
Technical Research for the Food Guide Pyramid for Young Children

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This article describes the technical research for the Food Guide Pyramid for Young Children. Composites for food groups and subgroups were developed using food intake data for children 2 to 6 years old. Data were from the Continuing Survey of Food Intakes by Individuals 1989-91. The composites were used in creating 1,300- and 1,600-calorie Food Guide Pyramid diet patterns. For children 4 to 6 years old, the 1,600-calorie pattern met all nutrient requirements, except for vitamin E. The 1,300-calorie pattern provided the RDA for most nutrients for 2- to 3-year-olds and 4- to 6-year-olds. The major exceptions were iron and zinc for both age groups and copper and vitamin E for the 4- to 6-year-olds. When breakfast cereals fortified with iron and zinc were used in the grain composites, the patterns provided recommended levels of these nutrients. Children could improve their diet by making different food choices, in particular, by eating more dark-green and deep-yellow vegetables; legumes; whole grains; and lean meat, poultry, or fish.

The Food Guide Pyramid for Young Children ages 2 to 6 years is a nutrition education tool to help teach healthful eating concepts to young children. The technical research conducted in developing and documenting the research base for this food guide followed procedures similar to those described in the development and documentation of the original food guide (1,9). Food selections and serving sizes reported for young children, in a national food consumption survey, were incorporated into diet patterns based on the Food Guide Pyramid to determine whether such patterns would meet nutritional goals.

A composite was developed for each Pyramid food group (e.g., meat, poultry,

fish) or subgroup (e.g., whole grain). Composites were based on children's actual food choices and reflected the relative use of individual foods within the group or subgroup. An example: the composite for deep-yellow vegetables reflected children's consumption of 89 percent as carrots and 11 percent as other deep-yellow vegetables. A nutrient profile was then calculated for each composite, after which composites and their nutrient profiles were used to calculate expected nutrient levels in 1,300- and 1,600-calorie diet patterns based on the Food Guide Pyramid. The nutrient totals were then analyzed to determine whether children's nutrient requirements could be met by diet patterns that conform to Pyramid recommendations and that consist of the foods most commonly eaten by children.

Methods

Data Sources

Data on 3-day food and nutrient intakes reported in the Continuing Survey of Food Intakes by Individuals (CSFII) 1989-91 for 1,053 children 2 to 6 years old were used in this study. This data set was used because when work was started, the data set offered the largest number of individuals and days for analysis. Sample weights were applied to provide estimates that were representative of the population. The data that were used to calculate the nutrient profiles of the composites for the food groups and subgroups came from the U.S. Department of Agriculture's (USDA) Nutrient Data Base for Individual Intake Surveys, Release 7 (1991).

The Food Guide Servings Data Base was used to report the amounts of food consumed as numbers of food guide servings. USDA's Center for Nutrition Policy and Promotion (CNPP) developed this data base by using the foods reported in the CSFII 1989-91. The Food Guide Servings Data Base consists of food-item descriptions and the number of Pyramid servings per 100 grams of food. Servings data are provided for the 5 major food groups and 21 subgroups identified in the Food Guide Pyramid.

Most foods, including mixed dishes, were broken down into ingredient components, and their food group servings were calculated for more than one food group. When a food code's typical serving size, defined in the Survey Code Book for CSFII 1989-91 and based generally on median serving sizes reported in USDA food consumption surveys, provided less than one-fourth of a serving of a Pyramid food group or subgroup, it was usually not

counted. For example, a serving of oatmeal raisin cookies provided less than one-fourth of a Pyramid serving of raisins, so those raisins were not counted toward fruit servings. These small amounts were not counted because one objective of the original food guidance system was "usability." It is unrealistic to expect Americans to "count" small amounts of some foods toward food group servings. However, if several "other vegetables" like tomatoes and onions were in small amounts in a mixture, and these amounts together added up to at least one-fourth serving, these "other vegetables" were counted toward vegetable servings.

Procedures

CNPP began the research process by breaking down the foods that were consumed by children 2 to 6 years old, as reported in the CSFII 1989-91, into numbers of food group and subgroup servings. The Food Guide Servings Data Base was used for this process. To identify specific food components, CNPP staff reviewed food codes that contributed food guide servings.

All food items with similar food components were grouped in the same item-group. For example, broccoli soup and broccoli casserole both contained cooked broccoli and so were placed in the item-group for cooked broccoli within the subgroup for dark-green vegetables. A composite was then constructed by summing intakes from all the item-groups within a food group, with each item-group being weighted by the numbers of servings reported for children 2 to 6 years old. Then the percentage contributed by each item-group in the food group or subgroup was calculated. The total number of servings of cooked broccoli consumed, for example, was divided by the total number of servings of dark-green

vegetables consumed. This calculation produced the percentage of the composite for dark-green vegetables that was cooked broccoli. Any item-group totaling less than 1 percent of the composite was combined with another item-group, based on the similarity in nutrient composition or its use in meals.

A food code most representative of an item-group was then selected to represent each food-item group in each of the composites. The nutrient values of these food codes were used to calculate the nutrient profiles of the composites. In developing the original nutrient profiles for the food groups and subgroups, researchers included foods with the least amount of fat and without added sugars; thus, the original philosophical goal of flexibility for the food guide was met. The food guide was used to show consumers how to obtain nutrients while allowing them flexibility to choose sources of fat and added sugars within the fat and calorie limits specified (9). In addition, the Food Guide Pyramid is an educational tool to help put the Dietary Guidelines into practice (8).

To minimize fat, added sugars, and sodium, CNPP staff used the form of the food item that was lowest in these components. For example, the deep-yellow vegetable subgroup contained the item-group for sweet potatoes. To represent the latter in the composite, CNPP used the code for a baked sweet potato without added fat—despite the fact that children usually eat candied sweet potatoes. For most vegetable and cooked-grain item-groups, CNPP used food codes that specified "no salt added in preparation." In a few cases, CNPP used the salted form to represent popular vegetables that are canned. Estimates of the percentage selected

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in canned form were calculated from data of the food supply (4).

Non-fortified ready-to-eat and cooked breakfast cereals were used in both the composites for whole grains and enriched grains. Hence nutrient profiles of the composites do not overestimate the nutrients for children who do not eat fortified breakfast cereals. Nutrients added at standard enrichment levels, as in enriched bread, were included in the nutrient profiles for the composites. Folate fortification was not mandated by the Government at the time the CSFII 1989-91 was conducted, so it was not reflected in any of the nutrient profiles for grain products.

Once CNPP chose the food code to represent each item-group, we calculated grams of the food code and corresponding nutrient values for its portion of the composite serving. Nutrient values were then summed across all items in the food group or subgroup to determine the composite's nutrient profile per serving.

Composites were not developed for the meat alternates (eggs, nuts and seeds) or for the milk, yogurt, and cheese group. The nutrient profiles of a food group or subgroup reflect proportionately the nutrient content of the foods within them; consequently, the nutrient profile of a food group or subgroup most reflects the nutrient content of the most frequently consumed foods within that group.

Nutrient profiles for the meat alternates were represented by the nutrients in one large boiled egg and 2 tablespoons of peanut butter, each of which counts as 1 ounce from the meat, poultry, fish group. Peanut butter was 90 percent of young children's servings of nuts and seeds in the CSFII 1989-91; thus, peanut

butter's nutrient profile was used instead of calculating a composite of all the different nuts and seeds that were consumed in small quantities by young children.

All legumes were counted as vegetables in the earlier research on Pyramid food patterns (1) and so were counted similarly in this research project. One-half cup of cooked legumes may be counted as 1 ounce of meat, poultry, or fish rather than 1 serving of vegetables.

The nutrient profile for the milk, yogurt, and cheese group was represented by 1 cup of nonfat milk, except for vitamin A. The amount of vitamin A used was the 76 RE per cup found in whole milk, instead of the 149 RE per cup found in fortified nonfat milk. Thus over-estimation of vitamin A was avoided for those who consumed non-fortified whole milk products.

The data on food intake, which were used to develop the composites, were examined to identify the most popular foods (at the food code level) and preparation styles in each item-group. Amounts reported eaten were also analyzed. For each item-group, the average number of servings per report was calculated. This was the average quantity of a specified food that was eaten by consumers during an eating occasion (at a single time). Then, the average number of servings per report was calculated for each food group or subgroup.

The food-group composites and nutrient profiles for young children were compared with another set of composites that were developed for all individuals ages 2 years and older who provided 3 days of data in the CSFII 1989-91 (N=11,488).

Composites and their nutrient profiles indicated that while children do eat somewhat differently from the rest of the population of all individuals ages 2 years and older, few substantial differences resulted in the expected nutrient profile of a composite serving of any of the food groups or subgroups.

Next, the composites and nutrient profiles were used in Food Guide Pyramid diet patterns that included added fat and added sugars. In these patterns, a fat composite was used to represent “discretionary” fat added to the diet above what would be found in lean meats and forms of the other composite foods that were lowest in fat. For example, the fat in cakes and the margarine spread on bread are discretionary fats. The nutrient profile for the fat composite was based on the percentages of different animal and vegetable fats in the food supply from 1989 to 1991 (7).

“Added sugars” are added to the diet when a person either chooses foods that contain added sugars as ingredients (e.g., cookies) or adds some form of sugar (e.g., pancake syrup) to foods at the table. The nutrient profile for added sugars was represented by the nutrients in 1 teaspoon of granulated sugar.

CNPP analyzed the Food Guide Pyramid diet patterns to determine whether young children’s nutrient requirements would be met by a diet pattern set at a calorie level close to what children eat and based on their food choices within food groups. The nutritional objective for food energy was to be within the range of the Recommended Energy Intake (REI) for 2- to 6-year-olds. Protein, vitamins, and minerals were to meet the Recommended Dietary Allowances (RDA) for young children.

The objective for dietary fat for young children was that after age 2, children should gradually adopt a diet so that it contains no more than 30 percent of calories from fat by the time they are 5 years old (8). For this study, the fat level was to be the same as the CSFII 1989-91 level for 2- to 3-year-old children (34 percent of calories from fat) and was to decrease in older age groups to 30 percent of calories by age 5. The *Dietary Guidelines for Americans* also advise that saturated fat be less than 10 percent of calories (8). For 2- to 3-year-old children, saturated fat was targeted at the consumption level of 13.6 percent of calories, and for the older preschooler (5 to 6 years old), saturated fat was targeted at less than 10 percent of calories. Cholesterol was to average 300 milligrams or less per day (3).

Food Guide Pyramid diet patterns were to provide a minimum of “age (in years) plus 5” grams of dietary fiber, recommended by the American Health Foundation (10). The objective for sodium was that diet patterns were to provide 2,400 milligrams or less per day (3). Diet patterns could include added sugars in order to meet the targeted calorie levels of 1,300 or 1,600, after calories from servings of the food groups and added fats were totaled.

Results

Composites

Table 1 summarizes the food group and subgroup composites for young children and for all individuals ages 2 and older. For example, in the subgroup for dark-green vegetables, cooked broccoli was about 74 percent of the reported food guide servings of dark-green vegetables for young children; cooked broccoli was 52 percent of such servings for all individuals.

Table 2 lists the amounts of selected nutrients per serving of the composite for each food group and subgroup for the young child and for all individuals. Despite differences in food selection, as shown in the composites in table 1 and described later in this study, the differences in the nutrient profiles between the young child’s and all individuals’ composites were relatively minor. As expected, young children ate somewhat different types and amounts of food items within each food group and subgroup than did the total population.

Fruit. *Children obtained much of their fruit servings in juice form.*

Young children consumed a large share of their fruit servings as juices—nearly 47 percent, compared with 35 percent for all individuals (table 1). The largest single component of children’s fruit composite was orange juice (23 percent), followed by apple juice (20 percent).

Higher percentages of apple juice and grape juice in the composite for children than in the composite for all individuals contributed to the higher carbohydrate and calorie levels in children’s nutrient profile for fruit (table 2). The smaller amount of orange juice in the children’s fruit composite, compared with the composite for all individuals, was likely related to the lower potassium, vitamin C, and folate levels in the children’s nutrient profile. The absence of cantaloupe in the children’s composite was associated with a lower vitamin A value for the children’s fruit composite, compared with that for all individuals.

Table 1. Food group composites for young children and all individuals¹

Food group	Item-group	Child	All indiv.	Food group	Item-group	Child	All indiv.
		<i>Percent</i>				<i>Percent</i>	
Fruit	Orange juice	22.9	24.3	Legume	Kidney beans	17.6	19.6
	Grapefruit juice	-	2.2		Chickpeas	-	1.6
	Apple juice	19.9	6.8		Soybeans	-	1.4
	Grape juice	<u>3.8</u>	<u>1.7</u>		White beans	30.8	26.9
	Total juice	46.6	35.0		Black beans	3.7	2.7
	Orange, raw	3.9	3.7		Pinto beans	34.7	32.2
	Grapefruit, raw	-	2.8		Lima beans	5.9	6.7
	Strawberries	2.1	4.2	Split peas	3.3	3.8	
	Cantaloupe	-	3.0	Lentils	1.1	1.5	
	Watermelon	4.4	4.4	Cowpeas	2.8	3.6	
	Apple, raw	9.2	10.0	Starchy vegetable	Corn	18.2	13.5
	Banana	8.4	10.1		Potatoes, boiled	66.9	64.9
	Grapes	4.7	5.2		Potatoes, baked	6.7	12.8
	Peach, raw	1.8	3.9	Green peas	8.2	8.8	
	Plums, raw	1.3	2.0	Other vegetable	Tomatoes, ck	40.1	25.5
	Raisins	<u>1.6</u>	<u>1.5</u>		Tomatoes, raw	8.1	11.3
	Total raw	37.4	50.8		Tomato juice	-	<u>1.4</u>
	Applesauce	7.1	3.2		Total tomatoes	48.2	38.2
	Apple, ck*	-	1.3		Green beans, ck	19.1	10.9
	Peach, ck, cnd*	5.3	5.5		Iceberg lettuce	11.6	21.6
Pears, ck, cnd	1.5	2.0	Cucumber, raw		1.9	3.1	
Pineapple, ck, cnd	<u>2.0</u>	<u>2.4</u>	Onions, raw		-	1.8	
Total canned	15.9	14.4	Celery, raw		2.1	2.3	
Dark-green vegetable	Broccoli, ck	73.9	51.6		Green pepper, raw	-	1.8
	Broccoli, raw	<u>2.2</u>	<u>6.7</u>	Cabbage, raw	<u>4.0</u>	<u>3.6</u>	
	Total broccoli	76.1	58.3	Total raw vegetable	19.6	34.2	
	Spinach, ck	14.1	12.4	Celery, ck	1.8	1.2	
	Mustard greens, ck	-	3.0	Onions, ck	2.8	2.5	
	Collards, ck	2.7	7.8	Mushrooms, ck	1.5	2.3	
	Kale, ck	3.0	1.9	Cabbage, ck	3.0	4.2	
	Turnip greens, ck	<u>2.5</u>	<u>4.8</u>	Mung bean sprouts	2.4	1.3	
	Total ck greens	22.3	29.9	Cauliflower, ck	-	1.4	
	Romaine, etc., raw	1.7	9.9	Zucchini, ck	1.6	2.5	
Spinach, raw	-	<u>2.0</u>	Asparagus, ck	-	<u>1.4</u>		
Total raw greens	1.7	11.9	Total other ck	13.1	16.8		
Deep-yellow vegetable	Carrots, ck	41.8	48.5				
	Carrots, raw	<u>47.0</u>	<u>37.3</u>				
	Total carrots	88.8	85.8				
	Pumpkin, ck	2.3	1.3				
	Sweet potato, ck	5.1	9.2				
	Winter squash, ck	<u>3.7</u>	<u>3.8</u>				
Total other DY*	11.1	14.3					

Table 1. Continued

Food group	Item-group	Child	All indiv.	Food group	Item-group	Child	All indiv.
		<i>Percent</i>				<i>Percent</i>	
Whole grain	WW* bread	33.2	35.6	Meat, poultry, fish	Beef, fresh	18.6	21.4
	Rye bread	-	4.2		Pork, fresh	6.2	7.2
	Oatmeal bread	2.5	3.3		Pork, cured	2.9	3.2
	WW quick bread	<u>2.1</u>	<u>2.4</u>		Lamb	<u>0.7</u>	<u>1.1</u>
	Total breads	37.8	45.5		Total meat cuts	28.4	32.9
	WW crackers	4.2	2.8		Ground beef	21.5	18.8
	Corn tortilla	9.5	11.6		Beef lunchmeats	8.1	3.6
	Popcorn	3.6	5.2		Pork lunchmeats	<u>4.4</u>	<u>4.9</u>
	Brown rice	-	<u>1.6</u>		Total lunchmeat	12.5	8.5
	Total snacks/other	17.3	21.2		Liver	0.3	0.5
	WW cereal, RTE* & ck	11.5	16.9		Chicken	23.0	21.5
	Oatmeal, ck	15.9	8.4		Turkey	<u>3.9</u>	<u>5.1</u>
	Oat RTE cereals	<u>17.5</u>	<u>8.0</u>		Total poultry	26.9	26.6
	Total cereals	44.9	33.3		Lean finfish	3.3	4.3
Enriched grain	White bread	35.1	35.4	Fatty finfish	1.6	1.7	
	French bread	1.4	4.0	Finfish, cnd	4.5	4.2	
	English muffins	1.1	2.4	Shellfish	<u>1.0</u>	<u>2.8</u>	
	Flour tortilla	1.4	2.3	Total fish	10.4	13.0	
	Enr* crackers	<u>4.2</u>	<u>2.8</u>				
	Total bread/crx*	43.2	46.9				
	Enr quick breads	7.1	5.9				
	Biscuit	1.6	2.7				
	Cornbread	<u>2.4</u>	<u>3.3</u>				
	Total quick breads	11.1	11.9				
	Pasta, noodles	13.6	11.5				
	White rice	5.3	6.1				
	Grits	<u>1.5</u>	<u>1.0</u>				
	Total pasta, rice	20.4	18.6				
Enr flour desserts	14.4	17.8					
Corn RTE cereals	8.2	3.7					
Rice RTE cereals	<u>2.7</u>	<u>1.1</u>					
Total cereals	10.9	4.8					

¹Children 2 to 6 years old and all individuals ages 2 years and older.

- Item-group had <1 percent representation in the composite.

*Abbreviations: ck - cooked, cnd - canned, DY - deep-yellow, WW - whole wheat, RTE - ready-to-eat, Enr - enriched, crx - crackers.

Source: CSFII 1989-91, 3-day weighted samples.

Table 2. Nutrient profiles for food group composites and milk: Nutrient values per serving for young children and all individuals¹

Nutrient	Dark-green vegetable		Deep-yellow vegetable		Legume		Starchy vegetable		Other vegetable	
	Child	All indiv.	Child	All indiv.	Child	All indiv.	Child	All indiv.	Child	All indiv.
Calories, kcal	24	21	34	37	108	109	75	78	21	19
Sodium, mg	29	26	43	44	164	155	27	24	100	74
Potassium, mg	278	244	205	207	372	368	260	278	205	184
Protein, g	2.6	2.1	0.8	0.8	7.2	7.3	1.9	2.0	1.0	1.0
Fat, g	0.3	0.3	0.1	0.1	0.3	0.5	0.3	0.2	0.3	0.2
Saturated fat, g	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0
Mono.* fat, g	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0
Poly.* fat, g	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.1	0.1	0.1
Cholesterol, mg	0	0	0	0	0	0	0	0	0	0
Carbohydrate, g	4.4	3.8	7.9	8.7	19.7	19.5	17.3	17.9	4.4	3.9
Fiber, g	2.3	2.0	2.2	2.2	5.6	5.7	2.1	2.0	1.3	1.2
Vitamin A, RE	239	238	1685	1723	0	0	6	6	45	38
Vitamin C, mg	55	43	5	6	1	1	7	7	12	12
Folate, ug	57.9	56.1	10.8	11.4	82.1	84.0	16.6	15.8	16.8	20.6
Vitamin B12, ug	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Calcium, mg	55	52	20	21	43	42	7	8	25	20
Magnesium, mg	29.3	25.4	9.9	10.3	43.2	43.1	20.0	20.6	12.8	11.1
Iron, mg	1.10	0.97	0.39	0.40	2.25	2.27	0.46	0.54	0.61	0.52
Zinc, mg	0.38	0.32	0.18	0.19	0.93	0.93	0.32	0.32	0.19	0.18

Dark-green vegetable. *Broccoli was the predominant vegetable in this composite for children. Of all the composites, the one for dark-green vegetables had the highest vitamin-C value per serving.*

Cooked broccoli was the largest (74 percent) component and cooked spinach was the second largest (14 percent) component of the composite for dark-green vegetables (table 1). Thus the high percentage of broccoli helps to explain the high value of vitamin C per serving of this composite: 55 mg

(table 2). Children consumed much less cooked greens, raw broccoli, and romaine than did all individuals (table 1).

Deep-yellow vegetable. *This composite was mostly carrots, and it provided the highest amount of vitamin A of any composite.*

Most (89 percent) of the children's deep-yellow vegetable composite was carrots (table 1). Children ate more raw carrots than cooked carrots. Eaten primarily in candied form, sweet potatoes ranked a distant second in the composite.

One serving of the deep-yellow vegetable composite provided 1,685 RE vitamin A for children (table 2).

Legume. *Pinto beans accounted for the highest percentage of the children's composite for legumes. Of all the composites, this one contained the most calories and fiber per serving.*

Pinto beans ranked first (35 percent for children) in the legume composite (table 1). The top food codes in the item-group for pinto beans were pinto beans without fat and refried beans

Table 2. Continued

Nutrient	Fruit		Whole grain		Enriched grain		Meat, poultry, fish (per ounce)		Milk ²
	Child	All indiv.	Child	All indiv.	Child	All indiv.	Child	All indiv.	1 cup nonfat
Calories, kcal	74	68	80	78	86	83	56	55	86
Sodium, mg	3	2	60	69	104	115	82	67	126
Potassium, mg	237	245	60	56	30	31	89	88	406
Protein, g	0.7	0.8	2.8	2.6	2.3	2.3	7.7	7.7	8.4
Fat, g	0.2	0.2	1.2	1.1	1.1	1.1	2.5	2.4	0.4
Saturated fat, g	0.1	0.1	0.2	0.2	0.2	0.3	0.9	0.9	0.3
Mono. fat, g	0.0	0.0	0.4	0.4	0.5	0.5	1.0	1.0	0.1
Poly. fat, g	0.1	0.1	0.4	0.4	0.3	0.3	0.2	0.2	0.0
Cholesterol, mg	0	0	0	0	2	2	22	24	4
Carbohydrate, g	18.3	16.8	14.9	15.0	16.3	15.5	0.2	0.1	11.9
Fiber, g	1.1	1.2	2.1	2.0	0.6	0.6	0.0	0.0	0.0
Vitamin A, RE	12	28	2	2	2	2	9	18	76
Vitamin C, mg	24	30	0	0	0	0	1	1	2
Folate, ug	23.8	26.9	7.4	7.8	6.5	6.9	2.3	2.4	12.7
Vitamin B ₁₂ , ug	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.6	0.9
Calcium, mg	13	13	19	20	23	26	4	4	302
Magnesium, mg	12.3	13.5	24.6	23.0	7.4	7.4	6.8	7.0	27.8
Iron, mg	0.34	0.27	0.81	0.76	0.80	0.80	0.55	0.55	0.10
Zinc, mg	0.08	0.10	0.54	0.50	0.20	0.21	1.11	1.10	0.98

¹Children 2 to 6 years old and all individuals ages 2 years and older.

²A composite was not developed for the milk group. The nutrient profile was based on nonfat fluid milk.

*Abbreviations: Mono. – monounsaturated; Poly. – polyunsaturated.

with added fat. White beans (eaten mostly in pork and beans/baked beans) and kidney beans (eaten mostly in chili con carne with beans) were, respectively, the second and third largest item-groups. Legumes contributed the most calories and dietary fiber per serving of all the composites; for children, one legume serving provided 108 calories and 5.6 g fiber (table 2). Legumes also provided the most copper per serving of all the composites, 0.20 mg.

Starchy vegetable. *Fried potatoes were the starchy vegetable most commonly eaten by young children.* White potatoes were the primary constituent of the composite for starchy vegetables (table 1); they were most often eaten with added fat—as potato chips and French fries. Because the composite was created using the form of the food lowest in fat, boiled potatoes were chosen as a proxy for fried potatoes. The smaller amount of baked potatoes in the children’s composite, compared with that for all individuals, contributed

to a lower potassium value in children’s nutrient profile (table 2). The second largest item-group in this composite was corn (table 1).

Other vegetable. *Almost half of children’s servings of “other vegetables” were of tomatoes. This composite had one of the smallest servings per report (0.5), because the foods in this subgroup were used in small amounts in many mixed dishes.*

Tomatoes were the primary component (48 percent) of the composite for other

Across all the food groups and sub-groups, children tended to have smaller serving sizes than did all individuals.

vegetables; a higher percentage of its cooked form was consumed, compared with its raw form (table 1). Most of the servings of the cooked form were eaten as ingredients in grain mixtures. The main sources of raw tomatoes, other than those eaten by themselves, were Mexican mixtures (taco/tostada) and hamburger sandwiches. The large amount of cooked tomatoes, represented as canned in the composite, was the major contributor to the 100 mg sodium and 205 mg potassium per composite serving (table 2). The second largest item-group in the other vegetable composite for children was cooked green beans (19 percent) (table 1). Lettuce represented 12 percent of the children's composite, and the most frequently consumed food was plain lettuce. One composite serving of other vegetables provided 12 mg vitamin C, second to the dark-green vegetable subgroup, 55 mg per serving (table 2).

Whole grain. *About 45 percent of this composite was ready-to-eat and cooked cereals; most were fortified.* Whole-grain cereals were the largest component of the composite for whole grains (table 1). Both the ready-to-eat and cooked forms of wheat and oat cereals were eaten, and the instant variety was the most consumed type of all the cooked oatmeals. Many of the cereals in the item-groups for wheat and oat cereal were fortified. Children obtained added nutrients by eating these fortified cereals. Whole-wheat bread was 33 percent of the composite for whole grains, but cracked-wheat bread was the predominant food code in the item-group for whole-wheat bread. Cracked-wheat bread was in this item-group, because the wheat-based breads were grouped together. Corn tortilla had a fairly large representation (10 percent) in the composite for whole grains. Tortilla chips and corn chips

were the top food codes in the item-group for corn tortilla. For children, one serving from the composite for whole grains provided 2.1 g dietary fiber, 24.6 mg magnesium, and 0.5 mg zinc (table 2).

Enriched grain. *White bread was the largest component of the children's composite for enriched grains.*

White bread was the first (35 percent) and "enriched flour desserts and other sources of enriched flour" (shortened to just "enriched flour desserts") was the second largest component (14 percent) of the enriched-grain composite (table 1). The term "desserts" was used to identify the latter item-group because many of the food codes in it were sweet foods like cookies, doughnuts, pastries, pies, and cakes. Enriched flour in each of these foods was counted toward servings of enriched grains. The enriched flour in pizza crust was also included in this item-group. A low-sugar and low-fat food was used to represent the item-group for enriched flour desserts in the composite, but children were consuming added sugars and fat from these foods.

The third largest component of this composite was enriched pasta and noodles. The foods in this item-group that were most commonly eaten by children were macaroni and cheese and spaghetti with or without tomato sauce. Corn and rice ready-to-eat cereals combined were 11 percent of the children's composite; most were fortified. Wheat-flour tortillas constituted a separate item-group in the composite for enriched grains, because they were consumed in large amounts. Children ate more wheat-flour tortillas than English muffins or bagels. (Bagels were placed in the item-group for English muffins.)

As expected, the amount of fiber, magnesium, and zinc in the composite for enriched grains was lower than in the composite for whole grains.

Meat, poultry, fish. *Beef was 48 percent and poultry 27 percent of the children's composite for meat, poultry, and fish.* Children ate most of their beef in ground form: 22 percent of their composite for meat, poultry, and fish (table 1). Fresh beef, as in steak and roast beef, was about 19 percent of the children's composite for meat, poultry, and fish. Children's composite also contained about 8 percent beef lunch meats—mostly frankfurters. About 12 percent of the children's composite for meat, poultry, and fish was frankfurters and other lunch meats. Because of their higher fat content or water content or both, 2 ounces of sausages and lunch meats were counted as 1 ounce of lean meat in the Food Guide Servings Data Base. For example, a child who ate a 2-ounce hot dog was credited 1 ounce of lean meat.

Chicken, compared with turkey, was the most commonly eaten poultry: 23 versus 4 percent of the children's composite. And it was the roasted chicken breast without skin and chicken nuggets that accounted for 12 percent of all chicken servings. Many of the 188 food codes with poultry servings, which were reported consumed by children, were various fried chicken parts. Fried chicken was not, however, represented as such in the composite, because the leanest form of a food was used. All chicken was represented in the composite by a food code described as "chicken, boneless, not specified as to part, roasted, light or dark meat, skin not eaten."

Within the item-group for liver, children ate more chicken liver than beef liver.

Because children ate less beef liver than did all individuals, the children's composite contained less of vitamins A and B₁₂ (table 2).

Canned finfish, mostly tuna in water, was the predominant fish item-group (table 1). For both children and all individuals, the top foods consumed in the item-group for lean finfish were fried. Most servings of fatty finfish were fried catfish for both children and all individuals. Shrimp was the largest component of the item-group for shellfish for children and all individuals, both of whom ate more servings of steamed or boiled shrimp than fried shrimp.

The composite for meat, poultry, and fish contributed the most fat and saturated fat of all the composites (table 2). For children, 1 serving of meat, poultry, and fish provided 2.5 g fat, 0.9 g saturated fat, 7.7 g protein, 22 mg cholesterol, 0.5 ug vitamin B₁₂, 0.55 mg iron, and 1.11 mg zinc.

Milk. *Children consumed more whole milk than did all individuals.*

Although a composite was not developed for the milk group, because the nutrient profile was to be based on nonfat fluid milk, CNPP did analyze how children consumed their servings of the milk group. Findings showed that about 84 percent of children's servings from the milk group were of fluid milk, 15 percent were of cheese, and 1 percent were of yogurt.

Children obtained the bulk of their servings of the milk group by drinking milk: about 92 percent of children's "milk as beverage" servings were whole, 2-percent, 1-percent, or skim milk. The remaining 8 percent of their "milk as beverage" servings were cocoa, milk shakes, chocolate milk,

and other flavored milks. Young children consumed a larger percentage of the category entitled "milk as beverage" as whole milk (47 percent) than did all individuals (35 percent). Children had 14 percent of servings from 1-percent or skim milk; all individuals had 21 percent from these types of milk.

Ice cream and ice milk were also part (about 4 percent) of children's servings of fluid milk. Children ate less pudding (1 percent of the servings of fluid milk) than ice cream and ice milk. Children also obtained fluid milk in mixtures such as cream sauces and soups, but in small amounts.

The milk group is represented by 1 cup skim milk, which provides 8.4 g protein, 86 calories, 0.3 g saturated fat, and 302 mg calcium (table 2).

Serving Sizes

Across all the food groups and subgroups, children tended to have smaller serving sizes than did all individuals. Children's average intake was 1 serving per report for fruits and juices. When children ate cooked greens, raw broccoli, and romaine (dark-green vegetables), their serving sizes were much smaller than those for all individuals. Children had 0.9 servings, on average, per report. Of all five vegetable subgroups (dark-green, starchy, etc.), children's number of servings per report (0.4) was the smallest for the deep-yellow vegetable subgroup.

Children averaged 0.7 servings per report for legumes and 0.8 servings for starchy vegetables. Among starchy vegetables, children averaged 0.9 servings for potato chips and 0.7 servings for French fries. Children's number of servings per report of other vegetables

By selecting foods somewhat differently in the food groups and subgroups, children can improve their nutrient intakes.

averaged 0.5. The number of servings per report (0.2 for children) for individual item-groups was particularly small for cooked onions, raw celery, and cooked mushrooms, used in small amounts in many mixed dishes.

Children had an average of 1.2 servings per report from the composite for whole grains and 1.4 servings per report from the item-group for whole-wheat bread. Children averaged 1.2 servings per report across all foods in the composite for enriched grains, 1.4 servings for white bread, and 1.3 servings (a little over $\frac{1}{2}$ cup) for enriched pasta and noodles. The halves of an English muffin or bagel constitute 2 servings of grains; children averaged 1.4 servings per report.

For items in the composite for meat, poultry, and fish, children averaged 1.4 ounces per report. For the milk composite, children consumed about $\frac{3}{4}$ cup of milk (0.8 servings) per report and $\frac{2}{3}$ cup of ice cream per eating occasion. For pudding, the average amount eaten per report was 0.5 servings ($\frac{1}{2}$ cup).

Generally, the amounts reported for children 2 to 6 years old were about 60 to 80 percent of those for all individuals. This suggests that it is appropriate to continue to use two-thirds of the serving size designated for adults as a serving size for 2- to 3-year-olds when assessing nutrient levels in Food Guide Pyramid patterns for young children ages 2 to 3 (1,9). Two- to three-year-olds need two-thirds of the serving size for adults, except for milk. Two cups of milk are recommended for 2- to 3-year-old children. Four- to six-year-old children need the same serving sizes designated for adults.

Food Guide Pyramid Diet Patterns for Young Children

The REI for 1- to 3-year-old children is 1,300 calories (2). A 1,600-calorie pattern was considered an appropriate objective for 4- to 6-year-old children. Although the REI for 4- to 6-year-old children is 1,800 calories, food consumption data reported for this age group in the CSFII 1989-91 averaged 1,533 calories.

Focus groups with parents, a consumer research aspect of the development of the Food Guide Pyramid for Young Children, indicated that parents were concerned that the amount of food their children ate might not be adequate to meet their nutrient needs.¹ It was important to determine whether a diet pattern set at a calorie level close to what children reportedly eat, and based on their reported food choices within food groups, could meet their nutrient requirements. It is not wise to have parents feed their children more food than needed—considering the prevalence of childhood obesity in the United States.

CNPP created the diet patterns as follows. For each food group and subgroup composite, the nutrients per Food Guide Pyramid serving were multiplied by the number of servings in the pattern and summed. Discretionary fat was added to bring the level of total fat in the 1,600-calorie pattern to 30 percent of calories and in the 1,300-calorie pattern to 34 percent of calories, the actual consumption level in the CSFII 1989-91 for 2- to 3-year-old children. Added sugars, represented as teaspoons of sugar, were then included to bring calories to the levels targeted for the two diet patterns.

¹See Tarone (5).

Table 3. Comparison of children's recommended intake with their consumption: Food group and subgroup servings per day

Food group Subgroup	Recommended intake		Actual intake ¹	
	Food group servings		Avg daily servings CSFII 1989-91	
	1,300 calories	1,600 calories	2-6 yrs	All individuals
Fruit	1.33	2.00	1.19	1.12
Vegetable	2 servings	3 servings	1.41 servings	2.62 servings
Dark-Green	0.29	0.43	0.08	0.13
Deep-Yellow	0.38	0.57	0.06	0.14
Legume	0.29	0.43	0.08	0.17
Starchy	0.38	0.57	0.61	0.94
Other	0.67	1.00	0.58	1.25
Grain	4 servings	6 servings	4.55 servings	5.50 servings
Whole Grain	2.00	3.00	0.96	1.27
Enriched Grain	2.00	3.00	3.59	4.22
Meat, poultry, fish	3.33 ounces	5.00 ounces	2.55 ounces	4.37 ounces
Meat, Poultry, Fish	2.86	4.57	2.17	3.95
Egg	0.29	0.43	0.24	0.32
Nuts and Seeds	0.18	0.0	0.14	0.10
Milk	2.00	2.00	1.94	1.48
Fat, total	49.5 grams	53.4 grams	54.5 grams	70.4 grams
Added sugars	7 tsp	6 tsp	13.2 tsp ²	19.5 tsp ²
Total calories	1,304 kcal	1,613 kcal	1,435 kcal	1,796 kcal

¹ Calculated by dividing the total weighted number of servings reported over 3 days by 3 and then dividing by the weighted number of people in the samples.

² Estimated extra calories from added sugars in foods and small amounts of foods not accounted for in Food Guide Servings Data Base.

The 1,600-calorie pattern contained the minimal number of Food Guide Pyramid servings at the serving size recommended in the original Food Guide Pyramid (table 3). There were 2 servings of fruit, 3 of vegetables, 6 of grains, 5 ounces of meat, and 2 cups of nonfat milk, along with added fat and sugars. The 1,300-calorie pattern had the minimal numbers of Food Guide Pyramid food group servings reduced in size by

one-third for all food groups and subgroups except milk, to represent the one-third smaller serving size estimated for 2- to 3-year-old children. For example, 2 servings of fruit multiplied by two-thirds equaled 1.33 Food Guide Pyramid fruit servings in the 1,300-calorie pattern.

A total of 2 cups of milk was included in both diet patterns to meet calcium

recommendations. Because there is more fat permitted in the younger child's diet, CNPP substituted peanut butter for a portion of the meat servings in developing the 1,300-calorie pattern for 2- to 3-year-old children. This meat alternate, which is higher in fat content, represented the percentage of the meat group that young children consumed as nuts.

Table 4. Nutrient levels in Food Guide Pyramid patterns for young children¹

Nutrient	RDA ² or recommendation Child		1,300-calorie pattern Child		1,600-calorie pattern Child	CSFII 1989-91 consumption Child	
	1-3 yrs	4-6 yrs	2-3 yrs	4-6 yrs	4-6 yrs	2-3 yrs	4-6 yrs
----- <i>Kcal</i> -----							
Calories (avg)	1,300	1,800	~1,300	~1,300	~1,600	1,288	1,533
----- <i>Percent of RDA</i> -----							
Protein	16 g	24 g	361	241	325	305	244
Calcium	800 mg	800 mg	98	98	109	94	107
Magnesium	80 mg	120 mg	259	173	225	219	169
Iron	10 mg	10 mg	74	74	110	96	117
Zinc	10 mg	10 mg	77	77	107	68	82
Copper	0.7 mg	1.0 mg	100	70	100	98	81
Vitamin A	400 RE	500 RE	267	214	295	177	162
Vitamin E	6 mg	7 mg	98	84	89	78	77
Vitamin C	40 mg	45 mg	169	150	220	194	186
Niacin	9 mg	12 mg	122	92	130	143	134
Vitamin B ₆	1.0 mg	1.1 mg	104	95	133	117	126
Folate	50 ug	75 ug	329	219	303	378	295
Vitamin B ₁₂	0.7 ug	1.0 ug	513	359	460	492	371
----- <i>Percent of Kcal</i> -----							
Fat ³	<34	30	34.1	34.1	29.8	34.4	34.0
Saturated fat ³	<13.6	<10	10.5	10.5	9.3	13.6	13.3
----- <i>Milligrams</i> -----							
Cholesterol ⁴	300	300	161	161	230	182	210
Sodium ⁴	<2,400	<2,400	1,127	1,127	1,485	2,122	2,534
----- <i>Grams</i> -----							
Fiber ⁵	8	9-11	12.0	12.0	17.4	8.5	10.4

¹Composite nutrient profiles based on children 2 to 6 years old.

²Recommended Dietary Allowances (RDA), 1989.

³U.S. Department of Agriculture and U.S. Department of Health and Human Services, 1995, *Nutrition and Your Health: Dietary Guidelines for Americans*.

⁴National Research Council. 1989. *Diet and Health*. National Academy Press, Washington, DC.

⁵American Health Foundation for "age plus 5" per day (Williams et al., 1995).

Source: CSFII 1989-91, 3-day weighted sample.

Total nutrient levels in the 1,300- and 1,600-calorie patterns were then compared with the 1989 RDA for children 1 to 3 and 4 to 6 years old and with other recommendations, as specified earlier, for fat, saturated fat, cholesterol, sodium, and dietary fiber (table 4).

Except for vitamin E (89 percent of the RDA), the 1,600-calorie pattern met or exceeded all nutrient requirements for children ages 4 to 6. Vitamin E was also less than the RDA in the 1,300-calorie pattern. However, the levels of vitamin E in the patterns exceeded the

amounts consumed by children, as reported in the CSFII 1989-91, because the composite for discretionary fat, which was based on food supply data for individuals of all ages, contained more vegetable fat (rich in vitamin E) than young children ate. The fat

composite had more polyunsaturated fat and less saturated fat than the amount consumed by children.

The 1,300-calorie pattern provided at least 100 percent of the RDA for most nutrients for both 2- to 3-year-olds and 4- to 6-year-olds. The major exceptions were the trace minerals—iron and zinc for both age groups and copper for the 4- to 6-year-olds. The amount of iron provided by the 1,300-calorie pattern was lower than the amount consumed by children, according to the CSFII 1989-91. The reason for this difference: composites for whole grains and enriched grains contained non-fortified breakfast cereals, but the cereals children ate were fortified. Additional analysis showed that when breakfast cereals included in the grain composites were changed to contain iron and zinc at fortification levels, the Food Guide Pyramid patterns provided recommended levels of iron and zinc for children.

The 1,300- and 1,600-calorie patterns met or nearly met objectives for fat, saturated fat, cholesterol, sodium, and dietary fiber. At 10.5 percent of calories in the 1,300-calorie pattern, saturated fat was somewhat lower than the actual level of consumption targeted for the 2- to 3-year-old child: 13.6 percent.

Consumption of Food Groups

Table 3 shows the recommended numbers of food group and subgroup servings for the 1,300- and 1,600-calorie Food Guide Pyramid patterns developed for young children. The numbers of servings for vegetables, grains, and meat and meat alternates were derived as follows. Originally when the food guide was developed, the daily servings of vegetables were divided equally among dark-green/deep-yellow, legumes/

starchy, and other vegetables (*I*). For vegetables, “several” servings was defined as 3, so several times a week meant 3 times a week or 3/7 of 1 serving per day. For the 1,600-calorie pattern, 3 vegetable servings were divided into 1 serving each from dark-green/deep-yellow, legumes/starchy, and other vegetables. Hence the 3/7 (0.43) dark-green and 4/7 (0.57) deep-yellow provided 1 serving per day, the 0.43 legumes and 0.57 starchy provided another serving, and other vegetables provided the third serving per day. The numbers of grain servings were based on the Food Guide Pyramid recommendation to choose “several” servings a day of foods made from whole grains (6). For the meat and meat alternates, the number of egg servings was based on 3 eggs per week, and the meat, poultry, fish servings were calculated by difference (0.43 eggs subtracted from 5.0 ounces total meat and meat alternates).

The Food Guide Servings Data Base used in this study did not quantify the amount of added sugars in foods. These values were estimated from the calories in added sugars in foods and from the calories in small amounts of foods, such as raisins in oatmeal raisin cookies and garnishes and condiments, which were not counted by the Food Guide Servings Data Base. Calories were then expressed as average daily servings of added sugars, in teaspoons. Thus the average daily servings of added sugars may somewhat overestimate actual intakes of sugar. However, these estimated consumption levels of sugars were much higher than the levels of 6 teaspoons and 7 teaspoons (1,600- and 1,300-calorie patterns, respectively) suggested in the Food Guide Pyramid patterns.

Conclusions

Children ate somewhat differently from the rest of the population, as indicated by composites of the food groups and subgroups, which were based on reported food consumption by young children ages 2 to 6 and all individuals ages 2 and older. However, the variations resulted in few substantial differences in the nutrient profiles of a composite serving of any of the food groups or subgroups.

Young children consumed smaller servings of foods, typically 60 to 80 percent of the average amounts for individuals of all ages. A serving that is two-thirds of the original Food Guide Pyramid serving is a reasonable estimate for assessing nutrient levels in patterns for 2- to 3-year-old children.

The 1,300-calorie Food Guide Pyramid diet pattern, which used the children’s composites and nutrient profiles, met or nearly met objectives for most nutrients except for iron, zinc, and copper. The 1,600-calorie pattern met all of the objectives except for vitamin E. When iron and zinc were included at regular fortification levels in the ready-to-eat cereals used in the grain composites, diet-pattern levels of these nutrients met the RDA. Breakfast cereals were popular with young children, so ensuring that these cereals are fortified with iron and zinc can contribute substantially to meeting targeted intakes of these nutrients.

Copper was less than the RDA in the 1,300-calorie pattern for the 4- to 6-year-old, but the older child would probably be consuming closer to 1,600 calories. Older children could improve their reported copper intake by eating more legumes. Both the 1,300- and 1,600-calorie patterns were somewhat

low in vitamin E, but they exceeded the CSFII 1989-91 reported consumption levels of this nutrient. It is important to reduce fat in the diet as children age, from 2 to 5 years. Emphasis should also be given to replacing a portion of animal fats with vegetable oils, both to decrease saturated fat intakes and to increase vitamin E intakes. The results of the analysis on the RDA showed that most RDA would be met when the children's composites were used in the diet patterns. By selecting foods somewhat differently in the food groups and subgroups, children can improve their nutrient intakes.

Children's diets could be improved by including more servings of vegetables, especially dark-green and deep-yellow vegetables and legumes, and more whole-grain products. Replacing some of the apple and grape juices that children frequently drink with more servings of whole fruit could improve consumption of nutrients and dietary fiber. Replacing some lunch meats with lean meat, poultry, and fish may also improve nutrient intakes. Children's diets could be improved by their choosing foods that contribute more food guide servings and less added sugars.

References

1. Cronin, F.J., Shaw, A., Krebs-Smith, S.M., Marsland, P., and Light, L. 1987. Developing a Food Guidance System to implement the Dietary Guidelines. *Journal of Nutrition Education* 19:281-302.
2. National Academy of Sciences, National Research Council, Food and Nutrition Board. 1989. *Recommended Dietary Allowances* (10th ed.). National Academy Press, Washington, DC.
3. National Research Council. 1989. *Diet and Health*. National Academy Press, Washington, DC.
4. Putnam, J.J. and Allshouse, J.E. 1996. *Food Consumption, Prices, and Expenditures, 1996: Annual Data, 1970-94*. U.S. Department of Agriculture, Economic Research Service. Statistical Bulletin No. 928. pp. 59, 61.
5. Tarone, C. 1999. Consumer research: Food Guide Pyramid for Young Children. *Family Economics and Nutrition Review* 12(3&4):33-44.
6. U.S. Department of Agriculture, Center for Nutrition Policy and Promotion. 1996. *The Food Guide Pyramid*. Home and Garden Bulletin No. 252.
7. U.S. Department of Agriculture, Center for Nutrition Policy and Promotion. 1997. *U.S. Food Supply Series 1909-1994*. (In-house data base.)
8. U. S. Department of Agriculture and U.S. Department of Health and Human Services. 1995. *Nutrition and Your Health: Dietary Guidelines for Americans* (4th ed.). Home and Garden Bulletin No. 232.
9. Welsh, S.O., Davis, C., and Shaw, A. 1993. *USDA's Food Guide: Background and Development*. U.S. Department of Agriculture, Human Nutrition Information Service. Miscellaneous Publication No. 1514.
10. Williams, C.L., Bollella, M., and Wynder, E.L. 1995. A new recommendation for dietary fiber in childhood. *Pediatrics* 96:985-988.