	13.1	16.2	3.0	1.3	5.3	6.4	7.7	8.1	9.4	11.2	2.5	< 1

Source: 1994-1996, 1998 CSFII.

[a]EAR = Estimated Average Requirement. For Vitamin C, the EAR is 35 mg/d higher for smokers. For calcium, the value is an AI = Adequate Intake.

[b]For most nutrients, the % Inadequate = % < EAR. For iron, the probability approach is used to estimate the % Inadequate.

[c]FSP = Food Stamp Program.

[d]WIC = Special Supplemental Nutrition Program for Women, Infants, and Children

*(**): p-value for difference between participants and income-eligible nonparticipants is <0.05(0.01)

Table 8a

distributions and the prevalence of inadequacy less precise than FSP subgroups with larger sample sizes.)

Most differences between FSP participants and income-eligible nonparticipants in the percentage with inadequate intake are small, with the following exceptions:

- The prevalence of inadequate usual intakes of vitamin C is higher for most of the adolescent and adult FSP participant groups than for income-eligible nonparticipants, although the difference is statistically significant only for females 51 years of age and over.
- Male FSP participants 19 to 30 years of age have a higher prevalence of inadequate intake of most nutrients (except iron) than income-eligible nonparticipants. The differences are statistically significant for folate and magnesium.

For calcium, mean usual intake of FSP participants is generally less than the mean usual intake for income-eligible nonparticipants. Males 19 to 30 years of age show an unusually large and significant difference in mean intakes of calcium—800 mg/d for FSP participants compared with 1,134 mg/d for income-eligible nonparticipants. For children 4 to 8 years and males 14-18 years and 31-50 years, however, the mean calcium intake of FSP participants is close to or even higher than the mean for nonparticipants.

Differences in nutrient adequacy for WIC participants and nonparticipants show that infants and toddlers participating in WIC generally have higher mean intakes, as well as higher usual intake percentiles, than income-eligible nonparticipants (Table 8a). For most nutrients, however, the prevalence of inadequacy is low and differences between WIC participants and income-eligible nonparticipants are not large. For iron, however, 7.1 percent of WIC infants 7 to 11 months of age have inadequate intakes compared with 17.2 percent of income-eligible nonparticipants.

Both the mean and median of usual energy intake of adolescent and adult females, as well as the estimated percentiles of the usual energy intake distributions, are considerably less than the comparable percentiles of the EER distributions (Table 8b). This pattern is observed for both FSP participants and income-eligible nonparticipants. For males, the difference between mean energy intake and mean EER is less than for females and not consistent in direction. For children 4 to 8 years, mean energy intake exceeds the mean estimated energy requirement, while for children 9 to 13 years, mean energy intake is close to mean EER.

For infants and children receiving WIC, and for eligible nonparticipating children, mean energy intake exceeds mean EER (Table 8b). An important caveat to this result, however, is that breastfeeding infants and toddlers are included in these analyses. Since the CSFII data do not include energy and nutrients from breast milk, energy intake for breastfeeding infants and toddlers is underestimated. To the extent that breastfeeding is less prevalent among WIC infants than among eligible nonparticipants (Schwartz, et al. 1992), mean energy intake will be underestimated more for eligible nonparticipants than for WIC participants. In addition, the difference between mean intake and mean EER for both WIC participants and nonparticipants would be even larger if the energy from breast milk were included in the nutrient totals.[2]

Results for macronutrients are similar to findings presented for other subgroups. High proportions of children, adolescents, and adults have usual fat intake outside the AMDR (above the upper bound); lower, but still relatively high, proportions of adult subgroups have usual carbohydrate intake below the lower bound of the AMDR; and, for some subgroups, the prevalence of inadequate protein intake is moderately high, although the proportion outside the AMDR for protein is low, usually under one percent (Table 8c). Some FSP participant

[2] An alternative would have been to delete breastfeeding infants and toddlers from the analysis. However, this would have deleted a large proportion of the infant and toddler sample and left a very self-selected sample for analysis purposes. Even with energy and nutrient intakes underestimated for infants under age 1 due to the exclusion of breast milk, usual intakes of micronutrients are adequate for almost all nutrients examined.

Table 8b

Estimated Energy Requirements and Usual Intake of Food Energy: FSP and WIC Participants

	Distribution Percentiles (kcal)							Distribution Percentiles (kcal)					
	10th	25th	Median	Mean	75th	90th		10th	25th	Median	Mean	75th	90th
FSP[a] participants and income-eligible nonparticipants													
Kids 4 - 8, FSP							Kids 4 - 8, not in FSP						
Usual intake	1,354	1,578	1,839	1,877	2,132	2,446	Usual intake	1,328	1,496	1,715	1,751 *	1,968	2,221
EER[b]	1,225	1,344	1,525	1,530	1,703	1,854	EER	1,227	1,349	1,495	1,523	1,654	1,835
Kids 9 - 13, FSP							Kids 9 - 13, not in FSP						
Usual intake	1,409	1,665	1,982	2,020	2,333	2,680	Usual intake	1,550	1,720	1,925	1,945	2,149	2,367
EER	1,622	1,802	1,975	2,031	2,240	2,601	EER	1,595	1,789	1,988	2,065	2,229	2,702
Males 14 - 18, FSP							Males 14 - 18, not in FSP						
Usual intake	2,185	2,420	2,699	2,719	2,996	3,281	Usual intake	1,940	2,296	2,745	2,813	3,256	3,773
EER	2,384	2,661	2,978	2,953	3,244	3,517	EER	2,489	2,689	2,935	2,940	3,146	3,450
Males 19 - 30, FSP							Males 19 - 30, not in FSP						
Usual intake	1,939	2,298	2,727	2,760	3,186	3,624	Usual intake	1,864	2,346	2,937	3,079	3,647	4,464
EER	2,447	2,694	2,829	2,920	3,109	3,616	EER	2,498	2,681	2,843	2,910	3,122	3,410
Males 31 - 50, FSP							Males 31 - 50, not in FSP						
Usual intake	1,700	2,081	2,614	2,802	3,363	4,199	Usual intake	1,692	2,024	2,444	2,507	2,921	3,404
EER	2,333	2,402	2,678	2,713	3,018	3,218	EER	2,340	2,529	2,798	2,793	2,978	3,269
Males 51+, FSP							Males 51+, not in FSP						
Usual intake	1,204	1,489	1,840	1,876	2,223	2,596	Usual intake	1,082	1,329	1,652	1,715	2,032	2,429
EER	1,990	2,229	2,497	2,506	2,799	2,979	EER	2,041	2,216	2,414	2,439	2,670	2,873
Females 14 - 18, FSP							Females 14 - 18, not in FSP						
Usual intake	1,236	1,476	1,764	1,787	2,073	2,369	Usual intake	1,567	1,783	2,046	2,074 *	2,335	2,618
EER	1,849	1,985	2,095	2,150	2,336	2,442	EER	1,771	1,884	2,069	2,084	2,238	2,381
Females 19 - 30, FSP							Females 19 - 30, not in FSP						
Usual intake	1,225	1,505	1,846	1,879	2,216	2,575	Usual intake	1,245	1,485	1,778	1,810	2,101	2,417
EER	1,945	2,073	2,285	2,334	2,566	2,787	EER	1,877	1,972	2,127	2,179	2,346	2,596
Females 31 - 50, FSP							Females 31 - 50, not in FSP						
Usual intake	1,068	1,348	1,702	1,753	2,103	2,504	Usual intake	1,105	1,321	1,589	1,622 *	1,887	2,182
EER	1,903	2,060	2,220	2,255	2,391	2,712	EER	1,892	2,004	2,198	2,217	2,397	2,608
Females 51+, FSP							Females 51+, not in FSP						
Usual intake	885	1,072	1,305	1,337	1,567	1,829	Usual intake	901	1,063	1,263	1,285	1,482	1,697
EER	1,672	1,763	2,031	2,029	2,223	2,498	EER	1,519	1,679	1,883	1,913	2,111	2,309
WIC[c] participants and income-eligible nonparticipants													
Infants < 1, WIC							Infants < 1, not in WIC						
Usual intake	410	597	782	805	982	1,220	Usual intake	222	457	725	725	957	1,203
EER	454	532	653	660	777	886	EER	406	499	613	631	745	881
Toddlers 1 - 3, WIC							Toddlers 1 - 3, not in WIC						
Usual intake	939	1,135	1,378	1,408	1,649	1,917	Usual intake	970	1,157	1,379	1,419	1,641	1,920
EER	797	910	1,099	1,105	1,280	1,448	EER	869	999	1,179	1,174	1,337	1,460

Source: 1994-1996, 1998 CSFII.

[a]FSP = Food Stamp Program.

[b]EER = Estimated Energy Requirement.

[c]WIC = Special Supplemental Nutrition Program for Women, Infants, and Children

*(**): p-value for difference between participants and income-eligible nonparticipants is <0.05(0.01)

Table 8c
Usual Nutrient Intake: Macronutrients, FSP and WIC Participants

	Fat		Carbohydrate		Protein	
	% < AMDR[a]	% > AMDR	% < EAR[b]	% < AMDR	% <Inadeq	% outside AMDR
FSP participants and income-eligible nonparticipants						
Kids 4 - 8, FSP[c]	< 1	33.4	< 1	1.1	< 1	< 1
Kids 4 - 8, not in FSP	< 1	33.8	< 1	2.2	8.1	< 1
Kids 9 - 13, FSP	< 1	47.7	< 1	<1	2.3	< 1
Kids 9 - 13, not in FSP	< 1	18.3 **	< 1	1.7	15.5 **	1
Males 14 - 18, FSP	< 1	43.8	< 1	<1	< 1	< 1
Males 14 - 18, not in FSP	< 1	40.7	< 1	8.4	11.5	3.6
Males 19 - 30, FSP	< 1	72.1	< 1	31.5	4.2	< 1
Males 19 - 30, not in FSP	< 1	31.8	< 1	23.5	2.2	1.7
Males 31 - 50, FSP	< 1	32.9	< 1	20.2	2.7	< 1
Males 31 - 50, not in FSP	1.0	40.6	< 1	29.4	3.9	< 1
Males 51+, FSP	< 1	42.0	4.6	37.5	11.9	< 1
Males 51+, not in FSP	< 1	43.3	3.3	27.9	22.8 *	< 1
Females 14 - 18, FSP	< 1	31.4	1.6	<1	6.8	< 1
Females 14 - 18, not in FSP	< 1	31.4	< 1	1.8	3.5	2.2
Females 19 - 30, FSP	< 1	33.5	1.4	12.1	17.9	1.4
Females 19 - 30, not in FSP	1.9	31.9	< 1	11.9	11.0	1.4
Females 31 - 50, FSP	< 1	32.0	3.5	11.7	24.2	2.1
Females 31 - 50, not in FSP	< 1	49.2	2.1	22.0	23.9	<1
Females 51+, FSP	< 1	35.8	7.9	16.4	37.0	< 1
Females 51+, not in FSP	2.3	28.0	5.2	9.3	34.7	< 1
WIC[d] participants and income-eligible nonparticipants						
Toddlers 1 - 3, WIC	25.4	5.5	5.7	4.8	< 1	< 1
Toddlers 1 - 3, not in WIC	20.5	4.9	2.8	11.2 **	5.1	< 1

Source: 1994-1996, 1998 CSFII.
[a]AMDR = Acceptable Macronutrient Distribution Range.
[b]% Inadequate = % with usual intakes < EAR (Estimated Average Requirement).
[c]FSP = Food Stamp Program.
[d]WIC = Special Supplemental Nutrition Program for Women, Infants, and Children.
*(**): p-value for difference between participants and income-eligible nonparticipants is <0.05(0.01)

subgroups—children 9 to 13 years and males 19 to 30 years—have a higher proportion with usual fat intake outside the AMDR than comparable nonparticipant subgroups, although the opposite pattern is observed for males 51 years and over and females 31 to 50 years. In addition, males 51 years and over participating in the FSP have a significantly lower prevalence of inadequate protein intake than income-eligible nonparticipants.

For children 1 to 3 years, two interesting results are shown in Table 8c. First, low-income children not participating in WIC are significantly more likely than WIC children to have usual carbohydrate intake below the lower bound of the AMDR. Second, they are more likely to have usual fat intake less than the lower bound of the AMDR compared with older children and adults who are more likely to be above the upper bound. This is largely the result of the fact that the lower bound of the AMDR for fat is higher for young children. Specifically, the AMDR for fat is 30 to 40 percent of energy for children 1 to 3 years, 25 to 35 percent for children 4 to 18, and 20 to 35 percent for adults. Thus, it is easier for children to have diets with usual fat intake below the AMDR.

Usual dietary fiber intakes are substantially less than the AI (Table 8d). Both participants and income-eligible nonparticipants have usual dietary fiber intake distributions that do not come close to meeting fiber recommendations.

NSLP and SBP Participants. Results for the subgroups participating in the NSLP and SBP, as well as for nonparticipants of the same age subgroups, confirm many of the findings reported for other age groups (Tables 9a and 9b). First, the prevalence of inadequacy for the micronutrients is less for younger children than for older children and for males than for females (Table 9a). Second, the nutrients with highest prevalence of inadequacy are vitamin E, folate, and magnesium. Differences by NSLP or SBP participation status are small for children 4 to 8 years and inconsistent for older children.

Table 8d
Usual Intake of Dietary Fiber: FSP and WIC Participants

	Usual Intake Distributions (g/d)						
	AI[a]	10th	25th	Median	Mean	75th	90th
FSP[b] participants and income-eligible nonparticipants							
Kids 4 - 8, FSP	25	8	10	12	13	15	17
Kids 4 - 8, not in FSP	25	9	10	12	12	14	16
Kids 9 - 13, FSP	31/26	9	10	12	12	15	17
Kids 9 - 13, not in FSP	31/26	9	11	13	13	15	18
Males 14 - 18, FSP	38	12	14	15	16	17	19
Males 14 - 18, not in FSP	38	11	13	15	15	18	20
Males 19 - 30, FSP	38	10	13	17	18	22	27
Males 19 - 30, not in FSP	38	11	14	19	20	25	31
Males 31 - 50, FSP	38	9	12	16	17	21	27
Males 31 - 50, not in FSP	38	10	14	18	19	23	28
Males 51+, FSP	30	6	9	13	15	19	26
Males 51+, not in FSP	30	8	11	15	16	19	25
Females 14 - 18, FSP	26	9	11	12	12	14	16
Females 14 - 18, not in FSP	26	12	12	13	13	14	15
Females 19 - 30, FSP	25	7	8	11	11	13	16
Females 19 - 30, not in FSP	25	8	10	13	13 *	16	20
Females 31 - 50, FSP	25	6	8	12	13	16	21
Females 31 - 50, not in FSP	25	7	9	12	12	15	19
Females 51+, FSP	21	7	9	12	12	15	18
Females 51+, not in FSP	21	8	10	12	13	15	18
WIC[c] participants and income-eligible nonparticipants							
Infants < 1, WIC	…	0	1	2	3	4	7
Infants < 1, not in WIC	…	0	1	2	3	5	8
Toddlers 1 - 3, WIC	19	4	6	9	9	12	15
Toddlers 1 - 3, not in WIC	19	6	7	9	9	11	14

Source: 1994-1996, 1998 CSFII.
[a]AI = Adequate Intake.
[b]FSP = Food Stamp Program.
[c]WIC = Special Supplemental Nutrition Program for Women, Infants, and Children.
*(**): p-value for difference in mean intakes between participants and income-eligible nonparticipants is < 0.05(0.01)

Table 9a

Usual Nutrient Intake: Micronutrients, NSLP and SBP Participants

	Usual Intake Percentiles						Assessing Inadequacy	
	10th	25th	Median	Mean	75th	90th	EAR[a]	% Inadeq[b]
Vitamin C (mg/d)								
NSLP[c] participants and nonparticipants								
Kids 4 - 8, NSLP	47	65	91	99	124	161	22	< 1
Kids 4 - 8, not in NSLP	52	68	90	95	117	145	22	< 1
Kids 9 - 13, NSLP	48	64	87	93	115	146	39	4.4
Kids 9 - 13, not in NSLP	45	64	93	103	131	174	39	6.6
Males 14 - 18, NSLP	60	83	117	128	161	210	63	13.7
Males 14 - 18, not in NSLP	44	64	95	108	137	188	63	26.3
Females 14 - 18, NSLP	46	63	89	98	123	162	75	21.7
Females 14 - 18, not in NSLP	38	53	77	86	109	146	75	30.9
SBP[d] participants and nonparticipants								
Kids 4 - 8, SBP	50	67	90	96	119	150	22	< 1
Kids 4 - 8, not in SBP	47	63	87	94	117	152	22	< 1
Kids 9 - 13, SBP	57	72	92	97	117	143	39	1.5
Kids 9 - 13, not in SBP	47	64	89	97	121	157	39	5.3
Folate (mcg/d)								
NSLP participants and nonparticipants								
Kids 4 - 8, NSLP	162	205	261	275	330	404	160	9.4
Kids 4 - 8, not in NSLP	164	202	252	261	310	369	160	9.0
Kids 9 - 13, NSLP	160	199	250	261	312	376	250	49.8
Kids 9 - 13, not in NSLP	168	209	266	280	336	410	250	42.9
Males 14 - 18, NSLP	180	236	312	333	408	512	330	55.4
Males 14 - 18, not in NSLP	185	232	294	308	369	448	330	63.3
Females 14 - 18, NSLP	127	160	203	213	256	311	330	92.9
Females 14 - 18, not in NSLP	136	165	204	215	253	307	330	93.5
SBP participants and nonparticipants								
Kids 4 - 8, SBP	173	208	256	266	312	373	160	6.4
Kids 4 - 8, not in SBP	161	204	260	272	327	398	160	9.8
Kids 9 - 13, SBP	170	200	238	242	279	321	250	58.1
Kids 9 - 13, not in SBP	160	203	261	277	335	415	250	45.2
Magnesium (mg/d)								
NSLP participants and nonparticipants								
Kids 4 - 8, NSLP	165	189	217	221	249	282	110	< 1
Kids 4 - 8, not in NSLP	168	193	223	225	255	285	110	< 1
Kids 9 - 13, NSLP	166	196	231	238	273	317	200	27.8
Kids 9 - 13, not in NSLP	187	216	253	258	295	336	200	15.7 **
Males 14 - 18, NSLP	208	252	310	321	378	447	340	62.2

	Usual Intake Percentiles						Assessing Inadequacy	
	10th	25th	Median	Mean	75th	90th	EAR[a]	% Inadeq[b]
Vitamin E (mg/d)								
NSLP participants and nonparticipants								
Kids 4 - 8, NSLP	5	5	6	6	7	8	6	42.1
Kids 4 - 8, not in NSLP	4	5	6	6	7	8	6	49.4
Kids 9 - 13, NSLP	5	6	7	7	9	11	9	76.9
Kids 9 - 13, not in NSLP	5	6	7	8	9	11	9	74.7
Males 14 - 18, NSLP	6	7	9	9	11	13	12	85.5
Males 14 - 18, not in NSLP	6	8	9	10	11	13	12	82.0
Females 14 - 18, NSLP	5	6	7	7	7	8	12	100.0
Females 14 - 18, not in NSLP	5	6	7	7	7	8	12	100.0
SBP participants and nonparticipants								
Kids 4 - 8, SBP	5	6	7	7	7	8	6	26.2
Kids 4 - 8, not in SBP	5	5	6	6	7	8	6	44.8
Kids 9 - 13, SBP	4	5	7	7	9	11	9	79.5
Kids 9 - 13, not in SBP	5	6	7	8	9	12	9	72.1
Calcium (mg/d)								
NSLP participants and nonparticipants								
Kids 4 - 8, NSLP	591	715	864	884	1,031	1,200	**800**	…
Kids 4 - 8, not in NSLP	586	717	880	901	1,062	1,243	**800**	…
Kids 9 - 13, NSLP	598	734	908	936	1,108	1,310	**1,300**	…
Kids 9 - 13, not in NSLP	605	753	942	974	1,160	1,382	**1,300**	…
Males 14 - 18, NSLP	608	811	1,097	1,181	1,458	1,860	**1,300**	…
Males 14 - 18, not in NSLP	663	852	1,106	1,164	1,412	1,738	**1,300**	…
Females 14 - 18, NSLP	423	565	754	793	979	1,215	**1,300**	…
Females 14 - 18, not in NSLP	413	516	650	676 *	808	971	**1,300**	…
SBP participants and nonparticipants								
Kids 4 - 8, SBP	619	728	860	873	1,004	1,143	**800**	…
Kids 4 - 8, not in SBP	596	722	877	897	1,051	1,222	**800**	…
Kids 9 - 13, SBP	672	763	871	880	987	1,100	**1,300**	…
Kids 9 - 13, not in SBP	578	724	914	948	1,136	1,363	**1,300**	…
Vitamin A (mcg RAE)								
NSLP participants and nonparticipants								
Kids 4 - 8, NSLP	410	517	656	690	825	1,011	275	1.3
Kids 4 - 8, not in NSLP	482	591	730	760	894	1,075	275	< 1
Kids 9 - 13, NSLP	428	547	705	747	898	1,117	420	9.2
Kids 9 - 13, not in NSLP	447	562	714	747	896	1,088	420	7.5
Males 14 - 18, NSLP	398	562	803	890	1,122	1,491	630	32.2

	Usual Intake Percentiles						Assessing Inadequacy		Usual Intake Percentiles						Assessing Inadequacy	
	10th	25th	Median	Mean	75th	90th	EAR[a]	% Inadeq[b]	10th	25th	Median	Mean	75th	90th	EAR[a]	% Inadeq[b]
Males 14 - 18, not in NSLP	216	258	313	322	375	439	340	62.1	420	583	820	897	1,126	1,473	630	30.0
Females 14 - 18, NSLP	157	183	216	220	252	288	300	92.9	282	388	544	599	748	984	485	40.8
Females 14 - 18, not in NSLP	142	169	205	212	247	290	300	92.1	283	375	511	565	695	914	485	45.4
SBP participants and nonparticipants									**SBP participants and nonparticipants**							
Kids 4 - 8, SBP	175	195	219	222	246	273	110	< 1	405	494	608	630	743	883	275	< 1
Kids 4 - 8, not in SBP	166	191	221	224	254	285	110	< 1	428	548	706	753	904	1,134	275	1.2
Kids 9 - 13, SBP	176	195	217	219	241	265	200	30.1	458	544	652	672	778	911	420	5.7
Kids 9 - 13, not in SBP	169	201	241	248	287	336	200	24.3	425	544	700	745	894	1,117	420	9.5
				Iron (mg/d)								**Zinc (mg/d)**				
NSLP participants and nonparticipants									**NSLP participants and nonparticipants**							
Kids 4 - 8, NSLP	9.5	11.3	13.5	14.1	16.2	19.3	4.1	<1	7.1	8.3	9.8	10.1	11.6	13.4	4.0	< 1
Kids 4 - 8, not in NSLP	10.0	11.6	13.6	14.0	16.0	18.6	4.1	<1	6.9	7.9	9.3	9.5	10.8	12.4	4.0	< 1
Kids 9 - 13, NSLP	10.9	12.9	15.3	15.8	18.2	21.3	5.9	<1	7.9	9.3	11.0	11.4	13.0	15.2	7.0	4.2
Kids 9 - 13, not in NSLP	10.4	12.6	15.6	16.4	19.2	23.3	5.9	<1	7.8	9.2	11.0	11.4	13.2	15.5	7.0	4.9
Males 14 - 18, NSLP	13.0	15.9	19.8	20.7	24.5	29.6	7.7	<1	10.1	12.1	14.7	15.2	17.7	20.9	8.5	3.1
Males 14 - 18, not in NSLP	13.6	16.1	19.2	19.9	23.0	27.2	7.7	<1	10.7	12.1	13.9	14.3	16.0	18.3	8.5	1.2
Females 14 - 18, NSLP	9.1	11.1	13.5	13.9	16.3	19.2	7.9	10.0	7.2	8.6	10.3	10.6	12.2	14.2	7.3	10.7
Females 14 - 18, not in NSLP	8.3	9.9	11.9	12.5	14.4	17.4	7.9	14.5	6.1	7.2	8.6	8.8	10.2	11.7	7.3	26.5
SBP participants and nonparticipants									**SBP participants and nonparticipants**							
Kids 4 - 8, SBP	10.0	11.5	13.3	13.7	15.5	17.8	4.1	<1	8.0	8.9	10.0	10.2	11.3	12.6	4.0	< 1
Kids 4 - 8, not in SBP	9.6	11.4	13.8	14.3	16.6	19.6	4.1	<1	7.0	8.2	9.7	9.9	11.4	13.1	4.0	< 1
Kids 9 - 13, SBP	10.7	12.1	13.9	14.1	15.9	17.9	5.9	<1	7.8	8.9	10.3	10.6	12.0	13.6	7.0	4.0
Kids 9 - 13, not in SBP	10.4	12.6	15.4	16.2	18.8	22.8	5.9	<1	7.6	9.0	10.9	11.2	13.0	15.3	7.0	6.0

Source: 1994-1996, 1998 CSFII.

[a]EAR = Estimated Average Requirement. For Vitamin C, the EAR is 35 mg/d higher for smokers. For calcium, the value is an AI = Adequate Intake.

[b]For most nutrients, the % Inadequate = % < EAR. For iron, the probability approach is used to estimate the % Inadequate.

[c]NSLP = National School Lunch Program.

[d]SBP = School Breakfast Program.

*(**): p-value for difference between NSLP/SBP participants and nonparticipants is <0.05(0.01)

Table 9a

Table 9b

Estimated Energy Requirements and Usual Intake of Food Energy: NSLP and SBP Participants

	Usual and required intake percentiles (kcal)							Usual and required intake percentiles (kcal)					
	10th	25th	Median	Mean	75th	90th		10th	25th	Median	Mean	75th	90th
NSLP[a] participants and nonparticipants													
Kids 4 - 8, NSLP							Kids 4 - 8, not in NSLP						
Usual intake	1,416	1,602	1,823	1,854	2,071	2,328	Usual intake	1,443	1,606	1,784	1,799	1,975	2,172
EER[b]	1,336	1,458	1,619	1,635	1,796	1,963	EER	1,337	1,448	1,580	1,598	1,729	1,909
Kids 9 - 13, NSLP							Kids 9 - 13, not in NSLP						
Usual intake	1,481	1,721	2,002	2,044	2,318	2,659	Usual intake	1,577	1,810	2,098	2,135	2,420	2,741
EER	1,658	1,806	2,013	2,076	2,264	2,667	EER	1,602	1,781	1,952	2,025	2,238	2,520
Males 14 - 18, NSLP							Males 14 - 18, not in NSLP						
Usual intake	1,982	2,353	2,829	2,911	3,379	3,944	Usual intake	1,903	2,247	2,686	2,761	3,193	3,714
EER	2,414	2,622	2,897	2,906	3,170	3,374	EER	2,468	2,695	2,913	2,983	3,211	3,570
Females 14 - 18, NSLP							Females 14 - 18, not in NSLP						
Usual intake	1,438	1,672	1,950	1,970	2,245	2,527	Usual intake	1,321	1,540	1,809	1,841	2,107	2,402
EER	1,845	1,951	2,068	2,114	2,192	2,468	EER	1,863	1,987	2,100	2,132	2,236	2,451
SBP[c] participants and nonparticipants													
Kids 4-8, SBP							Kids 4-8, not in SBP						
Usual intake	1,524	1,676	1,856	1,870	2,049	2,235	Usual intake	1,435	1,611	1,815	1,837	2,037	2,265
EER	1,299	1,439	1,584	1,604	1,757	1,886	EER	1,339	1,458	1,608	1,630	1,793	1,954
Kids 9-13, SBP							Kids 9-13, not in SBP						
Usual intake	1,682	1,840	2,015	2,026	2,198	2,382	Usual intake	1,463	1,719	2,044	2,098	2,419	2,803
EER	1,544	1,794	1,975	2,037	2,220	2,621	EER	1,641	1,806	1,990	2,064	2,269	2,629

Source: 1994-1996, 1998 CSFII.

[a]NSLP = National School Lunch Program.

[b]EER = Estimated Energy Requirement.

[c]SBP = School Breakfast Program.

Usual intakes of food energy are close to the estimated energy requirement distributions for the school-age children, regardless of whether they participate in the NSLP or SBP (Table 9b). Although children 4 to 8 years have mean energy intake about 13 percent higher than mean EER and females 14 to 18 years have mean energy intake less than mean EER, the differences are not as pronounced as observed for many of the adult subgroups.

The usual intake of macronutrients shows high percentages with usual fat intakes, and low percentages with usual carbohydrate and protein intakes, that fall outside the AMDRs (Table 9c). The percentage with usual fat intakes above the upper bound of the AMDR is higher for three of the four NSLP subgroups and both SBP subgroups than for nonparticipants. The prevalence of inadequate protein and carbohydrate intake is relatively low for all NSLP and SBP subgroups.

Table 9c

Usual Nutrient Intake: Macronutrients, NSLP and SBP Participants

	Fat		Carbohydrate		Protein	
	%< AMDR[a]	% > AMDR	% Inadeq[b]	% < AMDR	% Inadeq	% outside AMDR
NSLP[c] Participants and Nonparticipants						
Kids 4-8, NSLP	< 1	28.1	< 1	1.4	< 1	< 1
Kids 4-8, not in NSLP	1.9	16.9*	< 1	0.6	< 1	< 1
Kids 9-13, NSLP	< 1	31.5	< 1	1.0	2.5	< 1
Kids 9-13, not in NSLP	2.2	17.7*	< 1	0.4	< 1	< 1
Males 14-18, NSLP	3.1	34.8	< 1	2.4	< 1	< 1
Males 14-18, not in NSLP	1.3	22.8	< 1	1.1	2.4	< 1
Females 14-18, NSLP	2.1	30.4	< 1	2.6	2.4	< 1
Females 14-18, not in NSLP	5.8	30.5	< 1	6.6	10.4	3.4
SBP[d] Participants and Nonparticipants						
Kids 4-8, SBP	< 1	33.3	< 1	1.5	< 1	< 1
Kids 4-8, not in SBP	< 1	23.2*	< 1	1.0	< 1	< 1
Kids 9-13, SBP	< 1	47.9	< 1	1.4	1.5	< 1
Kids 9-13, not in SBP	< 1	26.4*	< 1	1.2	1.7	< 1

Source: 1994-1996, 1998 CSFII.

[a]AMDR = Acceptable Macronutrient Distribution Range

[b]% Inadequate = % with usual intakes < EAR (Estimated Average Requirement).

[c]NSLP = National School Lunch Program

[d]SBP = School Breakfast Program

*(**): p-value for difference between NSLP/SBP participants and nonparticipants is < 0.05(0.01)

As with all other subgroups examined, dietary fiber intakes are far less than requirements (Table 9d). Differences on dietary fiber intakes by NSLP and SBP participation status are small.

Table 9d

Usual Intake Distributions of Dietary Fiber: NSLP and SBP Participants

	Usual Intake Distributions (g/d)						
	AI[a]	10th	25th	Median	Mean	75th	90th
NSLP[b] Participants and Nonparticipants							
Kids 4-8, NSLP	25	9	10	12	12	14	16
Kids 4-8, not in NSLP	25	9	10	12	12	14	16
Kids 9-13, NSLP	31/26	9	11	13	13	16	19
Kids 9-13, not in NSLP	31/26	10	12	14	15*	17	20
Males 14-18, NSLP	38	12	14	17	18	21	25
Males 14-18, not in NSLP	38	11	14	17	17	21	24
Females 14-18, NSLP	26	9	10	12	12	14	16
Females 14-18, not in NSLP	26	9	11	13	13	15	18
SBP[c] Participants and Nonparticipants							
Kids 4-8, SBP	25	10	11	13	13	14	16
Kids 4-8, not in SBP	25	9	10	12	12	14	16
Kids 9-13, SBP	31/26	9	10	12	12	14	16
Kids 9-13, not in SBP	31/26	9	11	14	14*	17	21

Source: 1994-1996, 1998 CSFII.
[a]AI = Adequate Intake
[b]NSLP = National School Lunch Program
[c]SBP = School Breakfast Program
*(**): p-value for difference in mean intakes between NSLP/SBP participants and nonparticipants is < 0.05(0.01)

C. PREVALENCE OF EXCESSIVE USUAL INTAKE LEVELS

Assessing nutrient adequacy involves determining not just the prevalence of inadequate intakes but also the likelihood of excessive intakes. With the newly released Tolerable Intake Levels (ULs), the risk of excessive intakes is assessed by estimating the percentage with usual intakes above the UL. The ULs vary considerably across nutrients; for some nutrients, the UL applies to intakes from foods, beverages, and supplements; for other nutrients, the UL applies to intakes from supplements or fortified foods only; and for others, the UL is not yet determined. Since the CSFII data do not include intakes from supplements, the analysis of the prevalence of excessive intake levels could not be conducted for nutrients where the UL applies to intakes from supplements, pharmacological agents, synthetic forms of the nutrient, or fortified foods only. As a result, using the CSFII data, estimates of the percentage with intakes above the UL are obtained only for vitamin C, calcium, iron, and zinc. In addition, given that the CSFII data were collected prior to more recent fortification of foods with calcium, the prevalence of intakes above the UL for calcium may be lower for some subgroups than what would be observed with more recent dietary intake data.

The principal findings regarding the percentage with usual intakes from food and beverages exceeding the UL are the following:[3]

- For vitamin C and iron, the prevalence of excessive intake is very low. For vitamin C, the prevalence is zero; the highest value of usual vitamin C intake is far less than the UL for all subgroups examined. For iron, less than 1 percent of each subgroup has usual intakes exceeding the UL.
- For almost all subgroups, the 99th percentile of usual calcium intake is less than the UL, suggesting a low prevalence of excessive calcium intake from food. Adolescent males and males 19 to 30 years have 99th percentiles of usual calcium intake close to the UL, suggesting that, at most, only 1 to 2 percent of these two subgroups may be at risk of excessive calcium intake.
- The prevalence of excessive zinc intake is low for older children, adolescents, and adults, but is high for toddlers and young children.
  - About 60 percent of WIC and income-eligible nonparticipating children 1 to 3 years of age have usual zinc intakes exceeding the UL.
  - More than 10 percent of children 4 to 8 years of age have usual zinc intakes exceeding the UL.

Because the CSFII data do not include intakes from supplements, these estimates are underestimates of the percentage exceeding the UL. As discussed earlier, NHANES III data do

[3] Because of the sheer number of subgroups and nutrients, and because the prevalence of excessive intake levels is fairly low, detailed tables on the percentage with usual intakes above the UL are not presented. The text describes the noteworthy analysis findings on the percentage exceeding the UL.

include information on supplement intake, based on a food-frequency type of questionnaire on supplement use. Because supplement use data are from a food frequency type of questionnaire, however, there are some methodological challenges in combining dietary recall data on foods consumed with dietary recall data on supplements consumed.

To examine the effects of supplement use on estimates of the prevalence of excessive intakes, we conducted an additional analysis, based on NHANES III data, combining dietary recall data with food frequency data on supplement use to obtain estimates of usual intake from food and supplements. Specifically, estimates of usual intake at the individual level were added to reported usual supplement intakes of individuals from a food frequency questionnaire for a selected group of nutrients and subgroups—vitamin C, zinc, and vitamin B_{12} for male and female older adults and adolescent females. Estimates of the percentage with usual intakes exceeding the UL was less than 1 percent and was consistent with findings from the CSFII.

IV. SUMMARY AND CONCLUSIONS

This study is a comprehensive analysis of the nutrient adequacy of subgroups at risk of inadequate nutrient intake, excessive intake, or dietary imbalances. It adds to a growing literature that uses improved knowledge of nutrient requirements (DRIs) and recommended nutrient assessment methods to assess nutrient intakes. The study indicates inadequate intakes of key micronutrients, especially magnesium, calcium, folate, and vitamin E; reported energy intakes less than estimated energy requirements for adults; too much food energy from fat and not enough from carbohydrate; and inadequate intakes of fiber. In addition, the adequacy of diets deteriorates as individuals get older. Children—especially infants and young children—have diets that are more nutritionally adequate than adolescents and adults.

In interpreting these results, several limitations of the data must be noted. First, the CSFII data are nearly 10 years old now, and there have been substantial changes in food fortification, program regulations, and food consumption patterns since the CSFII data collection. For example, although the study results indicate a high prevalence of inadequacy for folate, current estimates of inadequacy based on Dietary Folate Equivalents are likely to be much lower. Starting in 1998, enriched cereal grains were required to be fortified with folic acid. The effect of this fortification is twofold; it increases both the amount of folate consumed and the absorption of folic acid compared with food folate, suggesting that usual folate intakes are much higher now compared with the time of the 1994-96 CSFII (Lewis et al. 1999; and Suitor and Bailey 2000).

The results for NSLP and SBP participants also are important to interpret in the context of the timing of the 1994-1996 CSFII. USDA regulations in June 1995 required school food authorities to prepare meals that met new nutrition standards for fat, saturated fat, and other key nutrients. These requirements were not imposed on most schools during the period covered by the 1994-1996 CSFII, so dietary intakes of NSLP and SBP participants surveyed during that time period do not accurately reflect current intakes of program participants.

Another limitation of the CSFII data is that nutrients from dietary supplements are not available. To examine the possible effects of dietary supplements, a limited analysis of data from the Third National Health and Nutrition Examination Survey (NHANES III) was conducted. The results from the analysis of NHANES III data suggest that including supplements does not change estimates of inadequacy much. Results on supplement use from another study suggest that for some groups, supplement use may contribute to closing the gap between nutrient consumption from foods and nutrient requirements (Fox and Cole 2004). That study, also based on NHANES III data, found that among adults over age 60 with incomes below 130 percent of poverty, 25 percent reported taking a multivitamin or vitamin/mineral combination. Higher income seniors were even more likely to take such a supplement (37 percent), but many groups reported smaller proportions: only 7 percent of male teens in households below 130 percent of poverty reported taking a multivitamin or vitamin/mineral combination.

Few respondents reported taking a single mineral supplement such as calcium, and the calcium content of most multivitamin supplements is low relative to requirements; thus intakes of calcium appear to be unlikely to have been increased substantially by supplement use. Similarly, fiber intake from supplements is probably low for all groups other than older adults. For micronutrients such as vitamins E, A, and C, however, the prevalence of inadequacy could be somewhat lower with supplement use taken into account. Further research is needed to determine whether supplement use is higher for individuals with lower nutrient intakes from foods, and how regularly supplements are actually consumed. In addition, the limited sample sizes of some of the vulnerable subgroups in NHANES III, as well as methodological issues on how to combine food frequency data on supplement with 24-hour dietary recall data on foods consumed, suggest that additional research is needed on how best to collect and analyze data on supplement use in studies of nutrient adequacy.

The difference between mean estimated energy requirements (EERs) and mean energy intakes for adolescents and adults suggests that some individuals are underreporting intakes. If energy intakes are less than requirements for specific subgroups, then individuals cannot maintain their weight and these subgroups would then experience weight loss. It is well documented, however, that the opposite has occurred; over the past three to four decades, there has been an increase in the prevalence of overweight and obesity. Given the increase in the prevalence of overweight and obesity, underreporting of food intakes is the likely explanation for the difference between mean EER and mean energy intakes. Moreover, given that the difference between mean EER and mean energy intakes is typically greater for overweight than for non-overweight subgroups, underreporting appears to be associated with overweight.

Given the underreporting of energy intakes, an important question is the extent to which the prevalence of inadequacy for micronutrients and protein is therefore overestimated. It is not possible to answer this question precisely since it depends on the extent of underreporting and the correlation between energy and micronutrient intakes. Nonetheless, given the very high prevalence of inadequacy for some micronutrients—vitamin E and magnesium in particular—and the low intakes of calcium, it is unlikely that underreporting accounts fully for the apparent deficiencies in the intakes of these nutrients. For protein, however, it is likely that underreporting accounts for much of the prevalence of inadequacy for some subgroups, especially in light of the finding that the percentage with usual protein intakes outside the AMDR is low for almost all subgroups.

For children, underreporting of energy intakes does not appear to be an issue. In fact, the opposite is observed; mean energy intakes are considerably larger than mean EERs for children 1 to 3 years and 4 to 8 years. Although the increasing prevalence of overweight and obesity among children is consistent with an excess of energy intakes over requirements, the magnitude of the difference between mean intake and mean EER suggests that parents or caregivers parents either overestimate what their child actually consumes or report weight and height of their child that results in an underestimate of mean EER (underestimate their child's weight or overestimate their child's height). This finding of excess energy intakes relative to energy requirements also has been observed in other studies (Devaney et al. 2004). An interesting implication is the extent to which overreporting food intakes (because of its social desirability) leads to overfeeding of foods to children. In addition, if parents overreport the intakes of children, then the true prevalence of inadequacy for children may be higher than that estimated from dietary recall data.

Caution is needed when interpreting the high prevalence of inadequacy for vitamin E. Vitamin E shows extremely high levels of inadequacy; for some subgroups, the prevalence is 100 percent, and it is the only nutrient with a high prevalence of inadequacy among young children. This result of apparent inadequate vitamin E intakes has been found in other studies (Devaney et al. 2004; Suitor and Gleason 2002). However, clinical data on vitamin E inadequacy suggest otherwise. Data from NHANES III show that, although a majority of age and gender subgroups had a large proportion with usual intakes below the EAR, less than 5 percent had low plasma vitamin E levels (Institute of Medicine 1997). The possible reasons for the very high estimate of nutrient inadequacy in light of a low prevalence of clinical inadequacy include the difficulty in providing accurate information on the types and amounts of oils and fats added during cooking and potential issues related nutrient databases. In addition, the results for vitamin E may also suggest additional research is needed to support the DRIs established for vitamin E.

For magnesium, the proportion with inadequate intake is high for most subgroups examined. For adolescent and adult subgroups, the estimates all exceed 50 percent and are as high as 98 percent for adolescent females. Other studies also report this finding about high levels of inadequacy for zinc (Suitor and Gleason 2002; and Institute of Medicine 2004).

For all subgroups examined, mean intakes of dietary fiber are far below the AI for total fiber. Since total fiber includes both dietary fiber and functional fiber, it is somewhat misleading to compare intakes of dietary fiber with an AI for total fiber. However, the discrepancy between the intakes of dietary fiber and the AI—even the 90th percentile of dietary fiber is usually less than the AI—suggests that the U.S. population as a whole does not consume enough fiber.

Interestingly, a substantial proportion of children, especially young children, have usual intakes of zinc exceeding the UL. This finding is reported in other studies (Devaney et al. 2004; and Institute of Medicine 2004) and is apparently the result of a narrow margin between the RDA and UL for zinc in young children. In addition, this finding of a substantial proportion of children having usual zinc intakes above the UL appears inconsistent with empirical evidence showing few adverse health outcomes associated with excessive zinc consumption.

While the discussion and caveats above clearly suggest caution in interpreting the results presented in this report, concerns persist about dietary inadequacies and imbalances. Mean calcium intake of all adolescent and adult females is far below the AI set for calcium, suggesting calcium inadequacy. In addition, usual fat and carbohydrate intakes as a percent of food energy intake indicate an imbalance in diets of many adolescent and adult subgroups—too much fat and not enough carbohydrate. Finally, many of the dietary concerns are more pronounced among low-income and overweight individuals, as well as some age and gender subgroups known to have dietary problems—adolescent females and older adults.

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APPENDIX A

USUAL NUTRIENT INTAKE DISTRIBUTIONS:

INDIVIDUALS IN FOOD INSUFFICIENT VERSUS FOOD SUFFICIENT HOUSEHOLDS

This appendix includes distributions of usual intake for individuals from food insufficient and food sufficient households. Overall, these results suggest that individuals in food insufficient households have poor dietary outcomes. For all age groups, the prevalence of inadequacy is higher for individuals in food insufficient households than for individuals in food sufficient households. In addition, mean intakes of calcium, food energy, and fiber are lower for individuals in food insufficient households than for individuals in food sufficient households. In some of these cases, these differences are statistically significant.

Because of small sample sizes, however, these results need to be interpreted with caution. Only a very small number of individuals report living in households that sometimes or often do not have enough to eat. Thus, even large differences are generally not statistically significant. Further, those differences that are statistically significant often involve percentages close to 0 or 100, and statistical tests for the difference in the percentages inadequate (percentage with usual intake < EAR) are not reliable at these two extremes. Finally, as with the other comparisons, the analysis does not account for other factors affecting intake or for potential selection bias.

Usual Nutrient Intake: Vitamin C (mg/d), Individuals in Food Insufficient versus Sufficient Households

Sex-Age Category	N	Mean	5th	10th	25th	50th	75th	90th	95th	99th	% < EAR[a]
Kids 4-13, Food Insufficient	173	82	60	64	71	81	91	101	108	121	< 1%
Kids 4-13, Food Sufficient	4,949	101	38	47	66	93	127	165	191	249	3.0% **
Males 14-30, Food Insufficient	58	71	20	26	41	63	92	126	150	204	62.3%
Males 14-30, Food Sufficient	1,317	120	35	45	68	104	153	214	259	365	32.7%
Males 31-50, Food Insufficient	56	56	12	16	27	45	73	110	138	209	83.7%
Males 31-50, Food Sufficient	1,741	106	30	39	60	92	137	189	227	312	44.6% **
Males 51+, Food Insufficient	25	44	22	26	33	43	54	65	73	88	98.2%
Males 51+, Food Sufficient	2,361	106	26	36	58	92	139	195	235	328	42.3% **
Females 14-30, Food Insufficient	43	97	34	43	61	88	124	163	190	251	31.6%
Females 14-30, Food Sufficient	1,286	90	30	38	55	81	116	155	183	245	35.0%
Females 31-50, Food Insufficient	50	62	34	39	48	60	73	88	97	116	79.0%
Females 31-50, Food Sufficient	1,674	87	26	34	50	76	112	154	184	256	42.7%
Females 51+, Food Insufficient	37	91	19	26	44	73	119	178	224	337	43.0%
Females 51+, Food Sufficient	2,222	94	28	36	56	85	122	164	193	258	34.4%

Source: 1994-1996, 1998 CSFII.

[a]EAR = Estimated Average Requirement.

*(**): p-value for difference between food insufficient and food sufficient is < .05(.01)

Usual Nutrient Intake: Vitamin E (mg/d), Individuals in Food Insufficient versus Sufficient Households

Sex-Age Category	N	Mean	5th	10th	25th	50th	75th	90th	95th	99th	% < EAR[a]	
Kids 4-13, Food Insufficient	173	7	4	5	6	7	9	10	12	14	31.7%	
Kids 4-13, Food Sufficient	4,949	7	4	5	5	7	8	9	11	13	38.4%	
Males 14-30, Food Insufficient	58	10	5	6	8	9	11	14	15	18	80.3%	
Males 14-30, Food Sufficient	1,317	10	5	6	7	9	12	15	17	21	75.7%	
Males 31-50, Food Insufficient	56	8	3	4	5	7	10	13	16	21	85.2%	
Males 31-50, Food Sufficient	1,741	10	5	6	7	10	12	16	18	24	73.2%	
Males 51+, Food Insufficient	25	5	3	3	4	5	6	7	8	10	99.8%	
Males 51+, Food Sufficient	2,361	9	4	5	6	9	11	15	18	25	78.7%	
Females 14-30, Food Insufficient	43	6	4	4	5	6	6	7	8	9	100.0%	
Females 14-30, Food Sufficient	1,286	7	4	5	6	7	9	10	11	14	96.6%	**
Females 31-50, Food Insufficient	50	6	4	4	5	6	7	8	8	9	100.0%	
Females 31-50, Food Sufficient	1,674	7	4	4	5	7	9	11	13	17	93.0%	**
Females 51+, Food Insufficient	37	5	3	3	4	5	6	7	8	10	100.0%	
Females 51+, Food Sufficient	2,222	7	3	4	5	6	8	11	12	16	94.5%	**

Source: 1994-1996, 1998 CSFII.

[a]EAR = Estimated Average Requirement.

*(**): p-value for difference between food insufficient and food sufficient is < .05(.01)

Usual Nutrient Intake: Folate (mcg/d), Individuals in Food Insufficient versus Sufficient Households

Sex-Age Category	N	Mean	5th	10th	25th	50th	75th	90th	95th	99th	% < EAR[a]
Kids 4-13, Food Insufficient	173	265	149	167	202	251	312	382	431	541	7.8%
Kids 4-13, Food Sufficient	4,949	275	137	158	202	261	332	407	457	571	10.4%
Males 14-30, Food Insufficient	58	310	158	182	228	292	372	460	522	657	60.0%
Males 14-30, Food Sufficient	1,317	319	147	172	222	293	388	499	577	752	58.4%
Males 31-50, Food Insufficient	56	244	113	134	176	232	299	370	417	517	80.6%
Males 31-50, Food Sufficient	1,741	302	141	165	213	280	366	466	539	707	63.2%
Males 51+, Food Insufficient	25	123	71	79	96	119	145	173	192	232	100.0%
Males 51+, Food Sufficient	2,361	291	126	150	197	268	360	460	534	715	65.5% **
Females 14-30, Food Insufficient	43	235	146	162	192	230	272	315	342	399	91.2%
Females 14-30, Food Sufficient	1,286	228	109	127	163	214	278	345	393	504	85.6%
Females 31-50, Food Insufficient	50	179	83	100	131	171	219	268	300	366	96.9%
Females 31-50, Food Sufficient	1,674	225	102	121	157	209	276	350	403	524	85.3% **
Females 51+, Food Insufficient	37	193	98	112	139	178	231	293	339	447	93.3%
Females 51+, Food Sufficient	2,222	225	104	123	160	210	273	345	397	515	86.1%

Source: 1994-1996, 1998 CSFII.

[a]EAR = Estimated Average Requirement.

*(**): p-value for difference between food insufficient and food sufficient is < .05(.01)

Usual Nutrient Intake: Calcium (mg/d), Individuals in Food Insufficient versus Sufficient Households

Sex-Age Category	N	Mean	5th	10th	25th	50th	75th	90th	95th	99th
Kids 4-13, Food Insufficient	173	916	580	643	758	900	1,057	1,211	1,309	1,507
Kids 4-13, Food Sufficient	4,949	922	514	587	723	894	1,092	1,292	1,424	1,707
Males 14-30, Food Insufficient	58	919	437	506	646	848	1,112	1,420	1,644	2,165
Males 14-30, Food Sufficient	1,317	1,050	490	579	752	983	1,272	1,602	1,838	2,373
Males 31-50, Food Insufficient	56	709	314	377	500	669	874	1,094	1,243	1,563
Males 31-50, Food Sufficient	1,741	915 **	414	491	644	853	1,116	1,414	1,626	2,103
Males 51+, Food Insufficient	25	571	337	380	459	558	669	780	852	998
Males 51+, Food Sufficient	2,361	777 *	349	416	550	732	955	1,194	1,357	1,706
Females 14-30, Food Insufficient	43	600	281	329	426	561	731	921	1,054	1,350
Females 14-30, Food Sufficient	1,286	705	350	409	524	675	853	1,040	1,164	1,425
Females 31-50, Food Insufficient	50	550	390	421	478	545	617	685	728	812
Females 31-50, Food Sufficient	1,674	657	303	360	472	624	806	999	1,128	1,403
Females 51+, Food Insufficient	37	478	300	333	392	467	552	638	694	808
Females 51+, Food Sufficient	2,222	603 *	274	327	431	571	741	920	1,042	1,299

Source: 1994-1996, 1998 CSFII.

*(**): p-value for difference between food insufficient and food sufficient is < .05(.01)

Usual Nutrient Intake: Magnesium (mg/d), Individuals in Food Insufficient versus Sufficient Households

Sex-Age Category	N	Mean	5th	10th	25th	50th	75th	90th	95th	99th	% < EAR[a]
Kids 4-13, Food Insufficient	173	226	185	193	207	224	242	260	272	298	< 1%
Kids 4-13, Food Sufficient	4,949	235	148	163	192	229	271	314	343	406	< 1%
Males 14-30, Food Insufficient	58	314	180	203	246	302	370	440	488	589	61.5%
Males 14-30, Food Sufficient	1,317	329	179	205	254	315	388	471	529	660	56.0%
Males 31-50, Food Insufficient	56	281	125	152	205	272	347	421	469	566	75.8%
Males 31-50, Food Sufficient	1,741	337	185	213	263	325	398	475	528	642	59.6% *
Males 51+, Food Insufficient	25	223	150	164	189	220	254	287	308	351	99.0%
Males 51+, Food Sufficient	2,361	305	159	186	234	294	364	440	492	602	71.0% **
Females 14-30, Food Insufficient	43	203	105	122	155	196	244	292	324	389	79.4%
Females 14-30, Food Sufficient	1,286	226	133	150	180	220	265	310	340	409	70.2%
Females 31-50, Food Insufficient	50	208	125	141	169	204	243	280	304	352	85.0%
Females 31-50, Food Sufficient	1,674	238	132	152	187	231	280	333	369	445	68.4% *
Females 51+, Food Insufficient	37	194	117	132	156	186	223	267	299	376	89.7%
Females 51+, Food Sufficient	2,222	233	131	150	184	226	274	325	359	432	71.1%

Source: 1994-1996, 1998 CSFII.
[a]EAR = Estimated Average Requirement.
*(**): p-value for difference between food insufficient and food sufficient is < .05(.01)

Usual Nutrient Intake: Vitamin A (mcg RAE), Individuals in Food Insufficient versus Sufficient Households

Sex-Age Category	N	Mean	5th	10th	25th	50th	75th	90th	95th	99th	% < EAR[a]	
Kids 4-13, Food Insufficient	173	673	428	471	552	656	775	897	977	1,145	< 1%	
Kids 4-13, Food Sufficient	4,949	741	363	419	537	697	896	1,116	1,273	1,605	1.1%	*
Males 14-30, Food Insufficient	58	639	195	248	364	549	812	1,140	1,388	1,984	58.7%	
Males 14-30, Food Sufficient	1,317	818	312	381	523	732	1,015	1,360	1,619	2,244	37.4%	
Males 31-50, Food Insufficient	56	516	148	196	302	460	669	908	1,077	1,454	70.7%	
Males 31-50, Food Sufficient	1,741	839	305	376	525	744	1,041	1,411	1,696	2,407	36.6%	**
Males 51+, Food Insufficient	25	403	164	199	270	372	501	645	745	969	88.6%	
Males 51+, Food Sufficient	2,361	982	318	397	541	818	1,217	1,757	2,193	3,335	33.3%	**
Females 14-30, Food Insufficient	43	575	218	269	374	525	722	945	1,103	1,456	43.5%	
Females 14-30, Food Sufficient	1,286	624	233	287	397	557	773	1,037	1,239	1,734	39.0%	
Females 31-50, Food Insufficient	50	418	120	157	239	367	540	744	892	1,229	70.4%	
Females 31-50, Food Sufficient	1,674	654	252	309	425	592	811	1,072	1,267	1,740	36.3%	**
Females 51+, Food Insufficient	37	464	210	245	319	426	567	732	851	1,126	64.7%	
Females 51+, Food Sufficient	2,222	715	276	335	459	644	891	1,183	1,397	1,894	30.7%	

Source: 1994-1996, 1998 CSFII.

[a]EAR = Estimated Average Requirement.

*(**): p-value for difference between food insufficient and food sufficient is < .05(.01)

Usual Nutrient Intake: Iron (mg/d), Individuals in Food Insufficient versus Sufficient Households

Sex-Age Category	N	Mean	5th	10th	25th	50th	75th	90th	95th	99th	% < EAR[a]
Kids 4-13, Food Insufficient	173	14.3	10.3	11.0	12.4	14.0	15.9	17.9	19.2	22.1	< 1%
Kids 4-13, Food Sufficient	4,949	15.1	8.9	9.9	11.8	14.4	17.6	21.1	23.6	29.2	< 1%
Males 14-30, Food Insufficient	58	18.0	10.8	11.9	14.1	17.2	20.9	25.1	28.0	34.4	< 1%
Males 14-30, Food Sufficient	1,317	19.8	11.2	12.6	15.1	18.7	23.3	28.4	32.1	40.9	< 1%
Males 31-50, Food Insufficient	56	15.0	7.2	8.6	11.3	14.6	18.3	22.0	24.4	29.2	4.1%
Males 31-50, Food Sufficient	1,741	19.0	10.2	11.5	14.2	17.8	22.4	27.9	31.9	42.0	< 1%
Males 51+, Food Insufficient	25	10.6	7.2	7.9	9.1	10.4	11.9	13.7	15.0	18.0	3.0%
Males 51+, Food Sufficient	2,361	17.1	8.5	9.9	12.4	15.9	20.5	25.8	29.7	39.0	1.2%
Females 14-30, Food Insufficient	43	11.3	6.1	7.0	8.7	10.9	13.4	16.0	17.7	21.1	21.9%
Females 14-30, Food Sufficient	1,286	13.5	7.6	8.5	10.3	12.8	16.0	19.3	21.8	27.6	12.4%
Females 31-50, Food Insufficient	50	11.8	6.3	7.3	9.2	11.6	14.2	16.7	18.2	21.4	19.8%
Females 31-50, Food Sufficient	1,674	13.1	7.0	7.9	9.8	12.3	15.6	19.3	22.0	28.6	18.4%
Females 51+, Food Insufficient	37	10.7	5.2	6.1	7.8	10.2	13.0	16.0	18.1	22.6	15.4%
Females 51+, Food Sufficient	2,222	12.4	6.7	7.7	9.4	11.8	14.7	18.0	20.3	25.6	2.2%

Source: 1994-1996, 1998 CSFII.
[a]EAR = Estimated Average Requirement.

Usual Nutrient Intake: Zinc (mg/d), Individuals in Food Insufficient versus Sufficient Households

Sex-Age Category	N	Mean	5th	10th	25th	50th	75th	90th	95th	99th	% < EAR[a]
Kids 4-13, Food Insufficient	173	9.7	7.1	7.7	8.5	9.6	10.7	12.0	12.8	14.7	< 1%
Kids 4-13, Food Sufficient	4,949	10.5	6.5	7.2	8.5	10.2	12.2	14.3	15.7	18.7	< 1%
Males 14-30, Food Insufficient	58	12.7	6.5	7.4	9.3	11.9	15.2	18.9	21.4	27.1	18.0%
Males 14-30, Food Sufficient	1,317	14.9	8.6	9.6	11.7	14.3	17.4	20.9	23.3	28.6	4.5%
Males 31-50, Food Insufficient	56	11.4	5.9	6.9	8.7	11.1	13.8	16.5	18.3	22.0	32.1%
Males 31-50, Food Sufficient	1,741	14.3	8.2	9.2	11.1	13.7	16.8	20.1	22.4	27.3	11.2%
Males 51+, Food Insufficient	25	8.0	4.5	5.1	6.2	7.6	9.4	11.3	12.6	15.4	75.0%
Males 51+, Food Sufficient	2,361	12.5	6.6	7.5	9.2	11.7	14.9	18.5	21.1	27.2	26.8% **
Females 14-30, Food Insufficient	43	8.0	4.2	4.8	6.0	7.6	9.6	11.8	13.3	16.7	37.5%
Females 14-30, Food Sufficient	1,286	9.7	5.7	6.4	7.6	9.3	11.3	13.3	14.7	17.7	14.6%
Females 31-50, Food Insufficient	50	8.4	4.3	5.0	6.4	8.1	10.2	12.3	13.7	16.5	31.1%
Females 31-50, Food Sufficient	1,674	9.6	5.3	6.0	7.3	9.1	11.3	13.8	15.5	19.6	19.1%
Females 51+, Food Insufficient	37	8.1	5.9	6.3	7.1	8.0	9.0	9.9	10.5	11.7	18.2%
Females 51+, Food Sufficient	2,222	8.6	4.9	5.5	6.6	8.2	10.1	12.2	13.7	16.9	27.3%

Source: 1994-1996, 1998 CSFII.

[a]EAR = Estimated Average Requirement.

*(**): p-value for difference between food insufficient and food sufficient is < .05(.01)

Estimated Energy Requirements and Usual Intake of Food Energy (kcal): Individuals in Food Insufficient versus Sufficient Households

Sex-Age Category	N	Mean	5th	10th	25th	50th	75th	90th	95th	99th
Kids 4-13, Food Insufficient										
Usual intake	173	1,866	1,331	1,439	1,621	1,834	2,074	2,331	2,510	2,906
EER[a]	103	1,763	1,167	1,257	1,470	1,644	1,924	2,529	2,729	3,209
Kids 4-13, Food Sufficient										
Usual intake	4,949	1,941	1,295	1,411	1,629	1,898	2,205	2,519	2,730	3,204
EER	4,214	1,820	1,270	1,354	1,520	1,770	2,043	2,375	2,631	3,019
Males 14-30, Food Insufficient										
Usual intake	58	2,643	1,361	1,566	1,966	2,508	3,172	3,892	4,386	5,456
EER	55	2,793	2,242	2,354	2,447	2,783	2,974	3,300	3,734	3,908
Males 14-30, Food Sufficient										
Usual intake	1,317	2,827	1,652	1,870	2,253	2,725	3,291	3,913	4,346	5,293
EER	1,303	2,911	2,352	2,449	2,675	2,894	3,126	3,366	3,555	3,979
Males 31-50, Food Insufficient										
Usual intake	56	2,143	1,076	1,287	1,666	2,116	2,587	3,029	3,301	3,831
EER	49	2,761	2,241	2,326	2,481	2,767	2,985	3,218	3,410	3,820
Males 31-50, Food Sufficient										
Usual intake	1,741	2,549 *	1,534	1,713	2,044	2,475	2,969	3,468	3,811	4,614
EER	1,729	2,810	2,313	2,393	2,575	2,793	3,022	3,234	3,381	3,698
Males 51+, Food Insufficient										
Usual intake	25	1,475	771	911	1,162	1,458	1,769	2,058	2,236	2,581
EER	25	2,366	1,859	1,866	2,131	2,288	2,549	2,790	2,856	2,969
Males 51+, Food Sufficient										
Usual intake	2,361	2,069 **	1,166	1,336	1,642	2,012	2,431	2,875	3,173	3,798
EER	2,338	2,542	1,937	2,093	2,300	2,543	2,777	2,997	3,135	3,408
Females 14-30, Food Insufficient										
Usual intake	43	1,611	937	1,073	1,313	1,595	1,891	2,168	2,339	2,669
EER	38	2,146	1,729	1,829	1,973	2,071	2,276	2,624	2,645	2,754
Females 14-30, Food Sufficient										
Usual intake	1,286	1,860	1,169	1,307	1,547	1,826	2,134	2,453	2,667	3,113
EER	1,248	2,199	1,817	1,873	2,002	2,150	2,343	2,586	2,744	3,068

Sex-Age Category	N	Mean	5th	10th	25th	50th	75th	90th	95th	99th
Females 31-50, Food Insufficient										
Usual intake	50	1,714	935	1,085	1,354	1,683	2,040	2,385	2,601	3,028
EER	46	2,224	1,806	1,851	2,027	2,223	2,442	2,566	2,712	2,877
Females 31-50, Food Sufficient										
Usual intake	1,674	1,700	1,045	1,175	1,400	1,664	1,958	2,270	2,480	2,922
EER	1,610	2,176	1,741	1,817	1,960	2,149	2,351	2,586	2,739	3,080
Females 51+, Food Insufficient										
Usual intake	37	1,302	841	935	1,100	1,292	1,493	1,680	1,795	2,017
EER	33	2,057	1,513	1,740	1,932	2,059	2,139	2,504	2,569	2,665
Females 51+, Food Sufficient										
Usual intake	2,222	1,488	918	1,029	1,225	1,458	1,717	1,983	2,159	2,521
EER	2,149	1,970	1,505	1,598	1,764	1,961	2,154	2,355	2,476	2,778

Source: 1994-1996, 1998 CSFII.

[a]EER = Estimated Energy Requirement.

*(**): p-value for difference between food insufficient and food sufficient is < .05(.01)

Usual Nutrient Intake: Fat, Carbohydrate, and Protein, Individuals in Food Insufficient versus Sufficient Households

		Fat		Carbohydrate		Protein	
	N	% < AMDR[a]	% > AMDR	% < EAR[b]	% outside AMDR	% < EAR	% outside AMDR
Kids 4-13, Food Insufficient	173	<1	33.6	< 1	2.9	<1	<1
Kids 4-13, Food Sufficient	4,949	1.5	23.7	<1	2.5	<1	<1
Males 14-30, Food Insufficient	58	<1	46.7	<1	15.7	3.8	<1
Males 14-30, Food Sufficient	1,317	<1	27.0	<1	14.0	2.1	<1
Males 31-50, Food Insufficient	56	<1	36.8	2.8	8.1	7.2	<1
Males 31-50, Food Sufficient	1,741	<1	39.0	<1	27.5	3.3	<1
Males 51+, Food Insufficient	25	<1	9.0	<1	5.6	35.0	1.0
Males 51+, Food Sufficient	2,361	1.4	40.3	1.3	28.7	10.2	<1
Females 14-30, Food Insufficient	43	2.1	16.7	2.4	7.1	22.8	8.4
Females 14-30, Food Sufficient	1,286	1.0	28.0	<1	12.9	7.8	1.7
Females 31-50, Food Insufficient	50	<1	5.8	1.1	4.6	27.2	<1
Females 31-50, Food Sufficient	1,674	<1	34.4	2.1	20.7	13.1	<1
Females 51+, Food Insufficient	37	<1	51.0	7.6	29.5	25.8	<1
Females 51+, Food Sufficient	2,222	2.2	30.9	3.0	18.2	17.7	<1

Source: 1994-1996 CSFII.

[a]AMDR = Acceptable Macronutrient Distribution Range.

[b]EAR = Estimated Average Requirement.

Usual Nutrient Intake: Fiber (g/d), Individuals in Food Insufficient versus Sufficient Households

Sex-Age Category	N	Mean	5th	10th	25th	50th	75th	90th	95th	99th
Kids 4-13, Food Insufficient	173	12.9	4.6	5.8	8.3	11.3	15.3	21.5	26.8	41.2
Kids 4-13, Food Sufficient	4,949	13.1	7.7	8.6	10.3	12.6	15.3	18.1	20.1	24.4
Males 14-30, Food Insufficient	58	19.0	8.7	10.4	13.7	18.1	23.3	28.7	32.2	39.7
Males 14-30, Food Sufficient	1,317	18.1	9.0	10.5	13.4	17.1	21.7	26.9	30.4	38.3
Males 31-50, Food Insufficient	56	16.3	7.7	9.1	11.9	15.6	19.9	24.4	27.4	33.6
Males 31-50, Food Sufficient	1,741	18.8	9.4	11.0	14.0	17.9	22.6	27.8	31.4	39.3
Males 51+, Food Insufficient	25	11.8	7.9	8.5	9.8	11.4	13.4	15.5	17.0	20.1
Males 51+, Food Sufficient	2,361	18.3 *	8.0	9.7	13.0	17.3	22.4	28.1	32.1	40.7
Females 14-30, Food Insufficient	43	12.3	5.6	6.7	8.8	11.6	15.1	18.8	21.3	26.7
Females 14-30, Food Sufficient	1,286	13.1	6.8	7.9	9.9	12.5	15.7	18.9	21.1	26.1
Females 31-50, Food Insufficient	50	12.1	8.5	9.2	10.5	12.0	13.6	15.1	16.1	18.0
Females 31-50, Food Sufficient	1,674	13.9	6.5	7.7	10.1	13.3	17.0	21.0	23.6	29.1
Females 51+, Food Insufficient	37	11.9	5.9	7.0	8.9	11.5	14.4	17.4	19.4	23.4
Females 51+, Food Sufficient	2,222	14.3	6.8	8.1	10.5	13.7	17.4	21.3	23.9	29.2

Source: 1994-1996 CSFII.

*(**): p-value for difference between food insufficient and food sufficient is < .05(.01)