Trends in Energy Intake in U.S. between 1977 and 1996: Similar Shifts Seen across Age Groups

Samara Joy Nielsen, Anna Maria Siega-Riz, and Barry M. Popkin

Abstract

NIELSEN, SAMARA JOY, ANNA MARIA SIEGA-RIZ, AND BARRY M. POPKIN. Trends in energy intake in U.S. between 1977 and 1996: similar shifts seen across age groups. *Obes Res.* 2002;10:370–378.

Objective: To determine the trends in locations and food sources of Americans stratified by age group for both total energy and the meal and snack subcomponents.

Research Methods and Procedures: Nationally representative data was taken from the 1977 to 1978 Nationwide Food Consumption Survey and the 1989 to 1991 and 1994 to 1996 (and 1998 for children age 2 through 9) Continuing Surveys of Food Intake by Individuals. The sample consisted of 63,380 individuals, age 2 and up. For each survey year, the percentage of total energy intake from meals and snacks was calculated separately for 2- to 18-year-olds, 19- to 39-year-olds, 40- to 59-year-olds, and those 60 years and older. The percentage of energy intake by location (at-home consumption or preparation, vending, store eaten out, restaurant/fast-food, and school) and by specific food group was computed for all age groups separately.

Results: The trends in location and food sources were almost identical for all age groups. Key dietary behavior shifts included greater away-from-home consumption; large increases in total energy from salty snacks, soft drinks, and pizza; and large decreases in energy from low- and medium-fat milk and medium- and high-fat beef and pork.

Discussion: Total energy intake has increased over the past 20 years, with shifts away from meals to snacks and from at-home to away-from-home consumption. The similarity of changes across all age groups furthers the assertion that broad-based environmental changes are needed to improve the diets of Americans.

Key words: dietary trends, food sources, locations, fast-food, restaurants, total energy

Introduction

The rapid increase in obesity across all age groups, coupled with reductions in the age when obesity comorbidities emerge, force us to focus on the overall American diet for individuals of all ages (1–3). During this time of rising prevalence in obesity, the levels of physical activity have decreased, and important shifts in diet have occurred (4). Americans have increased their consumption of sugars and energy-dense foods (5). Some of these shifts may be explained by the fact that people are obtaining a greater percentage of their food outside the home, specifically from restaurant and fast-food places (6–9). The largest increases in types of food consumed mirror the shifts in consumption from at home to away from home (10,11). These shifts include increased intakes of salty snacks, soft drinks, and pizza (12,13).

Although there have been many studies that looked at various components of the American diet as well as at selected age groupings, there have been no studies that looked solely at total energy intake or at all age groups in one analysis. Furthermore, we lack information on whether similar shifts across the age groups have occurred. It is important to examine total energy intake because certain scholars feel that there is a continually increasing amount of energy being consumed by Americans over the past 20 years (13,14). We investigated energy intake trends among much of the American population by looking at the ages broken into broad age categories: children 2 to 18 years old, young adults 19 to 39 years old, middle-aged adults 40 to 59 years old, and older adults (hereafter termed elderly) age 60 and up. The use of age-adjusted results allowed us to assess trends explained by changes in eating behavior. This study focuses on the shifts in energy intake related to eating

Submitted for publication September 19, 2001.
Accepted for publication in final form January 2, 2002.
Department of Nutrition, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina.
Address correspondence to Barry M. Popkin, Professor of Nutrition, Carolina Population Center, University of North Carolina at Chapel Hill, CB 8120 University Square, 123 West Franklin Street, Chapel Hill, NC 27516-3997.
E-mail: popkin@unc.edu

location and the concurrent changes in consumption of certain key food items between 1977 and 1996.

Research Methods and Procedures

Survey Design and Sample

This study used data on subjects age 2 years and above from four nationally representative surveys of the U.S. population. Of the 63,380 individuals, 29,695 participated in the 1977 to 1978 (hereafter referred to as 1977) Nationwide Food Consumption Survey (NFCS77), 14,658 participated in the 1989 to 1991 (hereafter referred to as 1989) Continuing Survey of Food Intake by Individuals (CSFII89), and 19,027 participated in the 1994 to 1996 (hereafter referred to as 1996) Continuing Survey of Food Intake by Individuals (CSFII96). This last survey also included a sample of children age 2 to 9 surveyed in 1998. The United States Department of Agriculture (USDA) surveys from 1977 and 1989 contained stratified area probability samples of non-institutionalized U. S. households in the 48 contiguous states and, in 1996, all 50 states. These surveys were self-weighting, multistage, stratified area samples of the U.S. population. Detailed information pertaining to each survey has been previously published (15–17).

The NFCS77 and CSFII89 surveys collected information on 1 day of intake by an in-home, interviewer-administered 24-hour recall and 2 additional days of self-administered 1-day food records. The CSFII96 collected two non-consecutive, interviewer-administered 24-hour recalls by phone ~10 days apart.

For each food consumed in all four surveys, the respondent was asked whether this eating occasion was a meal or snack. The respondent was also asked where the food was obtained; if the food was bought in a store, then it was determined whether the food was eaten at home or whether the food was ever brought into the home. This led to the classification of food sources as either from a vending machine, eaten or prepared at home, from a store but not eaten or ever brought into the home (called store eaten out), from a fast-food establishment or restaurant (called restaurant/fast-food), from a school (termed school), or as a gift from someone or any other source. Aside from food that was bought from a store, food from any other source was considered to be from that source, even if brought into the home. For example, if someone ordered pizza from a pizza place or picked up fast-food on the way home and ate it in the home, that food was still considered to be part of the restaurant/fast-food category.

To examine the thousands of foods contributing to energy intake, the University of North Carolina-Chapel Hill food-grouping system was used. This system aggregates all the foods in the USDA nutrient composition tables into 74 descriptive and nutrient-based subgroups. In addition, selected popular foods such as pizza, hamburger, and french fries were also identified to examine trends in intake of these foods over time. These foods were identified in a previous paper to examine trends in fat intake (18). It should be noted that the individual food entries actually represent a large number of foods and food codes from the food table.

Statistical Analysis

Descriptive statistics were generated for selected sociodemographic variables of interest, weighted and controlled for sample design effects with STATA 7 (Table 1). Significance testing was done on the sociodemographic variables with a *z* statistic to test the difference between two proportions. The USDA data contained each food item a person consumed, along with the self-reported eating occasion and self-reported place where food was obtained and eaten. Once foods were categorized by eating occasion (snacks vs. non-snack meals), the average energy (in kilocalories) and the percentage of energy contributed by snacks and non-snacks (meals) was computed for each survey year by age group. Then, for each survey year, the average percentage of energy consumed from selected snack food categories (salty snacks, desserts, candy, soft drinks, fruit drinks, and alcohol) and other selected food groups (pizza, Mexican, etc.) as well as the location (at home, vending, store eaten out, restaurant/fast-food, and school) were determined separately for each age group: 2- to 18-year-olds, 19- to 39-year-olds, 40- to 59-year-olds, and those 60 years and older. These results were adjusted by age, sex, education level, ethnicity, region of the country, urban classification, household size, and poverty level ($<$185% and $>$350% of national level). To test for statistical differences, SAS 8.1 (SAS Institute, Cary, NC) and SUDAAN 7.5.6 (Research Triangle Institute, Research Triangle Park, NC) software packages were used; this also allowed for weights and control of sample design effects. A value of $p \leq 0.01$ was used to denote statistical significance.

In addition, the same age breakdowns for food location and food sources were examined for sex, race, education, and income for meaningful trends. To explore overall trends and the role of age, we also examined the total amount of calories obtained across the population from a specific location or a key food item. The proportion of the population in each age group in 1980 was multiplied by the mean percentage of energy from each of the elements, thereby weighting the total energy for location or food group by the distribution of the population. This allowed us to look at our results and take into account one of the possible biases that would affect our data.

Results

Total Energy Percentages by Location

Between 1977 and 1996, Americans increased the proportion of total energy obtained from restaurants and fast-food establishments and decreased the proportion from

Table 1. Percentages of population by sociodemographic characteristics, 1977 to 1996

	1977	1989	1994
Sociodemographic characteristics			
Age 2 to 18 years	31.0%*†	26.1%*	26.0%†
Age 13 to 39 years	31.7%*	34.8%*	33.5%
Age 40 to 59 years	22.1%†	22.2%	24.3%†
Age 60+ years	15.2%	16.8%	16.2%
Total (*n*)	29,695	14,658	19,027
Male	44.0%*†	47.9%*	48.8%†
Non-Hispanic white	80.3%†	77.4%	72.9%†
Non-Hispanic black	12.6%	11.9%	12.5%
Hispanic	5.8%†	8.2%	10.4%†
Other	1.3%*†	2.5%*‡	4.3%†‡
Poverty level			
<185% of national level	32.1%	28.2%	30.6%
>350% of national level	30.6%*†	41.6%*	39.3%†
Northeast	24.5%*	20.7%*	19.7%
Midwest	26.4%	24.3%	23.5%
South	31.2%	34.6%	34.9%
West	17.9%	20.4%	21.9%
Central cities	30.0%	30.1%	31.5%
Suburban	37.7%*†	47.6%*	47.2%†
Non-metropolitan	32.3%*†	22.3%*	21.3%†
Low education level			
12 years of education or less	70.3%*†	55.5%*	51.6%†
Mean household size	3.9*†	3.4*	3.4†

$p \leq 0.01$.
* Significant difference between 1977 to 1978 and 1989 to 1991.
† Significant difference between 1977 to 1978 and 1994 to 1996.
‡ Significant difference between 1989 to 1991 and 1994 to 1996.

home. Energy intake from foods eaten at home decreased by between 11.1% and 20.8% for all age groups from 1977 to 1996. Energy intake from restaurant/fast-food increased by between 91.2% and 208% for all age groups. There was little or no change (13.5% to 34.2%) in the amount of energy obtained from the store-eaten-out category (this only accounts for, at most, 7.8% of the total caloric intake).

For Americans, there was a larger increase in absolute energy intake and a much larger relative increase in energy consumed as snacks, rather than meals, over the past 20 years such that snacks represented 17.7% of the average American's energy in 1996 compared with only 11.3% in 1977 (Table 2). Snacks represented a larger portion of the diets of 2- to 18-year-olds than the diets of other age groups (in 1996, >20% of their energy intake, up from 13% in 1977). Although the elderly still snacked the least, with 14.0% of their energy from snacks, they had the largest jump in snacking, up from 7.7% in 1977. Although energy from meals has been decreasing for all age groups (down about 7.2% for the average American), the elderly had the smallest decrease in energy from meals; meals still constituted 86.1% of their diet.

There were some important age-group differences in location of consumption. The average American increased restaurant/fast-food consumption for meals from 9.6% to 23.5% between 1977 and 1996, and this represents a change between 104% and 255% per age group. Although all age groups have increased their consumption of meals from restaurants/fast-food establishments, the 19- to 39-year-olds have continued to consume the greatest percentage of restaurant/fast-food meals. In 1996, snacks from the store eaten out represented up to 12.2% of all energy from snacks, whereas meals from the store eaten out represented only up to 5.6% of all energy from meals for this age group.

Table 2. Trends in energy intake by eating occasion and location (% energy)*

	Total energy			Meals			Snacks		
	1977 to 1978	1989 to 1991	1994 to 1996	1977 to 1978	1989 to 1991	1994 to 1996	1977 to 1978	1989 to 1991	1994 to 1996
Age 2 to 18 years									
Vending	0.3†‡	0.1†§	0.5‡§	0.2†‡	0.1†§	0.3‡§	1.1†‡	0.5†§	1.3‡§
At home	75.7†‡	71.1†	65.2‡	75.2†‡	70.2†§	64.2‡§	79.4†‡	76.4†§	69.1‡§
Store/out	5.2†‡	1.9†§	4.5‡§	5.0†‡	1.2†§	3.2‡§	6.9‡	5.9§	9.3‡§
Restaurant/fast-food	4.8†‡	14.6†§	14.8‡§	4.7†‡	15.4†§	16.7‡§	5.7†‡	10.4†§	7.9‡§
School	10.9†‡	9.8†	8.7‡	12.1†‡	11.1†	10.2‡	2.4†‡	2.5†§	3.0‡§
Other	3.1†‡	2.4†§	6.3‡§	2.9†‡	2.1†§	5.5‡§	4.3†‡	4.2†§	9.5‡§
Total	100	100	100	100	100	100	100	100	100
Total energy (kcal)	1840†‡	1778†§	1958‡§	1600†‡	1510†§	1549‡§	240†‡	267†§	409‡§
Age 19 to 39 years									
Vending	1.1†‡	1.0†§	1.2‡§	0.7†	0.5†§	0.6§	4.4‡	3.8§	4.0‡§
At home	72.4‡	68.4§	57.3‡§	73.0†‡	68.3†§	56.8‡§	68.1†‡	69.7†§	59.5‡§
Store/out	7.8†	3.0†§	6.7§	7.5†‡	2.3†§	5.6‡§	10.0†‡	7.5†§	12.2‡§
Restaurant/fast-food	14.2†‡	24.0†§	28.1‡§	14.6†‡	25.7†§	30.7‡§	11.5†‡	12.9†§	15.7‡§
School	0.5†‡	0.4†§	0.6‡§	0.5†‡	0.4†§	0.6‡§	0.3‡	0.3§	0.3‡§
Other	4.0†‡	3.2†§	6.1‡§	3.7†‡	2.8†§	5.7‡§	5.8†‡	5.8†§	8.2‡§
Total	100	100	100	100	100	100	100	100	100
Total energy (kcal)	1856†‡	1940†§	2198‡§	1631†‡	1682†§	1811‡§	244†‡	258†§	387‡§
Age 40 to 59 years									
Vending	0.5†‡	0.7†§	0.8‡§	0.3†‡	0.4†§	0.5‡§	1.9‡	3	2.7‡
At home	78.1†‡	73.9†	66.8‡	78.2†‡	73.5†§	66.1‡§	76.9†‡	76.5†§	70.8‡§
Store/out	7.6†‡	2.5†§	5.0‡§	7.5†‡	2.1†§	4.1‡§	9.0‡	5.1§	9.2‡§
Restaurant/fast-food	11.5†‡	19.2†§	21.8‡§	11.8†‡	20.7†§	24.1‡§	8.5‡	9.0§	10.1‡§
School	0.2†‡	0.4†	0.4‡	0.2†‡	0.4†	0.4‡	0.2	0.4	0.4
Other	2.1†‡	3.2†§	5.1‡§	2.0†‡	2.8†§	4.8‡§	3.4†‡	5.8†§	6.8‡§
Total	100	100	100	100	100	100	100	100	100
Total energy (kcal)	1747‡	1753§	1954‡§	1572†‡	1534†§	1632‡§	175†‡	219†§	323‡§
Age 60+ years									
Vending	0.1†‡	0.1†§	0.1‡§	0.0†‡	0.0†§	0.1‡§	0.3†‡	0.6†	0.5‡
At home	88.5†‡	84.2†§	78.7‡§	88.4†‡	84.1†§	78.0‡§	90.1†‡	84.5†§	83.2‡§
Store/out	3.4†‡	1.2†§	2.4‡§	3.3†‡	1.1†§	2.2‡§	4.8†‡	2.7†§	3.9‡§
Restaurant/fast-food	5.3†‡	11.8†§	13.9‡§	5.5†‡	12.5†§	15.3‡§	2.4†‡	5.7†§	5.2‡§
School	0.5†‡	0.0†§	0.2‡§	0.6†‡	0.0†§	0.2‡§	0.0†‡	0.0†§	0.1‡§
Other	2.1†‡	2.7†§	4.7‡§	2.1‡	2.2§	4.3‡§	2.3†‡	6.5†§	7.1‡§
Total	100	100	100	100	100	100	100	100	100
Total energy (kcal)	1619†	1574†§	1633§	1495†‡	1412†	1406‡	125†‡	162†§	228‡§
All Americans age ≥2 years									
Vending	0.6‡	0.6§	0.8‡§	0.4†‡	0.3†§	0.4‡§	2.3†‡	2.3†§	2.5‡§
At home	76.9†‡	72.6†§	64.5‡§	77.0†‡	72.3†§	63.8‡§	76.0†‡	74.8†§	67.4‡§
Store/out	6.3†‡	2.3†§	5.2‡§	6.1†‡	1.8†§	4.2‡§	8.2†‡	6.0†§	9.8‡§
Restaurant/fast-food	9.4†‡	18.7†§	21.3‡§	9.6†‡	20.0†§	23.5‡§	7.9†‡	10.5†§	11.0‡§
School	3.7†‡	2.8†	2.6‡	4.1†‡	3.1†	2.9‡	1.1‡	1.0§	1.1‡§
Other	3.0‡	2.9§	5.7‡§	2.8†‡	2.5†§	5.2‡§	4.5†‡	5.4†§	8.2‡§
Total	100	100	100	100	100	100	100	100	100
Total energy (kcal)	1791‡	1795§	1985‡§	1588†‡	1559†§	1634‡§	203†‡	236†§	351‡§

* Adjusted for age, sex, education level, ethnicity, region, urban classification, household size, and % poverty, $p \leq 0.01$.

† Significant difference between 1977 to 1978 and 1989 to 1991.

‡ Significant difference between 1977 to 1978 and 1994 to 1996.

§ Significant difference between 1989 to 1991 and 1994 to 1996.

Table 3. Trends in energy intake by meal pattern type and specific food groups*

	Total energy			Meals			Snacks		
	1977 to 1978	1989 to 1991	1994 to 1996	1977 to 1978	1989 to 1991	1994 to 1996	1977 to 1978	1989 to 1991	1994 to 1996
Age 2 to 18 years									
Salty snacks	2.2†‡	3.6†§	5.1‡§	1.4†‡	2.0†§	2.7‡§	7.6†‡	13.0†§	14.2‡§
Desserts	9.8†‡	9.0†§	9.6‡§	6.5†‡	5.6†	5.6‡	31.2‡	28.6§	24.9‡§
Candy	1.1†‡	1.4†§	2.1‡§	0.3†‡	0.6†§	0.6‡§	6.0†‡	6.5†§	7.8‡§
Soft drinks	3.0†‡	4.0†§	5.5‡§	2.2†‡	3.3†§	4.7‡§	7.7†‡	7.9†§	8.3‡§
Fruit drinks	1.8†‡	2.1†§	3.1‡§	1.6†‡	1.8†§	2.8‡§	3.4†‡	3.6†§	4.1‡§
Alcohol	0.1†	0.0†§	0.1§	0.0†‡	0.0†§	0.0‡§	0.4†‡	0.1†§	0.3‡§
French fries	1.7†‡	2.5†§	2.6‡§	1.9†‡	2.8†§	3.0‡§	0.5†‡	0.6†§	0.9‡§
Hamburgers	0.7†‡	0.9†§	0.6‡§	0.8†‡	1.0†§	0.8‡§	0.3‡	0.3§	0.2‡§
Cheeseburgers	0.3†‡	1.2†§	1.2‡§	0.3†‡	1.3†§	1.5‡§	0.1†‡	0.6†	0.4‡
Pizza	1.4†‡	3.2†§	3.4‡§	1.4†‡	3.5†§	3.9‡§	1.4‡	1.3§	1.7‡§
Mexican	0.4†‡	1.2†§	1.6‡§	0.4†‡	1.3†§	1.8‡§	0.1†‡	0.4†§	0.9‡§
Low- and medium-fat milk	14.1†‡	12.0†§	9.8‡§	14.2†‡	12.3†§	10.0‡§	13.5†‡	10.6†§	8.8‡§
Med- and high-fat beef and pork	8.9†‡	4.0†§	3.1‡§	10.0†‡	4.6†§	3.8‡§	1.2†‡	0.6†§	0.6‡§
High-fat lunchmeats and hot dogs	2.9†‡	2.1†§	2.1‡§	3.2†‡	2.4†	2.4‡	1.2†‡	0.8†§	0.9‡§
Other	51.7†‡	52.6†§	50.1‡§	55.6†‡	57.5†	56.5‡	25.4†‡	25.0†§	26.1‡§
Total	100	100	100	100	100	100	100	100	100
Total energy (kcal)	1840†‡	1778†§	1958‡§	1599†‡	1510†§	1549‡§	240†‡	267†§	409‡§
Age 19 to 39 years									
Salty snacks	1.8†‡	3.2†§	4.2‡§	1.3†‡	2.1†§	2.5‡§	5.8†‡	10.0†§	11.9‡§
Desserts	7.3†‡	6.8†§	7.0‡§	5.1†‡	4.2†§	4.3‡§	23.8†‡	23.6†§	19.7‡§
Candy	0.6†‡	0.9†§	1.3‡§	0.2†‡	0.3†§	0.3‡§	3.2†‡	5.3†§	5.7‡§
Soft drinks	4.1†‡	5.3†§	7.0‡§	3.1†‡	4.3†§	6.2‡§	10.9†‡	11.7†§	10.7‡§
Fruit drinks	1.0†‡	1.1†§	1.8‡§	0.9‡	0.9§	1.5‡§	1.8†‡	1.9†§	3.0‡§
Alcohol	2.6†‡	2.7†§	3.6‡§	1.6†‡	1.7†§	2.1‡§	10.0†‡	9.0§	10.6‡§
French fries	1.7†‡	2.2†§	2.5‡§	1.9†‡	2.4†§	2.9‡§	0.4†‡	0.6†§	0.8‡§
Hamburgers	0.9‡	0.9§	1.0‡§	1.0‡	1.0‡§	1.1‡§	0.4†	0.2†§	0.2
Cheesburgers	0.4†‡	1.6†§	1.7‡§	0.4†‡	1.7†§	1.9‡§	0.1†‡	0.7†§	0.7‡§
Pizza	1.3†‡	3.6†	3.1‡	1.3†‡	3.9†	3.4‡	1.7†‡	2.0†§	1.6‡§
Mexican	0.3†‡	1.2†§	1.9‡§	0.4†‡	1.3†§	2.1‡§	0.1†‡	0.6†§	0.8‡§
Low- and medium-fat milk	7.0†‡	5.9†§	4.6‡§	6.8†‡	5.7†§	4.3‡§	8.3†‡	6.7†§	5.9‡§
Medium- and high-fat beef and pork	11.7†‡	5.3†§	4.3‡§	13.1†‡	6.0†§	5.0‡§	2.0†‡	0.9†§	0.9‡§
High-fat lunchmeats and hot dogs	3.1†‡	1.9†§	1.9‡§	3.4†‡	2.1†§	2.2‡§	1.5†‡	0.9†§	0.8‡§
Other	56.1†‡	57.5†§	54.2‡§	59.6†‡	62.3†§	60.1‡§	30.2‡	25.9§	26.7‡§
Total	100	100	100	100	100	100	100	100	100
Total energy (kcal)	1855†‡	1940†§	2198‡§	1631†‡	1682†§	1811‡§	224†‡	258†§	387‡§
Age 40 to 59 years									
Salty snacks	1.4†‡	3.2†§	3.8‡§	1.0†‡	1.9†§	2.2‡§	5.3†‡	12.1†§	11.6‡§
Desserts	8.3†‡	7.6†§	8.9‡§	6.2†‡	5.3†§	5.5‡§	27.2†‡	23.7†§	26.5‡§
Candy	0.5†‡	0.8†§	1.4‡§	0.2†‡	0.3†§	0.4‡§	3.3†‡	4.5†§	6.6‡§
Soft drinks	1.9†‡	3.3†§	4.0‡§	1.5†‡	2.7†§	3.3‡§	5.6†‡	8.1†§	7.7‡§
Fruit drinks	0.6†‡	0.8†§	1.3‡§	0.5†‡	0.7†§	1.2‡§	0.9†‡	1.4†§	1.7‡§
Alcohol	2.4†‡	2.9†§	2.9‡§	1.5†‡	2.1†§	1.8‡§	10.1†‡	8.5†§	8.2‡§
French fries	1.2†‡	1.6†§	1.6‡§	1.3†‡	1.8†§	1.9‡§	0.1†‡	0.3†§	0.3‡§
Hamburgers	0.5†‡	0.6†§	0.7‡§	0.5†‡	0.7†§	0.8‡§	0.3†	0.0†§	0.1§
Cheeseburgers	0.2†‡	1.0†§	0.7‡§	0.2†‡	1.1†§	0.8‡§	0.0†‡	0.1†§	0.2‡§
Pizza	0.5†‡	2.1†§	1.7‡§	0.5†‡	2.2†	1.9‡	0.6†‡	1.1†§	0.5‡§
Mexican	0.2†‡	0.8†§	1.2‡§	0.2†‡	0.9†§	1.4‡§	0.0†‡	0.1†§	0.3‡§
Low- and medium-fat milk	5.4†‡	5.2†§	4.5‡§	5.1†‡	4.9†§	4.3‡§	8.4†‡	7.0†§	5.5‡§
Medium- and high-fat beef and pork	12.7†‡	5.5†§	4.4‡§	13.9†‡	6.1†§	5.1‡§	1.5†‡	1.0†	0.7‡

Table 3. continued.

	Total energy			Meals			Snacks		
	1977 to 1978	1989 to 1991	1994 to 1996	1977 to 1978	1989 to 1991	1994 to 1996	1977 to 1978	1989 to 1991	1994 to 1996
High-fat lunchmeats and hot dogs	3.0†‡	2.2†	2.0‡	3.2†‡	2.4†	2.2‡	1.5†‡	0.8†§	0.9‡§
Other	61.2†‡	62.4†§	60.9‡§	64.1†‡	66.9†§	67.2‡§	35.1†‡	31.4†§	29.0‡§
Total	100	100	100	100	100	100	100	100	100
Total energy (kcal)	1747†‡	1753§	1954‡§	1572†‡	1534†§	1632‡§	175†‡	219†§	323‡§
Age 60+ years									
Salty snacks	1.3†‡	1.9†§	2.6‡§	1.0†‡	1.2†§	1.4‡§	4.9†‡	8.4†§	9.5‡§
Desserts	9.3†‡	8.9†§	10.4‡§	7.5†‡	6.7†§	7.2‡§	30.3†‡	28.1†§	30.5‡§
Candy	0.4†‡	0.6†§	0.9‡§	0.1‡	0.2§	0.2‡§	3.3†‡	4.3†§	5.3‡§
Soft drinks	0.9†‡	1.6†§	1.8‡§	0.7†‡	1.3†§	1.4‡§	4.1†‡	4.7†§	4.1‡§
Fruit drinks	0.6†‡	0.8†§	1.1‡§	0.5†‡	0.7†§	0.9‡§	1.6†‡	1.9†§	2.2‡§
Alcohol	1.5‡	1.6§	1.9‡§	1.0†	0.9†§	1.2§	6.4†‡	7.7†§	6.1‡§
French fries	0.8‡	0.9§	1.0‡§	0.9‡	0.9§	1.1‡§	0.1†‡	0.2†§	0.2‡§
Hamburgers	0.2†‡	0.3†§	0.3‡§	0.2†‡	0.4†§	0.4‡§	0.0†‡	0.0†§	0.0‡§
Cheeseburgers	0.0†‡	0.3†§	0.3‡§	0.0†‡	0.4†§	0.3‡§	0.0†‡	0.0†§	0.1‡§
Pizza	0.2†‡	0.7†§	0.6‡§	0.2†‡	0.7†§	0.6‡§	0.3†‡	0.4†	0.3‡§
Mexican	0.1†‡	0.3†§	0.3‡§	0.1†‡	0.3†§	0.3‡§	0.0	0.0	0.1
Low- and medium-fat milk	6.5†‡	6.4†§	5.6‡§	6.2†‡	6.1†§	5.3‡§	10.8†‡	9.4†§	7.4‡§
Medium- and high-fat beef and pork	10.9†‡	4.5†§	3.9‡§	11.7†‡	4.9†§	4.5‡§	1.2†‡	0.4†§	0.4‡§
High-fat lunchmeats and hot dogs	2.5†‡	1.9†§	2.0‡§	2.7†‡	2.1†	2.1‡	0.8‡	0.5§	1.1‡§
Other	64.8†‡	69.3†	67.3‡	67.2†‡	73.4†§	72.9‡	36.3†‡	33.9†§	32.7‡§
Total	100	100	100	100	100	100	100	100	100
Total energy (kcal)	1619†	1574†§	1633§	1495†‡	1412†	1406‡	125†‡	162†§	228‡§
All Americans age ≥2 years									
Salty snacks	1.8†‡	3.1†§	4.1‡§	1.2†‡	1.9†§	2.4‡§	6.3†‡	11.1†§	12.3‡§
Desserts	8.6†‡	7.8†§	8.6‡§	6.1†‡	5.2†§	5.3‡§	27.7†‡	25.6†§	23.9‡§
Candy	0.7†‡	1.0†§	1.5‡§	0.2†‡	0.3†§	0.4‡§	4.2†‡	5.4†§	6.5‡§
Soft drinks	2.8†‡	4.0†§	5.2‡§	2.1†‡	3.2†§	4.4‡§	8.1†‡	9.0†§	8.6‡§
Fruit drinks	1.1†‡	1.2†§	1.9‡§	1.0†‡	1.1†§	1.7‡§	2.2†‡	2.3†§	3.0‡§
Alcohol	1.6†‡	1.9†§	2.3‡§	1.0†‡	1.2†§	1.4‡§	6.2†‡	6.1†§	6.5‡§
French fries	1.5†‡	1.9†§	2.1‡§	1.6†‡	2.2†§	2.4‡§	0.4†‡	0.5†§	0.6‡§
Hamburgers	0.7†‡	0.7†§	0.7‡§	0.7†‡	0.8†§	0.9‡§	0.3†‡	0.2†§	0.2‡§
Cheeseburgers	0.3†‡	1.2†§	1.2‡§	0.3†‡	1.3†§	1.3‡§	0.1†‡	0.5†§	0.4‡§
Pizza	1.0†‡	2.7†	2.5‡	1.0†‡	2.9†	2.8‡	1.3†‡	1.4†§	1.2‡§
Mexican	0.3†‡	1.0†§	1.4‡§	0.3†‡	1.1†§	1.6‡§	0.0†‡	0.4†§	0.6‡§
Low- and medium-fat milk	8.8†‡	7.4†§	6.0‡§	8.6†‡	7.3†§	5.8‡§	10.4†‡	8.2†§	6.9‡§
Medium- and high-fat beef and pork	10.9†‡	4.9†§	4.0‡§	12.1†‡	5.5†§	4.7‡§	1.5†‡	0.8†§	0.7‡§
High-fat lunchmeats and hot dogs	3.0†‡	2.0†	2.0‡§	3.2†‡	2.2†§	2.2‡§	1.3†‡	0.8†§	0.9‡§
Other	57.0†‡	59.0†§	56.5‡§	60.5†‡	63.8†	62.7‡§	30.0†‡	27.7†§	27.6‡§
Total	100	100	100	100	100	100	100	100	100
Total energy (kcal)	1791‡	1795§	1985‡§	1588†‡	1559†§	1634‡§	203†‡	236†§	351‡§

* Adjusted for age, sex, education level, ethnicity, region, urban classification, household size, and % poverty, $p \leq 0.01$.

† Significant difference between 1977 to 1978 and 1989 to 1991.

‡ Significant difference between 1977 to 1978 and 1994 to 1996.

§ Significant difference between 1989 to 1991 and 1994 to 1996.

Total Energy Percentages by Key Food Groups

Among the foods that we chose to examine, the largest increases were in consumption of salty snacks, soft drinks, and pizza. For 2- to 18-year-olds and 19- to 39-year-olds, the intake of salty snacks and pizza increased between 132% and 143% from 1977 to 1996. Furthermore, for these two age groups, soft drink consumption increased between 70% and 83% in this time period. During this time, 40- to 59-year-olds increased their salty snack intake by 280% and of soft drinks by 110%. The increases for the elderly were very small. Consumption of candy, fruit drinks, french fries, cheeseburgers, and Mexican food also increased for all age groups but only accounted for a small percentage of the total diet, and the changes over time were small. Low- and medium-fat milk and medium- and high-fat beef and pork consumption decreased substantially across all age groups, and high-fat luncheon meat and hot dog intake decreased slightly (Table 3).

For all Americans age 2 years and up, there were some overall differences in energy intake in snacks and meals with respect to key food items. In general, across all age groups for both snacks and meals, consumption of low- and medium-fat milk and desserts decreased. The other food groups with important trends, french fries, hamburgers, cheeseburgers, pizza, Mexican food, and medium- and high-fat beef and pork, were not important components of snacks but rather of meals. Overall, Americans increased their energy intake of french fries, hamburgers, cheeseburgers, pizza, and Mexican food as part of meals from 3.9% to 9% from 1977 to 1996. If one looks at the age patterns for these foods as a meal, 2- to 18- and 19- to 39-year-olds increased their intake from ~5% of energy to 9% to 11% of energy; the increases were much smaller for the other age groupings.

Sugared beverages (combined food group of fruit drinks and soft drinks) increased more for meals overall but played a larger role in snacks. Overall, Americans increased their consumption of sugared beverages as part of a meal from 3.1% to 6.1% and as part of a snack from 10.3% to 11.6%. Furthermore, sugared beverages were consumed more by younger age groups, 2- to 18-year-olds and 19- to 39-year-olds.

For snacks, the largest increases were in the salty snack category; overall, Americans increased their salty snack consumption as a snack from 6.3% to 12.3% over 20 years; however, for meals, these foods only increased from 1.2% to 2.4%. All age groups significantly increased their consumption of this group of foods.

Are there age-related differences in the trends? An important and interesting finding was the fact that although each age group increased its energy intake from certain locations as well as from certain key foods, the increase was in proportion to that of the other age groups. In Figures1 and 2, we present the age-adjusted relative shift in the energy consumed by selected food locations and selected food groupings from 1977 to 1996. These results were age-adjusted to the 1980 U.S. census age distribution of persons ≥2 years in the U.S. because of the significant shift in the age distribution of the population between the years of 1977 and 1996. These figures provide a sense of how the proportion of energy for the average American in 1977 changed for each age group in the subsequent 20 years. For instance, 2- to 18-year olds are consuming ~28% of their total energy intake from foods consumed at home, whereas 19- to 39-year-olds are consuming ~35%, 40- to 59-year-olds are consuming 21%, and the elderly are consuming 17%. This has remained remarkably constant over the past 20 years as has restaurant/fast-food consumption. For instance, the younger 2- to 18-year-olds consumed 27% and 28% of total at-home energy in 1989 and 1996, respectively. In other words, there was no shift in the relative proportion of energy consumed at home for this age group. It is important to note, however, that the total energy from at-home food increased for this 2- to 18-year-old age group, i.e., the total kilocalories consumed in 1977 and 1996 were 1839 and 1958 kilocalories, respectively. In all cases, the absolute energy changed over time; however, the percentage shifts in types of food and locations were very small.

We can also see that the 2- to 18-year-olds consumed 28% of all energy from the home but only 19% of all energy from restaurant and fast-food sources, whereas the proportions were much greater for the away-from-home category for 19- to 39-year-olds (24% of at-home and 51% of restaurant/fast-food energy; Figure 1).

Interestingly, if there was any shift in the types of foods consumed by the age groupings, there was a small shift away from those aged 2 to 18 toward those aged 19 to 39 with regard to the total proportion of the fast-food grouping of hamburgers, cheeseburgers, french fries, and pizza. Approximately 34% of salty snacks were consumed by 2- to 18-year-olds, and this has remained relatively constant for the past 20 years. This is also true for the other age groups in which another ~38% of salty snack calories were eaten by 19- to 39-year-olds, ~18% by 40- to 59-year-olds, and ~9% for 60-year-olds. This trend is further confirmed with other food categories, including a combined fruit drink and soft drink category and a combined fast-food category that includes hamburgers, cheeseburgers, french fries, and pizza (Figure 2).

In addition, the same age breakdowns for food location and food sources were examined for meaningful trends by sex, race, education, and income. The differences between-groups were very small and are not reported. The only very substantial difference was that men's intake of alcohol as a snack was much higher than that of women.

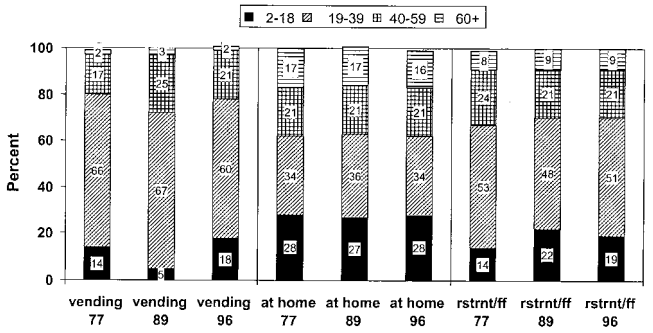

Figure 1: Trends in the proportion of food consumption for selected eating locations by age groups, 1977 to 1996.

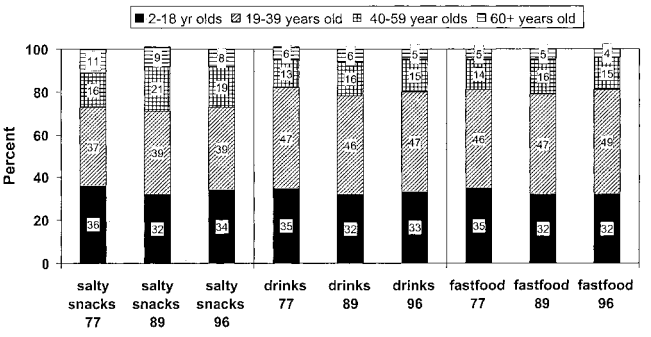

Figure 2: Trends in the proportion of food consumption for selected food groupings by age groups, 1977 to 1996.

Discussion

At a time of increased concern about a positive energy imbalance and the resulting increase in obesity, few studies have focused on trends in total energy intake and its sources. If the trends in total energy intake are to be believed, then Americans have increased their energy consumption over the past 20 years (4,12–14). Although there are many shortfalls in the methods used to collect dietary data and thus the possibility of measurement error exists, there is still much that can be obtained from the data that has been collected. Although there were major methodological differences in the survey methodologies for collecting dietary data for both the National Center for Health Statistics (NCHS) National Health and Nutrition Examination Survey and the USDA's CSFII, there is still some feeling that there has been a real increase in energy intake between 1989 and 1996 (14). This is further supported by the fact that underreporting has increased over time (19). Also there is no information in the U.S. to indicate systematic bias in reporting by eating location. Thus, we feel that the trends in eating behavior highlighted are still representative of those occurring among Americans.

The most significant trend is clearly the continued shift of our energy intake from home to away-from-home sources. Today the average American consumes <65% of his/her energy at home. Over the past 20 years the decline has been from 76.9% of energy consumed at home to 64.5%. The vast amount of this increase has been a more than doubling of the energy consumed at restaurants and fast-food establishments. Some age groups, such as young adults aged 19 to 39, consume close to 30% of their energy from restaurant and fast-food establishments. Older adults and the elderly consume much less. Many other scholars have reported similar shifts toward greater food consumption in restaurants and fast-food places (6–9).

At the same time there have been important changes in the foods consumed. As would be expected from the increase in restaurant and fast-food consumption, important increases have occurred in the proportion of the energy intake from pizza, cheeseburgers, and french fries. The largest shifts have been in energy from sugared beverages. The most important relative decreases have been in milk and meat products eaten alone. This reflects the important shift to higher-fat mixed-grain-based dishes (20,21). Another interesting point is that in 1996 all of the hamburgers and cheeseburgers that were consumed and 50% or more of the french fries that were consumed by all age groups were consumed in a restaurant or fast-food establishment. This means that few individuals are preparing at home certain items that can easily be obtained outside the home.

As would be expected when restaurants and fast-food establishments are where people go to get meals, there have also been increases in consumption of french fries, cheeseburgers, hamburgers, pizza, and Mexican food as meal items. Furthermore, it has been shown that for snacks, salty snacks as well as soft drinks are being consumed in greater quantities. In addition, store eaten out is the location that is increasing for snacks. This further confirms the assertion that the changes in food location and the changes in food items are not separate issues but really the same issue. One cannot look at these issues individually without missing part of the story behind why the changes are taking place. To completely understand the changes in the diets of Americans one needs to look at the diet from the perspective of both key foods and food location. This enables us to present the whole picture of how American diets are changing.

Our results contradict the general feeling that the major shifts in eating behavior are among the young. Although most nutritionists and many authors have felt that certain age groups were changing at a faster pace than others, specifically that adolescents and young adults were eating more fast-foods outside the home than middle-aged adults and the elderly, this is not the case (22,23). All age groups are increasing their energy intake from specific locations and for specific food items in proportion to one another. Although there are differences in the amounts of foods consumed and the location of foods consumed by age, these differences have remained constant over the past 20 years. This dispels the idea that certain age groups are increasing

their intake disproportionately (e.g., the explosion in intake of soft drinks or french fries was only for teenagers or other selected subpopulation groups). In other words, it has been shown that intake of foods eaten outside the home is increasing and contributes to increased energy intake and, possibly, the increase in obesity as well (4,24). Indeed, even so-called fast-foods such as burgers, french fries, and pizza are consumed more by the young and the middle-aged, but over time these age groups are still consuming the same proportion of these foods in 1996 as they were in 1977. This similarity of trends across all age groups also dismisses the idea of a cohort effect taking place. This raises a very important issue that our whole environment is changing, not just the actions of certain individuals.

It is apparent that people of all ages are making unhealthy choices both inside and especially outside the home, and this should be the focus of public health policies and interventions. Although there have been some positive changes, including decreased consumption of medium- and high-fat beef and pork, there seem to be many other components of the American diet that need to be changed. One important way of changing people's diets is to encourage them to eat at home more and to make healthier choices when eating out. Consumers need to be encouraged to eat more fruits and vegetables and fewer high-fat mixed-grain-based dishes. It is hoped that if consumers change their diets to include more healthful food choices inside and outside the home, the rise in obesity will be curbed along with the accompanying rise in chronic diseases (9,25).

Acknowledgments

This analysis was funded by the University of North Carolina at Chapel Hill. We thank Dan Blanchette for his programming assistance, Tom Swasey for graphics support, and Frances Dancy for support in administrative matters.

References

1. **Flegal KM, Carroll MD, Kuczmarski RJ, Johnson CL.** Overweight and obesity in the United States: prevalence and trends, 1960–1994; *Int J Obes Relat Metab Disord.* 1998;22:39–47.
2. **Troiano RP, Flegal KM, Kuczmarski RJ, Campbell SM, Johnson CL.** Overweight prevalence and trends for children and adolescents. The National Health and Nutrition Examination Surveys, 1963 to 1991. *Arch Pediatr Adolesc Med.* 1995;149:1085–91.
3. **Allison DB, Fontaine KR, Manson JE, Stevens J, VanItallie TB.** Annual deaths attributable to obesity in the United States. *JAMA.* 1999;282:1530–8.
4. **McCrory MA, Fuss PJ, Hays NP, Vinken AG, Greenberg AS, Roberts SB.** Overeating in America. Association between restaurant food consumption and body fatness in healthy adult men and women ages 19 to 80. *Obes Res.* 1999;7:564–71.
5. **Guthrie JF, Morton JF.** Food sources of added sweeteners in the diets of Americans. *J Am Diet Assoc.* 2000;100:43–51.
6. **Lin B, Frazao E, Guthrie J.** Away from home foods increasingly important to quality of American diet. *Agric Info Bull* 1999;749:1–22.
7. **Lin B, Guthrie J, Blaylock JR.** The diets of America's children: influence of dining out, household characteristics, and nutrition knowledge. *Agric Econ Report* 1996;746:1–37.
8. **Lin B, Frazao E, Guthrie J.** Contribution of away from home foods to American diet quality. *Fam Econ Nutr Rev.* 1999;12: 85–9.
9. **Clemens LH, Slawson DL, Klesges RC.** The effect of eating out on quality of diet in premenopausal women. *J Am Diet Assoc.* 1999;99:442–4.
10. **Jahns L, Siega-Riz AM, Popkin BM.** The increasing prevalence of snacking among U.S. children from 1977 to 1996. *J Pediatr.* 2001;138:493–8.
11. **Zizza C, Siega-Riz AM, Popkin BM.** Significant increase in young adults' snacking between 1977–1978 and 1994–1996 represents a cause for concern! *Prev Med.* 2001;32:303–10.
12. **Harnack L, Stang J, Story M.** Soft drink consumption among U.S. children and adolescents: nutritional consequences. *J Am Diet Assoc.* 1999;99:436–41.
13. **Cavadini C, Siega-Riz AM, Popkin BM.** U.S. adolescent food intake trends from 1965 to 1996. *Arch Dis Child.* 2000; 83:18–24.
14. **Anand RS, Basiotis P, Kennedy E.** Rise in amount of total fat and number of calories consumed by Americans. *FASEB J.* 1997;11:A183 (abstract).
15. **Tippett KS, Cypel YS.** Design and Operation. The Continuing Survey of Food Intakes by Individuals and the Diet and Health Knowledge Survey 1994–96. Continuing survey of food intakes by individuals 1994–96. Nationwide Food Surveys Report No. 96–98. Washington, DC: U.S. Department of Agriculture, Agriculture Research Service; 1997.
16. **Tippett KS, Mickle SJ, Goldman JD, Sykes KE, Cook DA, Sebastian RS.** Food and nutrient intakes by individuals in the United States, 1 day, 1989–91. Continuing survey of food intakes by individuals 1989–91. Nationwide Food Surveys Report No. 91–2.95. Washington DC: U.S. Department of Agriculture, Agriculture Research Service; 1995.
17. **Rizek, RL.** The 1977–78 Nationwide Food Consumption Survey. *Fam Econ Rev.* 2001;4:3–7.
18. **Popkin BM, Siega-Riz AM, Haines PS, Jahns L.** Where's the fat? Trends in U.S. 6 diets, 1965–1996. *Prev Med.* 2001; 32:245–54.
19. **Heitmann BL, Lissner L, Osler M.** Do we eat less fat, or just report so? *Int J Obes Relat Metab Disord.* 2000;24:435–42.
20. **Popkin BM, Haines PS, Reidy KC.** Food consumption trends of U.S. women: patterns and determinants between 1977 and 1985. *Am J Clin Nutr.* 1989;49:1307–19.
21. **Popkin BM, Siega-Riz AM, Haines PS.** A comparison of dietary trends among racial and socioeconomic groups in the United States. *N Engl J Med.* 1996;335:716–20.
22. **Thomas JA, Call DL.** Eating between meals—a nutrition problem among teenagers? *Nutr Rev.* 1973;31:137–9.
23. **Bigler-Doughten S, Jenkins RM.** Adolescent snacks: nutrient density and nutritional contribution to total intake. *J Am Diet Assoc.* 1987;87:1678–9.
24. **Binkley JK, Eales J, Jekanowski M.** The relation between dietary change and rising U. S. obesity. *Int J Obes Relat Metab Disord.* 2000;24:1032–9.
25. **Stockmyer C.** Remember when mom wanted you home for dinner? *Nutr Rev.* 2001;59:57–60.