

## Report

## Development of sample handling procedures for foods under USDA's National Food and Nutrient Analysis Program

D. Trainer<sup>a,\*</sup>, P.R. Pehrsson<sup>a</sup>, D.B. Haytowitz<sup>a</sup>, J.M. Holden<sup>a</sup>, K.M. Phillips<sup>b</sup>, A.S. Rasor<sup>b</sup>, N.A. Conley<sup>b</sup><sup>a</sup> Nutrient Data Laboratory, ARS, USDA, Beltsville, MD 20705, USA<sup>b</sup> Virginia Polytechnic Institute and State University, Blacksburg, VA 24061, USA

## ARTICLE INFO

## Article history:

Received 3 December 2008

Received in revised form 5 March 2010

Accepted 22 March 2010

## Keywords:

NFNAP

Sample handling

FALCC

Food sample procurement

Food composition database

Sampling strategy

Data management and compilation

Quality assessment

Food analysis

Food composition

## ABSTRACT

The National Food and Nutrient Analysis Program (NFNAP) was implemented in 1997 to update and improve the quality of food composition data maintained by the United States Department of Agriculture (USDA). NFNAP was designed to sample and analyze frequently consumed foods in the U.S. food supply using statistically rigorous sampling plans, established sample handling procedures, and qualified analytical laboratories. Methods for careful handling of food samples from acquisition to analysis were developed to ensure the integrity of the samples and subsequent generation of accurate nutrient values. The infrastructure of NFNAP, under which over 1500 foods have been sampled, mandates tested sample handling protocols for a wide variety of foods. The majority of these foods were categorized into several major areas: (1) frozen foods; (2) fresh produce and/or highly perishable foods requiring refrigeration; (3) fast foods and prepared foods; (4) shelf-stable foods; (5) specialized study and non-retail (point of production) foods; and (6) foods from remote areas (e.g. American Indian reservations). This paper describes the sample handling approaches, from the collection and receipt of the food items to the preparation of the analytical samples, with emphasis on the strategies developed for those foods. It provides a foundation for developing sample handling protocols of foods to be analyzed under NFNAP and for other researchers working on similar projects.

Published by Elsevier Inc.

## 1. Introduction

The National Food and Nutrient Analysis Program (NFNAP) was implemented in 1997 by the Nutrient Data Laboratory (NDL), U.S. Department of Agriculture, in cooperation with the National Institutes of Health, National Heart Lung and Blood Institute, in order to update and improve the quality of food composition data maintained in the USDA National Nutrient Database for Standard Reference (SR; NDL, 2008). This ongoing program is designed to sample and analyze frequently consumed foods in the U.S. food supply in order to obtain robust and nationally representative estimates of their mean nutrient content, with the intent of updating and expanding the quantity and quality of food composition data in USDA's databases (Haytowitz et al., 2008). Over the last 12 years, NFNAP has received support from nine to seventeen Institutes and Offices of the National Institutes of Health to generate nationally representative analytical data for key dietary contributors in both retail and fast-food markets. The

National Cancer Institute currently coordinates the National Institutes of Health collaboration in this program.

The NFNAP, a multi-site coordinated process (Fig. 1), includes the development of statistically based sampling plans at NDL, food sampling, food compositing and sub-sampling, and ultimately nutrient analysis and data review, compilation, and dissemination (Haytowitz et al., 2008; Phillips et al., 2006). Because of extensive experience in these areas, the Food Analysis Laboratory Control Center (FALCC) at Virginia Polytechnic Institute and State University (VPI) in Blacksburg, Virginia has been responsible for sample preparation, distribution, and analytical quality control. This lab serves as the centralized coordinating center and processing facility for the NFNAP and is responsible for receiving, storing, homogenizing, inventorying, and then dispensing food samples to the analytical laboratories.

Careful handling of food samples from the time of acquisition to the time of analysis is critical to ensuring the integrity of the samples and subsequent generation of accurate nutrient values. No single university/research facility currently can meet the analytical demands for all components and foods for the entire project. Therefore, NDL has qualified a number of commercial food analysis laboratories and identified government and university laboratories for analysis of specific nutrients where specialized expertise is required. Once the analytical results are received by NDL from the

\* Corresponding author at: Nutrient Data Laboratory, ARS, USDA, 10300 Baltimore Avenue, Building 005, BARC-West, Beltsville, MD 20705, USA. Tel.: +1 301 504 0712.

E-mail address: [denise.trainer@ars.usda.gov](mailto:denise.trainer@ars.usda.gov) (D. Trainer).

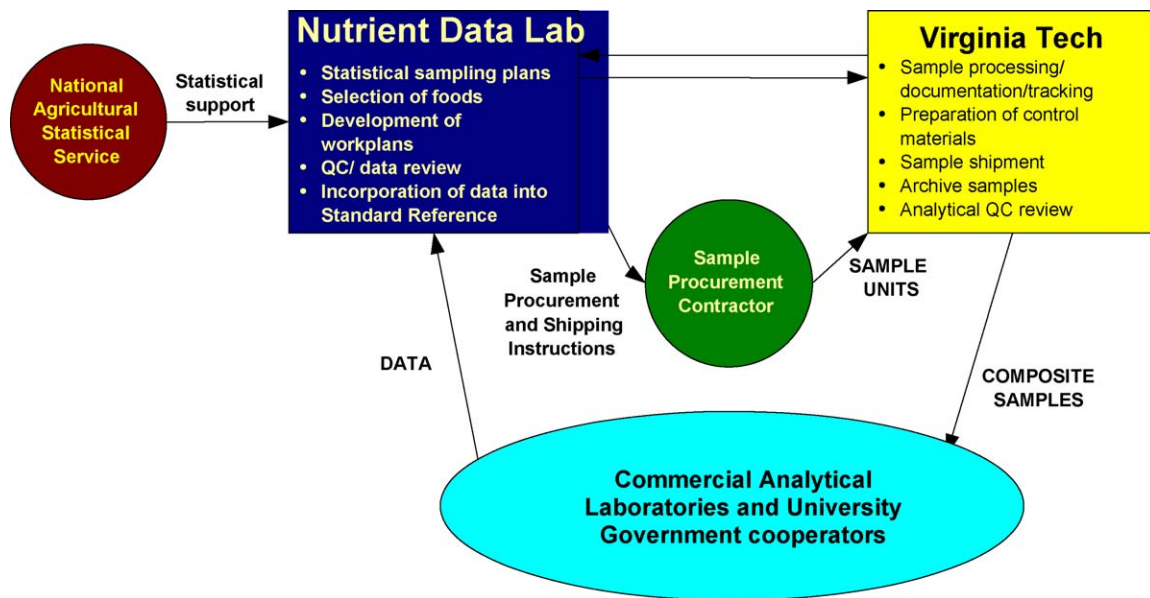


Fig. 1. NFNAP infrastructure.

labs, they are reviewed by NDL's Quality Control panel, migrated into the Nutrient Databank System and released in annual updates of the USDA National Nutrient Database for SR on NDL's Web Site ([www.ars.usda.gov/nutrientdata](http://www.ars.usda.gov/nutrientdata)).

Since 1997, as the NFNAP infrastructure evolved, a systematic approach was developed for collecting and handling a wide range of foods to optimize the stability of nutrients in various types of products, such that the levels would not deteriorate beyond what they would be at the point of purchase/consumption. The expense of purchasing and shipping food samples throughout the United States under a nationally representative sampling plan is not inconsequential, and therefore it is imperative that sample integrity is maintained at all levels.

To date, the published literature is limited documenting proper protocols for large-scale food sample collection and shipment from retail outlets in order to preserve product integrity and minimize vitamin and other nutrient deterioration. The Total Diet Study, conducted by the U.S. Food and Drug Administration (FDA), is an ongoing program to analyze nutrients and contaminants in selected foods consumed by the U.S. population (FDA, 2010). Similar to NFNAP, foods in the Total Diet Study are analyzed as consumed (table-ready). The Total Diet Study foods are sampled in several large cities across the U.S.; NFNAP sampling, however, has a greater breadth of geographical dispersion, with at least 12 sampling locations selected according to a probability-proportional-to-size plan, brand selection reflective of current market share data, and specific sample handling procedures. This paper summarizes the NFNAP sample handling approaches, from the collection and receipt of the food items from statistically rigorous, nationally representative sampling plans, to the preparation and dissemination of the analytical samples, that have been developed for different foods, including perishable products, fast foods, shelf-stable retail items, and industrial ingredients.

## 2. Program overview

### 2.1. Selection and ranking of foods

Foods to be analyzed are identified by NDL scientists using the USDA Key Foods approach (Haytowitz et al., 2000, 2002), which utilizes food composition and food consumption data to set

priorities for foods and nutrients for analysis. Different sources of market share data are used to identify specific brands and/or menu items within the various classes of foods. For high consumption retail foods, A.C. Nielsen (The Nielsen Company) and Information Resources, Inc. (IRI) data are considered. Market data for retail foods are analyzed based on grams consumed rather than dollar volume sales. For other foods, company and trade association data are utilized. An alternative approach has been applied to fast foods. Rankings from Restaurants and Institutions<sup>TM</sup>, a trade journal which covers quick-service and limited-service chains, have been used to select nationally representative fast-food chains for each specific food category (e.g. fast-food fried chicken) based on total dollar sales. Based on industry data and market information provided by the company's corporate offices, the top consumed items within these chains were sampled.

### 2.2. Development of sampling plans

A probability-proportional-to-size food sampling plan has been developed by NDL staff in collaboration with statisticians from the National Agricultural Statistics Service, USDA (Pehrsson et al., 2000). The original NFNAP sampling design was stratified in three stages and incorporated adjusted 1990 census data for four geographic regions (nearly equal in population size) across the 48 conterminous states. A revised sampling design was developed using 2000 census data (Perry et al., 2003); it was also based on a stratified three-stage design using 2001 Census Bureau-projected state population sizes and census regions (U.S. Census Bureau, 2002; Fig. 2). To establish specific retail stores in 24 locations within statistically selected counties, sales volume data were purchased from TradeDimensions (Westport, CT) for supermarkets which had over \$2 million dollars in annual sales. Pick-ups of sample units (e.g. bottles, packages, boxes) have been performed in 24 locations, though more typically taken from a random and geographically dispersed subset of 12 locations. A modified NFNAP sampling frame was used for sampling fast foods. For each fast-food chain, food samples were picked up at 12 different locations across the U.S. With few exceptions, fast-food restaurants were located within a 25-mile radius of the retail grocery outlet selected by the original NFNAP sampling plan. Actual retail and fast-food sampling sites have been modified throughout the course of the

Download English Version:

<https://daneshyari.com/en/article/1218516>

Download Persian Version:

<https://daneshyari.com/article/1218516>

[Daneshyari.com](https://daneshyari.com)