

Current Research



Continuing Education Questionnaire, page S150
Meets Learning Need Codes 3000, 3020, 4000, and 4150

Average Portions of Foods Commonly Eaten by Infants and Toddlers in the United States

MARY KAY FOX, MEd; KATHLEEN REIDY, DrPH, RD; VATSALA KARWE, PhD; PAULA ZIEGLER, PhD, RD

ABSTRACT

Objectives To examine average portion sizes consumed per eating occasion by infants and toddlers. Average portions reported for toddlers were compared to average portions for comparably aged children reported in the 1994 to 1996 and 1998 Continuing Survey of Food Intakes by Individuals. In addition, reported average portions were compared with minimum required portion sizes for meals served to infants and toddlers in the Child and Adult Care Food Program (CACFP).

Design Data from 24-hour recalls collected in the 2002 Feeding Infants and Toddlers Study (FITS) were analyzed. Average portion sizes were determined for major food groups and individual foods that were reported by at least 5% of the population. Most foods were reported separately; however, sandwiches were disaggregated into their components. Gram weights of portions consumed were converted, on a food-by-food basis, to household units so that foods with different volume-to-weight ratios could be analyzed together.

Subjects/setting A national random sample of 3,022 US infants and toddlers 4 to 24 months of age.

Statistical analyses performed For each food and food group, average portion sizes per eating occasion were computed

for up to six age groups. An average per-eating occasion portion was determined for each child who consumed a given food by summing the total amount of food consumed over the day and dividing by the number of eating occasions. These estimates were then summed across all children who consumed the food and divided by the total number of consumers. The number of eating occasions was defined as the total number of times a child had anything to eat or drink during the day, excluding eating occasions that included only water and/or supplements.

Results For most foods, there was a gradual increase in the average portion as age increased. Average portions reported for FITS toddlers were consistent with those reported for comparably aged children in the most recent Continuing Survey of Food Intakes by Individuals. The average portions reported for FITS infants and toddlers were consistent with CACFP-recommended portion sizes for formula, juice, meats, and cheese. For milk (toddlers only), cereal, breads, fruits, and vegetables, average portions reported in FITS were consistently larger than CACFP portion sizes. Distributions showed that, in many cases, the per-eating occasion portion sizes of 50% to 90% of FITS infants and toddlers exceeded the CACFP portion sizes.

Conclusions Dietitians, pediatricians, and health educators can use the data presented in this article to provide guidance to parents and caregivers about reasonable portion sizes for infants and toddlers. The data should also be useful to those who plan meals for infants and toddlers in child care settings and to researchers studying dietary intakes of infants and toddlers. Advice about reasonable portion sizes should always be tempered with appropriate cautions about avoiding coercive "clean your plate" feeding practices. Parents and caregivers should be encouraged to offer infants and toddlers appropriate portions of healthful foods from the basic food groups, with a special emphasis on fruits, vegetables, and whole grains, and allow them to eat until they are satiated.

J Am Diet Assoc. 2006;106:S66-S76.

M. K. Fox is a senior researcher at Mathematica Policy Research, Inc, Cambridge, MA; at the time of the study, she was an independent consultant. K. Reidy is director of nutrition and regulatory affairs and P. Ziegler is an adjunct, assistant professor, Department of Foods and Nutrition, College of Saint Elizabeth, Morristown, NJ; at the time of the study, she was a principal scientist, Gerber Products Co, Parsippany, NJ. V. Karwe is senior programmer/analyst, Mathematica Policy Research, Inc, Princeton, NJ.

Address correspondence to: Mary Kay Fox, MEd, Senior Researcher, Mathematica Policy Research, Inc, 955 Massachusetts Ave, Cambridge, MA 02139. E-mail: mfox@mathematica-mpr.com

Copyright © 2006 by the American Dietetic Association.

0002-8223/06/10601-1011\$32.00/0

doi: 10.1016/j.jada.2005.09.042

Information on the average portions of food consumed by specific population groups is useful for a number of reasons. Such data are widely used in the development of food package labels and have also been used in devel-

oping food and nutrition policy, associated guidance and education materials, and in dietary assessment and counseling (1,2). Data on typical portion sizes are also commonly used to define “default” portions for nutrient analyses, and in the development of food frequency questionnaires (2).

The primary source of information on portion sizes has been national surveys of food consumption conducted by the US Department of Agriculture (USDA). Since 1975, the USDA has issued periodic reports on the amounts of food consumed by individuals per eating occasion and per day (2). However, data for infants and toddlers have been lacking. The most recent reports in this series, based on data collected in the 1989 to 1991 and 1994 to 1996 rounds of the Continuing Survey of Food Intakes by Individuals (CSFII) do not include data for infants or children under 2 years of age (1,3). The youngest age group for which data are reported is children 2 to 5 years old. To our knowledge, there have been no published reports of portion sizes consumed by infants, and only one report that included children less than 2 years of age. That report, published by McConahy and colleagues in 2002, used data from the 1977 to 1978 and 1994 to 1996 and 1998 CSFII for 1- and 2-year-old children, but did not report data separately by year of age (4). Data for a longitudinal sample of infants were also reported for 12, 15, and 18 months of age, but the sample was small (n=55).

This article is intended to fill this information gap by reporting average portion sizes consumed by infants and toddlers. The analysis uses data from the 2002 Feeding Infants and Toddlers Study (FITS), which collected dietary intake data on a stratified, random sample of infants and toddlers 4 to 24 months of age. Average portions reported for toddlers are compared with the average portions for 1- and 2-year-old children in the 1994 to 1996 and 1998 CSFII, as reported by McConahy and colleagues (4). In addition, average portion sizes for both infants and toddlers are compared with the minimum portion sizes required in the Child and Adult Care Food Program (CACFP), the USDA nutrition assistance program that provides funding for meals and snacks served to infants and children in eligible family child-care homes and child-care centers. Padgett and Briley (5) recently studied food consumption of preschool children in child-care centers in Texas and reported that the portion sizes required in CACFP meals were small, relative to the portion sizes recommended in the Food Guide Pyramid for Young Children (6). We were interested in how the portion sizes reported in FITS compare with the portion sizes used in CACFP guidelines for infant and toddler meals.

METHODS

Sample Design and Subjects

The 2002 FITS was sponsored by Gerber Products Company to update our knowledge of the food and nutrient intakes of infants and toddlers in the United States (7). FITS included a stratified random sample of infants between 4 and 24 months of age. The sample was drawn from Experian's New Parents Database, February to May 2002, Experian (Lincoln, NE) because it was judged to provide the greatest coverage of infants and toddlers.

Infants and toddlers were sampled in six age groups: 4 to 6 months, 7 to 8 months, 9 to 11 months, 12 to 14 months, 15 to 18 months, and 19 to 24 months. Infants 4 to 6 months of age and 9 to 11 months of age were oversampled because these two age groups typically experience significant transitions in infant feeding patterns and practices (from liquid diets to the addition of complementary foods, and from complementary foods to the addition of table foods, respectively). Sample weights were developed to adjust for oversampling, nonresponse, and undercoverage of some subgroups of children not included in the sample frame. A detailed overview of the FITS study design and sample is available elsewhere (7,8).

In this article (and others in this supplement), we have modified the reporting categories for the two youngest age groups, relative to the age groups that have been used in previous reports of FITS data (9-16). This change was made in response to recent clarifications about the intended age groups for infants in the Dietary Reference Intakes (DRIs) (17-22). The life-stage groups used in the DRIs define infancy as the period from birth through 12 months of age and “divide [it] into two 6-month intervals.” Thus, although some text and tables in the DRI reports refer to 0 to 6 months and 7 to 12 months, the actual intent is 0 through 5 months (0-5.99)—the first 6 months of life—and 6 through 11 months (6.0-11.99)—the second 6 months of life (Janice Rice Okita, PhD, RD, senior program officer, Food and Nutrition Board, Institute of Medicine, personal communication, June 7, 2005). For this reason, this article limits the youngest age group to infants 4 and 5 months old and includes infants 6 months of age in the second age group (6-11 months). The sample includes 3,022 infants, in the following age groups: 4 to 5 months (n=624), 6 to 8 months (n=708), 9 to 11 months (n=687), 12 to 14 months (n=371), 15 to 18 months (n=312), and 19 to 24 months (n=320).

Data Collection Methods

FITS data were collected by Mathematica Policy Research, Inc (Princeton, NJ). All data collection instruments and procedures were reviewed and approved by Mathematica Policy Research, Inc's institutional review board compliance officer and quality assurance system. Parents or primary caregivers of sampled infants and toddlers completed a single 24-hour dietary recall. All recalls were completed between March and July 2002. Trained interviewers conducted the 24-hour recalls over the telephone using the Nutrition Data System for Research (version 4.03, 2001, University of Minnesota Nutrition Coordinating Center, Minneapolis). An information packet was mailed to respondents a week to 10 days prior to the interview. The packet included a detailed two-dimensional booklet for use in reporting portion sizes. The booklet was designed specifically for FITS and was pilot-tested with mothers of infants and toddlers. It included graphic depictions, drawn to scale, of common infant feeding utensils, including eight popular “sippy” cups, four different spoons, and two different bowls. Also included were circles from 1 to 8 inches in diameter, for use in reporting the size of round foods such as cookies, pancakes, and hamburger patties, and a 5×5-inch grid for use in reporting square and rectangular foods, such as crackers and cheese, and for estimating thickness. For

Table 1. Average portion sizes per eating occasion of foods commonly consumed by infants from the 2002 Feeding Infants and Toddlers Study^a

Food group	Reference unit	4-5 Months (n=624)	6-8 Months (n=708)	9-11 Months (n=687)
<i>mean ± SEM^b</i>				
Formula				
Formula	fl oz	5.0±0.09	5.3±0.10	5.6±0.09
Formula, as a beverage	fl oz	5.1±0.09	5.4±0.09	5.6±0.09
Breads and grains				
Infant cereal, dry	tblsp	3.1±0.14	4.5±0.14	5.2±0.18
Infant cereal, jarred	tblsp	— —	5.6±0.26	7.4±0.34
Ready-to-eat cereal	tblsp	— —	2.3±0.34	3.4±0.21
Crackers	oz	— —	0.2±0.02	0.3±0.01
	saltine	— —	2.2±0.14	2.7±0.12
Bread	slice	— —	0.5±0.10	0.8±0.06
Fruits and juices				
All fruits	tblsp	3.6±0.19	4.7±0.11	5.8±0.17
Baby food fruit	tblsp	3.3±0.16	4.6±0.11	5.6±0.17
Baby food peaches	tblsp	3.6±0.37	4.4±0.26	5.3±0.36
Baby food pears	tblsp	3.5±0.46	4.5±0.21	6.0±0.40
Baby food bananas	tblsp	3.4±0.23	5.0±0.21	5.9±0.35
Baby food applesauce	tblsp	3.7±0.29	4.6±0.17	5.6±0.25
Canned fruit	tblsp	— —	4.5±0.59	4.8±0.25
Fresh fruit	tblsp	— —	5.3±0.52	6.4±0.37
100% juice	fl oz	2.5±0.17	2.8±0.11	3.1±0.09
Apple/apple blends	fl oz	2.7±0.22	2.9±0.13	3.2±0.11
Grape	fl oz	— —	2.6±0.19	3.1±0.21
Pear	fl oz	— —	2.6±0.29	3.1±0.28
Vegetables				
All vegetables	tblsp	3.8±0.20	5.8±0.16	5.6±0.20
Baby food vegetables	tblsp	4.0±0.20	5.9±0.16	6.6±0.21
Baby food green beans	tblsp	3.5±0.33	5.1±0.28	6.1±0.50
Baby food squash	tblsp	4.3±0.47	5.6±0.30	6.9±0.41
Baby food sweet potatoes	tblsp	4.3±0.31	6.1±0.34	7.2±0.69
Baby food carrots	tblsp	3.5±0.33	5.6±0.27	6.7±0.48
Cooked vegetables, excluding french fries	tblsp	— —	4.2±0.47	3.8±0.31
Deep yellow vegetables	tblsp	— —	3.2±0.59	3.2±0.39
Mashed potatoes	tblsp	— —	4.1±0.67	2.8±0.37
Green beans	tblsp	— —	3.2±0.62	5.0±0.61
Meats and other protein sources				
Non-baby food meats	oz	— —	0.9±0.16	0.8±0.05
Cheese	oz	— —	— —	0.7±0.05
Scrambled eggs	cup	— —	— —	0.2±0.02
Yogurt	oz	— —	— —	3.1±0.20
Baby food dinners	oz	2.9±0.24	3.3±0.09	3.8±0.11
Desserts and sweetened beverages				
Cookies	oz	— —	0.4±0.03	0.4±0.03
Baby food desserts	tblsp	— —	5.9±0.21	6.2±0.26
Sweetened beverages	fl oz	— —	2.5±0.23	2.9±0.22

^aDashes indicate that cell size was too small to generate a reliable estimate.

^bSEM=standard error of the mean.

statistical purposes, a random subsample of 703 respondents completed a second 24-hour dietary recall 3 to 10 days after the first recall, on a different day of the week. This second recall was used to generate estimates of usual energy and nutrient intake at the population level and was not used in this analysis. Additional details about collection, processing, and quality control of 24-hour recall data are reported elsewhere (7,8).

Analytic Methods

The methods used in estimating average portion sizes were designed to be as consistent as possible with those used in the previously mentioned USDA reports (1,3). Tabulations are based on data reported in the single 24-hour recall collected for all respondents. Reported foods were categorized into major and minor food groups, based on the one- and two-digit codes and item descriptions included in the Nutrition Data Systems for Research database. The food group classification system is described in detail elsewhere (10). Foods were selected for inclusion in this analysis based on the percentage of the population reporting the food. Only foods that were consumed by at least 5% of the total population were considered. This is consistent with the approach used in the USDA reports on portion size (1,3) and is designed to maximize statistical reliability of estimates for individual age groups. In most cases, foods were reported separately. Sandwiches were disaggregated so that breads and fillings could be grouped together with comparable foods that were reported separately. Similarly, omelets and scrambled egg mixtures were disaggregated so that the scrambled eggs in these mixtures could be considered with scrambled eggs reported separately. The most recent USDA reports on portion size (1,3) disaggregated other mixed foods “when the ingredient of the mixture would tend to be eaten in an amount equivalent to the portions reported separately.” This included, for example, pasta in spaghetti and rice in fried rice. We were unable to disaggregate these other mixed foods because the gram weights in component (recipe) files provided by the Nutrition Data System for Research database are not adjusted for moisture loss or gain during cooking. Breaded chicken was tabulated separately because we were unable to subtract the weight of the breading.

Infant formulas that were not ready-to-feed and dry infant cereals could be reported by respondents as separate ingredients (eg, dry powder and water) or as mixtures (eg, “formula, from powder, prepared”). For both formulas and cereals, the former type of reporting (separate ingredients) was most common. To ensure that all formulas were in a consistent form, linking codes were used to identify liquids that were mixed with dry powders or concentrates and weights of the individual items were summed to yield the weight of the prepared formula. The opposite approach was taken for dry infant cereals. Infant cereals that were reported as mixtures were disaggregated so the weight of the dry cereal could be counted together with the cereals that were reported separately.

The total number of eating occasions was defined as the total number of times a child ate during the day, excluding occasions that included only water and/or supplements. In some cases, a food was reported multiple times in one eating occasion. When this occurred, the amounts

Table 2. Portion sizes specified in CACFP^a menu planning requirements for meals served to infants

Food group	Age Group	
	4-7 Months	8-11 Months
Formula or breast milk	4-8 fl oz	6-8 fl oz
Dry infant cereal	0-3 tbspb	2-4 tbspb
Fruit, vegetables, or both ^c	0-3 tbspb	1-4 tbspb
Meat, fish, poultry, egg yolk, cooked dry beans or peas		1-4 tbspb

^aChild and Adult Care Food Program.
^bWhen the infant is developmentally ready to accept it.
^c100% juice is included in menu plans for snacks only and only for infants 8-11 months. The specified portion size is 2-4 fl oz.

were summed and the total was used as the amount consumed for that eating occasion. This occurred most often for milk and formula, which were consumed both as beverages and as additions to other foods, most often cereal. Linking codes were used to allow separate tabulation of portions consumed as beverages and portions added to cereal.

To facilitate interpretation and application of results, gram weights were converted, on a food-by-food basis, into units of common household measures (eg, tablespoons, cups, fluid ounces, slices) wherever possible. When this was not feasible (eg, for cooked meats), gram weights were converted to ounces. Separate tabulations were prepared for each of the six FITS age groups. Data are presented separately for infants (under 12 months) and toddlers (12-24 months) because the mix of foods consumed by the two groups is so different, ie, toddlers consume many table foods that younger infants do not consume. The tables present mean portions per age group. In virtually all cases, sample medians were comparable to means.

Statistical Analyses

Statistical Analysis Software (version 8.2, 2001, SAS Institute, Inc, Cary, NC) was used in preparing data. Data were analyzed using SUDAAN (version 9.0, 2004, Research Triangle Institute, Research Triangle Park, NC), incorporating appropriate sample weights and design effects. Mean portion sizes were computed for each age group and standard errors were also generated. We followed accepted reporting guidelines for nutrition data with respect to the reliability of point estimates (23). Average portion sizes are reported only for food group/age group cells that met minimum sample size requirements ($n > 25$) and had reliable point estimates (coefficient of variation $< 30\%$). Separate tables present data for infants (4-5 months, 6-8 months, and 9-11 months) and toddlers (12-14 months, 15-18 months, and 19-24 months).

Table 3. Average portion sizes per eating occasion of foods commonly consumed by toddlers: FITS^a 2002 and CSFII^b 1994-96, 1998

Food group	Reference unit	FITS 2002 ^a			CSFII 1994-96, 98 ^b
		12-14 Months (n=371)	15-18 Months (n=312)	19-24 Months (n=320)	12-36 Months (n=1,039)
		← mean ± SEM ^c →			
Milk and formula					
Formula	fl oz	5.7±0.27	5.9±0.69	4.7±0.98	
Formula, as a beverage	fl oz	6.1±0.26	5.7±0.76	4.9±0.99	
Milk	fl oz	5.6±0.14	5.9±0.14	6.2±0.17	6.4±0.22
Milk, as a beverage	fl oz	5.7±0.14	6.1±0.14	6.4±0.17	7.2±0.45
Milk, on cereal	fl oz	3.4±0.37	2.7±0.26	3.6±0.29	4.0±0.10
Breads and grains					
Bread	slice	0.8±0.04	0.9±0.05	0.9±0.05	1.0±0.04
Rolls	oz	0.9±0.11	1.0±0.10	0.9±0.15	
Ready-to-eat cereal	cup	0.3±0.02	0.5±0.03	0.6±0.04	0.7±0.03
Hot cereal, prepared	cup	0.6±0.05	0.6±0.05	0.7±0.05	
Crackers	oz	0.3±0.02	0.4±0.02	0.4±0.02	
	saltine	3.3±0.22	3.5±0.22	3.7±0.22	
Pasta	cup	0.4±0.04	0.4±0.04	0.5±0.05	0.7±0.04
Rice	cup	0.3±0.04	0.4±0.05	0.4±0.05	0.3±0.02
Pancakes and waffles	1 (4-in diameter)	1.0±0.08	1.4±0.21	1.4±0.17	
Fruits and juices					
All fruits	cup	0.4±0.02	0.5±0.03	0.6±0.03	
Canned fruit	cup	0.3±0.02	0.4±0.03	0.4±0.04	
Fresh fruit	cup	0.4±0.02	0.5±0.03	0.6±0.03	
Fresh apple	cup, slice	0.4±0.05	0.6±0.07	0.8±0.14	
	1 medium	0.3±0.04	0.5±0.06	0.6±0.11	0.5±0.03
Fresh banana	cup, slice	0.4±0.02	0.5±0.03	0.5±0.03	
	1 medium	0.6±0.03	0.7±0.03	0.7±0.04	0.7±0.01
Fresh grapes	cup	0.2±0.01	0.3±0.03	0.3±0.02	
100% juice	fl oz	3.7±0.15	5.0±0.20	5.1±0.18	5.9±0.19
Orange/orange blends	fl oz	3.3±0.38	4.5±0.33	5.2±0.35	
Apple/apple blends	fl oz	3.6±0.21	4.5±0.29	4.9±0.27	
Grape	fl oz	3.6±0.38	5.6±0.43	4.7±0.31	
Vegetables					
All vegetables	cup	0.4±0.02	0.4±0.03	0.4±0.02	
Cooked vegetables, excluding french fries	cup	0.3±0.03	0.3±0.03	0.3±0.02	
Deep yellow vegetables	cup	0.2±0.03	0.3±0.05	0.3±0.05	
Corn	cup	0.2±0.03	0.2±0.03	0.2±0.03	0.3±0.02
Peas	cup	0.2±0.02	0.2±0.02	0.2±0.02	
Green beans	cup	0.4±0.05	0.4±0.05	0.3±0.03	0.4±0.03
Mashed potatoes	cup	0.3±0.05	0.4±0.05	0.3±0.05	
Baked, boiled potatoes	cup	0.3±0.05	0.4±0.06	—	0.5±0.04
French fries	cup	0.4±0.05	0.6±0.05	0.6±0.05	0.8±0.04
Meats and other protein sources					
All meats	oz	1.2±0.06	1.3±0.08	1.3±0.07	
Beef	oz	0.8±0.08	1.2±0.15	1.2±0.14	1.4±0.11
Chicken or turkey, plain	oz	1.3±0.10	1.3±0.16	1.3±0.10	1.4±0.07
Hot dogs, luncheon meats, and sausages	oz	1.3±0.13	1.5±0.13	1.5±0.12	
Chicken, breaded ^d	oz	1.5±0.14	1.5±0.13	1.8±0.12	
	nugget	2.4±0.22	2.4±0.21	2.8±0.19	
Scrambled eggs	cup	0.2±0.02	0.3±0.03	0.3±0.02	
Peanut butter	tbsp	0.7±0.08	0.7±0.09	0.9±0.13	0.9±0.06
Yogurt	oz	3.4±0.19	3.8±0.26	3.8±0.28	4.7±0.28
Cheese	oz	0.8±0.05	0.8±0.05	0.7±0.04	0.8±0.04

(continued)

Table 3. Average portion sizes per eating occasion of foods commonly consumed by toddlers: FITS^a 2002 and CSFII^b 1994-96, 1998 (continued)

Food group	Reference unit	FITS 2002 ^a			CSFII 1994-96, 98 ^b
		12-14 Months (n=371)	15-18 Months (n=312)	19-24 Months (n=320)	12-36 Months (n=1,039)
← mean ± SEM ^c →					
Mixtures					
Macaroni and cheese	cup	0.5 ± 0.06	0.5 ± 0.04	0.6 ± 0.07	0.7 ± 0.04
Pizza	1/8 12-in pizza	1.0 ± 0.10	1.1 ± 0.14	1.3 ± 0.19	
Pasta with tomato sauce, meat, and/or cheese	cup	0.5 ± 0.08	0.5 ± 0.06	0.7 ± 0.08	0.9 ± 0.05
Soup	cup	0.4 ± 0.05	0.5 ± 0.07	0.5 ± 0.07	
Desserts, sweets, sweetened beverages, and salty snacks					
Cookies	oz	0.5 ± 0.03	0.5 ± 0.03	0.6 ± 0.03	
Frozen milk desserts and puddings	cup	0.3 ± 0.03	0.4 ± 0.04	0.3 ± 0.04	
Sweetened beverages	fl oz	4.6 ± 0.22	4.6 ± 0.21	5.0 ± 0.22	
Salty snacks	cup	0.3 ± 0.02	0.6 ± 0.10	0.5 ± 0.05	
Syrup, jam, jelly, preserves, honey	tbsp	0.5 ± 0.04	0.6 ± 0.07	0.7 ± 0.09	
Candy	oz	0.5 ± 0.08	0.7 ± 0.08	0.7 ± 0.07	

^aFITS=Feeding Infants and Toddlers Study. Dashes indicate that cell size was too small to generate a reliable estimate.

^bCSFII=Continuing Survey of Food Intakes by Individuals. As reported in McNahy KL, Smiciklas-Wright H, Birch LL, Mitchell DC, Picciano MF. Food portions are positively related to energy intake and body weight in early childhood. *J Pediatr.* 2002;140:340-347. Standard errors for household portions calculated from standard errors reported for gram weights.

^cSEM=standard error of the mean.

^dNot included in total for all meats because weight includes breeding.

RESULTS

Average Portion Sizes per Eating Occasion: Infants

Table 1 shows average portion sizes per eating occasion for foods commonly consumed by infants. With the exception of meats and other protein sources, the table is limited to foods for which the sample size was adequate to produce reliable estimates for at least two of the three age groups.

The two younger groups of infants consume about 5 fl oz of formula at a feeding; the oldest infants consume closer to 6 fl oz. Most formula is consumed as a beverage, so the average portion sizes for all formula (including formula that may have been mixed into dry cereal or other foods) and for formula consumed as a beverage are essentially the same. On average, infants 4 and 5 months of age consume 3 tbsp of dry infant cereal per feeding and infants 6 to 11 months consume about 5 tbsp. The average portion size reported for all types of fruit is about 4 tbsp for infants 4 and 5 months. Average portion sizes increase by about 1 tbsp for each of the successive older age groups (ie, to 5 and 6 tbsp, respectively, for infants 6 to 8 months and 9 to 11 months). The average portion size for 100% juice is approximately 3 fl oz for all infants.

On average, infants 4 and 5 months consume 4 tbsp of vegetables per feeding, while infants 6 to 11 months consume about 6 tbsp. Average portions for baby food vegetables were consistently larger than average portions for cooked non-baby food vegetables. Baby food meats were consumed so infrequently (10) that reliable esti-

mates of average portion sizes could not be generated. Several other protein sources were consumed so infrequently by infants less than 9 months that reliable estimates could only be generated for infants 9 to 11 months. A previous FITS analysis showed that caregivers of younger infants are more likely to feed commercial baby food dinners than plain, baby food meats, or other protein sources (10). The average portion size for non-baby food meats is about 1 oz for 6 to 11 months. The average portion size for cheese, available for 9 to 11 months only, is 0.7 oz. Average portions for scrambled eggs and yogurt, for 9 to 11 months, are 0.2 cups and 3.1 oz, respectively, and average portions for commercial baby food dinners ranged from about 3 to 4 oz.

Comparison with CACFP Portion Size Guidelines. Table 2 summarizes minimum portion size requirements for infant meals planned in the CACFP (24). All portion sizes are specified as ranges. CACFP guidance materials indicate that the specified portions are guidelines only and that caregivers need to be sensitive to infants' hunger and satiety as well as to their readiness for solid foods. For meals to be reimbursable, the minimum portions must be offered but all of the food does not have to be consumed.

Portion sizes reported for FITS infants are generally consistent with the CACFP portion size guidelines for formula and juice. For formula (as a beverage), the average portion reported in FITS for infants 4 and 5 months and infants 6 to 8 months is 1 oz smaller than the midpoint of the CACFP portion size range for infants 4 to 7

months. Moreover, distributions of portion sizes reported in FITS (not shown) indicate that the CACFP portion size range covers all but the bottom 10% of portions reported in FITS for infants 4 to 8 months. The average portion size reported in FITS for infants 9 to 11 months is at the lower end of the existing CACFP range for infants 8 to 11 months. FITS distributions indicate that 50% of 9- to 11-month-olds consumed less than 6 fl oz of formula at a feeding (range from about 4 to 5 fl oz). The higher end of the CACFP portion size range is equivalent to the average FITS portion at the 90th percentile (data not shown). The CACFP only allows juice to be served as part of a snack and only for infants 8 to 11 months. The mid-point of the specified portion size range is exactly the same as the average portion size reported in FITS.

For dry infant cereal, fruits, and vegetables, the average portion sizes reported in FITS are substantially larger than the mid-points of the ranges specified in the CACFP requirements. For dry infant cereal, the average portion sizes reported in FITS are 50% larger than the mid-points of the CACFP portion size ranges (assuming an effective range of 1 to 3 tbsp for infants 4 to 7 months). Distributions of portion sizes reported in FITS indicate that the higher end of the CACFP portion size range is equivalent to the average portion size reported at the 50th percentile of the distribution for infants 4 and 5 months and to the average portion size reported at the 30th percentile of the distribution for infants 6 to 8 months (data not shown). This means that, on average, 50% of 4- and 5-month-olds and 70% of 6- to 8-month-olds consumed portions of dry infant cereal that were larger than the high-end of the CACFP portion size range. For older infants, the disparity between the CACFP portion size range and the average portion reported in FITS is even greater. The average portion size reported in FITS for infants 9 to 11 months exceeds the high end of the CACFP portion size range for infants 8 to 11 months.

A similar pattern is noted for fruits and vegetables. Reported average portion sizes in FITS are considerably larger than the mid-points of the CACFP portion size ranges. In fact, for both fruits and vegetables, the average portion sizes reported in FITS exceed the high end of the CACFP portion size ranges. For fruits, the high end of the CACFP portion size ranges are smaller than the portion sizes reported at the 50th, 30th, and 40th percentiles of the distributions for infants 4 and 5 months, 6 to 8 months, and 9 to 11 months, respectively. For vegetables, the high end of the CACFP ranges are smaller than the portions reported at the 50th, 20th, and 50th percentiles of these distributions (data not shown).

Meats and other protein sources are included only in the CACFP meal pattern for infants 8 to 11 months. The minimum portion size is expressed as tablespoons of meat, fish, poultry, and egg yolks. The FITS data were tabulated in ounces, so comparisons are not straightforward. For purposes of this discussion, we use chicken as an example. One tablespoon of chopped or diced chicken, the most frequently reported non-baby food meat, weighs about 0.3 oz and 4 tbsp weighs about 1.2 oz. Thus, the average portion reported in FITS for non-baby food meat consumed by infants 9 to 11 months approximates the mid-point of this range (0.75 oz). The computed range of 0.3 oz to 1.2 oz is equivalent to portions reported at the

20th percentile and somewhere between the 70th and 80th percentile of the FITS distribution.

Average Portion Sizes per Eating Occasion: Toddlers

Table 3 shows average portion sizes per eating occasion for foods commonly consumed by toddlers. The table is limited to foods for which the sample size was adequate to produce reliable estimates for at least two of the three age groups. The table also includes average portions reported in CSFII 1994 to 1996 and 1998, as reported by McConahy and colleagues (4). Direct comparisons cannot be made between FITS and the CSFII because of differences in age groups (12 to 24.0 months vs 12 to 35.9 months). It is possible, however, to draw conclusions about the relative consistency of data from the two surveys by examining trends observed in the FITS data across age groups and whether these trends appear to continue in the older children included in the CSFII data. This comparison reveals that the portion sizes reported for FITS toddlers are quite consistent with the portion sizes reported in the CSFII. For example, the upward trend in the portion size for milk consumed as a beverage that is apparent in the FITS data continues in the CSFII data, which include older children—up to 36 months of age. On the other hand, the portion size for milk on cereal, which one would expect to be more stable, is consistent in the two surveys. In addition, the relative stability in portion sizes that would be expected based on the FITS data is observed in the CSFII data, eg, for bread, rice, fresh banana, and beef. For other foods, the portion sizes reported in CSFII, are largely consistent with or slightly greater than the FITS portions for infants 19 to 24 months.

For both formula and milk, consumed as beverages, the average portion size reported in FITS is about 6 fl oz for toddlers 12 to 14 months and 15 to 18 months. Among older toddlers (19-24 months), the average portion of milk remains essentially the same, but the average portion of formula decreases to 5 fl oz. The average portion size for milk added to cereal is 3 to 4 fl oz for all age groups. For most breads and grains, average portion sizes are consistent for all three groups of toddlers: 1 slice of bread, a 1 oz roll, about $\frac{2}{3}$ cup hot cereal, 3 to 4 crackers, roughly $\frac{1}{2}$ cup pasta, and about $\frac{1}{3}$ cup rice. For ready-to-eat cereals and pancakes, the average portion sizes for infants 12 to 14 months are smaller than those for infants 15 to 24 months. Toddlers 12 to 14 months consume about $\frac{1}{3}$ cup of ready-to-eat cereal and about one 4-inch diameter pancake, on average, compared with about $\frac{1}{2}$ to $\frac{2}{3}$ cup cereal and closer to 1 $\frac{1}{2}$ pancakes for toddlers 15 to 24 months.

For all toddlers, the average portion size for fruit approximated $\frac{1}{2}$ cup; the average portion for 12 to 14 months was slightly smaller and the average portion for 19 to 24 months was slightly larger. The average portion for 100% juice is 4 fl oz for 12 to 14 months and 5 fl oz for 15 to 24 months. Average portions for all types of vegetables combined were consistent across age groups, at about $\frac{1}{2}$ cup. However, the data on average portions for specific types of vegetables show that average portions for many cooked vegetables are actually closer to $\frac{1}{4}$ to $\frac{1}{3}$ cup. The overall average is influenced by the vegetables that were consumed most frequently. For all three groups of toddlers, the two most frequently consumed vegetables were french fries and green beans [french fries were the

Table 4. Portion sizes specified in CACFP^a menu planning requirements for meals served to toddlers ages 1 and 2 years

Food group	Portion size
Fluid milk	1/2 cup
Fruit, 100% juice ^b , or vegetable	1/4 cup
Bread and grains	
Bread	1/2 slice
Cornbread, biscuit, roll, muffin	1/2 serving
Cold dry cereal	1/4 cup
Hot cooked cereal	1/4 cup
Pasta, noodles, grains	1/4 cup
Meats and meat alternates	
Meat, poultry, fish	1 oz
Cheese	1 oz
Egg	1/2
Peanut butter	2 tbsp
Yogurt	4 oz

^aCACFP=Child and Adult Care Food Program.
^b100% juice can be used to provide only 1/2 the required amount at lunch and dinner. For breakfast, 100% juice can be used for the full amount.

second most common vegetable for toddlers 12-14 months and the leading vegetable for the two older groups of toddlers (10)]. As Table 3 illustrates, in many instances average portion sizes of french fries were two to three times as large as average portion sizes of other vegetables. When french fries are excluded from the calculation of the average portion size for vegetables, the overall average is about 1/3 cup.

For all three groups of toddlers, the average portion size for meat, fish, and poultry is about 1 oz. On average, toddlers 12 to 18 months consume the equivalent of 2 to 2.5 chicken nuggets, while toddlers 19 to 24 months consume the equivalent of about 3 nuggets. Average portions for alternative protein sources are about 1/4 to 1/3 cup scrambled egg, 3/4 to 1 tbsp peanut butter, 3 to 4 oz yogurt, and about 1 oz of cheese. For infants 12 to 18 months, average portions for frequently consumed mixed dishes are about 1/2 cup for macaroni and cheese, pasta with tomato sauce, and soup, and about 1 slice of pizza (1/8 of a 12-inch pizza). Average portions for infants 19 to 24 months are closer to 2/3 cup for macaroni and cheese and 3/4 cup for pasta with tomato sauce.

Finally, for all groups of toddlers, approximate average portions for sweets, salty snacks, and desserts are about 1/2 oz of cookies (equivalent to about 3 arrowroot cookies or about 1.5 sandwich cookies), 1/3 cup ice cream/ice milk/frozen yogurt or pudding, 5 fl oz of sweetened beverages (fruit drinks [most common] and carbonated sodas), 1/3 to 2/3 cup salty snacks, 1/2 to 3/4 tsp syrup/jam/jelly/preserves/honey, and 1/2 to 3/4 oz candy.

Comparison with CACFP Portion Size Guidelines. Table 4 shows the minimum portion sizes required for toddler meals planned in the CACFP (25). For toddlers, a single portion size is specified rather than a range (CACFP guidelines also specify minimum portions for children ages 3-5 years and 6-12 years). With the exception of meats and cheese, the average portion sizes reported for FITS toddlers are larger than the CACFP portion sizes. For milk, the

CACFP portion size is 33% smaller than the average portion reported (as a beverage) in FITS. Only about 20% of toddlers 12 to 14 months consumed portions of milk that, on average, were equivalent to or smaller than the CACFP portion and only about 10% of toddlers 19 to 24 months did so (data not shown). Data from CSFII 1994 to 1996 and 1998 (Table 3) suggest that the disparity between actual portions and the CACFP portion size is even larger for older toddlers.

CACFP portion sizes for breads and grains are also smaller than the average portions observed in FITS and in the CSFII. Distributions of FITS average portion sizes indicate that, for all breads and grains, 50% to 90% of toddlers consumed average portions that were larger than the CACFP portion sizes (data not shown). Data from CSFII 1994 to 1996 and 1998 suggest that, for some foods, the discrepancy between actual portions and CACFP portions is even larger for older toddlers.

The situation is comparable for fruits and vegetables. Average portion sizes for fruits, juice, and vegetables in FITS were approximately double the minimum portion size specified in CACFP menu planning guidelines. (Note that none of the 0.3 cup portions shown in Table 3 were rounded up from numbers between 0.25 and 0.29). As mentioned above, the average portion size of vegetables is influenced by french fries. When french fries are excluded from the analysis, the FITS average portion size for vegetables is still larger than the CACFP portion size.

The average portion sizes reported in FITS for meat, poultry, fish, and cheese are consistent with the minimum portions required in the CACFP. The one instance in which the CACFP portion size exceeds the average portion size reported in FITS is peanut butter. In FITS, fewer than 10% of toddlers consumed a portion of peanut butter at an eating occasion that was equivalent to or greater than the CACFP portion size (data not shown).

DISCUSSION

To our knowledge, this article is the first to present data on average portions consumed by infants and toddlers based on a national sample. These data should be useful to dietetics professionals in a number of different settings. Food guidance for children 2 years of age and older is plentiful. For infants and toddlers, however, guidance is less available and tends to be much more general. The rule of thumb that toddlers should be served "one Tbsp for each year of age" is frequently cited (26,27). While this rule may apply to the introduction of new foods, the FITS data indicate that this is not a realistic guideline for parents to use in determining reasonable portion sizes for routinely eaten foods. Moreover, research has shown that most people are unaware of what constitutes an appropriate portion size and do not notice variations in portion size (28,29). Birch and Davison (30) have suggested that providing parents with reasonable guidelines about portion sizes is an important strategy for avoiding development of coercive child feeding practices that may ultimately contribute to a diminished capacity to regulate energy intake.

In addition to providing descriptive data on portion sizes, we examined the extent to which the portion sizes specified in CACFP meal planning regulations reflect the portions actually being consumed by infants and toddlers

at an eating occasion. This assessment revealed that the minimum portions currently included in CACFP meal planning regulations are not entirely consistent with the portions actually being consumed by infants and toddlers. For infants, the CACFP portions are consistent with the average portions reported in FITS for formula, juice, and meats. For toddlers, the CACFP portions for meat and cheese are consistent with average portions observed in FITS, but the CACFP portion size for peanut butter is high, relative to the portions reported in FITS. For both infants and toddlers, the average portions reported in FITS for cereals, other breads/grains, fruits, and vegetables, are larger than the CACFP portion sizes.

Consistency between recognized nutrition standards, national nutrition goals, and menu planning guidelines for food assistance programs is an important goal.

It is important to recognize that the CACFP portions are described as minimum required portions. Caregivers are free to serve larger portions to children who want more food. A national study of the CACFP that included observations of the amounts of food served to and consumed by children found that the average portions of food actually served to toddlers 1 to 2 years of age ($n=312$) were larger than the specified minimum portions (infants were not included in the sample) (31).

With the advent of the DRIs (17-22) and the recent release of revised *Dietary Guidelines for Americans* (32) and the MyPyramid food guidance system (33), policy makers may be reexamining existing meal planning requirements. Padget and Briley (5) have pointed out that the CACFP portion sizes specified for children ages 3 to 5 are consistently smaller than the portion sizes recommended in the Food Guide Pyramid for Young Children. Other researchers have shown that meals served to young children in child care may supply inadequate amounts of energy, iron, zinc, and magnesium (31,34,35). Consistency between recognized nutrition standards, national nutrition goals, and menu planning guidelines for food assistance programs is an important goal. Given that 61% of the 19 million US children under the age of 5 are enrolled in some form of child care on a regular basis, child-care homes and centers provide an ideal environment in which to nurture the development of healthful eating habits (36). The portion sizes presented in this report may be useful in developing menu planning guidelines for child-care centers and homes that will help infants and toddlers achieve desired levels of intake, particularly of fruits, vegetables, and wholesome grains. Such menu planning guidelines can increase the likelihood that meals served in child-care settings provide adequate amounts of energy and essential nutrients and promote food consumption patterns among older infants and toddlers that are consistent with the *Dietary Guidelines for Americans* (32) and the MyPyramid food guidance system (33). The detailed recommendations in-

cluded in these guidelines are oriented toward children 2 years of age and older and some of the recommendations, eg, limiting energy and fat, are not appropriate for infants and younger toddlers. However, the basic tenets of the recommended eating pattern, which emphasize consumption of whole grains, fruits, and vegetables, are appropriate for older infants who are consuming solid foods and for 1-year-olds. Moreover, previous analyses of FITS data revealed that the poor dietary habits the *Dietary Guidelines for Americans* and MyPyramid are designed to address are emerging at very young ages (10,12).

LIMITATIONS

This study has some limitations that should be acknowledged. First, all of our data were self-reported. Caregivers may have over- or underreported intakes. There is reason to believe that overreporting was more common than underreporting, particularly for infant formula (7). However, mean energy intakes of FITS toddlers are consistent with mean energy intakes reported for 1-year-olds in CSFII 1994 to 1996 and 1998 (37) and the Third National Health and Nutrition Examination Survey (38) and, as shown, the portion sizes reported in FITS are consistent with the portion sizes reported in CSFII 1994 to 1996 (4). Thus, if overreporting is present, it appears to be comparable to that observed in national nutrition monitoring surveys. Second, analyses are based on intake of foods during a single 24-hour period rather than "usual" food intake. Methods for estimating usual food intake are limited and cannot be applied to detailed food groups. Moreover, there is some evidence to suggest that there is less day-to-day variation in dietary intake among infants and toddlers than among older children and adults (39).

CONCLUSIONS

Dietetics professionals, pediatricians, and health educators can use the data presented in this article to provide guidance to parents and caregivers about reasonable portion sizes for infants and toddlers. The data should also be useful to those who plan meals for infants and toddlers in child-care settings and to researchers studying dietary intakes of infants and toddlers. Advice about reasonable portion sizes should always be tempered with appropriate cautions about avoiding coercive feeding practices, such as admonitions to "clean your plate" and overrestriction of intake prompted by fears that children are overeating. Parents and caregivers should be encouraged to offer infants and toddlers appropriate portions of healthful foods from the basic food groups, with a special emphasis on fruits, vegetables, and whole grains, and allow them to eat until they are satiated.

This research project was funded by Gerber Products Company. This research project was a collaborative effort among Mathematica Policy Research, Inc staff (author Karwe), consultant Fox, and staff (authors Reidy and Ziegler) for the Gerber Products Company.

The opinions or views expressed in this supplement are those of the authors and do not necessarily reflect the opinions or recommendations of Gerber.

References

1. Smiciklas-Wright H, Mitchell DC, Mickle SJ, Cook AJ, Goldman, JD. Foods Commonly Eaten in the United States: Quantities Consumed Per Eating Occasion and in a Day, 1994-1996. 2002. US Department of Agriculture NFS Report No. 96-5, prepublication version. Available at: www.barc.usda.gov/bhnrc/foodsurvey/Products9496.html. Accessed September 2004.
2. Smiciklas-Wright H, Mitchell DC, Mickle SJ, Goldman JD, Cook AJ. Foods commonly eaten in the United States, 1989-1991 and 1994-1996: Are portion sizes changing? *J Am Diet Assoc.* 2003;103:41-47.
3. Krebs-Smith SM, Guenther PM, Cook A, Thompson FE, Cucinelli J, Udler J. *Foods Commonly Eaten in the United States: Quantities Consumed Per Eating Occasion and in a Day, 1989-1991*. Hyattsville, MD: US Department of Agriculture, Agricultural Research Service; 1997. NFS Report No. 91-3.
4. McConahy KL, Smiciklas-Wright H, Birch LL, Mitchell DC, Picciano MF. Food portions are positively related to energy intake and body weight in early childhood. *J Pediatr.* 2002;140:340-347.
5. Padget A, Briley M. Dietary intakes at child-care centers in central Texas fail to meet Food Guide Pyramid recommendations. *J Am Diet Assoc.* 2005;105:790-793.
6. US Department of Agriculture Center for Nutrition Policy and Promotion. Food Guide Pyramid for Young Children. 1992. Available at: www.cnpp.usda.gov. Accessed June 2005.
7. Devaney B, Kalb L, Briefel R, Zavitsky-Novak T, Clusen N, Ziegler P. Feeding Infants and Toddlers Study: Overview of the study design. *J Am Diet Assoc.* 2004;104(suppl 1):S8-S13.
8. Ziegler P, Briefel R, Clusen N, Devaney B. Feeding Infants and Toddlers Study (FITS): Development of the FITS survey in comparison to other dietary survey methods. *J Am Diet Assoc.* 2006;106(suppl 1):S12-S27.
9. Devaney B, Ziegler P, Pac S, Karwe V, Barr SI. Nutrient intakes of infants and toddlers. *J Am Diet Assoc.* 2004;104(suppl 1):S14-S21.
10. Fox MK, Pac S, Devaney B, Jankowski L. Feeding Infants and Toddlers Study: What foods are infants and toddlers eating? *J Am Diet Assoc.* 2004;104(suppl 1):S22-S30.
11. Briefel R, Reidy K, Karwe V, Devaney B. Feeding Infants and Toddlers Study: Improvements needed in meeting infant feeding recommendations. *J Am Diet Assoc.* 2004;104(suppl 1):S31-S37.
12. Skinner JD, Ziegler P, Ponza, M. Transitions in infants' and toddlers' beverage patterns. *J Am Diet Assoc.* 2004;104(suppl 1):S45-S50.
13. Carruth BR, Ziegler P, Gordon A, Hendricks K. Developmental milestones and self-feeding behaviors in infants and toddlers. *J Am Diet Assoc.* 2004; 104(suppl 1):S51-S56.
14. Carruth BR, Ziegler P, Gordon A, Barr S. Prevalence of picky eaters among infants and toddlers and their caregivers' decisions about offering a new food. *J Am Diet Assoc.* 2004;104(suppl 1):S57-S64.
15. Skinner JD, Ziegler P, Pac S, Devaney B. Meal and snack patterns of infants and toddlers. *J Am Diet Assoc.* 2004;104(suppl 1):S65-S70.
16. Ponza M, Devaney B, Ziegler P, Reidy K, Squatrito C. Nutrient intakes and food choices of infants and toddlers participating in WIC. *J Am Diet Assoc.* 2004; 104(suppl 1):S71-S79.
17. Institute of Medicine. Food and Nutrition Board. *Dietary Reference Intakes: Calcium, Phosphorus, Magnesium, Vitamin D, Fluoride*. Washington, DC: National Academy Press; 1999.
18. Institute of Medicine. Food and Nutrition Board. *Dietary Reference Intakes for Vitamin C, Vitamin E, Selenium, and Carotenoids*. Washington, DC: National Academy Press; 2000.
19. Institute of Medicine. Food and Nutrition Board. *Dietary Reference Intakes for Thiamin, Riboflavin, Niacin, Vitamin B₆, Folate, Vitamin B₁₂, Pantothenic Acid, Biotin, and Choline*. Washington, DC: National Academy Press; 2000.
20. Institute of Medicine. Food and Nutrition Board. *Dietary Reference Intakes: Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium, and Zinc*. Washington, DC: National Academy Press; 2002.
21. Institute of Medicine. Food and Nutrition Board. *Dietary Reference Intakes: Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids*. Washington, DC: National Academy Press; 2002.
22. Institute of Medicine. Food and Nutrition Board. *Dietary Reference Intakes for Water, Potassium, Sodium, Chloride, and Sulfate*. Washington, DC: National Academy Press; 2004.
23. Life Sciences Research Office, Federation of American Societies for Experimental Biology. *Third Report on Nutrition Monitoring in the United States: Volumes 1 and 2*. Washington, DC: US Government Printing Office; 1995.
24. US Department of Agriculture, Food and Nutrition Service. CACFP Infant Meal Pattern. Available at: www.fns.usda.gov/cnd/care/ProgramBasics/Meals. Accessed April 15, 2005.
25. US Department of Agriculture, Food and Nutrition Service. Child Care Meal Pattern. Available at: www.fns.usda.gov/cnd/care/ProgramBasics/Meals. Accessed April 15, 2005.
26. American Dietetic Association. Feeding Infants and Toddlers Under Two Years. 2005. Available at: www.eatright.org/Public/NutritionInformation. Accessed May 10, 2005.
27. American Academy of Pediatrics. *Pediatric Nutrition Handbook*. 5th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2004.
28. Young LR, Nestle M. Variation in perceptions of a "medium" food portion: Implications for dietary guidance. *J Am Diet Assoc.* 1998;98:458-459.
29. Young LR, Nestle M. Portion sizes in dietary assessment: Issues and policy implications. *Nutr Rev.* 1995; 53:149-158.
30. Birch LL, Davison KK. Family environmental factors influencing the developing behavioral controls of food intake and childhood overweight. *Pediatr Clin North Am.* 2001;48:893-907.
31. Fox MK, Glantz FB, Geitz L, Burstein N. *Early*

- Childhood and Child Care Study: Nutritional Assessment of the CACFP, Final Report, Vol. 11.* Report submitted by Abt Associates Inc to the US Department of Agriculture; 1997.
32. US Department of Agriculture, US Department of Health and Human Services. *Nutrition and Your Health: Dietary Guidelines for Americans.* 5th ed. Washington, DC: US Government Printing Office; 2005.
 33. US Department of Agriculture. MyPyramid: Steps To A Healthier You. 2005. Available at: <http://www.mypyramid.gov>. Accessed June 6, 2005.
 34. Roberts SB, Heyman MB. Micronutrient shortfalls in young children's diets: Common, and owing to inadequate intakes both at home and at child care centers. *Nutr Rev.* 2000;58:27-29.
 35. Wu Y, Hertzler A, Miller S. Vitamin A, vitamin C, calcium and iron content of federally funded preschool lunches in Virginia. *J Am Diet Assoc.* 2001; 101:348-351.
 36. American Dietetic Association. Position of the American Dietetic Association: Benchmarks for Nutrition Programs in Child Care Settings. *J Am Diet Assoc.* 2005;105:979-986.
 37. US Department of Agriculture, Agricultural Research Service. Food and Nutrient Intakes by Children 1994-96, 1998. 1999. Available online at <http://www.barc.usda.gov/bhnrc/foodsurvey/home.htm>. Accessed June 6, 2005.
 38. Cole N, Fox MK. *Nutrition and Health Characteristics of Low-Income Populations, Volume II: WIC Participants and Nonparticipants.* US Department of Agriculture, Economic Research Service, Electronic publication number E-FAN-04-010-2. 2004. Available at: <http://www.ers.usda.gov>. Accessed June 16, 2005.
 39. Heinig MJ, Nommsen LA, Peerson JM, Lonnderal B, Dewey KG. Energy and protein intakes of breast-fed and formula-fed infants during the first year of life and their association with growth velocity: The DARLING study. *Am J Clin Nutr.* 1993;58:152-161.