



## ORIGINAL RESEARCH

# Adapting Methods for Determining Priorities for the Analysis of Foods in Diverse Populations

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Identifying and prioritizing the most significant foods and nutrients for sampling and analysis is essential in creating national food composition databases. A prioritized food list for the United States population has been developed using the Key Foods approach, where data from food consumption surveys are combined with USDA nutrient data to determine a food's relative nutrient contribution to the diet. However, the population of the United States is diverse. Foods consumed by the many ethnic groups include traditional recipes, which use unique ingredients and preparation methods. Foods which are relatively minor contributors to the diet of the total population often make a much larger contribution to the diet of a particular ethnic group. The Key Foods approach has been used to develop food lists for ethnic groups identified in large nationwide surveys, such as African Americans. For these groups, extensive demographic and consumption data, as well as comprehensive food composition data, are available. More limited data exists for other groups, such as American Indians. Therefore, alternative methods of collecting information, such as small localized surveys and interviews, are used. Methodologies used to identify foods consumed by both groups will be examined. Using these techniques, researchers can develop cost-effective approaches for selecting foods.

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## INTRODUCTION

The population of the United States is diverse (Table 1) and to accurately monitor the diet of all Americans, researchers and government officials must have accurate data on the foods consumed by members of various ethnic groups. For large minorities such as African Americans and Hispanics, the large nationwide surveys can provide adequate information on the foods consumed by these groups. The Nutrient Data Laboratory (NDL) has been using the Key Foods approach to select and prioritize foods for nutrient analyses for over 10 years. This approach has allowed NDL to concentrate analytical resources on those foods that contribute significant amounts of nutrients, targeted as of public health interest, to the diet. Recently NDL, in cooperation with the National Heart, Lung and Blood Institute of National Institutes of Health (NIH), initiated the National Food and Nutrient Analysis Program (NFNAP) to improve the quality and quantity of data, including foods consumed by members of various ethnic groups, in USDA nutrient databases. Use of the Key Foods approach is a major component of this program. Procedures used to develop Key Foods lists for

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TABLE 1  
U.S. population (1990 census)

Group	Population	%
White	185 239 291	74.5
African American	30 486 000	12.3
Hispanic	23 416 000	9.4
Asian and Pacific Islanders	7 458 000	3.0
American Indians	2 065 000	0.8
Total	248 718 291	100.0

large minority groups, such as African Americans and Hispanics, will be described below. However, this approach can be misleading when applied to smaller minority groups such as American Indians, which, while identified in the nationwide surveys, have small sample populations. Therefore, other approaches must be developed to identify foods consumed by these groups.

### PROCEDURE

The procedure for developing the Key Foods list was described by Haytowitz *et al.* (1996). The "USDA Nutrient Data Base for Individual Food Intake Surveys" (USDA, 1998) was developed by the NDL and the Food Surveys Research Group (FSRG) to provide nutrient values for all foods reported by survey respondents in the 1994–1996 Continuing Survey of Food Intakes by Individuals (CSFII) (USDA, 1998). A number of files are used to create this database: (1) the recipe file, which contains a list of food items or ingredients and their weights, yields and codes referencing nutrient retention factors; (2) the Primary Nutrient Data Set, which contains nutrient values on food items used in the recipe file; and (3) a file containing retention factors for a variety of cooking and preparation methods. A computer program was then used to calculate the nutrient values using information from the three files. NDL used the food consumption data generated by FSRG for the CSFII and food composition files to generate ranked lists of foods (Fig. 1).

The Third Scientific Report on Nutrition Monitoring (LSRO, 1995) lists nutrients (Table 2) of public health concern or potential public health concern. The percent contribution of each of these nutrients was calculated. The resulting list for each nutrient was ranked by food item from highest to lowest percent contribution. A cumulative percentage was then determined for each food item. Those foods contributing up to a cumulative total of 75% for these nutrients are included in the Key Foods list. The resulting list of 666 food items represents foods consumed by the entire population of the United States. This gives us a more manageable number of foods to analyse, compared to over 6000 foods in the USDA Nutrient Database for Standard Reference (USDA, 1998), almost 6700 foods in the USDA Nutrient Data Base for Individual Food Intake Surveys, or approximately 3300 items in the Primary Data Set (USDA, 1998). The first 10 of the 666 items on this list are presented in Table 3.

Since this approach involves disassembling or dismantling food mixtures into their component parts, few food mixtures are included. As a result, some variations seen in food mixtures served in different settings such as restaurants, schools, and other food service locations are underrepresented. To address this issue, we looked at other sources of consumption data, such as consumer research companies, trade associations,

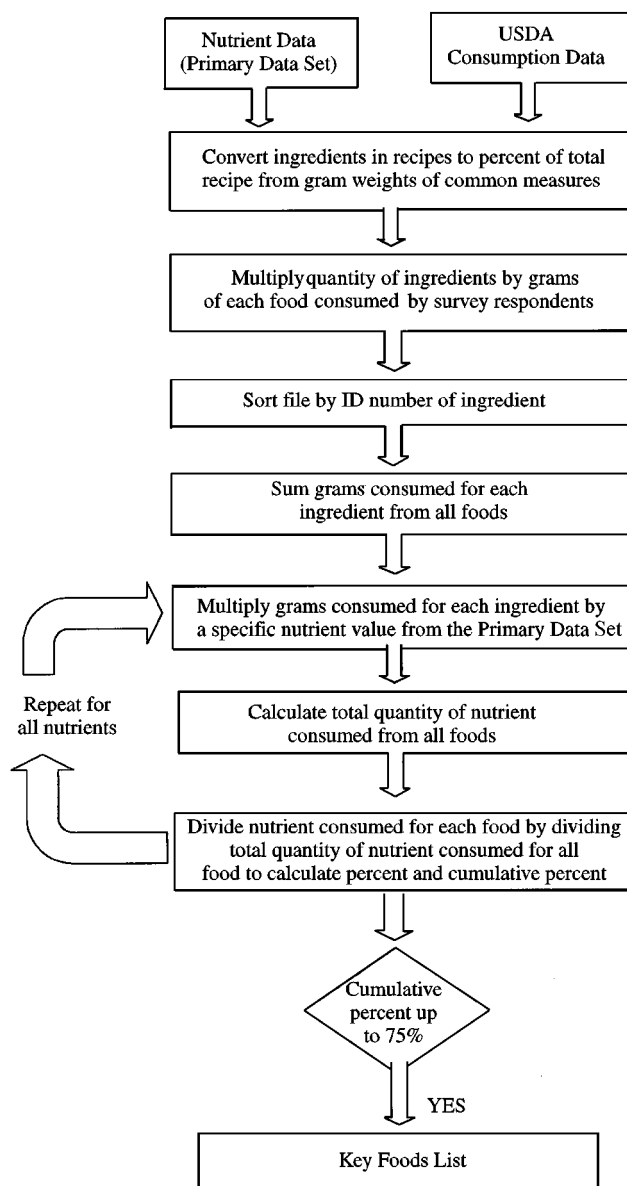


FIGURE 1. Overview of procedure for developing Key Foods list.

and other government agencies as well as data on mixed dishes from USDA's Nationwide Food Surveys. Using these sources, additional food mixtures were added to the list from items in the 1994-1996 CSFII. Items representing ingredients, foods used in NIH Clinical Centers and USDA research projects, new foods and ethnic foods were also added to the list, expanding it to a total of approximately 1000 food items.

Although this is a much more manageable number of foods to analyse, some foods are considered more important than others. Funding for analysis is not unlimited,

TABLE 2  
Nutrients of current and potential public health concern

Food energy	Calcium	Vitamin A
Protein	Iron	Vitamin C
Total fat	Magnesium	Vitamin E
Saturated fatty acids	Phosphorus	Folate
Monounsaturated fatty acids	Potassium	
Polyunsaturated fatty acids	Sodium	
Cholesterol	Zinc	
	Copper	

TABLE 3  
Key foods list: U.S. population, 1st 10 items

NDB no.	Description	Score	1st Quartile nutrients
01077	Milk, cow, whole	5743	Protein, fat, energy, Ca, Mg, P, K, Zn, SFA, MFA, PFA
01079	Milk, cow, 2% fat	5212	Protein, fat, energy, Ca, Mg, P, K, Zn, Folate, SFA
01123	Eggs, whole, fresh and frozen	4901	Protein, Fe, P, Zn, folate, cholesterol, MFA
13312	Beef, ground, regular, medium done	3239	Protein, fat, energy, Fe, Zn, SFA, MFA
18350	Rolls, hamburger or hotdog	3094	Protein, energy, TDF, Fe, Mg, Zn, Cu, folate
02047	Salt, table	2710	Na
04610	Margarine, regular, stick, composite, 80% fat	2704	Fat, energy, vitamin E, MFA, PFA
09207	Orange juice	2655	Fe, Mg, K, Cu, vitamin C, folate
01046	Cheese food, pasteurized processed, American	2517	Protein, fat, P, Zn, SFA
11124	Carrots, raw	2480	Vitamin A

and we need to decide priorities. In the development of the Key Foods list, a percentage contribution for each food and nutrient was calculated. The list was then broken into quartiles based on the cumulative percents (1st quartile, 1–25%; 2nd quartile, 25.01–50%; 3rd quartile, 50.01–75%; and 4th quartile, 75.01–100%). Items in the first three quartiles are included in the Key Foods list. To determine priorities for both foods and nutrients within the Key Foods list, a scoring system based on consumption was developed. The percentage contribution for each nutrient in the first three quartiles in a food was multiplied by 100 and summed to give a score. To illustrate the scoring system, the scores assigned for each nutrient in whole milk are shown in Table 4. The list of foods was then sorted by score from highest to lowest (Table 3).

Once collected, prepared, homogenized and composited, food samples will be analysed for all the nutrients in the USDA Nutrient Database for Standard Reference. Details of the sampling plan are described by Pehrsson *et al.* (2000). Those nutrients which have been identified as being important contributors to the diet are analysed at higher rates, that is more samples of the selected foods are analysed for nutrients in the

TABLE 4  
Calculating score for whole milk (NDB no. 01077)

Nutrient	% Consumption
Protein	334
Fat	347
Energy	235
TDF	0
Ca	1133
Fe	25
Mg	387
P	581
K	440
Na	107
Zn	259
Cu	65
Vitamin A (IU)	151
Vitamin E ( $\alpha$ -tocopherol eq.)	97
Vitamin C	71
Folate	143
Cholesterol	413
Saturated fatty acids	625
Monounsaturated fatty acids	262
Polyunsaturated fatty acids	66
Score	5743

1st quartile, less for nutrients in the 2nd quartile, still fewer for those in the 3rd quartile and the fewest for nutrients in the 4th quartile. The nutrients in the 1st quartile for each food are also listed in Table 3.

During sample preparation, reserve and archive samples are set aside. Reserve samples are used when a questionable value is reported by the lab and a repeat analysis is needed. Archive samples can be shared with researchers looking for those food components which have been identified only recently as being of possible interest.

Once such class of components are the isoflavones, which are of interest to researchers for their possible role in preventing or treating various chronic diseases. NDL recently released a table of isoflavone values (USDA, 1999). Some of the samples collected for this project were analysed for other nutrients, to provide more extensive data on soy ingredients.

#### DEVELOPING KEY FOOD LISTS FOR VARIOUS ETHNIC GROUPS

The population of the United States is diverse and foods consumed by the many ethnic groups include traditional recipes, which use unique ingredients and preparation methods. Foods which are relatively minor contributors to the diet of the total population often have a much larger contribution within a particular ethnic group. In addition, many foods previously identified as ethnic foods have become mainstream and are consumed by significant segments of the population.

We have used the Department of Agriculture's CSFII 1994–1996 and the National Health and Nutrition Examination Survey III (NHANES) conducted by the Department of Health and Human Services and the Key Foods approach to identify these foods. Sample sizes for various ethnic groups in both surveys are given in Table 5. However, each survey reported race/ethnicity differently. In the USDA survey,

TABLE 5  
Sample sizes for CSFII 1994–1996 and NHANES III

Ethnic group	CSFII '94–96		NHANES II
	Individuals	Households	Individuals
White	12 345	8456	11 652
Black	2078	1038	9074
Hispanic	Not reported	Not reported	10042
Asian and Pacific Islanders	422	202	Not reported
American Indians and Alaskan Natives	119	72	Not reported
Other	1029	469	543

TABLE 6  
Key Foods list: African-Americans, 1st 10 items

NDB no.	Description	Score	1st Quartile nutrients
01077	Milk, cow, whole	6785	Protein, fat, energy, Ca, Mg, P, K, Zn, SFA, MFA
01123	Eggs, whole, fresh, and frozen	6048	Protein, energy, Fe, P, Zn, folate, cholesterol
18350	Rolls, hamburger or hotdog	4265	Protein, energy, TDF, Fe, Mg, P, Zn, Cu, folate
13312	Beef, ground, regular, cooked, medium done	3937	Protein, fat, energy, Fe, P, K, Zn, SFA, MFA
21138	French-fried potatoes	3500	Fat, energy, TDF, Mg, P, K, Cu, folate, MFA
09207	Orange juice	3334	Mg, K, Cu, vitamin C, folate
01046	Cheese food, pasteurized processed, American	3051	Protein, Ca, P, Zn, SFA
19411	Potato chips	2999	Energy, TDF, Mg, K, Cu, vitamin E, PFA
04610	Margarine, regular, stick, composite, 80% fat	2931	Fat, vitamin E, MFA, PFA
02047	Salt, table	2894	Na

Hispanics are not reported separately, but are included with other race/ethnic groups. In NHANES III, Hispanics are reported as Mexican-American or other Hispanics; Asian and Pacific Islanders and American Indians and Alaskan Natives are reported under the category “other”. Using the same approach as that for the entire U.S. population, a Key Foods list was developed for African Americans, containing 441 items. While all of these foods also appear on the Key Foods list for the entire population, the African American Key Foods list contains fewer items, and the relative contribution each nutrient is higher. This is due to smaller sample populations (Table 5). This translates into higher scores for the items in the Key Foods list for African Americans. The first 10 items on this list are presented in Table 6. This list is quite similar to that of the entire U.S. population, sharing eight of 10 items, though in different order. Two items unique to this list are french-fried potatoes and potato

chips. It is interesting to note that for both these products sodium does not appear on the list of 1st quartile nutrients, although both products contain significant amounts of added salt. This is caused by the presence of salt as a separate food item on the list. Since salt has been extracted from all the salt-containing recipes and reported separately, its sodium content contributes 28.66% of the sodium consumption, which completely occupies the 1st quartile. This unique situation pushes the sodium contribution for all other foods into the 2nd and higher quartiles. This situation also occurs in the list for the entire U.S. population.

While the Key Food approach can be used to analyse the foods consumed by American Indians, the small sample population size, reflecting their small percentage of the U.S. population (0.8%), causes problems. To begin with, there is no "typical" American Indian diet. There are over 550 Federally recognized Tribes, including 223 village groups in Alaska (Bureau of Indian Affairs, 1999). They are culturally and geographically diverse. While more than half live on or near reservations, the remaining population live primarily in urban areas, where they consume "mainstream" foods. Others use traditional recipes and foodstuffs, particularly older members and those wishing to "return to their roots" or during traditional holidays and ceremonies. Non-commercial sources of foods, particularly on reservations, such as hunting and foraging, add to the diversity of the diet. Another major source of food, again mostly on reservations, is USDA commodity programs. Though consisting of basic foods such as cheese, canned fruits/vegetables, and canned fish/meat, they may be prepared in ways different from those used by the rest of the U.S. population or supplemented with unique ingredients. These distinctive food sources are often obscured in the food consumption surveys. Due to lack of data, they are frequently grouped with other, similar, mainstream food items. Also, the American Indians sampled in the USDA food consumption surveys resided predominantly in urban areas. Therefore, those living on or near reservations were underrepresented.

Reviewing the first 10 items (Table 7) on the Key Foods list of American Indians of 299 items, we see that the list is quite similar to that of the entire U.S. population,

TABLE 7  
Key Foods list: American Indians, 1st 10 items

NDB no.	Description	Score	1st Quartile nutrients
01123	Eggs, whole, fresh, and frozen	6081	Protein, fat, P, Zn, Vitamin E, folate, cholesterol, MFA
01077	Milk, cow, whole	5837	Protein, fat, energy, Ca, Mg, P, K, Zn, SFA, MFA
13312	Beef, ground, regular, medium done	4875	Protein, fat, energy, Fe, Mg, P, K, Zn, SFA, MFA
01079	Milk, cow, 2% fat	4329	Protein, Ca, Mg, P, K, Zn, SFA
01046	Cheese food, pasteurized processed, American	3125	Protein, fat, P, Zn, SFA, MFA
18350	Rolls, hamburger or hotdog	2664	Energy, TDF, Fe
02047	Salt, table	2603	Na
09207	Orange juice	2522	Mg, K, Cu, vitamin C, folate
18069	Bread, white	2427	Energy, TDF, Fe, Mg, Cu
21138	French-fried potatoes	2410	Mg, K, MFA

sharing eight of 10 items, though in different order. The items unique to this list are white bread and french-fried potatoes, perhaps reflecting the ubiquitous presence of fast food restaurants in the United States. The situation described above for sodium in the Key Foods list for African Americans is also true for this list.

This list is just a starting point, and while the foods in it contribute a major portion of the nutrients in the diets of American Indians, it is necessary to expand the list and include traditional foods not on the list, to adequately monitor the nutrients consumed by this population. Given the limitations of nationwide surveys to identify small minority groups, other methods are needed. There are a number of small, targeted surveys which cover a single Tribe or group of Tribes, such as the work of Kuhnlein and Calloway (1977) on Hopi foods, Nobbman *et al.* (1992) on Alaska Native Adults and the Navajo Health and Nutrition Survey (Byers and Hubbard, 1997). We are using food lists from this type of survey to expand the food list to include more traditional foods. The use of tools such as focus groups, described by Samuda *et al.* (1998) in her research on foods consumed in Jamaica, can also be applied to American-Indian Tribes. Also, we consult dietitians working with the Indian Health Service and other health professionals working with American-Indians to learn about other foods and how they are prepared. These sources are being used to obtain traditional recipes, so that we may calculate additional variations of the foods and ingredients for which we will obtain analytical data.

Utilizing all these techniques, we are developing a list of foods consumed by American Indians to be analysed. Many of these foods will be "mainstream" foods and we have already begun to sample and analyse a number of them under NFNAP. Others will be analysed under a project developed in cooperation with the Office of Minority Affairs, National Institutes of Health and the Indian Health Service. This project will utilize many of the NFNAP protocols to provide high-quality data in order to develop a database of foods consumed by American Indians and Alaskan Natives.

## CONCLUSION

The Key Foods approach provides a useful tool to determine and prioritize foods for nutrient analysis. However, it may not be the best approach in all situations and other tools may be needed to develop or expand a list of foods for analysis. For the Key Foods approach, a food consumption survey, either designed for the entire nation or targeted to a particular population group, is needed. While appropriate for the entire population, the large nationwide surveys often do not provide the specific and variable information on consumption patterns among small ethnic groups. They are also expensive and many smaller or developing countries cannot afford them. In these situations, other techniques such as focus groups and small localized surveys, either separately or in conjunction with national surveys, can yield the needed information. A food composition database for American Indians and Alaskan Natives will improve nutritional monitoring of the diets of this important population and aid nutritionists working with these communities.

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