

## Data and Methods

ERS has developed new methods to adjust the food supply series for some of the data limitations mentioned in the previous chapter and to convert the aggregate food consumption estimates into food servings comparable with those in *The Food Guide Pyramid*. ERS can now use food supply data to compare diets with Food Guide Pyramid serving recommendations over a continuous time period. Also, because the food supply series is commodity-based, servings estimates developed from this data set can be readily converted back to the farm level, easing the translation of dietary recommendations into production and supply goals for the agricultural sector (Young and Kantor, forthcoming). This overcomes the difficulties—encountered in food-intake surveys—of separating foods as eaten (like lasagna) into the food commodities that they are made from (tomatoes, beef, cheese, wheat flour).

This study describes the data and methodology behind these conversion techniques, reports servings estimates generated from 1970 to 1996 food supply data, and compares these estimates with CSFII servings data for 1996.

### The Food Supply Data

The ERS food supply and utilization data series measures the national supply of more than 250 foods based on records of commodity flows from production to end uses (Putnam and Allshouse, 1997). The amount of food available for domestic consumption is estimated by developing supply and utilization data sets for raw and semi-processed agricultural commodities—wheat, corn, red meat, and fluid milk, for example—from which final food products are made. Human food use is not directly measured or statistically estimated. Rather, the amount of food available for human consumption is calculated as the difference between available commodity supplies (the sum of production, beginning inventories, and imports) and nonfood and other uses (exports, ending stocks, seed, feed, and industrial consumption). These components are either directly measurable or estimated by Government agencies using sampling and statistical techniques (fig. 2).

Estimates of the amount of food available for consumption are reported in pounds per capita and are

prepared at two levels for most commodities: a primary weight (manufacturing, milling, carcass weight) and a retail-weight equivalent. The basic consumption estimate is made at the primary distribution level, which is dictated for each commodity by the structure of the marketing system and data availability (box 2).

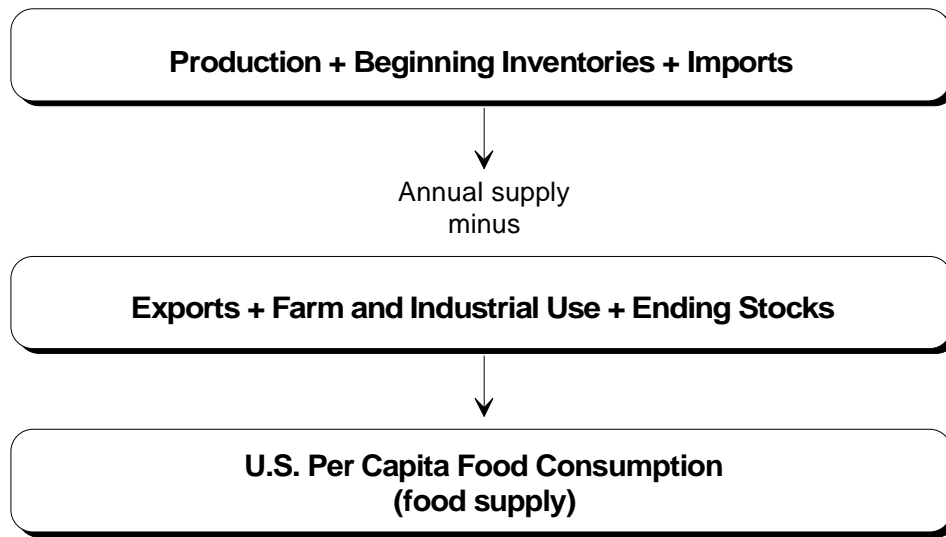
For some commodities (for example, fresh fruits, fresh vegetables, and processing vegetables) the primary distribution level is the farmgate. Most processed commodities—canned fruits, wheat flour, meat, poultry, and dairy products—are measured at the processing or manufacturing plant. In other words, the farmgate would be the primary weight of measurement for corn, but for cheddar cheese, the primary weight is the quantity of product shipments reported by dairy food processors in the U.S. Census of Manufacturers (U.S. Department of Commerce, 1995).

Once the primary level of distribution has been selected, conversion factors that account for subsequent processing, trimming, shrinkage, or loss between the farm and retail levels are used to adjust the data from a primary weight to a retail-weight equivalent. For most commodities, even the retail-weight equivalent is an aggregate measure defined at the basic commodity level. Final product forms and marketing channels are not usually known and little or no data exist on supplies of further processed products. In short, relatively good data exist for many food ingredients—flour, beef, canned tomatoes—but not for foods as usually eaten—bread, meatloaf, or lasagna (Putnam and Allshouse, 1997).

For example, the food supply series for beef is converted from a primary or carcass weight measured at the slaughtering plant, to a boneless, trimmed, equivalent weight measured at the retail or wholesale level. This conversion captures the 30-percent reduction in weight that occurs as the bones are removed and the meat is trimmed and divided into retail cuts. However, measuring the quantity of beef available for consumption at the boneless weight provides no information on how the beef was consumed—hamburger, frozen entree, steak; how it was prepared—baked, broiled, fried; where the beef was distributed for consumption—supermarket, hospital, school, restaurant, or food processor; or the socioeconomic characteristics of the consumer that ate the food.

Figure 2

## Estimating U.S. food consumption



Source: Putnam and Allshouse, 1997.

### Box 2—Final Marketing Stage at which Food Supplies Are Measured

**Grains:** white and whole wheat flour, durum flour, rye flour; corn, oat, and barley products (manufactured weight); rice (milled basis).

**Vegetables:** fresh (retail-weight equivalent); freezing and canned (farm-weight), dehydrated (farm-weight); dry beans, peas, and lentils (cleaned basis).

**Fruit:** fresh (retail-weight equivalent); frozen and canned (product weight); dried (processed weight); fruit juices (single-strength equivalent).

**Milk, yogurt, and cheese:** product-basis, manufactured weight.

**Meat, poultry, fish, dry beans, eggs, and nuts:** meat, poultry, fish (boneless-weight equivalent); eggs (retail weight equivalent); peanuts (kernel basis); peanut butter (product weight); tree nuts (shelled weight).

**Fats and oils:** fat basis, manufactured weight.

**Added sugars:** dry-basis, manufactured weight.

Also, since many farm-to-retail conversion factors are unchanged since 1970, the food supply data may not capture some changes in quality, marketing, and yield of product that have occurred since then. For example, food supply data for margarine assume an 80-percent fat content despite the proliferation of low and reduced-fat margarine and spreads in retail markets in recent years (Allshouse, Putnam, and Sanford, forthcoming). Although ERS is continually conducting research on these issues and annually adjusts the food supply series for changes of this type when data availability permits, all such changes are not reflected in current food supply estimates (Putnam and Allshouse, 1997).

### **Translating Food Supply Data into Food Servings**

A multistage process was used to convert aggregate food supply estimates into food servings comparable with those specified in *The Food Guide Pyramid*. Servings were estimated for more than 250 individual food commodities or commodity groups that were divided into the five major Pyramid food groups or separate groups for fats and oils and added sugars (box 3).

Annual per capita food supply estimates were then converted into daily servings and compared with the serving recommendations depicted in the Food Guide Pyramid. The food supply data were converted from pounds and ounces into grams to ease comparison with serving weights for different foods identified in USDA's Nutrient Database for Standard Reference, Release 11-1 (Nutrient Data Base) (USDA, ARS, October 1997).

Next, the food supply data were adjusted for spoilage and other waste by subtracting food losses from the final marketing weight (primary or retail-equivalent) reported for that commodity in the food supply series (box 4). Depending on the commodity, several different types of losses were identified and estimated including retail and foodservice and consumer losses, changes in weight due to cooking, and the discard of nonedible food parts. Losses averaged 27 percent across all food groups and were assumed to be constant over time. Loss rates varied among subsets of some food groups—for example, loss rates for fresh vegetables were different from loss rates for processed vegetables—but loss shares were the same for individual foods within subgroups; that is, loss shares for fresh broccoli were the same as loss shares for fresh snap beans.

### **Estimation of Serving Weights**

A single serving weight, consistent with sample servings identified in *The Food Guide Pyramid* bulletin Food Choices Chart (USDA, CNPP, 1996) and other USDA dietary guidance materials, was defined for each food supply commodity, using serving weights identified in the Nutrient Data Base. For each commodity, the selected food portion was that which most closely resembled the serving size defined for that commodity or commodity type (for example, fresh fruit, cooked vegetables, fluid milk) in the *Food Guide Pyramid*.

For most commodities, serving weights were dictated by data availability and the marketing level at which consumption was reported in the food supply series. For some commodity groups—milk, yogurt, and cheese, fruits, vegetables, and added sugars—serving weights matched those defined in *The Food Guide Pyramid* bulletin. On the other hand, because some Food Guide Pyramid serving recommendations—particularly those in the grains and meat groups—are product-based, rather than ingredient-based, this meant that serving weights for some foods were not consistent with standard serving sizes defined by dietary guidance. Additional detail on the methods used to estimate serving weights for individual commodities is available in Appendix 2.

### **Comparison with Food Guide Pyramid Serving Recommendations**

Once representative serving weights were identified for each food supply commodity, daily per capita consumption was divided by the assigned serving weight to calculate average servings for that commodity. Individual food servings were then aggregated to determine total daily servings for each Pyramid food group. The difference between the total number of daily servings provided by the food supply and Food Guide Pyramid serving recommendations was measured by comparing the total number of edible servings provided for each food group, with recommended intake.

The recommended servings used in this study were the midpoint of the recommended Pyramid servings for each food group, which are based on a sample diet of 2,200 calories. A 2,200-calorie diet was chosen as a standard because it approximates the daily Recommended Energy Allowance (REA) of 2,247

### **Box 3—Food Supply Servings Were Estimated for More Than 250 Commodities Shown Here Classified According to Food Guide Pyramid Food Groups**

#### **Bread, Cereals, Rice, and Pasta Group**

White and whole wheat flour; durum flour; rye flour; rice; corn flour and meal; corn hominy and grits; corn starch; oat products (rolled oats, ready-to-eat-cereals, oat flour, and oat bran); barley products (barley flour, pearl barley, and malt and malt extract used in food processing).

#### **Vegetable Group**

**Fresh:** Artichokes, asparagus, bell peppers, broccoli, Brussels sprouts, cabbage, carrots, cauliflower, celery, sweet corn, cucumbers, eggplant, escarole, endive, garlic, head lettuce, romaine and leaf lettuce, mushrooms, onions, potatoes, radishes, snap beans, spinach, sweet potatoes, and tomatoes.

**For freezing:** Asparagus, snap beans, broccoli, carrots, cauliflower, sweet corn, green peas, potatoes, other (blackeyed peas, collards, kale, mustard greens, okra, pumpkin, rhubarb, summer squash, turnip greens, turnips, and other miscellaneous vegetables).

**For canning:** Asparagus, snap beans, cabbage (for sauerkraut), chile peppers, carrots, sweet corn, cucumbers, green peas, mushrooms, potatoes, tomatoes, other (beets, lima beans, and spinach).

**Legumes and vegetables for dehydrating and chips:** Dry edible beans (black beans, blackeyed peas, cranberry, garbanzo, Great Northern, light and dark red kidney beans, large and baby lima, navy, pinto, small red, small white, other), dry field peas and lentils (Austrian winter peas, split green peas, whole green peas, regular lentils, other lentils, split yellow peas, whole yellow peas); dehydrating (onions and potatoes), for chips and shoestrings (potatoes).<sup>1</sup>

#### **Fruit Group**

**Fresh:** Apples, apricots, avocados, bananas, cantaloupe, cherries, cranberries, grapes, grapefruit, honeydew, kiwifruit, lemons, limes, mangos, nectarines, oranges and temples, peaches, pears, pineapples, papayas, plums, prunes, strawberries, tangelos, tangerines, and watermelon.

**Frozen:** Apples, apricots, blackberries, blueberries, cherries, peaches, raspberries, strawberries, other berries (boysenberries, loganberries).

**Canned:** Apples and applesauce, apricots, cherries (tart and sweet), olives, peaches, pears, pineapples, plums and prunes.

**Dried:** Apples, apricots, dates, figs, peaches, pears, prunes, raisins.

**Fruit juices:** Apple, grape, grapefruit, lemon, lime, orange, pineapple, and prune.

#### **Milk, Yogurt, and Cheese Group**

**Fluid milk products:** Whole, plain; 2-percent reduced fat, plain; light (0.5-1 percent), plain; fat-free (skim), plain; whole, flavored; lower fat, flavored; buttermilk; yogurt, and eggnog.

### **Box 3—Food Supply Servings Were Estimated for More Than 250 Commodities Shown Here Classified According to Food Guide Pyramid Food Groups—Continued**

**Cheese:** Cheddar, Colby, washed curd, stirred curd, Monterey Jack, Provolone, Mozzarella, Ricotta, Other Italian, Swiss (includes Gruyere and Emmenthaler); Brick, Muenster, Blue, Other; processed cheese, foods and spreads.

**Other dairy products:** Cottage cheese, regular; cottage cheese, lowfat; ice cream; ice milk; other frozen dairy products (mellorine, frozen yogurt and other nonstandardized dairy products); canned whole milk; bulk whole milk; bulk and canned skim milk; dry whole milk; dry buttermilk.

#### **Meat, Poultry, Fish, Dry Beans, Eggs, and Nuts Group**

**Meat, poultry, and fish:** Beef, veal, pork, lamb, chicken, turkey, fresh and frozen fish and shellfish, salmon, canned, sardines, canned, pitchards and herrings, canned, tuna, canned, shellfish, canned, other fish, canned, cured fish.

**Meat alternates:** Eggs; peanuts, snack, peanuts, cleaned in shell; peanut butter; tree nuts, almonds, filberts, pecans, walnuts, macadamias, pistachios, other tree nuts (Brazil nuts, pignolias, chestnuts, cashews, and miscellaneous); coconuts, dessicated.<sup>1</sup>

#### **Fats and Oils**

Butter, margarine, lard (direct use), edible beef tallow (direct use), shortening (soybean oil, cottonseed oil, palm oil, lard, edible tallow); salad and cooking oils (soybean oil, cottonseed oil, corn oil, peanut oil, olive oil); other edible fats and oils (includes specialty fats used mainly in confectionary products and nondairy creamers); half and half, light cream, heavy cream, sour cream, cream and neufchatel cheeses.

#### **Added Sugars**

Cane and beet sugars, High Fructose Corn Syrup, glucose, dextrose, honey, edible syrups (sorgo, maple, and sugarcane syrup, edible molasses, and edible refiner's syrup).

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<sup>1</sup>Dry beans, peas, and lentils can be counted in either the vegetable or meat, poultry, fish, dry beans, eggs, and nuts groups. In this study, they were counted in the vegetable group.

calories for the United States, derived from a population-weighted average of REA's for different age and sex groups of the population (National Research Council, 1989). *The Food Guide Pyramid* bulletin identifies a daily energy intake of 2,200 calories as appropriate for most children, teenage girls, active women, and sedentary men.

Although the choice of a recommended calorie intake does not affect the magnitude of the servings esti-

mates themselves, it does affect the size of the gap between average estimated servings and dietary recommendations. Using another serving recommendation, one based on a different level of caloric intake, would change the size of the gap between reported consumption and serving recommendations for all food groups.

### **Box 4—Estimating Food Losses**

The accuracy of the food supply servings estimates reported in this study depends in part on the estimated amount of available food supplies that are wasted, spoiled, or otherwise not eaten by consumers. See "Discussion" on page 26 for additional detail on the impact of alternative loss rates on the food supply servings estimates.

In this study, food loss was defined as the average reduction in weight that occurs to an agricultural commodity as that commodity leaves the farm, is processed into final food products, and purchased for consumption in supermarkets and eating places. Food loss was estimated by applying existing loss coefficients, gathered from published literature and discussions with commodity experts, to the amount of food available for human consumption in the United States in 1970-96. Losses were estimated for the more than 250 individual foods listed in box 3. They are itemized by food group in Appendix 2. The causes and nature of food losses and loss estimates for aggregate food groups for the retail, consumer, and foodservice sectors, have been previously reported (Kantor and others, 1997).

Where appropriate, the data were also adjusted for changes in weight due to cooking. Cooking adjustments were made for meat, poultry, fish, processed vegetables, and fresh vegetables not normally eaten raw—asparagus, artichokes, Brussels sprouts, eggplant, onions, potatoes, snap beans, sweet corn, and sweet potatoes—and were based on cooking yields identified by USDA (USDA, ARS, 1975). Average changes in weight due to cooking were 25 percent for meat, poultry, and fish and ranged from 3 to 36 percent for fresh and processed vegetables.

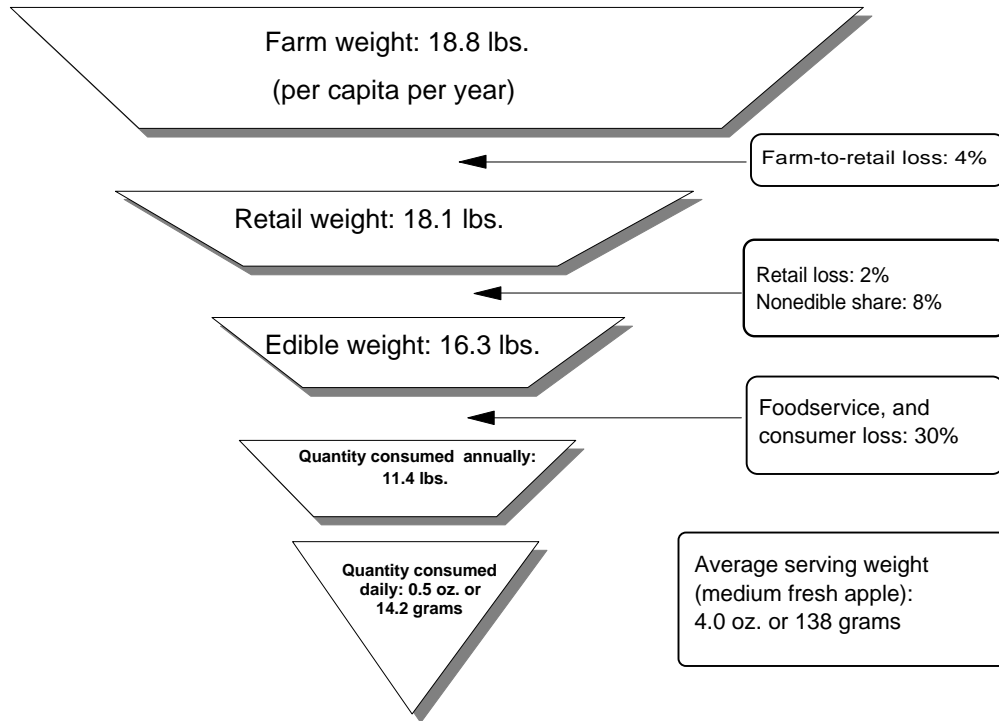
The data were also adjusted for the discard of nonedible food parts—peels, rinds, seeds, skins, cores, and stems—which were estimated for most commodities using the average refuse share for each commodity identified in USDA's Nutrient Data Base. Figure 3 illustrates an example for fresh apples.

Food supply estimates for shortening, lard, and edible beef tallow were adjusted for the discard of deep-frying fats by foodservice establishments. A 1987 study by SRI International indicated that used frying fat disposed of by restaurants and processed by renderers for use in animal feeds, pet foods, and industrial operations and for export amounts to about 6 pounds per capita, or about 9 percent of the total amount of fats and oils available for human consumption in 1995. A 1993 study estimated that 50 percent or more of the deep frying fats used by fast food places and other foodservice establishments were eventually discarded after use and were not available for human consumption (Hunter and Applewhite, 1993).

ERS does not know the share of total frying fats foodservice establishments use. Some of these products, for example, are sold at the retail level for home baking or are used by manufacturers of prepared bakery products. For this study, ERS overestimated losses of fats and oils by foodservice establishments by assuming that 100 percent of the total shortening, lard, and tallow provided in the food supply was used by foodservice establishments for deep-fat frying. Thus, total foodservice losses for these three commodities were assumed to be 50 percent.

Figure 3

### Estimating food supply servings for fresh apples



Average daily servings = (0.5 oz or 14.2 grams) / (4.9 oz. or 138 grams) = 0.10 servings  
Source: U.S. Department of Agriculture, Economic Research Service.