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It Depends on How You Measure the Price

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Are Healthy Foods Really More Expensive? It Depends on How You Measure the Price

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Abstract

Most Americans consume diets that do not meet Federal dietary recommendations. A common explanation is that healthier foods are more expensive than less healthy foods. To investigate this assumption, the authors compare prices of healthy and less healthy foods using three different price metrics: the price of food energy ($/calorie), the price of edible weight ($/100 edible grams), and the price of an average portion ($/average portion). They also calculate the cost of meeting the recommendations for each food group. For all metrics except the price of food energy, the authors find that healthy foods cost less than less healthy foods (defined for this study as foods that are high in saturated fat, added sugar, and/or sodium, or that contribute little to meeting dietary recommendations).

Keywords: Food prices, price metric, cost of food, price of healthy foods

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Summary

What Is the Issue?

Most Americans consume diets that fall short of the recommendations in the *Dietary Guidelines for Americans 2010*. A common perception is that diets consistent with the recommendations are not affordable. This perception may be influenced by studies that found many healthy foods to cost more per calorie than less healthy foods. This is one way, but not the only way, to measure the cost of a healthy diet.

For a balanced assessment, this study compares the prices of healthy and less healthy foods using three price metrics: the price per calorie, per edible gram, and per average portion. The authors also calculate the daily cost of meeting the food group recommendations, found at ChooseMyPlate.gov.

Previous studies also sometimes lack a clear definition of healthy foods, which are defined in this report as food items that:

- Contain an amount of a food in at least one of the major food groups (vegetables, fruits, grains, dairy, and protein foods) equal to at least half the portion size that the *Dietary Guidelines for Americans 2010* uses for measuring the nutrients in that food.
- Contain only moderate amounts of in saturated fats, added sugars, and sodium.

What Were the Major Findings?

The authors found that the metric used to measure the price of food items has a large effect on which foods are more expensive:

- Foods low in calories for a given weight appear to have a higher price when the price is measured per calorie. For example, vegetables and fruits, which are low in calories, tend to be a relatively expensive way to purchase food energy.
- Conversely, less healthy foods (called "moderation foods" in this report)—especially those high in saturated fat and added sugar—tend to be high in calories and to have a low price per calorie.
- When measured on the basis of edible weight or average portion size, grains, vegetables, fruit, and dairy foods are less expensive than most protein foods and foods high in saturated fat, added sugars, and/or sodium.
- In following the food group recommendations at ChooseMyPlate.gov, it is less costly to meet the grains, dairy, and fruit recommendations than those for vegetables or protein foods.

How Was the Study Conducted?

The authors estimated the cost for 4,439 food items by the price per calorie, per edible gram, and per average portion consumed. The study drew on three data sets: the National Health and Nutrition Examination Survey (NHANES) to estimate the types and quantities of foods consumed, the USDA's Center for Nutrition Policy and Promotion (CNPP) food prices database for food prices, and the USDA Food Pattern Equivalent Database (formerly known as the MyPyramid Equivalent Database) for information on food group classification, saturated fat, added sugars, and sodium content.

Background

Studies show that the diets of most Americans do not meet Federal dietary recommendations (Binkley and Golub, 2011; Blaylock et al., 1999; Mancino et al., 2008; U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2010). In particular, diets in the United States tend to be high in calories, saturated fat, and added sugars and low in healthy foods like fruits, vegetables, and whole grains. As indicated by questions asked at the press conference for release of the *Dietary Guidelines for Americans, 2010* (U.S. Department of Agriculture, 2011a) and by research on the relation between cost and diet quality (Blisard et al., 1999; Golan et al., 2008; Mhurchu, 2010; Munoz-Plaza et al., 2008; Raynor et al., 2002), a common perception is that healthy foods cost more than less healthy foods. This view has been reinforced by a number of articles in both professional journals (see, for example, Darmon et al., 2004; Drewnowski, 2010) and popular media. These reports conclude that the higher prices of healthy foods present barriers to consumer ability to buy recommended amounts of foods like fruits and vegetables.

These previous studies, however, measure the price of foods using the price per calorie. This metric was first introduced in 1894, when Wesleyan University chemist William Atwater published the amount of calories, fat, protein, and carbohydrates that could be purchased in 25 cents' worth of different foods (Atwater, 1894). In developing his early measures of the economy of foods, however, Atwater recognized that foods contributed more than just calories, so he examined prices from several different nutritional dimensions. Had vitamins and minerals been known at the time, it is likely that Atwater might have also estimated the amount of each known vitamin and mineral that could be purchased in his 25 cents' worth of each food item. Both Atwater and, later, Milner (1902) wanted consumers to understand the difference between the retail price and the nutritional economy of food and to realize that the cheapest food was not necessarily the most economical. In their view, a high-priced food could actually be viewed as cheap if it furnished large amounts of nutrients; similarly, a food that was a cheap source of calories might actually be an expensive source of other nutrients. In line with their reasoning, the price per calorie may not be an appropriate or useful metric for comparing food prices today.

A number of recent reports from the Economic Research Service (ERS) of the U.S. Department of Agriculture have compared prices between healthy and less healthy foods. Kuchler and Stewart (2008) examined whether the price of fresh fruits and vegetables has increased relative to the price of less healthy foods (desserts and snack foods), using both the Consumer Price Index (CPI) and direct comparisons of the prices of individual products. Standard price comparisons using the CPI suggest that prices of fresh fruits and vegetables have increased relative to prices of other foods. However, the CPI has been shown to overstate the rate of price increase for fresh fruits and vegetables because of the difficulty in accounting for quality changes such as the year-round availability of products like strawberries and more convenient, prewashed and chopped fresh produce. When Kuchler and Stewart examined price changes for fresh fruits and vegetables that have not had substantial quality improvements in availability and convenience (such as

whole carrots), they found that price patterns are similar to those of the less healthful foods.

Todd et al. (2011) compared prices (in $/100 retail grams)[1] for food pairs across regions and over time, where the pairs comprised a healthier and a less healthy substitute—for example, whole grains were compared with refined grains, and whole fruits were compared with sweet and salty snacks. Price comparisons showed that sometimes the healthy food was consistently cheaper across all regions as well as over time, sometimes it was consistently more expensive, and sometimes it varied depending on the region. For example, the study found that whole grains were consistently more expensive than refined grains, and low-fat milk had a higher price than carbonated beverages, although the margins decreased between 1998 and 2006; in contrast, whole fruit was consistently less expensive than sweet and salty snacks, both across regions and over time. Large geographic-related price dispersions were found for whole grains (compared with refined grains), low-fat milk (compared with soda), and fruit juice (compared with noncarbonated fruit drinks). However, as Todd et al. point out, the retail price per 100 grams makes sense when serving sizes are consistent between the food pairs being compared (such as two types of beverages or two types of grains). The findings are more difficult to interpret when serving sizes differ between the foods being compared (such as the comparison between the retail price per 100 grams of whole fruit and salty snacks). A food with a lower retail price per 100 grams may end up with a higher out-of-pocket cost if it has a large serving size. The point is that in making comparisons about the cost of healthy versus less healthy food, it is important to pay attention to the price metric used.

Stewart et al. (2011a) compare the prices of individual fruits and vegetables using the price per cup equivalent (a measure of serving size). They note that foods with the same retail price per pound do not necessarily have the same cup-equivalent price and that consumers wishing to eat a healthy diet may need to look beyond the retail price to determine which foods are "cheaper."

In this report, we compare the prices of healthy and less healthy foods using three different metrics to get a better sense of whether healthier foods are really more expensive than less healthy options: (1) price per calorie, or food energy ($/calorie), (2) price per edible weight ($/100 edible grams), and (3) price per average-portion size. Since none of these metrics addresses the cost of a healthy diet, for each metric we also estimate the daily cost of meeting dietary recommendations for each of the five major food groups (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2010). Consumers, nutrition educators, food vendors, and policymakers can make better informed food choices and improve educational strategies if they consider a variety of price metrics.

[1]As will be explained later in the report, there is a difference between retail and edible weight since the retail weight can include inedible parts such as bones, skins, seeds, and shells.

Metrics for Food Price Comparisons

The metrics in this paper were chosen because they are used in the literature or because we hypothesized that the metric might provide a basis for determining the cost of a food in meeting dietary recommendations.

Price of Food Energy, or Price per Calorie ($/calorie)

Of the metrics examined in this report, the price of food energy is most frequently used in the nutrition and development economics literature. The price of food energy is calculated as the price per 100 grams of a food divided by the number of calories contained in 100 grams.

Development economists have long used the price per calorie to describe the universal changes that occur in national diets as countries develop and transition from subsistence, cereal-based diets (very low price per calorie) to diets that include more fat, vegetables, and animal-based products, moving eventually to greater variety and more convenience foods, all of which provide more expensive types of calories than the subsistence cereals (Deaton, 2010; Frazão et al., 2008). Development economists use the price-of-food-energy metric as a measure of this transition, not as a factor influencing food choices. Indeed, when discussing food choices or the impact of rising world food prices, development economists rely on metrics such as commodity prices (Headey and Fan, 2008).

In recent years, a number of articles on nutrition research have used the price per calorie as the basis for comparing the prices of healthy and less healthy foods and diets. Drewnowski (2010) justifies the use of a per calorie price by referencing and updating Atwater's calculations from a century ago, ignoring that although vitamins and minerals had not yet been discovered, Atwater realized that foods provide more than just calories. Thus, Atwater (1894) explicitly defined "the cheapest foods" as those that provided the largest amount of "nutriment" (not calories) at the least cost. In order to update his estimates today, one would need to include vitamins and minerals, as well as the calories, fat, protein, and carbohydrate metrics that Atwater included. In contrast to development economics that uses price per calorie as an *indicator* of food choices, nutrition studies that use the price per calorie view it as a *determinant* of food choices, interpreting the findings that healthier foods have a higher price per calorie than less healthy foods to mean that healthier diets are not affordable, particularly to lower income households (Darmon et al., 2004; Drewnowski, 2010; Drewnowski and Barratt-Fornell, 2004; Townsend et al., 2009).

The use of price per calorie for comparing the price of healthy foods with that of less healthy foods, however, has been subject to three basic criticisms:

1. When less healthy foods are defined as energy-dense (a higher number of calories per edible gram), the metric suffers from mathematical coupling or negative autocorrelation. This occurs because the same variable—calories—appears in the numerator of the energy density (calories per edible gram) calculation as well as in the denominator of the price metric (price per calorie) (Burns et al., 2010; Lipsky, 2009). Thus, high-energy-dense foods tend to have a low price per calorie

because the price is divided by a large number of calories, while low-energy-dense foods tend to have a high price per calorie because the price is divided by a small number of calories.

2. Since the price per calorie does not account for the amount of food consumed, it is not a good proxy for out-of-pocket food costs. As Frazão et al. (2011) explain, a gallon of skim milk has about half as many calories as a gallon of whole milk. Thus, the price per calorie is nearly twice as much for skim milk as for whole milk. Yet consumers often pay the same out-of-pocket cost for a gallon of milk, regardless of whether they buy skim or whole milk. This is because the price per calorie metric ignores the total costs associated with the total number of calories consumed.[2] Frazão (2009) confirms this weakness of the price-per-calorie metric using data from Townsend et al. (2009) to show that the higher cost per calorie of the healthier, less energy-dense diets does not translate into higher total daily food costs after accounting for the higher number of total calories in the less healthy diets.

3. The price-per-calorie metric is inconsistent with low-calorie marketing claims. Lipsky et al. (2011) raise the point that if consumers used the price of food energy in their decision making, then no manufacturer would want to advertise that a product had fewer calories, since that would result in a higher price. As it is, many foods carry a claim of fewer calories.

Amounts of foods providing approximately 100 calories. Note that a price comparison based on calories would not account for the amount of food typically consumed.

Photo: Joseph Sanford

[2]If a gallon of milk costs $3.20, the price per calorie would be $0.0024 for the skim milk and $0.0013 for the whole milk. A cup of skim milk contains 83 calories, so the full price of a cup of skim milk would be $0.20 ($0.0024*83=$0.20). In comparison, a cup of whole milk contains 149 calories, so the full price of a cup of whole milk would also be $0.20 ($0.00134*149= $0.20).

Some researchers use a modification of the price-per-calorie comparison by standardizing the total cost of a daily diet through assuming everyone consumes the same number of calories (Bernstein et al., 2010; Waterlander et al., 2010). That is, the researchers divide the total cost of food consumed by the number of calories consumed to obtain a cost per calorie for each individual, then multiply this cost by a set number of calories—say 1,800 calories—and define this as the total daily cost. However, standardizing total diet costs to the same number of calories ignores the fact that individuals consume different amounts of calories. Rolls et al. (1999) and others (summarized in Dietary Guidelines Advisory Committee, 2004) find that as energy density increases, so does total daily energy intake. Thus, individuals who consume a higher energy-dense diet tend to consume more calories overall than those who consume a less energy-dense diet.

Price of Edible Weight ($/100 Edible Grams)

Given the criticisms of the price-of-food-energy metric, we consider other metrics such as the price of edible weight. After food is purchased at a store, it generally needs to be prepared in some way. This can be as simple as opening a package or washing a piece of fruit, or it may involve many steps, including peeling, chopping, and cooking. The edible weight metric measures the price of putting a given weight of a food item on the plate. The edible weight price differs from the purchase price for many store-purchased items because the skin, seeds, shell, bones, and other inedible parts have been removed. In addition, moisture and fat may be lost or gained from cooking. For foods such as crackers, where no preparation or waste is involved, the purchase price and the edible weight price are the same. For additional details, see the box "Calculating the Edible Weight: Example of Chicken Breasts."

Calculating the Edible Weight: Example of Chicken Breasts

The waste (bone, skin, and fat on the skin) of a chicken breast is about 35 percent of the purchased weight (U.S. Department of Agriculture, Agricultural Research Service, 2010). However, there is no waste if the chicken breast is purchased in boneless and skinless form. The amount of "meat" on both chicken breasts is the same, but the purchase price per pound is generally higher for the boneless-skinless chicken breast. Since there is no waste associated with the boneless-skinless chicken breast, a pound of it will yield more "meat" than a pound of chicken breast purchased with the bone and skin. To determine which is more expensive, we use the following formula:

$$edible\ weight = purchase\ weight(1 - 0.35)$$

Or,

$$purchase\ weight = \frac{edible\ weight}{0.65} = edible\ weight * 1.54$$

Thus, on an edible weight basis, the boneless-skinless chicken breast will be cheaper as long as its retail price per pound is less than 154 percent of the retail price per pound of the chicken breast with the bone and skin.

The edible-gram metric might let food marketers demonstrate the better food values by enabling consumers to compare similar foods sold in different ways (such as the chicken example or fresh versus frozen vegetables). The metric might also be useful to economic researchers using models where quantities are allowed to vary to examine consumer demand for products sold in a variety of formats.

Price of an Average-Size Portion ($/portion)

Consumers eat different amounts of the various types of foods, so the price comparison based on weight does not serve as a guide for their total out-of-pocket expense for food. For example, a consumer might eat a 1-ounce package of potato chips, but a slice of watermelon (1/16th of a watermelon) weighs approximately 10 edible ounces (U.S. Department of Agriculture Agricultural Research Service, 2010). Unless the consumer happened to know the weight of a slice of watermelon, a comparison based on ounces would not be very useful. Thus, measuring the price of specific foods, or of entire meals, may be more helpful. Some consumers already use a variation of this metric, as is evidenced by the many Web sites and store circulars promoting meals for under $10.00 (Allrecipes.com, 2011; Largeman-Roth, 2011).

Extending the average-size-portion metric to all foods enables us to compare the cost associated with current levels of consumption and eating patterns. We estimated the average portion as the mean amount consumed at a single eating occasion by individuals 19 years and older who reported eating the food (or foods that are very similar, such as various types of pasta with tomato-based sauces). This metric does not measure the cost associated with consuming a diet that meets dietary guidance, but only the expenditure reflected in current eating habits. The metric is affected by the amount consumed (average portion size) and does not differentiate between a low-cost food and a food that is consumed in small amounts. Thus, this metric may classify foods consumed in larger amounts—such as entrees and mixed dishes—as more expensive than foods consumed in smaller amounts, such as side dishes. However, it does provide information on how much it costs to eat an average amount of the food at a single sitting.

Cost of Meeting Dietary Recommendations

None of the metrics discussed above provide information on how much it would cost to meet Federal dietary recommendations. We based the metric for determining this on the USDA Food Pattern recommendations used to translate the *Dietary Guidelines for Americans* (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2010) into more consumer-friendly recommendations about the types and amounts of foods to consume. USDA developed cup and ounce equivalents for all foods—cups for fruits, vegetables, and dairy and ounces for grains and protein foods (see more detailed description in the Data and Methods section below). The equivalents were first used on the MyPyramid Web site, which was replaced by the ChooseMyPlate Web site in 2011 (U.S. Department of Agriculture, 2011b). For the present study, we use the price per cup or ounce equivalent to estimate the cost of meeting the food group recommendations in the *Dietary Guidelines for Americans, 2010*. This metric provides a guide to consumers and policymakers on the range of prices consumers might face in meeting

each of the food group recommendations. These data provide important information for understanding the cost of using healthy versus less healthy foods to fully meet dietary recommendations. For example, an average portion of potato chips might be cheaper than an average portion of baked potato, but if it takes two average portions of potato chips to make up a cup equivalent of starchy vegetables, then the baked potato might be a cheaper way to meet the recommendation.

Data and Methods

Data

We use three data sets in this study:

1. The National Health and Nutrition Examination Study (NHANES) 2003-04 (Centers for Disease Control and Prevention (CDC), 2003-04). We use the 2003-04 data because these are the years that correspond to the most recent releases of the other two data sets, at the time the study was conducted. NHANES is a multistage probability sample of noninstitutionalized individuals living in the United States. The study includes two 24-hour dietary recalls for most subjects. Like other dietary recall surveys, foods are listed in the form consumed by the respondent. Thus, a participant reporting carrots would be asked if they were cooked or raw, and cooked carrots would be considered a different food than raw carrots. Different preparation methods (e.g., broiled, fried, with or without fat) also count as different foods. Many packaged products such as ready-to-eat cereals, canned soups, and frozen meals are distinguished by the type of product (e.g., cornflakes, chicken noodle soup, thin-crust cheese pizza) and in some cases by the brand name. If the fat, sodium, or sugar content differs between two foods, they are generally considered two different foods. For example, reduced-fat milk (2 percent) is classified as a different food than skim, 1 percent, or whole milk. Some mixed dishes such as burritos, casseroles, pizza, soup, sandwiches, burgers, salads, ice cream novelties, and fruit pies are reported as single foods, although ready-to-eat cereal with milk is recorded as two items: the cereal (distinguished by brand and type of cereal) and the milk (distinguished by fat content and fortification).

   Along with the quantity of food reported to have been consumed, NHANES dietary recall data adds the nutrient information on the number of calories, grams of saturated fat, and milligrams (mg) of sodium in each item. We used the dietary recall data to generate a list of foods consumed by survey respondents and then estimated the nutrient content of the food and calculated the average portion size consumed by those who report consuming the food. The 2003-04 NHANES sample includes 8,901 participants with at least 1 complete day of dietary recall and 4,439 individual food items, excluding baby foods.

2. USDA's Center for Nutrition Policy and Promotion (CNPP) Food Prices Database (FPD) 2003-04 (Center for Nutrition Policy and Promotion, USDA, 2009). Because NHANES does not include food prices, USDA's CNPP developed a Food Prices Database for all foods reported consumed in the NHANES 2003-04. The database estimates the price per edible gram, that is, after the food is prepared. These prices also take into account the inedible parts included in the purchase weight. For example, in order to eat 100 grams of fresh watermelon, the consumer will need to purchase about 200 grams of a full watermelon (not precut) because most consumers do not eat the rind, which accounts for nearly half (48 percent) of the purchase

weight. Since each preparation method represents a different food in NHANES, a different price is calculated for each preparation method of the same food—thus, the price for boiled cabbage is different from both the prices for raw cabbage and coleslaw.

However, the developers of the CNPP data needed to make many assumptions about whether foods were prepared from scratch, prepared using convenience foods, or purchased as a ready-to-heat convenience food. Since the CNPP Food Prices Database is designed to assess the price of foods consumed in the United States, it uses the prices of ready-to-heat foods for commonly reported items such as pizza, soups, and snacks and appetizers. The development team assumed these foods were normally eaten in the most convenient form, since preparing them from scratch is time consuming and the frequency of consumption suggests that convenience items are being used. Similarly, the canned or most convenient form was assumed for foods (or ingredients) such as legumes or dried beans (black beans, chick peas, navy beans, etc.) that may be too time consuming for many consumers to prepare from the dried form. This puts some healthy foods on a more equal footing, both in terms of preparation time and price, with convenience foods that tend to be high in fat or added sugar (Carlson et al., 2008b).

3. MyPyramid Equivalent Database (MPED) release 2, 2003-04 (Bowman et al., 2008).[3] USDA translated many of the major recommendations of the *Dietary Guidelines for Americans, 2005* (U.S. Department of Health and Human Services and U.S. Department of Agriculture, 2005) into dietary recommendations for consumers via the USDA Food Patterns, which measures quantities of foods in terms of cups and ounce equivalents (Britten et al., 2006). The recommendations were revised for the *Dietary Guidelines for Americans, 2010* (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2010) and are now incorporated into ChooseMyPlate.gov. The MPED gives the number of cup and ounce equivalents and teaspoons of added sugars in 100 edible grams of each food item. Vegetables, fruits, and dairy products are measured in cup equivalents, grains and protein foods in ounce equivalents, and liquid oils in teaspoons. Each major food group is broken down into subgroups (table 1). Foods that contain components from more than one food group—for example, a pasta salad with whole grain pasta, green peppers, tuna, olive oil, and cheddar cheese—would have quantities for whole grains (pasta), other vegetables (green peppers), seafood (tuna), and dairy (cheddar cheese). Although the recommendations have changed, the cup- and ounce-equivalent amounts have not changed—a cup of skim milk remains the same weight.[4]

[3]Future updates of this database will be referred to as the "USDA Food Patterns Equivalent Database."

[4]One major change between the 2005 and the 2010 Dietary Guidelines was moving tomatoes and red peppers from the "other vegetables" subgroup to a new subgroup "red-orange vegetables," which also includes carrots, sweet potatoes, and winter squash. The MPED allowed us to approximate this new group by combining tomatoes with the former "orange vegetables," although it did not allow us to separate the red peppers from the "other vegetable" group for inclusion in the "red-orange vegetables" for our analysis. Despite this, we felt it was appropriate to use the MyPyramid Equivalent Database to examine quantities of foods under the new subgroup recommendations found at ChooseMyPlate.gov.

Table 1
Major food groups and subgroups

Grains
Whole grains
Enriched grains
Vegetables
Dark-green vegetables
Red and orange vegetables
Beans and peas (legumes)
Starchy vegetables
Other vegetables
Fruit
No subgroups
Dairy
No subgroups
Protein foods
Seafood
Meat, poultry, eggs
Nuts, seeds, soy products

Source: Dietary Guidelines for Americans, 2010 (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2010).

Methods

After merging the three data sets together, we created a list of all foods reported consumed in NHANES and grouped similar foods. For example, all types of milk were grouped together as fluid milk, with similar groupings for cream cheeses, pork chops, finfish, waffles, whole wheat bread and rolls, citrus fruits, citrus fruit juices, carrots, and raw tomatoes. (For more information and a complete list of the groups, see the appendix). We calculated the average portion size of the food groups rather than of individual foods because some foods, such as lactose-free milk, have low consumption rates, while skim milk has higher consumption rates. The average portion size is the average amount of the entire food group consumed by adults who ate any foods from the group. We calculated the price per average portion by multiplying the edible weight of the average portion (in 100-gram units) of the food group by the price per 100 edible grams from the FPD and including the NHANES sample weights:

$$(price\ per\ average\ portion)_k = \frac{\sum_{i=1}^{N}\sum_{j=1}^{J}(amount\ consumed)_{ij} * (sample\ weight)_i}{\sum_{i=1}^{N}(sample\ weight)_i * (eat)_i} \times (price\ per\ 100\ edible\ grams)_k$$

where N is the number of individuals in the sample, J is the number of foods in the food group, and eat_i is the number of eating occasions by adult i of all foods in the food group. Note that eat_i may be equal to zero, since not all individuals eat from all food groups. Thus, this is the average amount of food consumed only

by individuals who ate from the food group—those who did not eat any foods in the food group are not included in the calculation of average amount consumed. The amount consumed is measured in 100-gram units.

Similarly, the price per calorie for each food is:

$$price\ per\ calorie = \frac{price\ per\ 100\ edible\ grams}{number\ of\ calories\ per\ 100\ edible\ grams}$$

where the price per 100 edible grams comes directly from the CNPP- FPD, the number of calories per 100 edible grams is derived from the NHANES data.

Finally, in order to estimate the cost of meeting dietary recommendations, we had to estimate the price per cup or ounce equivalent of each food, as follows:

$$price\ per\ cup\ or\ ounce\ equivalent = \frac{price\ per\ 100\ edible\ grams}{number\ of\ cup\ or\ ounce\ equivalents\ per\ 100\ edible\ grams}$$

where the number of cup or ounce equivalents per 100 edible grams is from the MPED.

We then sorted the foods into one of the five major food groups and one of the subgroups listed in table 1, based on the predominant ingredient. We began this step by establishing the minimal amount of a cup or ounce equivalent that must be contained within an average portion for a food to be classified as a fruit, vegetable, grain, dairy food, or protein food. We defined the minimal amount as half the portion sizes listed in the appendices of the *Dietary Guidelines for Americans, 2010* (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2010) and termed our reduction of the *Guidelines* portion the "cutoff." For example, the *Guidelines* appendixes list a portion of vegetables as ½ cup, so we classified a food as a vegetable if our estimated average portion contained at least ¼-cup equivalent of vegetables. Standard portions for protein foods vary based on the type of food: red meat, poultry, and fish are listed as 3-ounce portions (3-ounce equivalents, implying a cutoff of 1½ ounces in an average portion), but eggs are listed as 1 egg (1-ounce equivalent, a cutoff of ½-ounce equivalent in an average portion), and legumes and soy products are listed as ½ cup (2-ounce equivalent, a cutoff of 1-ounce equivalent in an average portion). Foods that could be placed in more than one major food group, such as spaghetti and tomato sauce, are placed in the "mixed dishes" group. Foods that could not be placed in any food group were placed in a group called "moderation foods." The cutoffs, descriptions of what counts as a cup or ounce equivalent for each food group, and the number of foods assigned to each group are given in table 2.

Note that the number of food codes in each group is an artifact of the USDA food coding system used in NHANES; it does not represent the quantity consumed or the caloric or nutrient contribution to the overall diet. For example, ready-to eat-cereal is broken down by brand and type, resulting in 153 different food codes, while fluid milk is differentiated only by fat type and

Table 2
Definition of food groups used for analysis

Food group	Dietary Guidelines portion size[1]	Minimal cutoff	Number of food codes	Definition of equivalent
Vegetables	½ cup	At least ¼ cup-equivalent	632	1-cup equivalent = 1 cup of raw or cooked vegetables or 100% vegetable juice, 2 cups of raw leafy greens
Dark green			83	
Red and orange			58	
Beans, peas, and soy products			48	
Starchy			141	
Other			236	
Vegetable Mixtures			66	
Fruits	½ cup	At least ¼ cup-equivalent	140	1-cup equivalent = 1 cup of uncooked fruit or 100% fruit juice, ½ cup dried fruit
Whole			98	
100% Juice			42	
Dairy	1 cup	At least ½ cup-equivalent	26	1-cup equivalent = 1 cup of fluid milk, soy beverage or yogurt, 1½ ounces of natural cheese, 2 ounces of processed cheese
Low-fat and skim milk, soy beverage, and yogurt			21	
Low-fat cheese			5	
Protein foods			265	
Red meat	3 ounce	At least 1.5 oz-equivalents	43	1-ounce equivalent = 1 ounce of lean meat
Poultry	3 ounce	At least 1.5 oz-equivalents	71	1-ounce equivalent = 1 ounce of lean poultry
Fish	3 ounce	At least 1.5 oz-equivalents	34	1-ounce equivalent = 1 ounce of fish
Beans, peas, and soy products	1/2 cup (2-oz equivalent)	At least 1 oz-equivalent	48	1-ounce equivalent = ¼-cup cooked dry beans
Eggs	1 egg (1-oz)	At least ½ oz-equivalent	20	1-ounce equivalent = 1 egg
Nuts and seeds	1 ounce (2-oz equivalent)	At least 1 oz-equivalent	47	1-ounce equivalent = ½-ounce nuts or 1 tablespoon of nut butter
Protein group mixtures		At least ½ oz-equivalent of two or more protein foods	2	
Grains	1 ounce	At least ½ oz-equivalent	322	1-ounce equivalent = 1 slice of bread, 1 cup of ready-to-eat cereal, or ½ cup of cooked rice, pasta, or cooked cereal
Whole			49	
Mixed			63	
Non-whole			210	
Mixed dishes		Above cutoff for at least two of the food groups: vegetables, fruits, milk, meat, or grains	206	

continued—

Table 2
Definition of food groups used for analysis—continued

Food group	Dietary Guidelines portion size[1]	Minimal cutoff	Number of food codes	Definition of equivalent
Moderation foods		None of the above or: ≥ 480 mg sodium, or ≥ 1 teaspoon added sugar, or:	2,896	
Vegetable moderation		> 3 g saturated fat	143	
Fruit moderation		> 3 g saturated fat	88	
Milk moderation		> 3 g saturated fat	132	
Meat moderation		> 4 g saturated fat	382	
Grain moderation		> 3 g saturated fat	637	
Mixed moderation		≥ 600 mg sodium, ≥ 5 grams saturated fat, and more than 1.25 teaspoons added sugar	837	
No food group moderation		Below minimum cutoff for all food groups	677	

[1]Portion sizes are listed in the appendix tables of the *Dietary Guidelines for Americans 2010* (U.S. Department of Agriculture and U S. Department of Health and Human Services. 2010), Washington, DC: U.S. Government Printing Office. www.dietaryguidelines.gov.

lactose-reduced, for a total of 12 codes. In 2003-04 NHANES, adults reported consuming fluid milk 6,018 times but ready-to-eat cereal only 2,180 times.

Once foods were assigned to major food groups and subgroups, we imposed restrictions on the maximum amount of saturated fat, added sugar, and sodium allowed in the average portion of each food group; foods exceeding the limits for these substances were moved to the "moderation" foods (see box "Classifying Foods as Moderation Foods"). Moderation foods can be further divided between foods that meet the minimal cup or ounce equivalent in an average portion for a food group, but were high in saturated fat, added sugars, or sodium (e.g., canned vegetables high in sodium), and foods that do not meet the minimal cutoff for any food group, irrespective of their saturated fat, added sugars, or sodium content. These divisions are included in table 2.

In order to estimate the distribution of prices for meeting the food group and subgroup daily recommendations in the USDA Food Pattern for an individual consuming 2,000 calories (table 3), we had to calculate the prices for a cup or ounce equivalent for the non-moderation foods. We then created the food group cost distributions by randomly selecting one food from each subgroup and multiplying the cup-equivalent price by the recommended amount and then adding the subgroup prices together to get a price measurement for the food group recommendation. For example, for the grain group, the recommendation calls for 3 ounces of whole grain foods and 3 ounces of enriched grains each day. A random draw might produce whole grain pasta for the whole grain food and a white dinner roll for the enriched-grain food. We multiplied the price per ounce equivalent for both foods by the recommended 3 ounces and added them together to get a daily cost for grains. We then repeated the random draws 5,000 times for each food group. So, in our grain

Classifying Foods as Moderation Foods

We define a food item as a moderation food if at least one of the following criteria applies:

No food group - Classification for food items that do not contain at least the minimal amounts of any one food group, as detailed in table 2. These foods are labeled "no food group moderation." They include foods consumed in amounts too small to provide half a serving of any food group (e.g., a cup of coffee with a little milk).

Excess saturated fat - The criterion for saturated fat content associated with moderation foods varies by food group. Protein foods with more than 4 grams of saturated fat per average portion are classified as moderation foods, based on the Food and Drug Administration (FDA) upper level of 4 grams per labeled serving if manufacturers would like to make any health claim on the label (Office of Nutrition, 2009). For other foods, at least 3 grams of saturated fat results in their classification as moderation foods; we based this on the saturated fat content of 2 percent milk (3 grams), since the *Dietary Guidelines for Americans, 2010* recommended low (1 percent) and skim milk, rather than reduced-fat (2 percent) or whole milk (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2010).

Excess added sugars - Foods with more than 1 teaspoon of added sugars in an average portion are classified as moderation foods. We chose this sugar level because the *Dietary Guidelines for Americans 2010* recommend that no more than 5-15 percent of calories should come from solid fat or added sugars. For a 2,000 calorie diet, this would be from 100 to 300 calories. We assume the individual is conscientious about all other foods and can thus consume 300 calories of added sugars and solid fat and still maintain a healthy diet. We further assume that the individual allows half of these calories to come from solid fat, leaving 150 calories, or 10 teaspoons, of added sugars per day. We then assume that this would be divided between 10 foods and beverages throughout the day.

Excess sodium - Foods with at least 480 mg of sodium in an average portion are classified as moderation foods, based on the maximum amount allowed in the FDA definitions of nutrient content claims. If a food manufacturer wishes to make a nutrient content claim such as "low fat," then certain other nutrients, such as sodium, must be below certain levels. This regulation holds even if the product does not make a "low sodium" claim (Office of Nutrition, 2009).

More than one food group ("mixed dishes") - We applied higher cutoffs for mixed dishes—foods that meet the definition of more than one food group—because these dishes are likely to be a main entrée such as a casserole, pasta dish, or soup. For mixed dishes to be classed as moderation foods, they must contain at least 4.9 grams of saturated fat, at least 1.25 teaspoons of added sugars, or at least 600 mg of sodium per average portion.

Examples of moderation and non-moderation foods - Based on the preceding nutrient criteria and USDA's nutrient content database, a baked white potato with bacon and cheese would be classified as a moderation food due to its high saturated fat and sodium content, whereas a baked potato with or without fat added in cooking would be classified as a vegetable. Fruit salad with marshmallows (high in added sugars), granola (high in added sugars), fruit-flavored yogurt from low-fat milk (high in added sugars), and Buffalo wings (high in saturated fats) would all be classified as moderation foods, whereas fruit salad with cream would be a fruit; low-fat, plain, or artificially sweetened yogurt would be in the dairy group, toasted oat cereal would be a grain, and roasted or broiled chicken wings without the skin would be a protein food.

Table 3
USDA food pattern for the 2,000 calorie per day level

Food group	Quantity recommended for a 2,000-calorie diet
Fruits	2 cup-equivalents/day
Vegetables	2½ cup-equivalents/day
Dark-green vegetables	1½ cup-equivalents/week
Red and orange vegetables	5½ cup-equivalents/week
Beans and peas (legumes)	1½ cup-equivalents/week
Starchy vegetables	5 cup-equivalents/week
Other vegetables	4 cup-equivalents/week
Grains	6 ounce-equivalents/day
Whole grains	3 ounce-equivalents/day
Enriched grains	3 ounce-equivalents/day
Protein foods	5½ ounce-equivalents/day
Seafood	8 ounce-equivalents/week
Meat, poultry, eggs	26 ounce-equivalents/week
Nuts, seeds, soy products	4 ounce-equivalents/week
Dairy	3 cup-equivalents/day

For more information on cup and ounce equivalents, see appendix 7, *Dietary Guidelines for Americans 2010*.

Source: *Dietary Guidelines for Americans, 2010* (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2010).

example, subsequent combinations might include oatmeal and enriched pasta, or whole wheat crackers and a dinner roll. For the vegetable and protein subgroups, where the subgroup recommendations are given on a weekly basis, we estimated the price distribution of meeting the weekly requirements and then divided by 7 to estimate the price for 1 day. There is no fruit subgroup recommendation, so we assumed that half of the fruit is consumed as whole fruit and the other half as 100-percent juice.

We do not include moderation foods within the price distributions for meeting food group recommendations because these foods cannot be assigned to a specific food group or subgroup, and thus the cost of meeting the recommendation cannot be calculated. Similarly, mixed dishes are not included in this part of the analysis because of the difficulty in proportioning the price of the food from each food group contained in the mixed dish.

After estimating all the different prices and classifying foods into the major food groups and subgroups, we examined the distribution of prices for each major food group for each metric. We used common nonparametric tests such as the Spearman Rank-Order Correlation and the Kolmogorov-Smirnov test to compare the distributions, as well as a visual inspection. We also demonstrated the distribution of daily prices to meet each of the five food group recommendations in the USDA Food Patterns.

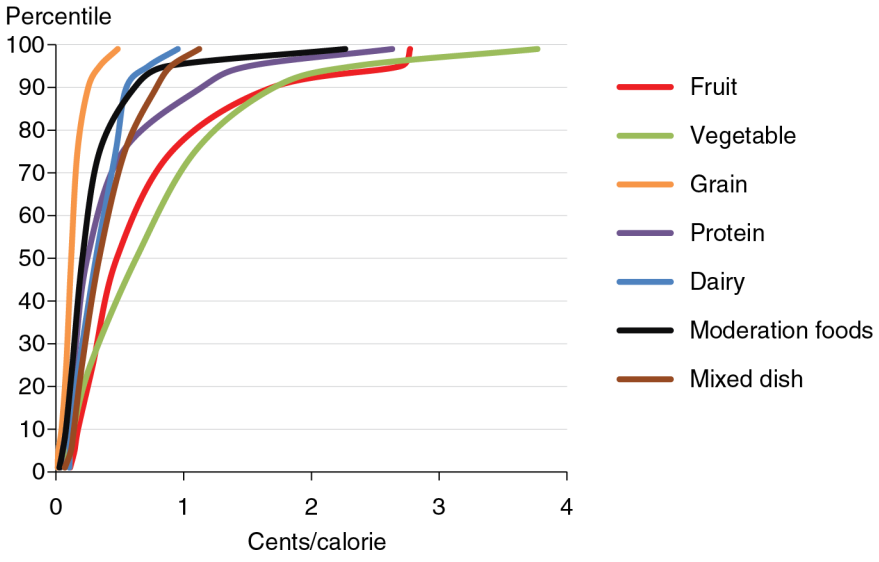
Findings

Figures 1-4 present the distributions of food prices for the price per calorie, the price per edible weight, the price per average portion, and the cost of meeting food group recommendations for the five major food groups (vegetables, fruits, grains, dairy, and protein). Figures 1-3 also include a single curve for all moderation foods and a curve for mixed dishes, while figure 4 (cost of meeting food group recommendations) does not include mixed dishes or moderation foods. In each chart, the percentile is on the y-axis and the relevant unit price is on the x-axis. At any percentile, curves that are closer to the y-axis represent foods with a lower price for that price metric. Curves that rise rapidly indicate smaller price variation. Tables 4-6 and 9 show the results of Kolmogorov-Smirnov (K-S) tests for differences in distributions between food groups for the price per calorie, price per edible weight, price per average portion, and the cost of meeting the food group recommendation. For each test, we compare the price distributions for two food groups (e.g., protein versus grains) and indicate on the table which of the two food groups costs more overall, along with the p-value. The K-S test is a powerful test for dealing with data that is clustered or lumpy, but it is not very strong at the tails (StataCorp, 2009); for this reason we also discuss the lower end of the distributions based on visual inspection of the data.

Food Energy Price

Figure 1a shows the distribution of the price per calorie across all foods within each of the five major food groups, as well as for moderation foods and mixed dishes. The results indicate that foods high in calories tend to have a lower price per calorie than foods that are lower in calories. For example, vegetables, which are naturally low in calories, tend to have the highest

Figure 1a
Distribution of food energy prices



Source: Estimated from the NHANES 2003-04, CNPP Food Prices Database, and MyPyramid Equivalent Database 2.0.

price per calorie, with fruits being slightly less expensive per calorie than vegetables. In contrast, foods in the grain group (grains low in saturated fats, added sugars, and sodium) have the lowest price per calorie, followed by moderation foods (in addition to high-calorie foods, this group includes foods and beverages that are high in sodium but not calories, such as canned vegetables). Protein foods, mixed dishes, and dairy fall in the middle. Most foods in the grain group have fairly similar prices per calorie, with even the most expensive grain food (bran cereal with extra fiber) costing about 0.5 cents per calorie. Fruits and vegetables show a wider variation, ranging from 0.03 cents per calorie (chick peas and pinto beans in cans) to 37.6 cents per calorie (watercress) for vegetables, and from 0.1 cents per calorie (bananas) to 2.8 cents per calorie (blackberries) for fruit. About 10 percent of fruits and vegetables cost more than 1.5 cents per calorie.

Table 4 shows the results of the Kolmogorov-Smirnov tests for differences in distribution. The last cell in the second data row of the table (vegetable and moderation foods comparison) indicates that the price distribution for vegetables is higher than the price distribution for moderation foods for this metric, and the p-value for this test is less than 0.001. The Kolmogorov-Smirnov test examines the entire distribution and finds that, overall, vegetables have a higher price than moderation foods. Table 4 also shows that all distributions are statistically different except for protein and dairy and mixed dishes and dairy.

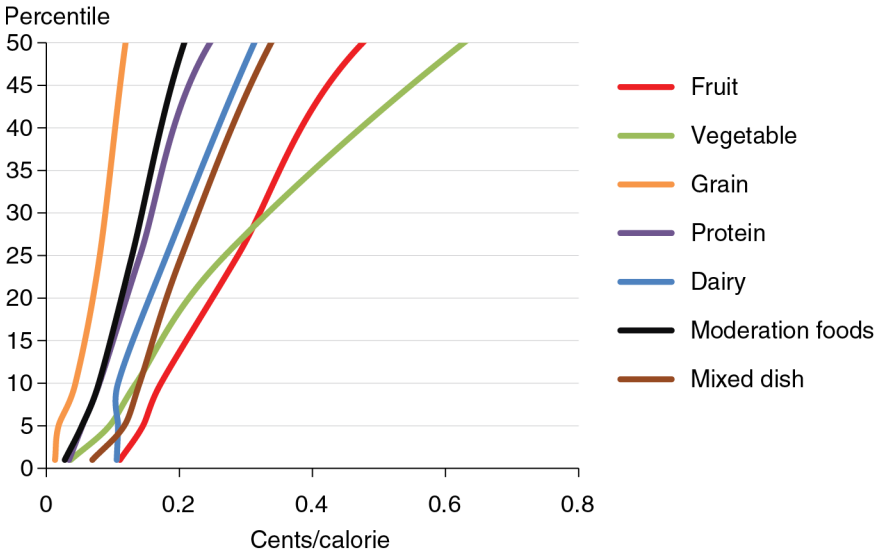
We also looked more closely at the foods in the lower half of the distribution because those foods may be more relevant to low-income consumers. Figure 1b shows the same distribution as that in figure 1a, but only for the foods with the lowest price per calorie (that is, up to the 50th percentile of foods). From this figure we can see that grains have a lower price per calorie than moderation foods. Among the lower priced foods, the price per calorie varies by as much as 0.3-0.6 cents for fruits and vegetables and by less than 0.1 cents for grain foods.

Table 4
Comparison of relative food group prices: Price per calorie

	Fruit	Vegetable	Grain	Protein	Dairy	Mixed dishes	Moderation
Fruit	.	Vegetable (0.02)	Fruit (< 0.001)	Fruit (< 0.001)	Fruit (0.01)	Fruit (< 0.001)	Fruit (< 0.001)
Vegetable	.	.	Vegetable (< 0.001)	Vegetable (< 0.001)	Vegetable (< 0.001)	Vegetable (< 0.001)	Vegetable (< 0.001)
Grain	.	.	.	Protein (< 0.001)	Dairy (< 0.001)	Mixed dishes (< 0.001)	Moderation (< 0.001)
Protein	.	.	.	.	=	Mixed dishes (< 0.001)	Protein (< 0.001)
Dairy	.	.	.	.	.	=	Dairy (0.009)
Mixed dishes	.	.	.	.	.	.	Mixed (< 0.001)
Moderation	.	.	.	.	.	.	.

Notes: The table shows higher priced distribution and p-value (in parens), based on Kolmogorov-Smirnov tests for statistical differences between the price distributions of different food groups; an = sign indicates no statistical difference. For example, the table shows that the price distribution for vegetables is significantly higher than the price distribution for fruit, and the p-value for this test is 0.02. Many tests have a p-value of 0.00, indicating that the probability of finding the distributions equal is very small. The table also shows that all distributions are statistically different except for protein and dairy and dairy and mixed dishes.

Figure 1b
Distribution of food energy prices, up to 50th percentile



Source: Estimated from the NHANES 2003-04, CNPP Food Prices Database, and MyPyramid Equivalent Database 2.0.

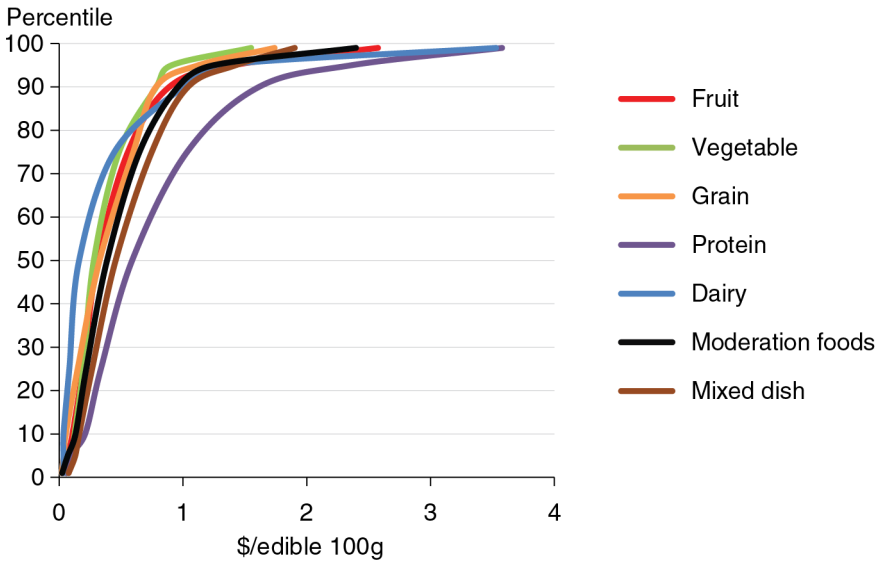
Edible Weight Price

Figure 2a, which shows the distribution of the price per 100 edible grams for the same five food groups, mixed dishes, and moderation foods, tells a different story. The dairy group is typically the least expensive per 100 edible grams. Fruits and vegetables have fairly similar prices per 100 edible grams and are slightly more expensive than grains. Protein foods have the highest price per 100 edible grams and mixed dishes have the second highest, with both more expensive than moderation foods. Within the moderation foods, the fruit- and vegetable-based moderation foods are the least expensive on an edible-gram basis, and the protein-group moderation foods are the most expensive (results not shown).

Table 5 shows the results from the Kolmogorov-Smirnov tests indicating that most distributions are statistically different; one exception is that grains and fruit have an equivalent price distribution.

Turning to the foods that fall below the 50th percentile in price per edible gram, we see that although grain foods vary little in their price per calorie, figure 2b shows considerable variation in their price per 100 edible grams. The cheapest grains are the least expensive food per 100 edible grams, but by the 5th percentile dairy becomes cheaper, and around the 40th percentile, grains are more expensive per 100 edible grams than fruits and vegetables. Figure 2b also allows us to see that about 5 percent of the least expensive protein foods (plant-based) are less expensive than the fruits and vegetables in the bottom 5 percent of the distribution.

Figure 2a
Distribution of price per 100 edible grams



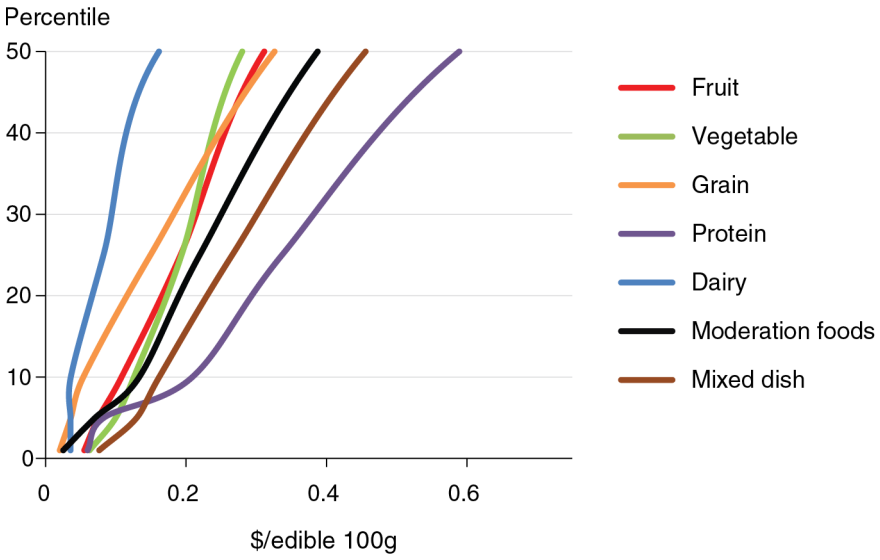
Source: Estimated from the NHANES 2003-04, CNPP Food Prices Database, and MyPyramid Equivalent Database 2.0.

Table 5
Comparison of relative food group prices: Price of edible gram

	Fruit	Vegetable	Grain	Protein	Dairy	Mixed dishes	Moderation
Fruit	.	Fruit (0.035)	=	Protein (< 0.001)	Fruit (0.007)	Mixed dishes (< 0.001)	Moderation (0.032)
Vegetable	.	.	Vegetable (< 0.001)	Protein (< 0.001)	Vegetable (0.001)	Mixed dishes (< 0.001)	Moderation (< 0.001)
Grain	.	.	.	Protein (< 0.001)	Grain (0.042)	Mixed dishes (< 0.001)	Moderation (< 0.001)
Protein	.	.	.	.	Protein (< 0.001)	Protein (< 0.001)	Protein (< 0.001)
Dairy	.	.	.	.	.	Mixed dishes (< 0.001)	Moderation (0.001)
Mixed dishes	.	.	.	.	.	.	Mixed dishes (0.001)
Moderation	.	.	.	.	.	.	.

Notes: The table shows higher priced distribution and p-value (in parens), based on Kolmogorov-Smirnov tests for statistical differences between the price distributions of different food groups; an = sign indicates no statistical difference. For example, the table shows that the price distribution for fruit and grain is significantly higher than the price distribution for vegetables, and the p-value for this test is 0.035. Many tests have a p-value of < 0.001, indicating that the probability of finding the distributions equal is very small. The table also shows that all distributions are statistically different except for protein and dairy and dairy and mixed dishes.

Figure 2b
Distribution of price per 100 edible grams, up to 50th percentile



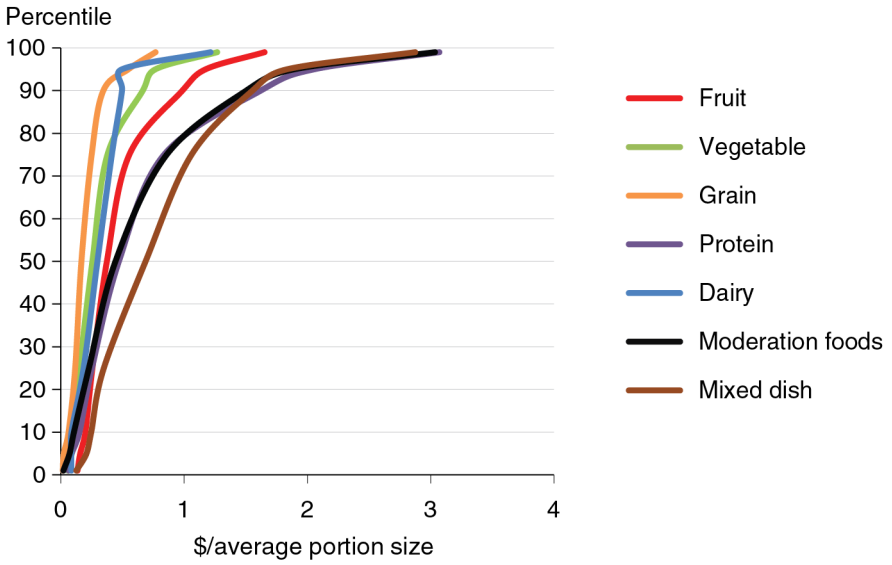
Source: Estimated from the NHANES 2003-04, CNPP Food Prices Database, and MyPyramid Equivalent Database 2.0.

Average-Portion Price

Figure 3a illustrates the price associated with the average-size portion of each food. As with the price-per-calorie metric, grains are the least expensive of the food groups. Vegetables and dairy (not statistically different, see table 6) are the second least expensive, followed by fruit, protein, and moderation foods. Mixed dishes are the most expensive, which may indicate larger portion sizes, particularly for the foods that are entrées.

Because the price per average portion is heavily influenced by the amount consumed for each food, we calculate the summary statistics for the weight of an average-portion size (table 7). A t-test of the means suggests that some average portion weights are not different at the mean. In particular, there is no difference in the following comparisons: between vegetables and protein; fruit and protein, dairy, mixed dishes and moderation foods; dairy and mixed dishes and moderation foods; and moderation and mixed dishes. However, since we are interested in the full distribution of the average amount consumed for each food group, we performed Kolmogorov-Smirnov tests and found that the distributions of the average-portion weight within each food group are all statistically different, with a p-value of less than 0.004. Note that mixed dishes, dairy, and moderation foods have the highest mean portion-size weight. However, the mean portion-size weight for dairy is somewhat misleading because the most commonly consumed dairy food is fluid milk, which has a high water content, and thus an average portion (about 8 fluid ounces) weighs more than the average portion of most foods. The moderation foods also include some beverages such as sodas, fruit drinks, coffee, and tea. Note that the range of average-portion-size weights for mixed dishes is higher than for all other food groups except moderation foods; with mixed dishes, consumers are eating from at least two food groups, which may explain the larger portion sizes. It may also explain in part why mixed dishes have a higher average-portion price.

Figure 3a
Distribution of price per average portion



Source: Estimated from the NHANES 2003-04, CNPP Food Prices Database, and MyPyramid Equivalent Database 2.0.

Table 6
Comparison of relative food group prices: Price of average portion

	Fruit	Vegetable	Grain	Protein	Dairy	Mixed dishes	Moderation
Fruit	.	Fruit (< 0.001)	Fruit (< 0.001)	Protein (0.001)	Fruit (0.048)	Mixed dishes (< 0.001)	Moderation (< 0.001)
Vegetable	.	.	Vegetable (< 0.001)	Protein (< 0.001)	=	Mixed dishes (< 0.001)	Moderation (< 0.001)
Grain	.	.	.	Protein (< 0.001)	Dairy (< 0.001)	Mixed dishes (< 0.001)	Moderation (< 0.001)
Protein	.	.	.	.	Protein (< 0.001)	Mixed dishes (< 0.001)	Moderation (< 0.001)
Dairy	.	.	.	.	.	Mixed dishes (< 0.001)	Moderation (< 0.001)
Mixed dishes	.	.	.	.	.	.	Mixed dishes (< 0.001)
Moderation	.	.	.	.	.	.	.

Notes: The table shows higher priced distribution and p-value (in parens), based on Kolmogorov-Smirnov tests for statistical differences between the price distributions of different food groups; an = sign indicates no statistical difference. For example, the table shows that the price distribution for vegetables is significantly higher than the price distribution for fruit, and the p-value for this test is < 0.001. Many tests have a p-value of
< 0.001, indicating that the probability of finding the distributions equal is very small. The table also shows that all distributions are statistically different except for vegetable and dairy.

Table 7

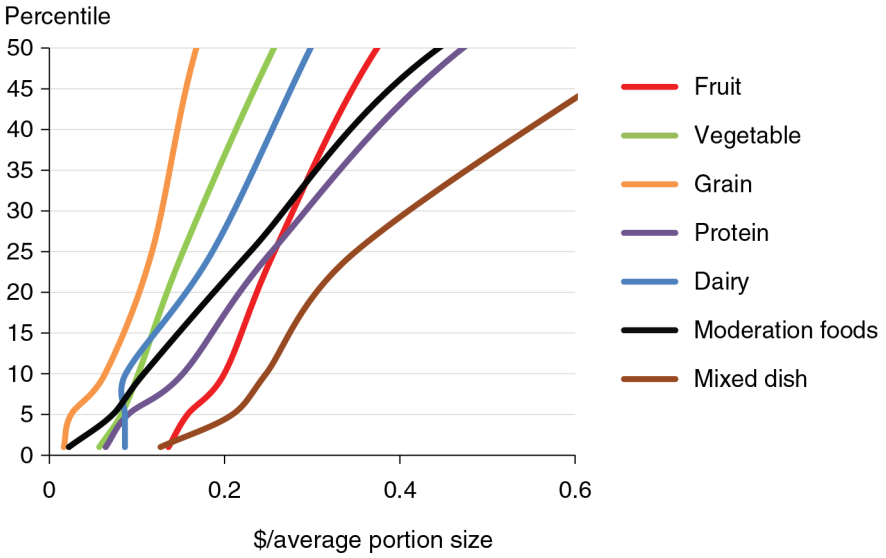
Summary statistics for the weight of an average portion, by food group

Group	Number of food codes	Mean (g)	Standard deviation	Minimum	Maximum
		Grams			
Vegetables	631	91.09	37.37	32.20	374.30
Fruit	140	156.45	104.60	21.91	501.13
Grain	322	78.16	65.05	11.14	378.60
Dairy	26	178.96	92.73	31.34	378.60
Protein	265	90.99	34.93	24.30	204.41
Mixed Dish	206	169.80	82.30	51.56	549.14
Moderation	2,896	161.42	127.50	2.25	790.50

Among the least expensive foods (foods in the lower half of the price distribution), fruit is in the middle of the spectrum, although—as can be seen from figure 3b— the cheapest fruits have a higher price per average portion than the cheapest protein foods (dry beans, purchased in cans) and moderation foods. Above the 35th percentile, mixed dishes and protein foods are more expensive than the other groups. Of all the moderation foods, the protein-based moderation foods are the most expensive, along with moderation mixed dishes, while moderation foods that do not contain any food groups are the least expensive (results not shown).

Figure 3b

Distribution of price per average portion, up to 50th percentile



Source: Estimated from the NHANES 2003-04, CNPP Food Prices Database, and MyPyramid Equivalent Database 2.0.

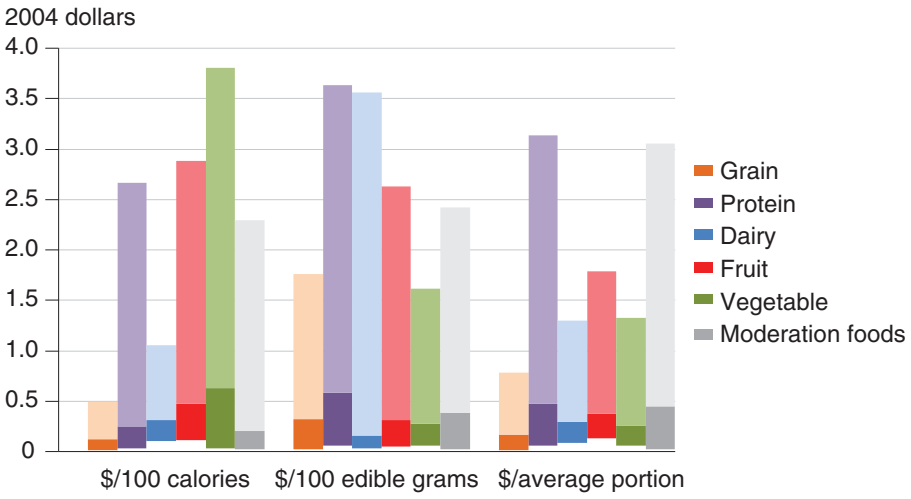
It is important to remember that this metric represents what consumers pay to eat a specific amount of food—the average amount per sitting. Economic theory suggests that for this metric, consumers are choosing the optimal quantity—that is, following their desire for taste, convenience, nutrition, and other personal factors, while also following their budget restrictions. The metric thus provides the total expenditure the average consumer will pay to consume a particular food on a single eating occasion. Since consumers may choose to eat a particular food several times during the day, this metric does not provide a measure of total daily cost.

Comparing the Metrics

Figures 1a-3b are summarized in figure 4. The chart illustrates how the price metric changes the relative cost of the food groups. Grains are always the least expensive group, regardless of which of the three metrics is used. Protein foods are the most expensive group when the price is measured per 100 edible grams or average portion, but rank in the middle when price is measured per calorie. The largest difference in ranking occurs in comparing prices for fruits and vegetables with moderation foods. When measured using price per 100 calories, the fruit and vegetable groups are both more expensive than the moderation foods. However, when the prices are measured using price per 100 edible grams, vegetables are less expensive than either fruits or moderation foods, whose cost is about equal. When compared by price per average-portion size, fruits and vegetables are both less expensive than moderation foods.

As a final measure of how the various metrics perform in determining whether healthy food items are more expensive than less healthy foods, we ranked all of the 4,439 foods by each of the three metrics—the price per

Figure 4
The prices of healthy versus less healthy foods vary with the measurement method



Notes: The dark areas of each bar represent the price range for the cheaper half of the foods in the category, while the lighter areas are the price ranges for the higher cost foods. White space at the bottom of the bars represents the start of the price range.

Moderation foods are foods that are high in sodium, added sugars, or saturated fat, or that did not contain foods from a food group.

calorie, the price per edible weight, and the price per average-size portion—and then compared the overall rankings of food prices using Spearman's rank order correlation (StataCorp, 2009). All three metrics provide statistically different rankings, although for each metric the price per calorie differed the most from the other two. The correlation between the price per calorie and the price per edible weight was 0.44; between the price per calorie and the price per average-size portion it was 0.5; and between the price per edible weight and price per average-size portion it was 0.57. A higher correlation indicates that the metrics are more closely related.

We illustrate the price-ranking differences across the three price metrics in table 8. The table shows how various foods, selected from among the most commonly reported foods in each food group, are ranked according to the price-per-calorie, price-per-edible-weight, and price-per-average-size-portion metrics. Lower rankings indicate that the food is less expensive, and higher rankings indicate that it is more expensive.

Table 8 confirms that the price-per-calorie metric tends to classify foods low in calories—such as coffee, romaine lettuce, and sugar-free soda—as expensive. For example, the price-per-calorie metric ranked coffee as 4,321 out of 4,439 foods, romaine lettuce as 4,371, and sugar-free soda as 4,413. Along the same lines, the price-per-calorie metric ranked milk in inverse proportion to its fat (and therefore, calorie) content—2 percent milk had a ranking of 1,156, while 1 percent milk ranked 1,609. Similarly—and in sharp contrast with the perception that less healthy foods cost less than healthier foods—the price-per calorie metric ranked non-diet soda as more expensive than 2 percent milk (1,542 vs. 1,156). This is not surprising, since a cup of a cola-type soft drink has fewer calories than a cup of 2 percent milk. Most of these lower calorie foods become less expensive (sometimes considerably so) when using the price per edible weight or the price per average-size portion. Under the average-size portion metric, romaine lettuce (rank 1,727) becomes less expensive than an ice cream sandwich (rank 3,052), and 1 percent milk (rank 900) is less expensive than soda (rank 1,791). Foods high in calories (such as sweet cinnamon rolls and salty snacks) tend to rank as less expensive under the price-per-calorie metric than under the other two metrics.

Certain foods, such as pinto beans, are ranked as cheaper no matter how the price is measured. Since beans were priced in canned form, they would be even cheaper if purchased in dried form and cooked at home.

Some foods, such as peanut butter and chocolate chip cookies, are ranked as considerably more expensive using price per edible weight than when the other metrics are used. This occurs because these foods are high in calories (and therefore tend to have a low price per calorie) and average-portion sizes tend to be small, by weight (which tends to give them a small price per average-size portion).

Foods consumed in large amounts tend to have a high price per average-size portion. This explains why cola-type soft drinks become considerably more expensive than milk when measured using the price per average-size portion—average reported consumption (per drinking occasion) of soft drinks is twice as large (approximately 2 cups) as average reported consumption of milk (approximately 1 cup).

Table 8

Rankings by price metric for selected foods

Food description	Ranking based on $/100 calories	Ranking based on $/100 edible grams	Ranking based on $/portion	Weight of average portion (g)
Healthy foods				
Vegetables				
Carrots, raw	3,658	1,254	560	47.66
Tomatoes, raw	4,365	2,390	1,309	56.36
Pinto, calico/red/Mex. beans; dry, cooked, fat added	67	138	189	119.98
Refried beans	965	827	1,553	146.17
Lettuce, raw	4,251	985	309	45.07
Onions, mature, raw (include red onions)	3,147	603	180	45.07
Romaine lettuce, endive, chicory, or escarole, raw	4,371	2,505	1,727	67.10
White potato, french fries, not specified as to fresh/frozen (not deep fried)	621	1,535	1,417	91.39
White potato, mashed, not further specified	673	310	811	161.56
Fruits				
Apple, raw	3,264	1,080	1,578	126.18
Banana, raw	1,671	645	1,068	126.18
Orange juice, canned, bottled, or in a carton	987	122	654	260.06
Grains				
Bread, multigrain	602	1,455	476	44.48
Oatmeal, cooked, regular, no fat added	936	227	727	199.36
Cheerios	1,627	3,243	1,605	43.86
Bread, white	398	1,045	441	52.39
Salty snacks, corn or cornmeal, tortilla chips	894	3,115	1,496	43.74
Tortilla, corn	4	28	25	78.44
Dairy				
Milk, cow's, fluid, 1% fat	1,609	209	900	242.56
Yogurt, w/fruit, nonfat milk, low-cal sweetener	3,477	1,335	2,369	163.62
Cheese, processed, American/cheddar type, low fat	2,916	3,141	1,080	33.41
Protein foods				
Beef, roast, roasted, lean only	3,675	4,156	3,983	110.65
Pork chop, broiled or baked, lean only	3,461	4,036	3,707	97.67
Chicken, breast, roasted/broiled/baked, w/o skin	3,028	3,064	2,923	99.66
Chicken, thigh, roasted/broiled/baked, w/o skin	2,634	3,125	2,970	99.66
Tuna, canned, not specified as to oil or water pack	3,052	2,513	2,957	133.07
Eggs, whole, fried (incl. scrambled, no milk added)	1,020	1,311	916	70.91
Peanut butter	226	1,977	425	32.28
Moderation foods				
Vegetable moderation:				
Pork & beans	762	320	737	146.17
White potato, chips (incl. flavored)	846	3,294	1,231	34.22
White potato, french fries, from frozen, deep-fried	501	1,671	1,552	91.39

continued—

Table 8
Rankings by price metric for selected foods—continued

Food description	Ranking based on $/100 calories	Ranking based on $/100 edible grams	Ranking based on $/portion	Weight of average portion (g)
Fruit moderation:				
Peach, cooked or canned, in light or medium syrup	3,055	905	1,378	126.18
Grain moderation:				
Ice cream sandwich	2,771	3,579	3,052	83.15
Roll, sweet, cinnamon bun, frosted	1,047	2,804	2,178	73.10
Cookie, chocolate chip	299	1,956	531	36.66
Popcorn, popped in oil, buttered	266	2,210	853	43.74
Frosted flakes, Kellogg	871	2,485	1,644	64.34
Dairy moderation:				
Milk, cow's, fluid, 2% fat	1,156	200	879	242.56
Yogurt, fruit variety, low-fat milk	2,704	1738	2691	163.62
Cheese, processed, American/cheddar-type	1,651	3,085	1,052	33.41
Protein food moderation:				
Ground beef or patty	2,409	3,370	3,103	96.61
Ham, sliced, prepackaged or deli, luncheon meat	3,013	2,769	1,978	67.60
Mixed dish moderation:				
Chicken patty/fillet/tenders, breaded, cooked	1,008	2,168	2,223	99.66
Pizza w/meat, thin crust	2,382	3,588	4,215	235.33
Spaghetti w/tomato sauce & meat sauce	1,066	1,040	3,415	372.11
Macaroni or noodles w/cheese	613	984	2,441	209.92
No Food Group moderation:				
Ice cream, regular, not chocolate	924	1,312	1,816	124.96
Milk chocolate candy, plain	1,184	3,643	1,292	30.30
Coffee, made from ground, regular	4,321	9	231	445.84
Soft drink, cola-type	1,542	147	1,791	501.13
Soft drink, cola-type, sugar-free	4,413	166	1,856	501.13

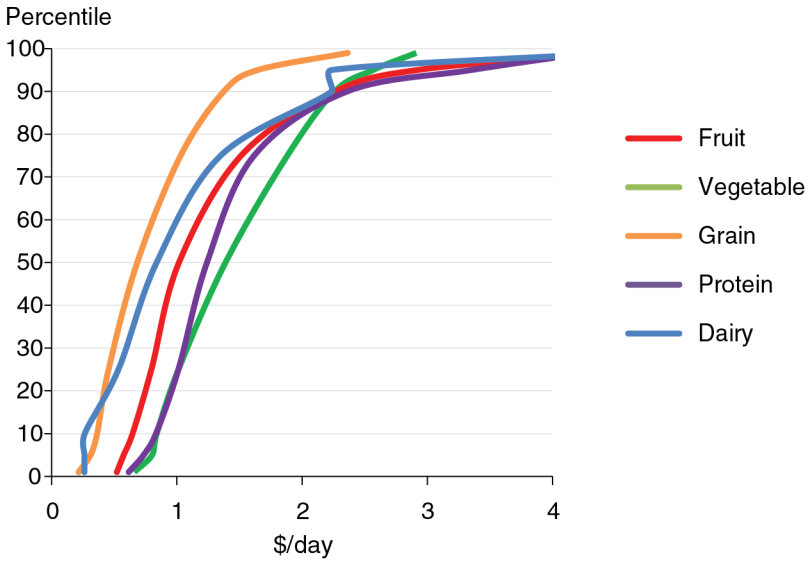
Cost of Meeting Daily Food Group Recommendations

Although the three previously described metrics allow consumers to make price comparisons between two or more foods, none of them really allows consumers or policymakers to gauge the cost of meeting dietary recommendations. This is illustrated in the range of prices for food needed to meet the recommendations of the USDA Food Patterns, using foods that NHANES survey participants report consuming.

Figures 5a and 5b show the distribution of the daily costs of meeting the individual food group recommendations in the USDA Food Pattern for an individual consuming 2,000 calories (see table 3). Table 9 shows that all price distributions are statistically different from each other, and the p-value for all tests is very small. We cannot assess the total daily price of meeting the full set of dietary guidelines by adding the curves because mixed dishes are not included in the analysis, and these dishes may prove to be more or less

Figure 5a

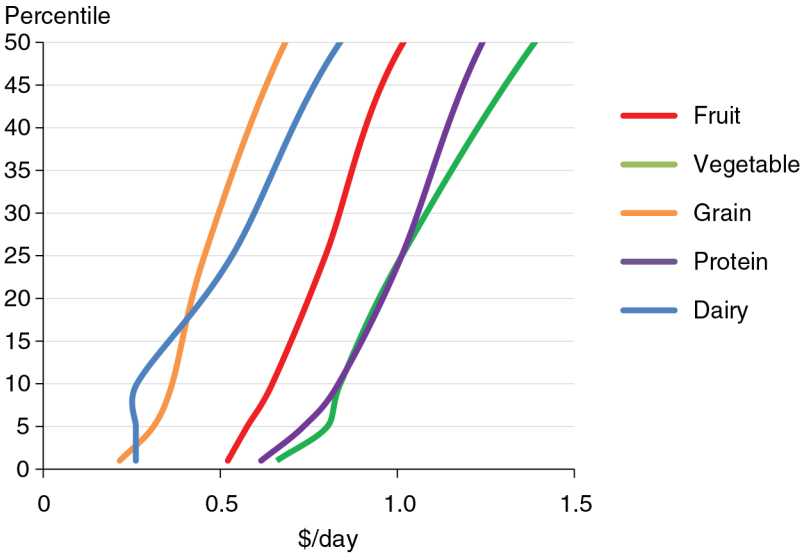
Distribution of cost of meeting daily recommendation for food groups



Source: Estimated from the NHANES 2003-04, CNPP Food Prices Database, and MyPyramid Equivalent Database 2.0.

Figure 5b

Distribution of cost of meeting daily recommendation for food groups, up to 50th percentile



Source: Estimated from the NHANES 2003-04, CNPP Food Prices Database, and MyPyramid Equivalent Database 2.0.

economically efficient at providing the recommended amounts of nutrients. In addition, the *Dietary Guidelines for Americans 2010* allows consumption of a small amount of food we classified as moderation food, which is not included in the analysis in figures 5a and 5b.

Table 9

Comparison of relative food group prices: Cost of meeting dietary recommendations

	Fruit	Vegetable	Grain	Protein	Dairy
Fruit	.	Vegetable (< 0.001)	Fruit (< 0.001)	Protein (< 0.001)	Fruit (< 0.001)
Vegetable	.	.	Vegetable (< 0.001)	Vegetable (< 0.001)	Vegetable (< 0.001)
Grain	.	.	.	Protein (< 0.001)	Dairy (< 0.001)
Protein	.	.	.	.	Protein (< 0.001)
Dairy	.	.	.	.	.

Notes: The table shows higher priced distribution and p-value (in parens), based on Kolmogorov-Smirnov tests for statistical differences between the price distributions of different food groups; from K-S test; an = sign indicate s no statistical difference. For example, the table shows that the price distribution for vegetables is significantly higher than the price distribution for fruit, and the p-value for this test is < 0.001. All tests have a p-value of < 0.001, indicating that the probability of finding the distributions equal is very small. The table also shows that all distributions are statistically different.

The daily cost metric shows that the vegetable and protein recommendations are the most expensive to meet, with fruit falling in the middle. Grains and dairy are the least expensive food group recommendations for consumers to meet. Under the new food group recommendations, fruits and vegetables should occupy half of the plate at each meal, so we might expect that in order to meet these recommendations, the consumer will spend at least as much as he or she does on other foods. Protein foods are the smallest quantity of food in the food pattern, but they constitute the second most expensive recommendation. For comparison, the USDA Food Plan outlines a budget for a healthy diet[5] that recommends that vegetables account for 22-26 percent of the food budget, fruit 15-16 percent, and protein foods about 21-22 percent (Carlson et al., 2007). A consumer who decided to purchase all of the recommended foods at the 50th percentile in figures 5a and 5b would spend 27 percent of the food budget on vegetables, 20 percent on fruit, and 24 percent on protein foods; these numbers are just slightly higher than the Food Plan estimates, which include the mixed dishes and moderation foods lacking in the figures.

Meeting the vegetable recommendation likely costs more because the recommended amount of vegetables is larger than the recommendation for any other group (see table 3). Stewart et al. (2011b) and Carlson and Stewart (2011) used the prices of fruits and vegetables per cup equivalent from their earlier study (Stewart et al., 2011a) and determined that most consumers, even low-income consumers who receive benefits from the USDA/Supplemental Nutrition Assistance Program (SNAP), could afford to purchase the recommended quantities of fruits and vegetables if they chose to allocate 40 percent of their food budget to fruits and vegetables. The fact that consumers choose to spend significantly less than that on fruits and vegetables (20-25 percent) (Carlson et al., 2008a) may indicate that they are making their budget allocations based on considerations other than meeting dietary recommendations, such as taste and convenience. If consumers are trying to meet all of the fruit and vegetable recommendations on a significantly

[5]The USDA Food Plan budgets are the appropriate budgets to follow for a complete overall healthy diet. The food plans account for dietary recommendations beyond the individual food groups, such as macronutrients, and include all foods, not just the ones that we classify as healthy. The results shown here are meant to provide a range of costs for individual food groups.

smaller share of their food budget than is recommended, it is understandable why they see fruits and vegetables as expensive. Other ERS authors have come to a similar conclusion: Stewart et al. (2003) have found that low-income consumers do not spend more on fruits and vegetables as their incomes rise, and the authors hypothesize that tastes and preferences play a large role in their choices.

The cost of meeting food group recommendations does not consider consumer food purchasing motivations other than a desire to follow dietary guidance. Our research suggests that consumers value other factors besides healthy eating. The research does provide guidance to policymakers who have a specific budget in mind on whether a recommendation might be affordable to the consumer who wishes to follow the recommendation.

Conclusions

For this study, we calculated three price metrics for each of the 4,439 foods reported to be consumed by adults in the 2003-04 NHANES: (1) food energy price or price per calorie ($/calorie), (2) price per edible weight ($/100 edible gram units), and (3) price per average portion ($/average portion). Our comparison of these metrics shows that the metric used can affect the conclusion as to whether healthier foods carry a higher price tag than less healthy foods. Regardless of the metric used, the analysis makes clear that it is not possible to conclude that healthy foods are more expensive than less healthy foods. Much depends on the specific foods compared. In particular, we find that:

- Foods low in calories for a given weight tend to have a higher price when the price is measured per calorie—vegetables and fruits without added fat or sugar are low in calories and, by this metric, tend to be a very expensive way to purchase food energy.
- Conversely, still using the price-per-calorie measure, less healthy (moderation) foods high in saturated fat and/or added sugars tend to be high in calories and have a low price per calorie.
- However, when measured on the basis of edible weight or average portion size, vegetables and fruit are less expensive than most dairy, protein, and moderation foods.

The price metrics in this analysis are not easily accessible to the consumer at the point of sale. Many grocery stores display price per purchase pound or some other unit price as a service to customers wishing to make price comparisons of similar items that come in a variety of package sizes. This metric is less effective for nutritional quality price comparisons than the edible weight price between products with differing amounts of waste, such as chicken with and without the skin and bones, or between a large watermelon and an apple, or between prewashed and chopped winter squash and a whole winter squash.

When making food choices, consumers may need to consider the entire cost of their diets. Cheap food that provides few nutrients may actually be "expensive" for the consumer from a nutritional economy perspective, whereas a food with a higher retail price that provides large amounts of nutrients may actually be quite cheap. Consumers should also consider the total daily cost—which is likely the one metric that will have the most relevance to consumers trying to control their food budgets. While the methods presented in this report do not allow a comprehensive view of the overall healthy diet cost, we present a range of prices for meeting each of the five food group recommendations in the "USDA Food Patterns" presented in the *Dietary Guidelines for Americans 2010.* These price ranges give consumers a tool for developing a healthy diet in line with current market prices.

Appendix—Defining Average-Portion Groupings

We grouped foods to calculate the average portion size of the group. This allowed a larger sample size for foods that were consumed by only a few study participants. We used the 3- or 4-digit food coding scheme from the Food and Nutrient Database for Dietary Studies (U.S. Department of Agriculture, Agricultural Research Service, 2006). After examining the average amounts consumed of the groups formed using 3-digit groups and individual foods in the groups, we further divided some categories in milk and milk products; meats, poultry, fish and mixtures; grains; and fruit groups into 4-digit groups. We did not use 4 digit codes in the other categories because amounts consumed were consistent across the foods and group average when we used the 3-digit codes.

Food-grouping description

Milk and milk products

Milks and milk drinks

111 Milk, fluid (regular; filled; buttermilk; and dry reconstituted)
112 Milk, fluid, evaporated and condensed
113 Milk, fluid, imitation
114 Yogurt

Flavored milk and milk drinks, fluid

1151 Milk-based
1152 Malted milk drinks
1153 Eggnog
1154 Milkshake, all milk-fat types
1155 Fruit and milk combinations
1156 Miscellaneous milk drinks

Milk-based meal replacements, fluid

1161 Instant breakfast
1162 Meal supplement
1163 High calorie
1164 High protein

Milk, dry, and powdered mixtures with dry milk, not reconstituted

1181 Dry milk
1183 Cocoa mix

Creams and cream substitutes

Sweet dairy cream

1210 Cream, not further specified
1211 Light cream
1212 Half-and-half
1213 Heavy cream
1214 Whipped cream

Cream substitutes

1220 Cream substitutes
1221 Cream substitute
1222 Non-dairy whipped topping

Sour cream

1231 Sour cream
1235 Sour cream-based dip

Milk desserts, sauces, gravies

Milk desserts, frozen

1311 Ice cream
1312 Ice cream bar, sandwich, cone
1313 Light ice cream
1314 Light ice cream bar, sandwich, cone
1315 Sherbet
1316 Fat-free ice cream, bars

Puddings, custards, and other milk desserts

1320 Pudding
1321 Pudding, custard
1322 Pudding from dry mix
1323 Pudding, canned
1324 Pudding with fruit
1325 Mousse, tiramisu
134 White sauces and milk gravies

Cheeses

140 Cheese, not specified as to type
141 Natural cheeses
142 Cottage cheeses
143 Cream cheeses
144 Processed cheeses and cheese spreads
145 Imitation cheeses
146 Cheese mixtures
147 Cheese soups

Meat, poultry, fish, and mixtures

200 Meat, not specified as to type

Beef

210 Beef, not further specified
211 Beef steak
213 Beef oxtails, neck bones, short ribs, head
214 Beef roasts, stew meat, corned beef, beef brisket, sandwich steaks
215 Ground beef, beef patties, beef meatballs
216 Other beef items (beef bacon; dried beef; pastrami)

Pork

220 Pork, not further specified; ground, dehydrated
221 Pork chops
222 Pork steaks, cutlets
223 Ham
224 Pork roasts
225 Canadian bacon
226 Bacon, salt pork
227 Other pork items (spareribs; cracklings; skin; miscellaneous parts)

Lamb, veal, game, other carcass meat

230 Lamb, not further specified
231 Lamb and goat
232 Veal
233 Game

Poultry

241 Chicken (breast; leg; drumstick; wing; back; neck or ribs; misc.)
242 Turkey
243 Duck
244 Other poultry

Organ meats, sausages and lunchmeats, and meat spreads

Organ meats and mixtures

2511 Liver
2512 Heart
2513 Kidney
2516 Tongue
2517 Other variety meats

Frankfurters, sausages, lunchmeats, meat spreads

2521 Frankfurter
2522 Sausage
2523 Lunch meats (loaf)
2524 Potted meat, spreads

Fish and shellfish

261 Finfish
262 Other seafood
263 Shellfish

Meat, poultry, fish with nonmeat items

Meat, poultry, fish in gravy or sauce or creamed

2711 Beef and tomato sauces and stews
2712 Pork with sauce
2713 Lamb, goat, veal with sauce
2714 Poultry with sauce
2715 Seafood with sauce
2716 Combination meats with sauce

Meat, poultry, fish with starch item (including white potatoes)

2721 Beef dish with starch item
2722 Pork dish with starch item
2723 Lamb, goat, veal with starch
2724 Poultry with starch
2725 Seafood with starch
2726 Combination meats with starch

Meat, poultry, fish with starch item and vegetables

2731 Beef with starch and vegetables
2732 Pork with starch and vegetables
2733 Lamb, goat, veal with starch and vegetables
2734 Poultry with starch and vegetables
2735 Seafood with starch and vegetables
2736 Combination meat with starch and vegetables

Meat, poultry, fish with vegetables (excluding white potatoes)

2741 Beef with vegetables
2742 Pork with vegetables
2743 Lamb, goat, veal with vegetables
2744 Poultry with vegetables
2745 Seafood with vegetables
2746 Combination meat with vegetables

Sandwiches with meat, poultry, fish

2750 Wraps
2751 Beef-based sandwich, including hamburger
2752 Pork-based sandwich, including bacon, ham
2754 Poultry-based sandwich, including chicken patty
2754 Seafood-based sandwich, including fish patty
2756 Frankfurters, luncheon meat, potted meat sandwiches
2757 Hors d'oeuvres, finger sandwiches

Frozen and shelf-stable plate meals, soups, and gravies with meat, poultry, and fish base; gelatin and gelatin-based drinks

Frozen or shelf-stable plate meals with meat, poultry, or fish as major ingredient

2811 Beef-based frozen or shelf-stable dinner
2813 Veal, goat, lamb frozen or shelf-stable dinner
2814 Poultry-based frozen or shelf-stable dinner
2815 Seafood-based frozen or shelf-stable dinner
2816 Combination meat-based frozen or shelf-stable dinner

Soups, broths, extracts from meat, poultry, fish base

2831 Beef-based soups
2832 Pork-based soups
2834 Poultry-based soups
2835 Seafood-based soups
2836 Puerto Rican soups
284 Gelatin and gelatin-based meal supplements

Gravies from meat, poultry, fish base

2850 Gravy
2851 Meat-based gravy from stew
2852 Sauces made with meat, poultry, seafood

Eggs and egg mixtures

Eggs

311 Chicken eggs
312 Other poultry eggs

Egg mixtures

321 Egg dishes
322 Egg sandwiches
323 Egg soups
324 Meringues

Egg substitutes

330 Egg substitute, not specified as to form
331 Egg substitute, from powdered mixture
332 Egg substitute, from frozen mixture
333 Egg substitute, from liquid mixture

Frozen plate meals with egg as major ingredient

350 Frozen plate meals with egg as major ingredient

Dry beans, peas, other legumes, nuts and seeds

Legumes

411 Dried beans
412 Dried beans mixtures
413 Dried peas, lentils, and mixtures
414 Soybean-derived products (excluding milks)
415 Frozen plate meals with legumes as major ingredient
416 Soups with legumes as major ingredient
418 Meat substitutes, mainly legume protein
419 Meat substitute sandwiches

Nuts, nut butters, and nut mixtures

421 Nuts
422 Nut butters
423 Nut butter sandwiches
424 Coconut beverages
425 Nut mixtures

Seeds and seed mixtures

431 Seeds

Carob products

441 Carob powder, flour
442 Carob chips, syrup 58

Grain Products

Flour and dry mixes

500 Flour and dry mixes

Yeast breads, rolls

510 Breads, rolls, not further specified

White breads, rolls

5111 Flavored bread (cheese, cinnamon, egg)
5112 Garlic, potato, raisin, sourdough bread
5114 Fried bread
5115 Rolls, including sub-rolls
5116 Sweet rolls, croissant
5118 Bagel, bread stuffing, bread sticks, English muffin

Whole wheat breads, rolls

5120 Bread
5122 Rolls

Wheat, cracked wheat breads, rolls

5130 Bread
5132 Rolls

Rye breads, rolls

5140 Bread
5142 Rolls
515 Oat breads

Multigrain breads

5160 Bread
5162 Rolls
5163 Bagel, bread sticks, English muffin
518 Other breads

Quick breads

521 Biscuits

Cornbread, corn muffins, tortillas

5220 Cornbread, hush puppy
5221 Tortilla, taco shell
523 Other muffins, popovers
524 Other quick breads

Cakes, cookies, pies, pastries

530 Cakes
532 Cookies
533 Pies
534 Cobblers, éclairs, turnovers, other pastries

Danish, breakfast pastries, doughnuts, granola bars

5350 Breakfast pastries
5351 Danish
5352 Doughnut
5353 Tarts
5354 Breakfast, cereal, or granola bar
536 Coffee cake, not yeast

Crackers and salty snacks from grain products

540 Crackers, not specified as to type
541 Sweet crackers
542 Low-sodium crackers

Nonsweet crackers

5430 Snack crackers
5431 Oyster or rice crackers, rice and popcorn cakes
5432 Saltines, sandwich-type
5433 Toast thins, water crackers, whole wheat

Salty snacks from grain products

5440 Corn or multigrain chips, popcorn, pretzels
5442 Multigrain mixtures, pretzels, cereals and cracker with nuts
5443 Yogurt chips
5444 Bagel chips

Pancakes, waffles, French toast, other grain products

551 Pancakes
552 Waffles
553 French toast
554 Crepes
555 Flour-water patties and pancakes
556 Flour-milk patties and dumplings
557 Rice flour cakes
558 Funnel cakes

Pastas, cooked cereals, rice

Pastas

5610 Macaroni
5611 Noodles
5613 Spaghetti
562 Cooked cereals and rice

Cereals, not cooked or not specified as cooked

570 Cereal, not specified as to cooked
571 Ready-to-eat cereals
572 Ready-to-eat cereals
573 Ready-to-eat cereals
574 Ready-to-eat cereals
576 Cereal grains, not cooked

Grain mixtures, frozen plate meals, soups

Mixtures, mainly grain, pasta, or bread

5810 Tacos, burritos, enchilada, and pizza
5811 Egg rolls, empanada,
5812 Filled dumplings, pasta, quiche,
5813 Lasagna, ravioli, pasta with sauce, lo mein
5814 Pasta with cheese, pasta salad
5815 Fried rice, sushi
5816 Rice with beans, vegetables or sauce, pilaf
5817 Tabbouleh
582 Mixtures, mainly grain, pasta, or bread
583 Frozen plate meals with grain mixture as major ingredient

Soups with grain product as major ingredient

5840 Grain soups
5842 Grain stews

Meat substitutes, mainly cereal protein

590 Meat substitutes, mainly cereal protein 60

Fruits

Citrus fruits, juices

611 Citrus fruits
612 Citrus fruit juices

Dried fruits

621 Dried fruits

Other fruits

631 Fruits, excluding berries
632 Berries
633 Mixtures of two or more fruits

Mixtures of fruits and nonfruit items

6340 Guacamole, fruit salad with nuts, dressings, or candies
6341 Cranberry salad
6342 Fruit juice frozen bar
6343 Sorbet

Fruit juices and nectars, excluding citrus

641 Fruit juices, excluding citrus
642 Nectars
644 Vinegar

Vegetables

White potatoes and Puerto Rican starchy vegetables

710 White potatoes, not further specified
711 White potatoes, baked and boiled
712 White potatoes, chips and sticks
713 White potatoes, creamed, scalloped, au gratin
714 White potatoes, fried
715 White potatoes, mashed, stuffed, puffs
716 Potato salad
717 Potato recipes
718 Potato soups
719 Puerto Rican starchy vegetables

Dark green vegetables

721 Dark-green leafy vegetables
722 Dark-green nonleafy vegetables
723 Dark-green vegetable soups

Deep-yellow vegetables

731 Carrots
732 Pumpkin
733 Squash, winter
734 Sweet potatoes
735 Deep-yellow vegetable soups

Tomatoes and tomato mixtures

741 Tomatoes, raw
742 Tomatoes, cooked
743 Tomato juices
744 Tomato sauces
745 Tomato mixtures
746 Tomato soups
747 Tomato sandwiches

Other vegetables

751 Other vegetables, raw
752 Other vegetables, cooked
753 Other vegetable mixtures, cooked
754 Other cooked vegetables, cooked with sauces, batters, casseroles
755 Olives, pickles, relishes (excluding tomatoes)
756 Vegetable soups

Vegetables with meat, poultry, fish

771 White potato with meat, poultry, fish (mixtures)
772 Puerto Rican starchy vegetable (viandas) mixtures
773 Other vegetable mixtures
775 Puerto Rican stews or soups with starchy vegetables (viandas)

Fats, oils, and salad dressings

Fats

811 Table fats
812 Cooking fats
813 Other fats

Oils

821 Vegetable oils

Salad dressings

831 Regular salad dressings
832 Low-calorie and reduced calorie salad dressings

Sugars, sweets, and beverages

Sugars and sweets

911 Sugars and sugar-sugar substitute blends
912 Sugar replacements or substitute
913 Syrups, honey, molasses, sweet toppings
914 Jellies, jams, preserves
915 Gelatin desserts or salads
916 Ices or popsicles
917 Candies
918 Chewing gums

Nonalcoholic beverages

921 Coffee
922 Coffee substitutes
923 Tea
924 Soft drinks, carbonated
925 Fruit drinks
926 Beverages, nonfruit
928 Nonalcoholic beers, wines, cocktails
929 Beverage concentrates, dry, not reconstituted

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