Current HNIS Nutrient Data Research

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The primary focus of the Nutrient Data Research Branch of the Human Nutrition Information Service is maintaining quality and currency of data in the nutrient data bases including the Standard Reference Data Base, the Primary Data Set, and the Survey Data Bases. I want to describe several aspects of quality and currency maintenance in our program.

Maintaining Quality of Data

Percentage of Analytical Data

One of the basic indices for quality of a data base is the percentage of analytical values. Hepburn[1] reported in 1987 on the percentage of analytical data in the Primary Data Set (PDS). The PDS contains nutrient profiles of basic food items taken from the USDA Nutrient Data Base for Standard Reference with additional nutrients and foods added from new analytical data and imputed with documentation.

The common perception is that analytical data are better in quality than imputed data.

The percentage of analytical data for proximates, calcium, iron, phosphorus, potassium, sodium, thiamin, riboflavin, and niacin is usually greater than 95 percent. Since the Hepburn report in 1987 over 900 items have been added to the PDS in response to requests from the Surveys. Some foods in the PDS contain low or negligible levels of certain nutrients (near level of detection for the nutrient) and contribute little to total food intake. However, other foods, such as milk and bread, contribute significantly to intake of several nutrients.

After food consumption data were obtained from recent surveys (CSFII 1985 and NFCS 1987-88) for each food item, total grams consumed were multiplied by the value of each nutrient.

The resulting figure provides the amount consumed for each PDS item. The foods that contribute to 80 percent of the total intake of each nutrient have been defined by NDRB as "key foods." These foods are important sources of nutrients of public health significance and are reported on here.

The percentage of analytical data increased considerably in the PDS for all nutrients between 1987 and 1991. In Table 1, you will note that the percentage of analytical data for vitamin B-6 and magnesium improved markedly to 92 and 90 percent from 72 percent for each of these nutrients in 1987. Copper, folate, dietary fiber, and vitamin E (alpha-tocopherol) remain less than 90 percent analytical. Alpha-tocopherol is lowest at 47 percent--up from 39 percent. Results of contract research (current and planned for next year) will increase the percentage of analytical data for alpha-tocopherol, making this nutrient comparable to the others.

Research for Generating Data

Since 1987, extramural research funds have been allocated for analyzing several species of farm-raised and wild fish, speciality fruits, miniature vegetables, and special cheeses; for strengthening data (increasing N) for mineral elements including selenium, copper,

Table 1. - Percentage of Analytical Data from Primary Data Set

Nutrient	1987[1]	1991
Vitamin C	92	95
Vitamin B-12	70	95
Carotene	88	93
Vitamin A (RE)	73	92
Vitamin B-6	72	92
Zinc	79	91
Magnesium	72	90
Copper	71	88
Folate	69	87
Dietary fiber	40	82
Alpha-tocopherol	39	47

[1] Hepburn

manganese, magnesium, and zinc; and for developing and verifying data on vitamin E, dietary fiber, and nutrient retention.

Today, some species of fish are marketed primarily as farm-raised. Table 2 shows fat and cholesterol values for four species of fish from our recent contract. Fat is higher in these species when farm-raised. Cholesterol values are not significantly different.

Table 2. - Fat and Cholesterol in Cooked Fish Wild vs Farmed

	Fat		Cholesterol	
Species	Wild	Farmed	Wild	Farmed
	g/100 g		mg/100 g	
Catfish	2.8	10.0	72	64
Trout	5.8	7.2	69	68
Salmon (coho)	4.3	9.0	55	62
Oysters	1.9	2.3	49	38

Research for Monitoring Data

Monitoring contracts for key foods have been divided as shown:

1) Analyses of proximates, vitamins, minerals, dietary fiber.
2) Analyses of lipid components--including fat, fatty acids (including geometric isomers), and sterols (including cholesterol).

Foods to be monitored are selected according to the amount consumed, the number of nutrients where the food is among the top 80 percent, and other sources of available data. For some nutrients such as vitamin A, only a few foods are responsible for 80 percent of the nutrient. For others such as magnesium, an extensive list of foods provides 80 percent contribution. The top 10 foods for six nutrients are given in Tables 3 through 8, with the percentage of the nutrient intake provided by that food. Needless to say, these foods have the greatest influence on the total nutrient intake.

Foods such as potatoes in several forms, milk and enriched white bread, toasted enriched white bread, and rolls and buns are at or near the top of lists for several nutrients in percentage of total intake. Effects of enrichment are evident for thiamin and iron, showing enriched white bread and rolls and buns at or near the top. Whole milk is definitely a "key" food as shown by its contribution of 4.0 percent of the diet's vitamin B-6, 3.9 percent of the thiamin, 9.2 percent of the potassium, 5.5 percent of the zinc, and 2.3 percent of the sodium intake.

Table 3. - Key Foods for Vitamin B-6 Intake

Food	Vitamin B-6 Intake %
Bananas	4.4
Whole milk	4.0
Potatoes, boiled w/o skin	3.1
2% lowfat milk	2.2
Gr beef, reg, broiled	2.0
Eggs	1.6
Potatoes, boiled w/ skin	1.4
Baked potatoes	1.4
Cheerios	1.3
Total (wheat)	1.3
	22.7

Table 4. - Key Foods for Thiamin Intake

Food	Thiamin Intake %
White bread, enriched	6.2
Rolls and buns	4.2
Whole milk	3.9
White flour, all-purpose	3.5
White bread, enriched, toasted	2.7
Orange juice, frozen concentrate, diluted	2.5
2% lowfat milk	2.2
Ham, cured, boneless, roasted	1.7
Ham, cured, boneless, unheated	1.6
Cracked wheat bread	1.5
	30.0

Table 5. - Key Foods for Iron Intake

Food	Iron Intake %
White bread, enriched	4.4
Rolls and buns, enriched	3.3
Kellogg Raisin Bran cereal	2.9
White flour, all-purpose, enriched	2.7
Beef, ground, regular cooked, broiled, medium	2.2
Eggs	2.1
Bread, white, enriched, toasted	1.9
Cheerios	1.5
Total (wheat)	1.4
Cracked wheat bread	1.4
	23.8

Table 6. - Key Foods for Potassium Intake

Food	Potassium Intake %
Whole milk	9.2
2% lowfat milk	5.0
Coffee, brewed	4.4
Orange juice, frozen concentrate, diluted	3.5
Potatoes, boiled w/o skin	2.4
Bananas, raw	2.0
Potatoes, frozen, French fries	1.8
Potato chips	1.7
Tea, brewed	1.4
Beef, ground, cooked	1.4
	32.8

Table 7. - Key Foods for Zinc Intake

Food	Zinc Intake %
Beef, ground, cooked, broiled, medium	5.7
Whole milk	5.5
2% lowfat milk	3.0
Beef, ground, lean, cooked, broiled, medium	2.8
Cheese, American, processed	2.2
Eggs, whole	1.9
Beef, ground, extra lean, cooked, broiled, medium	1.8
Beef, ground, regular, cooked, well done	1.8
Oyster, Eastern, raw	1.2
Ice cream, regular, 10% fat	1.2
	27.1

Table 8. - Key Foods for Sodium Intake

Food	Sodium Intake %
Table salt	27.0
Cheese, American, processed	3.4
White bread, enriched	3.3
Rolls and buns	2.4
Whole milk	2.3
Regular margarine, salted	2.2
Ham, cured, roasted	1.5
White bread, enriched, toasted	1.4
Tomato sauce	1.3
2% lowfat milk	1.3
	46.1

Quality Assurance Program

The Quality Assurance (QA) Program of the Branch includes four stages:

· A Three-Member Quality Assurance (QA) Panel coordinates and reviews work relative to QA including negotiating contracts for development of reference materials based on specific need. The Panel recommends QA steps during development of new contracts and serves on Technical Panels to review QA aspects of the proposal.

· Develop and Characterize Reference Materials

One member of the QA Panel serves as the Contracting Officer's Representative and negotiates contract for reference materials development and characterization. The three-member panel identifies appropriate materials to measure performance according to foods and nutrients being studied. At least one NIST Certified reference material is selected for each set of check samples.

· Stringent Screening of Contractors Before Award.

During evaluation of the proposal, a contractor's ability is proved through analysis of the check samples. Three reference materials must be analyzed for several important nutrients in a contract. Performance is measured against a standard reference value or range. Sometimes as few as 20 percent of prospective contractors are able to perform analyses as demonstrated by our screening program in the past 4 years.

· Annual Meeting of Contractors

Meetings are held each June to discuss problems in performance including sample preparation for analysis, plans for new work, sharing new developments and needs, or recommendations for new work. Special needs for problem solving and presentations on special subjects such as dietary fiber, vitamin A methods, and folate analyses are also part of the annual Contractor's Meeting.

International Collaborative Study for Dietary Fiber Analyses

In 1989, HNIS initiated an international collaborative study to ascertain what methods of analysis may be used for dietary fiber compilation. The methods compared were AOAC, Englyst, Mongeau, and simplified AOAC (NCL). The AOAC method of dietary fiber analysis was conducted in several laboratories by analyzing 25 U.S. foods in blind duplicate. The food samples were prepared in one lab and sent to all participating labs. Foods selected included some that had already presented problems in analysis. High-fat, high-starch components presented some problems for some laboratories. Participants were Eric Florence in Reading, England; Roger Mongeau, Canada; J. Robertson, Cornell University, D. Gordon, University of Missouri; J. Augustin, University of Idaho, and Betty Li, Nutrition Composition Laboratory, Beltsville, MD. All laboratories were provided with the same lot of Sigma kits (enzyme). I reported on these results at FASEB in 1990. Other methods were used for analyses of dietary fiber on the same food samples. Hans Englyst (Cambridge, England), Roger Mongeau and Dennis Gordon analyzed by the Englyst method; the latter two by the Mongeau method; and Augustin and Li, by the simplified AOAC procedure. Results showed good agreement for most labs using the AOAC procedure.

Consultant Panel

Early in 1991, HNIS appointed a three-member Consultant Panel for Nutrient Data Research. They represent industry, academia, and government. Their areas of expertise are data base management, data base building, and nutrient analytical methodology skills.

The Consultant Panel's role is to:

· identify issues of critical importance to maintain and enhance nutrient composition data

· and address issues NDRB would like recommendations on

The current members are:

Norman Bednarcyk, Nabisco Brands
Loretta Hoover, University of Missouri
A.C. Soliman, FDA, Atlanta, Georgia

Maintaining Currency of Data

Annual Supplements to AH-8

The first (1989) Annual Supplement to AH-8 was issued in 1990 to update values in sections already published and to add new foods and new data. In the first Supplement, calcium and manganese tables of values were added for AH-8-1, Dairy and Egg Products, and for AH-8-2, Spices and Herbs. We often receive questions about the date of publication, i.e. (-AH-8-1, Dairy and Eggs, published in 1976). Supplements are issued each year to keep data current. So far, 210 new or revised food items have been added including revised data on eggs as well as tables of dietary fiber and new guides. The second supplement, just published, has 80 new foods including 46 fish items and 34 revised foods including new data for light tuna in water and selected fruits and vegetables. Some new foods that have appeared in the Supplements are goat cheeses, miniature vegetables, asian pears, and new vegetable and fish oils.

The third Supplement will include approximately 110 fresh pork cuts based on recent research on market samples. It will also include cornish game hen, farm-raised fish, and other items.

Revised Sections of AH-8 and Regular Database Update.

The AH-8-13 on Beef Products was completely revised and published in June 1990. The data were available earlier that month on our Nutrient Data Bank Bulletin Board. It is operated as a public service to provide information about current HNIS publications and computer files on the nutrient composition of foods, as well as announcements about this conference and other relevant topics.

AH-8-8, Breakfast Cereals and AH-8-4, Fats and Oils revisions are planned for the future and willinclude new items and revised data. When new sections or supplements are issued, the data bases, are updated in new releases.

Other Publications

Next year we plan to issue an abridged AH-8 and a Master Index for ease in locating the food items in the data bases.

Industry Cooperation

NDRB has maintained close working relationships with industry over the years. All sections of Handbook 8 have been reviewed by industry representatives to assure no changes in production or formulations. For example, over 30 companies reviewed AH-8-19, Snacks and Sweets, in addition to trade associations such as, the Chocolate Manufacturers Association and the Snack Food Association. Over 30 industry groups are reviewing the Baked Products section, AH-8-18.

Some studies are planned with industry so that generated data will be suitable for our needs. We have cooperated with Texas A&M University, the National Livestock and Meat Board, United Egg Producers, Snack Food Association, and the Produce Marketing Association to discuss sampling and handling of the materials. For analyses of meats, we developed and recommended a standard protocol for nutrient analyses which has since been adopted by the American Meat Institute. The protocol calls for standard methods for storage, dissection, and handling of samples before, during, and in preparation for nutrient analyses.

Future Plans

-- Continue to monitor key foods -

Contracts on proximates, vitamins, minerals, and dietary fiber

Contracts for lipid components

-- Strengthen special data bases on:

Vitamin E--present total vitamin E as alpha-tocopherol equivalents and individual tocopherols and tocotrienols as needed.

Dietary fiber--including soluble and total dietary fiber

Vitamin K

-- Build a data base on fat-substituted or fat-replaced foods

Baked products
Salad dressings
Frozen desserts
Spreads
Other dairy items

Top brands of these foods varying in fat replacement or fat substitution components will be analyzed. Components include Simplesse , medium chain triglycerides (MCT), potato starch, rice starch, maltodextrin, polydextrose, carrageenan, guar gum and locust bean gum, and Olestra when approved by FDA.

As we move into the 21st century, effects of advances in biotechnology will become more and more evident as well as other technological advances in food production and processing which undoubtedly will markedly influence nutrient composition of foods. USDA will continue to monitor these advances and keep nutrient compostion data bases current and accurate.

[1] Hepburn, F.N. Food Consumption/Composition Interrelationships. Adm. Rpt. No. 382, pp 68-74. 1987.