Progress Report on the USDA National Food and Nutrient Analysis Program

D.B.Haytowitz, P.R. Pehrsson, J. Exler, L. Amy, D. Trainer, and J.M. Holden
Nutrient Data Laboratory, ARS, USDA, Beltsville, MD

ABSTRACT

Objective: The National Food and Nutrient Analysis Program (NFNAP) was implemented in 1998 in cooperation with the National Heart Lung and Blood Institute and 17 other Institutes and Offices of the NIH. The NFNAP is designed to improve the quality and quantity of nutrient data in USDA food composition databases by generating nationally representative analytical data for key dietary contributors.

Materials and Methods: The NFNAP calls for: identifying high priority foods; evaluating the quality of existing data; developing nationally representative sampling plans; acquiring, preparing, and analyzing the food samples; and evaluating and disseminating the results. Foods studied include: Key Foods (i.e., primary contributors of important nutrients); ingredients; ethnic foods; and foods used in clinical studies. Commercial, university, and government labs have been qualified to determine more than 100 traditional and emerging food components.

Results: To date, we have sampled and analyzed over 650 foods; approximately 150 foods in the last year. Of these, more than 300 foods have been rated acceptable by our QC panel. Any questionable results have been sent back to the lab for repeat analysis. NDL has also expanded the number of food components analyzed to include individual carotenoids, individual tocopherols and tocotrienols, individual sugars, vitamin K, flavonoids, and choline. This has resulted in improved, more representative data, which reflect changes in cultivars and growing practices. For example, using newly obtained data for individual carotenoids in broccoli, a vitamin A value of 660 IU/100 g was calculated; this replaces the old value of 1542 IU/100 g. A previously imputed selenium value of 55.8 mcg/100 g for cooked beef liver was replaced by an analytical value of 36.1 mcg/100 g. Analytical data will replace many formerly imputed values and will provide current and accurate data for many foods, as well as ingredients in formulated foods. These and other results will be presented.

Significance: The NFNAP has led to the updating and expansion of nutrient profiles for approximately 280 foods in the latest version (Release 16) of the USDA National Nutrient Database for Standard Reference. Data generated by NFNAP are an important contributor to a major expansion of the components in the nutrient profiles of food items used in the National Food Surveys. These new data will permit research and dietary assessment of population intakes.

METHODS

NFNAP data are generated through five linked processes:

Identification/prioritization of foods and nutrients – 1000 foods were identified for analysis, including single and multi-ingredients foods which contribute significantly to nutrient intakes (Key Foods), ethnic foods, commercial ingredients, foods used in clinical studies, and sources of important emerging nutrients. New survey data from USDA-USDHHS National Health and Nutrition Examination Survey (NHANES) indicate no change in top Key Foods (Table 1). Components analyzed include: proximates, sugars/starch/fiber, amino acids, fatty acids, minerals, vitamins, and recently, carotenoids, vitamin K, phytonutrients (flavonoids and proanthocyanidins), fluoride, choline, *trans* fatty acids, and *n*-3 fatty acids.

Evaluation of existing data quality - Nutrient data are classified as: 1) satisfactory analytical quality; 2) marginal quality, in need of upgrade; and 3) unsatisfactory, in need of replacement. Classification (based on number of samples, sampling plan, sample handling, analytical method and quality assurance) and importance of the food drive the level of sampling and analysis. Most data were either marginal quality or unsatisfactory, and new values were generated.

Development of the sampling approach – A Census-based, stratified, self-weighting design was used (Figure 1) and included retail stores with sales >$2m, and brand selections proportional to market share data. Specialized designs were developed for fast foods, American Indian foods, and tap water collection. A new sampling frame, utilizing data from the 2000 Census data (Figure 2) will be implemented this fall.

Sample analysis – This includes use of current official analytical methods at labs qualified by USDA, a quality control process (SRMs, control composites, blind duplicates), and internal and external data reviews. Samples are composited by brand or variety across locations; additional individual food samples are analyzed for selected nutrients for estimation of serving-to-serving variability.

Data dissemination – Data will be released in Standard Reference, **www.nal.usda.gov/fnic/foodcomp**, in special interest data tables and for monitoring nutrient intakes in the NHANES, currently in progress.

Table 1. Top Key Foods, NHANES 1999-2000 and Nutrients

Food	1st Quartile Nutrients
Milk, 3.25% fat	protein, fat, energy, Ca, Mg, P, K, Zn, SFA
Milk, 2% fat	protein, energy, Ca, Mg, P, K, Zn, SFA
Eggs, raw	protein, fat, Fe, Zn, cholesterol, MUFA
Rolls, hot dog/hamburger	protein, energy, fiber, Fe, Mg, Cu, alpha-tocopherol, folate
Margarine, 80% fat	fat, energy, alpha-tocopherol, MUFA, PUFA
Ground beef, broiled	protein, fat, energy, Fe, Zn, SFA, MUFA
American cheese	protein, fat, P, Zn, SFA, MUFA
Orange juice	Fe, Mg, K, Cu, vitamin C
Salt	Na
FF French fries	fat, energy, fiber, Mg, K, Cu, MUFA

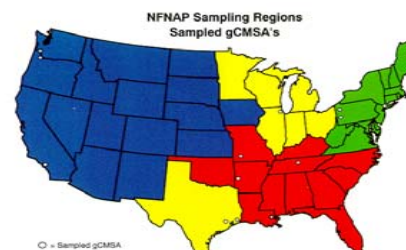### Figure 1. NFNAP Sampling Regions (1997- 2002)

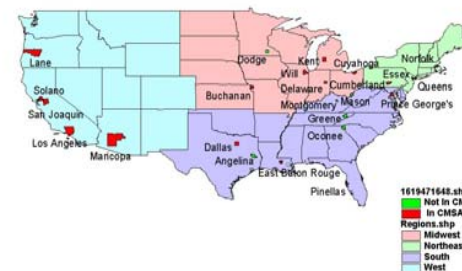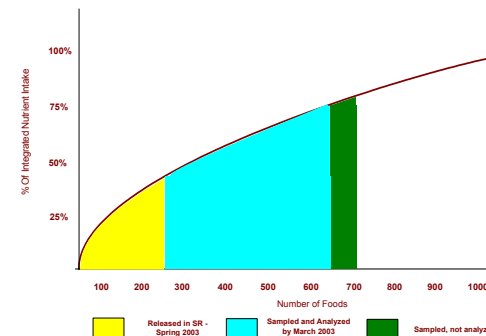### Figure 2. Revised NFNAP County Samples (2002+)

Figure 3. NFNAP Progress: %Nutrient Intake - April 2003

RESULTS

Nationwide sample acquisition from 12 or 24 retail locations and chemical analysis for over 100 nutrients have already been completed for approximately 700 types of foods across foods groups (Figure 3) that, in aggregate, contribute approximately 75% of the national intake for about 20 high priority Critical Nutrients (Figure 3). To date, about 40,000 samples have been analyzed. Analytical data from NFNAP samples are being used to:
▪ Update values for ~280 foods or ~7600 nutrient values in Release 16 of the USDA Nutrient Database for Standard Reference (SR). Selected updated values are presented in Table 2
▪ Reduce the number of missing values in each food profile: ~ 5000 values
▪ Expand SR to include values for individual carotenoids (α-carotene, ß-carotene, ß-cryptoxanthin, lycopene, lutein+zeaxanthin), vitamin K, total sugars, α-tocopherol [replacing α-tocopherol equivalents] for use in NHANES.
▪ Add other nutrients to SR (*trans* fatty acids, and *n*-3 fatty acids) and create new special interest tables on phytonutrients (flavonoids and proanthocyanidins), choline, and fluoride.

Data from an extensive sampling of 3 fast food hamburger chains and 1 fast food taco chain are currently being reviewed, and sampling of the top 4 pizza chains is underway. Approximately 40 traditional foods from American Indian reservations have been sampled and analyzed under the NFNAP program.

Table 2. Examples of new and updated values using NFNAP analytical values

NDB No.	Food Description	Nutrient	New Value	Type	Old Value	Type
11124	Carrots, raw	Vitamin A (IU)	12036	Analytical	24554	Not specified
11090	Broccoli, raw	Vitamin A (IU)	660	Analytical	1542	Not specified
01123	Eggs, whole, fresh	Lutein	331	Analytical	55	Analytical
		Choline	250	Analytical	-	-
09326	Watermelon	Lycopene	4532	Analytical	4868	Analytical
01001	Butter	Cholesterol (mg)	215	Analytical	219	Not specified
04132	Margarine, hard, stick	Vitamin K	93	Analytical	51	Not specified
09094	Figs	Fiber (g)	9.8	Analytical	12.2	Not specified
19078	Chocolate, baking	Selenium (mcg)	8.1	Analytical	7.5	Imputed
13326	Liver, beef, cooked	Selenium (mcg)	36.1	Analytical	55.8	Imputed
04020	Salad dressing, French, reduced fat	Fiber (g)	1.1	Analytical	0	Assumed zero
08147	Shredded wheat	Zinc (mg)	3.1	Analytical	2.61	Label claim
18069	Bread, white	Folate (mcg)	111	Analytical	95	Imputed

Conclusion

Over the next few years, all QC approved data will be released through our Web site: www.nal.usda.gov/fnic/foodcomp Additional studies of serving-to serving variability for select nutrients in high consumption foods and stability studies for vitamin C and folate are also underway. The NFNAP data provide an authoritative, nationally representative foundation of food composition information for nutrition and health research, nutrition policy development, and food industry applications. Continuation of NFNAP would allow continued monitoring of top contributors of nutrients in the food supply, sampling and analysis of foods consumed by ethnic populations, analysis of new foods in our dynamic food supply, and the flexibility to study new emerging nutrients of public health importance.