Nutrition Assistance Program Report Series

The Office of Analysis, Nutrition and Evaluation

Special Nutrition Programs Report No. CN-01-CD1

Changes in Children's Diets: 1989-1991 to 1994-1996

United States Department of Agriculture
Food and Nutrition Service

January 2001

Non-Discrimination Policy

United States Department of Agriculture
Food and Nutrition Service

January 2001
Special Nutrition Programs
Report No. CN-01-CD2

Changes in Children's Diets: 1989-1991 to 1994-1996

Authors:
Phil Gleason
Carol Suitor

Submitted by:
Mathematica Policy Research, Inc.
P.O. Box 2393
Princeton, NJ 08543-2393

Project Director: Phil Gleason

Submitted to:
Office of Analysis, Nutrition and Evaluation
USDA, Food and Nutrition Service
3101 Park Center Drive, Room 503
Alexandria, VA 22302-1500
Project Officer: Ed Herzog

This study was conducted under Contract number 53-3198-7-005 with the Food and Nutrition Service. Financial support for the study was provided by the Economic Research Service of the United States Department of Agriculture.

This report is available on the Food and Nutrition Service web site: *http://www.fns.usda.gov/oane.*

Suggested Citation:
U.S. Department of Agriculture, Food and Nutrition Service, Office of Analysis, Nutrition and Evaluation, *Changes in Children's Diets: 1989-1991 to 1994-1996,* CN-01-CD2, by Phil Gleason and Carol Suitor. Project Officer, Ed Herzog. Alexandria, VA: 2001.

ACKNOWLEDGMENTS

The authors would like to thank a number of people who contributed significantly to the preparation of this report. At the Food and Nutrition Service (FNS), Ed Herzog was the task leader for this study and provided many useful comments on the analysis plan and draft reports, as well as on analytical issues that arose in the process of writing the report. Jay Hirschman, Anita Singh, Dorothy Caldwell, and Louise Lapeze provided insights that helped us both develop the analytical approach used in the report and present the findings of the analysis in the report. Judy Wilson and Stan Garnett also provided support to the project. We received insightful comments on our analysis plan from an external reviewer, Johanna Dwyer, and from four reviewers outside of FNS but within the government: Peter Basiotis, Joanne Guthrie, Sue Krebs-Smith, and Jay Variyam. Peter Basiotis of the Center for Nutrition Policy and Promotion provided Healthy Eating Index data that was very helpful. He, Johanna Dwyer, Joanne Guthrie, Jay Variyam, and Alanna Moshfegh also provided comments on a draft of this report. A number of colleagues at Mathematica contributed to the report. Barbara Devaney and Anne Gordon provided insightful comments on both the analysis plan and a first draft of this report, Anu Rangarajan participated in the initial development of the analysis plan, Dexter Chu provided expert computer programming and help in solving various analytical problems, and Robert Wild, Jane Dokko, and Melissa Seeley provided outstanding research assistance and computer programming. Robert Wild also contributed to the development of the analysis plan. Last but not least, Monica Capizzi, Cathy Harper and Marjorie Mitchell organized the production of the report and Patricia Ciaccio edited the report. We gratefully acknowledge the contributions of these individuals and accept sole responsibility for any remaining errors or omissions in the report.

CONTENTS

Chapter		Page
	EXECUTIVE SUMMARY	xi
I	INTRODUCTION	1
	A. BACKGROUND AND RESEARCH QUESTIONS	2
	B. LITERATURE REVIEW	3
	1. Children's Dietary Status	4
	2. Changes in Children's Dietary Intake Over Time	4
II	DATA AND METHODOLOGY	9
	A. CSFII	9
	B. METHODOLOGICAL ISSUES	16
	1. Defining Reference Standards for Dietary Intake	17
	2. Measuring Usual Intake	24
	3. Estimating Food Group Consumption	26
	4. Defining SBP/NSLP Participation	28
	5. Defining Breakfast and Lunch	28
	6. Significance Testing	30
	7. Adjusting for Differences in Dietary Intake Data Collection Methodologies	31
III	CHANGE IN CHILDREN'S DIETARY INTAKE OVER TIME	33
	A. CHANGES IN MEAN INTAKES OF FOOD ENERGY, NUTRIENTS, AND OTHER DIETARY COMPONENTS	33
	1. Energy and Macronutrients	33
	2. Vitamins and Minerals	42
	3. Other Dietary Components	46

CONTENTS *(continued)*

Chapter **Page**

III *(continued)*

B. CHANGES IN PERCENTAGES OF CHILDREN MEETING NUTRIENT STANDARDS 47

1. Food Energy Distribution 48
2. Calcium Distribution 51
3. Distributions of Other Vitamins and Minerals 54

C. CHANGES IN INTAKES RELATIVE TO DIETARY GUIDELINES AND OTHER RECOMMENDATIONS 59

1. All Children 61
2. Age/Gender Groups 63
3. Racial/Ethnic Groups 65

D. CHANGES IN FOOD GROUP INTAKES 69

1. Mean Numbers of Servings 69
2. Distribution of Daily Food Group Servings 75

E. CONCLUSIONS 85

REFERENCES 87

APPENDIX A: DEFINING SBP/NSLP PARTICIPATION IN THE 1989-1991 AND 1994-1996 CSFII A.1

APPENDIX B: SUPPLEMENTARY TABLES TO CHAPTER III B.1

TABLES

Table		Page
II.1	KEY SIMILARITIES AND DIFFERENCES BETWEEN 1989-1991 AND 1994-1996 CSFII	10
II.2	CHARACTERISTICS OF SCHOOL-AGED CHILDREN, CSFII, 1989-1991 AND 1994-1996	14
II.3	1989 RECOMMENDED DIETARY ALLOWANCES AND DIETARY REFERENCE INTAKE-BASED DIETARY STANDARDS, BY AGE/GENDER	19
II.4	HEALTHY EATING INDEX TARGET NUMBER OF SERVINGS PER DAY FROM THE USDA FOOD GUIDE PYRAMID	27
III.1	MEAN DAY 1 NUTRIENT INTAKE RELATIVE TO DIETARY STANDARDS AMONG SCHOOL-AGED CHILDREN, 1989-1991 AND 1994-1996	34
III.2.A	MEAN DAY 1 24-HOUR NUTRIENT INTAKE AMONG SCHOOL-AGED CHILDREN, BY AGE, AMONG MALES, 1989-1991 AND 1994-1996	39
III.2.B	MEAN DAY 1 24-HOUR NUTRIENT INTAKE AMONG SCHOOL-AGED CHILDREN, BY AGE, AMONG FEMALES, 1989-1991 AND 1994-1996	40
III.3	MEAN DAY 1 24-HOUR NUTRIENT INTAKE AMONG SCHOOL-AGED CHILDREN, BY RACE/ETHNICITY, 1994-1996	41
III.4	24-HOUR USUAL FOOD ENERGY INTAKE DISTRIBUTION, OVERALL AND BY SUBGROUP, 1989-1991 AND 1994-1996	50
III.5	24-HOUR USUAL CALCIUM INTAKE DISTRIBUTION, OVERALL AND BY SUBGROUP, 1989-1991 AND 1994-1996	53
III.6.A	PERCENTAGE OF SCHOOL-AGED CHILDREN WHOSE USUAL DAILY NUTRIENT INTAKE IS AT OR ABOVE DIETARY STANDARDS, BY AGE, AMONG MALES, 1989 -1991 AND 1994-1996	57

TABLES *(continued)*

Table		Page
III.6.B	PERCENTAGE OF SCHOOL-AGED CHILDREN WHOSE USUAL DAILY NUTRIENT INTAKE IS AT OR ABOVE DIETARY STANDARDS, BY AGE, AMONG FEMALES, 1989-1991 AND 1994-1996	58
III.7	PERCENTAGE OF SCHOOL-AGED CHILDREN WHOSE USUAL DAILY NUTRIENT INTAKE IS AT OR ABOVE DIETARY STANDARDS, BY RACE/ETHNICITY, 1989-1991 AND 1994-1996	60
III.8.A	PERCENTAGE OF SCHOOL-AGED CHILDREN WHO MEET SELECTED DIETARY STANDARDS, BY AGE, AMONG MALES, 1989-1991 AND 1994-1996	64
III.8.B	PERCENTAGE OF SCHOOL-AGED CHILDREN WHO MEET SELECTED DIETARY STANDARDS, BY AGE, AMONG FEMALES, 1989-1991 AND 1994-1996	66
III.9	PERCENTAGE OF SCHOOL-AGED CHILDREN WHO MEET SELECTED DIETARY STANDARDS, BY RACE/ETHNICITY, 1989-1991 AND 1994-1996	68
III.10.A	24-HOUR FOOD GROUP INTAKES OF SCHOOL-AGED CHILDREN, BY AGE, AMONG MALES, 1989-1991 AND 1994-1996	73
III.10.B	24-HOUR FOOD GROUP INTAKES OF SCHOOL-AGED CHILDREN, BY AGE, AMONG FEMALES, 1989-1991 AND 1994-1996	74
III.11	24-HOUR FOOD GROUP INTAKES OF SCHOOL-AGED CHILDREN, BY RACE/ETHNICITY, 1989-1991 AND 1994-1996	77
III.12	DISTRIBUTION OF 24-HOUR FOOD GROUP INTAKES OF SCHOOL-AGED CHILDREN, 1989-1991 AND 1994-1996	79
III.13.A	DISTRIBUTION OF 24-HOUR FOOD GROUP INTAKES OF SCHOOL-AGED CHILDREN, BY AGE, AMONG MALES, 1989-1991 AND 1994-1996	81
III.13.B	DISTRIBUTION OF 24-HOUR FOOD GROUP INTAKES OF SCHOOL-AGED CHILDREN, BY AGE, AMONG FEMALES, 1989-1991 AND 1994-1996	82
III.14	DISTRIBUTION OF 24-HOUR FOOD GROUP INTAKES OF SCHOOL-AGED CHILDREN, BY RACE/ETHNICITY, 1989-1991 AND 1994-1996	83

FIGURES

Figure **Page**

II.1 RESPONSE RATES, 1989-1991 AND 1994-1996 CSFII 12

III.1 SCHOOL-AGED CHILDREN'S MEAN 24-HOUR FOOD ENERGY INTAKE, BY AGE/GENDER, 1989-1991 AND 1994-1996 36

III.2 SCHOOL-AGED CHILDREN'S MEAN INTAKE OF FAT AS A PERCENTAGE OF FOOD ENERGY, 1989-1991 AND 1994-1996 37

III.3 SCHOOL-AGED CHILDREN'S MEAN 24-HOUR INTAKES OF VITAMINS AND MINERALS, 1989-1991 AND 1994-1996 43

III.4 DISTRIBUTION OF FOOD ENERGY INTAKE AS A PERCENTAGE OF THE REA AMONG SCHOOL-AGED CHILDREN, 1989-1991 AND 1994-1996 49

III.5 DISTRIBUTION OF CALCIUM INTAKE AS A PERCENTAGE OF THE AI AMONG SCHOOL-AGED CHILDREN, 1989-1991 AND 1994-1996 52

III.6 PERCENTAGE OF SCHOOL-AGED CHILDREN WHOSE USUAL INTAKE MEETS STANDARDS, 1989-1991 AND 1994-1996 55

III.7 PERCENTAGE OF SCHOOL-AGED CHILDREN WHOSE USUAL INTAKE MEETS DIETARY RECOMMENDATIONS, 1989-1991 AND 1994-1996 62

III.8 PERCENTAGE OF SCHOOL-AGED CHILDREN MEETING TOTAL FAT AND SATURATED FAT DIETARY RECOMMENDATIONS, BY RACE/ETHNICITY, 1989-1991 AND 1994-1996 67

III.9 MEAN 24-HOUR FOOD GROUP INTAKES AMONG SCHOOL-AGED CHILDREN, 1989-1991 AND 1994-1996 70

III.10 BEVERAGE CONSUMPTION AMONG MALES AND FEMALES AGES 14 TO 18, 1989-1991 AND 1994-1996 76

III.11 PERCENTAGE OF SCHOOL-AGED CHILDREN MEETING AGE/GENDER-SPECIFIC TARGETS FOR FOOD GROUP CONSUMPTION, 1989-1991 AND 1994-1996 80

EXECUTIVE SUMMARY

Children's diets may influence their lives in a variety of ways, including affecting their growth, health outcomes, and cognitive development. Since the late 1980s, considerable attention has been given to identifying nutritional problems in children's diets and identifying and implementing initiatives that may help children (and adults) improve their diets. For example, public initiatives have focused on encouraging children to limit their fat intake and to eat a balanced diet that includes recommended numbers of servings of the five major food groups from the U.S. Department of Agriculture's Food Guide Pyramid. As a result, there is wide interest in whether children's diets have changed during recent years.

This report is the second of two reports on the nutrition of children using findings from the analysis of the 1989-1991 and 1994-1996 panels of the Continuing Survey of Food Intakes by Individuals (CSFII). The key objectives of the overall study are to describe the diets of school-aged children in the United States as of the mid-1990s, examine relationships between children's participation in the school meal programs and their dietary intake, and examine changes in intake between the periods 1989-1991 and 1994-1996. This second report describes changes between these periods in children's food and nutrient intakes and reports the percentages of children meeting various dietary standards. The first report (Gleason and Suitor 2000) focuses on children's dietary intakes as of 1994-1996 and also compares the diets of participants and nonparticipants in the school meal programs.

The 1989-1991 and 1994-1996 CSFII surveys collected dietary intake and other data from nationally representative samples of noninstitutionalized residents of the United States. The 1989-1991 CSFIIl collected dietary intake data on three consecutive days, with data on the first day collected through a 24-hour recall interview and data on the second and third days collected through food diary records. In contrast, the 1994-1996 CSFII collected two nonconsecutive days of dietary intake information, both by 24-hour recall interviews. The analysis in this report uses data from more than 2,900 children ages 6 to 18 who completed the first day of the 1989-1991 dietary intake interview and from nearly 2,700 children ages 6 to 18 who completed both days of the 1994-1996 dietary intake interviews.

The analysis presented in this report includes several important methodological features. To address the issue of what proportion of children meet various dietary standards, we used statistical methods to obtain unbiased estimates of the distribution of usual intake using two or three days of intake information for each child. For assessing the nutrient adequacy of children, we used the newly developed Dietary Reference Intake (DRI) values when possible. Since accepted reference standards (Estimated Average Requirements, or EARs) have not yet been developed for nutrients other than the B vitamins, phosphorus, and magnesium, we assigned reference standards derived from the 1989 Recommended Dietary Allowances (RDAs) for these nutrients. No reference standard was assigned for calcium; rather, the change in the full distribution of calcium intake was examined.

To describe changes in children's diets over time, we used data from two different surveys using two different samples. The analysis considered potential methodological differences between the two surveys. For example, because of differences in dietary intake interview methodology, much of the analysis is based on the Day 1 intake data, since both the 1989-1991 and 1994-1996 CSFII collected these data using a dietary recall interview. In particular, we limited the analysis to day one only when comparing mean intakes across the two periods. When comparing the distribution of usual intakes across time periods, however, we used three days of 1989-1991 CSFII data and two days of 1994-1996 CSFII data due to the statistical requirements for estimating the distribution of usual intake. Finally, we conducted tests to determine whether the observed changes in children's diets over time were statistically significant.

MAJOR FINDINGS

- ***Food energy intake among school-aged children increased between 1989-1991 and 1994-1996.***

Over the period 1989-1991 to 1994-1996, school-aged children's mean 24-hour food energy intake increased significantly from 88 to 94 percent of the 1989 Recommended Energy Allowance (REA). Comparison of the full distributions of food energy intake for the two periods shows that intakes increased among light, moderate, and heavy eaters. In addition, the increase was driven primarily by foods eaten at dinner and for snacks during the day, as children's mean food energy intakes at breakfast and lunch stayed about the same over this period.

The increase in energy intake held for all school-aged males and for females ages 14 to 18 but did not hold for the younger females. For females ages 6 to 8, in fact, mean food energy intake decreased from 94 to 87 percent of the REA (although this difference was not statistically significant). Among racial/ethnic groups, the increase in food energy intake was largest for white children. Black and Hispanic children experienced smaller (and statistically insignificant) increases in food energy intake.

- ***Despite the increase in food energy intake, children's intakes of most vitamins and minerals did not change much over this period.***

While school-aged children consumed more food energy in the middle 1990s than they did in the late 1980s to early 1990s, their intake of most vitamins and minerals stayed about the same. Of the 14 vitamins and minerals examined in this report, children's mean 24-hour intakes of only iron and niacin increased significantly between 1989-1991 and 1994-1996. An alternative way of measuring nutrient intake--estimating the proportion of children whose usual intakes meet recommended dietary standards (the EAR, if available)--tells a similar story. There were significant increases in the percentage of school-aged children meeting the relevant standard for only two of the vitamins and minerals--iron and vitamin E. To some extent, this was due to the fact that very high proportions of children met the standard for most water-soluble vitamins and vitamin A in the earlier period, leaving little room for improvement. However, relatively small percentages of children met the standards for nutrients like folate, magnesium, and zinc in 1989-1991, and these percentages did not increase over time either. The distribution of calcium intake among all children did not change significantly between 1989-1991 and 1994-1996, but there was a decrease in calcium intake among the younger and older females and among black children.

Males were more likely than females to experience increases in mean vitamin and mineral intake between 1989-1991 and 1994-1996. For example, mean intakes of vitamin E, vitamin B_{12}, niacin, iron, and zinc increased over this period among males ages 6 to 8, as did mean intakes of vitamin B_6, niacin, iron, and zinc among males ages 9 to 13. Among females, only iron intake increased over this period. Among females ages 6 to 8, in fact, mean intakes of vitamin E, riboflavin, folate, calcium, magnesium, and phosphorus *decreased* significantly between 1989-1991 and 1994-1996.

The pattern of an increase in food energy intake without a corresponding increase in vitamin and mineral intake is particularly clear among females ages 14 to 18. The mean energy intake among these teenage girls increased from 78 to 86 percent of the REA between 1989-1991 and 1994-1996. Over the same period, mean intake of only one micronutrient (iron) increased significantly. Since the increase in food energy intake clearly was not driven by an increase in foods rich in vitamins and minerals, one possibility is that it was driven by an increase in foods or drinks high in added sugars. This hypothesis is supported by two other trends over this period among females ages 14 to 18: (1) their intake of carbohydrates as a percentage of food energy increased, and (2) their consumption of soda and fruit drinks and fruit-flavored drinks increased. The increase in mean iron intake may have been due to the increased availability and consumption of highly fortified breakfast cereals.

Mean vitamin and mineral intakes increased more among white children than among the other racial/ethnic groups. For example, white children's mean intakes of vitamin B_6, niacin, thiamin, iron, and zinc increased significantly. Furthermore, the percentage of white children whose usual intakes met the dietary standard increased for vitamin E, iron, and zinc. Among black and Hispanic children, by contrast, mean intakes of no vitamins and minerals changed significantly over this period. Although the percentage of black children who met the dietary standard for vitamin C intake increased significantly between 1989-1991 and 1994-1996, the percentage meeting the folate standard decreased significantly, from an already low level of 47 percent in the earlier period to 38 percent in the later period. As mentioned above, black children's calcium intake also decreased over this period, especially among those with the highest intakes of calcium in the earlier period.

- ***Children's fat intake as a percentage of food energy decreased between 1989-1991 and 1994-1996, although absolute intakes of fat did not decline.***

Among all school-aged children, mean 24-hour total fat intake decreased from 34.1 to 32.4 percent of food energy, while saturated fat intake decreased from 13.0 to 11.7 percent of food energy. These decreases occurred at breakfast and lunch, as well as over 24 hours. Each of the age/gender groups we examined experienced similar decreases in fat intake, but there were differences by race/ethnicity. White children's total fat and saturated fat intake decreased substantially over this period. Among black and Hispanic children, however, total fat intake as a percentage of food energy stayed about the same, and saturated fat intake as a percentage of food energy decreased only moderately.

The decrease in fat intake as a percentage of food energy among all children translated into large increases in the percentage of children meeting the dietary guidelines for total fat and saturated fat intake. In 1989-1991, only 14 percent of children met the dietary guideline of limiting total fat to no more than 30 percent of food energy, and only 7 percent met the guideline of limiting saturated fat to less than 10 percent of food energy. By 1994-1996, these percentages had approximately doubled, to 25 percent for total fat and 16 percent for saturated fat. Despite the large increases in the percentage of children meeting the dietary guidelines for total fat and saturated fat, most children still failed to meet these guidelines by 1994-1996. In addition, the percentage of black and Hispanic children who met the total fat and saturated fat dietary guidelines did not increase over this period.

Despite the decline in fat intake as a percentage of food energy, children's fat intake measured in absolute terms did not change between 1989-1991 and 1994-1996. In the earlier years, children's mean intakes of total fat and saturated fat were 77 grams (g) and 29 g, respectively. In the later years, these mean intakes were about the same (78 g of total fat and 28 g of saturated fat). The decrease in fat intake as a percentage of food energy was caused by an increase in food energy intake without a correspondingly large increase in fat intake.

- ***Children's protein intake as a percentage of food energy decreased between 1989-1991 and 1994-1996, and their carbohydrate intake increased over this same period.***

Between 1989-1991 and 1994-1996, children's mean 24-hour intake of protein decreased significantly, from about 15 to 14 percent of food energy. This decrease in protein intake held across the board--at breakfast and lunch, for each of the age/gender groups, and for each of the racial/ethnic groups. However, children's absolute intake of protein did not change significantly, and was well above the protein RDA for most children. With the decreases in the proportion of food energy from both fat and protein intake, there was a corresponding increase in the proportion of food energy from carbohydrates. Children's mean 24-hour carbohydrate intake increased from 52.0 to 54.7 percent of food energy over this period. This was associated with a large increase in the percentage of children meeting the dietary recommendation of consuming more than 55 percent of food energy from carbohydrates (from 28 to 53 percent). Children's mean absolute carbohydrate intake also increased significantly.

- ***Children's cholesterol intake decreased, and their fiber intake increased, between 1989-1991 and 1994-1996.***

Over 24 hours, children's mean intake of cholesterol fell from 257 milligrams (mg) in 1989-1991 to 241 mg in 1994-1996. This decrease in cholesterol intake occurred primarily at breakfast, where mean intake fell from 71 to 57 mg. In addition, the decrease was strongest among younger children (under age 14) and white children. Mean cholesterol intake among children ages 14 to 18 and among blacks and Hispanics did not significantly decrease over this period. The percentage of all school-aged children who met the dietary recommendation of limiting their intake to no more than 300 mg increased slightly from 74 to 78 percent.

Among all school-aged children, mean fiber intake increased significantly, from 13.4 to 14.2 g between 1989-1991 and 1994-1996. This increase was driven by foods consumed at meals other than breakfast and lunch (at which fiber intake did not change over this period). The increase in fiber intake was associated with the overall increase in food energy intake; fiber intake per 1,000 calories of energy did not increase significantly. The increase in mean fiber intake was strongest among males and females ages 14 to 18 and among white children. As with cholesterol, the percentage of children meeting the recommended standard for fiber intake remained consistent, but at a low value (28 percent).

- ***Over the period under study, children increased their consumption of vegetables and grain products and consumed fewer milk products and meat and meat substitutes.***

Children's mean daily intake of grain products increased from 6.5 servings in 1989-1991 to 7.2 servings in 1994-1996. At the same time, their mean daily intake of vegetables increased from 2.3 to 2.6 servings. This increase in vegetable consumption was responsible for the increase in combined servings of fruit and vegetables, from 3.7 to 4.1 servings, bringing children's average consumption closer to, but still well below, the goal of a minimum of five servings of vegetables and fruit per day. The increase in vegetable consumption was largest among males and females ages 14 to 18.

In addition to the increase in mean consumption of grain products and vegetables, there were increases in the percentage of children whose intake of these foods was above recommended levels. For example, the percentage of children meeting an age/gender-specific target for grain product consumption increased significantly, from 17 to 23 percent. The corresponding increase for vegetable consumption was from 12 to 17 percent. As these figures show, however, most children failed to meet the recommended consumption levels even after the increase in grain product and vegetable consumption.

The patterns for the consumption of milk products and meat and meat substitutes are the reverse of those for grain products and vegetables. Children's mean intake of milk products decreased significantly, from 2.4 to 2.0 servings per day between 1989-1991 and 1994-1996, and their mean intake of meat and meat substitutes decreased significantly, from 1.7 to 1.4 servings per day. The percentage of children meeting the age/gender-specific targets for the consumption of these food groups also decreased significantly over this period, from 40 to 30 percent for milk products and from 19 to 7 percent for meat and meat substitutes.

- ***Children's beverage consumption shifted between 1989-1991 and 1994-1996 from high-fat milk to lower-fat milk, soda, and fruit and fruit-flavored drinks.***

The decline in school-aged children's consumption of milk products was driven primarily by a decrease in their consumption of whole milk, from 0.7 to 0.4 servings per day. However, their consumption of low-fat milk remained constant and their consumption of nonfat milk increased slightly but significantly over this period. Children consumed greater amounts of regular and diet soda (mean intake increased from 1.0 to 1.4 servings per day) and fruit drinks and fruit-flavored drinks (mean intake increased from 0.5 to 0.8 servings per day). These changes in beverage consumption were especially pronounced among older children (those ages 14 to 18).

- ***Changes in school-aged children's consumption of specific foods between 1989-1991 and 1994-1996 were consistent to some extent with changes in their nutrient intake.***

Several changes in children's food consumption were consistent with the substantial decrease in fat intake as a percentage of food energy. In particular, the declines in the consumption of whole milk and meat, along with the increases in the consumption of nonfat milk, soda, fruit drinks, and fruit-flavored drinks, are a potential explanation for the decrease in fat intake. The decrease in milk intake among females ages 6 to 8 and among black children may also help explain why mean calcium intake decreased significantly for these subgroups. Finally, the increase in children's mean consumption of vegetables and grain products may have played a role in the small increase in their fiber intake between 1989-1991 and 1994-1996.

I. INTRODUCTION

Since the late 1980s, considerable attention has been given to identifying nutritional problems in children's diets and how these diets change over time. The analysis of change in children's diets over time provides a useful way to monitor progress in improving children's nutritional adequacy and quality. This is important because children's diets have a wide range of potential effects on their lives. Dietary factors may be related to the increasing prevalence of obesity in children, which itself is associated with a variety of adverse health and social consequences. Children's diets may also be related to their cognitive development, as undernourishment may influence children's ability to concentrate in school.

This report uses the 1989-1991 and 1994-1996 Continuing Survey of Food Intake by Individuals (CSFII) to examine dietary changes among children. The goals of the analysis in this report are to measure progress that has been made in improving children's diets over this period and to identify areas for future improvement. Originally, the study had also been designed to provide information on change over time in the two largest nutrition programs operated by the U.S. Department of Agriculture (USDA)--the School Breakfast Program (SBP) and the National School Lunch Program (NSLP)--which serve breakfasts and lunches to students in most schools in the United States. However, problems with the comparability of the information on SBP and NSLP participation in the 1989-1991 and 1994-1996 CSFII survey (see Chapter II) prevented us from addressing this issue in this report.

The report consists of three chapters. The rest of this chapter provides background information on this study and describes previous research on changes over time in the quality of children's diets. Chapter II describes the data used in the analysis and outlines key methodological issues. Chapter

III presents findings on changes in the quality of children's dietary intake during the periods 1989-1991 and 1994-1996, for all school-aged children and for key subgroups. To complement the analysis in this report, a companion report (Gleason and Suitor 2000) provides a more detailed description of school-aged children's diets and the school meal programs during the 1994-1996 period.

A. BACKGROUND AND RESEARCH QUESTIONS

Two general public health initiatives may have indirectly influenced children's diets during the late 1980s and early 1990s. First, in 1989, the National Research Council (NRC) adopted specific quantitative guidelines for the intake of dietary components such as fat, sodium, and cholesterol. For example, the guidelines included the specific goal for individuals of reducing their fat intake to 30 percent of food energy rather than the general directive of reducing their fat intake to decrease their risk of chronic disease. Second, in 1992, the USDA published the Food Guide Pyramid, which contained specific recommendations for the consumption of five major food groups. Again, this provided government-sanctioned goals for consumption, such as three to five servings of vegetables a day, rather than general encouragement to eat more fruit and vegetables. These factors may have contributed to the finding reported in the *Third Report on Nutrition Monitoring in the United States* that "trends in the amounts of food available for consumption suggest that Americans are slowly changing their eating patterns toward more healthful diets" (Life Sciences Research Office 1995).

In addition to these public health initiatives, government policy may have led to dietary change among children over this period through the SBP and NSLP. These school nutrition programs--particularly the SBP--have grown in scale during the past 20 years. The average number of students served by the SBP per day increased from 3.4 million in 1985 to 6.6 million in 1996 (the last year covered by the data used in this study) and 7.3 million in 1999. In addition, the much-publicized results of the first School Nutrition Dietary Assessment (SNDA-1) Study (Burghardt et al. 1993) were first released in the early 1990s. These findings showed that students' intakes of dietary fat and the fat content of school meals were well above recommended levels. The publicity surrounding these findings may have led some schools to make changes to their meal programs in an attempt to make these meals healthier. Concern over the nutritional quality of school meals, partly in response to the SNDA-1 findings, led to the publication of new USDA regulations in June 1995. These new regulations required school food authorities to prepare meals that met new nutrition standards for fat, saturated fat, and other key nutrients (*Federal Register*, June 13, 1995). Although these requirements were not imposed on most schools during the period covered by the 1994-1996 CSFII, schools may have begun changing their meal programs in preparation for the requirements.

To update our knowledge on how children's diets have changed during the 1990s, this report addresses the following research questions:

- What have been the changes in children's mean intakes of food energy and key nutrients relative to accepted dietary standards between 1989-1991 and 1994-1996?
- How have the proportions of children meeting various dietary standards changed?
- How have children's intakes of foods from important food groups changed during this period? How closely are those changes linked to changes in nutrient intakes?

B. LITERATURE REVIEW

Research on children's diets typically has relied on data collected before the mid-1990s and focused on children's dietary status at a given point in time. These studies were reviewed in Gleason and Suitor (2000) and are briefly summarized in Section B.1. Fewer studies have examined changes in children's dietary intake over time. These studies are described in more detail in Section B.2.

1. Children's Dietary Status

As reviewed in Gleason and Suitor (2000), previous research on children's food and nutrient intake has had reasonably consistent findings. Some of the major findings from that literature include the following:

- Children's mean intakes of total fat and saturated fat exceed the recommended maximum level, while their mean carbohydrate intake is less than the recommended minimum level.

- Children's mean intakes of most vitamins and minerals exceed the 1989 Recommended Dietary Allowances (RDAs), but some subgroups have mean intakes of selected vitamins and minerals that are less than the RDAs. Teenagers (especially teenage girls) have been found to have low mean intake levels of vitamin A, vitamin E, calcium, magnesium, zinc, and (for girls only) iron.

- No studies have reported unbiased assessments of the proportion of children whose usual vitamin and mineral intakes are below recommended levels.

- On average, children underconsume dietary fiber and overconsume sodium. While most groups of children have mean cholesterol levels within recommended levels, teenage boys' mean cholesterol intake exceeds the recommended maximum intake.

- Children's food intake patterns are clearly not consistent with USDA Food Guide Pyramid recommendations. Most children fail to consume the recommended numbers of servings of fruit, vegetables, grain products, and foods from the meat and meat substitutes group.

- Breakfast skipping is relatively common among teenage girls; between one-third and one-half of this group skips breakfast on a given day.

2. Changes in Children's Dietary Intake Over Time

Previous research on children's diets has addressed the question of how dietary intake has changed over time. In assessing dietary change, the studies have tried to measure dietary intake at different points in time using a similar methodological approach. Most commonly, the studies have relied on repeated panels of the same data collection effort. Three dietary surveys--the CSFII, National Health and Nutrition Examination Survey (NHANES), and the Nationwide Food

Consumption Survey (NFCS)--have been conducted more than once during the general period of the mid-1960s through mid-1990s.

This previous research has shown that food energy intake among children has risen in recent years, after being stable or declining for a long time before the 1990s. For children ages 2 to 18, Morton and Guthrie (1998) found an increase in mean food energy intake, from 2,455 calories in 1989-1991 to 2,698 calories in 1994-1996. This increase is not simply due to a change in the age/gender distribution over this period, as Kennedy and Powell (1997) found a similar increase in food energy intake measured relative to the Recommended Energy Allowance (REA). Furthermore, food disappearance data over the full population (children and adults) showed an increase in per-capita food consumption, from 3,500 calories in 1989 to 3,800 calories in 1994 (Gerrior and Bente 1997).

Two studies suggest that energy intake among children was stable or declining before the 1990s. Nicklas et al. (1993) found that food energy intake among 10-year-olds in Bogalusa, Louisiana, was relatively stable, at 2,100 to 2,200 calories, on average, between 1973-1974 and 1987-1988.[1] Kennedy and Goldberg (1995) used two different repeated national data sets and found children's mean energy intake to be steady or declining (depending on the age/gender subgroup being examined) from 1971-1974 to 1988-1991 (NHANES) and from 1986 to 1989-1991(CSFII).

The most striking change in children's diets in recent years has been a decline in the intake of fat and saturated fat as a percentage of food energy.[2] In the Bogalusa study, total fat intake as a percentage of food energy fell from 38.4 percent in 1973-1974 to 35.6 percent in 1987-1988 (Nicklas

---

[1]This study also found that 10-year-olds were about three pounds heavier, on average, in 1987-1988 than they were in 1973-1974, suggesting a more sedentary lifestyle in the latter period.

[2]Each of the studies showing a decline in fat intake as a percentage of food energy shows a corresponding increase in carbohydrate intake as a percentage of food energy.

1995).[3] This decline was driven by a decrease in the absolute intake of fat, since food energy intake was relatively stable over this period. Over the same period, saturated fat intake fell from 15.9 percent to 13.0 percent of food energy. The decline in children's fat intake relative to food energy continued into the 1990s. Morton and Guthrie (1998) found that fat intake fell from 34 percent of food energy in 1989-1991 to 33 percent of food energy in 1994-1995. Kennedy and Powell (1997) found a similar trend in fat intake (35 percent in 1989 to 33 percent in 1994) and saturated fat intake (13 percent in 1989 to 12 percent in 1994). However, children's absolute intake of fat did not decline over this period. Morton and Guthrie (1998) found that absolute fat intake was slightly higher among preschoolers and adolescent males in 1994-1995 than in 1989-1991. However, since carbohydrate intake and food energy intake were rising fairly rapidly during the 1990s, fat intake as a percentage of food energy intake declined.

The trend in fat intake among children mimics the broader change in fat intake among all Americans. Anand and Basiotis (1998) documented the overall decrease in fat intake, from 45 percent of food energy in 1965 to 34 percent in 1995. Absolute intake of fat (in grams) fell from 1965 until 1989-1990, then began to rise (although not as rapidly as food energy intake, so that fat intake as a percentage of food energy continued to decline).

In addition to showing the decline in fat intake as a percentage of food energy, the Bogalusa study found that children's mean daily intake of cholesterol declined between the early 1970s and the late 1980s, from 324 to 285 mg (Nicklas et al. 1993). However, sodium intake increased over this period, from 3,330 mg in 1973-1974 to 3,768 mg in 1987-1988.

---

[3]Other studies, not designed to measure changes over time, have shown mean fat intake levels among children nationally that are broadly consistent with the fat intake levels in the Bogalusa study. For example, Evans and Cronin (1986) found mean fat intake among children to be 39 to 40 percent of food energy over the 1977-1978 period, while Kennedy and Goldberg (1995) found mean fat intake to be 34 to 36 percent in 1989.

Evidence is mixed on trends in vitamin and mineral intakes over time. Nicklas et al. (1993) found declines in children's mean intake of thiamin, niacin, vitamin E, and iron, as well as an increase in calcium intake, in Bogalusa between 1973-1974 and 1987-1988. National studies covering the 1990s have shown evidence of small increases in the mean intake of vitamin C, vitamin B_6, iron, and niacin between 1989-1991 and 1994-1995 (Kennedy and Powell 1997; and Morton and Guthrie 1998).

The evidence on changes over time in the consumption of specific foods is consistent with the decline in fat intake as a percentage of food energy. From the early 1970s to the late 1980s, the 10-year-olds in the Bogalusa study consumed less whole milk and more low-fat or skim milk, ate fewer eggs, and began substituting margarine for butter and fish and poultry for beef and pork (Nicklas et al. 1993). From the early 1990s to the mid-1990s, Morton and Guthrie (1998) found that the consumption of whole milk among children nationally declined, while skim milk consumption increased. This study also found that the overall consumption of beverages, especially fruit drinks and carbonated soft drinks, rose during this period.[4] Finally, grain consumption rose during the 1990s, mainly reflecting an increase in the consumption of grain mixtures, such as pasta, grain-based soups, Mexican foods, and pizza.

Two other time trends in children's dietary habits are worth noting. First, breakfast skipping among older children increased between 1965 and 1991 (Haines et al. 1996; and Siega-Riz et al. 1998). This trend may be related to the declines in the intakes of several vitamins and minerals over this period (discussed earlier). Second, as of 1989-1991, children were eating away from home more

[4]Morton and Guthrie point out that their evidence on the increase in soda consumption among children is backed by nationwide food consumption data, which showed an increase in carbonated soft drink consumption in the United States from 1989 to 1994, from 45.4 to 52.2 gallons per capita per year (Putnam and Allshouse 1996).

frequently than they had previously (Crockett and Sims 1995). This trend may also have influenced children's intake of food and nutrients.

II. DATA AND METHODOLOGY

The analysis presented in this report is based on samples of children ages 6 to 18 from the 1989-1991 and 1994-1996 panels of the CSFII. The report compares the mean food and nutrient intake levels of these school-aged children during the two time periods. It also assesses the degree to which children's diets meet specific dietary standards. In addition to examining children ages 6 to 18 as a group, the report focuses on specific subgroups of children. The subgroups include age/gender and race/ethnicity.

Section A of this chapter describes the CSFII data set and highlights differences between the 1989-1991 and 1994-1996 panels. Section B outlines key methodological issues confronted in the analysis.

A. CSFII

The 1989-1991 and 1994-1996 CSFII, conducted by the Agricultural Research Service of the USDA, are each based on independently drawn, nationally representative samples of the noninstitutionalized population of the United States. Both the 1989-1991 and 1994-1996 CSFII consist of three separate one-year samples combined to provide data for the three-year period. The samples were drawn using stratified, clustered, multistage techniques. In the 1994-1996 panel, low-income individuals were oversampled; in the earlier period, a supplemental low-income sample was drawn. Throughout this report, sample weights are used to adjust for nonresponse and the oversampling of low-income children.

Table II.1 summarizes the similarities and differences of the two CSFII surveys. Overall, the two surveys are somewhat similar. Their sample frames and sample designs are similar, and (with a few exceptions) the panels contain similar data. In both the 1989-1991 and 1994-1996 CSFII, the

TABLE II.1

KEY SIMILARITIES AND DIFFERENCES BETWEEN 1989-1991 AND 1994-1996 CSFII

Characteristic	1989-1991 Approach	1994-1996 Approach
Sample Frame	Nationally representative, with Alaska and Hawaii excluded	Nationally representative, with Alaska and Hawaii included
Sampling Technique	Stratified, clustered, multistage, with separate low-income sample	Stratified, clustered, multistage, with low-income households oversampled
Sample of Individuals	All individuals in sampled households	Subsample of individuals in sampled households
Response Rate	Day 1 response rate: 57.6 percent Three-day response rate: 45.2 percent	Day 1 response rate: 80.0 percent Two-day response rate: 76.1 percent
Available Data	Dietary intake, usual school meal program participation, socio-economic characteristics	Dietary intake, usual school meal program participation, socio-economic characteristics
Availability of Food Guide Pyramid Food Group Consumption Data	Not available in main data set; can be constructed from CSFII data on food items consumed	Available in main data set
Overall Method for Collecting Dietary Intake Data	Three consecutive days: first day by 24-hour recall, second and third days by food diary records	Two nonconsecutive days, both by 24-hour recall
Method for Collecting Dietary Intake Data from Children Under Age 12	Intakes of children under age 12 reported by proxy (parent or guardian)	Intakes of children ages 6 to 11 self-reported with assistance from the adult household member responsible for preparing the children's meals

key information is individuals' dietary intake over a 24-hour period. The dietary intake data include sample members' intake of individual food items along with their intake of food energy, key nutrients, and other dietary components. Because the data also include the time of day that each food was consumed, it is possible to measure food and nutrient intake for specific meals during the day. Both surveys also have information on a variety of demographic, socioeconomic, and other topics useful for defining subgroups of sample members.

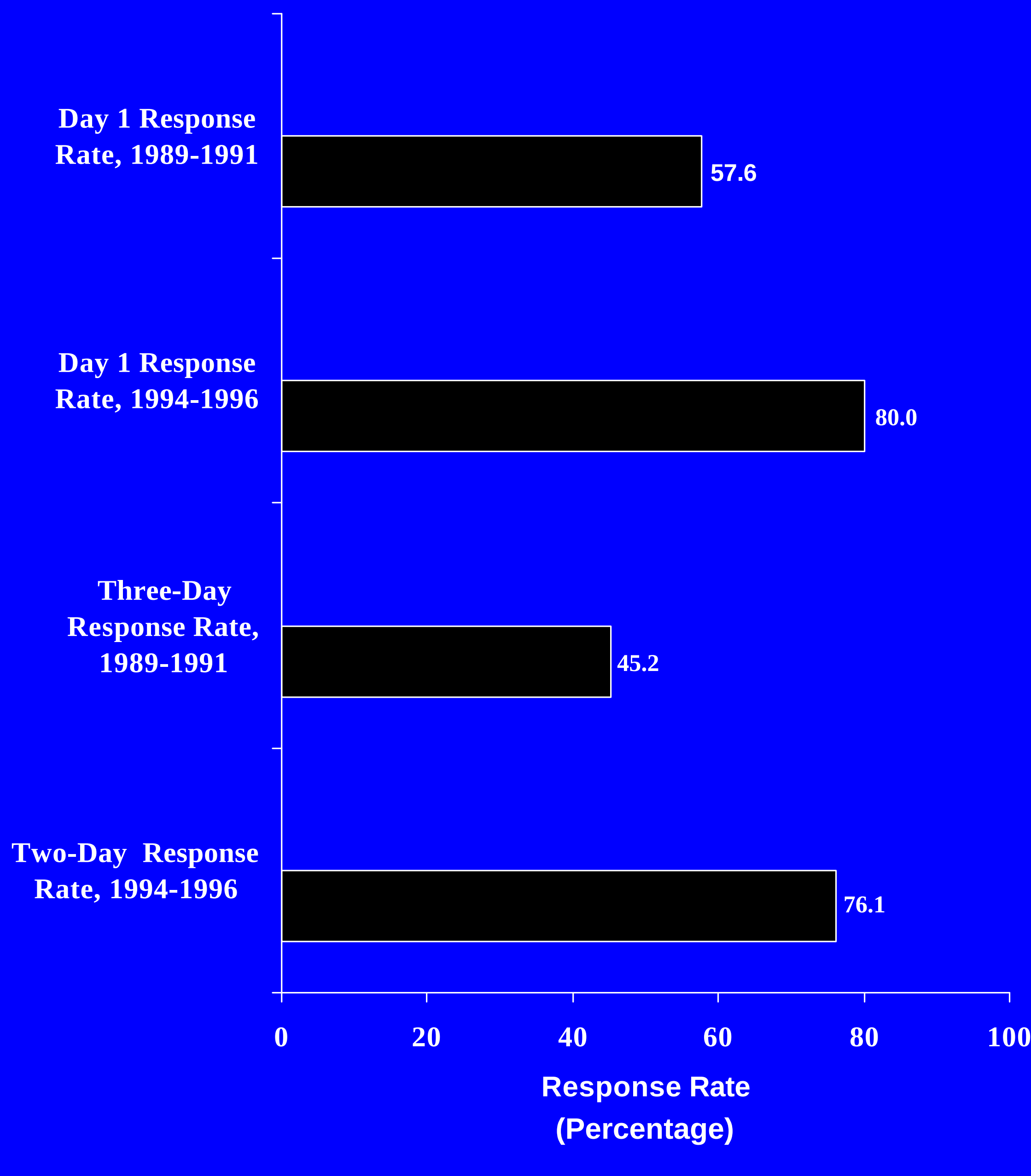
Major differences between the two CSFII surveys involve their methods for collecting dietary intake information. The dietary intake information in the 1989-1991 CSFII included three consecutive days of intake data. The first day of data was collected by a 24-hour recall interview, while the second and third days were collected through food diary records. In contrast, the 1994-1996 CSFII collected two nonconsecutive days of dietary intake information, both by 24-hour recall interviews.

The two surveys also differ in the way they collected dietary intake data from younger children. In the 1989-1991 CSFII, the food intake of children under age 12 was reported by proxy, typically a parent or guardian. In the 1994-1996 CSFII, all children who were at least six years old reported their own dietary intake data. Children ages 6 to 11 were assisted in their food intake reporting by the adult household member responsible for preparing the children's meals.

The response rates in 1989-1991 were dramatically lower than in 1994-1996 (Figure II.1). For example, the Day 1 response rates were 57.6 percent in the 1989-1991 CSFII and 80.0 percent in the 1994-1996 CSFII. Although there is no way to fully adjust for these differences in response rates, the sample weights attempt to adjust the data provided by respondents so that they are representative of the full population.

FIGURE II.1

RESPONSE RATES, 1989-1991 AND 1994-1996 CSFII



Finally, the two surveys differ in whether they report the number of food group servings consumed by respondents with the food group servings defined by the Food Guide Pyramid Services Database. While both report the amounts and types of food items that sample members consumed, only the 1994-1996 CSFII includes the Pyramid Servings Database, developed by the USDA's Agriculture Research Service to find out how well Americans eat compared to Pyramid recommendations. However, as described below, comparable information on the amounts and types of foods consumed was used in this report to generate information on the number of food group servings consumed and to construct comparable food group data for both surveys.

In addition, the 1994-1996 CSFII, unlike the earlier surveys, used a multiple pass method of collecting dietary information. After asking respondents what they ate over the previous 24-hour period, interviewers reviewed each eating occasion and the periods in between eating occasions in case respondents had forgotten any foods on the first pass-through. This may have reduced the degree of underreporting in the 1994-1996 CSFII as compared to the 1989-1991 CSFII.

The analysis in this report is based on a 1989-1991 and a 1994-1996 sample of school-aged children. The 1989-1991 sample includes 2,903 children ages 6 to 18 who completed the first day of 1989-1991 CSFII dietary intake interviews, including 2,303 who completed all three days of dietary intake interviews. The 1994-1996 sample includes the 2,692 children who completed both days of 1994-1996 CSFII dietary intake interviews. Throughout the report, the samples used for the comparison of mean intakes are limited to the first day only, while the samples used for comparisons of the distribution of usual intake are based on both days of the 1994-1996 CSFII and all three days of the 1989-1991 CSFII (the reasons for this are discussed in Section B.7).

Table II.2 presents the characteristics of school-aged children in 1989-1991 and 1994-1996 based on these samples. In this table, the samples of school-aged children for the two periods are

TABLE II.2

CHARACTERISTICS OF SCHOOL-AGED CHILDREN, CSFII, 1989-1991 AND 1994-1996
(Percentages)

Characteristic	1989-1991 CSFII	1994-1996 CSFII
Gender/Age		
Male, 6 to 8	12.1	11.7
Female, 6 to 8	12.7	11.2
Male, 9 to 13	20.4	19.8
Female, 9 to 13	18.4	19.7
Male, 14 to 18	18.5	19.6
Female, 14 to 18	17.9	18.1
Race/Ethnicity		
Hispanic	10.4	13.0
Non-Hispanic, black	15.8	15.5
Non-Hispanic, white	71.9	66.8
Other	2.0	4.7
Income		
Income less than or equal to 130 percent of poverty	23.3	24.6
Income 130 less than or equal to 185 percent of poverty	12.3	13.7
Income 185 less than or equal to 300 percent of poverty	23.6	20.8
Income more than 300 percent of poverty	40.8	40.9
Region		
Northeast	19.5	18.9
Midwest	25.1	24.5
South	35.1	34.2
West	20.2	22.4
Urbanicity		
Urban	27.6	29.0
Suburban	47.8	49.4
Rural	24.6	21.6
Intake Day		
School Day	50.8	48.9
Weekend Day	22.7	24.0
Summer Day	26.4	27.1
Food Insufficient	3.8	2.9
Sample Size	**2,903**	**2,692**
Weighted Sample Size (Thousands)	**45,806**	**49,696**

SOURCE: Weighted tabulations from respondents of the 1989-1991 and 1994-1996 CSFII.

compared with regard to their age and gender, racial/ethnic group, income, region of residence, urbanicity, type of intake day (school, weekend, or summer), and food sufficiency status. With a few exceptions, the distributions are very similar for the two periods, generally differing by no more than one or two percentage points. The age distribution changed somewhat, with a lower percentage of females ages 6 to 8 and 9 to 13 and a higher percentage of males ages 14 to 18 in 1994-1996 than in 1989-1991.

The racial/ethnic distribution of the CSFII samples of school-aged children also changed between 1989-1991 and 1994-1996. In particular, the percentage of Hispanics increased (from about 10 percent in 1989-1991 to 13 percent in 1994-1996), the percentage of "Others" doubled (from 2 to nearly 5 percent of the population), and the percentage of non-Hispanic whites decreased (from about 72 percent in 1989-1991 to about 67 percent in 1994-1996). The makeup of the group "Others" changed markedly as well: among the small number of "others" (2 to 5 percent of all children), the percentage of Asian/Pacific Islanders grew from 45 to 63 percent, the percentage of Native Americans decreased from 42 to 12 percent, and the percentage of undesignated "Others" grew from 13 to 26 percent (not shown in table). Because of these changes in the composition of the "Others" group, it is likely that changes in food and nutrient intake for this group reflect a combination of differences in the foodways of the various subgroups, along with changes in intake by one or more subgroups over time.

Finally, the percentage of school-aged children in households reporting some food insufficiency also changed between 1989-1991 and 1994-1996. Food insufficient households are those that report that they either sometimes or often did not have enough food to eat over the past three months. The percentage of school-aged children classified as food insufficient decreased from nearly four percent to just under three percent. However, the income distribution among school-aged children remained roughly the same between 1989-1991 and 1994-1996.

B. METHODOLOGICAL ISSUES

Before CSFII data could be used to describe and assess children's dietary intakes and to characterize changes over time in children's diets, seven major methodological issues had to be addressed. Six of these issues also arose in the companion report on children's dietary intake during the 1994-1996 period (Gleason and Suitor 2000). These six issues are (1) defining appropriate dietary reference standards against which to measure and assess children's dietary intake, (2) estimating the distribution of children's usual dietary intake using only two or three days of intake information, (3) estimating children's consumption of the USDA Food Guide Pyramid food group servings, (4) measuring students' SBP and NSLP participation status, (5) defining which foods children consume for breakfast and which they consume for lunch, and (6) determining statistical significance. With the exception of measuring students' SBP and NSLP participation status, the approach taken to addressing these issues is the same here as in the previous report, described next (Sections B.1 to B.6).

The last methodological issue described here (Section B.7) deals with the issue of comparing children's dietary intake at two points in time using the different CSFII surveys. According to Anderson (1986), in assessing dietary trends over time, measurement procedures and the definition of study populations should be identical and sampling procedures should be equivalent. Furthermore, as the Life Sciences Research Office (1995) noted, although these conditions are rarely met in comparing data between two different surveys, methodological differences between cycles of periodic surveys are typically smaller than differences between completely different surveys. As discussed in Section A, while the two surveys of the CSFII used in this study are similar, they are not identical. Section B.7 discusses the steps taken to make these two surveys as comparable as possible for the analysis presented in the report.

1. Defining Reference Standards for Dietary Intake

To describe and assess changes in the intake of nutrients and other dietary components by school-aged children, we use four sources: (1) Dietary Reference Intake (DRI) standards (Institute of Medicine 1997, and 1998), (2) 1989 RDAs for nutrients for which DRIs have not yet been developed (National Research Council 1989a), (3) 1995 *Dietary Guidelines for Americans*, (U.S. Department of Agriculture 1995) and (4) recommendations presented in *Diet and Health* by the National Research Council (1989b). The most recent reference value is used throughout. For example, the 1998 RDA is used for thiamin for food intake data collected in 1989-1991 as well as in 1994-1996. Since many of the reference values have changed since 1989, this means that our results for the earlier data set may vary somewhat from those reported by previous investigators using the same data set but an earlier set of reference values.

The use of DRIs merits special attention, since this is a new group of reference standards, few investigators have used DRIs in dietary studies, and guidelines for their use are currently under development. The DRIs consist of several measures: the Estimated Average Requirement (EAR), the RDA, the Adequate Intake (AI), and the Tolerable Upper Intake Level (UL).[1] The EAR is the intake that meets the estimated nutrient needs of 50 percent of people in a given group and is used to assess the adequacy of population intakes (Institute of Medicine 1997, 1998, and 2000). The RDA is based directly on the EAR; it is set at a level estimated to be two standard deviations above the

[1]We do not examine the ULs in this report.

EAR.[2] The AI is the average observed intake or an experimentally derived intake by a defined subgroup that appears to sustain a defined nutritional state, such as normal circulating nutrient values, growth, or other functional indicators of health (Institute of Medicine 1997). It is set when the state of knowledge is such that the EAR cannot be determined. The RDA and AI are both recommended intake amounts for individuals. DRIs have been set for nine of the nutrients covered in this report: calcium, phosphorus, magnesium, thiamin, riboflavin, niacin, vitamin B_6, folate, and vitamin B_{12}.[3] For only one of these (calcium), an AI (rather than an EAR and RDA) was set.

The mean nutrient intakes for both time periods are presented as a percentage of the most recent recommended intake values (RDAs or AIs) for all the vitamins and minerals examined. Table II.3 shows the dietary standards we use.[4] Presenting mean intakes as a percentage of these recommended intake values normalizes intakes by age and gender. In addition, it makes the findings presented in this report more comparable with previous research in this area. For food energy, we present mean intake as a percentage of the 1989 REA. The tables in Chapter III that present intakes as a percentage of recommended intake values are intended for descriptive purposes only, not as an assessment of adequacy of intake. In other words, mean intake as a percentage of RDA, REA, or AI values does not indicate the prevalence among children of inadequate intake of a particular nutrient.

---

[2]If the standard deviation of the EAR is not known, it is estimated to be a certain proportion of the EAR, typically 10 percent. Another way of saying this is that the coefficient of variation is assumed to be 0.10.

[3]The use of DRI values for folate is notable here because at about the same time the DRIs for folate were set (with the new RDA value set at a substantially higher level than the 1989 RDA), there was a requirement enacted that grains/breads be fortified with folate. Since both of these events occurred after 1996, it is likely that the percentage of children who meet the 1998 EAR today is higher than the percentage who met this standard in 1989-1991 or 1994-1996.

[4]Among the nutrients we examine, DRIs are available for calcium (AI only), magnesium, phosphorus, and the B vitamins. For the remaining nutrients, 1989 RDAs are used.

TABLE II.3

1989 RECOMMENDED DIETARY ALLOWANCES AND DIETARY REFERENCE INTAKE-BASED DIETARY STANDARDS, BY AGE/GENDER

Nutrient	Children, Ages 4 to 6	Children, Ages 4 to 8	Children, Ages 7 to 10	Males, Ages 11 to 14[a] (9 to 13)	Females, Ages 11 to 14[a] (9 to 13)	Males, Ages 15 to 18[a] (14 to 18)	Females, Ages 15 to 18[a] (14 to 18)
Food Energy (kcal)							
1989 REA	1,800	n.a.	2,000	2,500	2,200	3,000	2,200
80 percent of 1989 REA	1,440	n.a.	1,600	2,000	1,760	2,400	1,760
Vitamin A (mcg RE)							
1989 RDA	500	n.a.	700	1,000	800	1,000	800
80 percent of 1989 RDA	400	n.a.	560	800	640	800	640
Vitamin C (mg)							
1989 RDA	45.0	n.a.	45.0	50.0	50.0	60.0	60.0
80 percent of 1989 RDA	36.0	n.a.	36.0	40.0	40.0	48.0	48.0
Vitamin E (mg α-TE)							
1989 RDA	7.0	n.a.	7.0	10.0	8.0	10.0	8.0
80 percent of 1989 RDA	5.6	n.a.	5.6	8.0	6.4	8.0	6.4
Vitamin B_6 (mg)							
1989 RDA	1.1	n.a.	1.4	1.7	1.4	2.0	1.5
1998 RDA	n.a.	0.6	n.a.	1.0	1.0	1.3	1.2
80 percent of 1989 RDA	0.88	n.a.	1.12	1.36	1.12	1.60	1.20
1998 EAR	n.a.	0.5	n.a.	0.8	0.8	1.1	1.0
Vitamin B_{12} (mcg)							
1989 RDA	1.0	n.a.	1.4	2.0	2.0	2.0	2.0
1998 RDA	n.a.	1.2	n.a.	1.8	1.8	2.4	2.4
80 percent of 1989 RDA	0.8	n.a.	1.12	1.6	1.6	1.6	1.6
1998 EAR	n.a.	1.0	n.a.	1.5	1.5	2.0	2.0

Table II.3 *(continued)*

Nutrient	Children, Ages 4 to 6	Children, Ages 4 to 8	Children, Ages 7 to 10	Males, Ages 11 to 14[a] (9 to 13)	Females, Ages 11 to 14[a] (9 to 13)	Males, Ages 15 to 18[a] (14 to 18)	Females, Ages 15 to 18[a] (14 to 18)
Niacin (mg NE)							
1989 RDA	12.0	n.a.	13.0	17.0	15.0	20.0	15.0
1998 RDA	n.a.	8.0	n.a.	12.0	12.0	16.0	14.0
80 percent of 1989 RDA	9.6	n.a.	10.4	13.6	12.0	16.0	12.0
1998 EAR	n.a.	6.0	n.a.	9.0	9.0	12.0	11.0
Thiamin (mg)							
1989 RDA	0.9	n.a.	1.0	1.3	1.1	1.5	1.1
1998 RDA	n.a.	0.6	n.a.	0.9	0.9	1.2	1.0
80 percent of 1989 RDA	0.72	n.a.	0.8	1.04	0.88	1.2	0.88
1998 EAR	n.a.	0.5	n.a.	0.7	0.7	1.0	0.9
Riboflavin (mg)							
1989 RDA	1.1	n.a.	1.2	1.5	1.3	1.8	1.3
1998 RDA	n.a.	0.6	n.a.	0.9	0.9	1.3	1.0
80 percent of 1989 RDA	0.88	n.a.	0.96	1.2	1.04	1.44	1.04
1998 EAR	n.a.	0.5	n.a.	0.8	0.8	1.2	0.9
Folate							
1989 RDA (mcg)	75	n.a.	100	150	150	200	180
1998 RDA (mcg DFE)[b]	n.a.	200	n.a.	300	300	400	400
80 percent of 1989 RDA (mcg)	60	n.a.	80	120	120	160	144
1998 EAR (mcg DFE)	n.a.	160	n.a.	250	250	330	330
Calcium (mg)							
1989 RDA	800	n.a.	800	1,200	1,200	1,200	1,200
1997 AI	n.a.	800	n.a.	1,300	1,300	1,300	1,300

Table II.3 *(continued)*

Nutrient	Children, Ages 4 to 6	Children, Ages 4 to 8	Children, Ages 7 to 10	Males, Ages 11 to 14[a] (9 to 13)	Females, Ages 11 to 14[a] (9 to 13)	Males, Ages 15 to 18[a] (14 to 18)	Females, Ages 15 to 18[a] (14 to 18)
80 percent of 1989 RDA	640	n.a.	640	960	960	960	960
80 percent of 1997 AI	n.a.	640	n.a.	1,040	1,040	1,040	1,040
Iron (mg)							
1989 RDA	10.0	n.a.	10.0	12.0	15.0	12.0	15.0
80 percent of 1989 RDA	8.0	n.a.	8.0	9.6	12.0	9.6	12.0
Magnesium (mg)							
1989 RDA	120	n.a.	170	270	280	400	300
1997 RDA	n.a.	130	n.a.	240	240	410	360
80 percent of 1989 RDA	96	n.a.	136	216	224	320	240
1997 EAR	n.a.	110	n.a.	200	200	340	300
Phosphorus (mg)							
1989 RDA	800	n.a.	800	1,200	1,200	1,200	1,200
1997 RDA	n.a.	500	n.a.	1,250	1,250	1,250	1,250
80 percent of 1989 RDA	640	n.a.	640	960	960	960	960
1997 EAR	n.a.	405	n.a.	1,055	1,055	1,055	1,055
Zinc (mg)							
1989 RDA	10.0	n.a.	10.0	15.0	12.0	15.0	12.0
80 percent of 1989 RDA	8.0	n.a.	8.0	12.0	9.6	12.0	9.6

SOURCE: Institute of Medicine (1997, and 1998); and National Research Council (1989a).

[a] Age range for 1989 RDAs. Age range for DRI-based values is given in parentheses.

[b] The reported intake of niacin as a percentage of the RDA is an underestimate because intake is reported in mg of niacin and does not include an estimate of the niacin that is contributed by the conversion of tryptophan to niacin. The RDA is given in mg of niacin equivalents and assumes that all niacin will be considered.

α-TE = alpha-Tocopherol equivalent; AI = Adequate Intake; DFE = dietary folate equivalent; DRI = Dietary Reference Intake; kcal = kilocalories; mcg = micrograms; mg = milligrams; n.a. = not applicable; NE = niacin equivalent; RE = retinol equivalent; REA = Recommended Energy Intake.

We do not directly assess the adequacy of children's calcium intake because its most recent recommended intake value is an AI (rather than an RDA or EAR). According to the National Academy of Sciences subcommittee on the uses and interpretations of the DRIs, the AI cannot be used to assess the adequacy of intake of groups (Institute of Medicine 2000). As Table II.3 shows, the calcium AIs are slightly higher than the 1989 calcium RDAs for children. By definition, the AI is expected to meet or exceed the needs of essentially all healthy members of the population (as is also true for RDAs), but it is not known to what extent the AI underestimates or (more likely) overestimates the average requirement. Considering these facts, the decision was made to not assess the adequacy of calcium intake using the AI or some percentage of the AI. Instead, we present estimates of the full distribution of calcium intake for all children and for key subgroups of children for both 1989-1991 and 1994-1996. This allows qualitative comparisons of the distributions for the two time periods.

To assess change in the adequacy of intake over the two time periods for the remaining nutrients, we estimate the proportion of children whose usual intake equals or exceeds the EAR, if available. According to Beaton (1998) and Carriquiry (1999), the fraction of the population with nutrient intakes below the EAR may provide an accurate approximation of the prevalence of inadequacy. The higher the percentage of children with intakes at or above the EAR, the lower the risk that any of them have intakes below their requirement. Comparing individuals' nutrient intakes with the RDA (rather than the EAR) is not recommended for assessing adequacy (Institute of Medicine 2000). Nonetheless, for nutrients for which an EAR has not been set, we use 80 percent of the 1989 RDA as a reference value.[5] This percentage is intended to approximate the average

[5]This estimate is based on the assumption that the coefficient of variation for these nutrients is 0.125. If the RDA is assumed to be two standard deviations above the average requirement, a coefficient of variation of 0.125 implies that the average requirement is 80 percent of the RDA. This (continued...)

requirement. However, there is no way to predict the accuracy of working backward from the 1989 RDA to get the average requirement, since the 1989 RDA report (National Research Council 1989a) does not present estimates either of the average requirement or of the standard deviations of the requirements for most nutrients.

To assess change in the intake of macronutrients, we use the 1995 *Dietary Guidelines for Americans* (U.S. Department of Agriculture 1995) and NRC's *Diet and Health*. The 1995 edition of the *Dietary Guidelines* specified quantitative standards for total fat and saturated fat intakes. The recommendations are that individuals:

- Limit total fat to 30 percent or less of total food energy
- Limit saturated fat to less than 10 percent of total food energy

Diet and Health recommends the following standards for sodium, cholesterol, carbohydrate, and protein intake:

- Limit sodium intake to 2,400 mg or less per day
- Limit dietary cholesterol to 300 mg or less per day
- Carbohydrates should be at least 55 percent of food energy
- Protein should be no more than twice the RDA

Finally, although there are no explicit recommendations for fiber intake in the *Dietary Guidelines* or *Diet and Health,* Williams (1995) and Williams et al. (1995) suggest the simple formula "age plus 5" grams of fiber per day for children ages two and older. The American Heart

---

[5](...continued)
coefficient of variation is larger than the 0.10 used in the creation of the DRIs because a larger safety factor was used in creating the 1989 RDAs.

Association has also adopted this standard (Van Horn 1997) and it has been used in several previous research studies (for example, Hampl et al. 1997; Nicklas et al. 2000). We describe changes in school-aged children's mean intakes of macronutrients and also present the percentages of children whose macronutrient or fiber intake is consistent with each of these recommendations.

2. Measuring Usual Intake

Most standards of dietary adequacy are defined in terms of usual nutrient intake, which is the long-run average of daily intakes of a particular nutrient for an individual. Since the intake of a particular nutrient by an individual may vary considerably from one day to another, individuals' intakes for Day 1 will vary across the population more than a true measure of individuals' usual intake would vary. A person's Day 1 intake is an unbiased estimate of that individual's usual intake.[6] The distribution of Day 1 intakes across a population, however, is not an unbiased estimate of the distribution of usual intakes across that population. In particular, the dispersion of the intake distribution for one day will be larger than the dispersion of the usual intake distribution. Thus, if the Day 1 intake distribution is used to estimate the proportion of school-aged children whose usual intake of a particular nutrient is below or above a particular dietary standard, the results will be biased.

Since there are three days of dietary intake information in the 1989-1991 CSFII and two days of dietary intake information in the 1994-1996 CSFII, we can calculate a two- or three-day average intake for each person to estimate usual intakes for that individual. However, the two- or three-day average, although an improvement over a one-day intake, is still a biased estimate of the distribution of usual intakes across that population.

[6]In addition, the *mean* Day 1 intake of a nutrient in a population may be an unbiased estimate of the *mean* usual intake of that nutrient in that population.

The NRC proposed an empirical method for adjusting observed nutrient intake to obtain unbiased estimates of the distribution of usual intake using two or more days of intake information for each individual (National Research Council 1986). This method estimates the intra-individual variation in nutrient intake and removes this source of variation before estimating the distribution of usual intakes across a population. Nusser et al. (1996) proposed alternative methods for estimating the distribution of usual intake that improved upon the NRC methods by dropping the required NRC assumption of normality in the distribution of daily intake. The Nusser et al. method accounts for the fact that daily intake data for individuals are nonnegative and often very skewed.

The methods developed by Nusser et al. (1996) are used here in estimating the usual nutrient intake distribution of school-aged children to generate estimates of the percentile values of the usual distribution and the proportion of children whose usual intake is above or below particular dietary reference values. To implement these procedures, we use the Software for Intake Distribution Estimation (SIDE) program (Iowa State University 1996). To estimate the distribution of food intake, we are limited to using the two- or three-day average. The methodology and statistical software needed to estimate the distribution of usual food intake distribution has not been developed as fully as the methodology and software needed to estimate the distribution of usual nutrient intake. In particular, estimating the usual food intake distribution is complicated by the fact that the distribution of daily food intake is typically much more skewed and includes a larger proportion of values of zero than the distribution of daily nutrient intake. Thus, even if we were able to estimate the distribution of usual food intake, these estimates would not be as precise as our estimates of the distribution of usual nutrient intake.

3. Estimating Food Group Consumption

To assess change in school-aged children's adherence to the USDA Food Guide Pyramid recommendations, we examine the distribution of children's intake of the major pyramid food groups in 1989-1991 and 1994-1996. In addition, we compare the percentages of children meeting their age/gender-specific target for the consumption of each food group, using the Healthy Eating Index (HEI) target number of servings (see Table II.4).

The comparison of food group consumption over these two time periods is not straightforward. The 1994-1996 CSFII contains a set of variables that represent the number of servings of each of the USDA Food Guide Pyramid food groups that sample members consumed each day. These variables are based on information provided by sample members on the types and amounts of each individual food item they consumed on each intake day. Unfortunately, the 1989-1991 CSFII contains no similar set of pyramid food group servings variables.

To compare pyramid food group consumption over these two periods, an alternative source of food group consumption data is used. In the process of developing the HEI using the 1989-1991 CSFII, Kennedy et al. (1995) constructed a set of variables indicating the number of servings consumed from each of the five major Food Guide Pyramid food groups: grain products, vegetables, fruit, milk and milk products (hereafter, called milk products), and meat and meat substitutes. For this report, comparable HEI-based food group data sets for both the 1989-1991 and 1994-1996 periods were used to examine the changes in food group intake.[7]

---

[7]Bowman et al. (1998) describe the 1994-1996 HEI. We are grateful to Peter Basiotis of the Center for Nutrition Policy and Promotion for providing HEI data for both 1991 and the 1994-1996 period.

TABLE II.4

HEALTHY EATING INDEX TARGET NUMBER OF SERVINGS PER DAY
FROM THE USDA FOOD GUIDE PYRAMID

		Recommended Servings per Day, by Pyramid Food Group				
Gender/Age	Energy (kcal)	Grains	Vegetables	Fruits	Dairy	Meat
Children, 4 to 6	1,800	7.0	3.3	2.3	2.0	2.1
Children, 7 to 10	2,000	7.8	3.7	2.7	2.0	2.3
Females, 11 to 18	2,200	9.0	4.0	3.0	3.0	2.4
Males, 11 to 14	2,500	9.9	4.5	3.5	3.0	2.6
Males, 15 to 18	3,000	11.0	5.0	4.0	3.0	2.8
Minimum of Food Guide Pyramid Recommended Range		6.0	3.0	2.0	2.0	2.0

SOURCE: Kennedy et al. (1995); and Bowman et al. (1998).

NOTE: The target number of servings per day is based on the REA for age and gender rather than the amount of energy usually consumed by the individual. For females ages 11 to 18 who are pregnant or lactating, the recommended servings per day for each of the food groups (except dairy) is slightly higher than for those who are not pregnant or lactating.

kcal = kilocalories; REA = Recommended Energy Allowance.

4. Defining SBP/NSLP Participation

The companion report (Gleason and Suitor 2000) includes an analysis of the dietary intakes of SBP/NSLP participants compared with nonparticipants using the 1994-1996 CSFII. In principle, the current report could also include a comparison of participants' and nonparticipants' intakes using the 1989-1991 CSFII, which would allow an assessment of changes over time in the SBP and NSLP. However, because of problems in accurately measuring SBP/NSLP participation using the 1989-1991 CSFII, comparing the dietary intakes of participants and nonparticipants, using the 1989-1991 CSFII, could potentially be misleading. Thus, such comparisons are not made in this report. Appendix A fully describes the problems with the measurement of SBP/NSLP participation in the CSFII.

5. Defining Breakfast and Lunch

Part of the analysis in this report involves describing what children eat for breakfast and lunch. Two alternative approaches to defining breakfast and lunch are (1) to include all foods consumed during specific times during the day, and (2) to include all foods consumed during eating occasions that CSFII sample members themselves define as breakfast and lunch. A combination of these approaches is used in this report: breakfast and lunch are defined primarily according to the times that foods are consumed, but respondents' definitions of their eating occasions are also used to categorize foods consumed at ambiguous times of day into either breakfast or lunch (or neither). Our approach differs slightly for school days as opposed to holidays, weekends, and summer.

a. Breakfast

In particular, on *school days*, breakfast is defined as including (1) all foods consumed between 5:00 A.M. and 9:30 A.M., and (2) all foods consumed between 9:30 A.M. and 10:30 A.M. that the sample member reports as being part of breakfast. On *holidays, weekends,* and *summer days,* breakfast is defined as including (1) all foods consumed between 5:00 A.M. and 9:30 A.M., and (2) all foods consumed between 9:30 A.M. and 11:00 A.M. that the sample member reports as being part of breakfast.

b. Lunch

On *school days,* lunch is defined as including (1) all foods consumed between 10:30 A.M. and 2:00 P.M.; (2) all foods consumed between 9:30 A.M. and 10:30 A.M. that the sample member reports as being part of brunch, lunch, dinner, or supper; and (3) all foods consumed between 2:00 P.M. and 3:30 P.M. that the sample member reports as being part of brunch or lunch. On *holidays, weekends,* and *summer days,* lunch is defined as including (1) all foods consumed between 11:00 A.M. and 2:30 P.M.; (2) all foods consumed between 9:30 A.M. and 11:00 A.M. that the sample member reports as being part of brunch, lunch, dinner, or supper; and (3) all foods consumed between 2:30 P.M. and 4:00 P.M. that the sample member reports as being part of brunch or lunch.

c. Agreement of the Two Approaches

With these definitions, 18.6 percent of all foods consumed on school days (in the 1994-1996 CSFII) are defined as being part of breakfast, and 33.1 percent are defined as being part of lunch. Among these breakfast foods, 96.5 present were also labeled by sample members as being part of breakfast. Among foods not defined in our study as part of breakfast, 1.1 percent were labeled by sample members as part of breakfast. Among the school day lunch foods (according to our definition), 88.4 percent were labeled by sample members as part of lunch; among foods not defined as being part of lunch, 0.5 percent were labeled by sample members as part of lunch.[8] The numbers for nonschool days are similar. For lunch in particular, some snack foods may also be included.

6. Significance Testing

Throughout the report, the characteristics and dietary intake values of different groups of children across different points in time are compared. In particular, we are interested in whether children's dietary intake changed significantly between the 1989-1991 and 1994-1996 periods and whether subgroups of children experienced the same changes as all children. Because these comparisons are based on *samples* of children, the resulting observed differences could be due to chance. Thus, we conducted tests of statistical significance to determine whether the observed differences are large enough that they are unlikely to be due to chance. In particular, we conducted primarily t-tests comparing mean intake values in the 1989-1991 versus the 1994-1996 samples, assuming the samples drawn during the two sets of years are independent.[9] The statistical significance of observed differences across time was assessed using as a standard the five percent level of significance. This means that an observed difference will be called statistically significant if the probability that it resulted *only* from random variation (that is, from chance) is no more than five percent.

---

[8]The numbers obtained from the 1989-1991 CSFII panel are similar. Among all foods consumed by students on school days, 21.3 percent are defined as part of breakfast and 33.9 percent are defined as part of lunch. Among the breakfast foods, 96.6 percent were also labeled by sample members as part of breakfast. Among the foods not defined in our study as part of breakfast, 1.5 percent were labeled by sample members as part of breakfast. Among lunch foods, 86.9 percent were labeled by sample members as part of lunch; among foods not defined as part of lunch, 1.0 percent were labeled by sample members as part of lunch.

[9]In addition, we conducted tests comparing the distribution of usual intake for various nutrients. These tests took one of two forms. We either compared the percentile values of the distributions across the two time periods or compared the percentage of the distributions falling above or below particular thresholds.

Most of the significance tests in this report take into account the fact that the CSFII data set uses a complex sample design. Most statistical software packages assume that the observations in the sample are statistically independent of one another when calculating standard error estimates and conducting significance tests. This assumption would be correct with simple random sampling, but not with the complex CSFII design, implying that standard error estimates produced with such packages may be biased for the CSFII. Thus, we used the SUDAAN statistical package to estimate standard errors that take into account the complex sample design of the CSFII.

For the analysis of the distribution of usual intake conducted using the SIDE software package, we calculated most of the standard errors and conducted significance tests without correcting for the complex sample design of the CSFII. However, for selected key tables, we calculated both the uncorrected and corrected standard errors and found that the difference between the two was small. In particular, the "corrected" standard error is typically no more than five percent higher or lower than the "uncorrected" standard error.

7. Adjusting for Differences in Dietary Intake Data Collection Methodologies

As described in Section A, the 1989-1991 and 1994-1996 CSFII surveys differ in their methodologies for collecting dietary intake data from respondents. In the 1989-1991 CSFII, three consecutive days of dietary intake data were collected, the first day through a 24-hour recall interview and the second and third days through food diary records. In the 1994-1996 CSFII, two nonconsecutive days of dietary intake data were collected, both through 24-hour recall interviews.

To minimize the possibility that methodological differences between the two CSFII surveys are driving the results of the analysis, the sample is limited to the first day of dietary intake data when comparing means over time. In each survey, the dietary intake data on the first day were collected through a 24-hour recall interview.[10] With the same dietary intake data collection methodology, the resulting differences in observed intakes over the two periods are more likely to have been driven by behavioral change.[11] However, the fact that a multiple pass methodology of dietary intake data collection was used in 1994-1996 but not in 1989-1991 may have led to differences in the degree of underreporting in the two surveys.

One limitation of using only a single day of dietary intake data is that this makes it impossible to correctly estimate the distribution of usual dietary intake, which requires two or more days of dietary intake data for at least some sample members (see Section B.2). Thus, in showing estimates of the proportion of children with usual intakes of particular dietary components above or below particular thresholds (for example, EARs or Dietary Guidelines), the text tables are based on samples that include either all three days of dietary intake data (for the 1989-1991 CSFII) or two days of data (for the 1994-1996 CSFII).[12]

---

[10]A person's Day 1 intake is an unbiased estimate of that person's usual intake. Moreover, as noted above, the mean Day 1 intake of a nutrient is an unbiased estimate of the mean usual intake of that nutrient for a particular population.

[11]In addition to presenting dietary intakes based on Day 1 data in the text tables, Appendix B includes tables that present dietary intakes based on two days (for the 1994-1996 CSFII) or three days (for the 1989-1991 CSFII) of dietary intake data.

[12]The corresponding Appendix B tables show the proportion of children whose Day 1 intakes are above or below these thresholds.

III. CHANGE IN CHILDREN'S DIETARY INTAKE OVER TIME

This chapter describes changes in dietary intake of school-aged children, overall and for selected subgroups, using data from the 1989-1991 and 1994-1996 CSFII. For these two periods, the chapter compares (1) mean intakes of food energy, nutrients, and other dietary components; (2) distributions of energy and of calcium intakes and percentages of children meeting or exceeding recommended standards for the intake of nutrients; (3) percentages of children meeting dietary guidelines; and (4) mean intakes and intake distributions of selected food groups.

A. CHANGES IN MEAN INTAKES OF FOOD ENERGY, NUTRIENTS, AND OTHER DIETARY COMPONENTS

The comparison of mean intakes from two periods, expressed relative to the same dietary standards, is a useful method of examining intake changes over time. This is especially true when the data are examined for subgroups, since improvements in dietary intake by one group may be obscured by decrements by another group. However, these comparisons of mean intakes provide limited information on the extent to which the prevalence of overconsumption or underconsumption has changed, since the dispersion of the distribution, as well as the mean, may have changed.

1. Energy and Macronutrients

Among all school-aged children, mean food energy intake over 24 hours increased significantly between 1989-1991 and 1994-1996, from 88 to 94 percent of the REA (Table III.1).[1] However,

[1]Table III.1 contains information not only on children's mean food energy and macronutrient intakes, but also on their mean intakes of vitamins and minerals and other dietary components. The presentation of the vitamin and mineral and other dietary component intakes are discussed later in this section, with references made either to Table III.1 or to figures that summarize the data presented in Table III.1. See Appendix Table B.1 for a version of Table III.1 that is based on three days of 1989-1991 CSFII intake data and two days of 1994-1996 CSFII intake data rather than Day 1 alone.

TABLE III.1

MEAN DAY 1 NUTRIENT INTAKE RELATIVE TO DIETARY STANDARDS AMONG SCHOOL-AGED CHILDREN, 1989-1991 AND 1994-1996

	Mean Intake					
	Breakfast		Lunch		24 Hours	
Dietary Component	1989-1991	1994-1996	1989-1991	1994-1996	1989-1991	1994-1996
Food Energy						
As percentage of Recommended Energy Allowance	17	16	27	28	88**	94
As percentage of 24-hour food energy intake	19	17	31	30	n.a.	n.a.
Percentage of Food Energy from:						
Total fat	26.5**	24.9	34.5**	33.0	34.1**	32.4
Saturated fat	11.3**	9.8	13.0**	11.9	13.0**	11.7
Carbohydrate	61.3**	64.3	52.3**	54.4	52.0**	54.7
Protein	13.6**	12.6	14.7*	13.9	15.2**	14.2
Absolute Fat Intake						
Total fat (g)	12.5*	11.0	24.5	24.4	76.9	77.9
Saturated fat (g)	5.2**	4.3	9.2	8.7	29.1	28.1
Vitamins (as Percentage of RDA)[a]						
Vitamin A	40	39	27	26	117	117
Vitamin C	70	60	50	49	197	204
Vitamin E	19*	15	26	27	88	90
Vitamin B_6	59	60	43	44	178	188
Vitamin B_{12}	72*	61	72*	65	260	252
Niacin[b]	45	45	48	49	173*	182
Thiamin	60	57	49	50	188	194
Riboflavin	83	78	62	61	240	242
Folate[c]	39	36	20	19	91	89
Minerals (as Percentage of RDA)[a]						
Calcium	24**	21	25	24	85	82
Iron	39	44	31	32	121**	136
Magnesium	25	23	31	30	107	106
Phosphorus	33	31	41	39	139	135
Zinc	19	21	25	25	89	94
Other Dietary Components						
Fiber (g)	2.2	2.3	4.2	4.2	13.4*	14.2
Cholesterol (mg)	71**	57	68	62	257*	241
Sodium (mg)	548	522	1,010	1,048	3,283	3,392
Sample Size	**2,903**	**2,692**	**2,903**	**2,692**	**2,903**	**2,692**
Weighted Sample Size (Thousands)	**45,806**	**49,696**	**45,806**	**49,696**	**45,806**	**49,696**

SOURCE: Weighted tabulations based on Day 1 intake data from respondents of the 1989-1991 and 1994-1996 CSFII.

[a] Mean intakes of vitamin B_6, vitamin B_{12}, niacin, thiamin, riboflavin, folate, magnesium, and phosphorus in this table are measured as a percentage of the RDAs based on the new Dietary Reference Intakes (DRIs). For the remaining vitamins and minerals except calcium, mean intakes are measured as a percentage of the 1989 RDAs. For calcium, mean intake is measured as a percentage of the DRI-based Adequate Intake (AI).

[b] The reported intake of niacin as a percentage of the RDA is an underestimate because intake is reported in mg of niacin and does not include an estimate of the niacin that is contributed by the conversion of tryptophan to niacin. The RDA is given in mg of niacin equivalents and assumes that all niacin will be considered.

[c] The reported intake of folate as a percentage of the RDA is an underestimate because intake is reported in mcg of folate but the RDA is given in mcg of dietary folate equivalents. Expressing intake in mcg of folate does not make allowance for the high bioavailability of synthetic folic acid, as from fortified ready-to-eat cereals. Dietary folate equivalents consider bioavailability.

n.a. = not applicable.

*Difference across years is significantly different from zero at the .05 level, two-tailed test.
**Difference across years is significantly different from zero at the .01 level, two-tailed test.

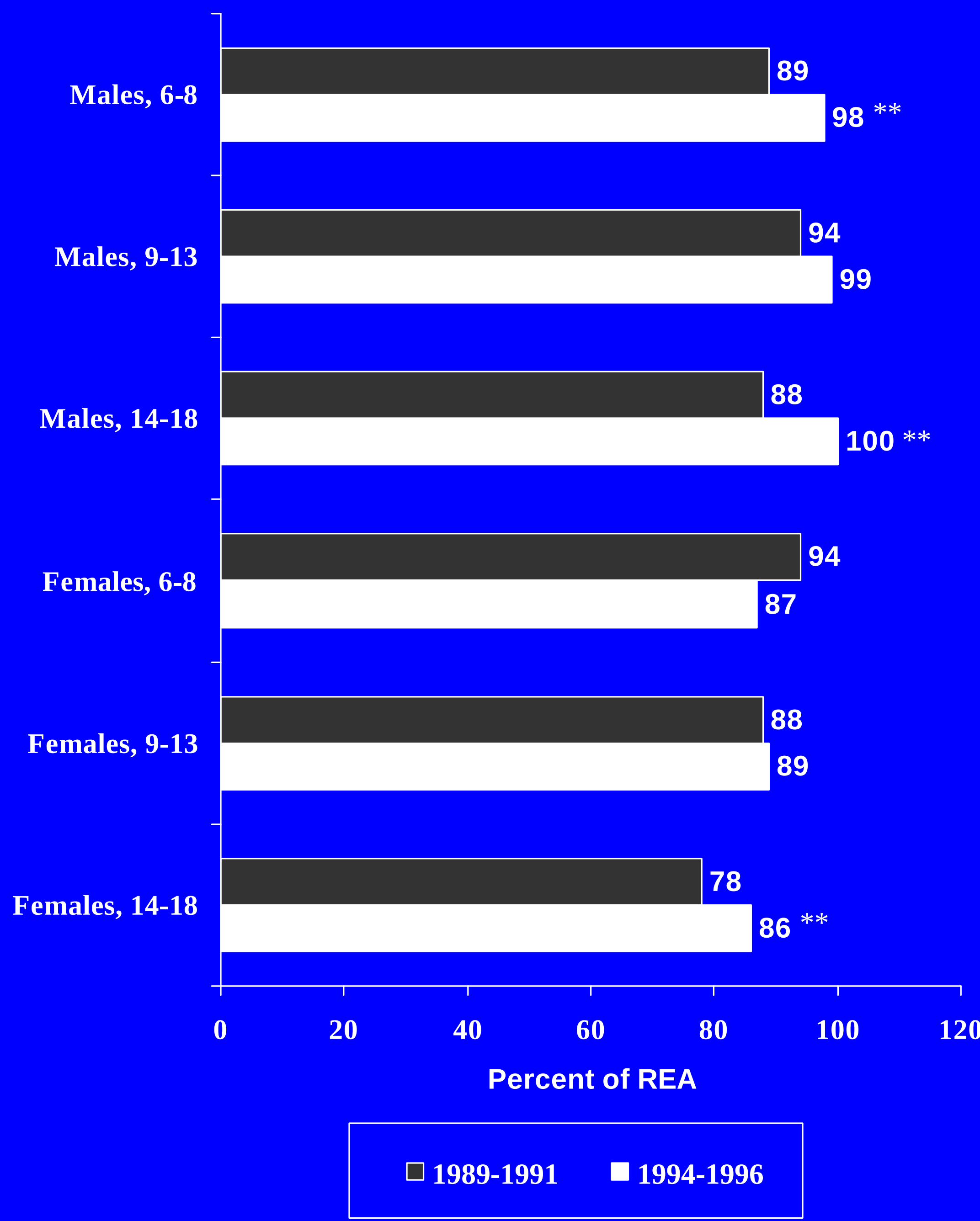
children's mean food energy intakes at breakfast and lunch did not change between these periods, suggesting that foods consumed as snacks or for dinner account for the increase in 24-hour food energy intake. Examination of the data by age and gender reveals a marked increase in food energy intake by males during the early to mid-1990s. For example, mean food energy intake increased significantly from 88 to 100 percent of the REA for males ages 14 to 18 and from 89 to 98 percent of the REA for males ages 6 to 8 (Figure III.1). For females, energy intake increased significantly only among those ages 14 to 18, rising from 78 to 86 percent of the REA. For 6- to 8-year-old females, food energy intake fell from 94 to 87 percent of the REA, although this difference was not statistically significant. Given that the change over time in food energy intake differs by age and gender, it is unlikely that methodological differences between the two CSFII surveys the overall increase in reported food energy intake.

Over the period when mean energy intake increased, the percentage of food energy from both total fat and saturated fat decreased significantly at breakfast and lunch and over 24 hours (Figure III.2). Over 24 hours, for example, the mean percentage of food energy from total fat fell from 34.1 percent in 1989-1991 to 32.4 percent in 1994-1996. Mean saturated fat intake fell from 13.0 to 11.7 percent of food energy. Thus, the average school-aged child came closer to meeting the goals of limiting total fat intake to less than 30 percent and saturated fat intake to less than 10 percent over this period. As a group, children also experienced a significant decrease in protein intake and a significant increase in carbohydrate intake. For example, children's mean 24-hour intake of carbohydrates increased from 52.0 percent in 1989-1991 to 54.7 percent in 1994-1996 (Table III.1).

Although children's intake of fat as a percentage of food energy decreased between 1989-1991 and 1994-1996, their absolute intake (in grams) of total fat and saturated fat did not change significantly during this period (except at breakfast). Children's mean 24-hour intake of total fat was

FIGURE III.1

SCHOOL-AGED CHILDREN'S MEAN 24-HOUR FOOD ENERGY INTAKE, BY AGE/GENDER, 1989-1991 AND 1994-1996

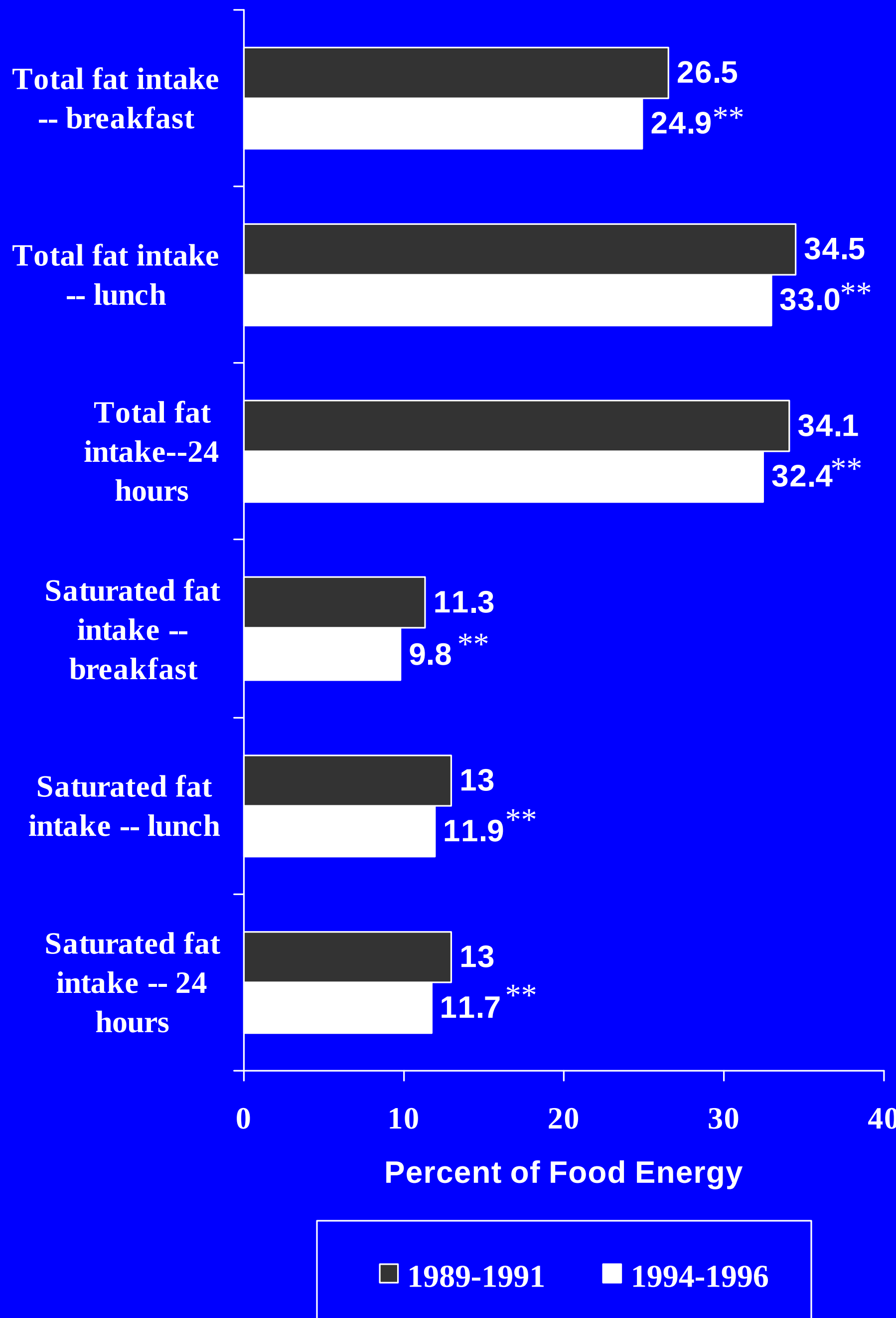


* Difference in intake across years is significantly different from zero at the .05 level, two-tailed test.
** Difference in intake across years is significantly different from zero at the .01 level, two-tailed test.

Source: CSFII

FIGURE III.2

SCHOOL-AGED CHILDREN'S MEAN INTAKE OF FAT AS A PERCENTAGE OF FOOD ENERGY, 1989-1991 AND 1994-1996



* Difference in intake across years is significantly different from zero at the .05 level, two-tailed test.
** Difference in intake across years is significantly different from zero at the .01 level, two-tailed test.

Source: CSFII

actually slightly (although insignificantly) higher in 1994-1996 (78 g) than in 1989-1991 (77 g), while mean saturated fat intake was insignificantly lower in the later period (28 versus 29 g). At breakfast, children's absolute intake of total fat decreased by 1.5 g and their intake of saturated fat decreased by 0.9 g. Overall, these results suggest that children reduced the percentage of food energy from fat in their diets at times other than breakfast by increasing their carbohydrate and food energy intake, not by consuming less total fat or saturated fat. Similarly, although children's intake of protein as a percentage of food energy declined significantly between 1989-1991, and 1994-1996, their absolute intake of protein did not change significantly over this period. It should be kept in mind that added sugars accounted for a large proportion of children's carbohydrate intake as of 1994-1996 (Gleason and Suitor 2000).[2]

Patterns of change in total fat, saturated fat, protein, and carbohydrate intake over this period were similar for each of the age/gender groups (Tables III.2.A and III.2.B). Male and female children of all ages experienced a decrease of one to two percentage points in total fat and saturated fat intake (as a percentage of food energy intake), a decrease of about one percentage point in protein intake, and an increase of two to three percentage points in carbohydrate intake. All of these changes over time were statistically significant. However, the age/gender groups had different patterns of absolute fat intake. Among females ages 6 to 8 and 9 to 13, grams of total fat and saturated fat intake decreased (significantly in three of four cases) between 1989-1991 and 1994-1996. Among both males of all ages and females ages 14 to 18, by contrast, grams of total fat intake increased, but this increase was not statistically significant.

When the data are examined by racial/ethnic group (Table III.3), non-Hispanic white children were the only group to significantly increase their food energy intake over this period (from 89 to

[2]Although the 1994-1996 CSFII has readily accessible information on children's added sugar intake, the 1989-1991 CSFII does not. Thus, we were not able to examine changes in children's added sugar intake over time.

TABLE III.2.A

MEAN DAY 1 24-HOUR NUTRIENT INTAKE AMONG SCHOOL-AGED CHILDREN, BY AGE, AMONG MALES, 1989-1991 AND 1994-1996

	Mean 24-Hour Intake					
	Males, Ages 6 to 8		Males, Ages 9 to 13		Males, Ages 14 to 18	
Dietary Component	1989-1991	1994-1996	1989-1991	1994-1996	1989-1991	1994-1996
Food Energy (as Percentage of REA)	89**	98	94	99	88**	100
Percentage of Food Energy from:						
Total fat	33.8*	32.0	34.7**	33.1	34.6**	32.8
Saturated fat	13.5**	11.8	13.2**	12.0	12.9**	11.6
Carbohydrates	52.8**	55.3	51.3**	54.1	51.1**	53.8
Protein	14.8*	14.0	15.3**	14.3	15.5**	14.3
Absolute Fat Intake						
Total fat (g)	65.0	68.5	82.4	83.1	99.5	107.0
Saturated fat (g)	25.8	25.3	31.2	30.0	36.9	38.3
Vitamins (as Percentage of RDA)[a]						
Vitamin A	147	150	112	114	107	113
Vitamin C	223	222	218	221	200	214
Vitamin E	80**	90	93	95	89	93
Vitamin B_6	249	292	178*	192	159*	183
Vitamin B_{12}	326**	346	276	279	258	245
Niacin[b]	217**	252	179*	192	162**	183
Thiamin	243	274	195	207	173	189
Riboflavin	327	354	254	263	196	210
Folate[c]	123	131	96	99	83	83
Minerals (as Percentage of RDA)[a]						
Calcium	114	115	82	80	88	93
Iron	127*	150	136**	161	155	174
Magnesium	166	176	109	112	74	79
Phosphorus	230	239	112	113	130	136
Zinc	87**	102	92*	101	96	100
Other Dietary Components						
Fiber (g)	11.5	12.5	14.1	15.2	16.7	18.1
Cholesterol (mg)	210	209	296*	255	309	325
Sodium (mg)	2,816	2,946	3,457	3,621	4,295	4,640
Sample Size	**383**	**357**	**617**	**552**	**465**	**446**
Weighted Sample Size (Thousands)	**5,517**	**5,804**	**9,649**	**9,858**	**7,802**	**9,717**

SOURCE: Weighted tabulations based on Day 1 intake data from respondents of the 1989-1991 and 1994-1996 CSFII.

[a] Mean intakes of vitamin B_6, vitamin B_{12}, niacin, thiamin, riboflavin, folate, magnesium, and phosphorus in this table are measured as a percentage of the RDAs based on the new Dietary Reference Intakes (DRIs). For the remaining vitamins and minerals except calcium, mean intakes are measured as a percentage of the 1989 RDAs. For calcium, mean intake is measured as a percentage of the DRI-based Adequate Intake (AI).

[b] The reported intake of niacin as a percentage of the RDA is an underestimate because intake is reported in mg of niacin and does not include an estimate of the niacin that is contributed by the conversion of tryptophan to niacin. The RDA is given in mg of niacin equivalents and assumes that all niacin will be considered.

[c] The reported intake of folate as a percentage of the RDA is an underestimate because intake is reported in mcg of folate but the RDA is given in mcg of dietary folate equivalents. Expressing intake in mcg of folate does not make allowance for the high bioavailability of synthetic folic acid, as from fortified ready-to-eat cereals. Dietary folate equivalents consider bioavailability.

*Difference across years is significantly different from zero at the .05 level, two-tailed test.
**Difference across years is significantly different from zero at the .01 level, two-tailed test.

TABLE III.2.B

MEAN DAY 1 24-HOUR NUTRIENT INTAKE AMONG SCHOOL-AGED CHILDREN, BY AGE, AMONG FEMALES, 1989-1991 AND 1994-1996

	Mean 24-Hour Intake					
	Females, Ages 6 to 8		Females, Ages 9 to 13		Females, Ages 14 to 18	
Dietary Component	1989-1991	1994-1996	1989-1991	1994-1996	1989-1991	1994-1996
Food Energy (as Percentage of REA)	94	87	88	89	78**	86
Percentage of Food Energy from:						
Total fat	33.3	32.2	34.2**	32.3	33.7*	32.0
Saturated fat	12.9*	12.0	13.1**	11.7	12.3**	11.0
Carbohydrates	53.5*	55.2	52.6**	55.4	51.9**	54.7
Protein	15.0*	14.1	15.1**	13.8	15.6*	14.4
Absolute Fat Intake						
Total fat (g)	68.1*	60.4	72.3	68.2	66.0	68.4
Saturated fat (g)	26.4*	22.5	27.7*	24.8	24.0	23.6
Vitamins (as Percentage of RDA)[a]						
Vitamin A	155	145	109	111	92	93
Vitamin C	196	202	203	197	148	170
Vitamin E	91*	80	90	90	81	87
Vitamin B_6	262	237	154	157	117	124
Vitamin B_{12}	382	329	221	212	153	165
Niacin[b]	230	210	154	154	128	137
Thiamin	251	232	168	168	137	139
Riboflavin	338*	310	213	214	168	166
Folate[c]	127*	111	84	81	55	54
Minerals (as Percentage of RDA)[a]						
Calcium	116**	102	70	67	58	56
Iron	113*	128	100*	113	79*	89
Magnesium	179**	159	95	94	59	61
Phosphorus	243**	214	97	93	88	87
Zinc	96	87	89	89	77	82
Other Dietary Components						
Fiber (g)	13.1	11.9	13.0	12.8	11.2*	12.9
Cholesterol (mg)	228*	190	250**	205	220	225
Sodium (mg)	2,876*	2,604	3,097	2,951	2,834	3,045
Sample Size	**383**	**336**	**544**	**560**	**511**	**441**
Weighted Sample Size (Thousands)	**5,794**	**5,558**	**8,650**	**9,778**	**8,394**	**8,982**

SOURCE: Weighted tabulations based on Day 1 intake data from respondents of the 1989-1991 and 1994-1996 CSFII.

[a] Mean intakes of vitamin B_6, vitamin B_{12}, niacin, thiamin, riboflavin, folate, magnesium, and phosphorus in this table are measured as a percentage of the RDAs based on the new Dietary Reference Intakes (DRIs). For the remaining vitamins and minerals except calcium, mean intakes are measured as a percentage of the 1989 RDAs. For calcium, mean intake is measured as a percentage of the DRI-based Adequate Intake (AI).

[b] The reported intake of niacin as a percentage of the RDA is an underestimate because intake is reported in mg of niacin and does not include an estimate of the niacin that is contributed by the conversion of tryptophan to niacin. The RDA is given in mg of niacin equivalents and assumes that all niacin will be considered.

[c] The reported intake of folate as a percentage of the RDA is an underestimate because intake is reported in mcg of folate but the RDA is given in mcg of dietary folate equivalents. Expressing intake in mcg of folate does not make allowance for the high bioavailability of synthetic folic acid, as from fortified ready-to-eat cereals. Dietary folate equivalents consider bioavailability.

*Difference across years is significantly different from zero at the .05 level, two-tailed test.
**Difference across years is significantly different from zero at the .01 level, two-tailed test.

TABLE III.3

MEAN DAY 1 24-HOUR NUTRIENT INTAKE AMONG SCHOOL-AGED CHILDREN, BY RACE/ETHNICITY, 1994-1996

	Mean 24-Hour Intake							
	Hispanic		Non-Hispanic Black		Non-Hispanic White		Others	
Dietary Component	1989-1991	1994-1996	1989-1991	1994-1996	1989-1991	1994-1996	1989-1991	1994-1996
Food Energy (as Percentage of REA)	84	88	88	92	89**	96	84	80
Percentage of Food Energy from:								
Total fat	32.8	32.7	34.9	34.8	34.2**	32.0	31.6	29.7
Saturated fat	12.7*	11.7	12.8	12.2	13.1**	11.6	12.0*	10.4
Carbohydrates	52.1	53.4	50.7	52.1	52.2**	55.4	52.4	56.3
Protein	16.1*	14.9	15.5**	14.1	15.0**	13.9	17.2*	15.2
Absolute Fat Intake								
Total fat (g)	68.1	73.3	76.8	81.7	78.4	79.1	68.5	62.1
Saturated fat (g)	26.2	26.1	28.2	28.8	29.8	28.7	26.2	21.7
Vitamins (as Percentage of RDA)[a]								
Vitamin A	98	111	113	98	120	125	115	93
Vitamin C	230	206	198	217	191	200	245	209
Vitamin E	76	84	91	88	89	93	72	74
Vitamin B_6	179	186	180	171	178*	192	177	188
Vitamin B_{12}	248	241	223	247	270	256	236	242
Niacin[b]	173	172	181	176	171**	186	175	167
Thiamin	189	189	193	185	187*	198	190	189
Riboflavin	225	235	218	214	247	252	212	204
Folate[c]	98	93	84	78	92	92	92	78
Minerals (as Percentage of RDA)[a]								
Calcium	75	79	72	65	89	88	78	66
Iron	119	129	109	122	124**	142	129	122
Magnesium	106	104	101	92	108	109	101	104
Phosphorus	136	131	129	119	142	140	126	120
Zinc	86	93	87	89	90*	95	92	88
Other Dietary Components								
Fiber (g)	14.1	14.4	12.8	13.1	13.4*	14.5	15.5	13.5
Cholesterol (mg)	269	265	269	268	253*	232	247	205
Sodium (mg)	2,938	3,174	3,358	3,357	3,306	3,470	3,671	2,999
Sample Size	**361**	**430**	**525**	**411**	**1,930**	**1,735**	**87**	**116**
Weighted Sample Size (Thousands)	**4,722**	**6,481**	**7,447**	**7,705**	**32,695**	**34,190**	**942**	**2,321**

SOURCE: Weighted tabulations based on Day 1 data from respondents of the 1989-1991 and 1994-1996 CSFII.

[a] Mean intakes of vitamin B_6, vitamin B_{12}, niacin, thiamin, riboflavin, folate, magnesium, and phosphorus in this table are measured as a percentage of the RDAs based on the new Dietary Reference Intakes (DRIs). For the remaining vitamins and minerals except calcium, mean intakes are measured as a percentage of the 1989 RDAs. For calcium, mean intake is measured as a percentage of the DRI-based Adequate Intake (AI).

[b] The reported intake of niacin as a percentage of the RDA is an underestimate because intake is reported in mg of niacin and does not include an estimate of the niacin that is contributed by the conversion of tryptophan to niacin. The RDA is given in mg of niacin equivalents and assumes that all niacin will be considered.

[c] The reported intake of folate as a percentage of the RDA is an underestimate because intake is reported in mcg of folate but the RDA is given in mcg of dietary folate equivalents. Expressing intake in mcg of folate does not make allowance for the high bioavailability of synthetic folic acid, as from fortified ready-to-eat cereals. Dietary folate equivalents consider bioavailability.

*Difference across years is significantly different from zero at the .05 level, two-tailed test.
**Difference across years is significantly different from zero at the .01 level, two-tailed test.

96 percent of the REA).[3] Mean food energy intake increased for Hispanic and non-Hispanic black children and decreased for children in the "Others" group, but these changes were smaller and not statistically significant.[4] White children also had significant decreases in total fat, saturated fat, and protein intakes and a significant increase in carbohydrate intake as a percentage of food energy. For the other racial/ethnic groups, total fat intake as a percentage of food energy remained about the same over this period, while changes in saturated fat, carbohydrate, and protein intake followed the same pattern as for non-Hispanic whites, but the changes were smaller and less likely to be significant (except for protein). Mean total fat and saturated fat intake in absolute terms did not change significantly for any of the racial/ethnic subgroups, nor did mean protein intake in absolute terms (not shown).

2. Vitamins and Minerals

a. All Children

Despite the increase in children's mean food energy intake between 1989-1991 and 1994-1996, their mean vitamin and mineral intake changed little over this period. In both 1989-1991 and 1994-1996, mean intakes exceeded the standards used in this report (RDAs or AI) for all vitamins and minerals except vitamin E, folate, calcium, and zinc (Figure III.3). Children's intakes of those

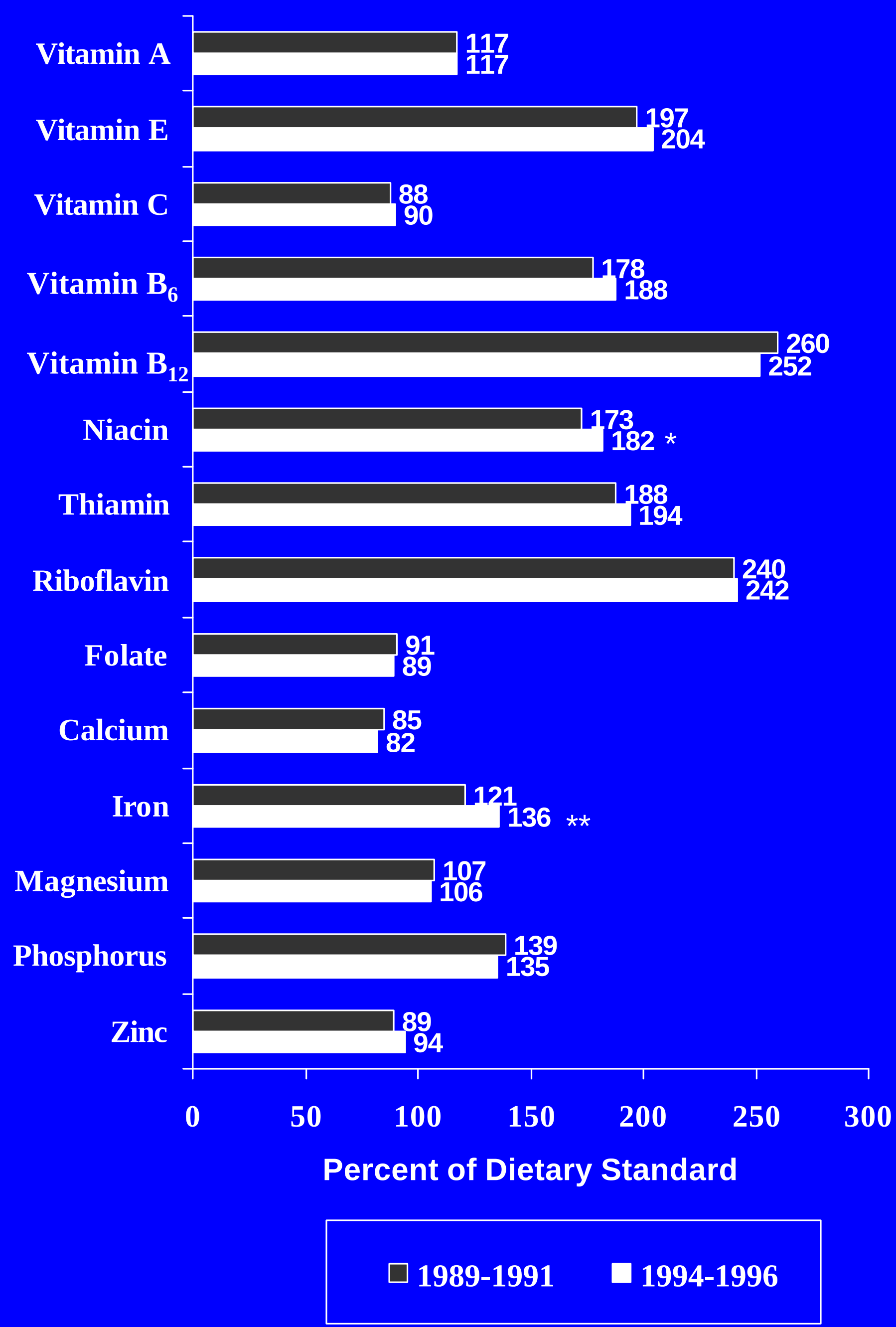
---

[3]To some extent, dietary changes among white children were more likely to be statistically significant than changes among the other racial/ethnic groups because the sample of white children is much larger than the samples of children in the other groups. In reporting on dietary changes over time among the racial/ethnic groups, we focus not only on statistical significance, but also on the magnitude of these changes.

[4]This decrease in mean food energy intake and a variety of other changes in intake between 1989-1991 and 1994-1996 among "Others" may reflect changes in the composition of this group. In particular, the percentage of "Others" who are Asian/Pacific Islander increased substantially over this period; thus, differences in mean intakes between Asians/Pacific Islanders and other children within this subgroup may drive the apparent changes over time in mean intakes of the subgroup as a whole.

FIGURE III.3

SCHOOL-AGED CHILDREN'S MEAN 24-HOUR INTAKES OF VITAMINS AND MINERALS, 1989-1991 AND 1994-1996



* Difference in intake across years is significantly different from zero at the .05 level, two-tailed test.
** Difference in intake across years is significantly different from zero at the .01 level, two-tailed test.

Source: CSFII

four nutrients changed little over time. By 1994-1996, children as a group had significantly higher 24-hour intakes of only two nutrients--iron and niacin--relative to the earlier period. Mean 24-hour intakes of the remaining vitamins and minerals did not change significantly over this period, however.

b. Age/Gender Groups

In general, males of various ages were more likely than females to experience significant increases in mean 24-hour vitamin and mineral intakes. Among males ages 6 to 8 and 9 to 13, for example, mean 24-hour intakes of vitamin E and vitamin B_{12} (6- to 8-year-olds only), vitamin B_6 (9- to 13-year-olds only), and niacin, iron, and zinc (both groups) increased significantly (Table III.2.A). For 14- to 18-year-old males, mean intakes of vitamin B_6 and niacin increased significantly, while intakes of several other vitamins and minerals had increases that were not statistically significantly.

Among females ages 9 to 13 and 14 to 18, the only significant change over time was an increase in mean iron intake--from 100 to 113 percent of the RDA for 9- to 13-year-olds and from 79 to 89 percent of the RDA for 14- to 18-year-olds (Table III.2.B). Among 14- to 18-year-old females, a group for whom inadequate vitamin and mineral intake is a concern (see, for example, Gleason and Suitor 2000), mean intakes of several key nutrients changed little over this period. In 1989-1991, for example, this group had mean intakes of 55 percent of the folate RDA, 58 percent of the calcium AI, and 59 percent of the magnesium RDA. By 1994-1996, these mean intakes were nearly unchanged--54 percent of the folate RDA, 56 percent of the calcium AI, and 61 percent of the magnesium RDA. Mean intakes for females ages 6 to 8 *decreased* over this period for a number of vitamins and minerals: mean intakes of vitamin E, riboflavin, folate, calcium, magnesium, and phosphorus decreased significantly (while mean iron intake increased significantly). However, these decreases in intake are not surprising for this group given their decrease in energy intake.

Furthermore, vitamin and mineral intakes relative to the RDA among females ages 6 to 8 remained higher than among older females for most of the nutrients.

The fact that mean intake of vitamins and minerals by 14- to 18-year-old females remained constant even though their food energy intake increased over this period suggests that the increase in energy intake was driven by foods with low nutrient density. We have no direct evidence on the change over this period in children's intake of added sugar. However, one plausible explanation is that an increase in the intake of added sugars was the primary reason teenage girls' food energy intake increased. This explanation is consistent with the fact that their carbohydrate intake increased over this period and is also consistent with the rise in their intake of beverages high in added sugar--regular soda and fruit drinks and fruit-flavored drinks (discussed in Section D).

Males ages 14 to 18 had a large increase in mean energy intake (from 88 to 100 percent of their RDA) and significant increases in their mean intakes of only two vitamins and minerals--niacin and vitamin B_6. As for the girls, data on changes in their mean intakes of beverages high in added sugar (regular soda and fruit drinks and fruit-flavored drinks) suggests that a substantial proportion of the increase in their food energy intake came from high-sugar foods.

c. Racial/Ethnic Groups

Among the racial/ethnic groups, non-Hispanic white children were the only group to experience significant increases in mean vitamin and mineral intake between 1989-1991 and 1994-1996. White children's mean intakes of vitamin B_6, niacin, thiamin, iron, and zinc increased significantly over this period (Table III.3). Among the other racial/ethnic groups, there were no significant changes in mean vitamin and mineral intake.

3. Other Dietary Components

a. All Children

For school-aged children as a group, mean 24-hour cholesterol intake in milligrams (mg) decreased significantly between 1989-1991 and 1994-1996: it was 16 mg lower in 1994-1996 than in the earlier period (Table III.1). This decrease in cholesterol intake occurred mainly at breakfast, at which mean intake fell by 14 mg. Mean 24-hour sodium intake increased by about 110 mg over this period, although this increase was not statistically significant.[5] Finally, mean 24-hour fiber intake among children increased significantly between 1989-1991 and 1994-1996. This increase arose from increases in fiber intake at meals other than breakfast or lunch; mean breakfast and lunch intake stayed relatively constant during the early to mid-1990s. This evidence suggests that the increase in fiber intake was not driven by an increase in the consumption of ready-to-eat breakfast cereals. Furthermore, to the extent that the increase in fiber intake was driven by increases in the consumption of grain products and/or vegetables (see Section D), these increases must have occurred at dinner or for snacks. However, the overall increase in fiber intake was associated with the increase in food energy intake; mean fiber intake per 1,000 calories of energy did not increase significantly.

b. Age/Gender Groups

Between 1989-1991 and 1994-1996, mean cholesterol intake decreased for both boys and girls ages 13 years and younger, and this decrease was statistically significant for each group except boys ages 6 to 8 (Tables III.2.A and III.2.B). For males ages 14 to 18, however, there was a slight (and statistically insignificant) increase in cholesterol intake, so that this group's mean cholesterol intake was 325 mg by 1994-1996, above the recommended daily maximum of 300 mg. Mean sodium

[5] The sodium intake figures reported in the CSFII do not include table salt added to food.

intake increased among each age group of males, although these increases were not statistically significant. Among females ages 6 to 8, however, mean sodium intake decreased significantly.

Changes in fiber intake by age and gender follow the changes in food energy intake described earlier (Tables III.2.A and III.2.B). Fiber intake increased slightly between 1989-1991 and 1994-1996 (by 1.0 to 1.7 g) for all males and for females ages 14 to 18, groups for whom mean energy intake also increased. Fiber intake decreased for the youngest females, whose mean energy intake decreased over this period.

c. Racial/Ethnic Groups

Children's intake of cholesterol, sodium, and fiber varied substantially among the racial/ethnic groups, although most changes over time were not statistically significant (Table III.3). From 1989-1991 to 1994-1996, mean sodium intake increased among Hispanic children and white children and decreased among children in the "Others" groups, although these changes were not statistically significant. Mean cholesterol intake decreased among white children (significantly) and among "Others" (insignificantly). Finally, fiber intake increased significantly by 1.1 g per day among non-Hispanic whites and decreased insignificantly by 2.0 g per day among "Others," consistent with the patterns in food energy intake.

B. CHANGES IN PERCENTAGES OF CHILDREN MEETING NUTRIENT STANDARDS

This section assesses changes in percentages of children meeting nutrient standards from 1989-1991 to 1994-1996. To generate unbiased estimates of the percentage of children whose *usual* intakes meet these dietary standards, we used all three days of 1989-1991 dietary intake data and both days of 1994-1996 data.[6]

---

[6]We also constructed analogous tables showing the percentages of children whose Day 1 intakes (continued...)

Before presenting information on whether children's intakes of most vitamin and mineral meet the relevant standards, we present information on the full distributions of usual food energy and calcium intakes. The full distribution of food energy intake is presented to provide readers with as much information as possible on food energy intake. The full distribution of calcium intake is presented because no appropriate cutoff for assessing the adequacy of calcium intake could be determined (see Chapter II).

1. Food Energy Distribution

For all school-aged children, the usual 24-hour intake of food energy as a percentage of the 1989 REA was significantly higher at each reported percentile of the distribution in 1994-1996 than it was in 1989-1991 (Figure III.4). At the 10th percentile, for example, children's food energy intake was 62 percent of the REA in 1989-1991 and 66 percent in 1994-1996; at the 90th percentile, food energy intake increased from 119 to 124 percent of the REA over this period. These changes show that the increase in *mean* food energy intake among school-aged children reported in Table III.1 was driven by increases in energy intake throughout the distribution--that is, increases in energy intake among heavy, average, and light eaters.

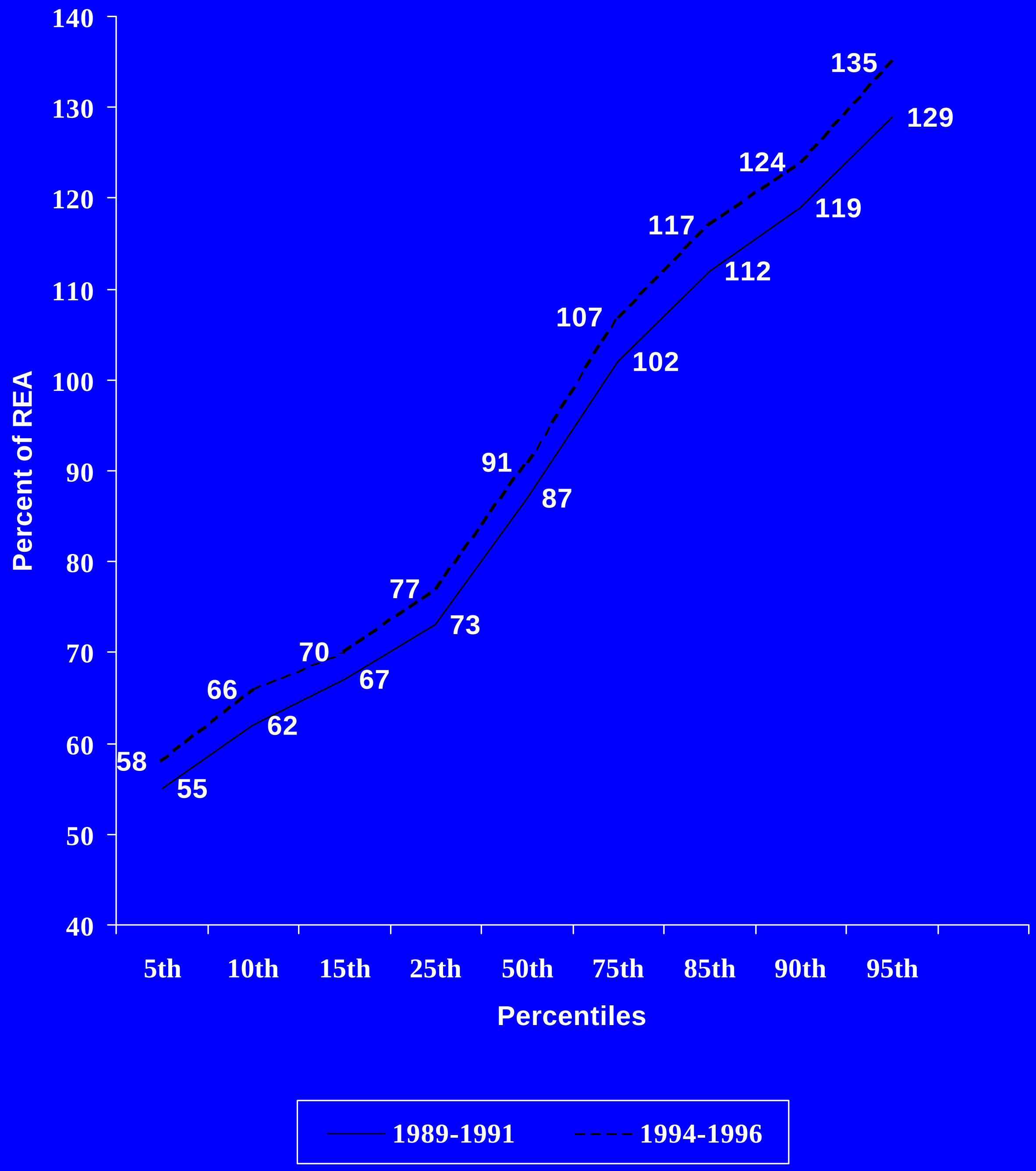
The same general pattern of an increase in usual food energy intake at all parts of the distribution holds for males in each of the age groups and for females ages 14 to 18 (Table III.4). On the other hand, the distribution of food energy intake among females ages 9 to 13 remained essentially unchanged between 1989-1991 and 1994-1996 and that of females ages 6 to 8 was lower in 1994-1996 than it was in the earlier period. For this youngest group of females, the decline in usual food energy intake was particularly pronounced at the upper end of the distribution--that is,

---

[6](...continued)
meet these dietary standards, presented in Appendix B (see Chapter II for a discussion of these two methods and their limitations using these two CSFII data sets).

FIGURE III.4

DISTRIBUTION OF FOOD ENERGY INTAKE AS A PERCENTAGE OF THE RDA AMONG SCHOOL-AGED CHILDREN, 1989-1991 AND 1994-1996



SOURCE: CSFII

TABLE III.4

24-HOUR USUAL FOOD ENERGY INTAKE DISTRIBUTION, OVERALL AND BY SUBGROUP, 1989-1991 AND 1994-1996

	24-Hour Usual Intake Distribution of Food Energy as a Percentage of the 1989 REA (Percentiles)								
Dietary Component	5th	10th	15th	25th	50th	75th	85th	90th	95th
Overall									
1989-1991	55**	62**	67**	73**	87**	102**	112**	119**	129*
1994-1996	58	66	70	77	91	107	117	124	135
Gender/Age									
Males, 6-8									
1989-1991	59*	65*	69**	75**	88**	102*	110*	116	125
1994-1996	67	73	77	84	97	111	119	125	136
Males, 9-13									
1989-1991	57*	64*	69**	77**	93*	109	118	124	134
1994-1996	65	72	77	83	97	112	121	128	138
Males, 14-18									
1989-1991	54	60	65*	73**	88**	107*	119	127	142
1994-1996	60	67	72	80	97	116	129	138	153
Females, 6-8									
1989-1991	67	73	77	83*	93**	105**	111**	116**	124*
1994-1996	65	69	72	77	86	96	102	106	111
Females, 9-13									
1989-1991	59	64	69	75	87	100	109	115	125
1994-1996	60	66	70	76	88	101	109	115	124
Females, 14-18									
1989-1991	48	54	58*	64*	77**	92**	100*	106*	116
1994-1996	53	59	64	70	84	100	109	116	127
Race/Ethnicity									
Hispanic									
1989-1991	54	59	63	69	81*	95	104	111	121
1994-1996	56	62	66	73	86	101	110	117	128
Non-Hispanic Black									
1989-1991	54	61	66	74	90	107	117	125	136
1994-1996	61	67	71	78	89	104	112	118	128
Non-Hispanic White									
1989-1991	57*	63**	68**	75**	88**	103**	112**	117**	127**
1994-1996	61	68	72	79	94	110	120	127	138
Other									
1989-1991	51	57	61	68	84	104	116	125	141
1994-1996	45	52	57	64	79	95	104	111	121

SOURCE: Weighted tabulations based on three days of intake data from respondents of the 1989-1991 CSFII and two days of intake data from respondents of the 1994-1996 CSFII.

NOTE: Children's usual intake distribution was determined based on two or three intake days using the Software for Intake Distribution Estimation (SIDE), developed by Iowa State University (1996).

*Difference across years is significantly different from zero at the .05 level, two-tailed test.
**Difference across years is significantly different from zero at the .01 level, two-tailed test.

there was a larger decrease in usual food energy intake among young girls who consume many calories than there was among young girls who consume very few.

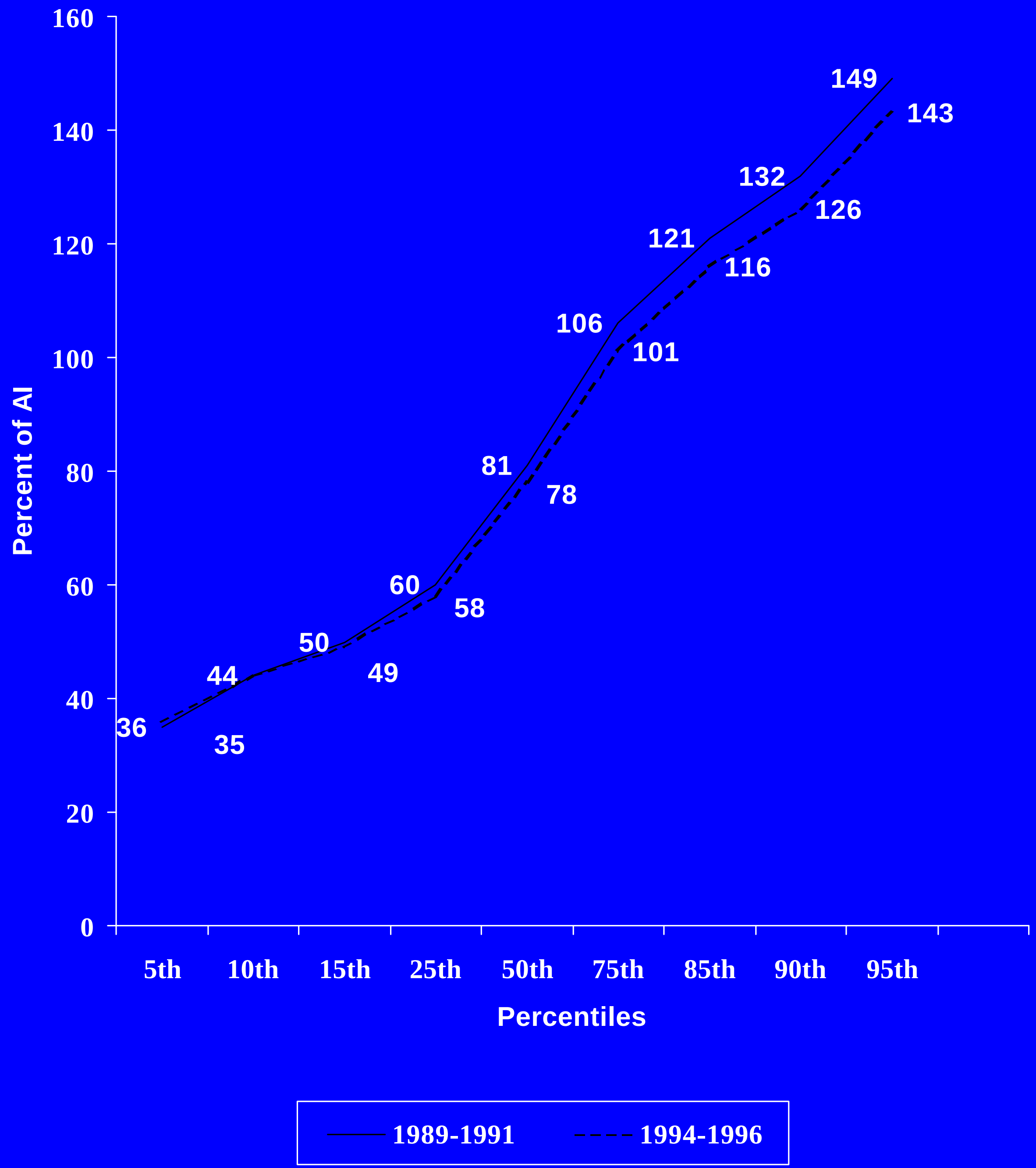
Non-Hispanic whites were the racial/ethnic group with the largest increase in usual food energy intake distribution (Table III.4). Hispanic children also experienced an increase in food energy intake, although this increase was statistically significant only at the 50th percentile. The usual food energy intake distribution among black children was less widely dispersed in 1994-1996 than it was in 1989-1991. In other words, there was an increase in food energy intake over this period at the lower end of the distribution and a decrease in food energy intake at the upper end of the distribution. None of the differences in black children's intakes at various percentiles was statistically significant, however.

2. Calcium Distribution

For all school-aged children, the usual intake distribution of calcium as a percentage of the AI was about the same in 1994-1996 as it was in 1989-1991 (Figure III.5). Calcium intakes were slightly lower in 1994-1996 beginning at about the 50th percentile and above, but these differences were not statistically significant. Some changes in the distributions of calcium intake over time can be seen among the age and gender groups (Table III.5). Calcium intakes among females decreased between 1989-1991 and 1994-1996, with the largest decreases at the upper end of the distribution. Among females ages 6 to 8, for example, the 90th percentile decreased from 157 percent of the AI in 1989-1991 to 139 percent in 1994-1996. The distribution of usual calcium intake did not significantly change among males. Finally, at the 50th percentile and higher, usual calcium intake among black children decreased substantially over this period. For example, the median fell from 74 to 63 percent of the AI and the 90th percentile fell from 125 to 95 percent of the AI. The

FIGURE III.5

DISTRIBUTION OF CALCIUM INTAKE AS A PERCENTAGE OF THE AI AMONG SCHOOL-AGED CHILDREN, 1989-1991 AND 1994-1996



SOURCE: CSFII

TABLE III.5

24-HOUR USUAL CALCIUM INTAKE DISTRIBUTION, OVERALL AND BY SUBGROUP, 1989-1991 AND 1994-1996

Dietary Component	24-Hour Usual Intake Distribution of Calcium as a Percentage of the AI (Percentiles)								
	5th	10th	15th	25th	50th	75th	85th	90th	95th
Overall									
1989-1991	35	44	50	60	81	106	121	132	149
1994-1996	36	44	49	58	78	101	116	126	143
Gender/Age									
Males, 6-8									
1989-1991	58	68	76	88	112	136	150	159	174
1994-1996	65	74	81	91	112	136	150	160	175
Males, 9-13									
1989-1991	41	48	54	62	80	99	110	117	129
1994-1996	45	51	56	63	77	94	104	110	121
Males, 14-18									
1989-1991	43	51	58	67	88	111	126	137	155
1994-1996	42	50	56	66	86	113	129	142	163
Females, 6-8									
1989-1991	66	75	82	93**	113**	135**	148**	157*	172*
1994-1996	60	68	74	83	101	120	131	139	151
Females, 9-13									
1989-1991	36	42	46	53	67	84	94	101	112
1994-1996	37	42	46	53	66	80	89	95	104
Females, 14-18									
1989-1991	25	30	35	42	57	76*	87*	95*	107
1994-1996	27	32	35	41	54	69	78	84	94
Race/Ethnicity									
Hispanic									
1989-1991	33	40	44	52	69	91	103	113	127
1994-1996	34	41	46	55	74	98	112	123	140
Black									
1989-1991	29	37	43	52	74**	99**	114**	125**	143**
1994-1996	33	39	43	50	63	79	88	95	105
White									
1989-1991	39	47	53	64	85	109	124	135	152
1994-1996	41	48	54	63	83	107	122	133	150
Other									
1989-1991	34	41	47*	56*	76*	101	118	130	150
1994-1996	23	29	34	43	61	84	99	110	127

SOURCE: Weighted tabulations based on three days of intake data from respondents of the 1989-1991 CSFII and two days of intake data from respondents of the 1994-1996 CSFII.

NOTE: Children's usual intake distribution was determined based on two or three intake days using the Software for Intake Distribution Estimation (SIDE), developed by Iowa State University (1996).

*Difference across years is significantly different from zero at the .05 level, two-tailed test.
**Difference across years is significantly different from zero at the .01 level, two-tailed test.

distribution of usual calcium intake also decreased over this period among "Others," but did not change significantly among white or Hispanic children.

3. Distributions of Other Vitamins and Minerals

a. All Children

Most children (92 percent or more) met the reference standards for the usual intake of thiamin, riboflavin, niacin, vitamin B_6, vitamin B_{12}, and vitamin C in both 1989-1991 and 1994-1996 (Figure III.6).[7] Thus, there were no large changes over time in the percentage meeting the standard for these nutrients. For most of the remaining nutrients as well, the percentage of children meeting the reference standard did not change significantly over this period. However, significantly larger percentages of children met the standards for vitamin E and iron. For vitamin E, the percentage of children whose usual intake exceeded 80 percent of the RDA rose from 52 percent in 1989-1991 to 59 percent in 1994-1996.[8] The percentage of children meeting the iron standard rose from 81 to 88 percent over this period.[9]

---

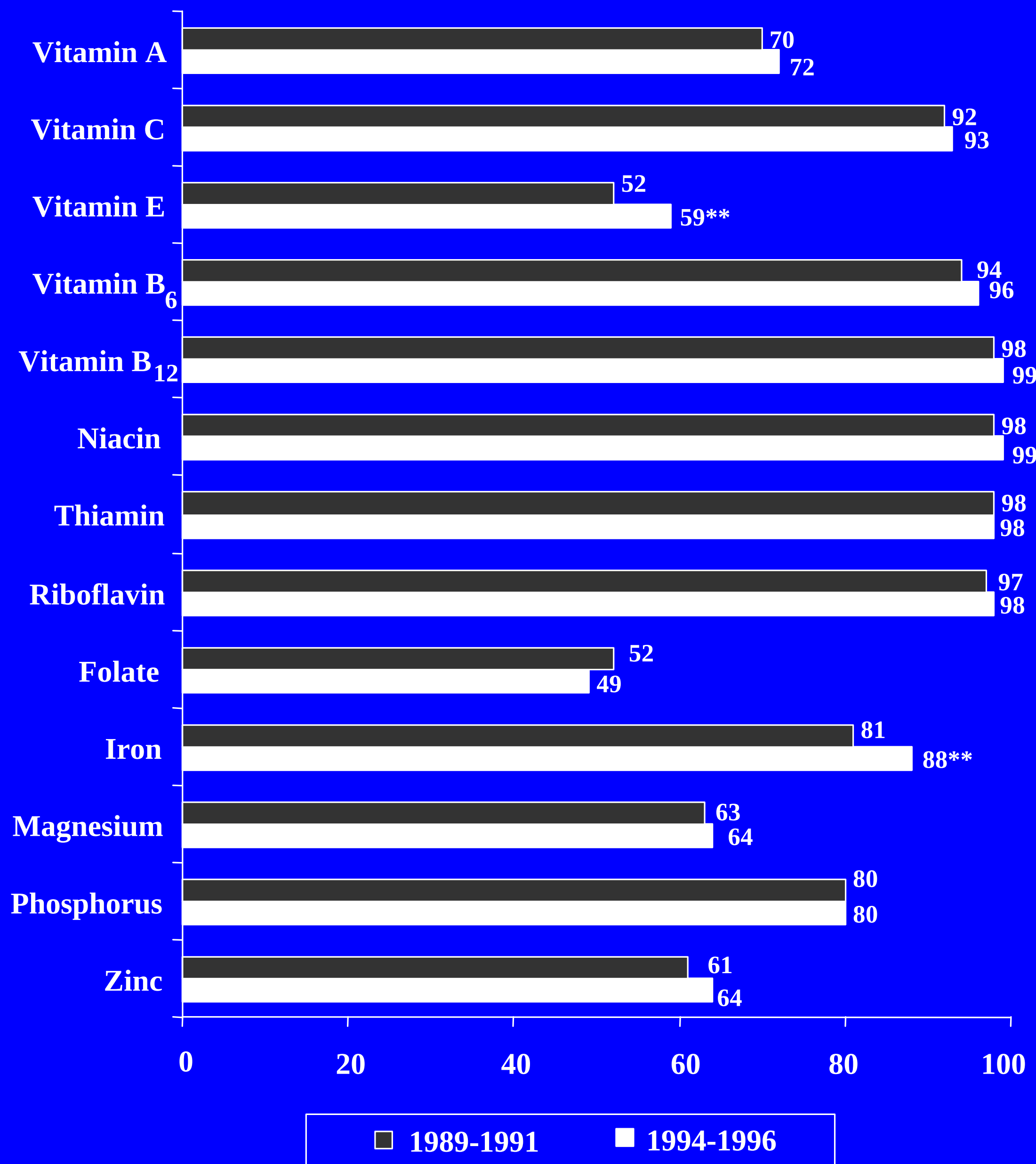
[7]Appendix Table B.2 shows the percentages upon which this figure is based.

[8]As described in Chapter II, 80 percent of the RDA is used as the reference standard for Vitamin E and other nutrients for which there is no EAR because it is a good estimate of the EAR assuming a coefficient of variation of 0.125.

[9]Appendix Table B.3 shows the percentages of children whose Day 1 (as opposed to usual) intakes meet these same dietary standards. In general, the percentage of children whose Day 1 intake meets the standard for a nutrient is lower than the percentage whose usual intake meets that standard. For example, while 70 percent of children had usual vitamin A intakes that met the standard in 1989-1991, only 54 percent had Day 1 intakes that met the standard. However, comparisons over time using Day 1 intakes are similar to comparisons over time using usual intakes. In other words, where there is an increase in the percentage of children whose usual intake met a particular standard, there is also an increase in the percentage of children whose Day 1 intake met that standard. For a graphical representation of these percentages during 1989-1991 and 1994-1996 for males ages 14 to 18, see Appendix Figure B.1.

FIGURE III.6

PERCENTAGE OF SCHOOL-AGED CHILDREN WHOSE USUAL INTAKE MEETS STANDARDS, 1989-1991 AND 1994-1996



Note: For Vitamins A, C, and E, iron, and zinc, the dietary standard used is 80 percent of the 1989 RDA. For the remaining nutrients, the dietary standard is the EAR.

* Difference in intake across years is significantly different from zero at the .05 level, two-tailed test.
** Difference in intake across years is significantly different from zero at the .01 level, two-tailed test.

SOURCE: CSFII

b. Age/Gender Groups

For all the B vitamins reported except folate, the percentages of all males whose usual intake met the reference standard was very close to 100 percent in both time periods (Table III.6.A). The same is true for females younger than 14 (Table III.6.B).[10] For vitamin B_6, the percentage of both males and females ages 14 to 18 meeting the standard rose--from 94 to 97 percent for males and from 78 to 85 percent for females (although neither of these differences is statistically significant). The percentage of children whose usual folate intake met the reference standard was quite low among older children and tended to be slightly (although insignificantly) lower in 1994-1996 than in 1989-1991. However, the recent mandate to fortify enriched cereal grains with folic acid has likely led to marked increases in folate intake since 1994-1996.

For most of the remaining vitamins and minerals, higher percentages of males met dietary standards for most vitamins and minerals in 1994-1996 than in 1989-1991, but these differences are rarely statistically significant (Table III.6.A). The most notable (and only statistically significant) improvements were the percentages of males ages 6 to 8 meeting standards for vitamin E (from 45 percent in 1989-1991 to 62 percent in 1994-1996), iron (from 88 to 97 percent), and zinc (from 58 to 76 percent), and the percentage of males ages 9 to 13 meeting the standard for zinc (from 64 to 76 percent).

For females, the percentages of children who met dietary standards did not change significantly between 1994-1996 and 1989-1991 for most nutrients (Table III.6.B). Among females ages 14 to 18, the group for whom vitamin and mineral intakes tend to be the lowest, the percentages meeting the standards for several nutrients rose over this period, but this increase was statistically significant only for vitamin E (from 42 to 59 percent) and iron (from 46 to 56 percent). Furthermore, in both

[10]Appendix Tables B.4.A and B.4.B are analogous to Tables III.6.A and III.6.B, but are based on children's Day 1 vitamin intake rather than their usual vitamin intake.

TABLE III.6.A

PERCENTAGE OF SCHOOL-AGED CHILDREN WHOSE USUAL DAILY NUTRIENT INTAKE IS AT OR ABOVE DIETARY STANDARDS, BY AGE, AMONG MALES, 1989-1991 AND 1994-1996

	Percentage of Children Whose Usual 24-Hour Intake Is at or Above EAR or 80 Percent of 1989 RDA[a]					
	Males, Ages 6 to 8		Males, Ages 9 to 13		Males, Ages 14 to 18	
Dietary Component	1989-1991	1994-1996	1989-1991	1994-1996	1989-1991	1994-1996
Vitamins						
Vitamin A	85	91	72	74	65	70
Vitamin C	96	95	94	98	92	91
Vitamin E	45**	62	55	59	58	64
Vitamin B_6	100	100	98	100	94	97
Vitamin B_{12}	100	100	100	100	99	100
Niacin	100	100	100	100	99	100
Thiamin	100	100	100	100	99	98
Riboflavin	100	100	99	100	97	97
Folate	84	87	59	64	46	42
Minerals						
Iron	88*	97	94	99	97	98
Magnesium	99	99	77	84	34	38
Phosphorus	100	100	82	85	91	93
Zinc	58**	76	64*	76	71	73
Sample Size	**301**	**357**	**500**	**552**	**354**	**446**

SOURCE: Weighted tabulations based on three days of intake data from respondents of the 1989-1991 CSFII and two days of intake data from respondents of the 1994-1996 CSFII.

NOTE: Children's usual intake distribution was determined based on two or three intake days using the Software for Intake Distribution Estimation (SIDE), developed by Iowa State University (1996).

[a] For vitamin B_6, vitamin B_{12}, niacin, thiamin, riboflavin, folate, magnesium, and phosphorus, the EARs based on the new DRIs are used. For all of the remaining nutrients, the table shows the percentage of individuals whose intake is at or above 80 percent of the 1989 RDAs (an approximation of the EAR). The percentages of children meeting the EAR for niacin and folate are underestimated. The intake estimates do not account for the conversion of tryptophan to niacin or for the high bioavailability of synthetic folic acid as from fortified ready-to-eat cereal, whereas the EARs cover these.

*Difference across years is significantly different from zero at the .05 level, two-tailed test.
**Difference across years is significantly different from zero at the .01 level, two-tailed test.

TABLE III.6.B

PERCENTAGE OF SCHOOL-AGED CHILDREN WHOSE USUAL DAILY NUTRIENT INTAKE IS AT OR ABOVE DIETARY STANDARDS, BY AGE, AMONG FEMALES, 1989-1991 AND 1994-1996

	Percentage of Children Whose Usual 24-Hour Intake Is at or Above EAR or 80 Percent of 1989 RDA[a]					
	Females, Ages 6 to 8		Females, Ages 9 to 13		Females, Ages 14 to 18	
Dietary Component	1989-1991	1994-1996	1989-1991	1994-1996	1989-1991	1994-1996
Vitamins						
Vitamin A	92	88	69	74	54	56
Vitamin C	97	99	94	92	81	86
Vitamin E	62	48	51	60	42*	59
Vitamin B_6	100	100	98	98	78	85
Vitamin B_{12}	100	100	99	99	88	92
Niacin	100	100	100	100	92	95
Thiamin	100	100	100	100	89	90
Riboflavin	100	100	99	100	90	95
Folate	90	86	48	41	13	10
Minerals						
Iron	96	97	67	81	46*	56
Magnesium	100	100	64	67	12	11
Phosphorus	100	100	67	63	53	52
Zinc	75*	60	61	61	44	48
Sample Size	**298**	**336**	**444**	**560**	**406**	**441**

SOURCE: Weighted tabulations based on three days of intake data from respondents of the 1989-1991 CSFII and two days of intake data from respondents of the 1994-1996 CSFII.

NOTE: Children's usual intake distribution was determined based on two or three intake days using the Software for Intake Distribution Estimation (SIDE), developed by Iowa State University (1996).

[a] For vitamin B_6, vitamin B_{12}, niacin, thiamin, riboflavin, folate, magnesium, and phosphorus, the EARs based on the new DRIs are used. For all of the remaining nutrients, the table shows the percentage of individuals whose intake is at or above 80 percent of the 1989 RDAs (an approximation of the EAR). The percentages of children meeting the EAR for niacin and folate are underestimated. The intake estimates do not account for the conversion of tryptophan to niacin or for the high bioavailability of synthetic folic acid as from fortified ready-to-eat cereal, whereas the EARs cover these.

*Differences in intake across years is significantly different from zero at the .05 level, two-tailed test.
**Differences in intake across years is significantly different from zero at the .01 level, two-tailed test.

periods, fewer than 15 percent of these teenage girls met the standard for folate and magnesium intake. Among females ages 9 to 13, there were no significant changes between 1989-1991 and 1994-1996 in the percentages meeting dietary standards. Among the youngest females, the only significant change was a decline in the percentage meeting the zinc standard, from 75 to 60 percent.

c. Racial/Ethnic Groups

White children were the racial/ethnic group most likely to experience an increase in the percentage meeting dietary standards for usual vitamin and mineral intake. The percentage of white children meeting the standards for vitamin E, iron, and zinc increased significantly between 1989-1991 and 1994-1996 (Table III.7).[11] For example, the percentage meeting the vitamin E standard rose from 55 to 63 percent. Among Hispanics, the percentage of children meeting the standard increased somewhat between 1989-1991 and 1994-1996 for four nutrients--vitamins A and E, iron, and zinc--but only the difference in the percentage meeting the vitamin A standard was statistically significant. Significantly higher percentages of non-Hispanic blacks met the standard for vitamin C in 1994-1996 compared with the earlier period, but significantly fewer black children met the folate standard (47 percent in 1989-1991 versus 38 percent in 1994-1996). There was relatively little change in the percentage meeting the standards for other nutrients. There were decreases in the percentages of "other" children meeting vitamin and mineral intake standards over this period, but this was likely due to the large change in the racial/ethnic makeup of this group.

C. CHANGES IN INTAKES RELATIVE TO DIETARY GUIDELINES AND OTHER RECOMMENDATIONS

During the 1989-1991 CSFII, a revised edition (the 1990 edition) of *Dietary Guidelines* was released. Similarly, another revision (the 1995 edition) was released during the 1994-1996 CSFII.

---

[11] Appendix Table B.5 is analogous to Table III.7 but is based on children's Day 1 vitamin intake rather than their usual vitamin intake.

TABLE III.7

PERCENTAGE OF SCHOOL-AGED CHILDREN WHOSE USUAL DAILY NUTRIENT INTAKE IS AT OR ABOVE DIETARY STANDARDS, BY RACE/ETHNICITY, 1989-1991 AND 1994-1996

	Percentage of Children Whose Usual 24-Hour Intake Is at or Above EAR or 80 Percent of 1989 RDA[a]							
	Hispanic		Black		White		Other	
Dietary Component	1989-1991	1994-1996	1989-1991	1994-1996	1989-1991	1994-1996	1989-1991	1994-1996
Vitamins								
Vitamin A	49**	66	65	60	74	78	78*	53
Vitamin C	94	95	91**	100	92	91	96	94
Vitamin E	36	48	50	65	55**	63	39	36
Vitamin B_6	96	96	95	96	94	96	100	97
Vitamin B_{12}	99	99	97	98	98	99	99	97
Niacin	99	98	98	99	98	99	100	98
Thiamin	99	97	97	98	98	98	100	96
Riboflavin	97	98	96	98	98	98	99	91
Folate	58	53	47*	38	53	52	61*	37
Minerals								
Iron	79	85	74	84	83**	90	82	79
Magnesium	64	62	61	54	63	66	62	59
Phosphorus	79	77	77	74	82	83	78	69
Zinc	53	63	63	61	61*	67	77	53
Sample Size	**270**	**430**	**381**	**411**	**1,572**	**1,735**	**80**	**116**

SOURCE: Weighted tabulations based on three days of intake data from respondents of the 1989-1991 CSFII and two days of intake data from respondents of the 1994-1996 CSFII.

NOTE: Children's usual intake distribution was determined based on two or three intake days using the Software for Intake Distribution Estimation (SIDE), developed by Iowa State University (1996).

[a] For vitamin B_6, vitamin B_{12}, niacin, thiamin, riboflavin, folate, magnesium, and phosphorus, the EARs based on the new DRIs are used. For all of the remaining nutrients, the table shows the percentage of individuals whose intake is at or above 80 percent of the 1989 RDAs (an approximation of the EAR). The percentages of children meeting the EAR for niacin and folate are underestimated. The intake estimates do not account for the conversion of tryptophan to niacin or for the high bioavailability of synthetic folic acid as from fortified ready-to-eat cereal, whereas the EARs cover these.

*Differences in intake across years is significantly different from zero at the .05 level, two-tailed test.
**Differences in intake across years is significantly different from zero at the .01 level, two-tailed test.

However, the message concerning fat, saturated fat, cholesterol, and salt intake remained essentially the same: limit total fat intake to 30 percent of food energy and saturated fat intake to 10 percent of food energy, and limit intake of sodium and cholesterol. This section describes changes in the percentages of children meeting the quantitative dietary guidelines regarding fat intake, and other quantitative recommendations regarding the intake of sodium, cholesterol, carbohydrates, fiber and protein.

1. All Children

Substantially higher proportions of children met the dietary guidelines for total fat, saturated fat, and carbohydrates as a percentage of food energy in 1994-1996 than in the earlier period, but there is much room for further improvement (Figure III.7).[12] The percentage of all children whose total fat intake was 30 percent of calories or less increased significantly, from 14 to 25 percent between 1989-1991 and 1994-1996, and the percentage of children whose saturated fat intake was 10 percent of calories or less more than doubled--from 7 to 16 percent. The percentage of all children staying within the guideline for saturated fat intake was particularly notable at breakfast, increasing from 30 to 53 percent (Table B.6). The percentage of children obtaining 55 percent of their food energy from carbohydrates nearly doubled, from 28 to 53 percent.[13]

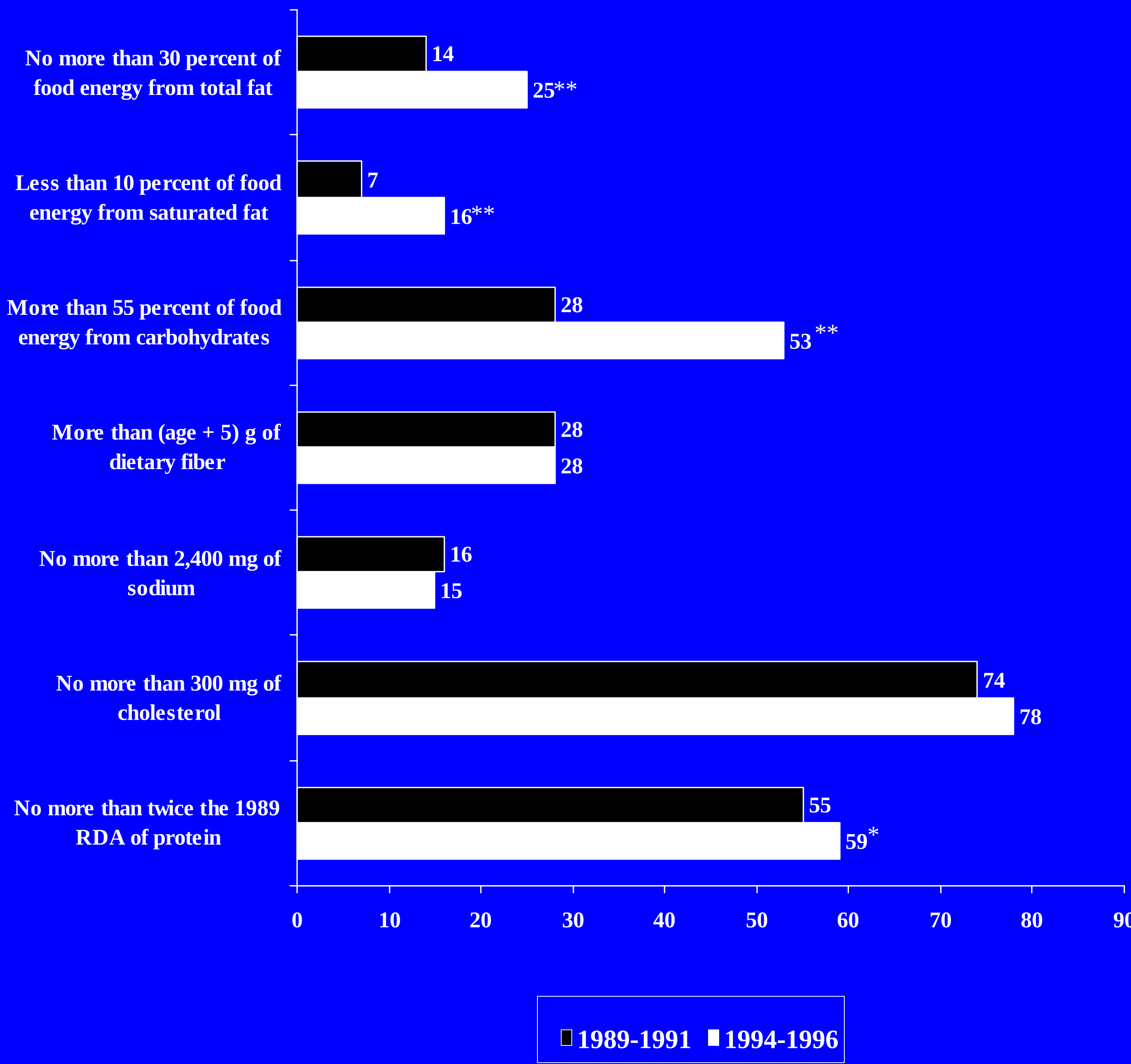
The percentages of all children meeting the guidelines for fiber, sodium, cholesterol, and protein were essentially unchanged from 1989-1991 to 1994-1996 (Figure III.7). In both periods, most

---

[12]Appendix Table B.6 shows the percentages upon which this figure is based, as well as the percentages of children meeting the fat and carbohydrate recommendations at breakfast and lunch.

[13]Using Day 1 intakes (Table B.7) rather than usual intakes (Table B.6) gives a more optimistic picture of the percentages of children meeting recommendations for fat and carbohydrates, but the direction of change over time is essentially the same for both. The differences in the results using the two methods suggest that children are more likely to avoid excessive intakes of fat or protein on a single day than on a usual basis.

FIGURE III.7
PERCENTAGE OF SCHOOL-AGED CHILDREN WHOSE USUAL INTAKE MEETS DIETARY RECOMMENDATIONS, 1989-1991 AND 1994-1996



*Difference in intake across years is significantly different from zero at the .05 level, two-tailed test.
**Difference in intake across years is significantly different from zero at the .01 level, two-tailed test.

SOURCE: CSFII

children limited their cholesterol intake to no more than 300 mg, but very few children met the age+ 5 guideline for fiber intake or limited their sodium intake to no more than 2,400 mg. The only significant change was a small increase in the percentage limiting their protein intake to no more than two times the RDA.[14]

2. Age/Gender Groups

The percentages of children meeting the dietary recommendations for total fat, saturated fat, and carbohydrates in 1989-1991 and 1994-1996 did not vary greatly by age and gender. The only age/gender group that did not make a substantial improvement in meeting the dietary guidelines for total fat and saturated fat was males ages 9 to 13: the percentage meeting the guidelines remained essentially unchanged over this period at 13 to 14 percent for total fat and 5 to 6 percent for saturated fat (Table III.8.A). Each of the other age/gender groups had substantial (and often significant) increases in the percentages meeting these guidelines. All the age and gender groups showed significant improvement in the percentages meeting the standard for carbohydrate intake (Tables III.8.A and III.8.B).

Few significant changes occurred in the percentages of males meeting the dietary recommendations for fiber, sodium, cholesterol, and protein. Among males ages 6 to 8, the percentage meeting the fiber guideline increased from 40 to 59 percent, and among males ages 9 to 13, the percentage limiting their cholesterol intake to no more than 300 mg also increased significantly, from 60 to 76 percent (Table III.8.A). However, all other changes in these outcomes

---

[14]When Day 1 intakes (Table B.7) are compared for the two time periods, they produce estimates of the changes in percentages of all children who meet dietary recommendations for fiber, sodium, cholesterol, and protein that are similar to those obtained using usual intakes (Table B.6). The data are less comparable when examined by age and gender; in all cases, however, the direction of change is the same regardless of whether Day 1 intakes or usual intakes are used.

TABLE III.8.A

PERCENTAGE OF SCHOOL-AGED CHILDREN WHO MEET SELECTED DIETARY STANDARDS,
BY AGE, AMONG MALES, 1989-1991 AND 1994-1996

	Percentage of Children Whose Usual 24-Hour Intake Meets the Recommendation					
	Males, Ages 6 to 8		Males, Ages 9 to 13		Males, Ages 14 to 18	
Dietary Recommendation	1989-1991	1994-1996	1989-1991	1994-1996	1989-1991	1994-1996
Percentage of Food Energy						
No more than 30 percent from total fat	17	25	13	14	9*	24
Less than 10 percent from saturated fat	5	10	5	6	4**	20
More than 55 percent from carbohydrates	34**	52	27*	40	22**	40
Other Dietary Components						
More than (age + 5) g of dietary fiber	40**	54	32	40	24	28
No more than 2,400 mg of sodium	31	24	11	5	3	1
No more than 300 mg of cholesterol	95	89	60*	76	50	46
No more twice the 1989 RDA of protein	26	25	39	42	75	69
Sample Size	**301**	**357**	**500**	**552**	**354**	**446**

SOURCE: Weighted tabulations based on three days of intake data from respondents of the 1989-1991 CSFII and two days of intake data from respondents of the 1994-1996 CSFII.

NOTE: Children's usual intake distribution was determined based on two or three intake days using the Software for Intake Distribution Estimation (SIDE), developed by Iowa State University (1996).

*Differences in intake across years is significantly different from zero at the .05 level, two-tailed test.
**Differences in intake across years is significantly different from zero at the .01 level, two-tailed test.

among males were statistically insignificant. In particular, meeting the sodium recommendation remained rare among all but the youngest males: only one percent of males ages 14 to 18 and only five percent of males ages 9 to 13 limited their sodium intake to no more than 2,400 mg by 1994-1996.

Among females ages 9 to 13 and 14 to 18, the percentage meeting the dietary recommendations for fiber, sodium, cholesterol, and protein were not statistically different in 1994-1996 than in 1989-1991 (Table III.8.B). However, the percentages of girls ages 6 to 8 meeting the recommendations for sodium and protein increased significantly, while the percentage meeting the fiber recommendation decreased significantly.

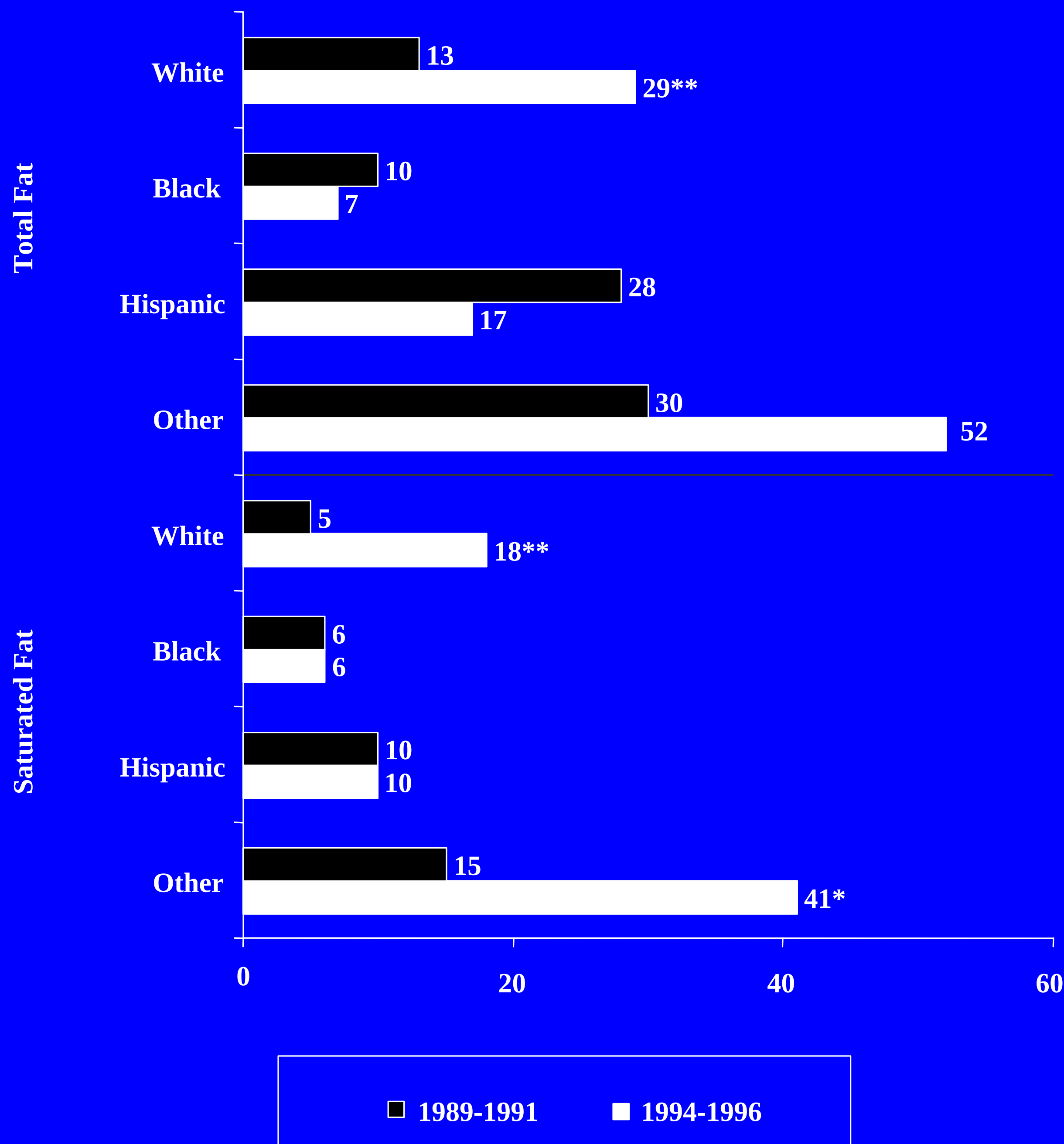
3. Racial/Ethnic Groups

The changes discussed above for all children do not apply to all racial/ethnic groups. While significantly higher percentages of white children met the dietary recommendations for total fat, saturated fat, and carbohydrate intake in 1994-1996 than in 1989-1991, this was not true for black and Hispanic children (Figure III.8). There was actually a decrease (statistically insignificant) in the percentages of these groups meeting the total fat guideline and no change in the percentages meeting the saturated fat guideline. Among black children, only seven percent met the total fat guideline and six percent met the saturated fat guideline by 1994-1996.

Among the racial/ethnic groups, the percentage meeting the protein recommendation increased significantly between 1989-1991 and 1994-1996 for each group except white children (Table III.9). On the other hand, the percentage of black children meeting the fiber recommendation decreased over this period. All other differences over time in the percentages of the racial/ethnic groups meeting the fiber, sodium, cholesterol, and protein standards were statistically insignificant.

FIGURE III.8

PERCENTAGE OF SCHOOL-AGED CHILDREN MEETING TOTAL FAT AND SATURATED FAT DIETARY RECOMMENDATIONS, BY RACE/ETHNICITY, 1989-1991 AND 1994-1996



* Difference in intake across years is significantly different from zero at the .05 level, two-tailed test.
** Difference in intake across years is significantly different from zero at the .01 level, two-tailed test.

SOURCE: CSFII

TABLE III.8.B

PERCENTAGE OF SCHOOL-AGED CHILDREN WHO MEET SELECTED DIETARY STANDARDS, BY AGE, AMONG FEMALES, 1989-1991 AND 1994-1996

	Percentage of Children Whose Usual 24-Hour Intake Meets the Recommendation					
	Females, Ages 6 to 8		Females, Ages 9 to 13		Females, Ages 14 to 18	
Dietary Recommendation	1989-1991	1994-1996	1989-1991	1994-1996	1989-1991	1994-1996
Percentage of Food Energy						
No more than 30 percent from total fat	17	27	11**	27	19*	33
Less than 10 percent from saturated fat	6	10	4	14	12**	31
More than 55 percent from carbohydrates	32**	52	29**	54	28**	47
Other Dietary Components						
More than (age + 5) g of dietary fiber	61*	47	26	18	2	5
No more than 2,400 mg of sodium	22*	39	15	17	26	20
No more than 300 mg of cholesterol	87	94	81	91	86	85
No more twice the 1989 RDA of protein	13*	29	64	71	91	90
Sample Size	**298**	**336**	**444**	**560**	**406**	**441**

SOURCE: Weighted tabulations based on three days of intake data from respondents of the 1989-1991 CSFII and two days of intake data from respondents of the 1994-1996 CSFII.

NOTE: Children's usual intake distribution was determined based on two or three intake days using the Software for Intake Distribution Estimation (SIDE), developed by Iowa State University (1996).

*Differences in intake across years is significantly different from zero at the .05 level, two-tailed test.
**Differences in intake across years is significantly different from zero at the .01 level, two-tailed test.

TABLE III.9

PERCENTAGE OF SCHOOL-AGED CHILDREN WHO MEET SELECTED DIETARY STANDARDS, BY RACE/ETHNICITY, 1989-1991 AND 1994-1996

	Percentage of Children Whose Usual 24-Hour Intake Meets the Recommendation							
	Hispanic		Black		White		Other	
Dietary Recommendation	1989-1991	1994-1996	1989-1991	1994-1996	1989-1991	1994-1996	1989-1991	1994-1996
Percentage of Food Energy								
No more than 30 percent from total fat	28	17	10	7	13**	29	30	52
Less than 10 percent from saturated fat	10	10	6	6	5**	18	15*	41
More than 55 percent from carbohydrates	30	31	17	24	30**	53	24*	58
Other Dietary Components								
More than (age + 5) g of dietary fiber	34	31	29*	16	26	31	39	26
No more than 2,400 mg of sodium	32	22	14	11	15	13	15	30
No more than 300 mg of cholesterol	74	73	66	69	76	81	72	90
No more twice the 1989 RDA of protein	49*	59	53*	63	57	57	42*	63
Sample Size	**270**	**430**	**381**	**411**	**1,572**	**1,735**	**80**	**116**

SOURCE: Weighted tabulations based on three days of intake data from respondents of the 1989-1991 CSFII and two days of intake data from respondents of the 1994-1996 CSFII.

NOTE: Children's usual intake distribution was determined based on two or three intake days using the Software for Intake Distribution Estimation (SIDE), developed by Iowa State University (1996).

*Difference across years is significantly different from zero at the .05 level, two-tailed test.
**Difference across years is significantly different from zero at the .01 level, two-tailed test.

D. CHANGES IN FOOD GROUP INTAKES

Examining changes in food group intakes provides useful information about shifts in food choices over time and helps us understand changes in nutrient intakes. In this section, changes in mean numbers of servings of the pyramid food groups and selected subgroups are identified, as are changes in the distribution of servings consumed by children and the percentages of children meeting age/gender specific targets for specific food groups. Where appropriate, the relationship between the changes in food group consumption presented here and the changes in nutrient intakes presented in the previous sections are discussed.

1. Mean Numbers of Servings

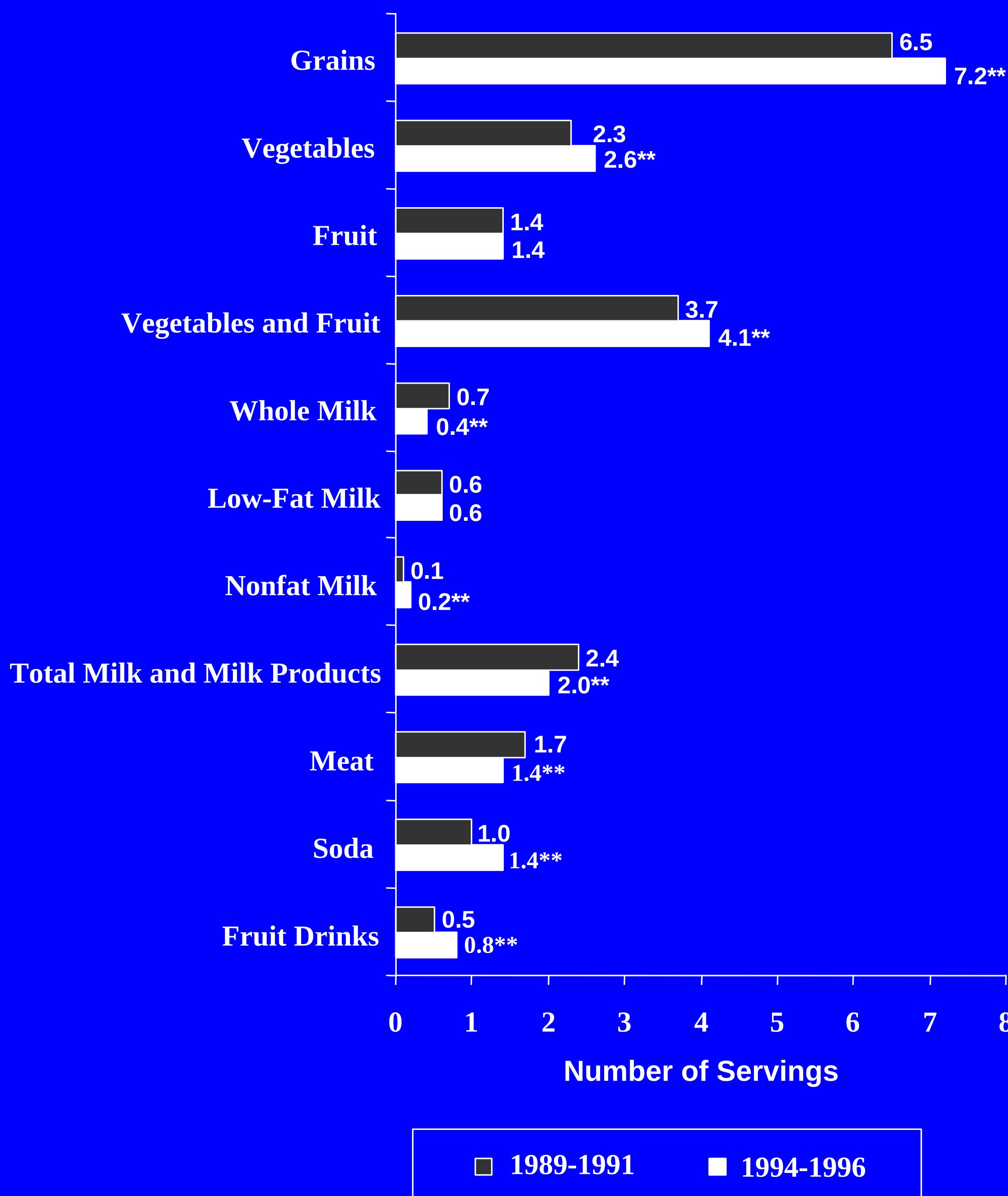
a. All Children

Children consumed significantly larger amounts of grains, vegetables, soft drinks, and fruit drinks and fruit-flavored drinks in 1994-1996 than in 1989-1991 (Figure III.9).[15] For example, children's vegetable consumption increased from 2.3 to 2.6 servings per day during this period. The National Cancer Institute's "Five-a-Day" initiative, which uses a variety of approaches to promote the consumption of at least five servings of fruits and vegetables daily, was under way during the period between the 1989-1991 and 1994-1996 CSFII. This initiative may have had an effect, since by 1994-1996, mean fruit and vegetable intake was closer to, although still well below, this goal. Although fruit consumption did not change, children's combined consumption of fruit and vegetables rose from an average of 3.7 servings per day in 1989-1991 to 4.1 servings per day in 1994-1996.

[15]Appendix Table B.9 shows the percentages upon which this figure is based.

FIGURE III.9

MEAN 24-HOUR FOOD GROUP INTAKES AMONG SCHOOL-AGED CHILDREN, 1989-1991 AND 1994-1996



*Difference in intake across years is significantly different from zero at the .05 level, two-tailed test.
**Difference in intake across years is significantly different from zero at the .01 level, two-tailed test.

SOURCE: CSFII

The increase in children's consumption of regular and diet soda over this period is notable.[16] In 1989-1991, children consumed an average of 1.0 servings of soda per day; by 1994-1996, soda consumption had increased 40 percent, to 1.4 servings per day. The increase in fruit drink consumption was also large and statistically significant.

With the increase in soda and fruit drink consumption, mean milk product consumption dropped significantly, from 2.4 to 2.0 servings per day between 1989-1991 and 1994-1996. There was a shift to lower-fat milk over this period--the mean number of servings of whole milk decreased from 0.7 to 0.4 per day, the mean number of servings of low-fat milk stayed the same, and the mean number of servings of nonfat milk increased from 0.1 to 0.2 per day. Finally, children's mean consumption of meat and meat substitutes dropped from 1.7 to 1.4 servings per day.

The increase in soda and fruit drink consumption, coupled with the decrease in the consumption of whole milk, may help explain the increase in carbohydrate intake and decrease in fat intake as a percentage of total energy over this period. The decrease in milk product consumption may also be related to the decrease in calcium intake for some subgroups. Finally, the relatively small increase in the consumption of vegetables and grain products may be related to the small increase in fiber intake among school-aged children.[17]

---

[16]We do not have information on how much of the increase in soda consumption was driven by an increase in the consumption of diet soda. However, Putnam and Allshouse (1996) found that, between 1989 and 1994, per-capita consumption of diet soda in the United States increased from 10.7 to 11.9 gallons per year, and per-capita consumption of regular soda increased from 34.7 to 40.3 gallons per year. In addition, the proportion of carbonated soft drink consumption that involved low calorie soft drinks ranged from 4 to 12 percent for males and females ages 6 to 19 (U.S. Department of Agriculture 1998).

[17]Although there was a substantial increase in the number of servings of grain products consumed overall, it is likely that most of this increase was driven by an increase in the consumption of nonwhole grains. Gleason and Suitor (2000) reported that, by 1994-1996, children consumed an average of six servings of nonwhole grains and only one serving of whole grains per day.

Two inconsistencies between changes in food intakes and changes in nutrient intakes can be observed. First, when comparing results for 1989-1991 with those for 1994-1996, one would expect the decreased intake of meat and meat substitutes to be accompanied by a decrease in mean iron intake and in the percentages of children meeting the standard for iron, but the opposite occurred. Second, the decreased intakes of meat and meat substitutes and of milk products in the later time period would be expected to result in lower zinc intakes, but they are higher in 1994-1996 than in 1989-1991. Increased availability and use of breakfast cereals highly fortified with iron and zinc may explain this inconsistency.

b. Age/Gender Groups

The patterns of food group consumption between 1989-1991 and 1994-1996 for all school-aged children also apply to the age/gender subgroups, with a few exceptions. For example, there was an increase in the number of servings of grain products consumed for each age/gender group except females ages 6 to 8 (Tables III.10.A and III.10.B). Vegetable consumption also rose for five of the six age/gender groups, although this increase is largest for 14- to 18-year-old males and females (and is statistically significant only for these groups). In particular, 14- to 18-year-old males consumed an average of 3.0 servings of vegetables per day in 1989-1991 and 3.7 servings per day in 1994-1996. This increase in vegetable consumption among older children was the primary factor in driving an increase in their combined consumption of vegetables and fruit, from 4.3 to 5.1 servings a day for males and from 3.2 to 3.9 servings a day for females.

All of the age/gender groups experienced decreases (which were usually statistically significant) in meat consumption and a shift from milk products (especially whole milk) to soda and fruit drinks. The decrease in milk product consumption tended to be larger for females than for males. The increase in soda and fruit drink consumption was pronounced for all groups but largest for males

TABLE III.10.A

24-HOUR FOOD GROUP INTAKES OF SCHOOL-AGED CHILDREN, BY AGE, AMONG MALES, 1989-1991 AND 1994-1996

	Mean Number of Servings Over 24 Hours					
	Males, Ages 6 to 8		Males, Ages 9 to 13		Males, Ages 14 to 18	
Food Group	1989-1991	1994-1996	1989-1991	1994-1996	1989-1991	1994-1996
Grain Products	5.6**	6.6	6.7**	7.6	8.3**	9.5
Vegetables	1.7	1.9	2.3	2.7	3.0**	3.7
Fruit	1.4	1.6	1.5	1.4	1.4	1.4
Vegetables and Fruit	3.1	3.6	3.8	4.1	4.3*	5.1
Dairy Products						
Whole milk	0.8*	0.5	0.7*	0.5	0.7	0.5
Low-fat milk	0.7	0.8	0.8	0.8	0.8	0.7
Nonfat milk	0.1	0.1	0.1	0.2	0.1*	0.2
Total milk products	2.4	2.2	2.6**	2.3	2.7	2.5
Meat and Meat Substitutes	1.3	1.2	1.8**	1.5	2.2**	1.9
Soda	0.5**	0.7	0.9**	1.2	1.7**	2.6
Fruit Drinks and Fruit-Flavored Drinks	0.5**	0.8	0.6*	0.8	0.5**	1.1
Sample Size	**265**	**357**	**441**	**552**	**315**	**446**

SOURCE: Weighted tabulations on food group servings derived from the 1989-1991 and 1994-1996 CSFII in the process of creating the Healthy Eating Index (Kennedy et al. 1995; and Bowman et al. 1998). Tabulations use three days of intake data for 1989-1991 CSFII respondents and two days of intake data for 1994-1996 CSFII respondents.

*Difference across years is significantly different from zero at the .05 level, two-tailed test.
**Difference across years is significantly different from zero at the .01 level, two-tailed test.

TABLE III.10B

24-HOUR FOOD GROUP INTAKES OF SCHOOL-AGED CHILDREN, BY AGE, AMONG FEMALES, 1989-1991 AND 1994-1996

	Mean Number of Servings Over 24 Hours					
	Females, Ages 6 to 8		Females, Ages 9 to 13		Females, Ages 14 to 18	
Food Group	1989-1991	1994-1996	1989-1991	1994-1996	1989-1991	1994-1996
Grain Products	6.0	5.8	6.0	6.4	5.9	6.3
Vegetables	1.9	2.0	2.4	2.3	2.2**	2.6
Fruit	1.7	1.5	1.6	1.5	1.0*	1.3
Vegetables and Fruit	3.6	3.5	3.9	3.8	3.2**	3.9
Dairy Products						
Whole milk	0.7*	0.5	0.7**	0.4	0.5**	0.3
Low-fat milk	0.7	0.7	0.5	0.6	0.4	0.3
Nonfat milk	0.1	0.1	0.1*	0.2	0.1	0.1
Total milk products	2.3**	1.9	2.3**	1.9	1.9**	1.4
Meat and Meat Substitutes	1.5**	1.1	1.6**	1.3	1.7**	1.4
Soda	0.4	0.5	0.8**	1.1	1.3**	1.7
Fruit Drinks and Fruit-Flavored Drinks	0.5*	0.7	0.5*	0.6	0.4**	0.8
Sample Size	**248**	**336**	**386**	**560**	**362**	**441**

SOURCE: Weighted tabulations on food group servings derived from the 1989-1991 and 1994-1996 CSFII in the process of creating the Healthy Eating Index (Kennedy et al. 1995; and Bowman et al. 1998). Tabulations use three days of intake data for 1989-1991 CSFII respondents and two days of intake data for 1994-1996 CSFII respondents.

*Difference across years is significantly different from zero at the .05 level, two-tailed test.
**Difference across years is significantly different from zero at the .01 level, two-tailed test.

ages 14 to 18. For example, Figure III.10 shows that teenage girls consumed an average of 1.9 servings of milk, 1.3 servings of soda, and 0.4 servings of fruit drinks per day in 1989-1991; by 1994-1996, these averages had shifted to 1.4 servings of milk, 1.7 servings of soda, and 0.8 servings of fruit drinks. The trends are similar for teenage boys. They shifted from consuming 2.7 servings of milk, 1.7 servings of soda, and 0.5 servings of fruit drinks per day to consuming 2.5 servings of milk, 2.6 servings of soda, and 1.1 servings of fruit drinks per day. In 1989-1991, both teenage boys and girls consumed more servings of milk products than soda and fruit drinks combined, on average; by 1994-1996, the reverse was true.

c. Racial/Ethnic Groups

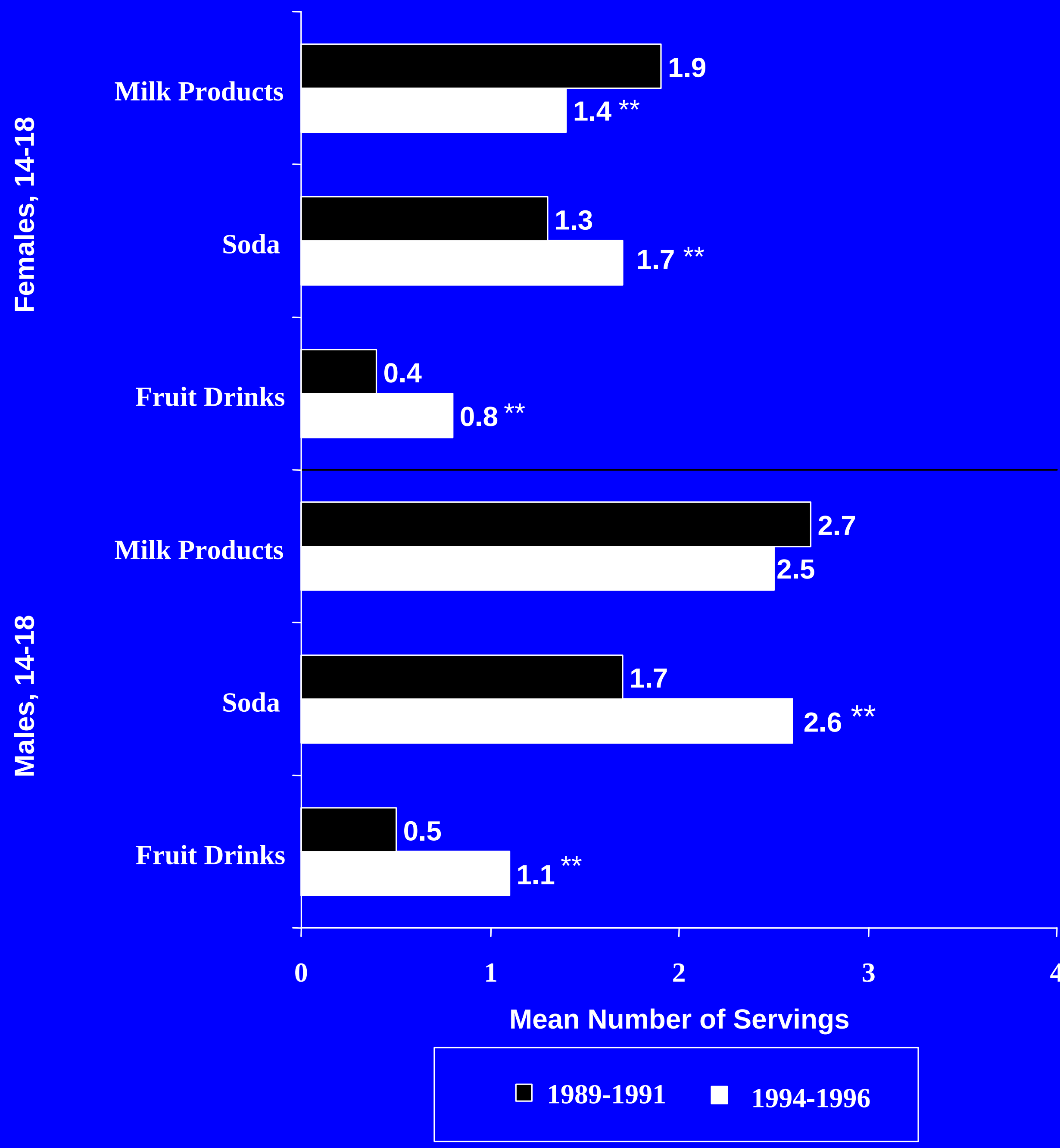
When examined by racial/ethnic group, the 1989-1991 to 1994-1996 changes in daily servings follow the pattern seen for all children (Table III.11). White children account for much of the increase in soft drink consumption: their mean intake increased from 1.0 to 1.6 servings per day, compared to an increase from 0.8 to 1.0 servings for blacks and from 0.9 to 1.2 servings for Hispanics. All of these changes over time were statistically significant. In contrast, the increase in fruit drink consumption was largest for black children. Milk product consumption decreased significantly over this period for each racial/ethnic group except Hispanic children. Among Hispanic children, there was a shift from consumption of whole milk to low-fat milk.

2. Distribution of Daily Food Group Servings

The distribution of daily pyramid food group servings indicates the percentages of children who have consumed specified numbers of servings from each group. The 1989-1991 to 1994-1996 changes in the distributions of food group servings indicate that fewer children are consuming recommended numbers of servings of meat and dairy products, but more children are consuming

FIGURE III.10

BEVERAGE CONSUMPTION AMONG MALES AND FEMALES AGES 14 TO 18, 1989-1991 AND 1994-1996



* Difference in intake across years is significantly different from zero at the .05 level, two-tailed test.
** Difference in intake across years is significantly different from zero at the .01 level, two-tailed test.

SOURCE: CSFII

TABLE III.11

24-HOUR FOOD GROUP INTAKES OF SCHOOL-AGED CHILDREN, BY RACE/ETHNICITY,
1989-1991 AND 1994-1996

	Mean Number of Servings Over 24 Hours							
	Hispanic		Black		White		Other	
Food Group	1989-1991	1994-1996	1989-1991	1994-1996	1989-1991	1994-1996	1989-1991	1994-1996
Grain Products	5.9*	6.8	6.2	6.5	6.6*	7.4	6.9	7.0
Vegetables	1.9*	2.4	2.6	2.7	2.3**	2.6	3.1	3.1
Fruit	1.5	1.4	1.4	1.2	1.4	1.5	1.9	1.9
Vegetables and Fruit	3.4	3.8	4.0	3.9	3.6**	4.1	5.0	5.0
Dairy Products								
Whole milk	1.1*	0.7	1.0**	0.6	0.5**	0.3	0.5	0.4
Low-fat milk	0.2**	0.4	0.2	0.2	0.8	0.8	0.6	0.6
Nonfat milk	0.0	0.1	0.0	0.0	0.1**	0.2	0.0	0.1
Total milk products	2.0	1.9	2.0**	1.5	2.5**	2.2	2.3*	1.6
Meat and Meat Substitutes	1.8**	1.5	1.8*	1.6	1.7**	1.4	2.0*	1.6
Soda	0.9**	1.2	0.8*	1.0	1.0**	1.6	0.7	1.0
Fruit Drinks and Fruit-Flavored Drinks	0.5*	0.7	0.7**	1.2	0.5**	0.8	0.8	0.5
Sample Size	**230**	**430**	**311**	**411**	**1,405**	**1,735**	**71**	**116**

SOURCE: Weighted tabulations on food group servings derived from the 1989-1991 and 1994-1996 CSFII in the process of creating the Healthy Eating Index (Kennedy et al.1995; and Bowman et al. 1998). Tabulations use three days of intake data for 1989-1991 CSFII respondents and two days of intake data for 1994-1996 CSFII respondents.

*Difference across years is significantly different from zero at the .05 level, two-tailed test.
**Difference across years is significantly different from zero at the .01 level, two-tailed test.

recommended numbers of servings of grain products and vegetables (Table III.12). For example, 71 percent of children had at least two servings of dairy products daily in 1989-1991, compared with 61 percent in 1994-1996 (the recommendation is two to three, depending on age). Similarly, the percentage of children who had at least two servings of meat and meat substitutes fell from 57 percent in 1989-1991 to 45 percent in 1994-1996. On the other hand, the percentage of children who had three or more servings of vegetables increased from 36 percent in 1989-1991 to 44 percent in the later period. The percentage of children consuming six or more servings of grain products also increased over this period.

The percentages of children meeting age/gender-specific targets for pyramid food groups tell a similar story. From 1989-1991 to 1994-1996, there were significant decreases in the percentages of all children meeting the age/gender specific target for meat and milk products--from 19 to 7 percent for meat and from 40 to 30 percent for dairy products (Figure III.11). Tables III.13.A and III.13.B show that the decrease in the meat and meat substitutes category was especially large for males ages 9 to 13 (23 percent met their target in 1989-1991, while only 9 percent did in 1994-1996) and for all females (15 to 21 percent met the target in 1989-1991, depending on age, while only 2 to 6 percent met the target in 1994-1996). On the other hand, there were increases in the percentage of children meeting the vegetable and grain products targets. The percentage of males ages 14 to 18 who met their target for grain products increased from 19 to 32 percent, and for vegetables it increased from 13 to 26 percent. Females ages 14 to 18 improved in the vegetable category (from 9 to 17 percent) and the fruit category (from 5 to 14 percent). The percentages of children meeting the age/gender targets follow similar patterns for the racial/ethnic groups as for school-aged children overall (Table III.14).

TABLE III.12

DISTRIBUTION OF 24-HOUR FOOD GROUP INTAKES OF SCHOOL-AGED CHILDREN, 1989-1991 AND 1994-1996

	24 Hours	
Number of Servings	1989-1991[a]	1994-1996
Grain Products (Percentages)		
0	0	0
1 to 3	12	9
4 to 5	31	24
6 to 11	51	58
More than 11	6	9
Percentage meeting age/gender specific target	17**	23
Vegetables (Percentages)		
0	9	8
1 to 2	55	48
3 to 5	30	36
More than 5	6	8
Percentage meeting age/gender specific target	12**	17
Fruit (Percentages)		
0	33	31
1	31	34
2 to 4	32	30
More than 4	4	5
Percentage meeting age/gender specific target	14	14
Vegetables and Fruit (Percentages)		
0	3	3
1 to 2	32	26
3 to 4	37	37
5 to 9	26	31
More than 9	3	4
Percentage meeting age/gender specific target	9	10
Milk Products (Percentages)		
0	5	9
1	24	31
2 to 3	54	49
More than 3	17	12
Percentage meeting age/gender specific target	40**	30
Meat and Meat Substitutes (Percentages)		
0	4	8
1	39	47
2 to 3	56	45
More than 3	1	0
Percentage meeting age/gender specific target	19**	7
Sample Size	**2,017**	**2,692**

SOURCE: Weighted tabulations on food group servings derived from the 1989-1991 and 1994-1996 CSFII in the process of creating the Healthy Eating Index (Kennedy et al. 1995; and Bowman et al. 1998). Tabulations use three days of intake data for 1989-1991 CSFII respondents and two days of intake data for 1994-1996 CSFII respondents.

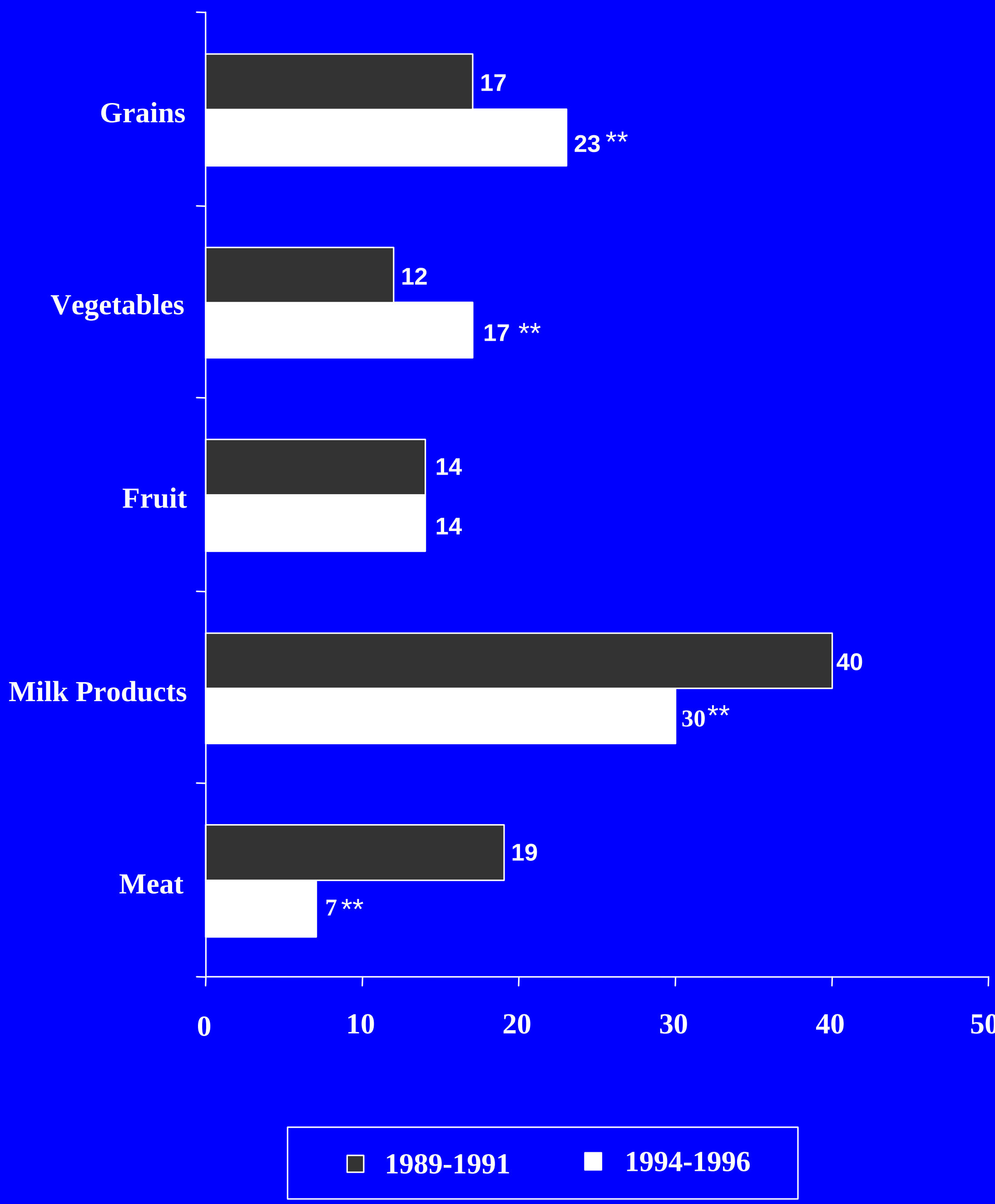
NOTE: Age/gender-specific targets are taken from the targets used in the construction of the Healthy Eating Index (Kennedy et al. 1995).

[a]Significance tests refer to differences in the percentage of children meeting the age/gender specific target in 1989-1991 versus 1994-1996. No significance tests were conducted on the differences in the servings distributions across these years.

*Difference across years is significantly different from zero at the .05 level, two-tailed test.
**Difference across years is significantly different from zero at the .01 level, two-tailed test.

FIGURE III.11

PERCENTAGE OF SCHOOL-AGED CHILDREN MEETING AGE/GENDER-SPECIFIC TARGETS FOR FOOD GROUP CONSUMPTION, 1989-1991 AND 1994-1996



* Difference in intake across years is significantly different from zero at the .05 level, two-tailed test.
** Difference in intake across years is significantly different from zero at the .01 level, two-tailed test.

SOURCE: CSFII

TABLE III.13A

DISTRIBUTION OF 24-HOUR FOOD GROUP INTAKES OF SCHOOL-AGED CHILDREN, BY AGE, AMONG MALES, 1989-1991 AND 1994-1996

	24 Hours					
	Males, Ages 6 to 8		Males, Ages 9 to 13		Males, Ages 14 to 18	
Number of Servings	1989-1991	1994-1996	1989-1991	1994-1996	1989-1991	1994-1996
Grain Products (Percentages)						
0	0	0	0	0	0	0
1 to 3	14	7	11	5	4	2
4 to 5	35	28	23	17	23	14
6 to 11	49	60	61	68	56	58
More than 11	2	5	5	9	16	26
Percentage meeting age/gender-specific target	16*	27	19	25	19**	32
Vegetables (Percentages)						
0	14	10	10	7	7	6
1 to 2	64	64	55	48	38	31
3 to 5	21	25	28	37	45	42
More than 5	1	2	8	8	10	21
Percentage meeting age/gender-specific target	8	11	13	17	13**	26
Fruit (Percentages)						
0	26	26	34	28	37	43
1	34	33	28	35	36	26
2 to 4	37	36	34	34	22	23
More than 4	3	5	5	4	5	8
Percentage meeting age/gender-specific target	17	21	15	10	11	10
Vegetables and Fruit (Percentages)						
0	5	2	4	3	2	3
1 to 2	39	34	30	23	23	19
3 to 4	32	36	35	37	34	27
5 to 9	23	27	28	33	35	42
More than 9	1	2	4	4	5	9
Percentage meeting age/gender-specific target	8	12	12	9	7	11
Milk Products (Percentages)						
0	3	4	4	5	4	8
1	21	29	20	24	21	24
2 to 3	57	56	49	56	54	48
More than 3	18	12	27	15	21	20
Percentage meeting age/gender-specific target	61*	51	49*	38	36	30
Meat and Meat Substitutes (Percentages)						
0	7	12	2	4	2	4
1	58	53	33	45	20	23
2 to 3	34	35	62	52	74	74
More than 3	1	0	2	0	4	0
Percentage meeting age/gender-specific target	8	7	23**	9	24	16
Sample Size	**265**	**357**	**441**	**552**	**315**	**446**

SOURCE: Weighted tabulations on food group servings derived from the 1989-1991 and 1994-1996 CSFII in the process of creating the Healthy Eating Index (Kennedy et al. 1995; and Bowman et al. 1998). Tabulations use three days of intake data for 1989-1991 CSFII respondents and two days of intake data for 1994-1996 CSFII respondents.

NOTE: Age/gender-specific targets are taken from the targets used in the construction of the Healthy Eating Index (Kennedy et al. 1995).

*Difference across years is significantly different from zero at the .05 level, two-tailed test.
**Difference across years is significantly different from zero at the .01 level, two-tailed test.

TABLE III.13.B

DISTRIBUTION OF 24-HOUR FOOD GROUP INTAKES OF SCHOOL-AGED CHILDREN, BY AGE, AMONG FEMALES, 1989-1991 AND 1994-1996

	24 Hours					
	Females, Ages 6-8		Females, Ages 9-13		Females, Ages 14-18	
Number of Servings	1989-1991	1994-1996	1989-1991	1994-1996	1989-1991	1994-1996
Grain Products (Percentages)						
0	0	0	1	0	1	0
1 to 3	14	14	14	10	17	16
4 to 5	34	35	35	28	37	29
6 to 11	49	51	48	58	42	50
More than 11	3	1	3	4	4	5
Percentage meeting age/gender-specific target	24	20	15	17	10	14
Vegetables (Percentages)						
0	13	11	8	7	8	9
1 to 2	65	59	59	55	54	41
3 to 5	18	30	26	34	36	44
More than 5	5	0	7	4	2	6
Percentage meeting age/gender-specific target	13	11	13	16	9**	17
Fruit (Percentages)						
0	24	21	33	25	41	38
1	28	38	24	40	36	32
2 to 4	45	37	37	31	22	25
More than 4	4	3	6	4	2	5
Percentage meeting age/gender-specific target	21	16	19	14	5**	14
Vegetables and Fruit (Percentages)						
0	1	2	2	2	4	3
1 to 2	33	31	35	30	33	25
3 to 4	42	43	30	39	47	41
5 to 9	21	24	31	28	15	28
More than 9	2	1	3	2	1	3
Percentage meeting age/gender-specific target	10	8	13	12	4**	10
Milk Products (Percentages)						
0	1	6	4	7	11	21
1	20	30	26	36	34	42
2 to 3	70	57	58	48	44	31
More than 3	9	7	12	9	11	6
Percentage meeting age/gender-specific target	55*	41	33	25	18*	10
Meat and Meat Substitutes (Percentages)						
0	4	11	6	10	3	9
1	49	67	43	57	42	50
2 to 3	47	22	51	33	54	41
More than 3	0	0	0	0	0	0
Percentage meeting age/gender-specific target	21**	3	15**	2	21**	6
Sample Size	**248**	**336**	**386**	**560**	**362**	**441**

SOURCE: Weighted tabulations on food group servings derived from the 1989-1991 and 1994-1996 CSFII in the process of creating the Healthy Eating Index (Kennedy et al.1995; and Bowman et al. 1998). Tabulations use three days of intake data for 1989-1991 CSFII respondents and two days of intake data for 1994-1996 CSFII respondents.

NOTE: Age/gender-specific targets are taken from the targets used in the construction of the Healthy Eating Index (Kennedy et al. 1995).

*Difference across years is significantly different from zero at the .05 level, two-tailed test.
**Difference across years is significantly different from zero at the .01 level, two-tailed test.

TABLE III.14

DISTRIBUTION OF 24-HOUR FOOD GROUP INTAKES OF SCHOOL-AGED CHILDREN,
BY RACE/ETHNICITY, 1989-1991 AND 1994-1996

	24 Hours							
	Hispanic		Black		White		Other	
Number of Servings	1989-1991	1994-1996	1989-1991	1994-1996	1989-1991	1994-1996	1989-1991	1994-1996
Grain Products (Percentages)								
0	0	0	0	0	0	0	0	0
1 to 3	13	12	17	12	11	7	20	13
4 to 5	39	27	29	31	30	23	21	18
6 to 11	45	54	49	52	53	60	46	60
More than 11	3	7	5	6	6	10	13	9
Percentage meeting age/gender-specific target	12**	22	15	14	18**	25	19	18
Vegetables (Percentages)								
0	15	8	14	10	8	8	2	4
1 to 2	52	53	44	44	58	48	49	48
3 to 5	31	33	30	40	29	37	36	31
More than 5	2	6	12	7	5	8	14	17
Percentage meeting age/gender-specific target	7	13	17	17	11**	17	22	29
Fruit (Percentages)								
0	29	25	33	32	34	33	23	22
1	39	41	30	37	30	32	22	35
2 to 4	24	29	33	30	33	30	43	33
More than 4	7	5	4	2	4	6	12	10
Percentage meeting age/gender-specific target	15	11	12	10	15	15	19	19
Vegetables and Fruit (Percentages)								
0	2	2	4	4	3	2	2	2
1 to 2	38	31	36	23	31	27	12	18
3 to 4	36	38	25	39	39	36	34	33
5 to 9	24	26	30	32	25	32	47	37
More than 9	1	3	6	2	2	4	6	9
Percentage meeting age/gender-specific target	8	7	16	7	8*	11	18	22
Milk Products (Percentages)								
0	4	9	11	15	4	6	8	19
1	39	33	30	42	21	28	24	36
2 to 3	45	50	46	40	57	51	59	42
More than 3	11	9	13	4	19	15	9	4

TABLE III.14 *(continued)*

	24 Hours							
	Hispanic		Black		White		Other	
Number of Servings	1989-1991	1994-1996	1989-1991	1994-1996	1989-1991	1994-1996	1989-1991	1994-1996
Percentage meeting age/gender-specific target	34	29	30**	15	43**	35	43*	19
Meat and Meat Substitutes (Percentages)								
0	4	5	2	5	4	9	2	4
1	29	43	33	38	43	51	25	43
2 to 3	67	51	65	57	52	41	73	53
More than 3	0	0	1	0	2	0	1	0
Percentage meeting age/gender-specific target	21	11	26**	11	17**	6	27*	7
Sample Size	**230**	**430**	**311**	**411**	**1,405**	**1,735**	**71**	**116**

SOURCE: Weighted tabulations on food group servings derived from the 1989-1991 and 1994-1996 CSFII in the process of creating the Healthy Eating Index (Kennedy et al. 1995; and Bowman et al. 1998). Tabulations use three days of intake data for 1989-1991 CSFII respondents and two days of intake data for 1994-1996 CSFII respondents.

NOTE: Age/gender-specific targets are taken from the targets used in the construction of the Healthy Eating Index (Kennedy et al. 1995).

*Difference across years is significantly different from zero at the .05 level, two-tailed test.
**Difference across years is significantly different from zero at the .01 level, two-tailed test.

Even for food groups in which improvements occurred, the percentages meeting age/gender-specific targets are very low. The highest percentages are for the younger children with regard to the milk product target, but these percentages have decreased substantially over time (for example, among those ages 6 to 8, percentages meeting the target decreased from 55 to 41 percent for females and from 61 to 51 percent for males).

E. CONCLUSIONS

The most notable findings regarding changes in school-aged children's intakes that occurred from 1989-1991 to 1994-1996 include:

- Overall, children's mean 24-hour food energy intake increased significantly between 1989-1991 and 1994-1996. Males in all age groups and females ages 14 to 18 had increased energy intakes; females ages 6 to 8 had decreased energy intakes and females ages 9 to 13 showed no change in food energy intake.

- Children's intakes of total fat, saturated fat, and protein as a percentage of food energy decreased substantially (and significantly) over this period. For example, total fat intake fell from 34.1 to 32.4 percent of food energy; saturated fat fell from 13.0 to 11.7 percent of food energy. Correspondingly, children's carbohydrate intake as a percentage of food energy increased. However, among all school-aged children, absolute intakes (in grams) of total fat and saturated fat did not change significantly over this period.

- The patterns of decreases in fat and protein intake and increases in carbohydrate intake held for all of the age/gender groups. However, these patterns held more strongly for white children than for black or Hispanic children.

- Along with these changes in mean fat and carbohydrate intakes as a percentage of food energy, children were also much more likely to meet the dietary recommendations for total fat, saturated fat, and carbohydrate intake in 1994-1996 than they had been in 1989-1991. However, the percentages of children meeting these recommendations remained low in absolute terms. For example, the percentages of children meeting recommendations increased from 14 to 25 percent for fat and from 7 to 16 percent for saturated fat.

- Children's mean intake of fiber increased and their mean intake of cholesterol decreased between 1989-1991 and 1994-1996.

- Children's mean intakes of iron (overall and for nearly all subgroups) and zinc (for selected subgroups) increased over this period, despite decreased consumption of meat and meat substitutes and milk products. Among all children, mean intake of niacin also increased significantly. However, children's mean intakes of other vitamins and minerals did not change significantly over this period.

- For females ages 14 to 18, mean intakes of most vitamins and minerals did not increase significantly despite a significant increase in food energy intake. One possible explanation for this is that the increase in food energy was driven by an increase in the consumption of foods high in added sugar, especially beverages such as regular soft drinks and fruit and fruit-flavored drinks. This is true to a lesser extent for males ages 14 to 18.

- Higher percentages of all children met nutrient standards for vitamin E and iron intake in 1994-1996 relative to 1989-1991. Differences in the percentages of all children meeting the standards for the other nutrients did not change significantly, despite the overall increase in food energy intake.

- There was a shift in children's beverage consumption from whole milk to low-fat milk, soda, and fruit drinks over this period. This shift, along with a decrease in meat consumption, may explain the decrease in children's fat intake as a percentage of food energy.

- In 1994-1996, children consumed higher mean numbers of servings of grains and vegetables and were more likely to meet USDA Food Guide Pyramid recommendations for these food groups. Despite this increase in vegetable consumption, however, most children's intake of vegetable and fruit servings remained well below the five-a-day target. However, they were less likely to consume recommended numbers of servings of meat and dairy products than in 1989-1991.

- In many cases, children of different age/gender and racial/ethnic groups differed in the types of changes in nutrient intake experienced from 1989-1991 to 1994-1996. In particular, white children had larger increases in mean vitamin and mineral intakes and larger decreases in fat intake (as a percentage of food energy) than the other racial/ethnic groups. For example, the percentage of children who limited their fat intake to no more than 30 percent of food energy rose from 5 percent in 1989-1991 to 18 percent in 1994-1996, whereas the percentage of black and Hispanic children meeting this guideline remained constant over this period. This suggests the need to target efforts at improving food intakes to the groups experiencing particular declines or lack of improvement in diet quality.

REFERENCES

Anand, Rajen S., and P. Peter Basiotis. "Is Total Fat Consumption Really Decreasing?" *Family Economics and Nutrition Review*, vol. 11, no. 3, 1998, pp. 58-60.

Anderson, S.A. "Guidelines for Use of Dietary Intake Data." Prepared for the Food and Drug Administration (FDA) under Contract No. FDA 223-84-2059 by the Life Sciences Research Office. Bethesda, MD: Federation of American Societies for Experimental Biology, 1986.

Beaton, George H. "Recommended Dietary Intakes: Individuals and Populations." In *Modern Nutrition in Health and Disease, Ninth Edition*, edited by Williams and Wilkins, chapter 103, 1998.

Bowman, Shanthy A., Mark Lino, Shirley A. Gerrior, and P. Peter Basiotis. "The Healthy Eating Index, 1994-96." *Family Economics and Nutrition Review*, vol. 11, no. 3, 1998, pp. 2-14.

Burghardt, John, Anne Gordon, Nancy Chapman, Philip Gleason, and Thomas Fraker. "The School Nutrition Dietary Assessment Study: School Food Service, Meals Offered, and Dietary Intakes." Final report submitted to the U.S. Department of Agriculture, Food and Nutrition Service. Princeton, NJ: Mathematica Policy Research, Inc., October 1993.

Carriquiry, Alicia L. "Assessing the Prevalence of Nutrient Inadequacy." *Public Health Nutrition*, vol. 2, no. 1, March 1999.

Crockett, S.J., and L.S. Sims. "Environmental Influences on Children's Eating." *Journal of Nutrition Education*, vol. 27, no. 5, pp. 235-249.

Daft, Lynn, Alyssa Arcos, Ann Hallawell, Cherie Root, and Donald W. Westfall. "School Food Purchase Study: Final Report." Report submitted to the Food and Nutrition Service, U.S. Department of Agriculture. Alexandria, VA: PROMAR International, October 1998.

Evans, M.D., and F.J. Cronin. "Diets of School-Age Children and Teenagers." *Family Economic Review*, 1986, vol. 3, pp. 14-21.

Federal Register. "National School Lunch Program and School Breakfast Program: School Meals Initiative for Healthy Children; Final Rule." *Federal Register*, vol. 60, no. 113, June 13, 1995, pp. 31188-31222.

Gerrior, S., and L. Bente. "Nutrient Content of the U.S. Food Supply, 1990-94." Home Economics Research Report No. 53. Washington, DC: U.S. Department of Agriculture, Center for Nutrition Policy and Promotion, 1997.

Gleason, Philip, and Carol Suitor. "Children's Diets in the Mid-1990s: Dietary Intake and Its Relationship with School Meal Participation." Final report submitted to the U.S. Department of Agriculture, Food and Nutrition Service. Princeton, NJ: Mathematica Policy Research, Inc., October 2000.

Haines, Pamela S., David K. Guilkey, and Barry M. Popkin. "Trends in Breakfast Consumption of U.S. Adults Between 1965 and 1991." *Journal of the American Dietetic Association*, vol. 96, no. 5, May 1996, pp. 464-470.

Hampl, Jeffrey S. Nancy M. Belts, and Beverly A. Benes. "The 'Age + 5' Rule: Comparisons of Dietary Fiber Intake Among 4- to 10-Year-Old Children. *Journal of American Dietetic Association,* vol. 98, 1998, pp. 1418-1423.

Institute of Medicine, Food and Nutrition Board. *Dietary Reference Intakes: Thiamin, Riboflavin, Niacin, Vitamin* B_6*, Folate, Vitamin* B_{12}*, Pantothenic Acid, Biotin, and Choline.* Washington, DC: National Academy Press, 1998.

Institute of Medicine, Food and Nutrition Board. *Dietary Reference Intakes: Calcium, Phosphorus, Magnesium, Vitamin D, and Fluoride.* Washington, DC: National Academy Press, 1997.

Institute of Medicine, Food and Nutrition Board. Dietary Reference Intakes: Application in Dietary Assessment. Washington, DC: National Academy Press, 2000.

Iowa State University. "Improvement of USDA's Food Intake Surveys: Design and Analysis." Final report submitted to the U.S. Department of Agriculture, Agricultural Research Service. Ames, IA: Iowa State University, Center for Agricultural and Rural Development and Department of Statistics, September 1996.

Kennedy, E., and J. Goldberg. "What Are American Children Eating?" *Implications for Public Policy,* 1995.

Kennedy, Eileen, and Renee Powell. "Changing Eating Patterns of American Children: A View from 1996." *Journal of the American College of Nutrition*, vol. 16, no. 6, pp. 524-529, 1997.

Kennedy, Elaine T., James Ohls, Steven Carlson, and Katherine Fleming. "The Healthy Eating Index: Design and Applications." *Journal of the American Dietetic Association,* vol. 95, no. 10, 1995.

Life Sciences Research Office (LSRO), Federation of American Societies for Experimental Biology. *Third Report on Nutrition Monitoring in the United States.* Prepared for the Interagency Board for Nutrition Monitoring in the United States. Washington, DC: U.S. Government Printing Office, December 1995.

Lin, B.H. and Joanne Guthrie. "Nutritional Quality of American Children's Diets." *Food Review*, vol. 19, no. 1, January-April 1996, pp. 16-23.

Morton, J.F., and J.F. Guthrie. "Changes in Children's Total Fat Intakes and Their Food Group Sources of Fat, 1989-91 Versus 1994-95: Implications for Diet Quality." *Family Economics and Nutrition Review*, vol. 11, no. 3, 1998, pp. 44-57.

National Research Council, Subcommittee on Criteria for Dietary Evaluation. *Nutrient Adequacy: Assessment Using Food Consumption Surveys.* Washington, DC: National Academy Press, 1986.

National Research Council, Subcommittee on Diet and Health. *Diet and Health: Implications for Reducing Chronic Disease Risk.* Washington, DC: National Academy Press, 1989b.

National Research Council, Subcommittee on the Tenth Edition of the RDAs. *Recommended Dietary Allowances*, 10th edition. Washington, DC: National Academy Press, 1989a.

Nicklas, Theresa A. "Dietary Studies of Children: The Bogalusa Heart Study Experience." *Journal of the American Dietetic Association*, vol. 95, 1995, pp. 1127-1133.

Nicklas, Theresa A., Leann Myers, Carol O'Neil, and Nancy Gustafson. "Impact of Dietary Fat and Fiber Intake on Nutrient Intake of Adolescents." *Pediatrics.* vol. 105, no. 2, 2000.

Nicklas, T.A., L.S. Webber, C.C. Johnson, S.R. Srinivasan, and G.S. Berenson. "Secular Trends in Dietary Intakes and Cardiovascular Risk Factors of 10-Year-Old Children in the Bogalusa Heart Study (1973-1988)." *American Journal of Clinical Nutrition*, vol. 57, 1993, pp. 930-937.

Nusser, S.M., A.L. Carriquiry, K.W. Dodd, and W.A. Fuller. "A Semiparametric Transformation Approach to Estimating Usual Daily Intake Distribution." *Journal of the American Statistical Association*, December 1996.

Putnam, J., and J. Allshouse. "Food Consumption, Prices, and Expenditures." Statistical Bulletin Number 928. Washington, DC: U.S. Department of Agriculture, Economic Research Service, 1996.

Siega-Riz, Anna Maria, Barry Popkin, and Terri Carson. "Trends in Breakfast Consumption for Children in the United States from 1965 to 1991." *American Journal of Clinical Nutrition*, vol. 67 (suppl.), April 1998, pp. 7485-7565.

U.S. Department of Agriculture. *The Food Guide Pyramid*. USDA Home and Garden Bulletin 252. Washington, DC: USDA, 1992.

U.S. Department of Agriculture, Agriculture Research Service. *Documentation: 1994-1996 Continuing Survey of Food Intakes by Individuals (CSFII) and Diet and Health Knowledge Survey (DHKS).* Washington, DC: U.S. Department of Agriculture, 1998 (CD-ROM).

U.S. Department of Agriculture and U.S. Department of Health and Human Services. *Nutrition and Your Health: Dietary Guidelines for Americans*. USDA Home and Garden Bulletin 232, Fourth Edition. Washington, DC: USDA, 1995.

Van Horn, Linda. "Fiber, Lipids, and Coronary Heart Disease." Statement For Healthcare Professionals from the Nutrition Committee, American Heart Association, www.americanheart.org/scientific/statements/1997/069704.html, 1997.

Williams, C.L. "Importance of Dietary Fiber in Childhood." *Journal of the American Dietetic Association*, vol. 95, 1995, pp. 1140-1149.

Williams, C.L., et al. "A New Recommendation for Dietary Fiber in Childhood." *Pediatrics*, vol. 96, 1995, pp. 985-988.

APPENDIX A

DEFINING SBP/NSLP PARTICIPATION IN THE 1989-1991 AND 1994-1996 CSFII

Neither CSFII survey provides a direct measure of children's SBP/NSLP participation status on the days on which dietary intake information was collected. In the companion report (Gleason and Suitor 1999), information on the number of servings of each food group that students obtained from the school cafeteria for breakfast or lunch, available in the 1994-1996 CSFII, was used to define SBP/NSLP participation status. However, in the 1989-1991 CSFII, information on food group servings is not directly available. Furthermore, while the 1989-1991 CSFII provides information on which foods children obtained from school, it does not distinguish between foods obtained from the school cafeteria versus foods obtained elsewhere in school. Thus, the approach used in the companion report was not an option for this report.

Both CSFII surveys provide proxy reports of the number of days per week or month the child usually eats a school breakfast or lunch. This information could be used to define SBP/NSLP participation on a given intake day according to whether a student usually eats a school breakfast or lunch a certain number of days per week (for example, all five days per week). Students who usually participate every day would be considered participants on the intake day, while those who do not usually participate every day would be considered nonparticipants.

Clearly, this definition of participation is subject to measurement error if the intent is to measure students' participation status on the intake day. Students who "usually" participate fewer than five times a week--defined as nonparticipants on the intake day--may have eaten a school breakfast or lunch on the intake day.[1] Alternatively, students who usually participate five days a week may have missed the school meal on the intake day for some reason (for example, if they were absent from

[1]This is particularly true for students who "usually participate" a positive number of days per week (although less than five days per week). However, most students reported usually participating either zero or five times per week. For lunch, the percentage of students reported to participate zero or five days per week was 82 percent in the 1989-1991 CSFII and 77 percent in the 1994-1996 CSFII. For breakfast, the percentage of students reported to participate either zero or five days per week was 90 percent in the 1989-1991 CSFII and 89 percent in the 1994-1996 CSFII.

school on that day). This measurement problem is compounded by the fact that, for most children in the CSFII, the information on usual participation is reported by proxy.

Using this definition of SBP/NSLP participation to compare the dietary intakes of the two groups in 1989-1991 and 1994-1996 is problematic for two reasons. First, the variable is subject to measurement error in each time period, for the reasons stated above.[2] Second, the empirical evidence suggests that the degree to which there is measurement error may differ across the two time periods. Estimated NSLP participation rates (using the "five days a week" measure of participation) among students attending schools that offer the NSLP are 66 percent according to the 1989-1991 CSFII and 55 percent according to the 1994-1996 CSFII.[3] Among students attending schools that offer the SBP, the estimated participation rates are 31 percent according to the 1989-1991 CSFII and 21 percent according to the 1994-1996 CSFII. However, administrative data suggest that NSLP participation remained relatively constant between 1989-1991 and 1994-1996, not that SBP/NSLP participation decreased dramatically.[4] The difference between CSFII surveys in the estimated participation rates appears to be due to differing degrees of error in the 1989-1991 and 1994-1996 CSFII usual participation variables or may be related to sample design differences between the two

---

[2]Although the variable indicating participation on the intake day (based on foods eaten from the school cafeteria) is positively correlated with this definition of participation based on usual participation, this correlation is far from perfect. For example, among children attending schools that offer the NSLP, the two versions of the participation variable differed in their classification of whether a particular child was a participant in 30 percent of cases (based on 1994-1996 CSFII data).

[3]Had students' participation status on the intake day been defined according to whether they usually participate at least three times a week, the NSLP participation rates would have been 72 percent according to the 1989-1991 CSFII and 65 percent according to the 1994-1996 CSFII. Had participation status been defined according to whether students usually participate at least one time a week, the NSLP participation rates would have been 84 percent according to the 1989-1991 CSFII and 78 percent according to the 1994-1996 CSFII.

[4]According to FNS administrative data, the average daily participation rates among all students attending schools that offer the NSLP were 52.9 percent in 1991-1992 and 53 to 55 percent in 1994-1996.

surveys.[5] As a result, if these variables were used in comparing the dietary intakes of participants and nonparticipants over the two time periods, it could not be determined whether any observed differences over time were due to this measurement error or to real changes in either the SBP/NSLP or children's behavior. For these reasons, a comparison of participants' and nonparticipants' dietary intakes during 1989-1991 and 1994-1996 is not included in this report.

---

[5]However, which methodological differences led to the higher reported usual participation levels in the earlier panel are not clear. The wording of the "usual participation" question was slightly different in the two surveys, but this difference does not obviously bias the sample members' responses to the question in one direction or another.

APPENDIX B

SUPPLEMENTARY TABLES TO CHAPTER III

This appendix contains the following tables that are supplementary tables to Chapter III:

- Table B.1 Mean Two- to Three-Day Nutrient Intake Relative to Dietary Standards Among School-Age Children, 1989-1991 and 1994-1996
- Table B.2 Percentage of School-Aged Children Whose Usual Daily Nutrient Intake Is At or Above Dietary Standards, 1989-1991 and 1994-1996.
- Table B.3 Percentage of School-Aged Children Whose Day 1 Daily Nutrient Intake Is At or Above Dietary Standards, 1989-1991 and 1994-1996
- Table B.4A Percentage of School-Aged Children Whose Day 1 Daily Nutrient Intake Is At or Above Dietary Standards, By Age, Among Males, 1989-1991 and 1994-1996
- Table B.4B Percentage of School-Aged Children Whose Day 1 Daily Nutrient Intake Is At or Above Dietary Standards, By Age, Among Females, 1989-1991 and 1994-1996
- Table B.5 Percentage of School-Aged Children Whose Day 1 Nutrient Intake Is At or Above Dietary Standards, By Race/Ethnicity, 1989-1991 and 1994-1996
- Table B.6 Percentage of School-AGED Children Whose usual Intake Meets Selected Dietary Recommendations, 1989-1991 and 1994-1996
- Table B.7 Percentage of School-AGED Children Whose Day 1 Intake Meets Selected Dietary Recommendations, 1989-1991 and 1994-1996
- Table B.8A Percentage of School-Aged Children Whose Day 1 Intake Meets Selected Dietary Standards, By Age, Among Males, 1989-1991 and 1994-1996
- Table B.8B Percentage of School-Aged Children Whose Day 1 Intake Meets Selected Dietary Standards, By Age, Among Females, 1989-1991 and 1994-1996
- Table B.9 24-Hour Food Group Intakes of School-Aged Children, 1989-1991 and 1994-1996
- Figure B.1 Percentage of Males Ages 14 to 18 Meeting Dietary Standards for Intakes of Selected Vitamins and Minerals, 1989-1991 and 1994-1996
- Figure B.2 Percentage of Females Ages 14 to 18 Meeting Dietary Standards for Intakes of Selected Vitamins and Minerals, 1989-1991 and 1994-1996

These tables are presented here in the appendix for two primary reasons. First, some of the tables serve as a check on the robustness of the results presented in the text. For example, whereas Table III.1 presents mean vitamin and mineral intakes using only Day 2 data (to maximize comparability across the two surveys), Table B.1 presents similar information using two and three days of intake data for each sample member. Conversely, whereas Figure III.6 presents information using two and three days of intake data (and corrects for usual intake), Table B.3 presents similar information using only Day 1 data.

Second, three of these appendix tables (Tables B.2, B.6, and B.9) present information in tabular form that was presented in graphical form in Chapter III. These three appendix tables are for Figures III.6, III.7, and III.9, respectively.

TABLE B.1

MEAN TWO- TO THREE-DAY NUTRIENT INTAKE RELATIVE TO DIETARY STANDARDS AMONG SCHOOL-AGED CHILDREN, 1989-1991 AND 1994-1996

	Mean Intake					
	Breakfast		Lunch		24 Hours	
Dietary Component	1989-1991	1994-1996	1989-1991	1994-1996	1989-1991	1994-1996
Food Energy						
As percentage of Recommended Energy Allowance	16.1	16.4	26.8*	28.1	84.9**	91.1
As percentage of 24-hour food energy intake	18.7	18.1	31.7	31.1	n.a.	n.a.
Percentage of Food Energy from:						
Total fat	27.7**	25.9	36.2**	33.8	34.9**	32.5
Saturated fat	11.7**	10.1	13.6**	12.1	13.2**	11.7
Carbohydrate	60.2**	63.4	50.4**	53.6	51.0**	54.5
Protein	13.4**	12.4	14.7**	14.0	15.4**	14.2
Absolute fat						
Total fat (g)	11.7	10.8	24.6	24.6	74.4	75.6
Saturated fat (g)	4.9	4.2	9.2	8.7	28.5	27.7
Vitamins (as Percentage of RDA)[a]						
Vitamin A	40	39	28	26	118	115
Vitamin C	66	60	47	49	188	195
Vitamin E	19*	15	27	28	87	87
Vitamin B_6	58	60	42	44	175	183
Vitamin B_{12}	68	63	69	66	257	249
Niacin[b]	43	45	47*	50	169**	178
Thiamin	58	57	48**	51	181*	190
Riboflavin	80	78	62	62	233	236
Folate[c]	38	35	19	19	87	86
Minerals (as Percentage of RDA)[a]						
Calcium	23*	21	26	24	83	80
Iron	39	43	29**	33	116**	131
Magnesium	24	23	31	30	103	103
Phosphorus	31	31	41	39	134	132
Zinc	19*	21	25	25	87*	92
Other Dietary Components						
Fiber (g)	2.1	2.2	4.2	4.2	12.7**	13.5
Cholesterol (mg)	67*	58	70*	63	252**	234
Sodium (mg)	521	533	1,016	1,059	3,199	3,309
Sample Size	**2,903**	**2,692**	**2,303**	**2,692**	**2,303**	**2,692**

SOURCE: Weighted tabulations based on three days of intake data from respondents of the 1989-1991 CSFII and two days of intake data from respondents of the 1994-1996 CSFII.

[a] Mean intakes of vitamin B_6, vitamin B_{12}, niacin, thiamin, riboflavin, folate, magnesium, and phosphorus in this table are measured as a percentage of the RDAs based on the new Dietary Reference Intakes (DRIs). For the remaining vitamins and minerals except calcium, mean intakes are measured as a percentage of the 1989 RDAs. For calcium, mean intake is measured as a percentage of the DRI-based Adequate Intake (AI).

[b] The reported intake of niacin as a percentage of the RDA is an underestimate because intake is reported in mg of niacin and does not include an estimate of the niacin that is contributed by the conversion of tryptophan to niacin. The RDA is given in mg of niacin equivalents and assumes that all niacin will be considered.

[c] The reported intake of folate as a percentage of the RDA is an underestimate because intake is reported in mcg of folate but the RDA is given in mcg of dietary folate equivalents. Expressing intake in mcg of folate does not make allowance for the high bioavailability of synthetic folic acid, as from fortified ready-to-eat cereals. Dietary folate equivalents consider bioavailability.

n.a.= not applicable.

*Differences in intake across years is significantly different from zero at the .05 level, two-tailed test.
**Differences in intake across years is significantly different from zero at the .01 level, two-tailed test.

TABLE B.2

PERCENTAGE OF SCHOOL-AGED CHILDREN WHOSE USUAL DAILY NUTRIENT INTAKE IS AT OR ABOVE DIETARY STANDARDS, 1989-1991 AND 1994-1996

	Usual 24-Hour Intake			
	Percentage of Children at or Above EAR [a]		Percentage of Children at or Above 80 Percent of 1989 RDA[a]	
Dietary Component	1989-1991	1994-1996	1989-1991	1994-1996
Vitamins				
Vitamin A	n.a	n.a	70	72
Vitamin C	n.a.	n.a	92	93
Vitamin E	n.a.	n.a.	52**	59
Vitamin B_6	94	96	n.a.	n.a.
Vitamin B_{12}	98	99	n.a.	n.a.
Niacin	98	99	n.a.	n.a.
Thiamin	98	98	n.a.	n.a.
Riboflavin	97	98	n.a.	n.a.
Folate	52	49	n.a.	n.a.
Minerals				
Iron	n.a.	n.a.	81**	88
Magnesium	63	64	n.a.	n.a.
Phosphorus	80	80	n.a.	n.a.
Zinc	n.a	n.a.	61	64
Sample Size	**2,303**	**2,692**	**2,303**	**2,692**

SOURCE: Weighted tabulations based on two days of intake data from respondents of the 1994-1996 CSFII and three days of intake data from respondents of the 1989-1991 CSFII.

NOTE: Children's usual intake distribution was determined based on two or three intake days using the Software for Intake Distribution Estimation (SIDE), developed by Iowa State University (1996).

[a] For vitamin B_6, vitamin B_{12}, niacin, thiamin, riboflavin, folate, magnesium, and phosphorus, the EARs based on the new DRIs are used. For all of the remaining nutrients, the table shows the percentage of individuals whose intake is at or above 80 percent of the 1989 RDAs (an approximation of the estimated average requirement). The percentages of children meeting the EAR for niacin and folate are underestimated. The intake estimates do not account for the conversion of tryptophan to niacin or for the high bioavailability of synthetic folic acid as from fortified ready-to-eat cereal, whereas the EARs cover these.

n.a.= not applicable.

*Differences in intake across years is significantly different from zero at the .05 level, two-tailed test.
**Differences in intake across years is significantly different from zero at the .01 level, two-tailed test.

TABLE B.3

PERCENTAGE OF SCHOOL-AGED CHILDREN WHOSE DAY 1 DAILY NUTRIENT INTAKE IS AT OR ABOVE DIETARY STANDARDS, 1989-1991 AND 1994-1996

	Day 1 24-Hour Intake			
	Percentage of Children at or Above EAR [a]		Percentage of Children at or Above 80 Percent of 1989 RDA[a]	
Dietary Component	1989-1991	1994-1996	1989-1991	1994-1996
Vitamins				
Vitamin A	n.a.	n.a.	54	54
Vitamin C	n.a.	n.a.	70	69
Vitamin E	n.a.	n.a.	42	47
Vitamin B_6	83	84	n.a.	n.a.
Vitamin B_{12}	89	85	n.a.	n.a.
Niacin	90	91	n.a.	n.a.
Thiamin	90	90	n.a.	n.a.
Riboflavin	92	92	n.a.	n.a.
Folate	48	43	n.a.	n.a.
Minerals				
Iron	n.a.	n.a.	67	74
Magnesium	57	56	n.a.	n.a.
Phosphorus	73	71	n.a.	n.a.
Zinc	n.a.	n.a.	50	51
Sample Size	**2,903**	**2,692**	**2,903**	**2,692**

SOURCE: Weighted tabulations based on Day 1 intake data from respondents of the 1994-1996 CSFII and 1989-1991 CSFII.

NOTE: No significance tests were conducted for this table.

[a] For vitamin B_6, vitamin B_{12}, niacin, thiamin, riboflavin, folate, magnesium, and phosphorus, the EARs based on the new DRIs are used. For all of the remaining nutrients except calcium, the table shows the percentage of individuals whose intake is at or above 80 percent of the 1989 RDAs (an approximation of the estimated average requirement). The percentages of children meeting the EAR for niacin and folate are underestimated. The intake estimates do not account for the conversion of tryptophan to niacin or for the high bioavailability of synthetic folic acid as from fortified ready-to-eat cereal, whereas the EARs cover these.

n.a.= not applicable.

TABLE B.4.A

PERCENTAGE OF SCHOOL-AGED CHILDREN WHOSE DAY 1 NUTRIENT INTAKE IS AT OR ABOVE DIETARY STANDARDS, BY AGE, AMONG MALES, 1989-1991 AND 1994-1996

	Percentage of Children Whose Day 1 Intake Is at or Above EAR or 80 Percent of 1989 RDA[a]					
	Males, Ages 6 to 8		Males, Ages 9 to 13		Males, Ages 14 to 18	
Dietary Component	1989-1991	1994-1996	1989-1991	1994-1996	1989-1991	1994-1996
Vitamins						
Vitamin A	71	71	59	55	47	47
Vitamin C	77	78	77	74	71	65
Vitamin E	40	48	46	49	40	50
Vitamin B_6	94	97	89	90	78	81
Vitamin B_{12}	96	95	94	92	91	87
Niacin	98	98	93	95	90	92
Thiamin	97	99	93	96	90	89
Riboflavin	100	99	95	97	87	88
Folate	74	68	53	52	38	35
Minerals						
Iron	70	86	80	87	83	87
Magnesium	94	94	70	68	28	36
Phosphorus	98	98	74	71	79	79
Zinc	47	57	53	55	58	55
Sample Size	**383**	**357**	**617**	**552**	**465**	**446**

SOURCE: Weighted tabulations based on day one intake data from respondents of the 1989 to 1991 CSFII and 1994 to 1996 CSFII.

NOTE: No significance tests were conducted for this table.

[a] For vitamin B_6, vitamin B_{12}, niacin, thiamin, riboflavin, folate, magnesium, and phosphorus, the EARs based on the new DRIs are used. For all of the remaining nutrients, the table shows the percentage of individuals whose intake is at or above 80 percent of the 1989 RDAs (an approximation of the estimated average requirement). The percentages of children meeting the EAR for niacin and folate are underestimated. The intake estimates do not account for the conversion of tryptophan to niacin or for the high bioavailability of synthetic folic acid as from fortified ready-to-eat cereal, whereas the EARs cover these.

*Differences in intake across years is significantly different from zero at the .05 level, two-tailed test.
**Differences in intake across years is significantly different from zero at the .01 level, two-tailed test.

TABLE B.4.B

PERCENTAGE OF SCHOOL-AGED CHILDREN WHOSE DAY 1 NUTRIENT INTAKE IS AT OR ABOVE DIETARY STANDARDS, BY AGE, AMONG FEMALES, 1989-1991 AND 1994-1996

	Percentage of Children Whose Day 1 Intake Is at or Above EAR or 80 Percent of 1989 RDA[a]					
	Females, Ages 6 to 8		Females, Ages 9 to 13		Females, Ages 14 to 18	
Dietary Component	1989-1991	1994-1996	1989-1991	1994-1996	1989-1991	1994-1996
Vitamins						
Vitamin A	73	65	49	54	39	40
Vitamin C	74	77	67	72	60	57
Vitamin E	47	45	45	49	35	42
Vitamin B_6	98	97	84	84	60	66
Vitamin B_{12}	98	95	90	84	69	65
Niacin	99	97	94	91	74	80
Thiamin	98	98	92	94	72	70
Riboflavin	99	99	94	94	78	81
Folate	74	64	46	38	20	17
Minerals						
Iron	79	81	56	63	39	47
Magnesium	96	93	57	54	18	19
Phosphorus	99	98	60	55	47	46
Zinc	56	49	51	49	35	42
Sample Size	**383**	**336**	**544**	**560**	**511**	**441**

SOURCE: Weighted tabulations based on day one intake data from respondents of the 1989-1991 CSFII and 1994-1996 CSFII.

NOTE: No significance tests were conducted for this table.

[a] For vitamin B_6, vitamin B_{12}, niacin, thiamin, riboflavin, folate, magnesium, and phosphorus, the EARs based on the new DRIs are used. For all of the remaining nutrients, the table shows the percentage of individuals whose intake is at or above 80 percent of the 1989 RDAs (an approximation of the EAR). The percentages of children meeting the EAR for niacin and folate are underestimated. The intake estimates do not account for the conversion of tryptophan to niacin or for the high bioavailability of synthetic folic acid as from fortified ready-to-eat cereal, whereas the EARs cover these.

*Differences in intake across years is significantly different from zero at the .05 level, two-tailed test.
**Differences in intake across years is significantly different from zero at the .01 level, two-tailed test.

TABLE B.5

PERCENTAGE OF SCHOOL-AGED CHILDREN WHOSE DAY 1 NUTRIENT INTAKE IS AT OR ABOVE DIETARY STANDARDS, BY RACE/ETHNICITY, 1989-1991 AND 1994-1996

	Percentage of Children Whose Day 1 24-Hour Intake Is at or Above EAR or 80 Percent of 1989 RDA[a]							
	Hispanic		Black		White		Other	
Dietary Component	1989-1991	1994-1996	1989-1991	1994-1996	1989-1991	1994-1996	1989-1991	1994-1996
Vitamins								
Vitamin A	42	48	46	42	58	58	56	46
Vitamin C	73	73	68	73	70	68	78	72
Vitamin E	29	43	43	49	44	49	33	35
Vitamin B_6	85	85	79	83	83	84	83	82
Vitamin B_{12}	91	86	84	82	90	86	92	79
Niacin	91	88	90	92	90	92	97	87
Thiamin	92	89	87	88	90	91	93	86
Riboflavin	93	91	88	91	92	93	87	83
Folate	56	45	39	36	49	45	59	31
Minerals								
Iron	63	72	58	71	70	76	60	66
Magnesium	52	53	52	49	59	58	50	52
Phosphorus	69	69	67	63	76	74	67	59
Zinc	47	52	48	48	51	52	47	45
Sample Size	**361**	**430**	**525**	**411**	**1,930**	**1,735**	**87**	**116**

SOURCE: Weighted tabulations based on Day 1 intake data from respondents of the 1989-1991 and 1994-1996 CSFII.

NOTE: No significance tests were conducted for this table.

[a] For vitamin B_6, vitamin B_{12}, niacin, thiamin, riboflavin, folate, magnesium, and phosphorus, the EARs based on the new DRIs are used. For all of the remaining nutrients, the table shows the percentage of individuals whose intake is at or above 80 percent of the 1989 RDAs (an approximation of the EAR). The percentages of children meeting the EAR for niacin and folate are underestimated. The intake estimates do not account for the conversion of tryptophan to niacin or for the high bioavailability of synthetic folic acid as from fortified ready-to-eat cereal, whereas the EARs cover these.

*Differences in intake across years is significantly different from zero at the .05 level, two-tailed test.
**Differences in intake across years is significantly different from zero at the .01 level, two-tailed test.

TABLE B.6

PERCENTAGE OF SCHOOL-AGED CHILDREN WHOSE USUAL INTAKE MEETS SELECTED DIETARY RECOMMENDATIONS, 1989-1991 AND 1994-1996

	Percentage Whose Usual Daily Intake Meets the Recommendation					
	Breakfast		Lunch		24 Hours	
Dietary Recommendation	1989-1991	1994-1996	1989-1991	1994-1996	1989-1991	1994-1996
Percentage of Food Energy						
No more than 30 percent from total fat	67*	74	20	24	14**	25
Less than 10 percent from saturated fat	30**	53	14	21	7**	16
More than 55 percent from carbohydrates	77	82	36**	54	28**	53
Other Dietary Components						
More than (age + 5) g of dietary fiber	n.a.	n.a.	n.a.	n.a.	28	28
No more than 2,400 mg of sodium	n.a.	n.a.	n.a.	n.a.	16	15
No more than 300 mg of cholesterol	n.a.	n.a.	n.a.	n.a.	74	78
No more than twice the 1989 RDA of protein	n.a.	n.a.	n.a.	n.a.	55*	59
Sample Size	**2,185**	**2,494**	**2,268**	**2,650**	**2,303**	**2,692**

SOURCE: Weighted tabulations based on three days of intake data from respondents of the 1989-1991 CSFII and two days of intake data from respondents of the 1994-1996 CSFII.

NOTE: Children's usual intake distribution was determined based on two or three intake days using the Software for Intake Distribution Estimation (SIDE), developed by Iowa State University (1996).

n.a.= not applicable.

*Difference across years is significantly different from zero at the .05 level, two-tailed test.
**Difference across years is significantly different from zero at the .01 level, two-tailed test.

TABLE B.7

PERCENTAGE OF SCHOOL-AGED CHILDREN WHOSE DAY 1 INTAKE MEETS SELECTED DIETARY RECOMMENDATIONS, 1989-1991 AND 1994-1996

	Percentage Whose Day 1 Intake Meets the Recommendation					
	Breakfast		Lunch		24 Hours	
Dietary Recommendation	1989-1991	1994-1996	1989-1991	1994-1996	1989-1991	1994-1996
Percentage of Food Energy						
No more than 30 percent from total fat	70	73	38	41	28	37
Less than 10 percent from saturated fat	54	64	36	43	20	33
More than 55 percent from carbohydrates	56	58	33	40	37	47
Other Dietary Components						
More than (age + 5) g of dietary fiber	n.a.	n.a.	n.a.	n.a.	28	32
No more than 2,400 mg of sodium	n.a.	n.a.	n.a.	n.a.	33	32
No more than 300 mg of cholesterol	n.a.	n.a.	n.a.	n.a.	72	74
No more than twice the 1989 RDA of protein	n.a.	n.a.	n.a.	n.a.	57	61
Sample Size	**2,754**	**2,494**	**2,859**	**2,650**	**2,903**	**2,692**

SOURCE: Weighted tabulations based on Day 1 intake data from respondents of the 1989-1991 and 1994-1996 CSFII.

n.a.= not applicable.

*Differences in intake across years is significantly different from zero at the .05 level, two-tailed test.
**Differences in intake across years is significantly different from zero at the .01 level, two-tailed test.

TABLE B.8.A

PERCENTAGE OF SCHOOL-AGED CHILDREN WHOSE DAY 1 INTAKE MEETS SELECTED DIETARY STANDARDS, BY AGE, AMONG MALES, 1989-1991 AND 1994-1996

	Percentage of Children Whose Day 1 24-Hour Intake Meets the Recommendation					
	Males, Ages 6 to 8		Males, Ages 9 to 13		Males, Ages 14 to 18	
Dietary Recommendation	1989-1991	1994-1996	1989-1991	1994-1996	1989-1991	1994-1996
Percentage of Food Energy						
No more than 30 percent from total fat	30	37	27	34	24	36
Less than 10 percent from saturated fat	15	28	18	30	20	36
More than 55 percent from carbohydrates	44	50	33	46	32	41
Other Dietary Components						
More than (age + 5) g of dietary fiber	40	46	30	39	20	32
No more than 2,400 mg of sodium	41	39	25	22	17	16
No more than 300 mg of cholesterol	80	79	67	73	63	59
No more twice the 1989 RDA of protein	37	37	44	49	71	68
Sample Size	**383**	**357**	**617**	**552**	**465**	**446**

SOURCE: Weighted tabulations based on three days of intake data from respondents of the 1989-1991 and 1994-1996 CSFII.

NOTE: No significance tests were conducted for this table.

*Differences in intake across years is significantly different from zero at the .05 level, two-tailed test.
**Differences in intake across years is significantly different from zero at the .01 level, two-tailed test.

TABLE B.8.B

PERCENTAGE OF SCHOOL-AGED CHILDREN WHOSE DAY 1 INTAKE MEETS SELECTED DIETARY STANDARDS, BY AGE, AMONG FEMALES, 1989-1991 AND 1994-1996

	Percentage of Children Whose Day 1 24-Hour Intake Meets the Recommendation					
	Females, Ages 6 to 8		Females, Ages 9 to 13		Females, Ages 14 to 18	
Dietary Recommendation	1989-1991	1994-1996	1989-1991	1994-1996	1989-1991	1994-1996
Percentage of Food Energy						
No more than 30 percent from total fat	30	38	27	39	32	39
Less than 10 percent from saturated fat	20	29	19	31	25	41
More than 55 percent from carbohydrates	43	48	38	51	37	49
Other Dietary Components						
More than (age + 5) g of dietary fiber	50	45	26	24	10	15
No more than 2,400 mg of sodium	42	52	34	37	45	40
No more than 300 mg of cholesterol	77	85	73	80	79	75
No more twice the 1989 RDA of protein	32	42	65	72	81	81
Sample Size	**383**	**336**	**544**	**560**	**511**	**441**

SOURCE: Weighted tabulations based on Day 1 intake data from respondents of the 1989-1991 and 1994-1996 CSFII.

NOTE: No significance tests were conducted for this table.

TABLE B.9

24-HOUR FOOD GROUP INTAKES OF SCHOOL-AGED CHILDREN, 1989-1991 AND 1994-1996

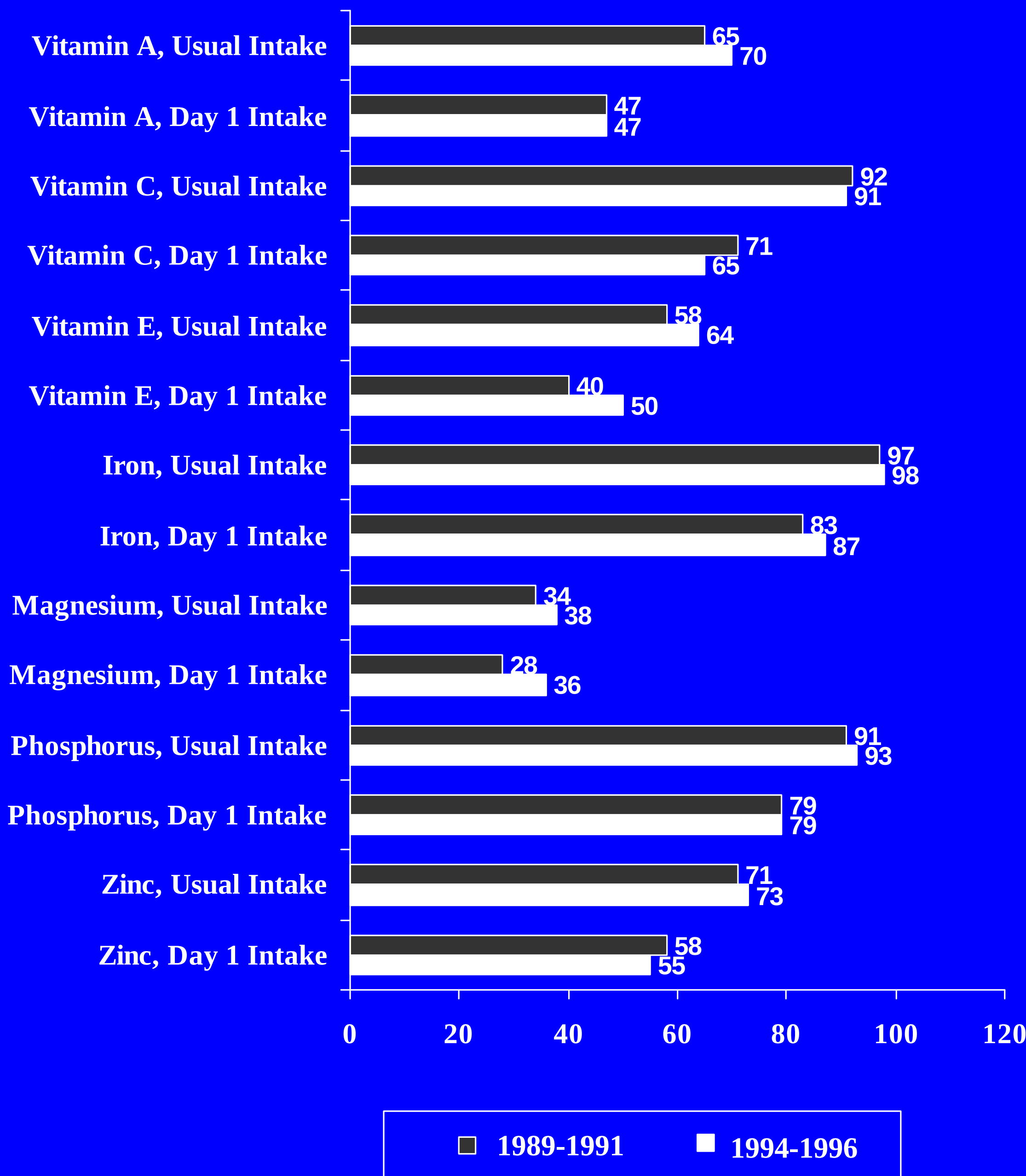
	Mean Number of Servings Over 24 Hours	
Food Group	1989-1991	1994-1996
Grain Products	6.5**	7.2
Vegetables	2.3**	2.6
Fruit	1.4	1.4
Vegetables and Fruit	3.7**	4.1
Dairy Products		
Whole milk	0.7**	0.4
Low-fat milk	0.6	0.6
Nonfat milk	0.1**	0.2
Total milk products	2.4**	2.0
Meat and Meat Substitutes	1.7**	1.4
Soda	1.0**	1.4
Fruit Drinks and Fruit-Flavored Drinks	0.5**	0.8
Sample Size	**2,017**	**2,692**

SOURCE: Weighted tabulations on food group servings derived from the 1989-1991 and 1994-1996 CSFII in the process of creating the Healthy Eating Index (Kennedy et al. 1995; and Bowman et al. 1998). Tabulations use three days of intake data for 1989-1991 CSFII respondents and two days of intake data for 1994-1996 CSFII respondents.

*Differences in intake across years is significantly different from zero at the .05 level, two-tailed test.
**Differences in intake across years is significantly different from zero at the .01 level, two-tailed test.

FIGURE B.1

PERCENTAGE OF MALES AGES 14 TO 18 MEETING DIETARY STANDARDS FOR INTAKES OF SELECTED VITAMINS AND MINERALS, 1989-1991 AND 1994-1996

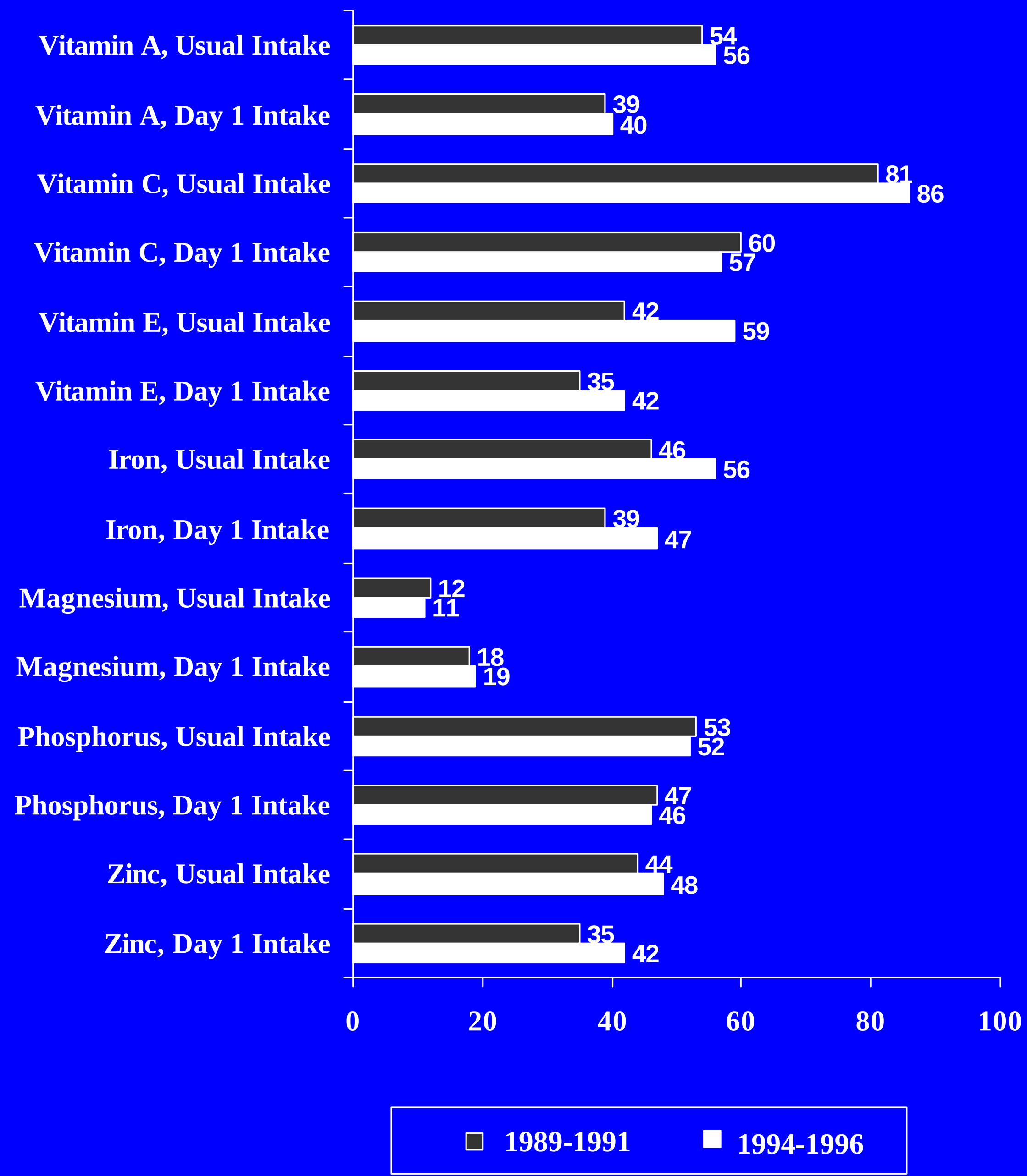


Note: For phosphorus, the dietary standard used is the EAR. For the remaining vitamins and minerals, the dietary standard used is 80 percent of the 1989 RDA.

SOURCE: CSFII

FIGURE B.2

PERCENTAGE OF FEMALES AGE 14 TO 18 MEETING DIETARY STANDARDS FOR INTAKES OF SELECTED VITAMINS AND MINERALS, 1989-1991 and 1994-1996



Note: For phosphorus, the dietary standard used is the EAR. For the remaining vitamins and minerals, the dietary standard used is 80 percent of the 1989 RDA.

SOURCE: CSFII