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A revision of the Block Dietary Questionnaire and database, based on NHANES III data.

Gladys Block,¹ Patricia Wakimoto,¹ Torin Block²

The Block food frequency questionnaire has been substantially revised, based on the NHANES III food intake data. The questionnaire includes foods representing at least 90 percent of the intakes of each of the nutrients on the NHANES III database. The food list was derived separately for African Americans, whites and Hispanics, to ensure that major nutrient contributors for each of those groups were included. Nutrient content was updated from NHANES and USDA databases. The resulting eight-page scannable booklet includes 109 food items, as well as additional questions to assess use of fat-modified foods, types of milk used, and other nutrient-related behaviors. The nutrient content database was developed using NHANES III and CSFII survey databases, and the USDA Standard Reference database.

Epidemiologic methods, diet, research design, data collection, nutrition

The Block Dietary Questionnaire is a quantitative food frequency questionnaire (FFQ), in use by over 700 research groups and public health agencies in the U.S. The original FFQ was developed using data from NHANES II (1), and was made available in 1992 as a scannable version, and revised again in 1995. The software was also revised under National Cancer Institute auspices in a PC version in 1994 (2).

The availability of individual food data from NHANES III made it possible to revise both the questionnaire and the nutrient database, to incorporate foods important in the U.S. diet in the 1990s, and nutrient content changes resulting from food fortification regulations and changes in the food supply. In addition, recent methodologic research has influenced the modification of other aspects of the questionnaire design.

METHODS

Development of the food list

The revision followed the same approach as the original food list development. NHANES III, a nationally representative sample of 20,050 adults, conducted a detailed 24-hour recall of the food intake of respondents. The methods have been described elsewhere (3). All food and drink consumed by respondents in the previous 24 hours was recorded, with probing by nutrition-trained interviewers and the use of three-dimensional models to improve portion size estimation. Foods represented by 4,312 different foodcodes were mentioned by the adult respondents. These foodcodes were recoded into similar foods (e.g., 29 codes of green beans were recoded to a new food group code representing "Green beans".) The resulting list of over 200 foods encompassed all foods and beverages mentioned by all respondents. The list was detailed, so as to permit an examination of the importance of individual members of a food category such as fruit.

The amount of nutrient contributed by each food (e.g., green beans) in the U.S. population was then calculated by multiplying, for each NHANES III respondent, the amount of green beans consumed, times the nutrient in that variety of green beans and survey sample weights, and then summed across all respondents. For each nutrient on the NHANES III nutrient data base, foods were then

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Abbreviations: NHANES: National Health and Nutrition Examination Survey. USDA: United States Department of Agriculture. FFQ: Food Frequency Questionnaire

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ranked according to how much of the nutrient each food contributed to total U.S. intake. This determination of the important nutrient sources is identical to the approach used in the previous questionnaire development (1,4). Foods contributing to the top 90 percent of population intake of each nutrient were candidates for inclusion in the questionnaire.

Unlike the previous approach, however, this process was repeated separately for whites and African Americans. In this way, foods important in both ethnic groups were certain to be included in the food list, whereas previously some foods important in the diets of African Americans could have been omitted simply due to small sample size. Data for Hispanics were also examined separately, and some foods were included because of their importance in that group.

Data base development

The nutrient (e.g., protein) content to be used for each food on the questionnaire (e.g., green beans) was chosen in two different approaches. For questionnaire food items that represent a fairly homogeneous food (e.g., “apples”, “sweet potatoes”), the detailed NHANES III food reports were examined to determine whether or not there was a single variety or preparation that predominated. If so, the nutrient content values from the USDA Database for Standard Reference, Version 12, were used for that food.

Other food items on the FFQ represent foods for which a great deal of heterogeneity exists (e.g., “Spaghetti with tomato sauce”, “Mixed dishes with chicken”). For food items like this, the NHANES III data are not ideal because the individual components are separated in NHANES III. Nutrient content for these foods was determined instead by using the 1994-96 CSFII survey data, which contains many more food items that represent a mixed dish. For example, in CSFII, all types of mixed dishes containing chicken were assigned a single code, and a computer algorithm identified the foodcode representing the median nutrient density, that variety of mixed dishes with chicken for which half the population ate it or a variety richer in the nutrient, and half the population ate it or a variety less rich in the nutrient. For foods in which a single food type predominated, this

approach selects that modal food item to represent the nutrient content of the FFQ food. This is done separately for each nutrient. In this way the probable error in assigning a nutrient content to an individual is minimized.

Since the NHANES III nutrient database was developed prior to the implementation of the folate fortification regulations, it was necessary to derive the folate content by reference to current USDA data (5). Thus, the folate content of foods on the revised Block98 database is consistent with current fortification practices.

Revised portion size approach

The FFQ contains a portion size question for each food, as before. In the earliest versions of the Block FFQ, portion sizes for all foods were asked as “Small, Medium, Large”. In the 1995 version, portion sizes for unitary items such as eggs were asked as “1, 2 or 3”. This is still the case, for unitary items, but clarity is improved by asking “How many, **each time?**”

The method of asking portion sizes for non-unitary foods, such as green beans, has been completely revised. Instead of “small, medium, large”, with actual grams based on age-sex-specific portion sizes from the NHANES data, in this revision portion size photos are provided as an aid in estimating usual portion size for each food. The photos are of simple abstract three-dimensional models representing four different amounts of food. The actual three-dimensional models have been in use in several studies using interviewer administration of the questionnaire. Gram amounts are then assigned based on the gram weight of the volume of the chosen model, for that particular food.

Design Issues

Recent research has suggested the desirability of some modifications to the previous questionnaire design. These modifications include changes to some of the frequency response categories, the inclusion of certain additional low-fat choices, and the handling of embedded questions.

Frequency response categories. Tylavsky et al. (6) investigated the possible underestimation of some nutrients, as a result of failure to capture infrequent intake of nutrient-dense foods. For

example, pumpkin pie is rich in beta-carotene; consumption of this food several times a year contributes considerable beta-carotene and provitamin A, which would not be captured by a set of frequency categories in which only foods eaten at least once a month are recorded. In addition, if a number of foods are eaten less than once a month, failure to capture their dietary contribution results in an underestimation of total caloric and other nutrient intake.

Errors of estimation at the other end of the distribution can also occur. In the 1995 version of the Block FFQ, the frequency categories were changed for most solid foods, such that the maximum reportable frequency was "every day". With few exceptions (such as breads and condiments), it is unlikely that persons actually consume specific foods (e.g., green beans) twice a day, 365 days a year. Consequently, one response category at the high end was deleted, permitting a maximum frequency of "Every day" for most solid foods, and a response category was added at the low end, to include "A few times per year".

Low-fat foods. Vandenlangenberg et al. (7) evaluated the effect of including additional low-fat food choices to the Block questionnaire. They conducted a study in which subjects completed four two-day records, as the "gold standard". Subjects also completed a version of the Block questionnaire. In addition to the standard questions on low-fat versions of salad dressing, cheese, ice cream and snack cakes, Vandenlangenberg et al. included additional questions about use of low-fat versions of lunch meats, cookies and several other foods that currently have low-fat versions in the food supply. They found that inclusion of several additional low-fat options improved both the point estimates and the correlations of the questionnaire with the multiple-day records. Consequently, the 1998 version of the Block questionnaire now includes low-fat lunch meats, hot dogs, cookies and salty snacks, in addition to the previous low-fat options.

Formatting. Subar et al. (8) examined the effect of various formatting options, on accuracy of responses to food frequency questionnaires. They found that embedded foods were often skipped by subjects, who failed to recognize them as a required part of the questionnaire. The revision presented here includes embedded questions, but formatted in

such a way that they appear to be just another line of the questionnaire to answer, rather than appearing "embedded".

Milk and other multiple-variety questions. In earlier versions, milk consumption was asked as three separate items, "Whole milk", "2% milk", and "Skim milk". A possible consequence of this approach was that some respondents could double- or even triple-count their milk consumption, resulting in mis-estimates of calcium and other milk-related nutrients. In the present version, milk is asked as a single item, "Glasses of milk, (any kind)". The type of milk is then asked as a follow-up question; response options include not only the previous three choices, but also 1% milk, rice milk and soy milk.

Other changes. The restaurant question has been omitted. Instead, reminders about restaurant usage are included in the wording of the item. A global "cereal-adjust" question has been added, to permit adjustment of apparent mis-estimates resulting from the three cereal items. The smoking, dieting, self-assessed health status and language questions of earlier versions were retained; in addition, a single question on hours of television watching has been added, as a proxy for physical activity.

RESULTS

The revised questionnaire remains an eight-page scannable booklet. There are 109 food items, representing at least 90 percent of each of the nutrients on the NHANES III database, plus additional nutrition-related questions such as servings of fruits and vegetables, frequency and type of fat in cooking, and vitamin supplement usage. The existing DIETSYS software can still be used, but will require pretreatment and reformatting of the data file with statistical software such as SAS. Proprietary software for analysis of the questionnaire is also available.

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