

Food Grouping System: Objectives, Process Requirements and Capabilities, and Applications

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The Human Nutrition Information Service has under development an Automated Food Grouping System that can be used to estimate consumption of specific foods, ingredients, or agricultural commodities. This system will link foods reported in USDA's food consumption surveys to recipes, separate each food into its ingredients, and assign those ingredients to groups based on selected characteristics for analysis.

In the past, project analysis required consumption data to be aggregated by specific criteria. Researchers needed to designate foods to specific groups by their codes. Sometimes this required food items to be examined on a case by case basis; often one had to look at nutrient content and additional information, including ingredients of the foods, before grouping assignments could be made. Yet, there were many similarities of tasks and processes required to group foods. Some of these similarities include use of common input data files and grouping procedures, as well as data definition and documentation. Therefore, it was considered advantageous to build specialized data bases and automated process capabilities that could meet a variety of analytical objectives.

The objective of the Food Grouping System Project has been to plan and develop an automated computer system that will facilitate the grouping of food and nutrient intake data. The system will retrieve and process input data based on user defined grouping criteria. The output from this system will be a customized (unique) project data set with codes that assign foods, ingredients, and/or commodities to user-defined groups. This will enhance researchers' abilities to conduct specific analysis and produce project or summary reports with data organized into defined groups. In addition, the system will also provide tracking capabilities and document grouping decisions. This will facilitate future modifications of groups and allow different researchers to document why intake of seemingly "the same group" is different.

Foods are consumed as either discrete food items or food mixtures. Discrete foods are those which cannot be broken down into other foods, such as hamburger, tomato, or lettuce. Food mixtures can either be mixed or composite foods. Mixed foods are those whose distinct ingredients can be individually recognized, such as a cheeseburger which contains distinct food ingredients, including hamburger, bun, cheese, lettuce, tomato, mustard, and catsup. Composite foods are those whose ingredients are not individually recognizable such as hamburger bun or catsup.

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Many foods reported in the Nationwide Food Consumption Surveys are mixtures of two or more ingredients. Food mixtures reported as a single item (such as cheeseburger or pizza) are usually coded as a single food and tabulated under the food group of its main ingredient. For example, cheeseburger is included in the meat, poultry, fish group; and pizza, in the grain products group. The ability to provide data on the specific intake of ingredients of mixtures, either as composite or discrete food items, and even as raw agricultural commodities, is becoming increasingly important, -- both, for dietary assessment and guidance, and for support of regulatory and policy decisions. HNIS is addressing this need through development of the Food Grouping System.

Food grouping can be described by three manipulation tasks: disaggregation, aggregation and normalization. Disaggregation breaks down food mixtures into ingredients. The Food Grouping System disaggregates mixtures into their ingredients using information from Survey Recipe Files which document the USDA Nutrient Data Bases for Individual Food Intake Surveys. Another recipe file, the Commodity Ingredient Formulary (CIF), has been developed for use within the Food Grouping System to further break down ingredients in the Survey Recipe Files that are mixtures (such as soup, bread, mayonnaise). CIF thus enables further breakdown of these ingredient food mixtures. Through disaggregation, a cheeseburger can be broken down into its components: hamburger, bun, cheese, catsup, etc. Additionally, some of these ingredients can be further broken down; for example, the hamburger bun can be broken down into enriched flour, milk, shortening, etc.

Aggregation draws or organizes existing or translated intake data into groups. The unique capability of the Food Grouping System is to group foods and their components on the basis of user-selected criteria according to project goals. Foods reported in the NFCS are currently grouped according to main product or nutrient group. But, the Food Grouping System will enable greater grouping flexibility through attribute (descriptor) files which identify numerous characteristics of the foods. These files include characterization of foods by their attributes, such as process form (fresh, frozen, canned), cooked status (raw, baked, fried), and use in meals (vegetable serving or condiment). Thus, foods that are consumed as different forms, served in different ways, or used as ingredients in many different products, can either be aggregated on the basis of its major food, or grouped with other foods on the basis of other user-selected attributes. For example, all forms of tomatoes -- whether reported as tomatoes (fresh, canned, or fried), as tomato products (catsup, sauces, soups), or as ingredients of other foods (soup, salads) -- can be aggregated into a single group for total tomato/tomato product intake. Or, the various representation of tomatoes in foods can be systematically identified as raw or cooked/processed, or as vegetable products or condiments and aggregated into specific groups as required by research specific needs.

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Normalization converts quantities of foods or ingredients consumed in different forms into comparable units. Suitable adjustment factors are needed for the changes in weight and changes in the nutrient content. Losses in weight occur at various stages of preparation and cooking. Changes in the nutrient content occur during cooking. Nutrient adjustments are made by using the retention codes for the nutrients in the recipe file. Use of adjustment factors will help translate various forms of a food to a comparable form. For example, all forms of tomatoes, can be translated to the weight of fresh, raw tomatoes (as purchased, before core is removed), whether tomatoes as reported were sliced raw, stewed, or in products such as catsup, or in mixtures, such as soup or salsa.

The Food Grouping System will produce data files specifying the intake of selected foods, ingredients, or agricultural commodities, for reporting separately or by groups. Files produced from the Food Grouping System will be ready for statistical analysis. The system will be modular and open-ended so as to accommodate new data, and incorporate added functions.

Applications of the Food Grouping System to date have included HNIS analysis of food consumption survey data to breakdown meat mixtures and grain mixtures reported consumed to their ingredient food groups. In the NFCS 1987-88, (for all individuals, 1 day) meat, poultry, and fish mixtures accounted for 45% of total meat, poultry, and fish consumption; and grain mixtures accounted for 30% of total grain consumption. Also, 34% of the weight of meat mixtures was from meat, poultry and fish components; 27% from vegetables; and 15% from grains. Grain ingredients comprised 30% of the weight of grain mixtures; vegetables, 25%; milk and milk products, 13%; and meat, poultry and fish, 9%.

Capabilities to disaggregate mixtures, adjust intake of mixture ingredients to quantities as consumed or to alternate forms, and to aggregate mixture ingredients into specified food groups will be utilized by HNIS as well as other researchers. HNIS will utilize FGS-generated data files in further development of dietary guidance materials and future food plan development. In addition, the Environmental Protection Agency needs intake data on food ingredients and commodities which the Food Grouping System can provide, to assess the potential dietary exposure to pesticide residues.