Methods of Measuring the Nutritional Quality of Food Products

Several basic considerations must be taken into account when selecting a methodology to measure nutritional quality. Such measures can focus on a nutrient-by-nutrient analysis of a food product or on computing an index of overall nutritional quality. Both approaches can yield important information. In the latter case, some technique of unit standardization for the different nutrients has to be applied. In addition, this process of standardization has to transform the levels of nutrients to relate them to dietary recommendations. Finally, the difficult issue of the relative importance of different nutrients has to be considered.

In the literature, researchers have constructed and used four basic indexes to measure the nutritional value of food products. These indexes were developed by Hansen and others (1979), Mojduszka (1997), Moorman (1998), and Padberg and others (1993). In addition, the Healthy Eating Index was developed to measure how well American diets conform to recommended healthy eating patterns (USDA, CNPP, 1995). Each of these indexes deals with the nutrition measurement problems outlined above in a somewhat different way.

Hansen's Nutritional Quality Index

Hansen and others (1979) developed a nutrient-by-nutrient approach to measuring nutritional quality. Their index focuses on the amounts of the specific nutrients in a food relative to the amount of calories it contains. In order to compute such an index, nutrient standards must be determined. In their work, the amounts of the U.S. Recommended Daily Allowances for each nutrient were considered as the standards. Then the nutritional quality index of a specific nutrient was calculated as the ratio of its percentage standard relative to its percentage standard of calories. An index was computed in this form for each nutrient in a food product.

Hansen's nutritional index measures quality in terms of each nutrient contained in a food relative to its calorie level. It does not measure the overall nutritional quality of a food product. For example, for calories in any food, the index will always be unity. For a desirable nutrient, such as fiber or protein, a product with an index of 1 or greater will be of high quality. For an undesirable nutrient, such as fat, saturated fat, or cho-lesterol, the index has the opposite meaning: a value less than one indicates better nutritional quality.

Mojduszka's Hedonic Nutritional Quality Index

Quality measurement methodology in the economics literature relies heavily on the hedonic pricing approach. Therefore, Mojduszka (1997) investigated the usefulness of the hedonic pricing technique for measuring changes in the nutritional quality of pack-aged foods offered for sale in the period 1992-95. The methodology used a regression equation with prices of different products as the dependent variable and the nutritional characteristics of those products as the independent variables. The estimated coefficients pro-vide the marginal values of the individual nutritional attributes. These in turn can be multiplied by observed amounts of each nutrient to compute the marginal monetary values of these nutrients. The sum of the marginal monetary values of individual nutrients yields the hedonic index of nutritional quality. To compute nutritional quality change over time, Laspeyre's or Paasche quantity change indexes are used.

The hedonic quality measurement method poses sever-al problems when applied to measuring objective changes in nutritional quality. The most serious is that hedonic indexes are based on consumer valuation of the nutritional characteristics of food products. Consumers' valuation of nutrients can be inconsistent with the recommendations of dietary guidelines. For example, an increase in the value of fat (or any other undesirable nutrient) would be viewed as a quality improvement, if consumers valued fat positively, while from the perspective of a dietician, such an increase would be viewed as a quality decline (see, for exam-ple, Harris, 1997). The hedonic method allows us to obtain the value of nutritional quality and nutritional quality change from a consumer viewpoint and can be used, for example, as a tool for evaluating consumer welfare changes resulting from implementation of government policies. It does not, however, provide a measure of objective nutritional quality or quality change.

A second problem with the hedonic approach concerns including only significant coefficients in the calcula-tion of quality change indexes. Considering that multi-collinearity is present between nutritional characteristics, some nutrients may be insignificant because of collinearity and not because consumers do not value

them. This can give inaccurate calculated values to the indexes. Another potential problem is possible bias in the estimates of the hedonic prices resulting from omitted variables and incorrect specification of the functional form.

The Healthy Eating Index

The Healthy Eating Index was developed by the USDA Center for Nutrition Policy and Promotion (CNPP) to measure how well the diets of Americans conform to the recommendations of the dietary guidelines and the food guide pyramid (USDA, CNPP, 1995). This index provides a single measure of overall dietary quality. It takes into account the foods people are consuming and the amount of variety in the diet, as well as compliance with specific dietary recommendations. Dietary components that were identified include the degree to which a person's diet conforms to the food guide pyramid; total consumption of fat, saturated fat, cholesterol, and sodium; and the amount of variety in a person's 3-day diet. Each of the 10 components has a scoring range of 0 to 10. The total value of the index can range from 0 to 100, where the latter value indicates an excellent dietary quality.

The Healthy Eating Index measures the nutritional quality of an individual's diet. It does not measure the nutritional quality of a specific food product. In its current form, this index cannot be applied to evaluate the nutritional quality of specific food products.

Moorman's Nutritional Quality Index

In her recent work, Moorman (1998) investigated the impact of market information related to the NLEA on the nutritional quality of food product offerings, on the nature of competitive rivalry among manufacturers, and on consumer activism in using information. To measure changes in the nutritional quality of base brands (that is, brands without nutritional positioning), the author calculated an index that showed the overall change to each brand's nutritional composition between 1993 and 1996. More specifically, this methodology compared the levels of 10 selected nutrients between the years examined using 2 separate indexes—1 composed of 5 selected undesirable nutrients and 1 composed of 5 desirable nutrients. The five selected undesirable nutrients were sodium, total fat, saturated fat, unsaturated fat, and cholesterol. Calories were excluded. The five selected desirable nutrients were vitamin A, total vitamin B, vitamin C, calcium, and iron. Protein and fiber were excluded. If an undesirable nutrient decreased

or a desirable nutrient increased, a value of +1 was added to the index. If an undesirable nutrient increased and a desirable nutrient decreased, a value of -1 was added to the index. Thus, the value of the index ranged from +5, in the case where all undesirable (desirable) nutrients decreased (increased), to -5, in the case where all undesirable (desirable) nutrients increased (decreased). This index of nutritional quality change is constructed as a numerical measure rather than a direct measure of the nutritional value of products.

Padberg's Nutritional Quality Index

Padberg and others (1993) developed an overall nutritional quality index that yields a score of 0-100 for individual food products. The Padberg index was developed to address the absence in the literature of such overall indexes of nutritional quality for food products. Nutritionists have not focused on such measures because their main concern is with the nutritional quality of diets rather than of individual products. The Padberg index was constructed by assigning initial quality points ranging from 0 to 100 for each nutrient level listed on the nutrition label, where the scoring is based on the requirements for nutrient content claims on food product packages included in the new labeling requirements. The step functions that resulted were then smoothed to yield point functions that calculated quality points. These quality points were then weighted by dieticians' views of the importance of specific nutrients to yield an overall index ranging from 0 to 100 of the nutritional quality of specific products (see "Methodology and Data Used").

Evaluation of Approaches

Our objective is to measure average nutritional quality change for food products during the mid-1990's. The Healthy Eating, Mojduszka, and Moorman indexes are not suitable for this purpose. The Padberg index is the only one available that is suitable for this purpose because it does provide a measure of the overall nutritional quality of food products. Hansen's nutrition index does not measure the average overall nutritional quality of food products and is, therefore, not a substitute for the Padberg index. Applying the Padberg index, a simple measure of overall nutritional quality change can be computed. A second approach based on a nutrient-by-nutrient evaluation of nutritional quality change is also presented. This approach can be treated as a substitute for Hansen's measurement technique, although it is not presented in the form of nutrient densities.