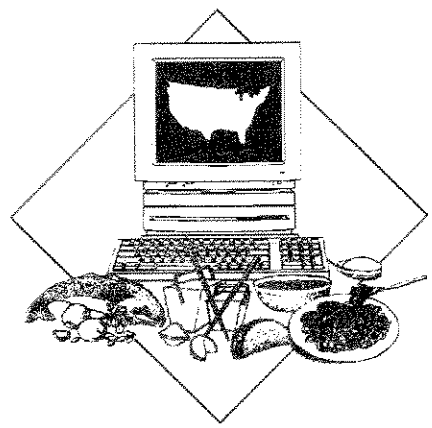
20th National Nutrient Databank Conference Proceedings

Diets and Databases



Reflections of Cultural and Technological Changes

June 11-13, 1995
Hyatt Regency Hotel
Buffalo, New York

Compiled and edited by Roberta Markel, Jean Pennington, and Phyllis Stumbo

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Foreword

The 20th National Nutrient Databank Conference was held in Buffalo, NY on June 11-13, 1995. The conference is organized by several committees of volunteers who give of their time and skills generously to assure a successful and informative meeting for all attendees. Chairs of the 1995 conference committees were: Steering Committee, Al Riley of Campbell Soup Company; Program Committee, Jean Pennington of the FDA and Phyllis Stumbo of the University of Iowa; Database Committee, Jack Smith of the University of Delaware; Communications Committee, Ruth Matthews of the USDA/ARS/NDL; Data Quality Committee, Suzanne Murphy of the University of California, Berkeley; and Arrangements Committee, Roberta Markel of the DINE Foundation. Special thanks go to the rest of the Arrangements Committee: Larry Bogdan of Rich Products, Darwin Dennison and Dominic Galante of DINE Foundation, Meg Garfoot of Erie Community College, Donna Hayes of Buffalo State College, Loretta Hoover of the University of Missouri-Columbia, Maureen Mangan-Ferrino and Brenda LiPuma of Buffalo General Hospital, Cindy McDonnell of St. Francis Health Care Center, Lisa Neuhaus of Buffalo General Hospital, Laura Olejniczak of Our Lady of Victory Hospital and Edward Weiss of D'Youville College. Special thanks go to The International Life Sciences Institute, who donated the cost of printing and distributing the proceedings of this conference. Special thanks are extended to Maureen Griffiths who, on ILSI's behalf, oversaw the production of the Proceedings.

The expertise of previous organizers of the Conference was especially valuable in preparing for this Conference. Special thanks go to Suzanne Murphy of the University of California, Berkeley, Jack Smith of the University of Delaware, Catherine Champagne, Pennington Biomedical Research Center, and Loretta Hoover of the University of Missouri-Columbia for providing notebooks from the previous conferences and especially for providing words of wisdom from their own experiences.

This Conference was made possible by funding support by several Federal agencies and corporations. Sincere appreciation is expressed to the following Federal agencies: Nutrient Data Laboratory, Agriculture Research Service, United States Department of Agriculture; National Center for Health Statistics, Centers for Disease Control, Department of Health and Human Services; and Human Nutrition, Agriculture Research Service, United States Department of Agriculture. Special thanks go to the corporate sponsors: Campbell Soup Company, The CBORD Group, The Coca Cola Company, CPC International-Best Foods Division, Frito Lay, Inc., The Gerber Companies Foundation, Hoffmann-LaRoche, Kraft General Foods, Nabisco Foods Group, Nestle, USA, Inc. and Rich Products Corporation.

Major funding for this Conference has been provided by the following United States Government agencies:

Agriculture Research Service - Nutrient Data Laboratory
United States Department of Agriculture

National Center for Health Statistics
Center for Disease Control
Department of Health and Human Services

Agriculture Research Service
United States Department of Agriculture

The National Nutrient Databank Conference extends sincere appreciation to the individuals representing these agencies that have made this support possible.

The 20th National Nutrient Databank Conference wishes to thank the following sponsors, listed in alphabetical order, for their generous and enthusiastic support:

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Rich Products
Sysco Food Service
Venture Marketing
Wegman's Food & Pharmacy

We extend our thanks and appreciation for their valuable contributions throughout this conference.

June 11-13, 1995

Hyatt Regency Hotel
Buffalo, New York

20th National Nutrient Databank Conference

Diets & Databases

Reflections of Cultural & Technological Changes

Conference Program

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Program Schedule

Sunday, June 11, 1995

10:00 am - 1:00 pm	Registration	Mezzanine Foyer
10:00 am - 1:00 pm	Posters Open	Regency A-C
10:00 am - 1:00 pm	Exhibits	Regency A-C
General Session		Grand Ballroom D-G

1:00 pm — Welcome!
Darwin Dennison, Chair, DINE Foundation
Roberta Markel, Chair, Arrangements Committee
Jean Pennington/Phyllis Stumbo, Co-Chairs, Program Committee
Frankie Schwenk, Program Leader, ARS, USDA

Session 1 — **Shifting Populations - Ethnic Diets and International Perspectives**
Moderator: Margaret McDowell, CDC-NCHS

1:30 - 2:15 pm — **Keynote**: Influence of Asian and South Pacific Diets on US Food Choices
Jean Hankin, University of Hawaii

2:15 - 3:00 pm — **Keynote**: Hispanic Foodways: Issues in Data Collection and Data Analysis
Diva Sanjur, Cornell University

3:00 - 3:30 pm	Break	Regency A-C
	Posters	Regency A-C
	Exhibits	Regency A-C

3:30 - 4:00 pm — The Swedish-American Influence on Databases
Lena Bergström, Swedish National Food Administration

4:00 - 4:30 pm — Cuisine and Food Descriptions
Jean Pennington, FDA

4:30 pm — Adjourn

Participants are invited to attend the following presentations:

5:00 - 5:30 pm — Nutrient-Based Composite Systems and Databases .... Grand Ballroom D-G
Darwin Dennison and Janice Cochran, DINE Systems

5:30 - 6:30 pm — Open Discussion of North American INFOODS .... Grand Ballroom D-G
Barbara Burlingame, INFOODS and Joanne Holden, USDA, ARS

7:00 pm - 9:00 pm — Welcome Reception - Sun Garden, Hyatt Regency

Monday, June 12, 1995

7:00 - 8:15 am	Posters..........Regency A-C Exhibits..........Regency A-C
7:30 - 8:15 am	Continental Breakfast..........Grand Ballroom Foyer
7:30 - 8:15 am	Registration..........Mezzanine Foyer
Session 2	**Trends and Changes in Computer Technology**..........Grand Ballroom D-G Moderator: Jean Pennington, FDA
8:15 - 8:45 am	IFDA Data Exchange Standard John Alexander, The CBORD Group
8:45 - 9:15 am	The International Food Data Exchange Joanne Holden, ARS, USDA
9:15 - 9:45 am	The International Interface Standard for Food Databases Judi Douglass, Technical Assessment Systems
9:45 - 10:15 am	Break..........Regency A-C Posters..........Regency A-C Exhibits..........Regency A-C
10:15 - 10:45 am	Selecting a Food Composition Database and Software John Orta, PhD, California State University
10:45 - 11:15 am	Use of Visuals in Dietary Assessment Lenore Kohlmeier, University of North Carolina
11:15am - 12:00 noon	Using Internet and Electronic Bulletin Boards for Food Composition Data David Haytowitz, ARS, USDA
12:00 noon - 1:15 pm	Lunch..........Grand Ballroom B-C Posters..........Regency A-C Exhibits..........Regency A-C
Session 3	**Trends and Changes in American Food Patterns**..........Grand Ballroom D-G Moderator: Catherine Champagne, Pennington Research Center
1:15 - 1:45 pm	Trends & Changes in Consumer Attitudes about Nutrition & Food Shopping Michelle Tuttle, Food Marketing Institute

1:45 - 2:15 pm	Toward 2001: A Look at Restaurant Trends Jane Wallace, Restaurants and Institutions Magazine
2:15 - 2:45 pm	Trends and Changes in Food Patterns from the CSFII: Implications for Databases Alanna Moshfegh, USDA, ARS
2:45 - 3:15 pm	Developing and Maintaining a Nutrient Database for Food Frequency Questionnai Helaine Rockett, Channing Laboratory
3:15 - 3:45 pm	Break....Regency A-C Posters....Regency A-C Exhibits....Regency A-C
3:45 - 5:15 pm	User – Vendor Exchange Moderator: Phyllis Stumbo
5:15 pm	Adjourn
7:00 pm	**Annual Banquet** – Rich Renaissance Niagara Atrium 7:00 pm hors d'oeuvres and open bar 8:00 pm Dinner 9:00 pm Speaker: Elizabeth Schwartz, Producer, CNN Health Unit Presentation: Nutrition and the News

Tuesday, June 13, 1995

7:00 - 8:15 am	Posters....Regency A-C Exhibits....Regency A-C
7:30 - 8:15 am	Registration....Mezzanine Foyer
7:30 - 8:15 am	Continental Breakfast....Grand Ballroom Foyer
Session 4	**Trends and Changes in the Food Supply**....Grand Ballroom D-G Moderator: Sue McPherson, University of Texas
8:15 - 8:45 am	Biologically Active Components in Foods Elliott Middleton, M.D., SUNY at Buffalo
8:45 - 9:15 am	New Food Ingredients and Pharmaceutical Foods Eric Decker, University of Massachusetts

9:15 - 10:15 am	Impact of NLEA on Food Composition Databases Roy Lyon, National Food Processors Association Cindy Schweitzer, National Livestock and Meat Board
10:15 - 10:45 am	Break....Regency A-C Posters....Regency A-C Exhibits....Regency A-C
10:45 - 11:15 am	Biotechnology and Food Composition Donald Beermann, Cornell University
11:15 - 11:45 am	System Drift and Dietary Data Analysis Alison Eldridge, University of Minnesota
11:45 am - 12:15 pm	Development of Key Foods for Food Composition Research Pamela Pehrsson, ARS, USDA
12:15 - 1:45 pm	Lunch....Grand Ballroom B-C Posters....Regency A-C Exhibits....Regency A-C
Session 5	**Data Quality Issues**....Grand Ballroom D-G Moderator: Suzanne Murphy, PhD, University of CA
1:45 - 3:00 pm	Activities of the NNDC Organizing Committee on Data Quality Suzanne Murphy, University of CA at Berkeley
	Subcommittee on Quality Codes **Co-Chairs**: Joanne Holden and Loretta Hoover
	Subcommittee on a Clearinghouse for Industry Data **Co-Chairs**: Jean Pennington and Jack Smith
	Subcommittee on Letters to Legislators **Co-Chairs**: Roberta Markel and Judi Douglass
	Subcommittee on Letters to Editors **Chair**: Phyllis Stumbo and Jean Hankin
	Subcommittee on Setting Priorities for Analyses **Co-Chairs**: Margaret McDowell and Betty Perloff
3:00 - 3:30 pm	The Future of the National Nutrient Databank Joanne Holden, ARS, USDA

3:30 - 3:40 pm	Closing Remarks and Announcements Phyllis Stumbo/Jean Pennington, Program Co-Chairs Catherine Champagne, Chair, Arrangements Committee - 21st NNDC
3:45 pm	Evaluation and Adjournment

Post Conference Activities

Tuesday, June 13, 1995
Trolley Tour of historical sites of Buffalo.......................................6:45 pm
Wednesday, June 14, 1995
Rich Products Research Center...9:00 am

Shifting Populations-Ethnic Diets and International Perspectives

Influence of Asian and South Pacific Diets on US Food Choices
Jean Hankin, University of Hawaii

Hispanic Foodways: Issues in Data Collection and Data Analysis
Diva Sanjur, Cornell University

The Swedish-American Influence on Databases
Lena Bergström, Swedish National Food Administration

Issues of Food Descriptions
Jean Pennington, Food and Drug Administration

Influence of Asian-Pacific Diets on Food Choices in the United States

by Jean Hankin, Cancer Research Center of Hawaii

Asian migrants to the United States during the past several years have had considerable influence on the eating patterns of Americans. In particular, migrants from China, Japan, Korea, Philippines, Vietnam, Laos and Thailand have affected both food choices and meal preparation of many Americans. Although a few persons from the South Pacific Islands, New Zealand, Australia and other Asian countries have also migrated to the United States in recent years, their impact on our food choices has been limited. This review will pertain to the following major areas:

1. Factors responsible for Asian-Pacific effects
2. Effects of Asian-Pacific cuisine on US eating patterns
3. Methods of quantifying Asian-Pacific changes in diets
4. Development of appropriate food composition databases

Factors Responsible for Asian-Pacific Effects

Migration is undoubtedly the primary factor responsible for the effects of Asia and the Pacific on US food choices. The following time line (Fig. 1) shows the approximate years of initial migration of various ethnic groups to the Hawaiian Islands (1). Migration to the large cities on the West coast of California, Washington and Canada are no doubt similar to these time periods. The Chinese, primarily from Canton Province, were the first group of Asians to arrive in Hawaii. Many became plantation workers in the sugar cane fields. The Japanese came a little later and were similarly employed on the plantations. In addition, both Japanese and Chinese men helped to build railroads on the island of Hawaii and the state of California. The first wave of Filipinos and Koreans occurred in the early 1900's. Later, during the Korean War period, many Korean nationals also migrated to Hawaii and particularly to Los Angeles. During and following the Vietnam War in the late 1960's and early 1970's, natives of Vietnam, Laos and Thailand migrated to Hawaii and the West Coast.

As suggested above, many Asian families settled in West coast cities, such as San Francisco, Los Angeles, San Diego, Seattle and Vancouver. Subsequently, Asian migrants moved Eastward, particularly to New York, Boston and Chicago. Each of these groups brought their own eating patterns, sought substitute foods when native items were not available, and gradually added popular Western foods, such as bacon and eggs, hamburgers and French fries, and spaghetti and meat balls, to their traditional diets. These practices have been apparent in our dietary interviews among participants in epidemiological studies of Hawaii and Los Angeles (unpublished data).

Simultaneously Caucasians, Hawaiians, African-Americans and Hispanics adopted many Asian food customs, such as using rice instead of potatoes or bread, stir-frying vegetables with a little meat or poultry, and adding tofu and other soybean products to their meals.

Most Asian migrants built their diets on a foundation of rice or noodles (1). They also consumed large quantities of fresh cooked vegetables. In Hawaii, fresh produce is costly because most vegetables and fruits are imported. Consequently, many of the early Japanese, Chinese and Filipino migrants planted vegetables in home gardens. Traditional foods for festive occasions or national holidays were imported. The desire for native foods led to the development of specialty Asian markets in the United States, such as found in the "Chinatown" areas of Honolulu, San Francisco and New York, "Japantown" in San Francisco, and "Koreatown" in Los Angeles. Also, supermarkets in Honolulu, Los Angeles and San Francisco (and in other urban areas with large Asian populations) have created special sections labeled "Oriental Foods"; newspaper advertisements also frequently list special prices for various Asian food items.

The second major factor that influenced US eating patterns is health. Comparisons of the incidence or mortality rates of various cancers, such as breast and prostate, or of coronary heart disease reveal distinct variations among Asians compared to Caucasians and among natives and migrants within particular Asian groups. For instance, the incidence of breast cancer (Fig. 2) and prostate cancer (Fig. 3) is very low among Chinese living in the Asian cities of Shanghai, Singapore and Hong Kong. Rates begin to rise among Chinese migrants living in Los Angeles, San Francisco and Hawaii, but do not approach the incidence rates of Caucasians from these same cities. Incidence rates of breast cancer (Fig. 4) and prostate cancer (Fig. 5) among Filipinos and Japanese reveal lower rates among natives in their own countries in contrast to migrants living in San Francisco, Los Angeles and Hawaii.

Also, comparisons of coronary heart disease mortality among Japanese men living in Japan, Hawaii and San Francisco have revealed a stepwise increase progressing from a low in Japan to a high in San Francisco.

Published reports of these kinds of differences appear in the media frequently. For instance, if the Journal of the American Medical Association, Journal of the National Cancer Institute or the New England Journal of Medicine publishes a scientific report on diet and cancer among Asians compared with Caucasians, the popular press is likely to highlight this finding in newspapers, radio and television. When the general public reads popular articles indicating that Chinese or Japanese women have lower breast cancer rates than Caucasians and that these Asian women consume greater amounts of soybean products than Caucasians, many women in America are likely to include more soybeans and tofu in their diets.

Although there has been a movement among many Caucasians and other non-Asians to add various Asian foods to their usual diets, there remain differences in the quantities consumed of various items. For instance, in a recent pilot dietary survey among 8,000 persons of eight ethnic groups with diverse cancer rates in Hawaii and Los Angeles, we observed large variations in the average daily intakes of selected food items (unpublished data). Among males, Filipinos consumed about 370 g of rice, compared to about 50 g among African-Americans. Hawaiians ate about three times as much processed meats as Chinese, and Hispanics ate more than four times as much legumes as any of the Oriental groups. We also found that the diets of the Chinese males included the highest quantities of green vegetables and citrus fruits. Females of the eight ethnic groups revealed similar patterns. Differences such as these may account for some of the variations in ethnic incidence rates of cancer.

During the past several years, the healthful qualities of some of the major foods in the Asian diets have been investigated. Their generous use of dark green vegetables, such as dark green lettuce, romaine, watercress, bok choy (white stemmed cabbage), kai choy (mustard cabbage), and gailon (Chinese broccoli or Chinese kale) contribute to their consistently high intakes of carotenoids, tocopherols, flavonoids and dietary fiber. However, we and others have found that vegetables per se offer greater protection from cancer than single nutrients, for instance, vitamin A, ß-carotene and vitamin C. In a recent case-control study on diet and lung cancer in Hawaii, Le Marchand et al. (2) found greater protection from dark green vegetables and total vegetables than from any single or combined nutrients. Indeed, the high consumption of vegetables among the Asians may be one explanation for their lower rates of several cancer sites than the rates observed among Caucasians and other non-Asians.

As noted earlier, Chinese and Japanese populations consume soybean products on a somewhat regular basis. This has led epidemiologists to hypothesize that soy products may be responsible for the lower incidence rates of breast cancer and prostate cancer among Chinese and Japanese migrants as compared with Caucasians, African-Americans and Hispanics. Soybean products are a rich source of isoflavonoids (primarily daidzein and genistein) which have weak estrogenic and anti-estrogenic properties and compete with endogenous estrogens for receptor sites. The increasing publicity about the potential benefits of isoflavonoids in cancer prevention has resulted in many Caucasians beginning to include various soybean products in their meals. Table 1 illustrates the isoflavonoid contents of a few selected soybean products.

Vegetarianism is also related to health. Many Asians, as well as non-Asians, follow a vegetarian diet for several reasons, including religion, compassion for animals, and simply for health beliefs. Because the Asian diet is built on grains, vegetables and legumes, it lends itself to vegetarian eating.

The third major factor contributing to the observed Asian effects on food choices is the increasing number of meals eaten away from home. As Asians settled in the larger cities of the United States, several of them established restaurants featuring their native cuisine. Chinese, Japanese, Korean, Thai and Vietnamese restaurants are particularly popular. And, if the food is good, these dining spots do a phenomenal business among both Asians and other ethnic groups. There are also newer restaurants (sometimes referred to as "Euro-Asian" or "Eurasian") that blend elements of western and Asian cuisine into specialty items. For example, items such as the following were listed on menus from Euro-Asian restaurants in Hawaii and Los Angeles:

- Smoked chicken jook (rice gruel) with pickled ginger
- Woked mussels with black beans and cilantro oil
- Fennel and lamb bao with peppered ginger plum sauce
- Crispy goat cheese wontons with fruit sauce
- Green salad with sashimi (raw fish) and vinaigrette
- Thai beef salad on greens with chili-lime vinaigrette
- Peking duck salad with stir fry vegetables
- Spicy Asian shrimp salad with Asian vegetables
- Chinois chicken salad with spicy honey mustard dressing
- Linguini with scallops and Chinese black bean sauce

A fourth factor influencing US food choices is the interest of non-Asians in buying foods in the Asian and ethnic food markets in the larger cities of the US and Canada. After exposure to Asian restaurants, many people have begun to practice Asian cooking in their homes. Furthermore, many large supermarkets have "deli" departments which feature various Asian dishes, such as teriyaki chicken or beef, Filipino lumpia, Chinese chicken salad, or Japanese somen salad.

Last but not least, there are an increasing number of cookbooks with tested recipes of various ethnic cuisines. Appendix 1 includes a selected list of Asian and Pacific Rim Cookbooks.

Effects of Asian and Pacific Cuisine on US Eating Patterns

Although quantitative data are not available as yet, we are collecting three 24-hour recalls from a random sample of 4,000 participants of Japanese, Caucasian, Hispanic, African-American and Hawaiian ethnicity as part of a large multiethnic cohort study being conducted in Hawaii and Los Angeles. A cursory review has revealed an increased use of tofu, legumes and fish in place of red meat and eggs, increased intake of stir-fried vegetables and noodles, with meats used more as a flavoring than as a main entree, and substitution of rice for potatoes. As I suggested earlier, cooking practices are also changing, with greater use of woks and steamers which allow for quick cooking.

The different Asian cuisines have influenced us in several ways. The country of China (Fig. 6) is of particular interest due to the different types of cuisine in geographic areas (1). The Mandarin area in the north grows more wheat than other parts of the country, and pancakes, buns and noodles are popular. Peking duck is also a specialty. Mandarin cuisine which is light and mildly seasoned has been considered the gourmet cuisine of China by some writers (1). Szechwan cooking is characterized by hot chili peppers, green onions, garlic and sesame oil. It is the spiciest style of Chinese cooking. Shanghai is very cosmopolitan and features seafood, tomato and red (soybean) sauces. Cantonese cooking is the most familiar to Americans because Chinese from Canton were the first group of migrants to leave China and establish restaurants in other countries. Characteristic items are stir-fried foods, sweet-sour dishes and dim sum or dumplings.

Although rice is a staple among the Chinese (except for those living in the North), they also enjoy both rice and wheat noodles in soups and mixed dishes. As suggested earlier, green vegetables, tofu and various soybean products are regular fare.

The Japanese eating patterns have many similarities to the Chinese food customs. There are some differences, however. For instance, the Japanese prefer the short grain sticky rice, whereas the Chinese tend to use the longer grain fluffy rice. The dish known as "ramen" or "saimin" is of Japanese origin; it consists of broth, noodles, often char siu (marinated and roasted pork), fishcake or green onions. It is popular among non-Asians, as well as Asians. However, the "instant ramen" or "saimin" is probably consumed more frequently in the United States due to its simple preparation. "Sushi bars" are found in most large metropolitan cities today and are a favorite place for lunch or snacks. A variation of sushi is "musubi", which is cooked rice shaped in individual balls or rectangles and wrapped in rehydrated seaweed. It may include canned tunafish or a pickled plum ("ume") in the center or a slice of "Spam" on the top. Similar to the Chinese, the Japanese also enjoy tofu, soybeans, soy sauce and stir-fried foods on a regular basis.

Korean food is increasing in popularity in Hawaii, Los Angeles, and other cities with large Korean populations. Their cuisine includes various kinds of "chige" (which is heavier than soup but lighter than stew), mixed rice and noodle dishes, barbecued beef ribs ("kalbi") and thinly sliced beef ("bulgogi"). Similar to the Szechuan Chinese, Korean foods are highly seasoned with chili peppers, garlic, green onions and sesame oil. "Kim chee" is consumed at all meals where rice is served. It consists of any kind of cabbage, cucumbers, zucchini or dark green leaves, seasoned with garlic and chile peppers. In many supermarkets which cater to Orientals, there can be found refrigerated shelves of various types of kim chee. Currently, kim chee is frequently eaten by many non-Koreans in Hawaii and Los Angeles.

In recent years, there has been an increasing patronage of Thai, Laotian and Vietnamese restaurants and fast-food lunch wagons in Hawaii, California and larger cities of Continental United States. Best sellers are noodle soups, fried spring rolls which consist of thin rice dough filled with vegetables, shrimp or chicken, steamed summer rolls with similar ingredients, and French bread sandwiches with tofu, chicken, meat, and raw or pickled vegetables. Lemon grass, garlic, ginger, chile peppers and basil are popular ingredients used in food preparation. The Thais also specialize in curries prepared with coconut milk and chile peppers with varied degrees of "hotness".

The Asian-Pacific diets are generally lower in fat than the meal patterns of Caucasians. Consequently, it would probably be desirable for many Americans to consume these Asian specialties in their original form or with some modification as an alternative to their usual diet.

Methods of Quantifying Asian-Pacific Changes in Diets

It would be of interest to quantify the effects of Asian-Pacific changes on the diets of the US population. Although food records may be used, my recent experiences lead me to recommend the collection of 2 or 3 24-hour recalls from large representative samples of the population. With food records, greater accuracy is likely. However, food records are a burden for participants who lead busy lives, refusal rates are high, and the subjects tend to be "volunteers". Thus, they are a "selected" sample rather than being representative of the population. With food records, some people will simplify their diets in order to reduce the tasks of measuring and recording amounts consumed. On the other hand, busy people are more likely to respond favorably to 24-hour recalls which usually require only a few minutes of their time. These can be quantified in various ways and can be obtained by telephone. With a large number of 24-hour recalls collected on randomly selected days, both individual and group data can be obtained at regular intervals. This method is currently being utilized among various ethnic groups in our calibration study.

Quantification of changes in food and nutrient intakes over time could be accomplished with US food consumption surveys and NHANES surveys. Studies such as these will permit comparisons over time concerning changes in the dietary patterns of the US population. In addition to analyzing the data for nutrients and other dietary components, data on the particular foods (including ethnic dishes) consumed, as well as methods of preparation, seasonings and particular eating patterns should be reported.

Development of Appropriate Food Composition Databases

The current trend of consuming various Asian or Euro-Asian food combinations among Americans will predictably increase in future years. Consequently, databases should accommodate these newer ways of eating. Instead of converting new ethnic food items to existing foods in the database, I recommend that we add the new items, along with recipes, so that particular eating patterns can be identified.

Appendix 2 lists the food composition resources we have utilized in our databases for Hawaii, Los Angeles and Singapore. These references have been helpful for selecting individual Asian foods and for analyzing prototype recipes for the databases. For instance, in Singapore we trained interviewers (non-dietitians and non-nutritionists) to obtain estimated, quantitative 24-hour recalls by home interview from representative samples of the population. From these reports, we developed prototype recipes which were entered into the database. We have utilized this procedure, along with adjustments for changes in moisture and fat contents, for computing the food composition of various composite dishes. In addition, mixed dishes from restaurants or takeout stands have been purchased, and the major components separated and weighed to develop "recipes" for the database. A useful method for confirming prototype recipes, as well as purchased restaurant mixed dishes, is through locally published cookbooks. Our dietitians have followed all of these methods for developing our databases with considerable success.

Summary

Asians of several ethnic groups have influenced the eating patterns of Caucasians and other non-Asians in the US. Changes have occurred in food selection, food preparation and eating practices. Several factors account for these modifications: migration of Chinese, Japanese, Filipinos, Koreans, Vietnamese, Laotians and Thais to the US, beginning in the 1850's to the 1970's; scientific reports of lower incidence and mortality rates of various cancers among Asian natives as compared with Caucasians; research on healthful qualities of major Asian food sources; increase of Asian and Euro-Asian restaurants and Asian markets in major cities; and promotion and use of ethnic cookbooks. US eating patterns now reflect greater use of soybean products, fish, vegetables and rice, with decreased intakes of red meat, eggs and fats. Asian methods of food preparation, such as stir-frying and steaming, have also increased. There is a need to quantify these changes in the US diet and to develop appropriate food composition databases for handling Asian foods and recipes.

References

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Appendix 1

Selected Asian and Pacific Rim Cookbooks

Japanese

Miura-Kaminaka M. *The Legacy of the Japanese in Hawaii: Cuisine.* Japanese Cultural Center of Hawaii, Honolulu, 1989.

Kishi A. *Sushi - A Light and Right Diet*. Japan Publications Inc., Tokyo. Farrar, Straus & Giroux, 19 Union Square West, NY, 1989.

Moriyama Y. *Quick & Easy - A Taste of Tofu.* JP Trading, Inc., 300 Industrial Way, Brisbane CA, 1988.

Yamaoka M. *A First Book of Japanese Cooking.* Kodansha International, Tokyo.

Thai

Sananikone K. *Keo's Thai Cuisine.* Keo's Thai Cuisine, 625 Kapahulu Ave., Honolulu, 1985.

Bhumichitr V. *The Essential Thai Cookbook.* Potter Inc., NY.

Solomon C. *Charmaine Solomon's Thai Cookbook.* Charles Tuttle, Boston.

Bellefontain J. *The Great Thai Cookbook.* CLB Publishing, Surrey, UK.

Korean

Chin-hwa N. *Practical Korean Cookery.* Hollym Corporation, Seoul, Korea, 1985.

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Filipino

Dajin-Perez E. *Recipes of the Philippines.* DM Press, Inc., Manila, 1969.

Filipino Women's League Executive Committee. *Hawaii Filipina's Favorite Recipes.* Filipino Women's League, Pearl City HI, 1992.

Chinese

Su-Huei Huang. *Chinese Cooking for Beginners. Weo-Chuan's Cook Book.* Wei-Chuan's Cooking, 844 Ridgeside Dr., Monterey Park, CA, 1984.

Su-Huei Huang. *Chinese Seafood.* Ibid, 1984.

Su-Huei Huang. *Chinese Snacks*. Ibid, 1990.

Lew J. *Quick & Easy - Enjoy Chinese Cuisine*. JP Trading, Inc., 300 Industrial Way, Brisbane CA, 1988.

Yew B. *Asian Delights: All-Time Favorite Recipes.* Times Books International, Singapore, 1992.

Hawaiian

Corum AK. *Ethnic Foods of Hawaii.* Bess Press, Honolulu HI.

Honpa Hongwanji Hawaii Betsuin. *Favorite Island Cookery.* Books I to V, Honolulu HI, 1973-1989.

Rea P and Ting R, *A Hundred Years of Island Cooking.* Hawaiian Electric Co., Honolulu.

Fusion Cooking (Blend of American and Oriental Flavors)

Josselin Jean-Marie. *A Taste of Hawaii.* Stewart, Tabori & Chang, Pub., Walden Book Stores, Honolulu, HI 1995.

Carpenter H. *Pacific Flavors.* Stewart, Tabori and Chong, NY.

Carpenter N. *Chopstix.* Stewart, Tabori and Chong, NY.

Carpenter N. *Fusion Food Cookbook.* Artisan Publishers, NY.

Appendix 2

Pacific Rim Food Composition Resources

Abdon IC and Rosario IF. *Food Composition Tables Recommended for Use in the Philippines*, 6th rev. Food and Nutrition Research Institute, Manila, Philippines, 1990.

Wong KY et al. *Chinese Food Composition Table.* Chinese Institute of Preventive Medicine, Beijing, China, 1991.

Siong TE et al. *Nutrient Composition of Malaysian Foods.* Institute for Medical Research, Kuala Lumpur, Malaysia, 1988.

Kagawa R. *Standard Tables of Food Composition in Japan.* Women's University, Tokyo, Japan, 1991.

Tzeng MS et al. *Food Composition Table of Taiwan.* Department of Health, Executive Yuan, Taiwan, R.O.C., 1994.

US Dept Health, Education and Welfare and FAO. *Food Composition Table for Use in East Asia.* DHEW Pub. 79-465, 1972.

Dignan CA, Burlingame BA, Arthur JM, Quigley RJ, Milligan GC. *The Pacific Islands Food Composition Tables.* New Zealand Institute for Crop & Food Research Limited, Palmerston North, New Zealand, 1994.

Figure 1

Asian Migration to Hawaii

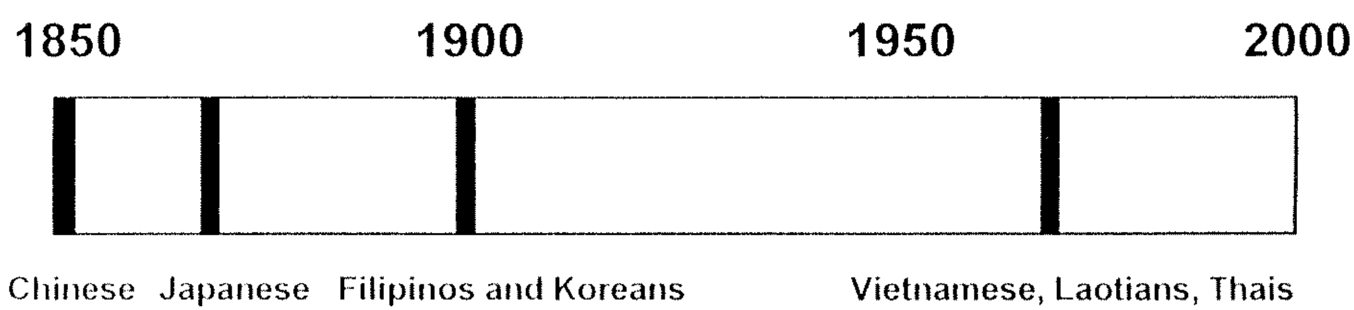

Figure 2

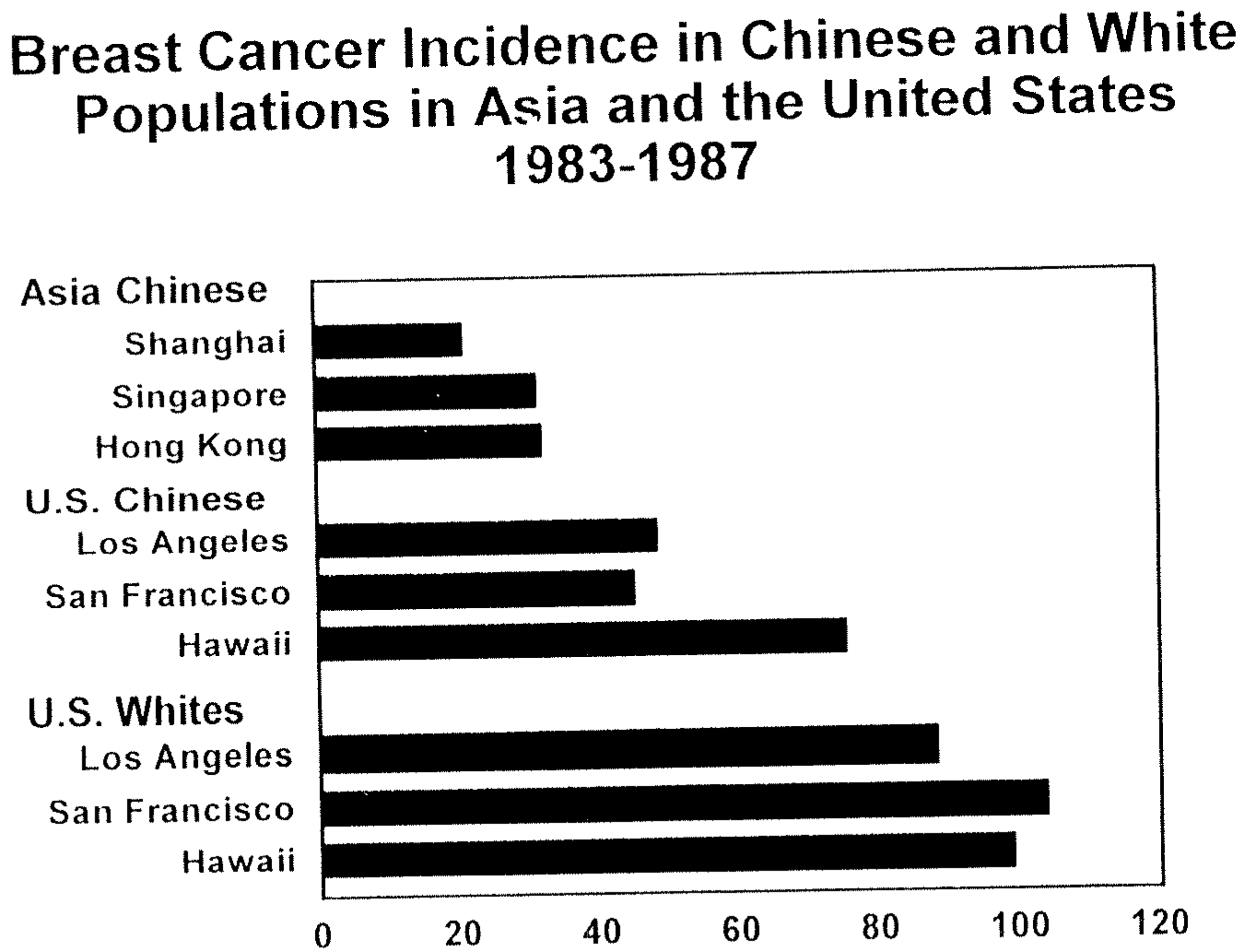
Breast Cancer Incidence in Chinese and White Populations in Asia and the United States 1983-1987
Asia Chinese
Shanghai
Singapore
Hong Kong
U.S. Chinese
Los Angeles
San Francisco
Hawaii
U.S. Whites
Los Angeles
San Francisco
Hawaii
0
20
40
60
80
100
120

Figure 3

Prostate Cancer Incidence in Chinese and White Populations in Asia and the United States 1983-1987

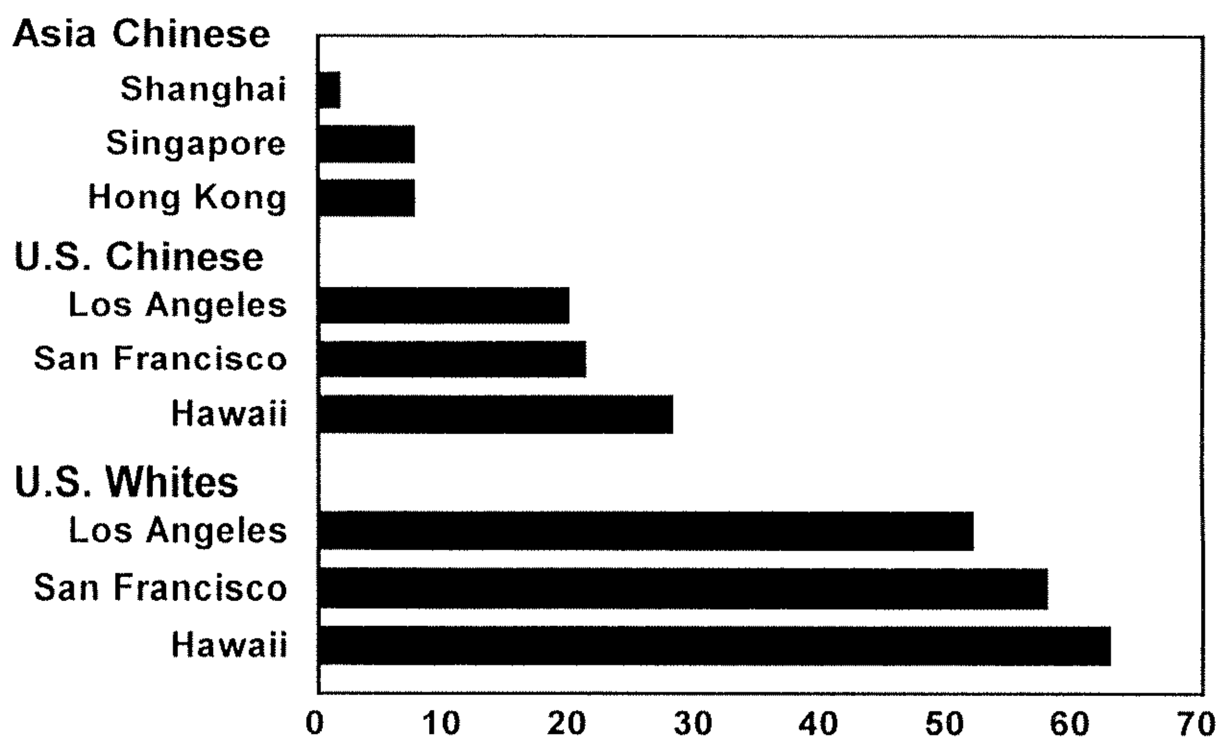

Figure 4

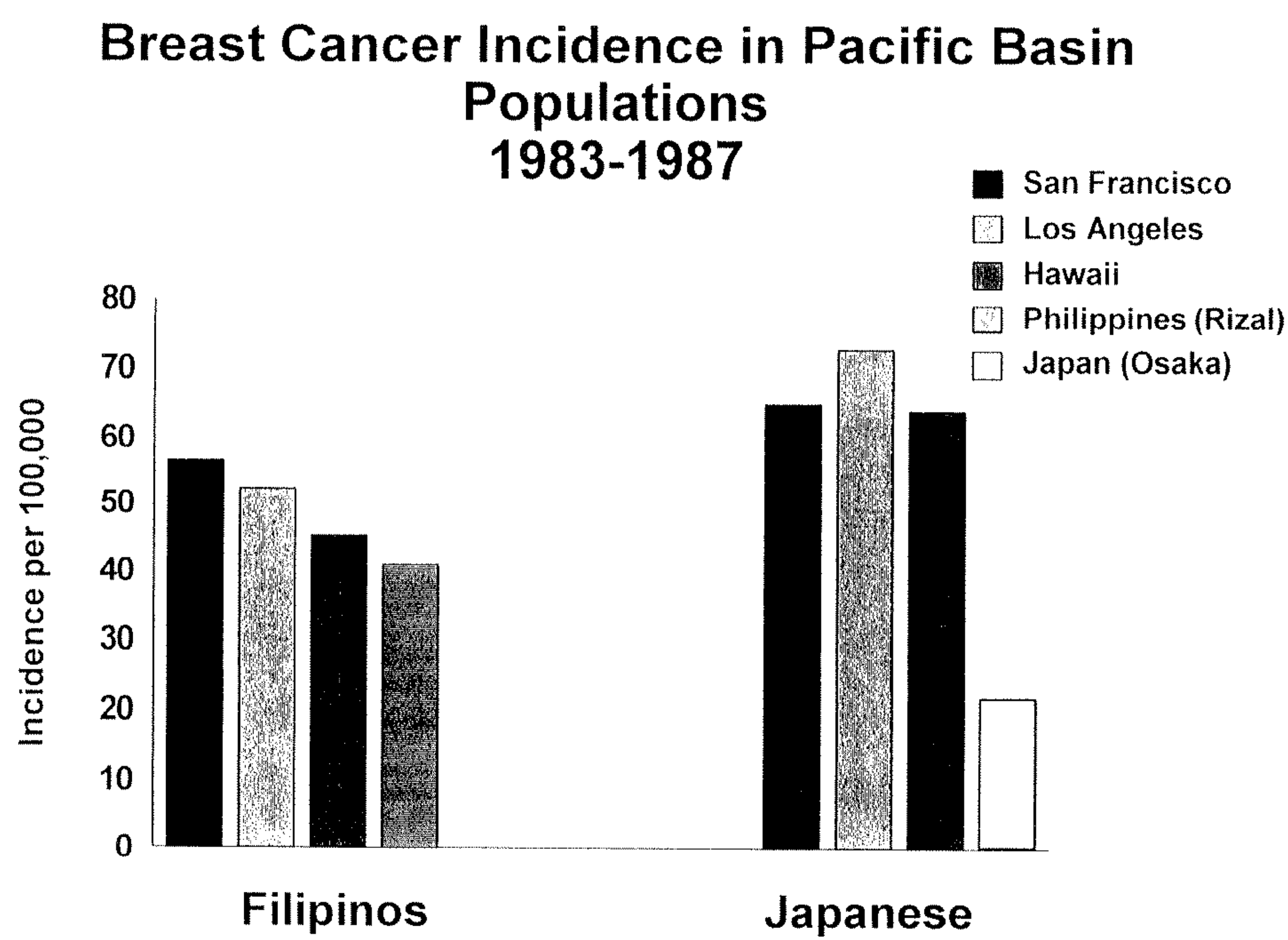
Breast Cancer Incidence in Pacific Basin Populations 1983-1987
San Francisco
Los Angeles
Hawaii
Philippines (Rizal)
Japan (Osaka)
Incidence per 100,000
80
70
60
50
40
30
20
10
0
Filipinos
Japanese

Figure 5

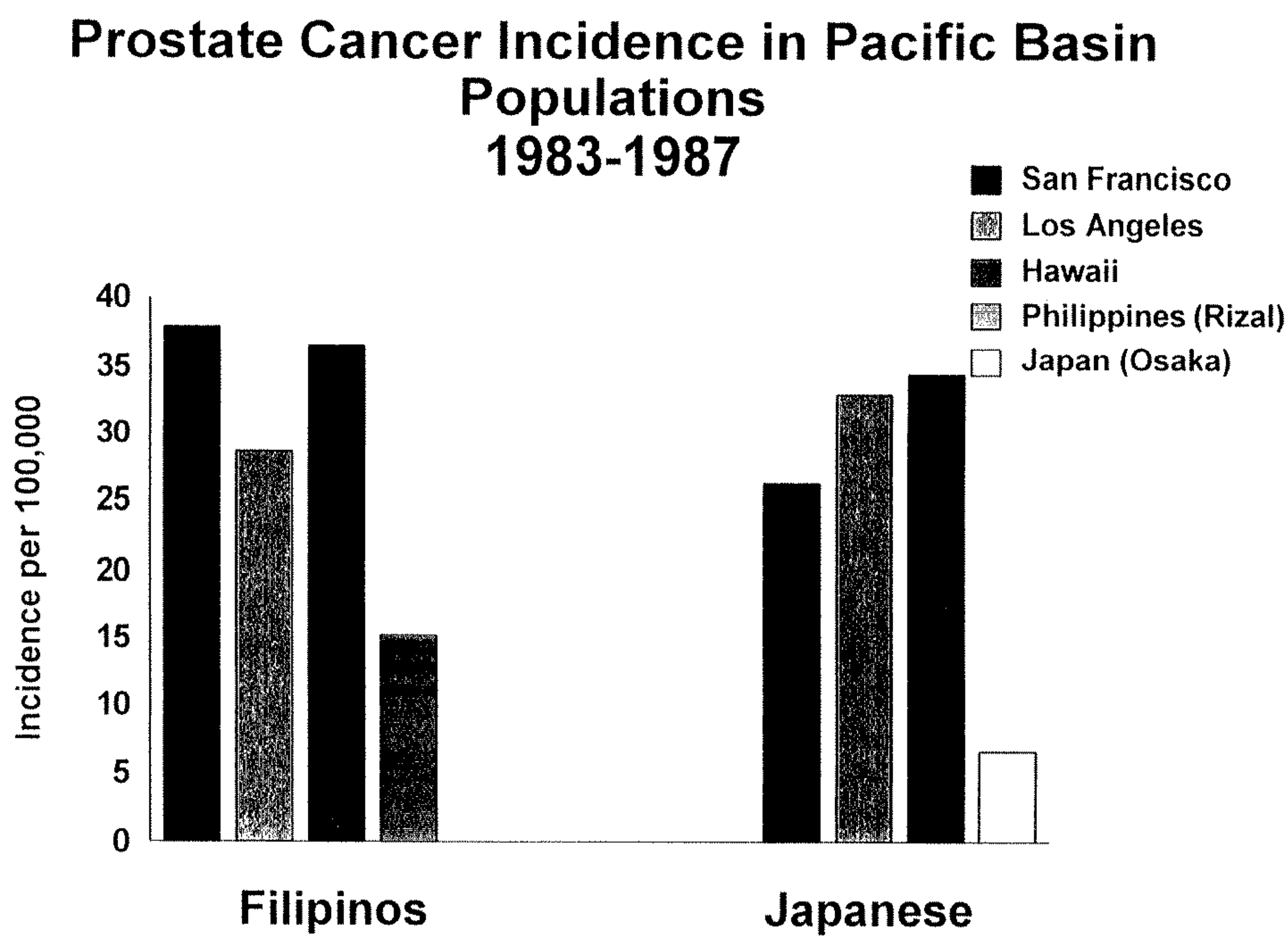
Prostate Cancer Incidence in Pacific Basin Populations 1983-1987
San Francisco
Los Angeles
Hawaii
Philippines (Rizal)
Japan (Osaka)
Incidence per 100,000
40
35
30
25
20
15
10
5
0
Filipinos
Japanese

Figure 6

Geographic Cuisines of China

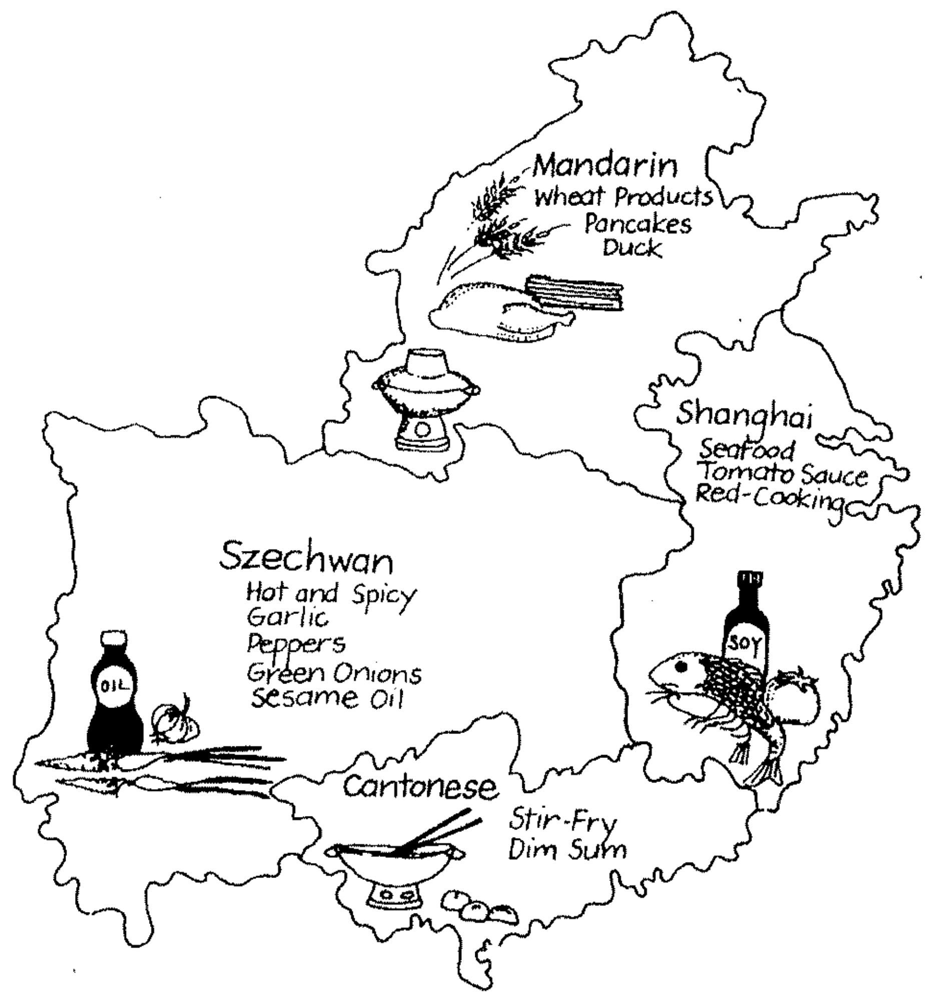

TABLE I
ISOFLAVONOID ANALYSIS OF SELECTED SOYBEAN PRODUCTS*

	Daidzein (mg/100g)	Genistein (mg/100g)
Fresh soybeans	12.8	14.8
Soy bean sprouts	22.7	30.2
Tofu	25.9	37.8
Fried bean curd	12.3	31.0
Soybean milk	8.0	21.0

*Franke A. Unpublished data. Cancer Research Center of Hawaii, University of Hawaii, Honolulu, HI, 1994.

Hispanic Foodways: Issues in Data Collection and Data Analysis

by Diva Sanjur, Division of Nutritional Sciences, Cornell University

Introduction and Objectives

All humans require the same basic nutrients, yet the foods that supply these nutrients are as different as the environments in which people exist and the cultures through which people have adapted to their environments. The reciprocity between humans and their environments involves the intersection of biological needs with physical, social, and cultural environments. And thus there is little doubt that the environmental changes occurring in many societies today have profound biological as well as social consequences, with particular reference to maintaining traditional food habits.

In assessing nutritional status of population groups, the crucial need to identify environmental and family factors has long been recognized. The household ecology represents one of the most closely associated set of factors influencing nutritional status of the family. Among those, *diet* is of particular importance in regulating nutritional conditions in young children and adults [Figure 1].

Either alone or in combination, biochemical, clinical, anthropometric and dietary indicators have been utilized to identify malnutrition [either under or overnutrition]. Nevertheless, what was contended by Krehl and Hodges thirty years ago (1), it is still true today, i.e., that " . . . it is evident that we are still a long way from having nutritional surveys which provide completely accurate and reliable information regarding nutritional status of human subjects.

Whether malnutrition arises from a deficiency or from an excess is immaterial -- the need for more and better information about the quantities and/or kinds of food eaten in modern contemporary urban settings is indicated. This presentation will attempt to illustrate selected issues relative to this complex topic in the context of US Hispanic/Latino families, particularly because this author feels that better understanding of social and cultural roots of any ethnic group will lead to better understanding of their rationale for healthy food choices.

Specific objectives of this paper will be:

- To provide a socio-demographic profile of US Hispanics
- To discuss the key role played by ethnicity in patterning food behavior
- To further recognize that lack of economic resources and institutional neglect may also explain differential health outcomes among ethnic groups
- To discuss issues relative to data collection and data analysis among US Hispanic/Latino groups, and lastly,
- To emphasize the need for a national nutrient data bank on ethnic foods.

Identifying the Hispanic/Latino Population

Historically, the US Census has had difficulty with the racial classification of Hispanics, and there has been continuing debate over how to count Hispanics. Hispanics/Latinos may be correctly classified as White, Black, American Indian, or Asian. Even within a single Hispanic group there may be much variation. This diversity also includes substantial variations not only in the racial composition, but also in the socioeconomic and health profiles.

With dramatic shifts in the US population in recent years, nutrition programs need to take into account sociodemographic and cultural determinants of food choices. No demographic change is greater than that represented by the Hispanic/Latino groups. By some estimates, Hispanics will make up one-third of the US population by the end of the century. In March 1991, the estimate of the Hispanic origin population in the United States was about 21.4 million, or about 8.6 percent of the total population. The Hispanic/Latino population consisted of the following groups (2): Mexican, 62 percent; Puerto Rican, 12 percent; Cuban origin, 5 percent; Central and South American, 12 percent, and Other Hispanic, 9 percent [Figure 2]. In New York State, by the end of the 1990s, it is estimated that the Hispanic population will increase to 30 percent of the population, compared to approximately 10 percent at present. Currently in New York State, there are more than 2 million documented Hispanics and an unknown but large number of undocumented Hispanics. In New York City, 25 percent of the adults and one-third of the children are Hispanic (3).

Understanding Food Choices and Ethnicity

Although it has been noted that indigenous food habits of any population group are deeply rooted in the local environment as well as local culture, food habits constantly change and are influenced by many factors. Ethnicity is an important factor in patterning and modifying dietary intake. Most definitions of ethnic groups stress the "distinct sense of culture which is fostered by an individuals' participation in or identification with a specified group." *The sense of sharing is the ethnic identity.* The importance for health practitioners to understand the overlap between culture, diet intake, and health was highlighted in the national report, *Healthy People 2000,* which contends that improving the health of all Americans depends on improving the health of certain groups that are at high risk, namely, people with low incomes, people belonging to certain ethnic groups, and people with disabilities.

The overlap between food habits and ethnicity is so pervasive that food habits are viewed by many as cultural markers of ethnicity. Researchers argue that foodways in subcultural groups "bind individuals together, define the limits of identity, and celebrate cultural cohesion" (4). Although it has been stated earlier that culture has a profound effect on the way nutrition and health is defined and experienced by certain ethnic groups, it is equally important, however, to recognize that not all members of a cultural or ethnic group share the same values, beliefs, and food choices. A person's cultural identity is dynamic, changing as a result of contact with different groups. The process of change, or *acculturation*, occurs naturally over time. Some Hispanic immigrants to the United States have maintained their original language, religion, and food customs, while also acquiring some of the values, practices, and language of the new culture needed to function in the new society. People have become bilingual and bicultural, identifying and blending with a new culture without discarding elements of the old culture (5).

The Process of Collecting Dietary Data

Undertaking dietary surveys as part of community nutrition research helps practitioners learn more about the diets of clients and about the community at large. Combining nutrition research and action programs is an invaluable and productive strategy, with tangible benefits for all participants. In a multicultural society such as urban America, dietary data collection among people of various backgrounds becomes a challenging and complex task. When conducting dietary surveys among US ethnic groups, the following three questions arise:

1. How well were dietary intakes assessed?
2. How well were the diets and nutrient intakes estimated, given that nutrient databases for indigenous, ethnic foods are often lacking?
3. Did dietary intakes reflect ethnicity, or given that many ethnic groups have low incomes, did intakes more likely reflect a low socioeconomic status?

On this issue, Cassidy (6) notes that culturally sensitive dietary research recognizes different values and the primacy of the respondent, while acknowledging that data accuracy is a function both of how well researchers know the people they want to understand and of how much respondents trust researchers. She suggests two additional questions:

1. How do the ways people perceive food affect their reporting of intake? And,
2. How do the ways people relate to the interviewer, the setting, or the assessment instrument affect their reporting of intake?

The following section addresses issues relative to assessing food intake in general, and in particular among Hispanic families. Emphasis will be placed on discussing issues that may lead to improving data quality, basically because this author believes that no matter how sophisticated the subsequent statistical analysis is, it cannot make up for poor earlier diet assessments. Some of the most common issues in dietary data collection include choosing the appropriate dietary method and research setting, selection and training of indigenous interviewers, use of bilingual, bicultural interviewers and interpreters, unfamiliarity with ethnic foods and lastly assessing portion sizes and composition of mixed dishes. A few comments relative to some of these issues follow.

Choosing the Appropriate Method

No method of dietary assessment is free of technical errors or reflects for any length of time the true biological variation of dietary intakes of free living individuals. Because no method is consistently best, nutrition researchers have to make tradeoffs and decide which method will best accomplish their objectives. Results from a study by Reese (7) among low-income people indicated that recording food intake for three-days was difficult to accomplish. Asking respondents to mail in their records was unsatisfactory because it placed too much burden on them. Also, people living in rural areas were more responsive than residents of central cities. In general, adult males had the lowest response rates, whereas women over 50 years of age had the highest response rates.

Bilingual Interviewers and Use of Interpreters

When field interviewers use interpreters they must be prepared to expect that some interpreters filter the data through their own personality and status. In addition, speaking the language is not enough. Methodological issues go beyond the language barrier. The wide range of food names and brands and their associated symbolic and cultural meanings must be considered in the training. A nutrition supervisor who hires bilingual Spanish interviewers must make sure to build in the study cross-checking validation techniques to ensure quality control of the data.

Unfamiliarity with Ethnic Foods

Detailed glossaries of the foods most commonly consumed by specific Hispanic/Latino subgroups are available. These glossaries provide serving portions, weight in grams, and energy values for selected foods. In addition the same foods often have different names and associations for different groups of people. For example, for an American nutritionist, starchy vegetables are just that; for a Puerto Rican mother they are *viandas,* for a Dominican they are *víveres*; and for a Panamanian they are *verduras*. Rice and beans are just that for a health practitioner. Yet for a Puerto Rican mother, they carry a strong symbolic meaning and are called *arroz manposteado;* in the Dominican Republic they are called *moros y cristianos*; in Cuba they are called *congrí,* and in Costa Rica they are called *gallo pinto.* Bananas are called guineos in El Salvador, in Mexico they are called plátanos.

One does not expect American nutritionists or dietary interviewers to learn all the Spanish names at this level of specificity, but recognizing that they exist and acknowledging their diversity among different Hispanic subgroups may help create sympathetic, friendly, and cooperative Spanish-speaking audiences, which ultimately will result in more and better quality of the dietary data being collected.

Assessing Portion Sizes and Mixed Dishes

Very little data exist on whether standard portion sizes vary among different ethnic groups or according to age or gender within particular groups. Investigations into this possible effect are needed to improve the accuracy of data.

Issues in Dietary Data Analysis

Analysis and interpretation of diets are central steps in the research process. The goal of analysis is to summarize the collected data in order to answer the questions that initiated the research. Interpretation refers to the search for the significance and implications of these answers within the framework of existing knowledge. Issues such as uses and limitations of nutrient data bank bases, including missing data on ethnic foods, use and limitations of Latin American and Caribbean food composition tables, the need for developing extended glossaries of selected Latino foods, and issues of validity and reliability of Hispanic/Latino diets are among the most important ones to consider in diet analysis. Following will be a brief discussion relative to selected issues in dietary data analysis.

Uses and Limitations of Food Composition Tables

Tables of food composition, useful for large-scale or epidemiological studies, are available for various Latin American and Caribbean countries. Such tables could certainly be employed to create a nutrient data bank of Hispanic/Latino foods for use in the United States. The ethnic or traditional Hispanic foods available to many individuals in urban America are already included in these tables.

Creating Your Own Nutrient Data Bank

Nutrient intakes can also be assessed and created by analyzing the caloric content of representative meals, single foods, or prepared "composites" of foods, either by the expensive chemical composition method, or from existing food composition tables. On a more practical level, many academic institutions or nutrition research institutes have available data that could be shared. One useful strategy to compensate for limited data on Hispanic foods is to substitute data on similar foods for which food compositions are available. Respondents are asked to name ingredients used in any mixed dishes. Then researchers can obtain nutrient data for these known components, even though nutrient data for a mixed dish are unavailable. Although the appropriateness of this strategy is also questionable, there are also problems associated with solely relying on national nutrient data bases for Hispanic/Latino foods.

The Need for a National Nutrient Database for Ethnic Foods

Computers are recognized for allowing fast, efficient, accurate, and uniform handling of dietary data through the use of nutrient data banks. However, nutrient data banks are only as complete as the nutrient composition data entered into them.

Loria et al. (8) maintain that the nutrient data for Mexican foods in the USDA databases are based on analysis of commercially prepared, Americanized versions of these foods, rather than on foods as they are prepared by Mexican-Americans at home. For example, Americanized tacos usually consist of a fried tortilla, filling, and shredded lettuce, whereas Mexican tacos most often consist of a tortilla cooked without fat, which is wrapped around a filling and eaten without lettuce. Tamales (filled dough steamed in cornhusks) may also have very different nutrient profiles, depending on whether traditional or Americanized versions are prepared. Mexican tamales are made with *masa harina,* a flour made from lime-treated corn, commercially prepared tamales, such as those in the USDA databases, are prepared with cornmeal. A tamale made with masa harina contains 47 mg of calcium per 100 g (9), whereas one made with degermed cornmeal contains only 11 mg of calcium per 100 g (10).

Conclusion

In view of the aforementioned issues, the need to develop nutrient databases for Hispanic/Latino foods through cross-sectional studies or other means, again, cannot be overemphasized. This is not a job for a community nutrition researcher but for governmental institutions charged with monitoring our food supply and its nutrients. Questions about the true dietary intake of Hispanic groups is of legitimate concern, given the limited nutrient data available for foods they commonly consume.

Celebrating cultural diversity is fine, but more information is needed to unravel the nutritional adequacy or inadequacy of these ethnic diets.

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Reese, R.B. Pilot study of measures of individual food intakes of the low-income population. In: *Research on Survey Methodology, USDA, Human Nutrition Information Service, Report No.382*, Washington, DC, 1987.

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USDA, Nutrient data base for individual food intake surveys. Release 2.1, 1986.

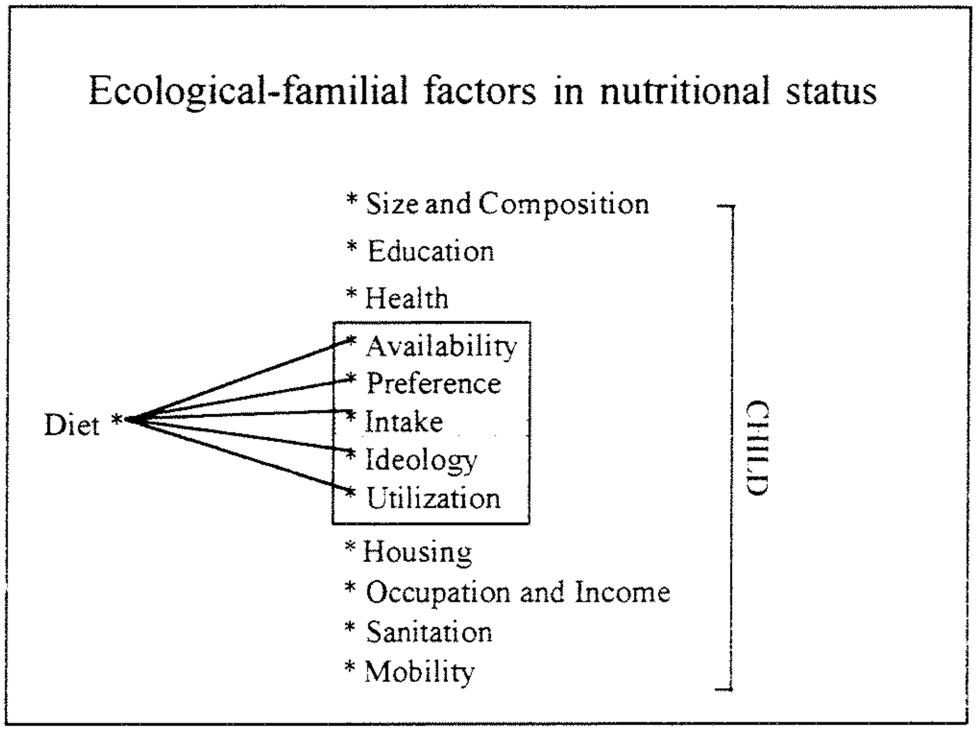

Figure 1

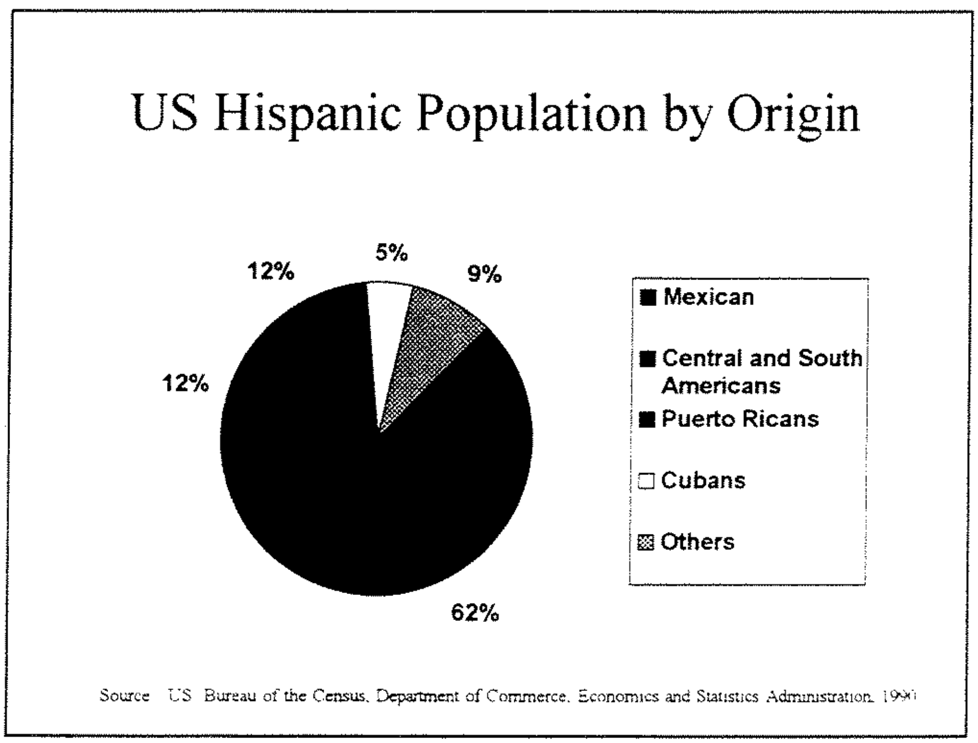

Figure 2

The Swedish-American Influence on Food Composition Databases

by L. Bergström, National Food Administration, Uppsala, Sweden

In a historical perspective the American influence on the nutrient databases of the world is far more comprehensive than the Swedish one. But let us first start with some comments on the written databases or the food composition tables.

Food composition tables

Albuminates + extractive substances, fat, carbohydrates, salts, water, refuse, the relation between the different energy providing nutrients, the price per kg and per 'skålpund' food, expressed in öre (1/100 of one SEK). A 'skålpund' is 425 g, thus similar to a pound. The relation between albuminates = protein, fat and carbohydrates should be 1 : 0.75 : 3 but could be 1 : 0.50 : 4. This information was included in the first Swedish food composition table: *The composition, the nutrient value, price and cheapness of our most common foodstuffs* (1). It was published in 1885 by a physician, August Almén. This table was followed by several food lists with nutrients added.

The former National Institute of Public Health, one of the forerunners to the National Food Administration, NFA, was established in 1938. One task of the institute was to analyze foodstuffs for nutrients. A new food composition table *Foodstuff tables* was published in 1947 (2) by Professor Ernst Abramson, the first head of the Institute. The nutrient values of this table were based on the institute´s own analyses and those from the Swedish food industry, but also, according to the introduction, on *McCance and Widdowson, Chemical Composition of Foods* and *Tables of Food Composition, U.S. Dep. of Agriculture No. 572.* Your 1945 edition of the Recommended Dietary Allowances (RDA) also seems to be included in this table, even if the reference is not given. This conclusion can be drawn from the second edition of the table, 1952, where the source is stated to be the Food and Nutrition Board, Washington, 1948. Still today the Swedish Nutrition Recommendations are largely based on your RDA and are used in nutrient databases and text-books. The Abramson table exists today side by side with the official tables published by our Administration. To Abramson´s name a new author has been added and the table has now changed name to *Diet table (3).*

The great American influence on food composition tables and databases started first in the 1960s. But other events have occurred that had and still have importance for both our food composition tables and databases.

Standardized measuring cups and spoons

At the end of the forties, the head of the KF Test Kitchen (KF = The Swedish Co-operative Union and Wholesale Society) Anna-Britt Agnsäter, visited the USA. There she was very impressed by your use of standardized measuring cups and spoons in recipe construction. As a matter of fact, she postponed the publishing of the first edition of the test kitchen´s cook book *Our Food* (4) in order to use standardized measures in the recipes. Furthermore, she also activated another KF branch, Gustavsbergs, in order to produce a measuring set in plastic. The set contained initially four parts: 1 dl (100 ml), 1 table spoon (15 ml), 1 teaspoon (5 ml) and a spice spoon (1 ml). Today a 1/2 dl measure and a coffee measuring spoon (20 ml) have also been added.

Standardized food measures

Mrs. Agnsäter was also influenced by your *Handbook of Food Preparation* (5), as the Test Kitchen produced a *Food cooking key* (6). The idea of that handbook was later passed on to the present National Board of Consumer Policies. So far Board has published 9 editions of *Measures for Foods* (7). As a matter of fact, when I started to work at the Board on revising the fifth edition of the booklet, I was given your handbook and a German one (8) and was asked to study it in order to pick up new tables for the booklet. These standardized food measures, as weights per household measure, per serving and density for foods are used in recipe construction for databases. As the National Food Administration needed more standardized portion sizes, food weights and density information to be used in our databases, we compiled our own *Weight table* (9). In producing that booklet we compared and sometimes borrowed values from two of your books, namely *Agriculture Handbook No. 456* (10) and Bowes & Church's *Food values of Portions Commonly Used* (11).
Lately the Board and the Nutrition Division at the NFA have discussed producing a handbook on standardized food weights and serving sizes for use in recipes and in meal planning. Another set of serving sizes is also needed for dietary studies. A Nordic project group is planned to review dietary surveys, in which the weighed food record method has been used, in order to establish serving sizes for different categories of people.

Yield studies

Another idea that Mrs. Agnsäter and others partly picked up in the USA was yield studies on home recipes. To consider yield and trying to find high-yield cooking methods for industry and catering foods was and is still vital for businesses, but to study yield on home recipes was not so common. One of the first things I learnt when working on the above-mentioned Board was how to perform yield studies on fish at the KF Test Kitchen. This knowledge I had good use for when revising the Measures for foods and later when making all the recipes for our database. As a matter of fact, the main part of the yield values in our database derive from Measures of Foods and the KF Test Kitchen, but some yields are also American (12,13). It was very good to have this background too, when writing the report on *Nutrient Losses and Gains in the Preparation of Foods* (14).

Food groups

Food guides have been in use since 1916, when the first was presented in the USA by Langworthy and Hunt (15). These guides have been presented in many different shapes: circles with different numbers of food groups, 8, 7, 6, 5, squares, rectangles, pillars, serpent form, pyramids - ordinary or squared - , plate or in plain text (16).
Since 1953 Sweden had a diet circle and the first official dates back to 1963. Both were based on the US Seven Groups´ Guide, but somewhat modified regarding the vegetable and fruit groups.

Even our circle has been revised since 1963 and given a new name, the Food Circle, we still have the old grouping system both in our food composition tables and in our food composition databases. The first figure in the code refers to the food group and you don't easily change a code system. But we are also using more differentiated food grouping in our national dietary survey and in other dietary studies.
In 1974 Mrs. Agnsäter created the Swedish Food Pyramid. This is used side by side with the circle, but is not official, like your pyramid. But nonetheless our new food circle is a compromise between the old diet circle and the pyramid.

Cooking terms

KF's Test Kitchen is one of the leading cookbook producers in Sweden. *Our Cookbook* has been published in 18 editions since 1951. For writing cookbooks standardized cooking terms are needed. But the list we have had was limited. Therefore, in 1992, the present head of KF Test Kitchen, Christina Möller came up with the idea of a book with standardized Swedish cooking terms with definitions and English translation of the terms included. The book, *Cooking Terms - The Test Kitchens explain* (17), was written in co-operation with two other test kitchens. Langual was one model available to the authors of the Cooking Terms and if the book will be fully translated to English you might also have use for the terms. The cooking terms in our database are not yet as differentiated as in the book. But these Swedish standardized terms will probably be used in the future together with Langual.

Earlier Swedish databases

In the beginning of the 1960s, the National Institute of Health, together with IBM in Sweden, developed the first Swedish computerized nutrient calculation system. That system was still used in the middle of the 1970s (18). At that time, Professor Arvid Wretlind was head of the Department of Food Hygiene and he seemed to have had good contacts with American scientists in nutrition. Considering that you started to use computer technology for nutrient databanks in the end of the 1950s, one must say that we in Sweden adopted your idea very quickly. I still remember when we had to go to the IBM office in order to get the database updated.
As the system was rather expensive both to update and to use in processing of different dietary studies, the NFA decided to make a new system of our own. This work started in earnest in the late 1970s in order to be used in a national dietary study on children in Sweden. The system was developed in co-operation with the Nutrition Division and the Data Processing Division and was ready for use in 1981 (19). All people involved collected and studied available literature on nutrient databanks, mostly in American journals and books. It was a real highlight both for the systems analyst, Hans-Björn Eriksson, and I, to come over here and study your systems, and for me to attend my first Nutrient Databank Conference in 1982.

NUTSYS

As all of you know, when you have been working for several years with a system you realise that it is possible to make the system function better. From 1984 to 1987 we had our second systems analyst for our nutrient data bank, Hernán Isakson. He was used to working with relation databases and he explained to us that all our information should be based on stable data structures, which are not affected by changes in the organisation, working routines or technology. Such stable structures enable large flexibility in the activities and, best of all, you don´t need to reconstruct the database from scratch when different changes in the base are needed. Under the chairmanship of Hernán Isakson, a symposium was held in 1987 with the Nutrition Division and the Data Processing Division on data modeling of food registers. Many of the ideas and wishes emerging from this symposium were taken up later in a pilot project group working between October 1991 to December 1992 with Wulf Becker as project leader and Hernán Isakson as consultant. In 1990, our old computer system that was run on a Nord-100 minicomputer was replaced by a UNIX-based network with personal computers as working stations. The main task of the pilot project group was to investigate the possibilities to replace our old system with a new system. The conclusion of the project report, *NUTSYS - a food and nutrition composition and information management system* (20), was that it would be necessary to develop a new food composition database system. The new system should fulfill the following main criteria:

Table 1

- based on modern computing and informatics techniques and standards
- flexible, i.e. easy to develop and modify further
- user-friendly
- designed to enable easy communication with other systems for data exchange
- NFA´s software for program development must be used

The group identified a number of functions and modules that should be included in the new system. The most important are:

Table 2

- registers for foods, nutrients and other substances
- database for nutrients and other substances
- recipe calculation system
- reference system for compositional data
- modules for print-out of food composition tables
- system for handling data from dietary surveys including validations of food and nutrient intake data
- system for menu planning

NUTSYS - specific requirements are:

Table 3

- storage of an 'unlimited' number of foods, components
- indication of origin, quality, source, etc. of a value
- indication of the period during which a value is valid
- indication of the origin (country, region) of a food
- indication of the method of preparation and processing of a food
- indication of the density, portion weight, etc. of a food
- grouping of foods and components according to different criteria
- use of multiple names, languages, codes etc.
- exchange of recipe ingredients, breakdown of recipes
- use of yield and retention factors in recipe calculation

The preliminary model shown in figure 1 was rather comprehensive. Therefore the project group limited it. The current model is within the dotted lines.

EuoroNIMS

At the FLAIR Eurofoods-Enfant Project meeting in May 1991 in Crete, we met a Belgian group working on a system similar to ours. This group suggested a European co-operation in order to build up a new common system, based on the Belgian NUBEL Institute system, NIMS (Nubel Information Management System). As we knew by experience how much it costs to develop a new system, Wulf Becker took contact with the Belgian party in order to discuss co-operation. Also other countries were interested in co-operation. From the beginning there were several countries in this co-operation together with two technical partners (Logimed, Belgium and IDUFIC - Ian Unwin, United Kingdom). The group took the name EuroNIMS that stands for European Nutrition Information Management Systems. Other countries have later joined the co-operation. The partners contributed with their own work in this early stage of the project. Sweden offered, e.g. the NUTSYS structure and suggestions. A Technical Advisory Committee, with people such as Wulf Becker, Sweden, Anders Møller, Denmark, Jayne Ireland-Ripert, France and Ian Unwin, UK, has been established and, together with the technical team of Logimed, is responsible for the development of EuroNIMS. The group is now evaluating and implementing all the suggestions received from the partners.

Here are some of EuroNIMS version 1.0 features:

Table 4

- client-server architecture
- multilinguality both at the user interface and data storage
- international food identification (country, organisation, sequential and version number)
- parallel management of different coding and classification systems
- registration of food manufacturers and distributors and of analytical laboratories
- registration of items as aggregated or representative foods
- a range of algorithms for the calculation of recipes, using yield and retention factors
- facilities for Langual encoding

A preliminary version 0.9 has been released. It is compatible with several data base management systems, e.g. Sybase, SQL Server, Oracle and Ingres.

The EuroNIMS application is an MDI (Multiple Document Interface) application. In other words, you can open several windows or documents in the main window. In version 0.9 there are four main documents:

Table 5

- A **food item** document: information about a certain food item
- An **organisation** document: information about an organisation
- A **contact person** document: information about a contact person
- A **value** document: information about values of a certain food item/component

Each document has one or more views. A view contains data about the document opened. For instance: a food item document contains the Naming View, that shows all the names that are related to a food item.
The EuroNIMS application has two toolbars, one menu and one document. The buttons included in the tool-bars make it easier to handle the different kinds of information that you want.

Ian Unwin and Wulf Becker have just finished a report, *Component Aspect Identifier. A Tool for Handling Food Component Information in a Food Database Management System* (21). The Component Aspect Identifier (CAId) is proposed as a convenient method of structuring and summarising data associated with analytical, calculated and imputed compositional values. Aspects include component identification, mode of expression, analytical or calculation method, source reference and value quality.

The information is structured as follows:

Mode of Expression with Code, Category Code, Meaning and Comments
Table 6

Xnon-weight expression of component (e.g. monosaccharide equivalents)
Rexpression as a ratio (e.g. essential to total amino acid ratio)
Fexpression in terms of alternative food measures
Cexpression in terms of another component (e.g. amino acids per g nitrogen)
Pexpression as a percentage (e.g. energy, percent contributed by carbohydrate)

Mode of Expression			
Code	Category	Meaning	Comments
M	X	as monosaccharide equivalents	For available carbohydrates. It may co-occur with other codes, in which case it precedes them
R	R	ratio	For any components. It requires two component part identifiers. It may co-occur with other codes, in which case it precedes any except code 'M'
W	F	per food weight	
V	F	per food volume	
D	F	per dry weight	
N	C	per g nitrogen	For amino acids
P	C	per g protein	For amino acids
F	C	per 100g total fatty acids	For fatty acids
E	P	percent contribution to energy	For alcohol, total available car-bohydrate, total fat and protein

Origin Type with Flag Code, Category Code, Meaning and Method Part Association
Table 7

A analytical results
C calculated values
I imputed values

Origin Type			
Code	Category	Meaning	Method part association
a	A	analytical result(s)	'Headline' analytical method
b*	A	analytical results set	'Headline' analytical method
c	A	selected value based on analytical results	'Headline' analytical method
d	C	value derived as simple average of accepted contributing results	'Headline' analytical method, if applicable
e	C	value derived as average of accepted contributing results, weighted by sample size	'Headline' analytical method, if applicable
g	C	calculated as aggregate food item	Missing value indicator
h	C	calculated as recipe	NLG factor set; Missing value indicator
i	I	imputed from similar food (value taken across unmodified)	Identifier of similar food
j	I	imputed from related food (value modified)	Identifier of related food
p	C	calculated on component profile	Component profile keyword or profile food identifier
s	C	summation from constituents	Constituent set keyword
t	C	summation including conversion factors	Conversion factor keyword, e.g. (ENERC) STDT: energy, Atwater, total carbohydrate (VITE) USDA: factors for alpha-tocopherol equivalents
x	–	no origin information available	–
* Reserved for possible implementation later			

Source Type with Flag Code, Code, Meaning and Reference Part Association
Table 8

Source Type			
Flag	Code	Meaning	Reference part association
o	own	inhouse or affiliated laboratory	Internal document identifier
i	ind	industry or independent laboratory	External document identifier
f	ftb	food composition table	Food table identifier
p	pub	published in (non-ftb) journal, book, report, etc.	Reference identifier
s	sys	value created within host-system	System identifier
e	els	other source (elsewhere)	External reference identifier

The work within EuroNIMS continues with different domains as:

Table 9

- parallel grouping systems for classification of food item.
- recipe system
- bibliography system
- quality index for values

The bibliographic information includes e.g.:

Table 10

- code
- author
- title
- publication
- volume
- year
- country

At present, partners from at least five countries, United Kingdom, Sweden, Norway, Hungary and France, are testing the 0.9 version. The 1.0 version is planned to be released later this year.

Conclusion

Now, when you have heard this information on the Swedish-American influence on food composition databases you might ask yourselves, how large the Swedish influence will be on the next generation of databases. Perhaps you will adopt some of the applications suggested by NUTSYS. Anyhow this question is rather difficult to answer. But I will try to do so with an experience that I had some years ago. At that time, I did a very interesting study of the Journal of the American Dietetic Association. I went through all the volumes we have in our library, and that goes back to the 1936 issue of the journal. I was looking for information on food composition tables, computer and computer processing, recipe calculation, yield studies, nutrient changes in the preparation of foods and diet information tools.
There I found the same thing that you realise in every domain when you look at it in a historical perspective. Every idea follows an undulation in time and place. What you think is completely new, has been dealt with before. It is a flow that continues. Sometimes, however, you get better tools that make it easier to develop the ideas though, such as the computer. What is important with, e.g. EuroNIMS, is that compiled knowledge in nutrition, chemistry, computer science, etc. from several countries is brought together. The inspiring fact is, that through co-operation between people, ideas are moving back and forth and the working result is constantly getting better. Good examples for this process and progress are EuroNIMS and your Nutrient Databank Conferences, with their dissemination of knowledge.

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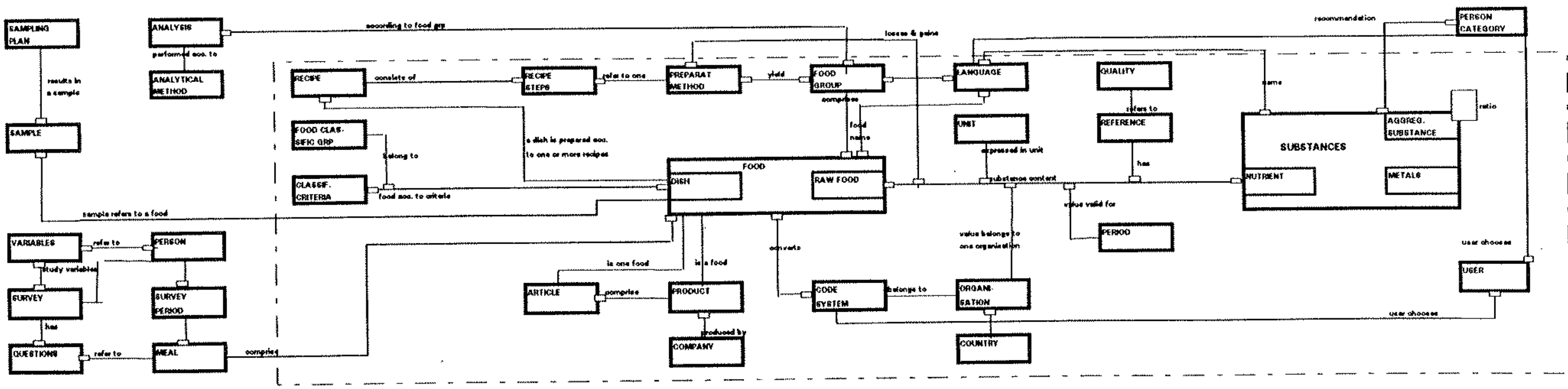
Figure 1. The preliminary data model. The current model is within the dotted lines.



Issues of Food Description

by Jean A.T. Pennington, Food and Drug Administration, Washington, DC

Food names and descriptions identify and distinguish among foods listed in databases. Descriptive terms may be captured in free form with the food name and in faceted systems. The INFOODS Food Description System is faceted with free text. The International Interface (which includes LANGUAL) is a faceted system with standardized vocabulary. Faceted systems provide a checklist to fully describe foods and they allow for retrievals and matching of foods among databases. On-line dictionaries can be used to clarify implicit and complex food names. Relevant descriptive information varies among foods and food types. Information about cooking methods, ingredients, recipes, cuisine, and preparation location are important to fully define some foods. Sample descriptions (as opposed to food descriptions) identify the products analyzed in the laboratory. Market share and default entries should be clearly identified. Pictures of foods (hardcopy or computerized) are useful for product identification. A universal system to describe foods will enhance the sharing and exchange of food composition data.

Introduction

Clear, accurate food descriptions are essential to identify and distinguish among foods listed in databases. Such descriptions enable database users to select the most relevant foods, obtain the most appropriate nutrient data, and avoid mistakes that might occur by selecting the wrong products. The number and types of food products available to consumers is huge and continues to grow. Productive, competitive food companies continue to challenge the retail market with new products. Trade across national borders enhances the availability of foreign food products. Even those who are experienced in the development and use of food composition databases encounter food names that are new or unusual. It is a continuing challenge to keep national databases current with the available food supply and to describe foods in a manner that is consistent and useful. This paper identifies and discusses issues relative to food names and descriptive terms used in databases and offers some suggestions to improve and enhance food descriptions.

How to Capture Descriptive Information

Descriptive information for foods in databases has traditionally been captured in free form (free text) with the food name. The information is usually recorded when the food is obtained for laboratory analysis. Relevant descriptive information distinguishes one product from another and may affect nutrient values. Most databases impose some order on descriptive terms to facilitate use of the database.

Descriptive information may also be captured in a specific format using a faceted system. The INFOODS Food Description System (Truswell et al., 1991) is a hardcopy, faceted system with free text. LANGUAL, a computerized food description vocabulary developed at the United States (US) Food and Drug Administration (FDA) beginning in 1975, uses standardized terms for 15 descriptive facets of foods (McCann et al., 1988). One of the unique features of LANGUAL is the hierarchy of standardized terms for each facet. The most relevant terms are selected to describe each food. Under contract with Technical Assessment Systems in Washington, DC, FDA developed an International Interface Standard which includes LANGUAL plus other important aspects of food description (Pennington & Hendricks, 1992, 1995).

Implicit/Complex Food Names

Implicit food names are unfamiliar names that have no meaning without prior knowledge or experience with the foods. An example is "hush puppies" (deep-fried cornmeal bread), a food of southern cuisine in the United States (US). Some food names are developed by industry and have no inherent meaning such as Whopper (fast-food hamburger) and Frankenberry (breakfast cereal). Some food names are lengthy as well as unclear or implicit such as "Ben & Jerry's Chocolate Chip Cookie Dough Ice Cream" and "I Can't Believe It's Not Butter."

Dictionaries for databases can define implicit and complex food names and identify preferred food names and synonyms. Database dictionaries are useful when national databases are used in other countries. The dictionaries can be on-line with computerized databases so that definitions of food names can be seen along with the nutrient data for foods.

Relevant Information

The way foods are described in databases is usually related to the intended uses of the databases. Databases developed for dietary assessment describe foods in the way that survey participants describe them. This makes it easier to find the best match between a food eaten and one listed in a database. Food databases used for other purposes (e.g., institutional menu development and inventory, industry product development, or epidemiology studies) have different emphases for food descriptions related to cost, technology, health issues, nutrient levels, or ingredients.

Relevant descriptive information also varies among foods and food types. For a raw, agricultural product (e.g., raw apple), the relevant information may relate to color, cultivar, Latin name, geographical location, season, year of harvest, soil type, use of pesticides or herbicides, storage time, and part consumed. For a processed or restaurant food such as frozen macaroni and cheese or fast-food hamburgers, the relevant information may be the brand name, the name and location of the manufacturer or restaurant, the ingredients and recipe, storage time, weight of the serving, production date, and preparation instructions. For a homemade food such as lasagna, the relevant information might be geographical area, cuisine, ingredients, and recipe. The Interface Standard allows for capture of these different facets using specific descriptive terms. Facets may be left blank if they are not relevant to a food or the information is not known. The terms "not known" and "not relevant" may be entered for clarification.

Cooking Methods

Specific information is needed about the methods used to cook foods because the methods can affect nutrient values and may be of interest regarding health matters (e.g., grilling, microwave use). Cooking methods that add fat (frying, sautéing) or cause loss of water (boiling, frying) or fat (broiling) lead to changes in nutrient values. Cooking method is included in the Interface Standards as one of the LANGUAL facets.

Ingredients and Recipes

Recipes specify the quantities of ingredients and explain how they are put together to form the completed product. This information is especially important for mixed dish and multi-ingredient foods that have the same names but contain different ingredients or are put together in different ways. Information about ingredients and recipes helps clarify the differences in nutrient values and assists data users in selecting the correct items from the database. Ingredients and recipes have been included as part of the International Interface Standard and are available on-line as one works with a database.

Cuisine

Populations in all countries are increasingly exposed to foods of different cultures and cuisines. Ethnic and cultural foods are widely distributed and available in markets, restaurants, and ethnic food stores. The mobility of populations also enhances food experiences. Information about cuisine in databases is important to help identify foods. It is also important to help distinguish foods from different cuisines that have the same names. For example, "tuna" is a fish in the US and a prickly pear in Mexico. "Tortilla" is a flat, unleavened pancake of corn or wheat flour in Mexico and the US, but is an omelet in Spain.

A draft cuisine hierarchy was developed for the Interface Standard to identify the cultural background of foods. Terms for the hierarchy were based on restaurant designations (in travel guides and phone books), culinary schools, scientific and cultural literature, and cookbooks. Eight groups of cuisine origin were identified, African, Caribbean, East Asian, European, Latin American, Mid-Eastern, Native American, and Native Australian. Among these eight general groups, 150 unique cuisines were identified.

Cuisine terms may be used in a national database to identify foods that are not part of the national cuisine. When ethnic foods (or foods that are different from a national cuisine) are entered into a database, the database compiler must decide whether to use the original food names or translations of the food names as the preferred terms. Databases used for national surveys in the US, have original food names for many Mexican, Asian, and Italian foods as preferred entry terms, but have American translations as the preferred entry terms for foods that are not well known, e.g., rice with chicken, Puerto Rican style (arroz con pollo).

Where Foods are Prepared/Obtained

Homemade, restaurant, and commercially manufactured versions of a food may have different nutrient content. Unfortunately, many databases do not specify the source of the food or location of preparation. The Interface Standard allows for information on the location of food preparation. Information about ingredients and recipes also helps distinguish between homemade, restaurant, and commercially manufactured foods.

Excess Information

The foods described in databases should match the product analyzed for nutrients in the laboratory. However, some descriptive information may not affect nutrient values, and database compilers usually choose to have single entries for foods that differ only in minor ways such as shape (e.g., pineapple slices or chunks) or flavor (e.g., plain or onion flavored potato chips). It is best to merge entries in databases based on nutrient content rather than have multiple listings of essentially similar foods. Extensive listings of similar foods may confuse and frustrate database users.

Sample Description, Market Share, Default Entries

The distinction between descriptive information for a food and descriptive information for the analytical sample is not always clear. Both types of descriptions are important to fully understand what the food data represent. Sample descriptions usually specify the variables included in the sampling plan. For example, the food description "Plaice, fried in retail blend oil" is accompanied by the sample description "20 samples purchased from fish and chip shops" in the British food composition table (Holland et al., 1993). Other examples are "Herring, canned in tomato sauce; 10 samples, 4 brands, whole contents" and "Apples, cooking, baked w/o sugar, flesh and skin; 10 samples, cored and baked, 180 C, 30-40 minutes" (Holland et al., 1992, 1993).

The nutrient values for market share entries in databases are determined by weighting nutrient data from different cultivars, seasons, brands, etc. The data are weighted based on the availability of a food to a defined population during a specific time period. Market share entries are useful when general nutrient information is needed such as average, year-round values for grapefruit or average values for various brands of enriched white bread. Market share data should be clearly identified in databases, e.g., grapefruit, raw (US market share, 1995); enriched white bread (US market share, first quarter 1993). The market share for grapefruit in the US would reflect a specific percent of pink and red and white grapefruit from California, Florida, and Texas, while the market share for enriched white bread would reflect sales of major brands.

Default entries are useful for survey databases when subjects in dietary studies or surveys cannot accurately describe the foods they ate. The databases for national food consumption surveys in the US have "not further specified" (NFS) entries such as meat, NFS; sandwich, NFS; and fruit pie, NFS. The data for these products may be based on analytical data for the most frequently consumed products (e.g., data for frozen apple pie may be used for pie, NFS) or calculated based on market shares (e.g., hamburger, NFS might be based on market shares of hamburgers from the top four fast-food chains).

Pictures - Hardcopy and Computerized

Color pictures in hardcopy and computerized databases allow foods to be more easily and specifically identified. They are especially useful for unfamiliar foods. Pictures are helpful to participants of food consumption surveys as they try to remember and name the foods they consumed.

Pictures are particularly useful for basic foods (fruits, vegetables, nuts, eggs, legumes) and for some pastries and breads, mixed dishes (tostadas, open-faced sandwiches, salads), and commercial products. Pictures of commercial products may display the packaged items. Pictures show differences between countries and regions in meat cuts and the degree of fat trim, and they distinguish between the parts of plants that are consumed and the parts discarded.

Pictures may not be useful for layered recipe items if the top layers are different from the lower layers (e.g., tuna noodle casserole topped with cheese and bread crumbs, beef and cheese enchiladas). They may also be confusing if there are various presentations of the same product, i.e., foods with the same name, but different appearances in pictures.

Advantages of Faceted Systems

Faceted systems provide a checklist as a reminder to fully describe foods. They also allow for retrievals of foods from databases based on standardized, descriptive terms. All food names in a database that have a particular characteristic or mixture of characteristics can be identified and retrieved. For example, one may want to retrieve all foods of Chinese cuisine that contain beef or all frozen foods in paperboard containers. The computer searches for the standardized terms and provides a printout of the identified foods, saving the users from tedious, and perhaps incomplete, manual searches. The retrieval feature is available on the Interface Standard.

Faceted systems may also be used to find the best match for a food in a database. The initial food may be one described by a survey participant, one analyzed in a laboratory, or one from another database. To match a food, the computer retrieves from the database all foods with the same (or almost the same) descriptive terms.

The use of faceted systems should not decrease the descriptive information presented with the food name. Some descriptive information should stay with a food name in a database, some should go into computerized facets (or hardcopy background documentation), and some should go in both places. Information regarding color, maturity, cultivar, part used, preparation state, physical state, preservation method, cooking method, and brand name should be included with the food name in databases and also in facets if a faceted system is used. If the food was obtained from a fast-food or other restaurant or is homemade, and this is not clear from the name, the term "fast-food," "restaurant," or "homemade" should be added. If the cuisine is regional or otherwise different from the national cuisine, the cuisine term should be included with the food name. Information about the language of the food name, the geographical location of where the food was obtained, and agricultural conditions can be included in the facets. If the food groupings are not otherwise indicated, they can be added if there is a possibility of confusion (e.g., chili as vegetable, powder/spice, or mixed dish; tuna as fish or vegetable).

Conclusions

There are currently a number of barriers to the sharing and exchanging of data among food composition databases. These barriers include differences in nutrient definitions, analytical methods, data quality, units, and food descriptions. The move toward a universal system to describe foods is a desirable one that will allow database users to more readily share and exchange food composition data. Different and innovative ways of describing and accessing food data should be considered to determine what works best. A system that merges the best aspects of current systems should be devised. Until a universal system is agreed upon, database developers should continue to promote the capture of thorough and accurate descriptive information about foods.

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Trends and Changes in Computer Technology

IFDA Data Exchange Standard
John Alexander, The CBORD Group

The International Food Data Exchange
Joanne Holden and Ellen Hurley, Nutrient Data Laboratory, ARS, USDA

The International Interface Standard for Food Databases
Judith Douglass, Sing-Bin Chew, Ki Lee, Judith Kidwell, and Barbara Petersen, Technical Assessment Systems, Inc., and Jean Pennington, Thomas Hendricks (retired), and Byron Bohannon, FDA

Selecting a Food Composition Database and Software
John Orta, PhD, California State University

Use of Visuals in Dietary Assessment
Lenore Kohlmeier, Alice Ammerman, and Marci Campbell, University of North Carolina

Using Internet and Electronic Bulletin Boards for Food Composition Data
David Haytowitz, ARS, USDA

IFDA Data Exchange Standard

by John Alexander, The CBORD Group

Thanks very much, and welcome to the 20th National Nutrient Databank Conference. It's a pleasure to have the opportunity to address this group, and to let you know that we've made significant progress toward the demolition of the "Tower of Babel" in the exchange of nutrient database.

The purpose of my presentation is to inform you that the International Foodservice Distributions Association's Technical Standards Committee has created a version of the IFDA Product Data Exchange Format which provides significantly enhanced functionality for the exchange of nutritional information. I will provide you with an understanding of the structure of the IFDA Product Data Exchange Format, and I hope that you'll adopt this format as a means of exchanging data between manufacturers, distributors, software and database suppliers, who currently serve your needs. In the future, it is likely that this data exchange format will be the primary way in which nutritional data is sent back and forth between organizations, much as the ANSI standard for Electronic Data Interchange, or "EDI" have standardized the interchange of data in this arena.

In the past few years there has been an increase in the demand for nutrient composition data and food product information. This has been fueled, in part, by the wholesale and retail sectors of the food industry, as a result of food labeling legislation. The passage of the Nutrition Labeling and Education Act of 1991 requires mandatory food labeling for all retail products. The wholesale sector has focused on developing a response to the need for a vehicle to efficiently exchange the needed information, in hopes of avoiding a mandatory labeling act for wholesale foodservice products.

At the same time, the lifestyle in the United States has changed. One out of every two meals is eaten away from home, and frequently the food served at home is prepared or processed elsewhere. The US Dietary Guidelines have suggested that a diet lower in fats, saturated fat, sugar, and sodium might reduce the risk for certain diseases. Manufacturers have responded to these situations by creating a market of ever-changing products, whose "brand name alternatives" are increasingly differentiated based upon nutritional claims. This has increased the demand for food composition data and product information on these "brand name" products by consumers, as well as by the healthcare education and foodservice industry in general.

In response to this need, the International Foodservice Distributors Association (IFDA), who are responsible for distribution of about 75 - 70% of the food sold in the wholesale markets, established a committee in 1990 to determine how they could meet the demands of their customers for up-to-date nutrient and product information.

A technical standards committee under the chairmanship of Tom Morin, Vice President of Quality Assurance for ComSource, was formed in September of 1990. It's goal was to create standardized data exchange format, that could be used by various trading partners, to exchange information regarding food and supply data. Members of this task force represented dietetics, manufacturers, software companies, trade associations, and distributors. The first version of the IFDA Product Data Exchange Format was approved in September of 1991.

Because of increased interest in nutrition, the committee realized that the original lists of nutrients in the first version had to be expanded. Further, the task force recognized that different interest groups such as manufacturers, distributors, brokers, software developers, researchers, etc., each had different data requirements, which should be taken into account in order to develop a more comprehensive exchange specification. A nutritional task force was formed in 1993 to study the additional information which was required to satisfy these diverse needs. I was selected to chair this task force.

By the time Version 2.0 of the IFDA Standard was released in 1994, it was apparent that the standard was becoming a widely-accepted vehicle for more than just the distributors and their customers. The IFDA standard was quickly becoming a vehicle for communication and updating of many of the nutritional databases used in the marketplace. But, version 2.0 lacked sufficient detail to provide insight into the quality control procedures associated with the data, or to allow independent validation of the data.

IFDA began working with the Nutrient Data Laboratory ("NDL") of the Agricultural Research Service ("ARS") in the Fall of 1994, to add validity and quality control information to the IFDA Product Data Exchange Format. Under the leadership of Dr. Wayne Wolf and Ms. Joanne Holden, three new record types were added to the IFDA standard in addition to the nutrition record. These three records contain the quality control information regarding the validation checks which have been performed on data prior to submission of data. These validation checks were developed by the Quality Assurance Team at the NDL, under the leadership of Karen Andrews, a nutritionist. This validation is voluntary, and ARS proposes to implement these standards over a 5-year period. It is hoped that the NDL's involvement with IFDA will result in an increased amount of "brand name" data being made available to the NDL, who produce Agricultural Handbook #8, and other nutrient data sets.

Let's spend a few minutes exploring the purpose for the data exchange format. Simply stated, the format is a standard for the *exchange* of data in ASCII format. In developing the data exchange format, we carefully studied the data exchange format which has been developed by INFOODS. The IFDA Product Data Exchange Format is a superset of the INFOODS standard, which is described in detail in John Klensin's book, "Identification of Food Components for INFOODS Data Interchange."

We all recognize that the format is a "work in progress". As such, it has been designed to accommodate growth and expansion in the future, as the requirements of the various market participants, federal regulators, nutrition researchers, and others, evolve and change. This current version will provide the user with an assurance of *upward compatibility* with future versions, so any investment in software which is made to bring systems into conformity with the current version will not be lost as a result of future "enhancements" to this standard.

Many have commented that the data exchange format does not seem a logical way to organize a database, or that a "relational database" would be a better way in which to present nutritional data. This format is merely a format for the *exchange* of data between systems, and is not meant to be a "normative guideline" for the best way of laying out a nutrition database. It is a structure in which all of the useful data pertinent to food items and their nutritional characteristics can be provided, in support of a variety of different applications.

The beneficiaries of the standard include: food and supply distributors, manufacturers, brokers, researchers, clinical dietitians, the Agricultural and Research Service (or USDA), the International Community, and software developers.

Some people have asked "why not just use the INFOODS data interchange standard?" This question was considered carefully by our committee before making our recommendations. There are three specific reasons why we chose to build on the INFOODS standard, rather than to take it "off the shelf".

1. The INFOODS standard only accommodates the food composition data, but the stakeholders in the IFDA Product Data Exchange Format require more product-specific information.
2. The INFOODS standard does not support the diversity of data representation formats which are needed in contemporary software. For example, some software programs utilize a "short name", while others use a longer, more verbose descriptive title for each product.
3. The INFOODS data interchange standard does not provide a structure that manufacturers and labs can easily understand.

Providing a relatively simple and easy to understand structure for the data is important if the standard is to gain widespread acceptance. There are many smaller food manufacturers and distributors who do not have the resources to deal with complex methods of data interchange, and who will need to rely on data editors provided by outside companies. These companies in turn will rely on the stability and robustness of the IFDA Product Data Exchange format, to maintain their competitive position and profitability. (It's an expensive business to keep re-writing software every 6 to 12 months.)

There were a variety of sources of feedback regarding the standard which resulted in the changes that have been incorporated in Version 3. One of the sources of information was the USDA Child Nutrition Program, at whose urging we included a number of important fields, including the following: Date of change or Product Introduction, Reason for Change (new, reformulated, updated), Product is produced specifically for Child Nutrition Program, and Child Nutrition Label Number.

You'll note that the attached table, which gives full details regarding the specification format, is organized by "field type". The field type is not a part of the specification, but is present to facilitate reading the fields in a more organized format.

In some instances, fields have been included in the standard which some would argue are redundant. For example, fields 225 and 230 are food energy, expressed in both Kcal and Kj. The reason for accommodating both of these items is that there are a large number of nutrient databases that use each of these two units of measure. Rather than requiring every user to design software to convert data from one unit to the other, it seemed more sensible to allow the transmission of energy in either unit of measure.

Most of the food composition attributes have an associated INFOODS Tag Name. The "Default Food Tag Name" which is specified in Attachment 1 allows the user to cross-reference the definition of each field description to the INFOODS descriptors, assuring that the proper item has been selected. If, for example, a user wished to provide information on the total protein value of a food, one would use field number 250 (protein, total). The IFDA standard specifies that the default food tag name for this food is "PROCNT," which is "Protein, total; calculated from total nitrogen (measured in grams)." The tag name can be omitted. If the protein values to be provided were calculated from amino nitrogen, for example, then the user would still use field number 250, but would specify an override food tag name of "Procan."

Illustration 2 is a copy of pages 43, 44 and 45 of John Klensin's "Identification of Food Components for INFOODS Data Interchange" (©The United Nations University, 1989) that provide detailed descriptions of several alternative means of communicating protein values. These examples also illustrate the method for utilizing secondary tag names to identify specific conversion factors used in determining the protein value.

By providing a default food tag name, and the ability to provide override food tags, we have given the data exchange format a level of generality that will allow it to fully accommodate all current and future food attributes which are accommodated via the INFOODS Data Exchange Standard.

In developing the IFDA Standard (Version 3), recommendations have been established for a "Recommended Data Set" as well as a "Minimum Data Set." The "Minimum Data Set" ("MDS") represents that set of food composition attributes that are required in order for the data to provide conformity with NLEA labeling legislation. The Recommended Data Set ("RDS") represents the set of data which is available from the US Department of Agriculture in its various nutrient datasets.

Because incomplete nutritional data can be misleading, it is recommended that when manufacturers, distributors, and others provide information on new food products, they provide at least all of the information outlined in the Minimum Data Set recommendation.

The current version of the data exchange format has been modified to include information that will allow end-users to create a date-sequenced or hierarchical database containing product information over time. By providing field 115 (Date of Change or Product Introduction), field 120 (Reason for Change), and by providing the ability to override these fields at the individual or food attribute level, the system provides an ability to download information over time, and for the end-user to construct a hierarchical or date-sequenced database containing nutritional information on products over time.

There is considerable interest in obtaining nutrition label data for research purposes, as well as for the purpose of comparing and contrasting brand name product nutrition claims. The Nutrition Labeling and Education Act (NLEA) provides specific standards for the creation and display of nutritional information. Among these standards are the precision to which data must be displayed.

Some practitioners have expressed concern in utilizing a data exchange structure to transmit and receive "rounded values". However, others (notably the manufacturers) are reluctant to provide unrounded information, since government regulations only require disclosure of rounded data. Accordingly, we provide field 145 (NLEA-adjusted values) as a yes/no field, so that the user can designate whether or not a record consists of rounded (adjusted) values. This allows the use of this format to collect both rounded information taken from nutritional labels, as well as more precise information such as might be expected from laboratories.

The data exchange format contains fields to accommodate both the American Diabetic Association's Diabetic Exchange Values for Foods and the Canadian Diabetes Association's Food Choice Values. Healthcare practitioners believe that the provision of these exchange values will make a nutrient data set even more valuable, since it is often the exchange values, not the nutrient values, which are used in patient education.

There are a number of fields which do not have associated default food tag names, and these have been brought to the attention of both USDA and IFDA personnel. It is the recommendation of the committee that IFDA tag names be established for all food composition attributes that might logically be exchanged between interested parties. It is expected that tag names will be established for these food attributes, and that these will be published in a future addendum to the current specification. The USDA is the designated authority on behalf of INFOODS to develop the tag names.

The data exchange format standard was developed with an eye toward future growth. Field number 215 provides the opportunity specify "Other Descriptor Information" which is not currently known or anticipated. The specifics of this descriptor information would be identified via a to-be-designated food tag name, which would appear on each field 215-type record. Field 215 provides "header information," while field number 998 provides a similar capability at the individual food component level. Other nutrient information with the associated food tag can be specified in a 998 record, eliminating the need for the standard to be modified each time a new nutrient or food composition value is identified as of interest to the foodservice community.

Descriptor and nutrient information provided in fields 225 through 999 may also contain additional optional information or positional subfields within each logical record. These subfields are separated by asterisks, the same way fields are separated in EDI-formatted records, and need only be specified when the information for a specific nutrient differs from the information specified in the record descriptor (i.e., fields 115, 120, 150, 155, 180, and 185). These sub-field values can override the corresponding field values specified in the header, on a field-by-field basis.

The optional subfields which can be overridden are as follows:

1. Food tag override, including tag names, key words, and other values
2. Date of information change
3. Reason for change, i.e., new product, reformulation, updated data.
4. Source Code, i.e., analytical, calculated, USDA
5. Basis (as purchases or as served/consumed)
6. Laboratory Code
7. IFDA data validation level
8. Number in sample
9. Standard deviation of sample

The IFDA data validation level is a two-digit numeric code that will eventually be tied into a hierarchical data quality scheme that will be developed jointly by IFDA and USDA, to provide quality assurance over data which is exchanged using the IFDA format.

There is a variety of other information available in the N-record, and I encourage those of you who are interested in learning more about the IFDA Product Data Exchange Format to contact IFDA's headquarters at 201 Park Washington Court, Falls Church, VA 22046, (703) 532-9400, to obtain a copy of the standard.

Our committee took the best of the capabilities of the INFOODS Data Interchange Standard, and incorporated them into what is now Version 3.0 of the IFDA Product Data Exchange Format. Illustration 1 includes an outline of Version 3.0 of this format, for your review. The IFDA Technical Standards Committee meets regularly, and we welcome any input you may have regarding changes that could be made to bring the standard into better conformity with your needs, or those of your customers.

<PROCNA> protein, total; calculated from amino nitrogen
Unit: g
Comments: Two pieces of data are associated with the tagname <PROCNA>. The first is the quantity of total protein and the second is the conversion factor used to calculate total protein from amino nitrogen.
Note: The total protein found in food tables is rarely calculated from amino nitrogen. <PROCNT> is the appropriate tagname for total protein in most cases.

<PROCNP> protein, total; calculated from protein nitrogen
Unit: g
Comments: Two pieces of data are associated with the tagname <PROCNP>. The first is the quantity of total protein and the second is the conversion factor used to calculate total protein from protein nitrogen.
Note: The total protein found in food tables is rarely calculated from protein nitrogen. <PROCNT> is the appropriate tagname for total protein in most cases.

<PROCNT> protein, total; calculated from total nitrogen
Unit: g
Comments: Three pieces of data are associated with the tagname <PROCNT>. The first is the quantity of total protein; the second is a keyword which identifies the source of the conversion factor used to calculate the total protein from total nitrogen; and the third is the actual conversion factor used. If possible, all three pieces of data should be included with <PROCNT>. However, it is acceptable to include only the keyword *or* the conversion factor (rather than both) with the total protein value if one or the other is unknown. If the conversion factor used was generated from a source other than one of those identified by the available keywords, the conversion factor should be listed without any keyword information.
Keywords: Following are the available keywords that can be used as the second value for the <PROCNT> tagname;
JONES conversion factor originally derived by Jones (7)
Tables: EGP, NE, EA
FAO conversion factor from a table in the FAO Nutritional Studies No 24 (4), reprinted in the World Health Organization Technical Report Series No. 522(3)
Tables: MW, DAN
USDA conversion factor from a table in the United States Department of Agriculture Handbook No. 8 (12)
Tables: USDA 203
STD standard conversion factor of 6.25, not specific for the type of food. (If this keyword is used, the 6.25 conversion factor should *not* be listed with the secondary tagname <XN>.)
Tables: SFK, IND, PRC

The following secondary tagname may be used to identify the specific conversion factor used when a keyword other than STD is present, or instead of a keyword (see above).

<XN> conversion factor for calculating total protein from total nitrogen

Examples: The 3.2 g/100 g of protein in cow's milk which is listed in the Nutritive Value of Indian Foods was calculated from total nitrogen using the 6.25 conversion factor. Therefore, the protein value would be listed using the <PROCNT> tagname and the STD keyword:

<PROCNT> 3.2 STD </PROCNT>

The 3.3 g/100 g of protein in cow's milk which is listed in McCance and Widdowson was calculated from total nitrogen using a 6.38 conversion factor. This factor was obtained from the FAO publication. Therefore, the protein value would be listed using the <PROCNT> tagname, FAO keyword, and the <XN> secondary tagname:

<PROCNT> 3.3 FAO <XN> 6.38 </PROCNT>

As a hypothetical example, if a value of 0.3 g/100 g of protein in watermelon seeds were calculated from total nitrogen using the conversion factor 5.30, and this value had not been taken from one of the tables identified by the list of keywords, the protein value would be listed using the <PROCNT> tagname in the following manner:

<PROCNT> 0.3 <XN> 5.30 </PROCNT>

Note: In these examples, </PROCNT> is an end-tag required in interchange format to indicate the end of the information about protein calculated from total nitrogen. See the *INFOODS Data Interchange Handbook* for details on interchange format.

<PRO-> protein, total; method of determination unknown

Unit: g

Comments: The <PRO-> tagname should be used for a total protein value when it is not known whether the value was the result of a direct analysis or whether it was calculated from total nitrogen, protein nitrogen, or amino nitrogen. The <PRO-> tagname should also be used if it is known that the total protein value was calculated from one of the nitrogen components, but the conversion factor used in the calculation is unknown. (It is meaningless to have <PRO-> in combination with either <PROCNA>, <PROCNP>, or <PROCNT> for a given food item.)

Field Type	Field Nmbr	Default Food Tag Name	Field Description	Field Size	IFDA RDS	MDS	Unit of Measure
Descriptor	100		Shipping UPC Code	A 14	Y	Y	
Descriptor	105		Unit UPC Code	A 12	Y	Y	
Descriptor	110		Manufacturer Product Number	A 14	Y	Y	
Descriptor	115		Date of Change or Product Introduction, as YYYYMMDD	N 8	Y		
Descriptor	120		Reason for Change (N=New, R=Reformulated,U=Updated)	A 1	Y		
Descriptor	125		Short Name	A 40	Y	Y	
Descriptor	130		Long Name	A 76			
Descriptor	135		Langual Name - variable length, comma-delimited field	A			
Descriptor	137		Product is produced specifically for Child Nutrition Program	A 1	Y		Y/N
Descriptor	140		Child Nutrition Label Number	N 6	Y		
Descriptor	145		NLEA Adjusted Values	A 1	Y	Y	Y/N
Descriptor	150		A=Analytical; U=USDA Data; C=Calculated=Default	A 1	Y	Y	
Descriptor	155		C=As Served/Consumed; P=As Purchased=Default	A 1	Y	Y	
Descriptor	165		USDA Nutrient Database Release Number	N 2.2	Y		
Descriptor	170		USDA Nutrient Database Code Number	N 10	Y		
Descriptor	175		IMP Specification	N 8			
Descriptor	180		Laboratory Code	N 8	Y		
Descriptor	185		IFDA Data Validation Level (0 through 99)	N 2	Y		
Descriptor	190		Weight Density (Specific Gravity - liquids only)	N 1.4	Y	Y	
Descriptor	195		Household Unit of Measure	A 8	Y		
Descriptor	200		Number of household measures in a serving	N 5.2	Y		
Descriptor	205		Weight of a serving in grams	N 5.2	Y		gm
Descriptor	210		Refuse Percentage	N 7.3			%
Descriptor	215		Other descriptor information				depends
Energy	225	ENERC/UNIT	Energy (in Kcal)	N 7.3	Y	Y	Kcal
Energy	230	ENERC	Energy (in kJ)	N 7.3			Kj
Energy	235	ENERPF	Calories from fat	N 7.3	Y	Y	%
Proximate	240	WATER	Water (Moisture)	N 7.3	Y	Y	gm
Proximate	245	CHOCDF	Carbohydrate,total	N 7.3	Y	Y	gm
Proximate	250	PROCNT	Protein,total	N 7.3	Y	Y	gm
Proximate	255	FAT	Fat,total (total lipid)	N 7.3	Y	Y	gm
Proximate	260	ASH	Ash	N 7.3	Y	Y	gm
Carbohydrate	270		Complex Carbohydrate	N 7.3	Y	Y	gm
Carbohydrate	275	FIBTG	Fiber,total dietary (TDF)	N 7.3	Y	Y	gm
Carbohydrate	280	FIBINS	Fiber,water-insoluble	N 7.3			gm
Carbohydrate	285	FIBSOL	Fiber,water-soluble	N 7.3			gm
Carbohydrate	290	FRUS	Fructose	N 7.3			gm
Carbohydrate	295	GALS	Galactose	N 7.3			gm
Carbohydrate	300	GLUS	Glucose	N 7.3			mg
Carbohydrate	305	MALS	Maltose	N 7.3			gm
Carbohydrate	310	MANTL	Mannitol	N 7.3			mg
Carbohydrate	315	PECT	Pectin	N 7.3			gm
Carbohydrate	320	SORTL	Sorbitol	N 7.3			mg
Carbohydrate	325	STARCH	Starch,total	N 7.3			gm
Carbohydrate	330	SUCS	Sucrose	N 7.3			gm
Carbohydrate	335	SUGAR	Sugars,total	N 7.3	Y	Y	gm
Carbohydrate	335	XYLTL	Xylitol	N 7.3	Y		mg

Field Type	Field Nmbr	Default Food Tag Name	Field Description	Field Size	IFDA RDS	MDS	Unit of Measure
Lipid	350	SITSTR	Beta-sitosterol	N 7.3			gm
Lipid	355	CHOLC	Cholesterol	N 7.3	Y	Y	mg
Lipid	360	CAMD5	Delta 5-campesterol	N 7.3			gm
Lipid	365	STID7	Delta 7-stigmasterol	N 7.3			mg
Lipid	370		Fat Replacements	A 1			Y/N
Lipid	375	PHYSTR	Phytosterol,total	N 7.3	Y		mg
Amino Acid	385	ALA	Alanine	N 7.3			mg
Amino Acid	387	ARG	Arginine	N 7.3			mg
Amino Acid	389	ASP	Aspartic Acid	N 7.3			mg
Amino Acid	391	CYS	Cystine	N 7.3			mg
Amino Acid	393	GLU	Glutamic Acid (Glutamate)	N 7.3			mg
Amino Acid	395	GLY	Glycine	N 7.3			mg
Amino Acid	397	HIS	Histidine	N 7.3			mg
Amino Acid	399	ILE	Isoleucine	N 7.3			mg
Amino Acid	401	LEU	Leucine	N 7.3			mg
Amino Acid	403	LYS	Lysine	N 7.3			mg
Amino Acid	405	MET	Methionine	N 7.3			mg
Amino Acid	407	PHE	Phenylalanine	N 7.3	Y	Y	mg
Amino Acid	409	PRO	Proline	N 7.3			mg
Amino Acid	411	SER	Serine	N 7.3			mg
Amino Acid	413	THR	Threonine	N 7.3			mg
Amino Acid	415	TRP	Tryptophan	N 7.3			mg
Amino Acid	417	TYR	Tyrosine	N 7.3			mg
Amino Acid	419	VAL	Valine	N 7.3			mcg
Saturated Fatty Acid	480	FASAT	Fatty acids,total saturated	N 7.3	Y	Y	gm
Saturated Fatty Acid	485	F4D0	4:0 (Butyric or butanoic acid)	N 7.3	Y		gm
Saturated Fatty Acid	490	F6D0	6:0 (Caprioc or hexanoic acid)	N 7.3	Y		gm
Saturated Fatty Acid	495	F8D0	8:0(Caprylic or octanoic acid)	N 7.3	Y		gm
Saturated Fatty Acid	500	F10D0	10:0(Capric or Decanoic acid)	N 7.3	Y		gm
Saturated Fatty Acid	505	F12D0	12:0(Lauric or dodecanoic acid)	N 7.3	Y		gm
Saturated Fatty Acid	510	F14D0	14:0(Myristic or tetradecanoic acid)	N 7.3	Y		gm
Saturated Fatty Acid	515	F15D0	15:0(Pentadecylic acid)	N 7.3	Y		gm
Saturated Fatty Acid	520	F16D0	16:0(Palmitic acid)	N 7.3	Y		gm
Saturated Fatty Acid	525	F17D0	17:0(Margaric acid)	N 7.3	Y		gm
Saturated Fatty Acid	530	F18D0	18:0(Stearic acid)	N 7.3	Y		gm
Saturated Fatty Acid	535	F20D0	20:0(Arachidic acid)	N 7.3	Y		gm
Saturated Fatty Acid	540	F22D0	22:0(Behenic acid)	N 7.3	Y		gm
Saturated Fatty Acid	545	F24D0	24:0(Lignoceric acid)	N 7.3	Y		gm
Monounsaturated Fatty Acid	555	FAMS	Fatty acids,total monounsaturated	N 7.3	Y		gm
Monounsaturated Fatty Acid	560	F14D1	14:1(Myristoleic acid)	N 7.3	Y		gm
Monounsaturated Fatty Acid	565	F16D1	16:1(Palmitoleic acid)	N 7.3	Y		gm
Monounsaturated Fatty Acid	570	F18D1TN9	18:1t (Elaidic acid)	N 7.3	Y		gm
Monounsaturated Fatty Acid	575	F18D1	18:1(Oleic acid)	N 7.3	Y		gm
Monounsaturated Fatty Acid	580	F20D1	20:1(Gadoleic acid)	N 7.3	Y		gm
Monounsaturated Fatty Acid	585	F22D1	22:1(Erucic acid)	N 7.3	Y		gm

Field Type	Field Nmbr	Default Food Tag Name	Field Description	Field Size	IFDA RDS	MDS	Unit of Measure
Polyunsaturated Fatty Acid	595	FAPU	Fatty acids,total polyunsaturated	N 7.3	Y	Y	gm
Polyunsaturated Fatty Acid	600	F18D2CN6	18:2cc n-6 Linoleic Acid	N 7.3	Y		gm
Polyunsaturated Fatty Acid	605		18:2cc not n-6 (Gamma-linoleic Acid)	N 7.3	Y		gm
Polyunsaturated Fatty Acid	610		18:2tc	N 7.3	Y		gm
Polyunsaturated Fatty Acid	615		18:2tt	N 7.3	Y		gm
Polyunsaturated Fatty Acid	620	F18D3N6	18:3 not n-3 (Gamma-linolenic acid)	N 7.3	Y		gm
Polyunsaturated Fatty Acid	625	F18D3N3	18:3n-3(Alpha-linolenic acid)	N 7.3	Y		gm
Polyunsaturated Fatty Acid	630	F18D4	18:4(Parinaric acid)	N 7.3	Y		gm
Polyunsaturated Fatty Acid	635	F20D4	20:4(Arachidonic acid)	N 7.3	Y		gm
Polyunsaturated Fatty Acid	640	F20D5	20:5(Eicosapentaenoic acid)	N 7.3	Y		gm
Polyunsaturated Fatty Acid	645	F22D5	22:5(Docosapentaenoic acid)	N 7.3	Y		gm
Polyunsaturated Fatty Acid	650	F22D6	22:6(Docosahexaenoic acid)	N 7.3			gm
Mineral	660	CA	Calcium	N 7.3	Y	Y	mg
Mineral	665	CLD	Chloride (Chlorine)	N 7.3			mg
Mineral	670	CR	Chromium	N 7.3			mcg
Mineral	675	CU	Copper	N 7.3	Y		mg
Mineral	680	FD	Fluoride (Fluorine)	N 7.3			mcg
Mineral	685	ID	Iodide (Iodine)	N 7.3	Y		mcg
Mineral	690	FE	Iron,total	N 7.3	Y	Y	mg
Mineral	695	MG	Magnesium	N 7.3	Y		mg
Mineral	700	MN	Manganese	N 7.3	Y		mg
Mineral	705	MO	Molybdenum	N 7.3			mcg
Mineral	710	P	Phosphorus	N 7.3	Y		mg
Mineral	715	K	Potassium	N 7.3	Y		mg
Mineral	720	SE	Selenium,total	N 7.3			mcg
Mineral	725	NA	Sodium	N 7.3	Y	Y	mg
Mineral	730	ZN	Zinc	N 7.3	Y		mg
Vitamin	740	BIOT	Biotin (Vitamin H)	N 7.3			mcg
Vitamin	745	FOL	Folate (Folacin or folic acid)	N 7.3	Y		mcg
Vitamin	750	NIA	Niacin,preformed	N 7.3	Y		mg
Vitamin	755	PANTAC	Pantothenic Acid (Vitamin B-5)	N 7.3	Y		mg
Vitamin	760	RIBF	Riboflavin (Vitamin B-2)	N 7.3	Y		mg
Vitamin	765	THIA	Thiamin (Vitamin B-1)	N 7.3	Y		mg
Vitamin	770	VITAA	Vitamin A (determined by bioassay)	N 7.3	Y	Y	IU
Vitamin	775	VITA	Vitamin A (Calculated by summation)	N 7.3			mcg
Vitamin	780	RETOL	Retinol (Vitamin A Preformed)	N 7.3	Y		mcg
Vitamin	785	CARTA	Alpha-carotene	N 7.3			mcg
Vitamin	790	CARTB	Beta-carotene	N 7.3	Y		mcg
Vitamin	795	CRYPX	Cryptoxanthin	N 7.3			mcg
Vitamin	800		Lutein	N 7.3			mcg
Vitamin	805		Lycopene	N 7.3			mcg
Vitamin	810	VITB12	Vitamin B-12 (Cobalamin)	N 7.3	Y		mcg
Vitamin	815	VITB6A	Vitamin B-6	N 7.3	Y		mg
Vitamin	820	VITC	Vitamin C - Total (Ascorbic acid)	N 7.3	Y	Y	mg
Vitamin	825		Vitamin C - Reduced	N 7.3	Y		mg
Vitamin	830	ASCDL	L-dehydroascorbic Acid	N 7.3			mg
Vitamin	835	VITD	Vitamin D (Calciferol)	N 7.3	Y		mcg
Vitamin	840	VITE	Vitamin E (Alpha-tocopherol equivalents)	N 7.3	Y		mg
Vitamin	845	TOCPHA	Alpha Tocopherol	N 7.3			mg
Vitamin	850	TOCPHB	Beta-Tocopherol	N 7.3			mg
Vitamin	855	TOCPHG	Gamma-Tocopherol	N 7.3			mg
Vitamin	855		Tocotrienol	N 7.3			mg
Vitamin	860	VITK	Vitamin K	N 7.3	Y		mcg

Field Type	Field Nmbr	Default Food Tag Name	Field Description	Field Size	IFDA RDS	MDS	Unit of Measure
Food Additives or Allergens	865		Aspartame	A 1	Y	Y	Y/N
Food Additives or Allergens	870	CAFFN	Caffeine	N 7.3	Y	Y	mg
Food Additives or Allergens	875	CASN	Casein	N 7.3			mg
Food Additives or Allergens	880		Egg	A 1	Y		Y/N
Food Additives or Allergens	883		Enriched or Fortified	A 1	Y		Y/N
Food Additives or Allergens	885		Erythrosine	A 1	Y		Y/N
Food Additives or Allergens	890	GLUTN	Gluten	N 7.3	Y		mg
Food Additives or Allergens	895		Hydrolized Vegetable Protein (HVP)	A 1	Y	Y	Y/N
Food Additives or Allergens	900	LACS	Lactose	N 7.3	Y		gm
Food Additives or Allergens	905		MSG	A 1	Y	Y	Y/N
Food Additives or Allergens	910	NITRA	Nitrates	N 7.3	Y		mg
Food Additives or Allergens	915		Saccharin	A 1	Y	Y	Y/N
Food Additives or Allergens	920		Sulfites	A 1	Y		Y/N
Food Additives or Allergens	925		Tartrazine	A 1	Y		Y/N
Food Additives or Allergens	930	THEBRN	Theobromine	N 7.3	Y		mg
Food Additives or Allergens	935		Theophylline	A 1	Y		Y/N
Food Additives or Allergens	940		Tyramine	N 7.3			mcg
Food Additives or Allergens	945		Vegetable Protein	N 7.3			gm
Diabetic Exchange - ADA (1995)	950		Carbohydrate Group - Starch	N 7.3	Y		Exch
Diabetic Exchange - ADA (1995)	952		Carbohydrate Group - Fruit	N 7.3	Y		Exch
Diabetic Exchange - ADA (1995)	954		Carbohydrate Group - Milk, Skim	N 7.3	Y		Exch
Diabetic Exchange - ADA (1995)	956		Carbohydrate Group - Milk, Low-fat	N 7.3	Y		Exch
Diabetic Exchange - ADA (1995)	958		Carbohydrate Group - Milk, Whole	N 7.3	Y		Exch
Diabetic Exchange - ADA (1995)	960		Carbohydrate Group - Other Carbohydrates	N 7.3	Y		Exch
Diabetic Exchange - ADA (1995)	962		Carbohydrate Group - Vegetables	N 7.3	Y		Exch
Diabetic Exchange - ADA (1995)	964		Meat and Meat Substitute Group - Very Lean	N 7.3	Y		Exch
Diabetic Exchange - ADA (1995)	965		Meat and Meat Substitute Group - Lean	N 7.3	Y		Exch
Diabetic Exchange - ADA (1995)	966		Meat and Meat Substitute Group - Medium-fat	N 7.3	Y		Exch
Diabetic Exchange - ADA (1995)	967		Meat and Meat Substitute Group - High-fat	N 7.3	Y		Exch
Diabetic Exchange - ADA (1995)	968		Fat Group	N 7.3	Y		Exch
Food Choice Values - CDA	970		Fat and Oil Choice - CDA	N 7.3	Y		Choice
Food Choice Values - CDA	972		Fruits and Vegetables Choice - CDA	N 7.3	Y		Choice
Food Choice Values - CDA	974		Protein Choice (Lean) - CDA	N 7.3	Y		Choice
Food Choice Values - CDA	976		Milk Choice (2%) - CDA	N 7.3	Y		Choice
Food Choice Values - CDA	978		Milk Choice (1%) - CDA	N 7.3	Y		Choice
Food Choice Values - CDA	980		Milk Choice (Skim) - CDA	N 7.3	Y		Choice
Food Choice Values - CDA	982		Milk Choice (Whole) - CDA	N 7.3	Y		Choice
Food Choice Values - CDA	984		Sugar Choice - CDA	N 7.3	Y		Choice
Food Choice Values - CDA	986		Starch Choice - CDA	N 7.3	Y		Choice
Food Choice Values - CDA	988		Extras Choice - CDA	N 7.3	Y		Choice
Miscellaneous	990	ALC	Alcohol (Ethanol)	N 7.3	Y	Y	gm
Miscellaneous	992	NT	Total Nitrogen	N 7.3	Y		gm
Miscellaneous	994		Vegetable Protein Product	A 1	Y		Y/N
Miscellaneous	998	(Required)	Other Nutrient Information, with associated food tag				depends

The International Food Data Exchange

by Joanne M. Holden and Ellen Hurley, Nutrient Data Laboratory, ARS, USDA, Riverdale, MD

The increased consumption of brand name and commercially prepared foods obtained from grocery stores, restaurants, and institutions has created a demand for food composition data for these products. As a result of the NLEA legislation, more food manufacturers are providing values for the components important to public health. These data provide a unique source of information to data users. A clearinghouse for the exchange of data can provide standardized access to food composition data for various applications. This development requires a standard data exchange format with well defined terms and protocols. Since data could be food label data, calculated data, or unrounded unadjusted analytical values, developers and users must agree about the nature of data to be provided. During 1994 the International Foodservice Distributors Association (IFDA) and the USDA initiated discussions to develop a concept for a food product data clearinghouse. The concept would use the newly revised IFDA Standard Data Exchange Format for the submission and retrieval of food data. It could be defined as a virtual clearinghouse with accessible "reservoirs" of data resident in remote sites managed by food manufacturers or commercial database enterprises. The development of the clearinghouse would evolve over a period of 4-5 years and include an assessment of the quality of the data. It is proposed that the first version of the clearinghouse would contain a minimum data set of the NLEA nutrients, ash, and water with quality data checks. Eventually the clearinghouse would provide calculated data as well as analytical data verified by data quality indicators. Cooperation and dialogue between the food industry, government agents, and other private sector groups is needed to achieve this goal.

International Interface Standard For Food Databases

by Judith S. Douglass, M.S., R.D., Sing-Bin Chew, M.S., Ki Lee, Judith L. Kidwell, Barbara J. Petersen, Ph.D., TAS, Inc.
and by Jean A.T. Pennington, Ph.D., R.D., Byron Bohannon, Ph.D., Thomas Hendricks (retired), U.S. Food and Drug Administration, Center for Food Safety and Applied Nutrition

Introduction

An abundance of data is available on food consumption, composition, safety, preparation practices, processing, and other food-related topics. However, these data have in many cases been difficult to use, and comparisons of data between datasets have been nearly impossible. Barriers to effective use of food-related data have included differences in food naming conventions, cultural differences in food production and use; technical differences, such as those mandated by legislation regarding food identity; and data formatting differences.

Technical Assessment Systems, Inc., under U.S. Food and Drug Administration Contract No. 223-92-5510, has developed an International Interface Standard for Food Databases and a computerized system based on the Standard to help overcome barriers to use of food-related data. The Interface Standard uses LanguaL, a versatile and adaptable food indexing language, as the primary basis for describing foods. A relational database model incorporates additional descriptive elements.

The schema for the Interface Standard appears in Figure 1. The schema was described in detail in the Quarterly Technical Progress Report for the Quarter Ending June 28, 1993 (1), and a paper describing the schema has been accepted for publication (2).

Since June, 1993, TAS has focused on development of the computer software system based on the Interface Standard. The system presently allows queries based on five of the ten major schema categories of descriptive information:

- Food/Food Product Identification
- Food Names
- LanguaL Factors
- Ingredients/Recipes
- Data Sources

TAS has also developed a series of program utilities for maintaining and updating system food data.

System Requirements

The Interface system is a run-time Windows-based application. It is written in FoxPro for Windows (version 2.6), but there is no need for the user to have FoxPro software.

For installation of the system software, the target computer should have 8 megabytes of RAM. The computer should have at least 20 megabytes of free hard disk space for the main program with data files, and at least 10 additional megabytes of free hard disk space for the utilities. The system will run on systems with 386 processors, but is much faster on 486 systems.

System Features

Main System

The Interface system stores food descriptions and data, and allows users to search for items of interest based on specific criteria. LanguaL, a versatile and adaptable food indexing language, serves as the primary basis for describing foods. Detailed information about LanguaL is available in the LanguaL Users' Manual (3).

System searches culminate in formation of sets of foods meeting user-specified criteria. Users can obtain reports on all foods in a set or on individual foods in a set. Reports can be created to show food/food product identification, LanguaL descriptors, recipes, food data, and/or source information.

Reports may be printed to the screen, an attached printer, text (*.TXT) files, or database (*.DBF) files. Most *.DBF files can be read by standard database packages other than FoxPro, but those containing memo fields cannot be read by database packages other than FoxPro.

Food data files included in the system are as follows:

- Carotenoid data from literature reviewed by USDA, Nutrient Composition Laboratory (CAROTNOX2.DBF)
- Carotenoid database developed by the USDA, Nutrient Composition Laboratory in cooperation with the U.S. National Cancer Institute (CAROTENE.DBF)
- Food and Drug Administration Total Diet Study Nutrient Data, 1982-91 (TOTDIET2.DBF)
- Food and Drug Administration Total Diet Study Data on Pesticides, Industrial Chemicals, and Heavy Metals, 1982-91 (TDSTOX.DBF)

It should be noted that food data included in the system are maintained in the original formats. These data are retrievable, but not searchable.

Utilities

Interface utilities, a group of password-protected programs, allow users to add food descriptions and food data to the System. This information can be added record by record at the keyboard, or by appending files containing relevant information.

Utilities for editing and printing the LanguaL tree are included. A utility for "autofactoring" foods with LanguaL codes is also included. This program allows users to search for foods with similar names to a new food and to apply LanguaL factors for these foods to the new food. Individual LanguaL factors may be added, edited, or deleted from food descriptions.

Future Development

The current system allows queries based on five of the ten major schema categories of descriptive information. Future development (currently unfunded) will focus on data storage and query programs for the remaining five schema categories. Adaptation of the system to CD-ROM technology, particularly for storage of graphic food images, is a possibility.

Sample Queries and Reports

Five sample queries and information about creating reports appear in the International Interface Standard For Food Databases Computer System Query and Report Guide.

References

Douglass, J.S., J.L. Kidwell, S.B. Chew, and B. Petersen. *Quarterly Technical Progress Report*. Quarter Ending June 30, 1993. FDA Contract #223-92-5510. Report submitted to FDA, June 1993.

Pennington, J.A.T., T.C. Hendricks, J.S. Douglass, B. Petersen, and J. Kidwell. *International Interface Standard for Food Databases*. Journal of Food Additives and Contaminants (in press).

McCann, A., D. Soergel, J. Holden, J. Pennington, E. Smith, and R. Wiley. *LanguaL Vocabulary Users' Manual*. U.S. Food and Drug Administration, Center for Food Safety and Applied Nutrition. Revised and updated March, 1992.

FIGURE 1. INTERNATIONAL INTERFACE STANDARD FOR FOOD DATABASES

I. FOOD/FOOD PRODUCT IDENTIFICATION

- Interface Food Number
- Source/Food Number

II. FOOD NAMES

Multiple Names in Various Languages

III. LanguaL FACTORS

1. Product Type
2. Food Source (plant or animal)
3. Part of Plant or Animal
4. Physical State, Shape or Form
5. Extent of Heat Treatment
6. Cooking Method
7. Treatment Applied
8. Preservation Method
9. Packing Medium
10. Container or Wrapping
11. Food Contact Surface
12. Consumer Group/Dietary Use
13. Geographic Places and Regions
    a. Area of origin (grown/produced)
    b. Area of processing
    c. Area of consumption
14. Cuisine
15. Adjunct Characteristics of Food (e.g., Color, Grade, Maturity/Ripeness, Location of Preparation, Specific Uses of Food)

IV. OTHER FOOD DESCRIPTORS

Agricultural Production Conditions
- Growing Period and General Conditions
  - Growing period
  - Length of growing period
  - Environment
  - Types of controls
  - Climate
  - Precipitation
  - Watering scheme
  - Humidity
  - Temperature
  - Soil and/or water type
  - Atmosphere
  - Animal diet
- Substances Administered or Applied During Productic
  - Substance
  - How administered or applied
  - Amount administered or applied per occasion
  - Fredquency of administration or application
  - Preharvest or preslaughter interval

Storage Conditions
- Storage Period and General Conditions
  - Location of storage
  - Container or medium
  - Storage period
  - Length of storage
  - Types of controls
  - Humidity
  - Temperature
  - Atmosphere
- Substances Administered or Applied During Storage
  - Substance
  - How administered or applied
  - Amount administered or applied
  - Frequency of administration or application
  - Postharvest or postslaughter interval

Weight: Volume Relationship
- Weight in grams
- Weight in unit other than grams
- Volume or number of units

Manufacturer/Institution/Restaurant/Laboratory/Home
- Organization
- Package weight
- Serving sizes

Additional Notes

V. OTHER DESCRIPTIVE CODING SYSTEMS

Codes/Descriptors Used in Other Systems (e.g., EUROCODE 2, USDA FGS)

VI. INGREDIENTS/RECIPES

May Include Quantities and/or Recipe Instructions

VII. STANDARDS

(e.g., CODEX, CFR)

FROM OUTSIDE SOURCES

FOOD DATA

Food Composition Data
- Date and location of collection
- Sampling scheme
- Number of samples
- Analytical methods
- Nutrient values (mean ± SD, median, range)

Food Consumption Data
- Population surveyed
- Number of people
- Number of days of diet records
- Methods of assessing consumption
- Demographic variables (age, sex, region, race, income, urbanization, season, disease status, smoking status, pregnancy, lactation, activity level)
- Food composition database used to assess intakes
- Daily intakes of individual foods

Food Production, Availability and Utilization

REFERENCE FILES

VIII. SUBSTANCES

As used in IV. above

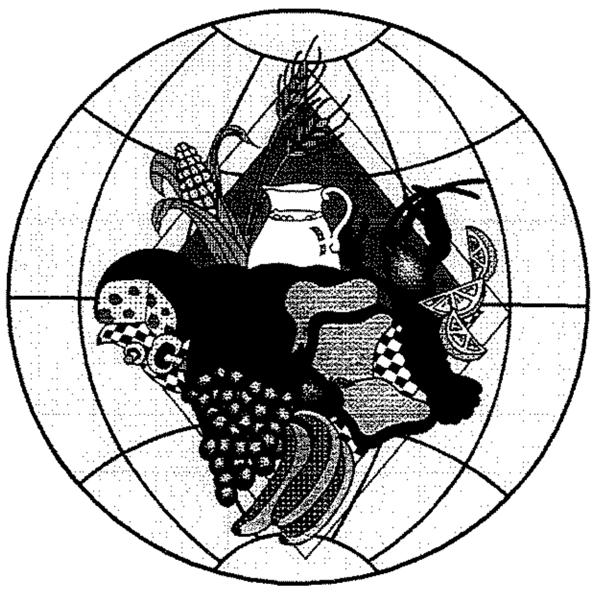
IX. ORGANIZATIONS

As used in IV. above

X. DATA SOURCES

Literature Citations
Databases (hardcopy/computerized)
Food Labels
Laboratory Data

International Interface Standard for Food Databases
Computer System Query and Report Guide



Prepared for:
U.S. Food and Drug Administration,
Center for Food Safety and Applied Nutrition
under Contract # 223-92-5510

Prepared by:
TAS, Inc.

March, 1995

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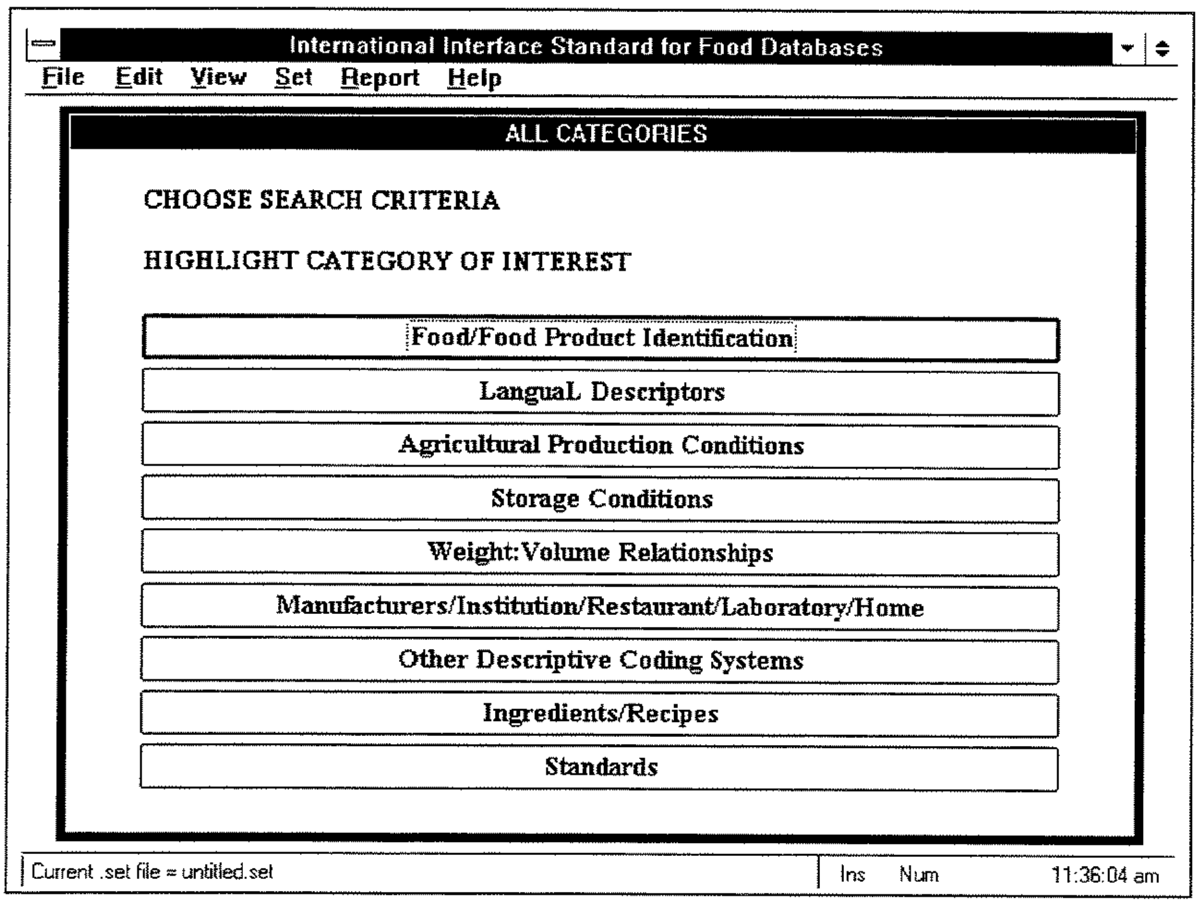
SAMPLE QUERIES

Sample Source Query

What foods were analyzed for nutrient content in the U.S. Food and Drug Administration's Total Diet Study between 1982 and 1991?

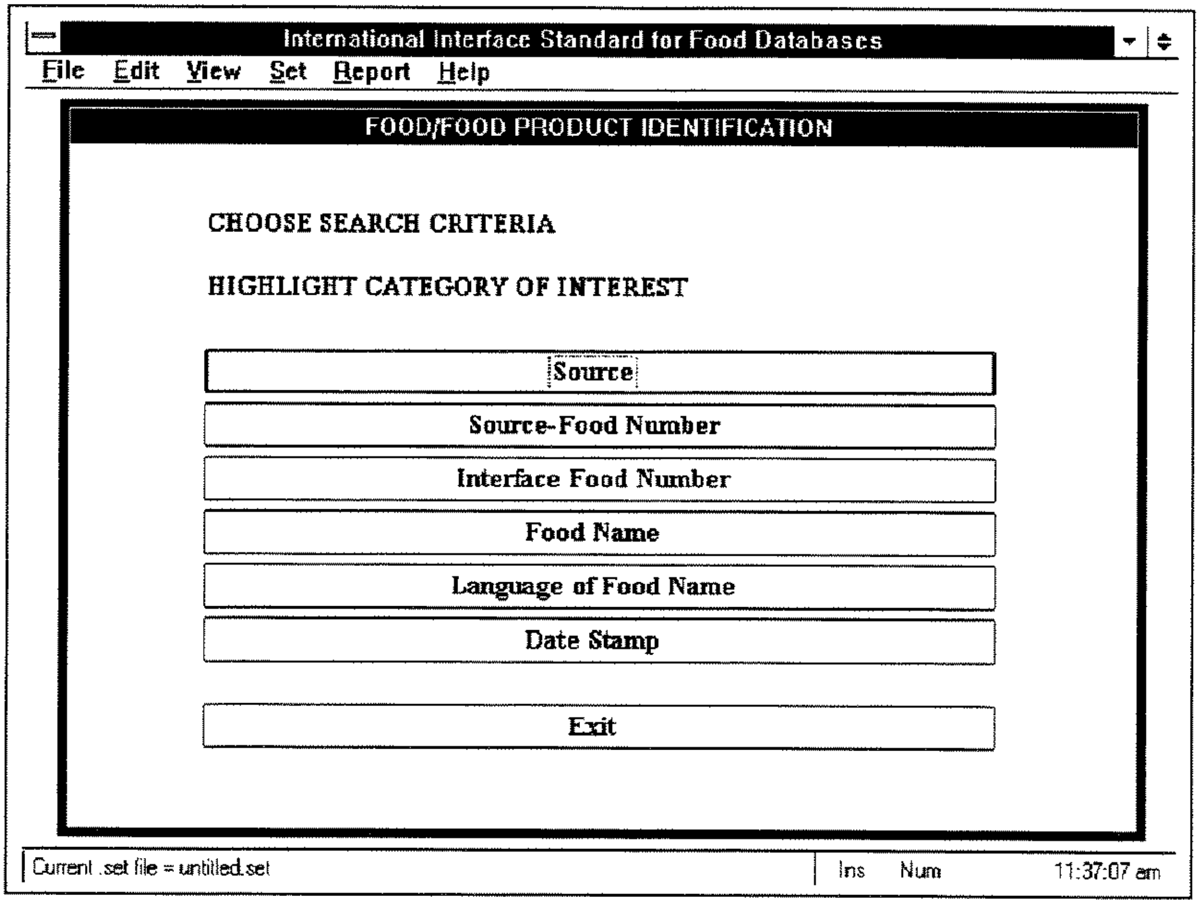
Interface System Main Menu



First step:

- Click on **Food/Food Product Identification.**

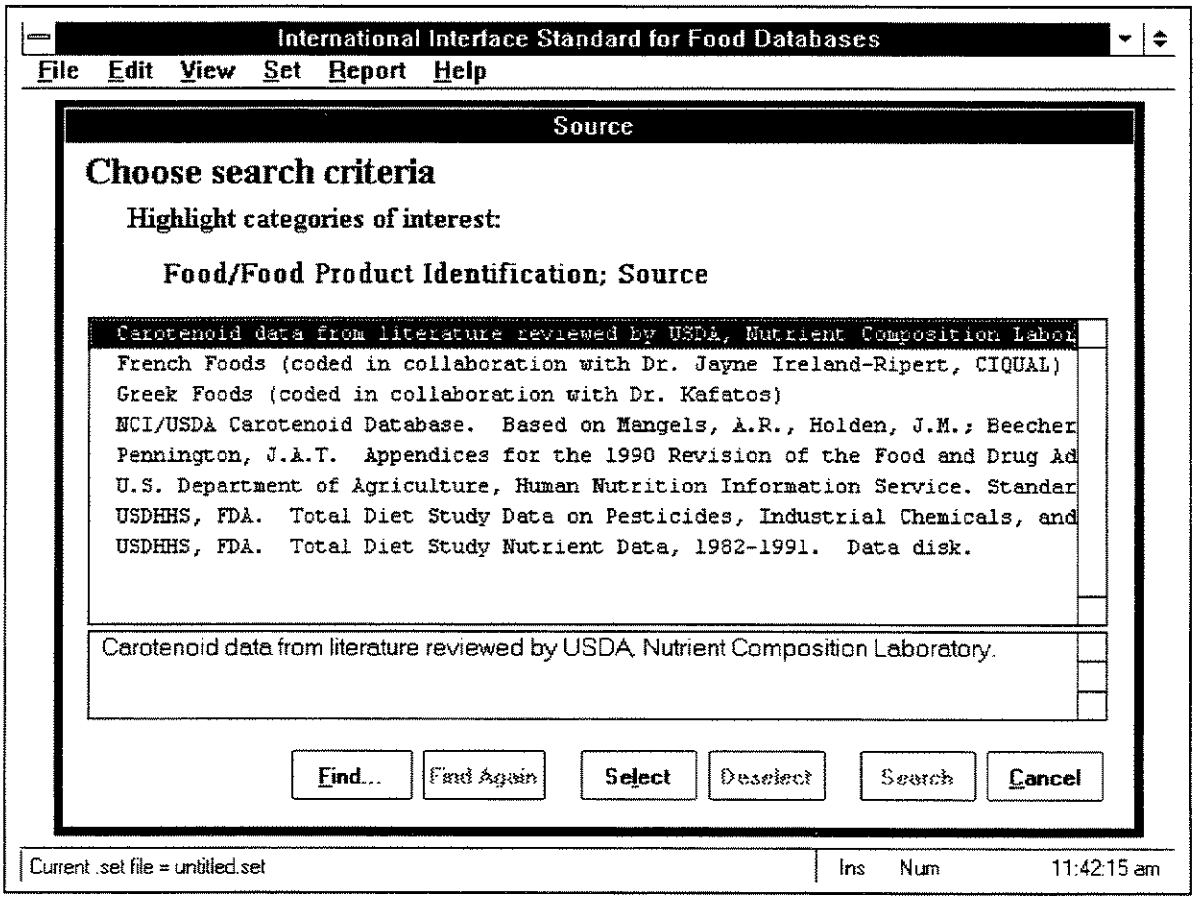
The Food/Food Product Identification Menu appears:



Next step:

- Click on **Source.**

A screen showing available data sources appears:



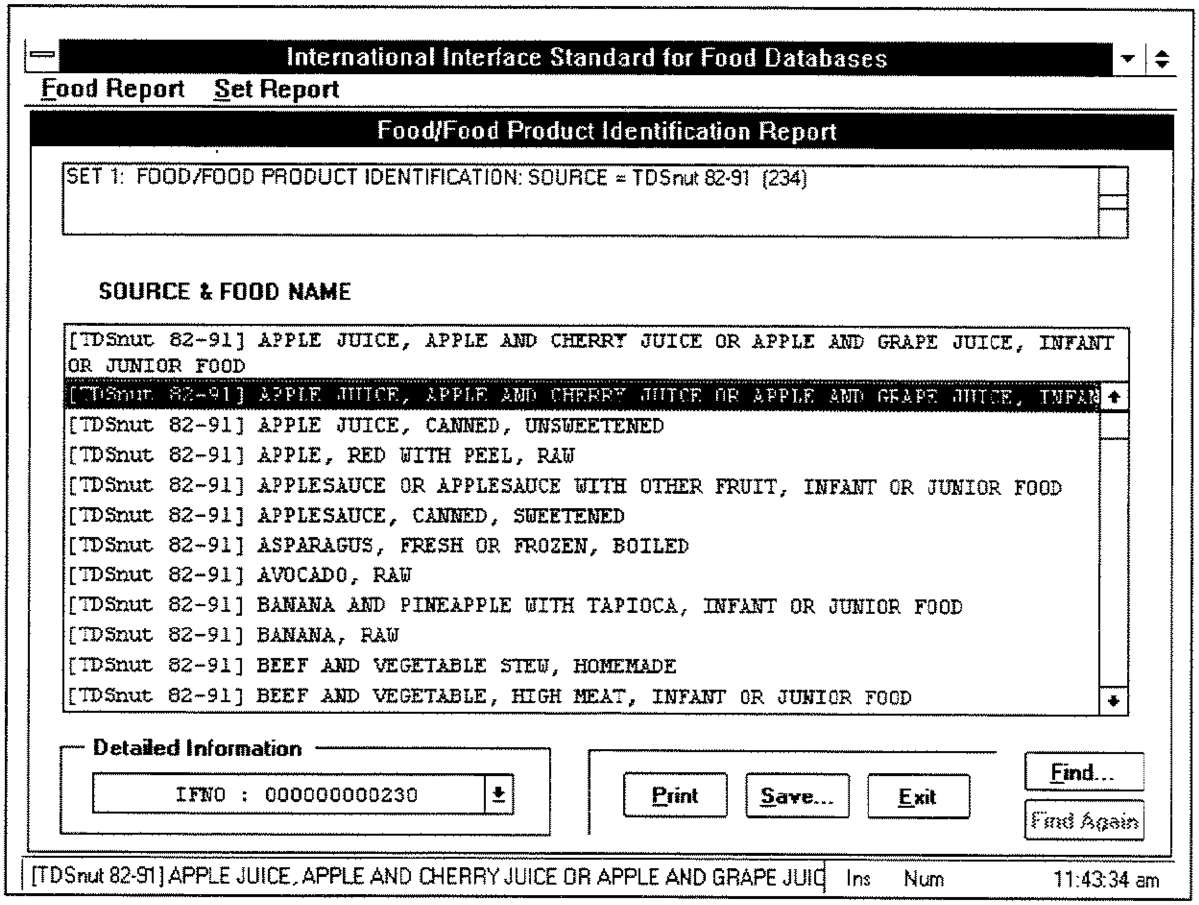
Final steps:

- Find and highlight *USDHHS, FDA. Total Diet Study Nutrient Data, 1982-91. Data disk.*

- Press the **Select** button. A dot will appear to the left of the selected source.

- Press the **Search** button to generate the set of foods included in the selected source.

The Food/Food Product Identification Report, shown below, is produced automatically to show search results.



Additional reports may be created to show food:

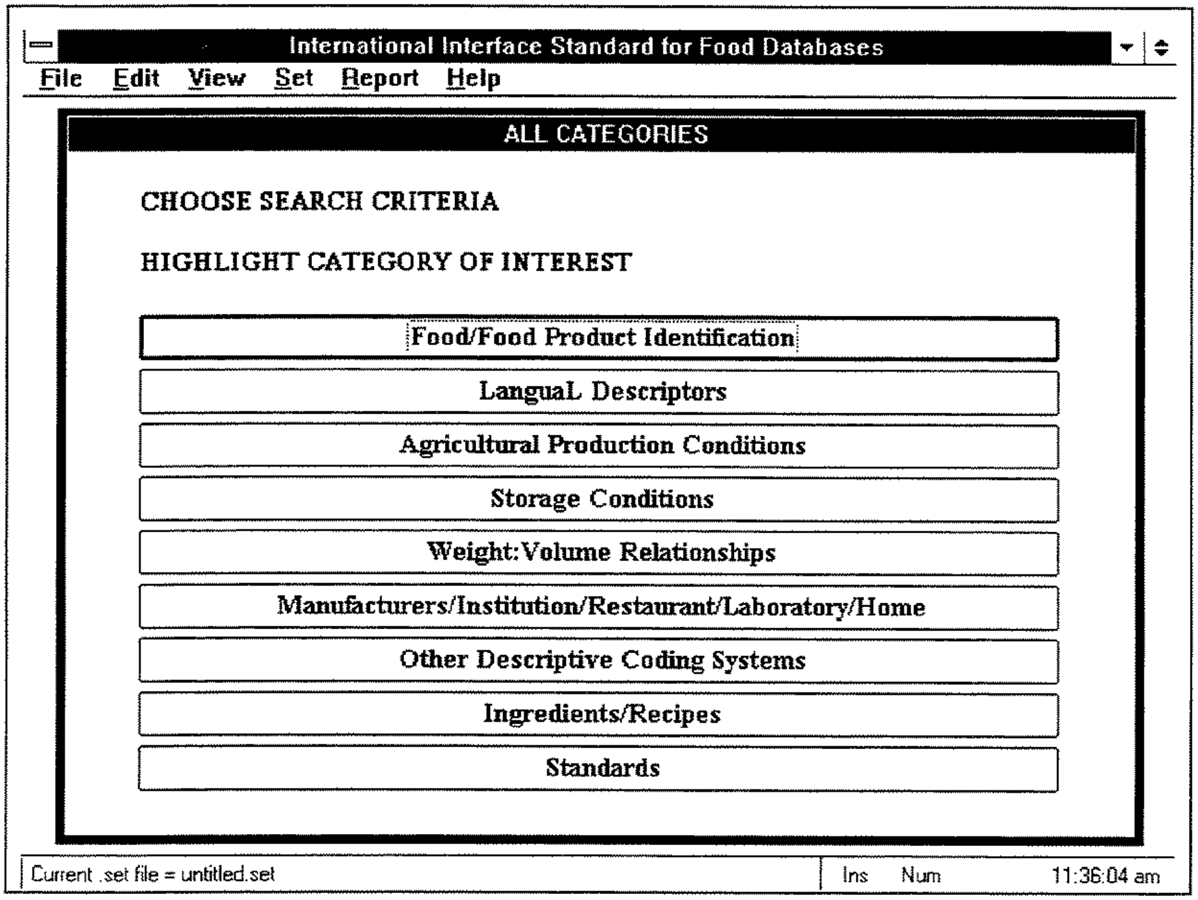
* LanguaL Descriptors
* Recipes
* Data
* Source Information

Instructions for creating these reports appear in the Report section of this Guide.

Sample Food Name Query

Does the Interface System have any data on lasagna? If so, what are the sources of the data?

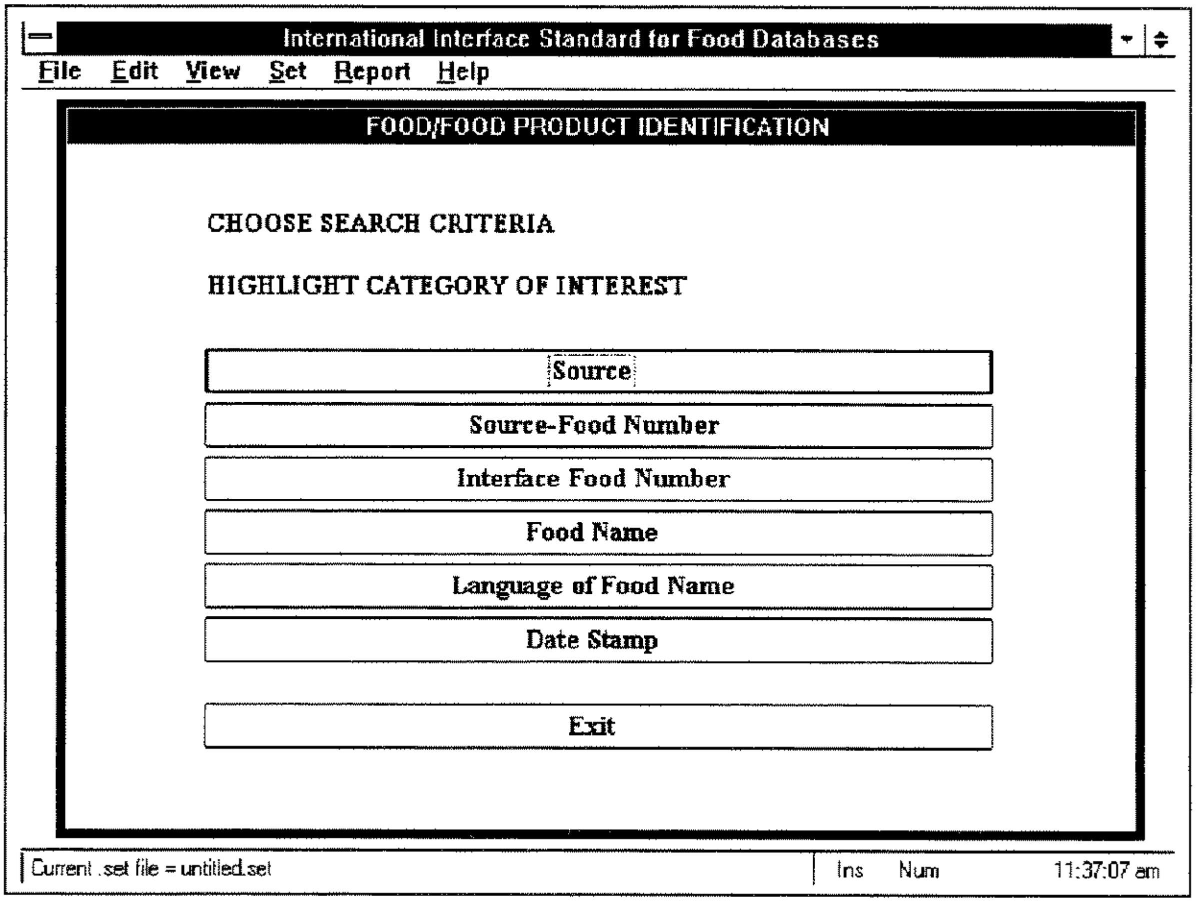
Interface System Main Menu



First step:

- Click on **Food/Food Product Identification**.

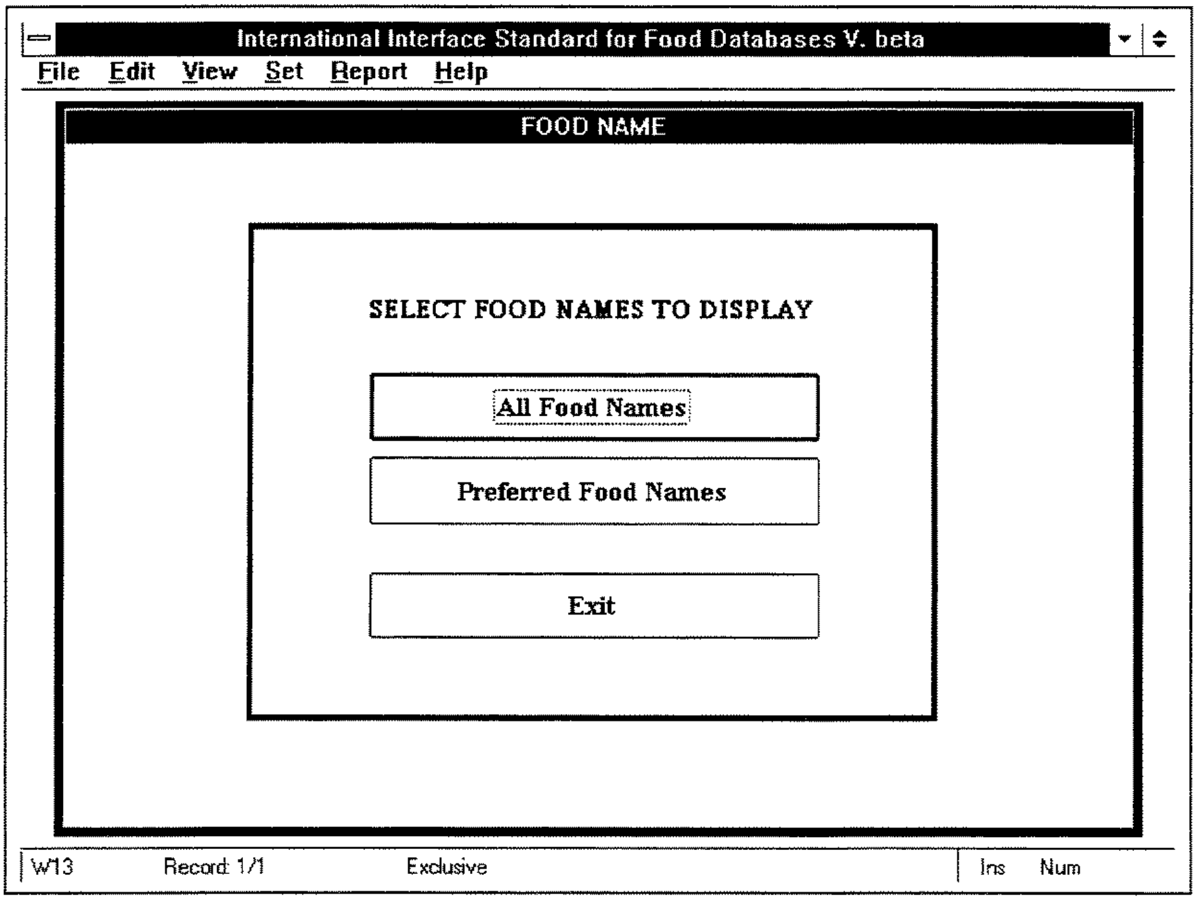
The Food/Food Product Identification Menu appears:



Next step:

- Highlight and click on **Food Name**.

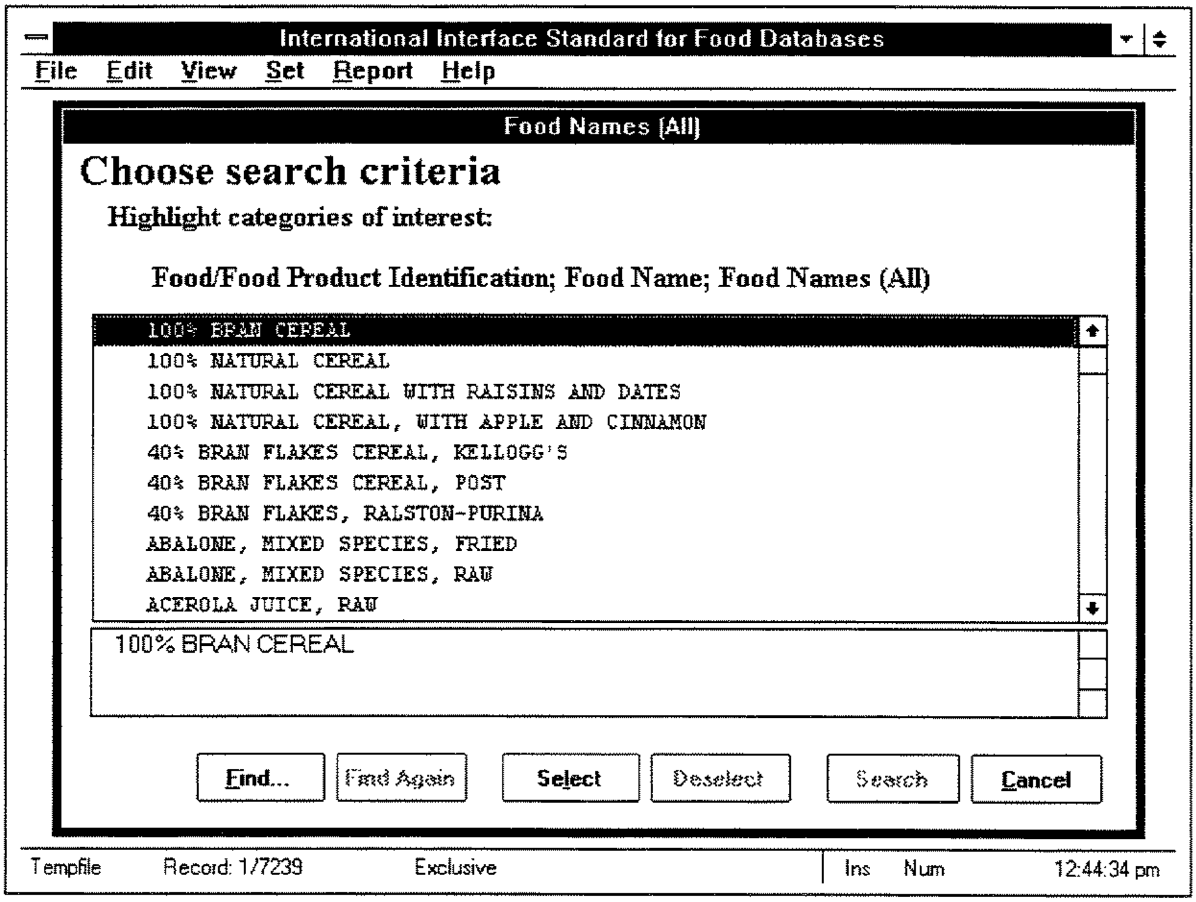
The following screen appears:



Next step:

- Click on **All Food Names**.

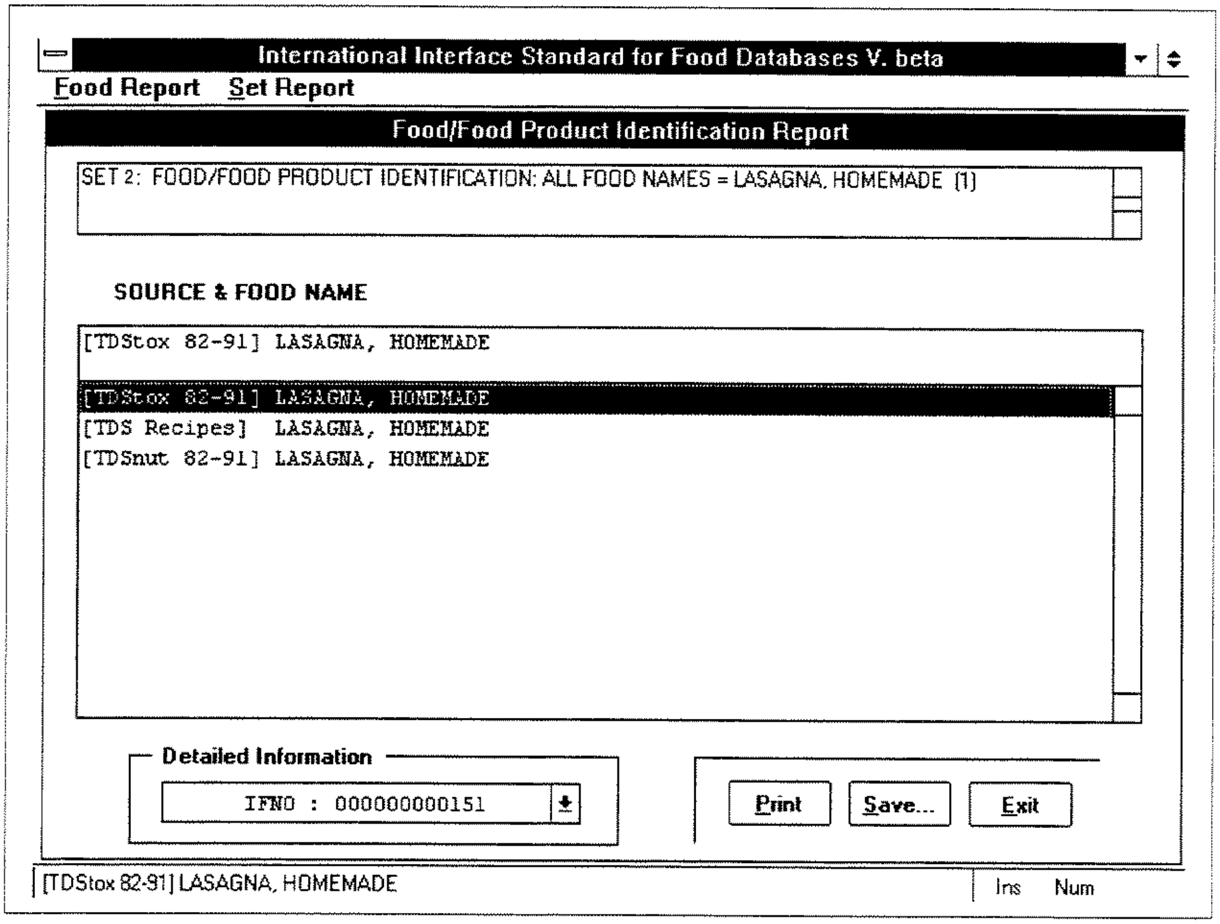
A screen appears showing names of all foods in the system:



Final steps:

- Find and highlight *Lasagna, homemade.*
- Press the **Select** button. A dot will appear to the left of the selected food name.
- Press the **Search** button to generate the set of foods with the selected food name.

The Food/Food Product Identification Report, shown below, is produced automatically to show query results.



Additional reports may be created to show:

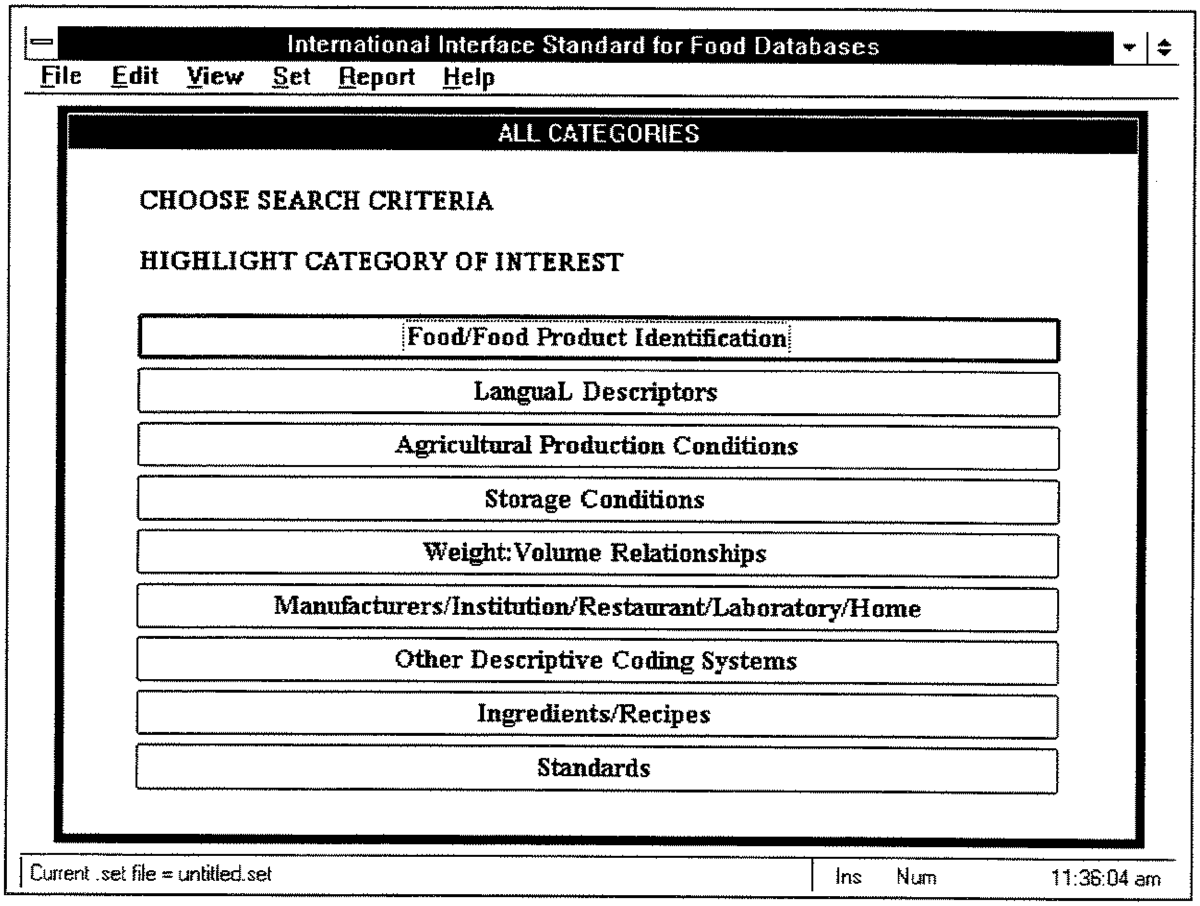
* LanguaL Descriptors
* Recipes
* Food Data
* Source Information

Instructions for creating these reports appear in the Report Section of this Guide.

Sample LanguaL Descriptors Query

Which foods in the Interface System are heat-treated?

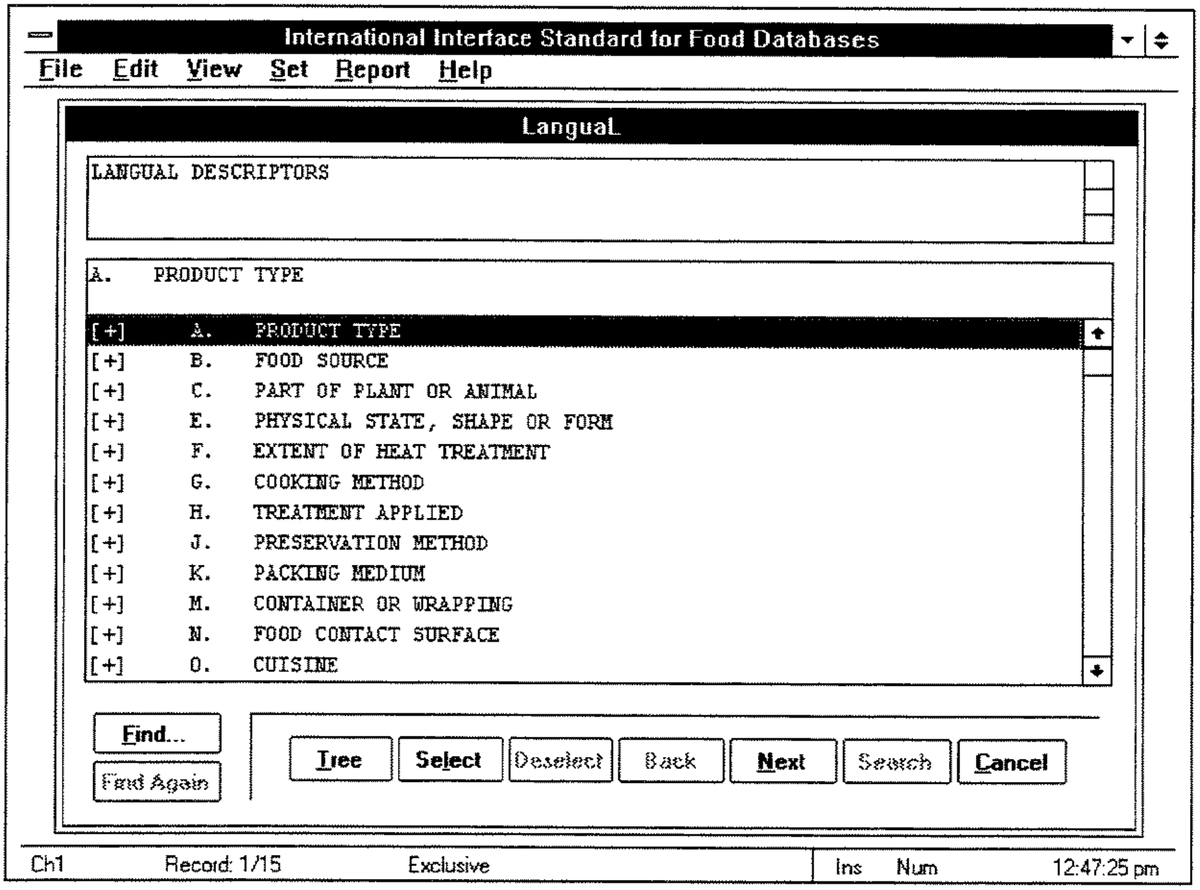
Interface System Main Menu



First step:

- Highlight and click on **LanguaL Descriptors**.

A screen appears showing the broadest LanguaL Descriptor categories:

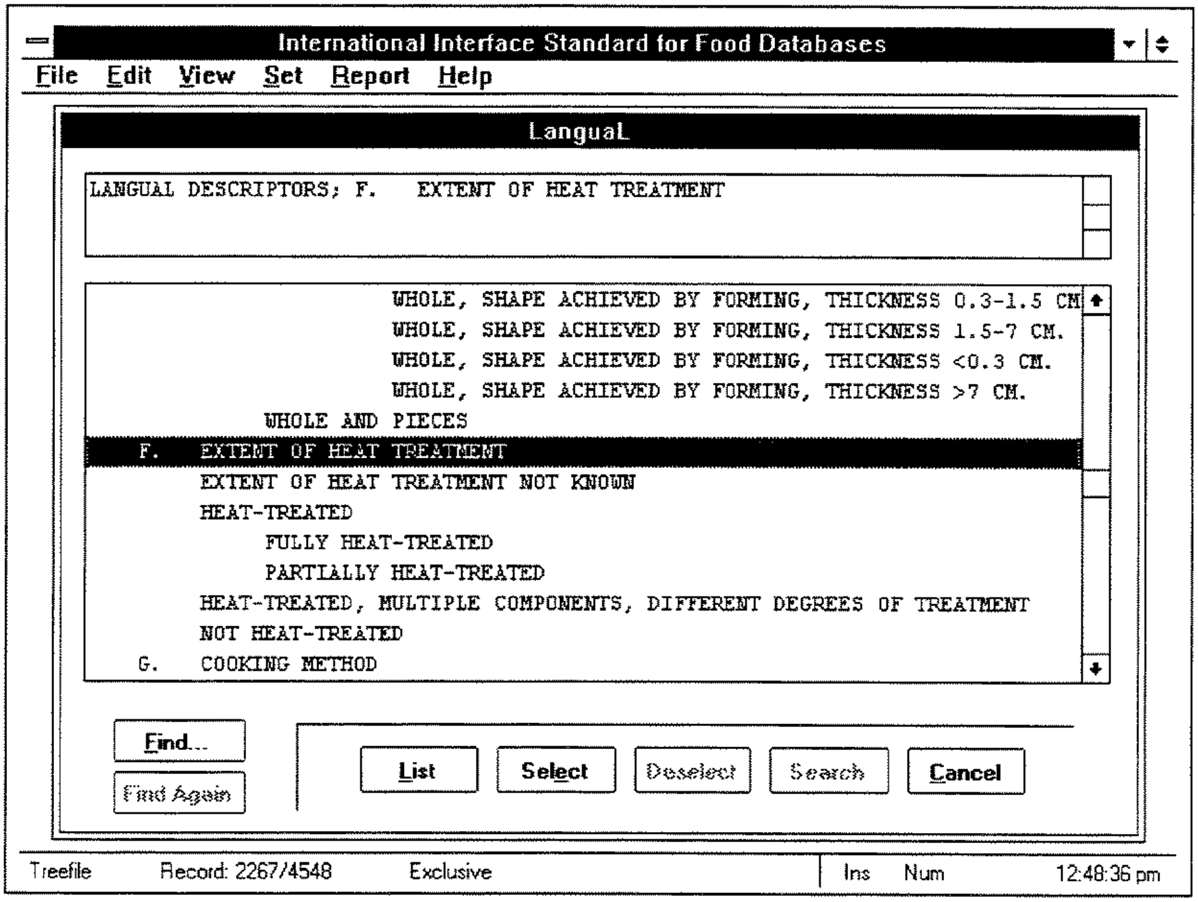


Descriptor terms are displayed in list mode, which allows the user to browse through terms level by level. To display narrower terms, highlight the factor of interest and double click - or press the **Next** button. To display terms in tree mode, highlight the top level term of interest, then press the **Tree** button.

Next steps:

- Find and highlight *EXTENT OF HEAT TREATMENT.*
- Press the **Tree** button.

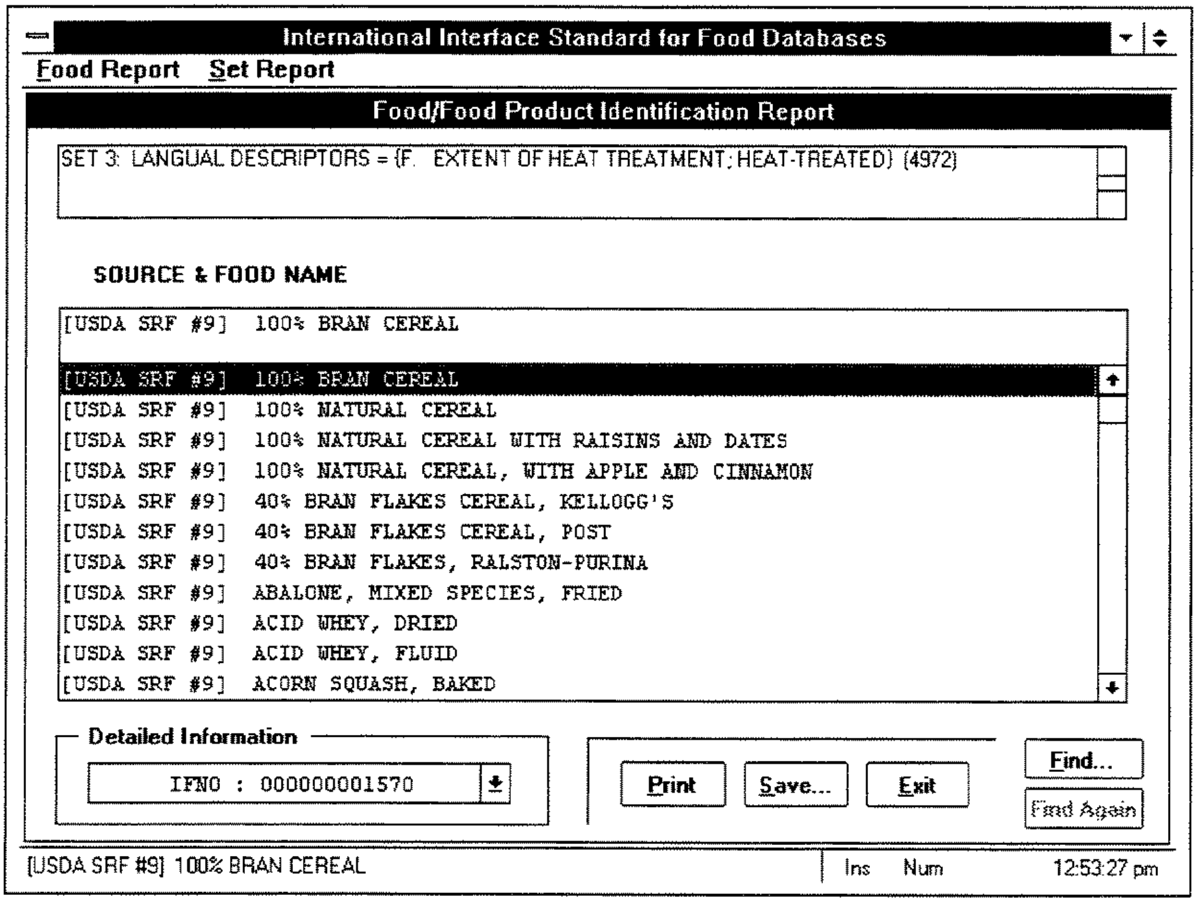
A screen showing the *EXTENT OF HEAT TREATMENT* LanguaL descriptors appears in tree mode:



Next steps:

- Find and highlight the factor term *HEAT-TREATED*.
- Press the **Select** button. A dot will appear to the left of this term and narrower terms in the hierarchy.
- Press the **Search** button to generate the set of foods containing the term *HEAT-TREATED* or a narrower term.

The Food/Food Product Identification Report, shown below, is produced automatically to show query results.



Additional reports may be created to show:

- LanguaL Descriptors
- Recipes
- Food Data
- Source Information

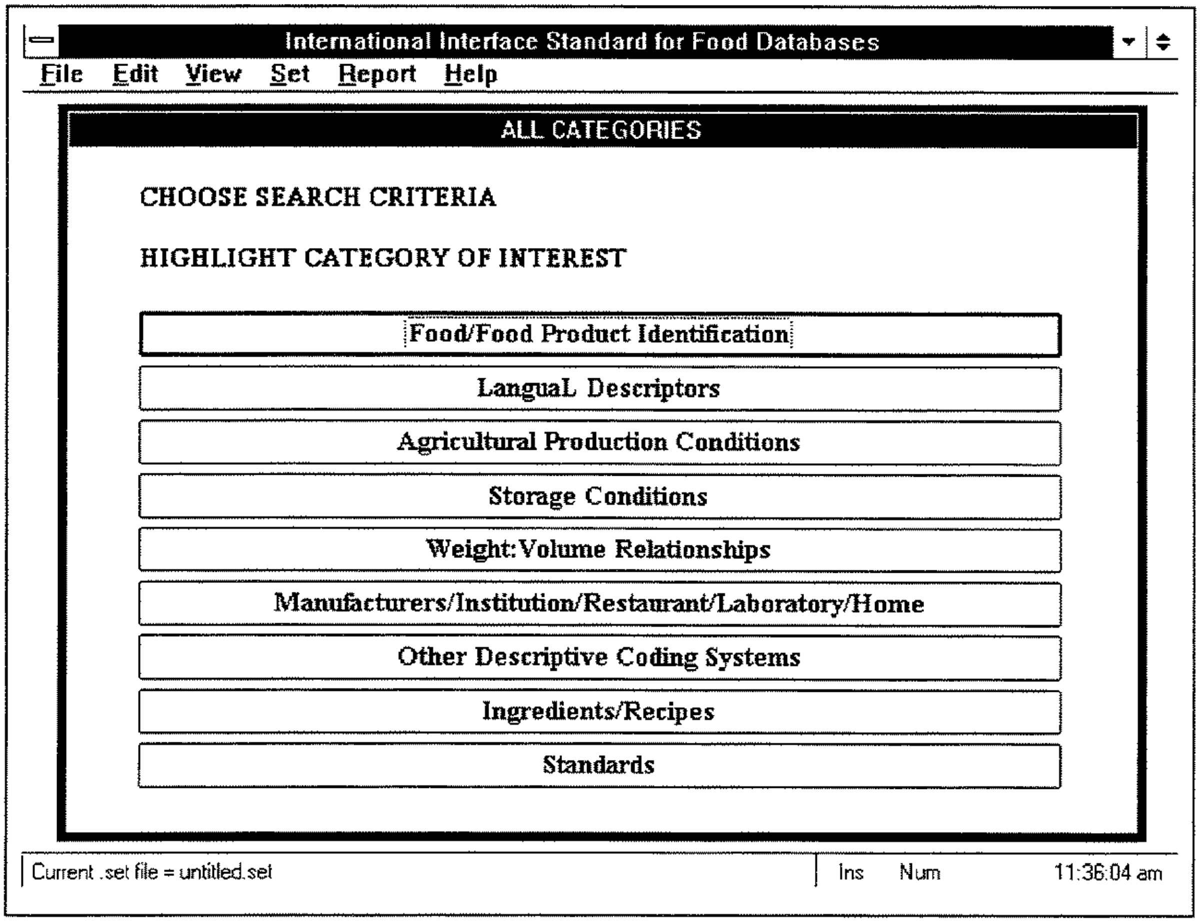
Instructions for creating these reports appear in the Report Section of this Guide.

Sample Ingredients/Recipes Query

Which foods in the Interface System contain eggs?

There are several ways to formulate a search to address this question; the strategy to be used here will be to search for *EGG OR EGG PRODUCT* (or a narrower term) as the LanguaL *PRODUCT TYPE* descriptor in foods or in food ingredients.

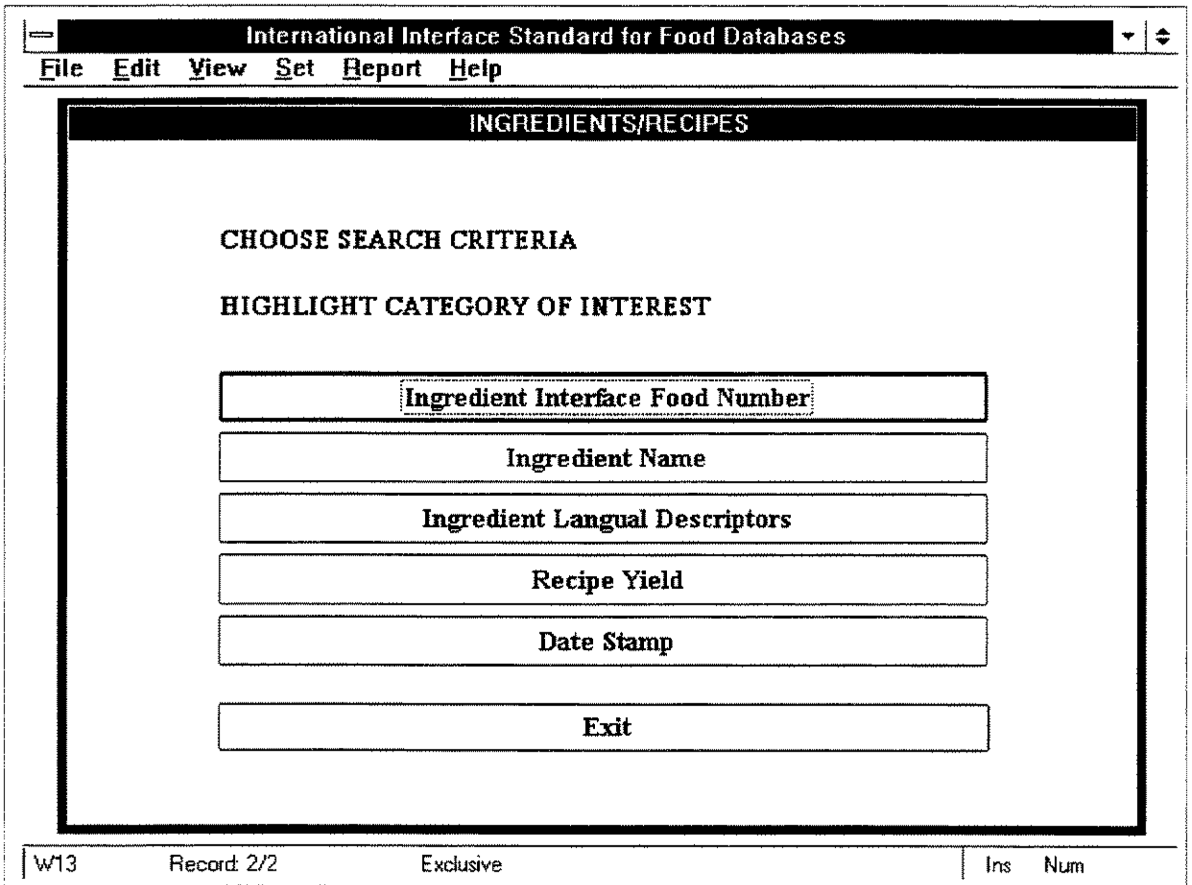
Interface System Main Menu



First step:

- Highlight and click on **Ingredients/Recipes**.

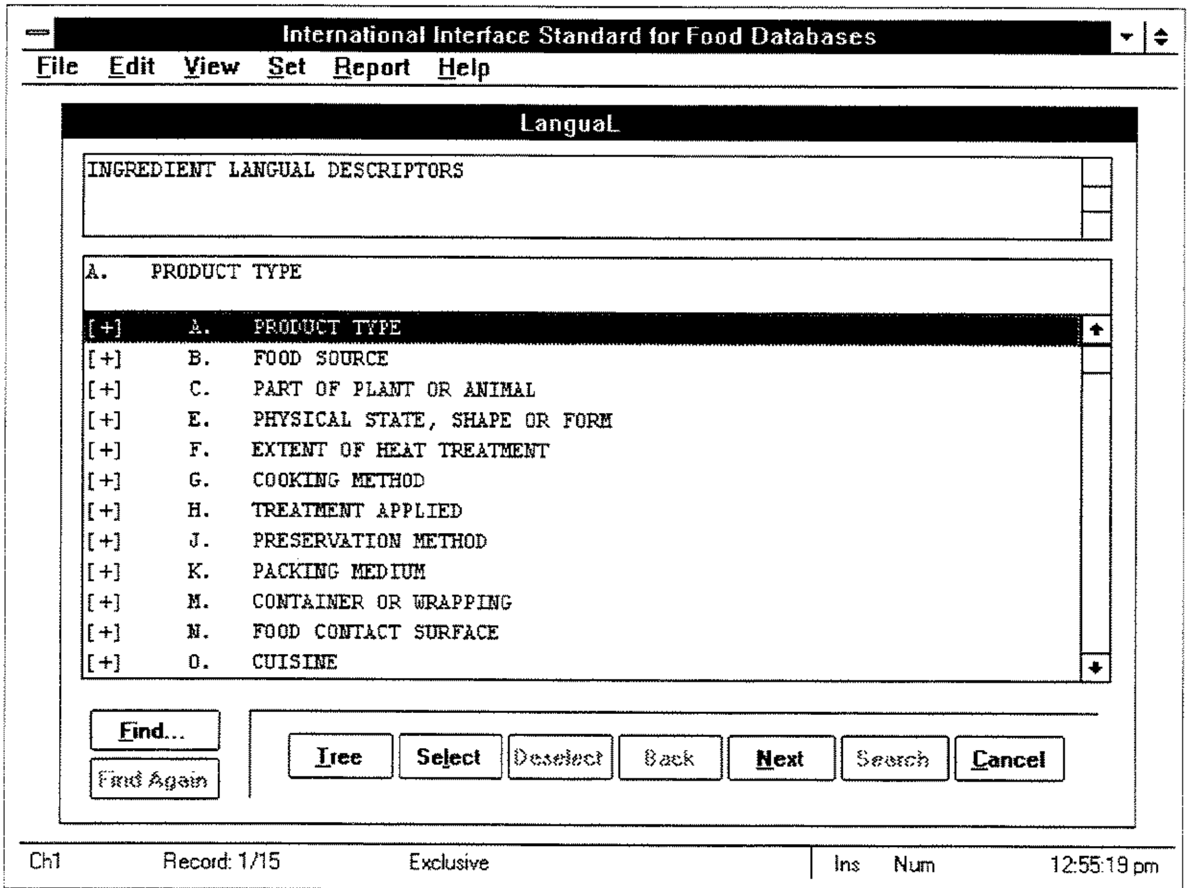
The Ingredients/Recipes Menu appears:



Next step:

- Click on **Ingredient LanguaL Descriptors**.

A screen appears showing the broadest LanguaL Descriptor categories:

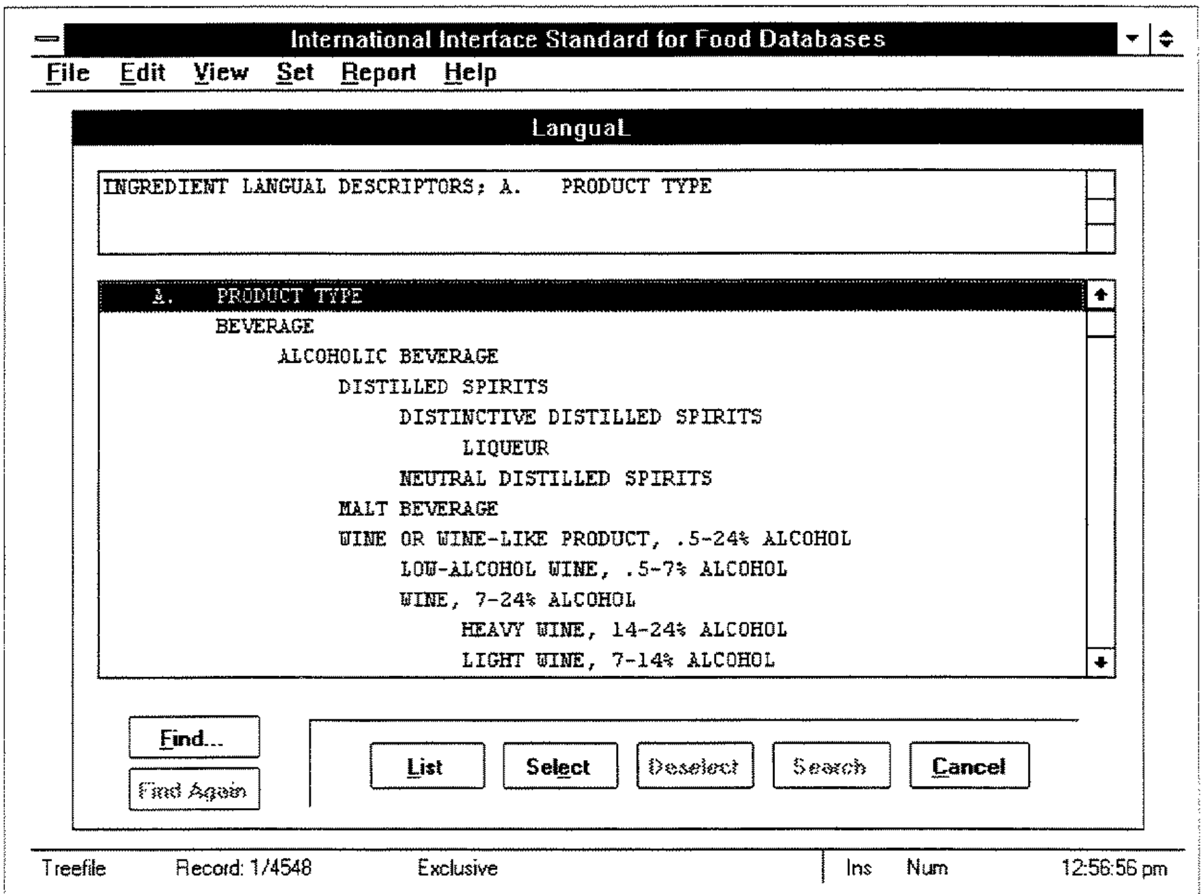


Descriptor terms are displayed in list mode, which allows the user to browse through terms level by level. To display narrower terms, highlight the term of interest and double click - or press the **Next** button. To display terms in tree mode, highlight the top level term of interest, then press the **Tree** button.

Next step:

- Press the **Tree** button.

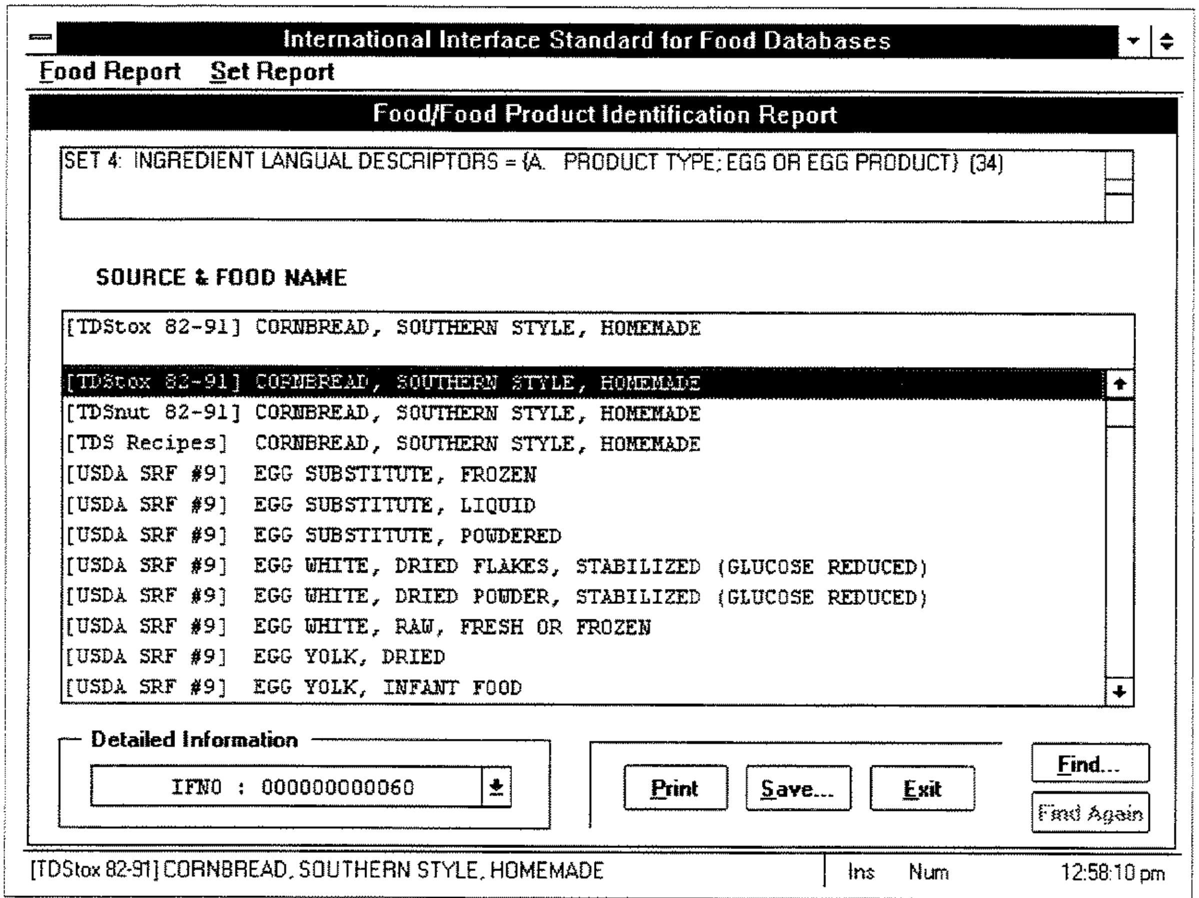
A screen appears showing the *PRODUCT TYPE* LanguaL descriptors in tree mode:



Final steps:

- Find and highlight the term *EGG OR EGG PRODUCT.*
- Press the **Select** button. A dot will appear to the left of this term and narrower terms in the hierarchy.
- Press the **Search** button to generate the set of foods containing the factor term *EGG OR EGG PRODUCT* or a narrower term.

The Food/Food Product Identification Report, shown below, is produced automatically to show query results.



Additional reports may be created to show:

* LanguaL Descriptors
* Recipes
* Food Data
* Source Information

Instructions for creating these reports appear in the Report Section of this Guide.

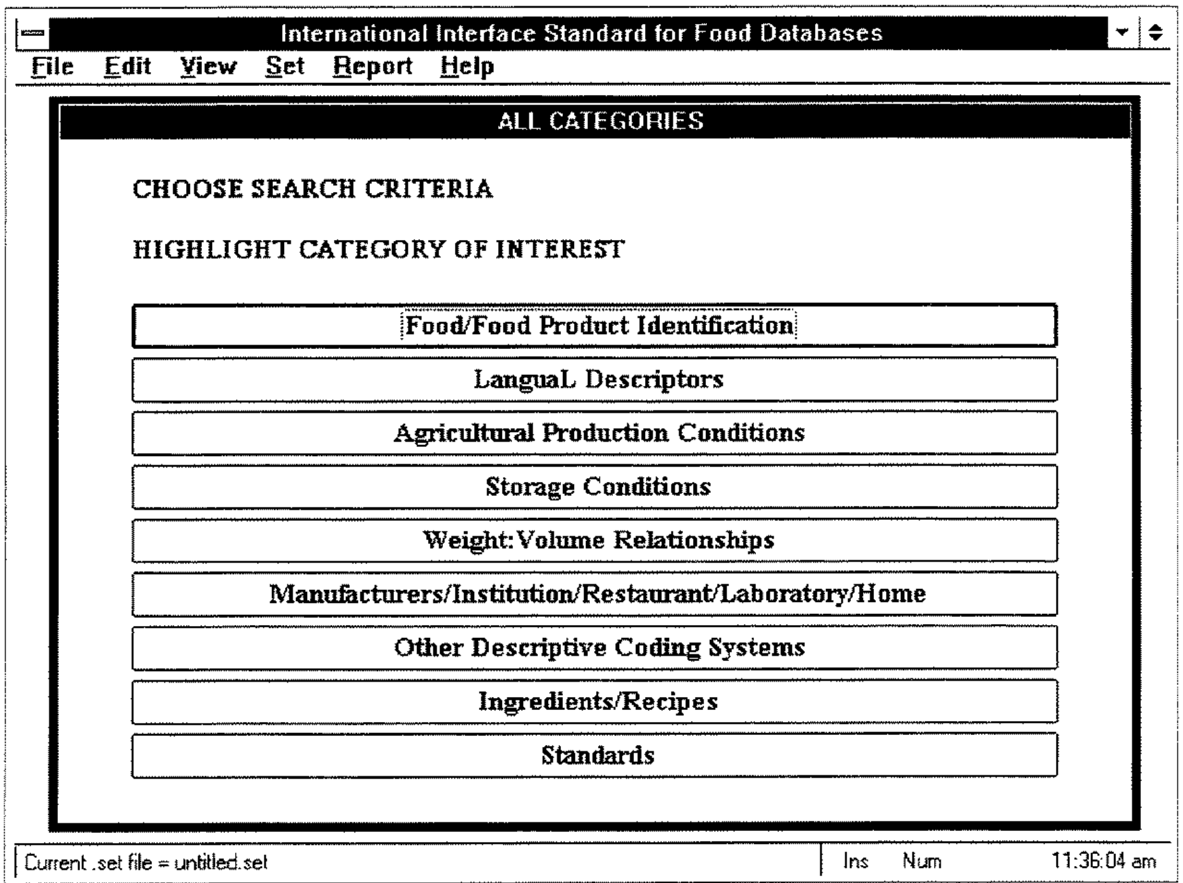
Sample Set Combination Query

Which foods in the Interface System are U.S. Food and Drug Administration Total Diet Study foods containing eggs?

This query will require combination of two sets:

1) Source Sample Query set of Total Diet Study foods
2) Ingredients/Recipes Sample Query set of foods containing eggs.

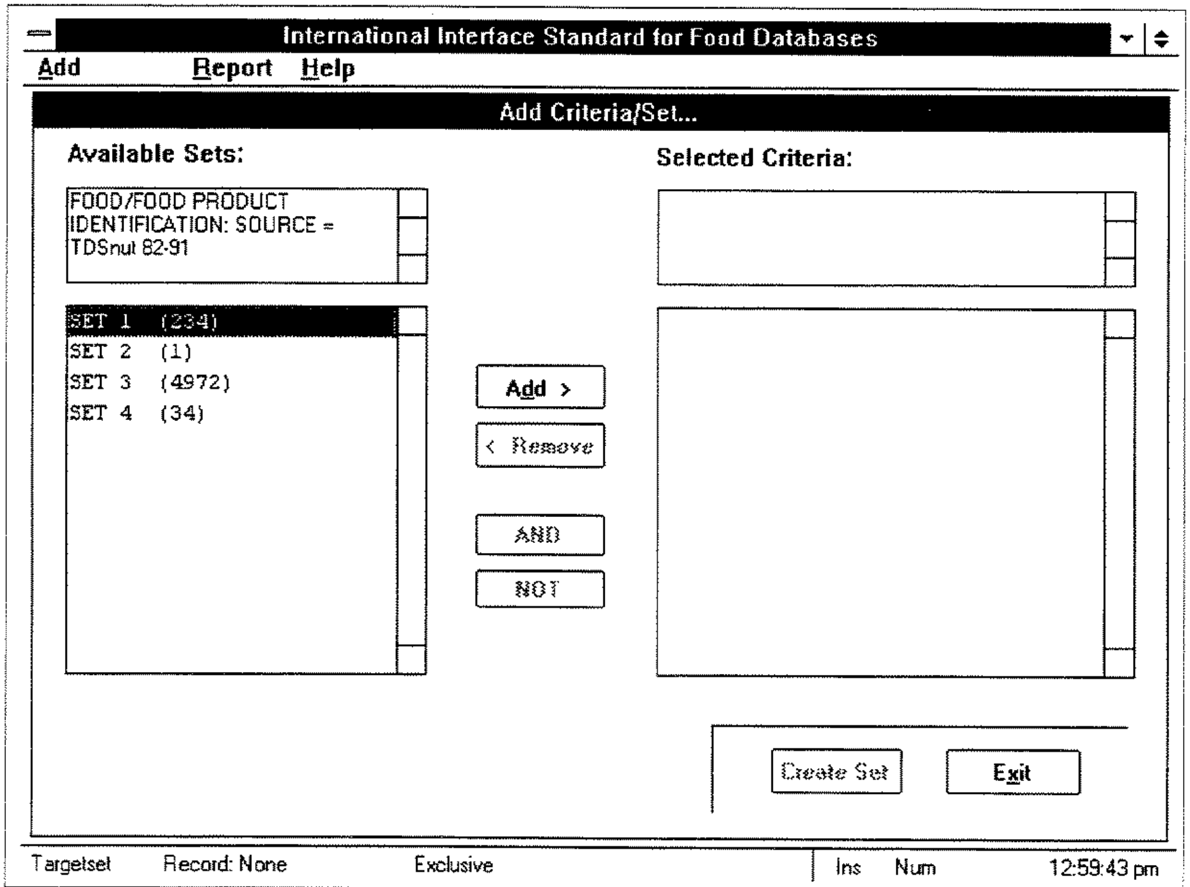
Interface System Main Menu



First step:

- Press **Set** in the menu bar. Highlight and click on **Add Criteria/Set**.

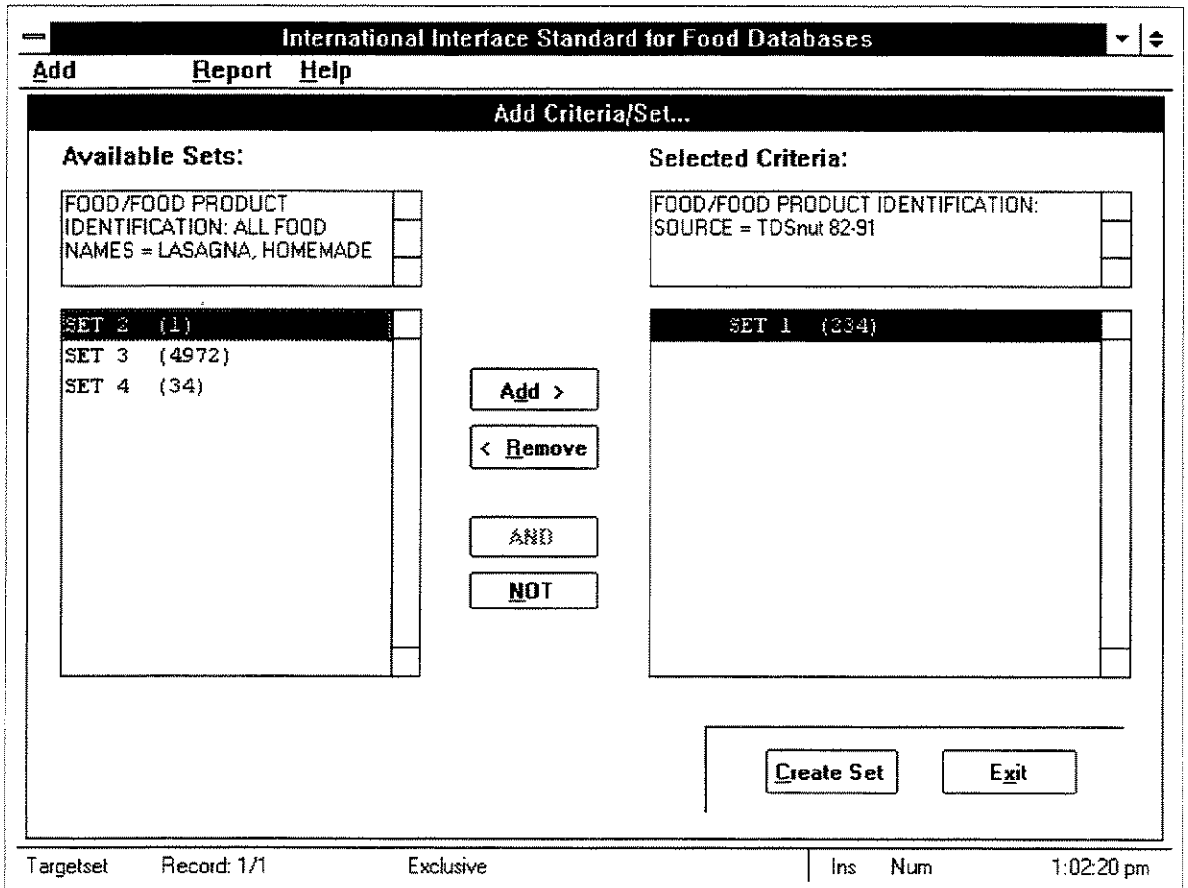
The following screen appears, showing sets available to be combined:



Next steps:

- Click on *Set 1* (Total Diet Study foods).
- Click on the **Add** button.

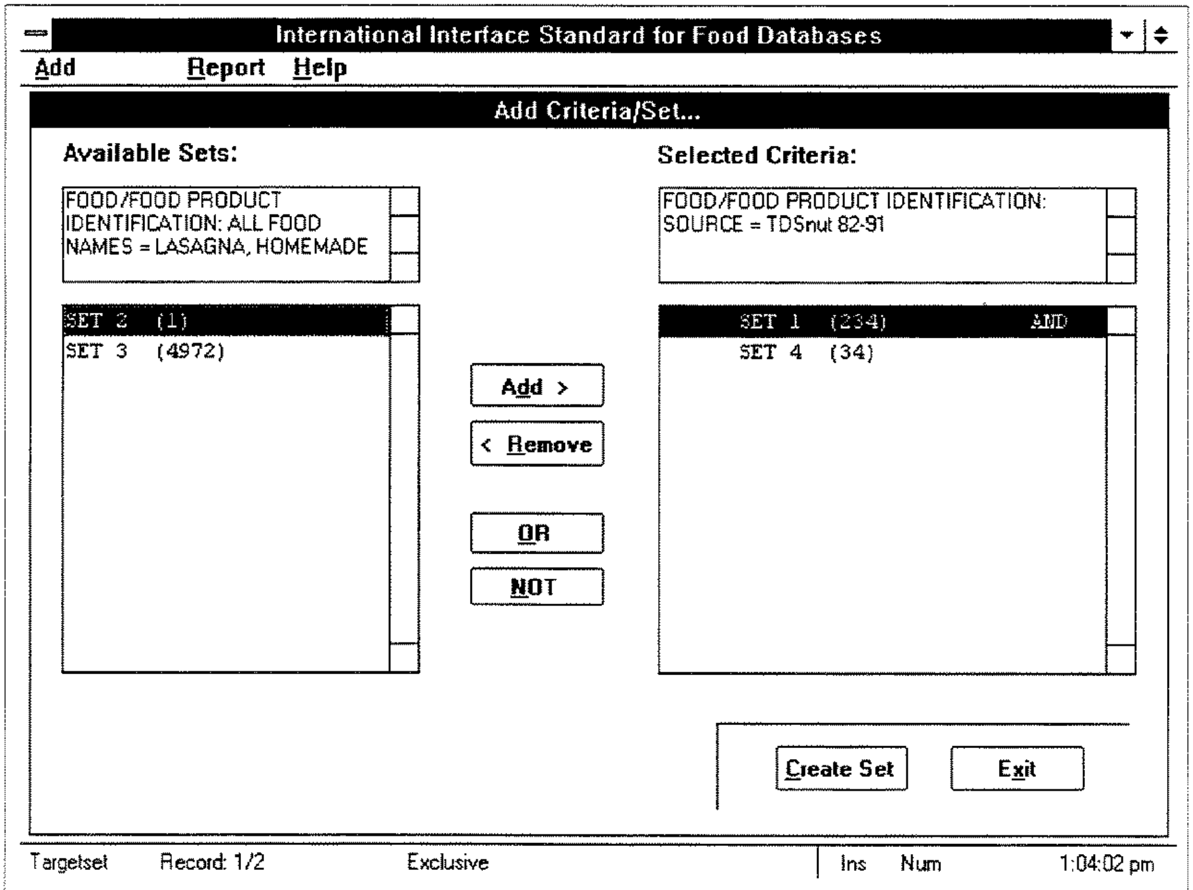
Set 1 is moved to the **Selected Criteria** box, as shown below:



Next steps:

- Click on *Set 4* (foods containing eggs).
- Click on the **Add** button.

Set 4 is moved to the **Selected Criteria** box.

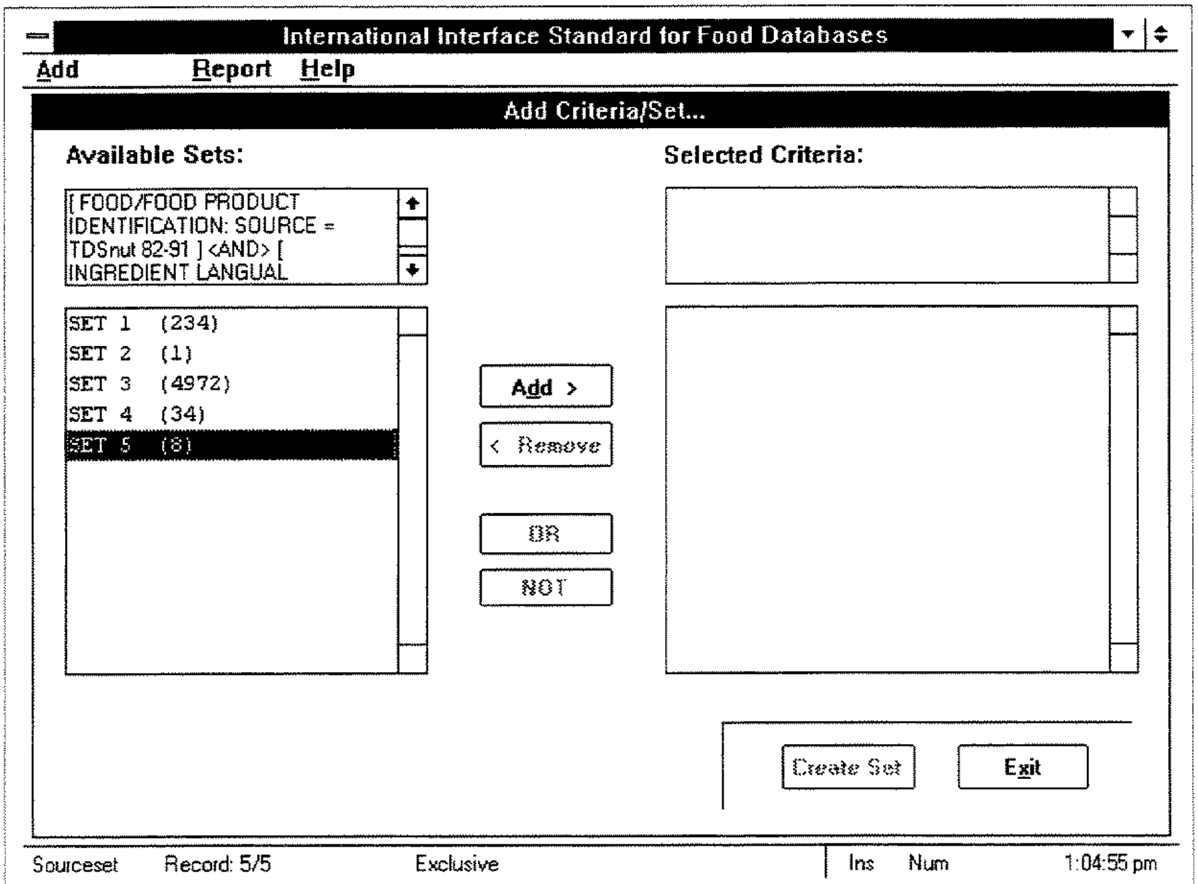


The boolean operator AND appears by default. This operator is appropriate for the sample query. (To change the boolean operator to OR or NOT, click on the set, then click on the button labeled with the desired operator.)

Final step:

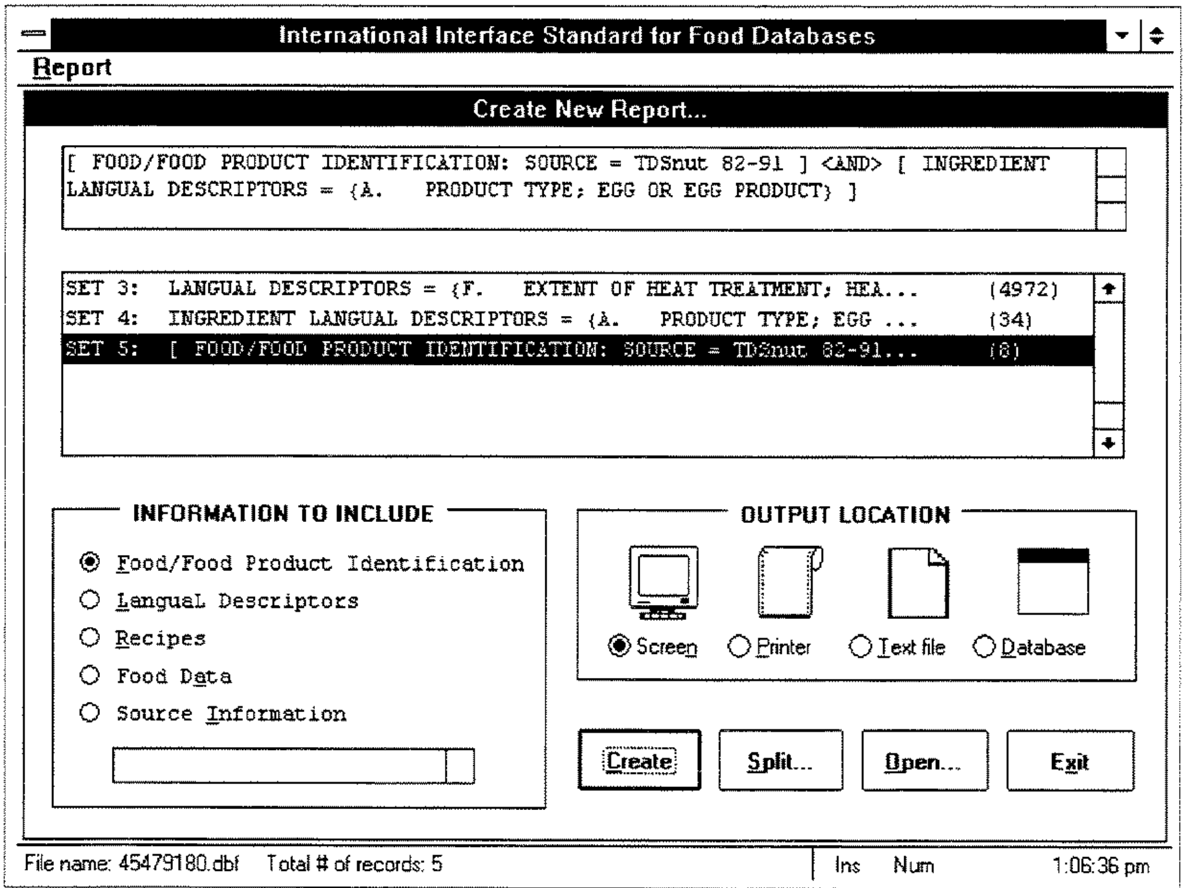
- Click on the **Create Set** button.

Set 5, formed from Sets 1 and 4, is now listed in the **Available Sets** box:



To view or print reports on foods included in Set 5, press **Report** in the menu bar, then click on **Create New Report**.

The Create New Report screen appears:



All Interface System reports are available from this screen.

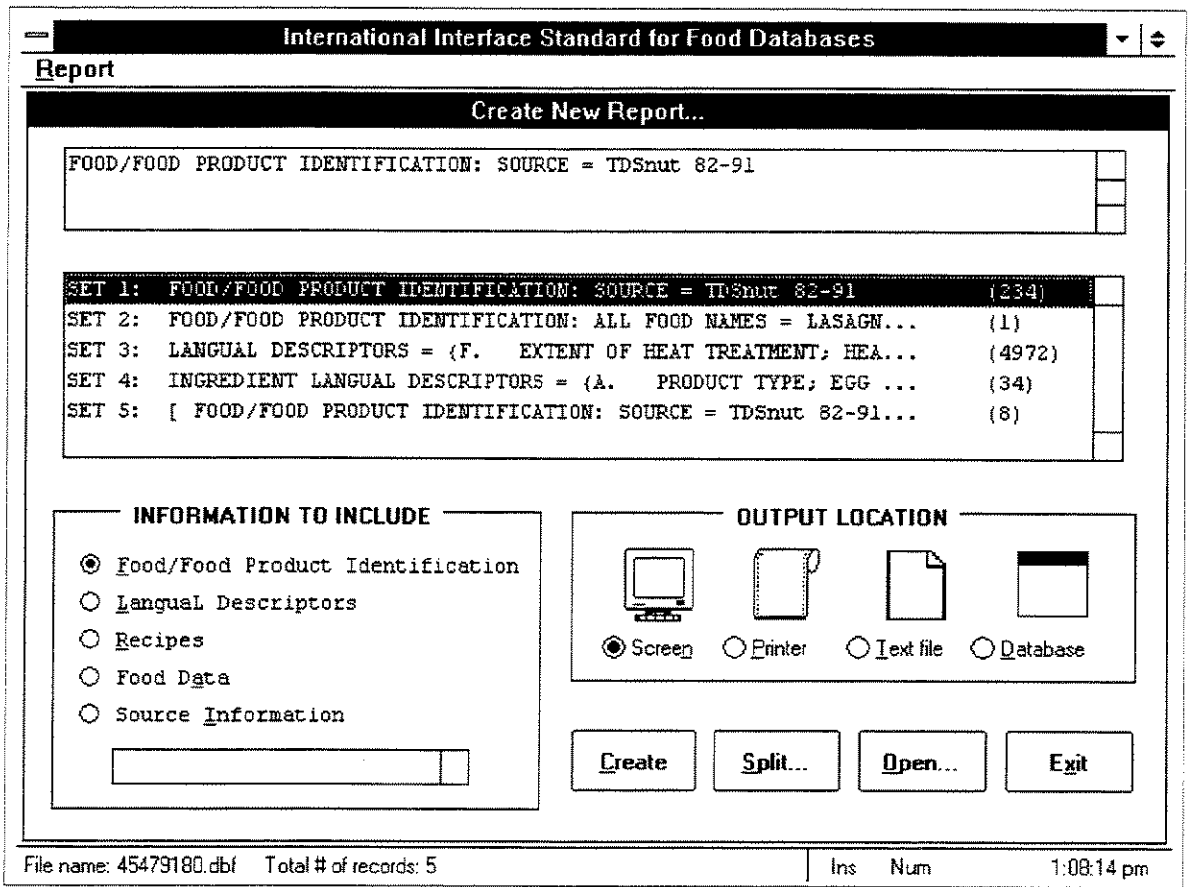
Creating and Interpreting Interface System Reports

General information

A variety of Interface System reports may be generated to provide information on foods in query sets.

Reports to the screen and printer are available immediately after a search is performed. Reports to text or database files must be generated from the Create New Report screen. Reports on sets other than the current set also must be generated from the Create New Report screen. To access the Create New Report screen, exit to the Main Menu (if necessary) and press Report on the menu bar. Highlight and click on **Create New Report**.

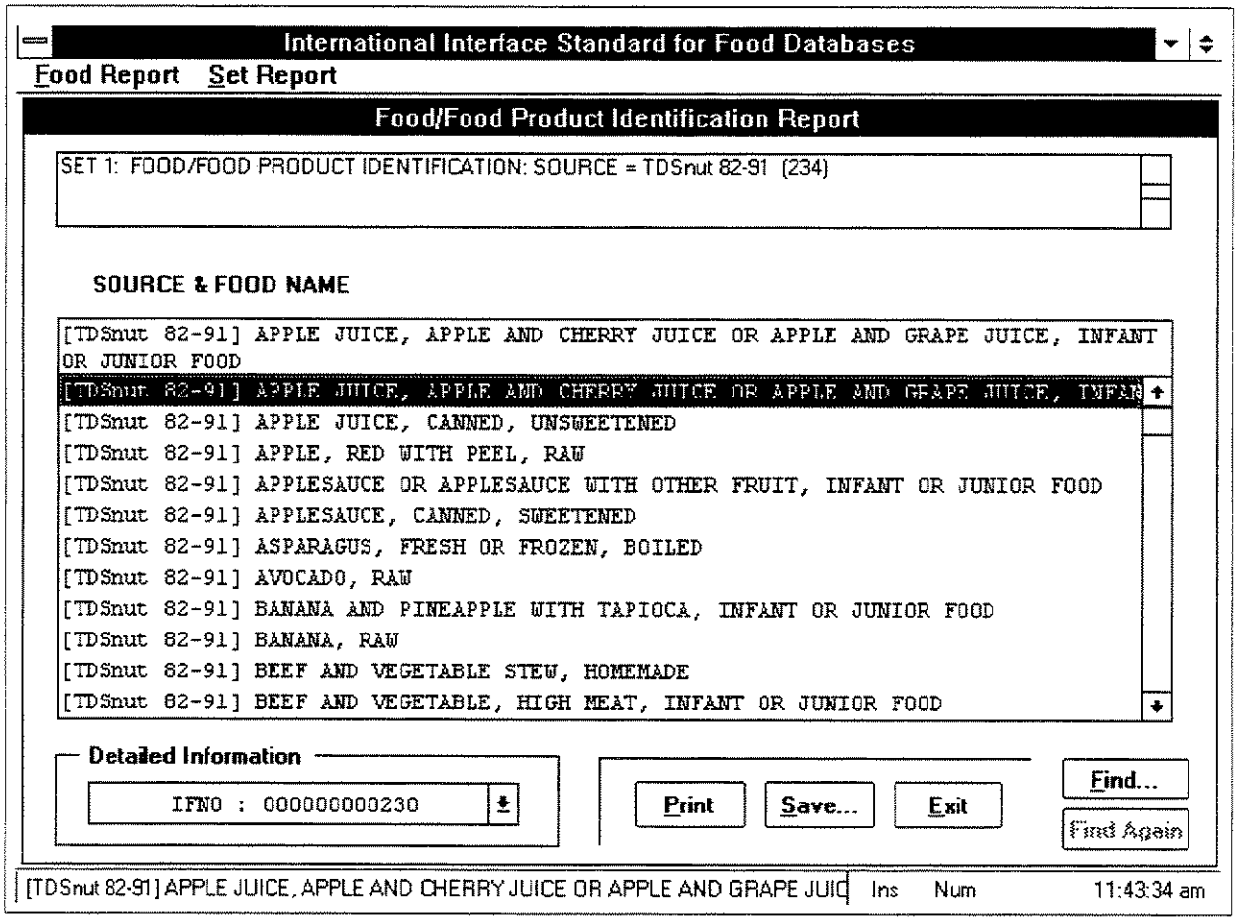
Reports and output locations may be selected from the following screen:



Specific types of reports are discussed in the following pages.

Food/Food Product Identification Report

This report is produced automatically after most types of searches to search results. A sample report is shown below:

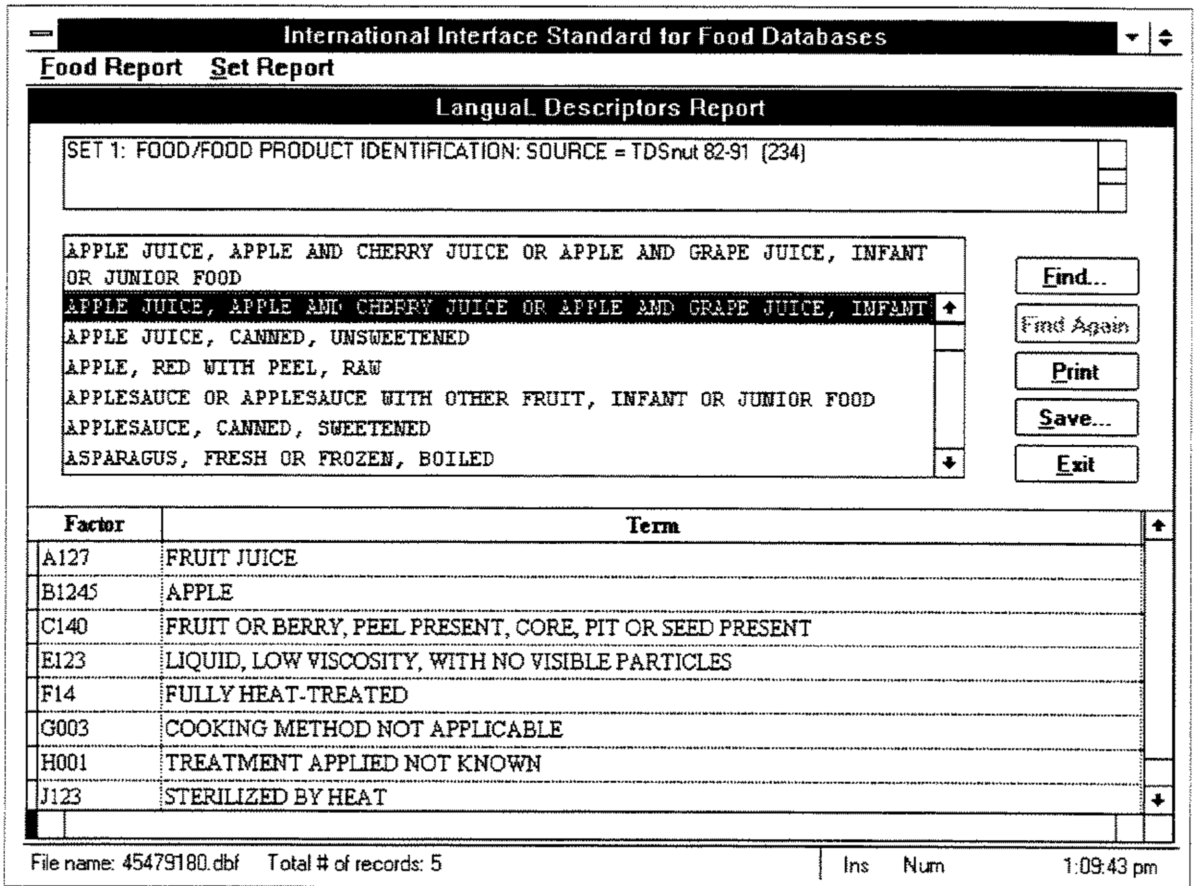


Reports showing LanguaL Descriptors, recipes, food data, and/or source information may be accessed from this screen. Reports may be created to show information on all foods in a set or on individual foods within a set.

To generate a report on the current set, press **Set Report** in the menu bar. Select a report type by highlighting and then clicking on the desired report.

To generate a report on a particular food in the current set, press **Food Report** in the menu bar. Select a report type by highlighting and then clicking on the desired report.

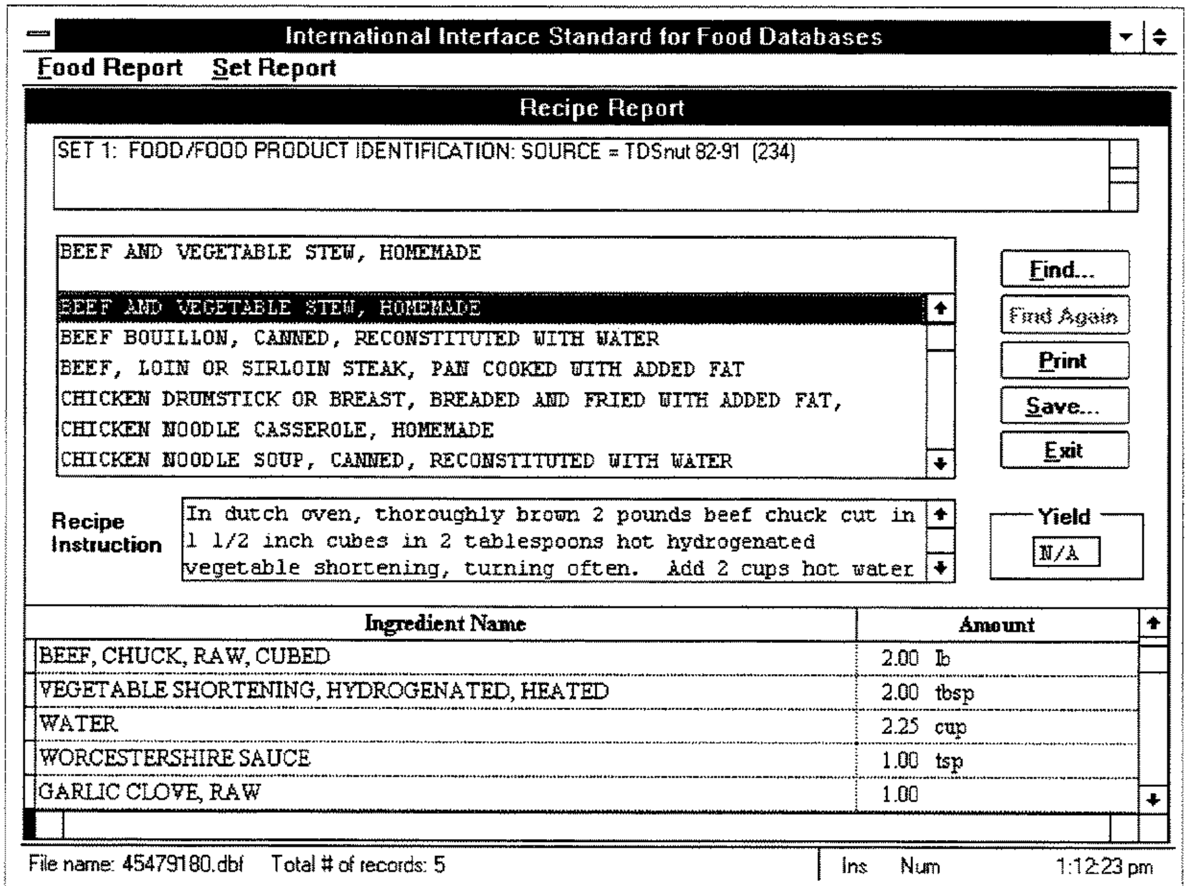
LangualL Descriptors Report



To view LangualL descriptors for a particular food, find and highlight the food name.

To view additional descriptors for a food, highlight the last descriptor showing, and move down the list using the down arrow key - or - press on the down arrow in the scroll bar to the right of the descriptor list.

Recipe Report



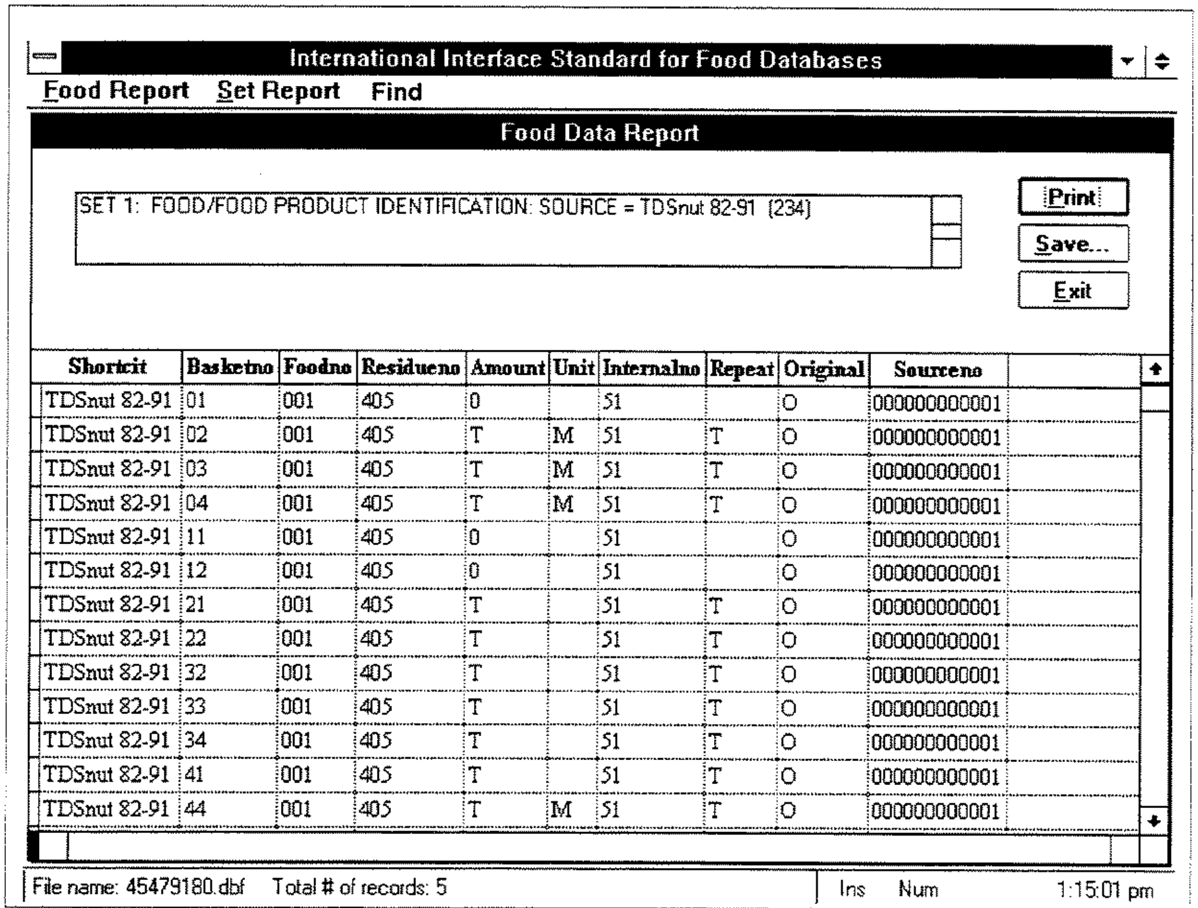
To view the recipe for a particular food, find and highlight the food name.

To view additional ingredients for a food, highlight the last ingredient showing, and move down the list using the down arrow key - or - press on the down arrow in the scroll bar to the right of the ingredients.

Food Data Report

Food Data Reports show data files in the original formats. Two source identifiers, SOURCENO and SHORTCIT (short citation), have been added.

The following is an example of a Food Data Report. This sample report shows data from the *U.S. Food and Drug Administration Total Diet Study Nutrient Data, 1982-91 Data disk.*



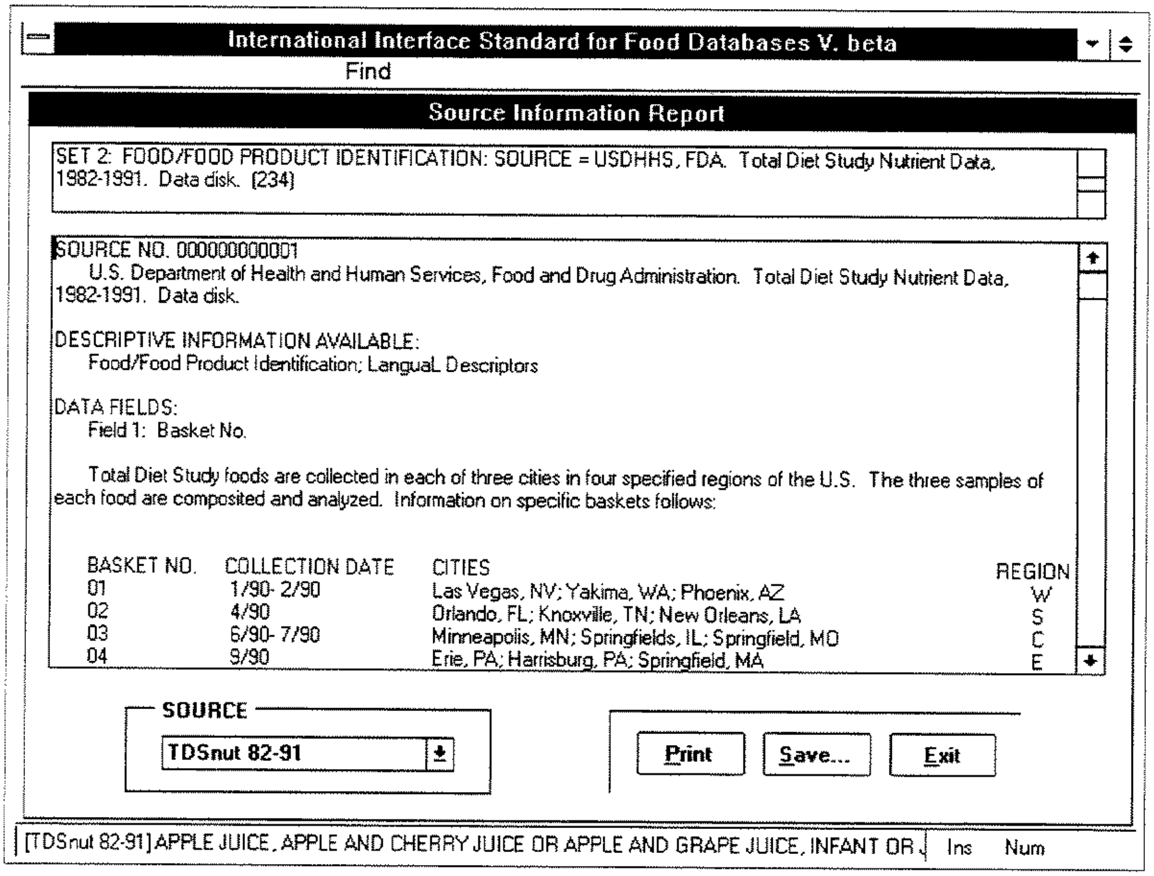
Shortcit	Basketno	Foodno	Residueno	Amount	Unit	Internalno	Repeat	Original	Sourceno
TDSnut 82-91	01	001	405	0		51		O	000000000001
TDSnut 82-91	02	001	405	T	M	51	T	O	000000000001
TDSnut 82-91	03	001	405	T	M	51	T	O	000000000001
TDSnut 82-91	04	001	405	T	M	51	T	O	000000000001
TDSnut 82-91	11	001	405	0		51		O	000000000001
TDSnut 82-91	12	001	405	0		51		O	000000000001
TDSnut 82-91	21	001	405	T		51	T	O	000000000001
TDSnut 82-91	22	001	405	T		51	T	O	000000000001
TDSnut 82-91	32	001	405	T		51	T	O	000000000001
TDSnut 82-91	33	001	405	T		51	T	O	000000000001
TDSnut 82-91	34	001	405	T		51	T	O	000000000001
TDSnut 82-91	41	001	405	T		51	T	O	000000000001
TDSnut 82-91	44	001	405	T	M	51	T	O	000000000001

Food data can be displayed along with reference data showing food names, source information on field descriptors, and other data in a Split Review Report. This report is described later in the Report section of the Query Guide.

Source Information Report

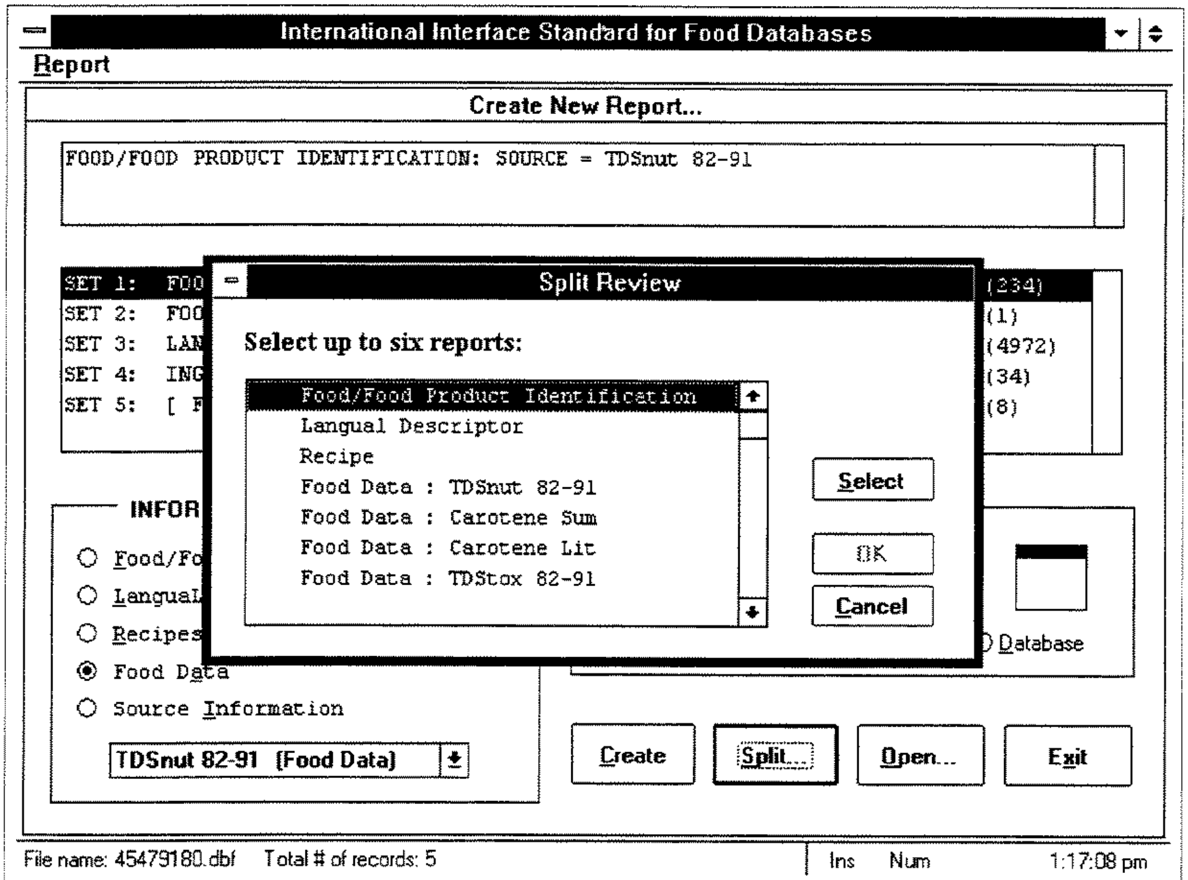
Source Information Reports display textual information describing the source and fields in source data files.

The following is a small part of the available information on the *U.S. Food and Drug Administration Total Diet Study Nutrient Data, 1982-91 Data disk.*

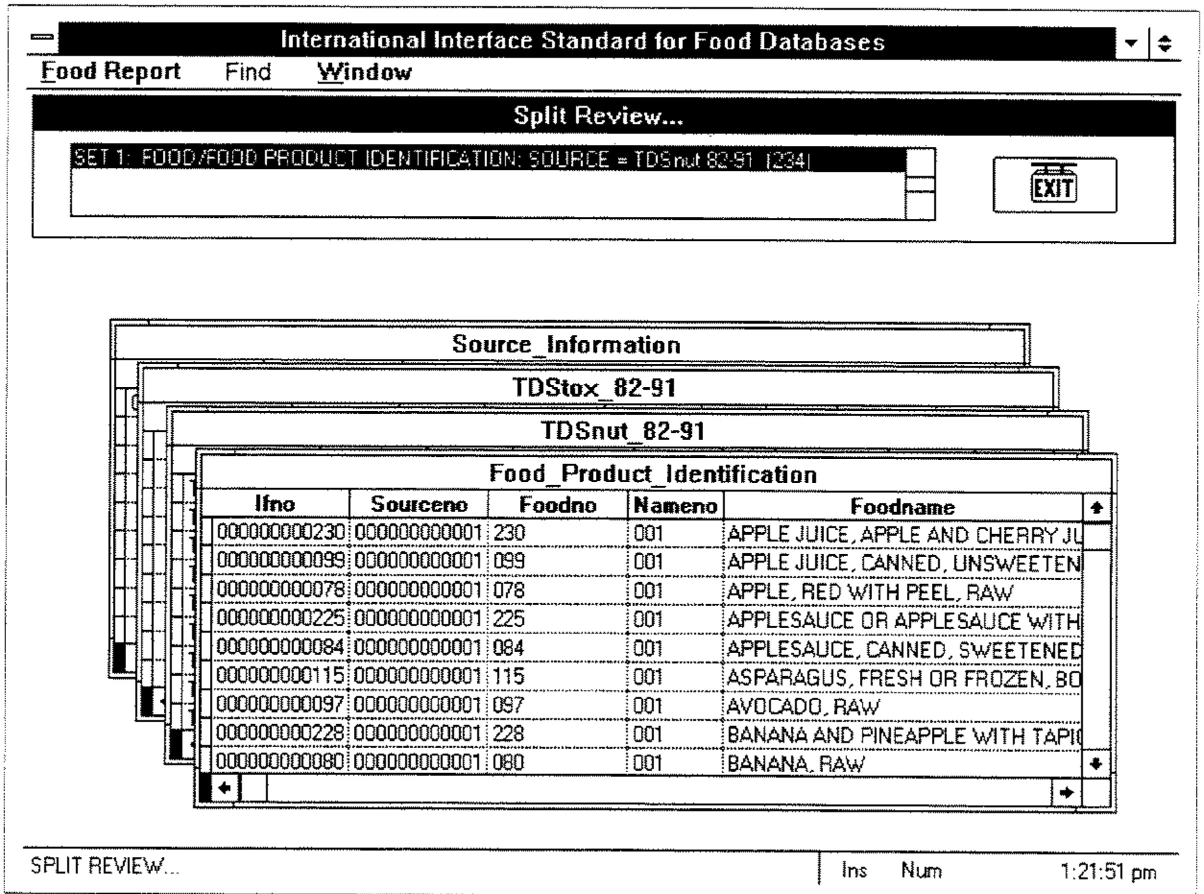


Split Review Report

Split Review Reports display up to six reports, in the form of browse windows showing actual database contents. The reports to be displayed are selected on the following screen:



Reports are displayed in a cascade, as follows:



To display all reports on the screen at once, press **Window** in the menu bar. Highlight and click on **Tile**. Reports may be moved and resized as desired; individual fields within reports may also be moved.

Selecting a Food Composition Database and Software

by John Orta, PhD, California State University

Professional nutritionists need to systematically plan for their food composition database software needs. They need information on where and how to locate appropriate food composition and database software packages. Additionally, they should consider the following steps in selecting appropriate software:

1. Identify nutritional analysis tasks to be performed.
2. Set evaluation criteria for the outcome of such tasks.
3. Pick promising prospects.
4. Apply evaluation criteria.
5. Weigh alternative products.
6. Accept or reject product(s).

Features to be considered in selecting an appropriate food composition database software package include: cost, flexibility, editability, comprehensiveness, accuracy, reliability, user-friendliness, input and data-entry procedures, and output generated.
Comparative examples will be presented.

Use of Visuals in Dietary Assessment

by Lenore Kohlmeier, Alice Ammerman, Marci Campbell, Departments of Nutrition and Epidemiology, School of Public Health, The University of North Carolina at Chapel Hill

Abstract

Language and literacy are two obstacles to dietary assessment which can be overcome with technologic support provided by computers. Currently available technology will now support computer-assisted interviews using interactive software which applies multi-media tools (digital video, color graphics, written text and audio) in the interview process. Such tools can provide cognitive advantages over traditional methods, and have the potential to address a number of data quality concerns. Multimedia programs, including pictures of foods and food groups, can serve to motivate participation, encourage subjects to complete the interview, and enhance concentration. Visualization of portions can improve the validity of quantitative information collected. Video demonstrations of various programs in development at the University of North Carolina, which incorporate food visuals for a number of purposes, including assessment, education, and evaluation, and are targeted to a variety of audiences will be presented. These include components of a CASI Diet History, a computer driven meal based interview asking detailed questions about habitual diet, HealthTalk, a multi media interactive dietary assessment and nutrition education program designed to reduce heart disease risk among low income individuals and StampSmart, a multimedia individually tailored nutrition education program for families receiving Food Stamps.

Dietary assessment is particularly challenging since it requires individuals to recall what they eat, how frequently the eat it and how much they generally consume of it. This task challenges memory, communication, attention levels and mathematical skills of the subjects. Among various approaches to improve the quality of the responses, and reduce the burden of dietary assessment to the subjects, one of the most promising is the use of visual presentations of images to stimulate episodic memory, improve communications, support attempts at quantifying amounts of food and enhancing motivation by stimulating the subject([i]).
Visual images may include still pictures, cartoons or animation and video tape segments. These images may be of foods themselves, their preparation, as well as other pictures which stimulate memory of various occasions which may relate to food consumption patterns. Currently, despite the fact that modern technology has put [into the hands of nutritionists([ii])] affordable tools which can store, sort, and rapidly access visual images during an interview, most dietary interviews remain pencil-paper based, and do not incorporate visuals ([iii]). The potential for storage and access of hundreds of graphic images should stimulate a new generation of supportive instruments for dietary interviews in prevention, research and clinical settings.
A number of prototypes which utilize this potential are currently under development. They apply different approaches to visual use to better reach target populations for specific purposes. Most of these are multi-media programs designed for direct user interaction. Three of these models are presented in this report: and extensive, quantitative, meal based assessment of habitual dietary intakes; an interactive talk show on computer designed to initiate dietary change in low literacy groups, and a murder mystery providing nutrition education to food stamp recipients.

The CASI Diet History

A computer assisted self interview (CASI), designed to implement multi-media tools in the assessment of habitual food consumption, has been developed. It is modeled after the central component of the traditional Burke diet history ([iv]),: an extensive, meal based assessment of an individual's usual intake, administered by a highly specialized interview. The CASI diet history stimulates an interviewer based interview. It offers the subject a selection of ethnically diverse interviewers of various ages and both gender ([5]). The choice of interviewer determines the dialect, speed and language of the interview. It is programmed to reproduce the extent of questions and depth of probing normally conducted by dietitian based interviews ([v]). It has the advantage however of insuring a standardized sequence of questions following a given response, and maintains the depth of probing required by the nutritionist for the purpose of the interview. The program employs visuals reminding the subject of the season under questions, and how it may have impacted usual diet. It then "asks" with pointer technology, for specific information about food consumption.
The program contains hundreds of pictures of people, people in various eating occasions, pregnant and breast feeding women, and images of foods and food components. It can overcome language and understanding problems such as in questions about the type of salad consumed, by showing green salads, mixed salads, fruit salads and other different options as separate entities. Multiple pictures of ethnic foods are presented to ease identification of foods which may not be known by name. Portions are displayed as color photographs which can be used as a reference for estimations independent of the units of measure (grams, ounces, mls) which are so difficult for most groups.

The subject is provided a computerized notebook of their diet at the end form which they can select information by topic (antioxidants, fats, energy intake, etc.) and evaluations of their own dietary intakes. The program is based on photographic images and audio interviewing techniques.

Health Talk

Health Talk is a multi-media computer interactive diet change program specifically designed for low literacy adults. The program uses state of the art computer technology to mimic a TV talk show program and create a user friendly medium for participants. Participants use a keypad which looks like a TV remote control device to interact with the computer ([vi]).

A talk show host guides the participant through four 45-60 minute sessions which include a dietary assessment, a priority ranking of problem food areas, goal setting and individually tailored behavior change messages designed to lower the intake of saturated fat and cholesterol. Guests on the talk show include an African American registered dietitian and a chef, who is a former truck driver and now owns a truck stop featuring a heart healthy menu. The host and guests entertain the participants while conveying dietary information and behavior change strategies to lower serum cholesterol levels. Other participants from a variety of age, gender and race groups discuss how they have overcome barriers to change and motivate the subjects to join them.

This program employs cartoon images of foods and the concept of building foods in its visual imagery. Photographic stills and video clips of the chef also impart nutritional information. Traffic sign like presentations of undesirable foods are also employed to ease comprehension. The program offers recipes and highlights the components, one by one, as components of the total picture.

HealthTalk is currently being tested in a multicenter randomized trial with serum cholesterol and dietary change as the major outcome variables of interest. Process and psychosocial data collected as part of the computer program as well as by interviewers will be used to further evaluate and refine the program.

Stamp Smart

The Stamp Smart program is an interactive multi-media computer-based nutrition education program designed for Food Stamp recipients who are single parent heads of households. The computer program collects baseline information from participants regarding household characteristics, dietary habits, nutrition and food selection knowledge and skills, and psycho social factors related to dietary behavior change. this information is then used to provide individualized, tailored nutrition feedback to each participant regarding dietary fat consumption, nutrition knowledge, and strategies based on stage of readiness to change habits. A soap opera video story provides additional entertainment and educational messages. Characters in the show model healthy behavior changes ([vii]).

An outcome evaluation of the program is underway which compares changes over time in dietary behavior, knowledge, and psycho social factors among 700 participants randomly assigned either to the intervention group (interactive multi-media program) or to a control group. Process evaluation is being applied to examine the extent to which the program was effectively implemented and met the needs and preferences of the target audience.

Visuals are used to assess dietary fat consumption as part of the multi-media program. the items and response choices are adapted from a fat screener developed by Block and associates ([viii]) and from the Health Habits and History Questionnaire ([ix]) and the Nurses Health Study food frequency questionnaire ([x]). Items were also added to assess consumption of high fat snacks and to assess consumption of several low fat alternatives, such as low fat milk and pretzels or graham crackers. Foods were photographed in medium portion size and scanned into the program. Responses are in the form of a 7 option frequency checklist where the participant presses a number that corresponds to how often she eats each food. The diet assessment feedback graphically shows whether the participant is consuming a high fat or a low to moderate fat diet, and identifies "problem" food categories (high fat meats, dairy foods, or snack foods) that are contributing the most to high fat intake based on their responses to the diet assessment questions. For participants already consuming a low fat diet, the feedback provides positive messages to encourage maintenance of behavior.

Summary

A variety of visual images are being used experimentally in a variety of programs designed to assess, to educate, and to motivate change. They incorporate the use of video clips which entertain, cartoons which represent specific foods simply, realistic photographic images of actual foods and portion sizes, as well as the elements of composite picture of multiple foods, and of the building of foods (such as pizza or salads) with a variety of additions during the course of the interview. Non-food visuals are also powerful motivational tools.

These programs present three different examples of the use of visuals and multi-media to reach difficult target groups, enliven difficult tasks and improve the quality of acquired dietary data. It has long been recognized that a picture is worth a thousand words. Now that pictures can readily be stored, and easily accessed by computer, they can be easily incorporated in many nutritional tasks, especially those involving the recall and description of patterns of food consumption. These approaches are designed to entertain, to enhance memory recall and to support nutritionists in providing individualized advice to vulnerable groups of individuals. They represent the start of a new generation of multi-media dietary and nutritional tools. Their innovative application should change the face of nutritional research and education in the coming decade.

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Using Internet and Electronic Bulletin Boards for Food Composition Data

by David Haytowitz, Nutrient Data Laboratory, Beltsville Human Nutrition Research Center, ARS, USDA

There is a lot of information and misinformation being printed on the "Information Superhighway" or whatever name one chooses to use for the electronic information systems under development in the United States and around the world. The attendees of the Nutrient Databank Conference have always been in the forefront of database development. This article provides a guide to locating food and nutrition resources on the information network to assist in this important work.

However, like the more traditional highway systems, the information superhighway is very much a highway under construction. There are delays, detours, and closed roads. The quality can vary from that of a modern superhighway to that of dirt track through the forest. It can also be intimidating to users. New "ramps" are added to the highway constantly and familiar routes to get to information can change as rapidly.

When one talks about the "Information Superhighway" one is most often talking about the Internet. Therefore, what is the Internet? The Internet was originally developed by the Department of Defense as ARPANET to link together universities and high-tech defense contractors. Later the National Science Foundation developed NSFNET to provide connections between supercomputer sites. The Internet is a loose amalgamation of computer networks worldwide which have agreed to connect to each other and adhere to common standards. As a result no one "owns" the Internet and no one controls it.

How do I get access?

Many universities, government agencies, and companies are already connected to the Internet. Your organization's computer staff will be your best source of information. If your organization is connected, they will be able to tell you what to do. If you are not connected, there are a number of local companies which sell both organization and individual accounts. You will need to determine which level of access is best for your needs. These can range from an E-Mail account up to and including access to the World Wide Web through Mosaic or similar software. It is also possible to get your own domain, that is, your company or organization name appears as part of the address. Whatever service you choose, it is best if it allows you to obtain additional features as your needs change. This way you won't need to change your E-Mail address. Ads for these companies can be found in the daily newspaper or check with your local computer user group. There are also a number of commercial software programs on the market which can connect you the Internet. Instructions on contacting a local company are provided with these packages.

E-Mail

E-Mail is probably the most common use of the Internet. It gives you the ability to send and receive text messages similar to conventional mail. There are many programs for writing, managing, and sending your E-Mail and it is beyond the scope of this article to cover them all. The manual which came with your program will explain the features of the program. These programs give you the capability of composing your mail in a word processing environment. They can also import files from your favorite word processing program. However, E-Mail is sent as straight text without any formatting such as underlining or bold type. If you wish to send a formatted document, there are ways to attach a file to your message. You will need to refer to the manual which accompanied your program to find out how.

One common and valuable feature of these programs is a phone book where you can store the electronic addresses of people with whom you correspond. This way you do not have to retype the address every time you send that person a message. E-Mail addresses are often cryptic and hard to remember. In addition computers require accurate addresses and accept exactly what you type as the address. If you misspell the street address on a letter, the mailman will probably get it to the right address. With E-Mail, incorrectly addressed mail will be returned to you. Therefore, it is very important that you type the addresses correctly, both when sending mail and when giving your E-Mail address to others.

These programs also allow you to keep and manage old letters. This can be very helpful when working on projects and you have forgotten some piece of information which was sent to you some time ago. However, if you keep too many messages, you can run out of disk space.

You can also send E-Mail to subscribers on one of the national services, such as America Online, Compuserve and MCI Mail. You will need to know the identifier or name of your intended recipient on each service. The manual or online help will give you information on how.

LISTSERVs

Listservs are electronic mail list and there are literally thousands of them. They can be created by almost anyone to communicate with a list of individuals who share a common interest. By subscribing to a listserv you receive all E-Mail sent to that list. Conversely, you can also send mail to everyone who subscribed to the list, by simply addressing your E-Mail to the list. Some food composition and nutrition related lists follow.

Food Composition

Established by the International Network of Food Data Systems (INFOODS) as a medium for individuals working in the area of food composition to discuss issues of common interest.

Subscription Command: Send a message indicating you want to subscribe to the listserv Address: food-comp-request@infoods.unu.edu Post messages to list: food-comp@infoods.unu.edu

IFT Announcements

A listserv established at Cornell University to allow posting of announcements of interest to IFT members.

Subscription Command: subscribe IFT-Announce-L your name
Address: listserv@cornell.edu
Post Messages to list: IFT-Announce-L@cornell.edu

Food Laws and Regulations

Established by the Food Law and Regulations Division of IFT to allow division members to discuss the latest developments in food law and regulatory issues. This list is maintained at the University of Minnesota.

Subscription Command: subscribe food-law your name
Address: listserv@vm1.spcs.umn.edu
Post messages to list: food-law@vm1.spcs.umn.edu

Biotechnology Education and Public Policy Network (BCEPP)

BCEPP enables people working in Biotechnology education and public policy to exchange information. Participants include representatives of biotechnology centers and associations, extension personnel, researchers, teachers, university administrators, and colleagues from industry. This listserv is maintained at the University of Wisconsin.

Subscription Command: SUBSCRIBE BCEPP your name
Address: listserver@relay.adp.wisc.edu
Post Messages to list: bcepp@relay.adp.wisc.edu

Food and Nutrition Specialists

Allows food and nutrition professionals to exchange information and easily contact their colleagues. Maintained by Purdue University.

Subscription Command: subscribe fnspec_mg
Address: almanac@ecn.purdue.edu
Post Messages to list: fnspec_mg@ecn.purdue.edu

Seafood Internet Network

Set up to facilitate information exchange about the Seafood HACCP Alliance and implementation of the FDA seafood HACCP program. Maintained at the University of California, Davis.

Subscription Command: subscribe seafood your name

Address: listproc@ucdavis.edu Post messages to list: seafood@ucdavis.edu

Some additional things to know about Listservs:

- To subscribe to one of the Listservs above send an E-Mail message to the address of the listserv you wish to join. The message contains only one line--the subscription command for that listserv. Also, leave the subject line blank. You do not need to supply your E-Mail address--the computer captures it from the header of your message.
- When you first subscribe to a listserv, you will be sent a message confirming your subscription and information on how to use the listserv. It is strongly recommended that you save this message as it contains valuable information, such as how to unsubscribe from the list.
- ALL MESSAGES SENT TO THE LIST are automatically posted to all other members of the list;
- IF YOU "REPLY" to such messages send out over the list, your reply will go ALL members on the list;
- IF YOU WANT TO SEND YOU ANSWER DIRECTLY TO AN INDIVIDUAL (rather than broadcast it to the whole list), you need to send your response addressed to that individual's user name and address.
- Some of the more active lists can generate hundreds of messages per day. At this point, none of the food or nutrition related lists have this level of activity. However, if you do not read your mail frequently, the messages can pile up. The are also programs available to help filter your mail. If you find the mail from a listserv overwhelming or if you just are not interested in that group, you can unsubscribe. See the information message sent to you when you first subscribed.

Gophers

Gopher is a menu driven system for accessing Internet resources developed at the University of Minnesota (whose mascot is the Golden Gophers) to "go for" information. By moving through a series of menus you can connect to a wide variety of resources. To assist in locating these resources, search programs such as Archie and Veronica are available. These enable you to locate information without knowing in advance exactly where the information might be located. A number of the gopher servers listed below are at universities. While the information given here is specific to food science and nutrition, university gophers contain a wealth of information on a large range of subjects. These include information on the campus, faculty and staff directories, and other information useful to faculty, staff and students. They also provide connections to other Internet resources in the state or elsewhere.

University of Maryland

gopher info.umd.edu

This site contains various USDA Food Composition Data bases such as the USDA Nutrient Data Base for Standard Reference and several data sets created for nationwide food consumption surveys. To get to the USDA Food Composition Data make the following selections from the menus:

Educational Resources
Academic Resources by Topic
Agriculture and Environment Resources
United States Department of Agriculture (USDA)
USDA Food Composition Data

Food and Nutrition Information Center, NAL

gopher gopher.nalusda.gov

This site contains information about the Food and Nutrition Information Center (FNIC) at USDA's National Agricultural Library. Electronic copies of many FNIC publications and references are available for downloading. These include compilations of references on a wide variety of food and nutrition topics, nutrient data base software, and other electronic source of information.

U.S. Department of Agriculture, Extension Service

gopher esusda.gov

This site contains a wealth of information on USDA. It also has other government information, such as the text of the GATT and, NAFTA agreements.

Environmental Protection Agency (EPA)

gopher gopher.epa.gov

This site contains EPA information and publications covering rules, regulations & legislation. There is also a section on consumer information. It also provides links to other environmental gophers.

Library of Congress

gopher marvel.loc.gov

This gopher contains data bases on legislation and Congress. There are also links to Senate and House gophers and information.

World Wide Web

The World Wide Web (WWW) is a more advanced protocol for accessing Internet resources. It is perhaps the next "killer" application for PCs and has been the subject of numerous articles in both the computer and the popular press. While adding such features as pictures and sound, it incorporates other, earlier protocols, such as gopher, as well. WWW resources are available through a graphical browser such as Mosaic (and its many competitors) or a text-based one such as Lynx. Many of the commercial services, such as CompuServe and America OnLine are adding WWW browsers to their repertoire.

WWW sites are accessed via a Universal Resource Locator (URL). The URLs for some food and nutrition related web sites and a capsule summary of the information provided are given below. Check the manual which came with your software to find out how to enter the URL and connect to that site. When you type in the URL for the site, an introduction or "home page" will be presented. These "home pages" provides connections to the various resources. While the URLs for universities given here are for the food science and/or nutrition departments, university WWW serves contain a wealth of information on a large range of subjects. These include information on the campus, faculty and staff directories, other information useful to faculty, staff and students, and connections to other Internet resources in the state or elsewhere.

Infoods

http://www.crop.cri.nz/crop/infoods/infoods.html

This WWW site in New Zealand provides information on Infoods, an international resource on food composition data. It also contains various food composition references and other relevant information.

USDA Food Composition Data

http://www.inform.umd.edu/EdRes/Topic/AgrEnv/USDA/ USDAFoodCompositionData

This WWW site hosted at the University of Maryland contains various USDA Food Composition Data bases such as the USDA Nutrient Data Base for Standard Reference and several data sets created for nationwide food consumption surveys.

Swiss Food Composition Data

http://food.ethz.ch:2000

A prototype food composition data base prepared by the Institute for Scientific Computing in Zurich, Switzerland. It contains a program for querying their data base, and a library containing software, pictures and additional documents. There are also links to other servers and information on other projects.

Food and Drug Administration

http://vm.cfsan.fda.gov/index.html

This WWW site contains information on CFSAN, including E-Mail addresses for all CFSAN employees. It also provides access to other U.S. Government WWW Servers as well as other U.S. Government Internet resources.

National Institutes of Health

http://www.nih.gov

This WWW site contains information from the National Institutes of Health on a variety of health related subjects. Health information is provided on cancer and AIDS. NIH consensus statements are also available. Information on NIH programs such as Grants and Contracts, and Scientific Resources is also provided.

University of Minnesota

http://fscn1.fsci.umn.edu

This WWW site contains information on Department of Food Science. There is also an outline of course on the Internet which is available for food science students. This site also hosts the home page for IFT's Food Law and Regulations Division. This home page has links to many food law resources such as food related government agencies; sites providing full text of the Federal Register, the Code of Federal Regulations and the U.S. Code; and other related materials. The Food Law and Regulations home page can be accessed directly through the following URL:

http://www.fsci.umn.edu/FoodLaw/foodlaw.html

Cornell University

http://aruba.nysaes.cornell.edu:8000/fst.htm

Another University WWW site. It contains information on Food Science Department. This WWW site allows the web browser to look up any food science faculty in the U.S.

University of Arizona

http://128.196.106.42/nutrition.html

This university WWW site has a link to USDA Food Composition Data at the University of Maryland. There are also a number of other resources in food and nutrition.

White House

http://www.whitehouse.gov

This very popular WWW site provides access to White House press releases and other information. There is also a section on White House family life and you can take a tour of the building. This site also provides connections to other government servers, both WWW and gopher.

Capitol Hill and Congress

http://thomas.loc.gov

This recently announced WWW site allows users to obtain all sorts of information on Congress. The full text of house and senate bills are provided, searchable by either free text or the bill number. The bills from the 103rd and 104th Congress are available. Access to the Congressional Record will also be provided. There is also access to the House gopher and the C-Span gopher.

CIA

http://www.ic.gov

This once secretive agency has joined the Information Superhighway. While not technically food or nutrition, the World Fact Book contains information on all the countries of the world prepared by the CIA which is useful in many disciplines.

Conclusion

The best way to find information on the Information Superhighway is to get on and try it. Look at some of the gopher and World Wide Web sites listed here. They will provide links to other sites and lead you to sources of information you didn't even know existed. If you do not find what you are looking for today, look again in a couple of weeks. New servers are being added constantly and new information is being added at existing sites. So, let's get on the Information Superhighway and see what's out there.

Trends and Changes in American Food Patterns

Trends and Changes in Consumer Attitudes about Nutrition and Food Shopping
Michele Tuttle, Food Marketing Institute

Toward 2000: A Look at Restaurant Trends
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Trends and Changes in Food Patterns from the CSFII: Implications for Databases
Alanna Moshfegh, ARS, USDA

Developing and Maintaining a Nutrient Database for Food Frequency Questionnaires
Helaine Rockett, Channing Laboratory

Trends and Changes in Consumer Attitudes About Nutrition and Food Shopping

by Michele M. Tuttle, MPH, RD, Director, Consumer Affairs, Food Marketing Institute

In 1994, the average supermarket contained approximately 30,000 items from which consumers could make selections. With so many choices to make, consumers can easily feel overwhelmed and confused, especially when it comes to making decisions about eating healthfully.

Each year, the Food Marketing Institute (FMI) conducts two consumer survey studies to assess what shoppers want from their supermarkets. The survey data include information on store attributes as well as attitudes about nutrition. The information presented today highlight results from *Trends in the United States: Consumer Attitudes and the Supermarket, 1995* (published annually by FMI since 1973) and *Shopping For Health, 1995: New Food Labels, Same Eating Habits?* (published jointly by FMI and Prevention Magazine since 1992). Both studies are conducted via telephone interviews with approximately 1,000 participants. Participants were contacted via random digit dialing and represent a nationwide sample of supermarket shoppers.

Trends in the United States, 1995

Store Attributes

Many factors influence where a consumer decides to shop. The five most important factors are having quality produce (99%), a clean and neat store (99%), good variety (98%), low prices (97%), and courteous employees (96%). In addition, 84% of shoppers report that having nutrition information available to them in the supermarket is very or somewhat important.

Factors in Food Selection

For many years now, a vast majority of consumers (90%) have reported that taste is their primary concern when selecting foods, followed by nutrition (74%), price (69%) and product safety (69%). Of these factors, the importance of price and product safety have fluctuated over time, while the other factors have remained relatively stable for the past 10 years.

Attitudes About Nutrition

While a majority of consumers report that nutrition is important to them when they select foods, 57% report that they are "very concerned" about the nutritional content of what they eat. The number of very concerned shoppers has fluctuated between 55 and 64% over the past 7 years, with no clear trend in either direction.

Consumers are currently most concerned about the amount of fat in their diets. This year, nearly 65% of shoppers reported fat as their main concern, an eight-fold increase since 1984. Only cholesterol has ever approached this level of concern when in 1990, 44% of shoppers ranked this as their main concern. In 1995, only 18% of shoppers felt that cholesterol in food was their primary concern.

Most consumers (70%) feel that their diets could be somewhat or a lot healthier. Only 20% feel their diets are healthy enough, while 10% feel that their diets are as healthy as possible. Most respondents (92%) report that they had made dietary changes for a more healthful diet. The most frequently reported dietary change was increasing consumption of fruits and vegetables (63%), followed by eating fewer fats and oils (34%), and eating less meat (34%).

When asked who has primary responsibility for ensuring that the food products they buy from the supermarket are nutritious, many shoppers (45%) feel that they themselves are responsible. An additional 23% report that manufacturers are responsible, while 13% feel that government agencies should be responsible.

Shopping for Health, 1995

Since 1992, the *Shopping for Health* study has surveyed shoppers on a variety of topics related to attitudes about health and eating. Each year, the study focuses on certain core areas and then also examines a specific area related to nutrition. This year's study focused on the Nutrition Facts label and its impact on shoppers.

Attitudes About Nutrition

Most shoppers are interested in nutrition when grocery shopping but confusion exists about how to make healthful selections. When shoppers were asked to respond to the statement, "There is so much conflicting information, I am not sure what to eat anymore," 44% mostly or strongly agreed. This number has risen somewhat since 1992 when 41% agreed that there was too much conflicting information.

Shoppers are also increasingly in agreement with the statement, "I am tired of experts telling me which foods are good for me." In 1994, 47% reported that they either mostly or strongly agreed with this statement, while this year, 55% agreed.

Although shoppers may be tired of experts, over 40% agree that they are concerned about fat but are unsure how to reduce their intake. However, this proportion of shoppers has declined from last year when nearly 50% agreed that they were unsure about how to reduce their dietary fat. The introduction of the new food label may be helping consumers gain confidence in their ability to make lower fat choices.

A greater number of consumers now believe that eating healthfully is more expensive. Fifty-one percent of consumers mostly or strongly agreed with this statement, which is a significant increase from 1992 when only 43% agreed.

Dietary Change

Although people feel there is a lot of conflicting information and that eating healthfully is more expensive, 53% reported that they had made major dietary changes for health reasons. This number has declined since 1992 when 58% reported making changes. Most people make changes for weight control and to achieve a healthier lifestyle. The most frequently mentioned change was dietary fat reduction (70%), which has steadily grown since 1992. In addition, 24% of shoppers report increasing their consumption of fruits and vegetables, while 15% report reducing dietary cholesterol.

Nutrition Labeling

Many shoppers report that they read the nutrition labels on food packages when purchasing a food item for the first time. More than 60% of consumers said that they almost always read the nutrition label, while an additional 19% report that they sometimes do. Despite this high number of label readers, only 43% report that they are aware of the new Nutrition Facts label, which began appearing on packages in late 1993 and 1994. This represents a slight increase since 1994 when 38% reported awareness of the new label.

The new label is having an impact on food purchasing behavior. Of those consumers who were aware of the new label, 22% report that they have started buying a product based on the labeling information. Approximately one-third (34%) of consumers reports that the label caused them to stop buying a product they had been regularly purchasing. When shoppers were asked what information had prompted their change in purchasing behavior, fat was mentioned most frequently. Sodium, cholesterol and calories were also factors that made people change their minds about buying products.

The results of this year's *Trends* and *Shopping for Health* studies clearly indicate the public's need for clear, consistent messages on healthful eating. There are also indications that people are beginning to understand ways of reducing dietary fat but they may be paying less attention to other nutrients. Unfortunately, there is also a trend to believe that healthful eating costs more. Although a majority of consumers are still unaware of the new label, a significant number of those who are aware are changing their purchasing decisions based on labeling information.

Toward 2000: A Look at Restaurant Trends

by Jane Y. Wallace, Editor/Publisher Emeritus, Restaurants & Institutions Magazine

As the American diet changes, they need for nutritional information also changes. Twenty years ago, who would have thought we would need a nutritional profile of fajitas? And as our lifestyles are changing, more and more food is being consumed away from home. Since new food trends often begin in foodservice, we will look at both lifestyles and foodservice menu trends during this presentation.

1. EATING OUT AND MENU TRENDS

2. Foodservice share of Total Food Market Today--45.9% Total Food Dollars, 34.9% Total Food Volume. Will reach 50% of dollars by 2000.

3. Meals Eaten Away from Home in Average Week: 11.6% Breakfast. 40.1% Lunch. 29.2% Dinner, 19.1% Snacks and Other.

4. Remember When? Although there have been restaurants for centuries, foodservice as we know it has really developed in the last 50 years.

5. Chicken Croquettes, canned peas are a typical restaurant meal from the '40s.

6. Togetherness was the by-word in the '50s--This illustration of mom in her apron with homemade cake made for her traditional family gathered for a family dinner is from the 50's edition of McCall's cookbook

7.Ethnics weren't called that in the '60s, But this spaghetti and meatballs with red wine was popular on menus even then.

8. In the '70s women went to work outside the home. The result was a foodservice revolution. And there's no indication that we will ever return to the traditional '50s meal service.

9. In the '80s, the biological clock caught up with the previous decade's rebels, and couples began to marry and have children. This caused yet another change in foodservice.

10. Mid-Life Crisis: The Influence of Aging Baby Boomers

11. Remember the Couch Potatoes? These two-income families--with a new potato and a tater tot to look after--didn't want to cook, because both were tired when they got home from their jobs. They were even too tired to face the hassle of going out to eat with the kids, so they made take-out and home delivery an important new part of foodservice.

12. These same aging Baby Boomers also focus on healthy lifestyles. They want to control their own bodies. Diet, exercise and genes are the three factors involved. While they haven't yet learned to control genes, diet and exercise are controllable.

13. Movable Feasts: More Meals Delivered to the Home

14. Ordering pizza for home delivery became so popular that it gave birth to a major chain--Domino's. Ultimately, the Couch Potatoes did re-join the eating out population, but take-out and home delivery remain a strong part of the way we eat.

15. Take out and home delivery have come a long way from ordering in pizza or Chinese. In urban areas, can order almost any ethnic or gourmet meal for take-out or home delivery. In fact, my daughter's pantry is full of take-out menus instead of staples!

16. Day Care Centers for Both the Young and Old. Two-income households have also caused other changes that provide opportunities and challenges for foodservice.

17. Eating away from home starts even before school for many children. Day care is a necessity for mothers who must work to support families. School foodservice, despite threatened cutbacks, continues to help children get proper nutrition. These meals are often the source for most of the nutrition inner-city children get.

18. But day care is no longer just for kids. The "sandwich generation" often finds it is necessary for aging parents as well. The same woman who can't be at home with her kids because of her job is also unable to care for older family members. Some experiments with mixing kids and seniors seem to work well.

19. Down-Aging: Increased Life Expectancy and Expectancy from Life. When we look into the mirror today, we see a person who is younger than we remember our parents were at our age. Some of this is perception, but some is also reality.

20. Not only are Americans living longer, but they are living healthier as well. The WOOF's (Well Off Older Folks) have both the means and desire to eat out. They are at the top of their income-earning years, their kids have finished college, and their mortgages are almost paid off. They appreciate The Good Life.

21. Today's retirees are not in the habit of eating three meals a day at home, either. They can exchange time for money, and are great users of "deals"

22. The Old-Old: A Growing Infirm Population

23. In spite of living healthier longer, our aging population has put a strain on nursing home facilities. Nearly half of all the money a person who lives into his or her 89's spends of health care is spent in the last two years of life! Society is seeking ways to deliver both food and health

services to the infirm in their homes to both hold down costs and lessen the psychological impact of "going into a home."

24. Great Expectations: Acceptance of Nutrition's Role in Disease Prevention

25. The idea of using diet and exercise to prevent disease has grown since its beginnings in the late 70's. The danger is that we may begin to expect too much. When we do, we embrace fad diets that may do more harm than good. But following the American Dietetic Assn.'s advice, "Eat what you want, but don't eat too much or too often," is appealing. Many Americans are actually changing the way they eat.

26. Today American diets include more grain and less fat than in the past as shown by this grilled chicken salad. Americans also demand more information on what is in the food they eat, no matter whether it is eaten at home or away. Grilled chicken Caesar salad was the dish most added to menus in 1993, according to R&I's Menu Census.

27. Multi-National Food Fright: International Concern for Food Safety

28. As the world's breadbasket has become multi-national, there is a demand for information on fertilizers and pesticides used not only in this country (remember the apple scare?), but....

29. ...overseas as well (remember the Chilean grape scare?)

30. We've Only Just Begun: Utilizing more of Nature's Bounty

31. As we look around the world for food sources, we add new foods to out diet--such as the kiwi which made its first appearance on menus in the 70's. "New" foods are a challenge to researchers who must provide nutritional data on them. Grains from around the world are currently finding their way onto American menus.

32. Aquaculture is another new area for food production. Seafood is now being farmed instead of hunted. This availability has made fish such as salmon and catfish widely available. But farmed fish may not have the same nutrient profile as wild fish. The good news is that once a farmed fish profile is developed, it is not as likely to change as wild fish.

33. Label of Contents: Greater Demand for Nutritional Content Information

34. The USDA Food Pyramid is only one basic guide, and must be constantly reviewed. What's more, Americans who take its advice seriously are demanding more information and better labeling on the food they consume.

35. Today even companies such as McDonald's are required to provide nutritional data, The demand for nutrient information will continue to grow even faster than in the past.

36. Bioengineered foods are another challenge to those providing nutritional data. The bioengineered tomato has caused foodservice to debate the use of these foods. Many feel that labeling should be required. There is concern that a peanut gene might effect those with peanut allergies, for example. Vegetarians do not want to eat berries that have a fish gene bioengineered into them to keep the berries from freezing as fast as they do naturally. The farther up the scale we go, the more people fear that if we can bioengineer the food we eat, we might also begin to bioengineer humans. John Naisbitt, author of "Megatrends," has called this fear the "abortion issue of the next century."

37. Variations of Vegetarianism; The Alternivoires

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38. Vegetarian-type items are one of the fastest-growing categories on today's foodservice menus. Some of the foods are strictly vegetarian, as the stuffed onion, spinach and tomato dish shown. But the big market is not for philosophical vegetarians. It is the group we call "alternivoires." Our research shows that this group orders both vegetarian offerings and hamburgers in the same week. They look at the vegetarian dishes as healthful and as menu variety.

39. Because of the alternivoires, vegetarian dishes have gone mainstream An example is this Chi-Chi's Veggie Chijita.

40. But don't be fooled. Americans are not embracing a vegetarian philosophy 100%. The other big growth area on the menu is beef. While the beef is much leaner than in earlier years, and, as this photo shows, it is combined with more grains and vegetables, meat is still an American mainstay.

41. Authentic Ethnics Go Mainstream

42. As this chart shows, four of the top five food categories that gained in popularity between 1983 and 1990 were ethnics. They are Mexican, +54.5%; Oriental, +47.4%; Pizza. +47.1%; and Other Italian. +46.7%. (The other category in the top 5 was Breakfast Sandwiches, +50%.)

43. In food service, most ethnic food served falls into the "Big Three" category: Mexican, Italian and Oriental. NRA research shows that 98% of all restaurants have some sort of ethnic dishes on the menu. 2/3 offer Italian. 1/4 offer Mexican, and nearly 1/5 offer some type of Oriental.

44. Italian dishes growing in popularity include the "pizza cousins" such as calzone and other stuffed pizzas, as well as the appetizer pizzas shown here.

45. In 1993, fajitas were the top ethnic entree added to menus, according to R&I's Menu Census.

46. While Oriental foods are not as widely served as other ethnics, dishes like dim sum (pot stickers) shown here, are no longer considered exotic.

47. After the Big Three, we find Second Wave Ethnics. The most popular, according to NRA research, are Hunan/Mandarin/Szechuan, German. Greek and Japanese.

47. Dishes such as the Szechuan Stir-Fry shown, not only have ethnic appeal, but also are perceived as healthful.

48. The sushi bar is only part of the appeal of Japanese food. The showmanship found in Japanese steak houses makes them one of the public's favorites.

49. Emerging ethnics, which are still found mostly in urban areas, but which may move into the mainstream, include Caribbean, Korean, Thai, Middle Eastern and Vietnamese. All of these cuisines tend to be more spicy than traditional American fare, and are part of the trend to foods with a higher flavor profile.

50. Caribbean offerings, such as the dish shown, often combine fruit with poultry and grains.

51. Two ethnics which are "on the horizon" may or may not make an impact. They are Brazilian and Indian.

52. The Indian dishes that seem most likely to find a place on menus are those such as the Grilled Chicken Kebob with Pesto Cous Cous shown. (Incidentally, today's ethnic offerings feature many grains such as cous cous and polenta that have not been a traditional part of American diet.) The other flavor that comes from India is curry, while the Brazilian dishes are often barbecued.

53. In addition to the general ethnics mentioned above, we also see an increase in regional ethnics such as this Tuscan bread tenderloin bread salad.

54. Probably the most important thing about these dishes, and the one that makes developing nutrient profiles difficult, is that they tend to combine several foods. Shown is a chicken lentil cassoulet which combines several different meat and poultry items with a variety of beans and lentils.

55. It Goes Both Ways. In this rapidly shrinking world we live in, it isn't just Americans who are embracing the cuisines from other countries. Other countries are also adding American dishes to menus--and it's not just Big Mac's or KFC chicken.

56. Shown here is one of the first Cajun dishes created by Paul Prudhomme in the 70's. As we all know, Cajun cuisine is now found around the world. This particular dish is not the original blackened redfish. It is Cajun rabbit served with crawfish--and a straight-up martini presented in a Mason jar.

56. Other American foods are also finding their way onto global menus. Shown is American trout with three different American Caviars.

57. But once again, let's not get carried away with the exotic. The US restaurant with the highest sales for an independent single unit is the Hilltop Steak House just outside Boston. It's menu remains basically steak and potatoes.

58. The Roadhouse Returns---Hilltop is not an isolated instance. Comfort food still appeals to our population. The roadhouse atmosphere is a bit of nostalgia. And while its offerings are definitely given a 90's make-over (skin-on mashed potatoes seasoned with swiss cheese and garlic), the old favorites such as meat loaf and beef stew can also be found.

59. Many road-house concepts also feature barbecue--often with a grill or pit as part of the exhibition cooking.

60. The Rotisseries Revolution.

61. Boston Chicken (now Boston Market) probably started the rotisserie trend, although it has been popular in Europe and Australia for decades. Today we find everything from chicken to bread being cooked on a rotisserie.

62. Sides--Shows

63. Vegetables and other side dishes are no longer just go-withs. They are making a name for themselves as independent menu items. Grilled vegetables, shown, are an example.

64. In addition to vegetables, chutney, salsa and relishes are gaining importance. The pork loin with blueberry-peach chutney shown is one example. And today's fruit salsas prove that tomatoes are not the only salsa base--making the development of nutritional profiles even trickier.

65. Daily Breads

66. Breads baked, or baked off, on-premise appeal to both restaurateurs and patrons. Old-fashioned dinner rolls have been replaced with whole-grain breads that come in every shape and size.

67. The Big Gulp. No matter what it is, if you can drink it, Americans will buy it. R&I's 1995 Menu Census shows that five of the top ten items that have grown in menu popularity since the early 70's. 5 are beverages.

68. The cappuccino coffee drink shown is only one of many coffee variations from cappuccino latte to espresso--and on and on. Specialty coffees can be found served everywhere from sports stadiums to hospitals today.

69. Fruit drinks are another big growth area--with cranberry, apple, tropical juices and blends all playing star roles.

70. To sum it all up, here is a list of What's Hot in foodservice:
- Breads--crusty, fresh, often ethnic
- Beans--especially black beans
- Grains, including rice, cornmeal, polenta and cous cous
- Chili--vegetarian or con carne
- Chilies--and other "hot" spices
- Chutney, salsa and relishes
- Marinades and vinaigrette
- Garlic--roasted, chopped, any everything else
- Asian ethnics including curries, satays, noodles and dumplings
- Grilled anything; also stir-fry
- Cheesecake (which has replaced apple pie as our top foodservice dessert)
- Coffee

71. And here's a list of some of the items consumers are ordering more often, based of R&I's Tastes of America Survey:
- Entree salad
- Grilled chicken
- Frozen yogurt
- Vegetarian entrees
- Decaf coffee
- Grilled fish
- Iced tea
- Stir-fry entree
- Grilled chicken sandwich
- Chicken wings
- Mexican food--fajitas
- Oriental food

72. But there are losers as well. Here is the list of some items consumers say they are ordering less:
- Cakes
- Pies
- Pork
- Spirits
- Ice Cream (regular)
- Soups

73. And here are the top items added to menus (in 1993) by category:
- Appetizer Chicken Wings
- Salad Grilled Chicken Caesar
- Vegetable Stir-Fry
- Starch Seasoned Fries
- Center of Plate Chicken-fried Steak
- Ethnic Entree Fajitas

Dessert Specialty Pie
Sandwich Chicken Fillet
Bread Pizza Bread/Focaccia
Beverage Cappuccino

74. According to R&I's 1993 Menu Census, these were the top entrees (sandwiches such as burgers not included) on foodservice menus:

Chicken Breast Fillet
Turkey Breast
Chili
Roast Beef/Prime Rib
Lasagna
Broiled/Grilled Chicken
Fried Chicken
Breaded/Fried Shrimp
Baked/Roast Chicken
Hamburger Steak

75. But it's important to remember that classics remain. While the french fries of the '70s have been given new twists as spiral fries, seasoned fries or skin-on fries, french fries remain on the top ten list year in and year out.

76. And while grilled chicken sandwiches have replaced burger as the top-selling item where served, more restaurants still serve burgers than any other sandwich item.

77. As America moves into the next century, it will be even more important, but also even more challenging, to have a nutritional data bank that is up to date and available to all. I know you will meet the challenge.

Trends and Changes in Food Patterns from the CSFII: Implications for Databases

by Alanna Moshfegh, USDA, BHNRC, Survey Systems/Food Consumption Laboratory

Data from the 1989-91 Continuing Survey of Food Intakes by Individuals indicate that diets in 1989-91 differed considerably from those in 1977-78. During this period, Americans shifted to a lower-fat, higher-carbohydrate diet. In 1989-91, Americans ate more grain products, especially grain mixtures; drank less whole milk and more lowfat and skim milk; ate more meat mixtures and fewer separate cuts of beef and pork; ate fewer eggs; and drank more carbonated soft drinks. Americans also ate more meals away from home and more "ethnic" foods. These dietary changes have implications for USDA's food coding data base. Over 1000 new food codes were created for items reported in CSFII 1989-91, including codes for frozen dinners, juice blends, processed cheeses, fast-food items, and many ethnic foods; as well as foods low in sodium, cholesterol, fat and calories.

Developing and Maintaining a Nutrient Data Base for Food Frequency Questionnaires

by Helaine R. H. Rockett, MS RD FADA, and Lisa B. Litin, RD CNSD

Food Frequency Questionnaire

The increased interest in nutritional etiology of disease has prompted development and evaluation of techniques to measure dietary intake (1). The food frequency questionnaire is an efficient, accurate method to assess individuals' diets in small and large studies (2,3). Food frequency questionnaires (ffq) are designed to measure average long-term diet rather than to provide a precise estimator of short-term intake such as that provided via a 24-hour dietary recall or multiple day dietary records (1). The epidemiological objective of the food frequency questionnaire is to categorize individuals by their nutrient intake (2).

Over the past 15+ years, investigators at Channing Laboratory, Harvard Medical School and Harvard School of Public Health have been developing and refining a semi-quantitative food frequency questionnaire used extensively in nutritional research studies. The earliest version of this food frequency questionnaire (ffq) consisted of a 61-item questionnaire which was shown to provide a reasonable measure of dietary intake among 200 registered nurses in the Boston area when compared with 4 one-week dietary records (1). This initial ffq has undergone constant evaluation and continues to be used in the ongoing Nurses' Heath Study of 200,000 women and the Health Professionals' Follow-Up Study of 50,000 men. Most recently, it has been reformatted and validated for an adolescent population. The current version of the adult ffq consists of approximately 140 food items.

The food frequency questionnaire is a list of foods with response categories answering "On average how often have you consumed this food in a specified time period (often 1 year)?". A typical set of frequency responses includes: never, 1-3/month, 1/week, 2-4/week, 5-6/week, 1/day, 2-3/day, 4-5/day and greater than or equal to 6/day.

Initially, the choice of foods on a questionnaire is often driven by a specific research interest. For example, the original Nurses' Health Study ffq sought to categorize individuals by their intake of nutrients and food items that were hypothesized related to cancer and heart disease(2,3). Therefore some of the nutrients and food items of interest were protein, fat and fatty acids, vitamin A, carotene, and cruciferous vegetables (2).

After determining which nutrients or foods are to be the focus of the research, three characteristics should be met when choosing a food for a ffq: the food should be eaten often by a considerable number of the sample studied, the food should have the nutrient(s) being studied in a substantial amount, and the amount eaten should vary between persons (1). Using the above criteria, a long list of foods is initially generated and systematically reduced.

To ascertain more specific nutrition information, it is often beneficial (barring cost and space constraints) to incorporate open-ended questions to identify specific brands of multiple vitamins, margarine, cooking oils, cereals and foods consumed at least once a week that were not asked on the ffq itself.

To quantify intake, the frequency response is given a weight (ie response of "1" or "never" receives a weighting factor of 0.00, response of "2" or "1-3/month" receives a weighting factor of 0.07, response of "3" or "1/week" receives a weighting factor of 0.14, etc) and the nutrients for a specific food are calculated by multiplying this frequency weight by the amount of the nutrient in a standard portion. For example, if the subject reports an average intake of 1 cup of skim milk 2-3 times / day, the nutrient values for 1 cup of skim milk are multiplied by the weighting factor of 2.5. This process continues for all food items in the ffq and the values are summed across all foods and vitamin supplements in order to derive a daily nutrient intake value across all nutrients. This method is useful in ranking subjects according to food or nutrient intake (i.e. by decile) so that extremes can be identified and compared.

The ffq is a relatively inexpensive tool because it is self-administered and therefore minimizes costs related to interviewer time. Optically scannable forms can be used to facilitate data entry of the responses and minimize errors. Due to its low cost, the ffq is a very popular dietary assessment tool for large scale dietary studies (1). However, as with any nutritional methodology, some drawbacks do exist. There is a potential bias in that the correct response is dependent upon the subjects' memories(1). Individuals may answer questions as they think would be viewed as better nutrition, that is, under-reporting foods considered unhealthy and over-reporting foods considered healthy(1). The food frequency questionnaire does not retrieve unique individual details of the diet unless,specifically designed to do so (1). Therefore, the items on the "typical ffq" may be inappropriate for subjects with culturally diverse food consumption patterns unless the ffq is designed for the specific population (4).

The Basis of Harvard's ffq Database:

The database used for Harvard's food frequencies questionnaires' nutrient analysis is a specifically designed program documented as "harvardsffq.date." The foundation of the database is the US Department of Agriculture Standard Reference supplemented with the Food Consumption Survey data and additional information from McCance and Widdowson's *The Composition of Foods* (4th and 5th editions), journals, and manufacturers (5-7).

US Department of Agriculture obtains data from USDA analyses and other government laboratories as well as food industry and literature. This is the number one source of nutrient values because of the standard experimental procedures and representative large sampling of American foods (5).

McCance and Widdowson's *The Composition of Foods* (4th and 5th editions) provide additional foods and nutrients not available in the Handbook 8 series. Again the majority of the analyses of the foods listed in the book were conducted by the government laboratories or other contracted facilities (6,7).

Scientific journals are used for specific nutrients that are not provided by USDA or provide the most recent analyses. This is used particularly when one specific nutrient is being studied by an epidemiologist.

Manufacturer's information is used primarily in our cereal and vitamin tables that are brand specific. Additional information from manufacturers is used for new foods that have recently been created or are not available from the usual sources.

How a Ffq Database is Different from a Dietary Record/Recall Database:

To understand the difference between a ffq database and a dietary record database, you must consider the instrument used to gather the individuals diet information. A food frequency questionnaire, as discussed above, is different than a dietary record or recall. The database therefore must also be different. The harvardsffq database has core foods that appear on the different versions of the questionnaire. Approximately 200 core foods (for several different food frequency questionnaires) are in our database. The preparation of the food in the database is specified by the questionnaire (ie raw, fresh, cooked, etc). So, each food item on the ffq has a corresponding food item with its nutritional composition in the database. In a dietary record database, one food might be a combination of food items in the database (ie fried fish = fish + breading + fat) thus individualizing the nutrients eaten.

Following this same format the harvardsffq database has a specific portion size that each food on the questionnaire states or implies (bread - 1 slice, milk - 1 cup) and this is how it is found or calculated in the database. Portion sizes can be natural units (1 slice of bread or 1 medium apple) or commonly used portions based on literature (8). Some food frequency questionnaires, such as Block (9), have variable portion sizes (small, medium, large) but these are also rigid sizes predetermined and the specific food frequency is multiplied by this portion. This is again different than the diet record database where portion sizes can vary from individual to individual.

The cereal, oil, margarine, and vitamin open-ended or write-in sections on the Harvard ffq are brand specific. The distinctive brands of these food items require maintenance of additional nutrient files for cereals, oils, margarines, and vitamins. The databases for these sections may be similar to a dietary record database. However, they are processed following the ffq format using weighted frequencies multiplied by specific nutrient content of that food. The frequencies of these items are based on the frequency response for that question using a standard portion size. For example, if the cereal write-in section has "Rice Krispies" as a response, the computer program first picks up the frequency of the cold cereal question provided in the ffq and then picks up nutrients specific for "Rice Krispies" in our cereal table. This occurs on every questionnaire for vitamins, oils, margarines and cereals. In addition to these write-in sections, there is also the additional foods section. If a food is consumed at least once a week and is not included in the frequency section of the questionnaire, it can be written in by the subject with any specified amount and frequency. The food is then coded with an appropriate portion and frequency, and then analyzed in a similar manner as the rest of the foods on the questionnaire.

The foods listed on the questionnaire and the nutrients stored in the database are driven by what epidemiologists are studying. This is another difference from the dietary record database. The dietary record database is based on all foods that the population eats. It does not differentiate foods in the database by those three criteria that put a food on an ffq: that a food must be eaten often by a considerable number of the population, foods must have the nutrient(s) being studied in a substantial amount, and the amount eaten must vary between persons. In addition to the core foods found on the Harvard questionnaires, specific foods are added to and deleted from the questionnaires based on what is being studied. New foods that have been added and/or deleted over time include onions, garlic, soy sauce, raw carrots, raw spinach, and coleslaw. In addition to the core nutrients in the database, other nutrients are entered based on new research that is looking at these "new" nutrients or non-nutrients. Some new nutrients and non-nutrients that we have updated our database with are: flavonoids(quercetin, kaempherol, and myricetin), fibers (Englyst, Southgate, AOAC, insoluble, cellulose, hemicellulose, lignin, soluble), trans fatty acids, phytate, and oxalate.

With more than 130 nutrients, there are foods in our database with blanks for specific nutrients because there is no resource available. In our nutrient analysis blanks or missing values are treated as zero. Therefore, the objective in the harvardffq database is to not leave a blank unless the nutrient is assumed to be negligible. To fill in these missing values, nutrients are imputed from either similar foods or from a recipe designed for that food. If there is not a similar food or a viable recipe cannot be written to fit its nutrient breakdown it is then left as a missing value. There are very few such foods and these have been documented to be blank. This may not be true in record databases that may allow more blanks.

Finally, the harvardffq reference system may be different from record databases in that it is designed for the investigators using the database. In research today, verification of the source of each nutrient is necessary, particularly when the research not only receives public attention through the media but also is shaping policy and health recommendations. For example, folate has been found to reduce the prevalence of neural tube defects (10) as well as reducing the incidence of colorectal cancer (11). Due to these and other on-going studies involving heart disease, the Recommended Daily Allowance for folic acid is being reevaluated. The source of the folate then must be accurate and exact. Our reference system documents the reference source for each nutrient of each food. This is very specific and each new reference has a specific number that can be used all through the database. There is also a date attached to the reference code to note when it was added or changed.

Updating the Database

A nutrient data base needs to be constantly updated and expanded as new foods and supplements become popular on the market or updated nutritional data becomes available. With the help of a computer programmer, an on-line editing system can be set up for the data entry of new foods and nutrients. Data entry by hand is the primary method for adding information to the data base that has been obtained from scientific journals or manufacturers. However, the majority of foods and nutrients in current databases are from data provided by USDA. In the past, this information was available on tape to purchase and thus minimized data entry time and inaccuracies. More recently, the entire USDA Handbook 8 Series as well as nutrients from the Nationwide Food Consumption Surveys are available over the Internet. Our programming is devised to electronically update or add new foods or nutrients to the system. Advanced technology has greatly enhanced the data entry process. This saves an extraordinary amount of time and minimizes errors associated with manual entry.

In order to maintain internal quality control of the database, various cross checks are performed on a regular basis. Our first quality control step is that all updates and additions that are hand-entered are cross checked for accuracy. Updates and additions that are computer driven are checked by the dietitian doing the update. The values that are imputed or recipe driven are linked throughout the data system so that if one food is updated then any other food that has it as an ingredient or is dependent on it will automatically be updated or flagged.

The second quality control step has three parts or programs. Before the temporary files, where all editing occurs, are updated to permanent files which cannot be altered, three programs are run to additionally check for errors. The first is a "nutdiff" program that compares the temporary file to the permanent file and records the differences. These changes are verified for accuracy. The second is a "checknut" program that checks all subcomponent parts of a specific nutrient that they add up to that nutrient. For example, this program would make sure that the sum of the amino acids do not exceed the total protein, the sum of the fatty acids do not exceed the total fat, the caloric content is approximately equal to 4*(carbohydrate + protein) + 9* fat + 7*alcohol. The last program of our second quality control step is a standard test file that is maintained with an analysis output. The standard test file is run each time the files are updated with the new permanent data file and the old analysis is compared to the new analysis. Differences must all be verified.

The third quality control step is added when the permanent version is made; the version is dated and a comment area is attached to the file to note what revisions (changes in the foods or nutrients) have been made. This provides additional control over a large database with numerous versions. In addition when an analysis is generated, the dated nutrient files and the analysis program are referenced on the output files. This provides a record of the specific files used for the analysis and any analysis can be reproduced if necessary.

Future

The future direction of food frequency databases will, of course, follow the demands of research. Some of the new areas that are being studied in nutritional epidemiology are the non nutrient components of food (phenols), the use of food frequency questionnaires with new groups (eg. older children and adolescents as well as elderly), and the use of additional biochemical markers and corresponding nutrients to validate questionnaires. Our changing food supply will also direct our efforts to maintain a database that is current with what people are eating. This includes the ever increasing cereal and vitamin markets as well as the different trends in formulated foods such as "no fat" bakery products as well as the nutrients they provide. Finally the continual changing technology of computers requires that we do things faster, more accurately and in a smaller space. Preparing the pc operating version of the harvardsffq database is in progress and will be our next technological change to our database.

In conclusion, the harvardffq database has changed tremendously since its inception in 1980. We have more than tripled the nutrients and quadrupled the number of foods. With the ever increasing pace of change brought on by computers and the information highway, we are now providing more information to more studies looking at what people eat and how this affects all of us.

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Trends and Changes in the Food Supply

Biologically Active Components in Foods
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New Food Ingredients and Pharmaceutical Foods
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Impact of NLEA on Food Composition Databases
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System Drift and Dietary Data Analysis
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Biologically Active Components in Foods

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The flavonoids comprise a large group of naturally occurring, low molecular weight compounds that are present in all vascular plants. They are present in fruits, vegetables, nuts, seeds, stems, flowers, bark, tea, and wine and the average Western diet contains approximately 100 to 1000 mgs per day. The remarkable properties exhibited by these compounds make it possible that they should be considered natural dietary biologic response modifiers, i.e. disease-preventing, health promoting substances. The flavonoids have been shown in both in vitro and in vivo experimental systems over several decades to possess antiallergic, antiinflammatory, antiviral, anticancer and anticarcinogenic activities. In addition, some of them are potent antioxidants.

With respect to antiallergic activity it is now well known that certain flavonoids, depending on structure, can inhibit the stimulated release of proinflammatory mast cell, basophil and eosinophil granular constituents that participate in the pathogenesis of diseases such as asthma, allergic rhinoconjunctivitis, urticaria and others. Quercetin is a particularly active inhibitor as described in greater detail below, while taxifolin (dihydroquercetin) lacked activity.

Antiinflammatory activity can be assessed by the effects of flavonoids on neutrophil function. Certain flavonoids including quercetin have the capacity to inhibit neutrophil activation with production of superoxide anion and activation of phospholipase A2 and NADPH oxidase.

Activation of the latter enzyme results in neutrophil generation of superoxide anion, a tissue-damaging oxygen radical. Quercetin inhibits the release of 3H-arachidonic acid from prelabelled cells following a non-immunologic stimulus (zymosan-activated serum) thus indicating that quercetin can inhibit neutrophil phospholipase A2.

Antiviral activity has been demonstrated with quite a few viruses although no clinically or commercially successful flavonoid has been discovered. Selected flavonoids can inhibit viruses such as polio virus type 1, parainfluenza virus type 3, respiratory syncitial virus and herpes virus type 1, amongst others. Four flavonoids were examined for their ability to affect viral infection of tissue culture monolayers or, once the monolayers were infected, the ability of the flavonoids to inhibit replication of the virus intracellularly. Quercetin (a flavonol) exhibited both antiinfective and antireplicative activity against each of the four viruses. Hesperetin (a flavanone) showed only antireplicative activity. Catechin (a flavan) had no antireplicative properties but showed antiinfective activity against respiratory syncitial virus and herpes simplex virus type 1. Naringin (a flavanone glycoside) exhibited neither anti-infective nor antireplicative activity against any of the four viruses. Clearly there are unique structure activity relationship to be considered with respect to antiviral activity of flavonoids. Of particular note with respect to antiviral activity is the fact that certain flavonoids have activity against three enzymes that are critically involved in the life cycle of the human immunodeficiency virus, namely, antireverse transcriptase activity, antiintegrase activity and antiprotease activity.

The antioxidant activity of certain flavonoids has been recognized for some time. Some of the flavonoids are as potent or more potent than familiar antioxidants such as vitamin E and beta carotene. Of current interest is the presence of potent antioxidant flavonoids in red wine. The explanation of the "French paradox" may lie in this observation. The French paradox indicates that Frenchmen eat quite a lot of fatty food but do not have a very high incidence of coronary artery disease. A possible explanation is that the French consume a fair amount of red wine with their meals and that the antioxidant activity of the red wine may account for the antiatherogenic activity.

Chemically, the flavonoids are phenylbenzo-,y-pyrones with two major groupings, i.e. flavones with the phenyl group at the 2 position of the chromone moiety and isoflavones with the phenyl group at the 3 position. There are a number of other chemical variations of the flavonoids that are characterized by the reduction of the C2-C3 bond and the degree of hydroxylation or methoxylation (or other substituents) in the A, B and C rings. There are now over 4,000 flavonoid compounds in nature that have been structurally characterized. Clearly these compounds must be of importance in plant physiology and biochemistry or they would not have survived evolution. The activity of various flavonoids in different mammalian cell testsystems is profoundly affected by structure including changes in the degree of hydroxylation, methoxylation, the state of oxidation of the C2-C3 double bond and the presence of the C4 keto grouping. Certain flavonoids can undergo dimerization or oligomerization to provide very interesting and novel compounds. It is of considerable interest that the antiallergic drug cromolyn, which is used in the management of asthma and allergic rhinoconjunctivitis, is structurally very closely related to naturally occurring flavonoids. Cromolyn is a bischromone, that is, 2 chromone moieties (the benzopyrone ring system) attached to each other via a short carbon bridge.

Information accumulated over the decades indicates that a number of mammalian enzyme systems can be affected by selected flavonoids. Some of these enzyme systems can be listed: protein kinase C, protein tyrosine kinases, myosin light chain kinase, phospholipase C, phospholipase A2, lipoxygenase, cyclooxygenase, cyclic nucleotide phosphodiesterase, and ATPases, amongst others. A number of these enzymes such as protein kinase C, protein tyrosine kinase, phospholipase A2 and phospholipase C are intimately involved in cell activation and signal transduction processes that occur in all physiologically stimulated cells.

A number of mammalian cell systems have been studied with respect to the effects of flavonoids on their function. These include (a partial listing) B and T lymphocytes, monocytes/macrophages, mast cells, basophils, eosinophils, neutrophils, and platelets. The effects of flavonoids on some of these cell systems will be briefly described.

In the mid 1970's, work was published from England showing that rat peritoneal mast cell histamine release stimulated either with antigen (from sensitized animals), the mitogen concanavalin A or the calcium ionophore A23187 was significantly inhibited by certain flavonoids. We decided to examine the effects of one of the flavonoids, quercetin, on the release of histamine from a somewhat related granule-containing cell, the human peripheral blood basophil. In summary, we found that quercetin caused a concentration-dependent (IC50 approximately 10 uM) inhibition of histamine release; quercetin only affected antigen-activated cells (see below); its onset of action was instantaneous; the inhibitory activity of quercetin was partially reversed by increased buffer calcium concentration (a nonsignificant effect); quercetin was antagonistic to the histamine release-augmenting effect of heavy water (ID20) suggesting an effect of the compound on microtubule assembly and function; and the action of quercetin was not potentiated by theophylline indicating that cyclic AMP-related mechanisms were probably not involved. Also, some interesting structureactivity relationships were discerned as will be described. A point of particular interest in these experiments was the observation that quercetin only inhibited histamine release when the cells had been activated by antigen; that is, peripheral blood leukocyte suspensions containing basophils could be incubated for 30 minutes with the flavonoid in the absence of antigen and washed later and then found to respond perfectly normally to the antigen stimulus with appropriate histamine release. That is, the basophils did not appear to have a tight-binding receptor for quercetin in the unstimulated state. On the other hand, if antigen was added to a suspension of basophil-containing leukocytes thereby initiating the histamine release reaction, then, the addition of quercetin to the ongoing histamine release reaction (at 2 or 5 or 10 minutes) caused an abrupt cessation of further histamine release. This suggests that a flavonoid- sensitive substance is generated in the antigenactivated basophil with interaction of quercetin with which abolished further histamine release. This is a rather novel pharmacological mechanism of action and is of considerable interest with respect to drug design.

In subsequent experiments with basophil histamine release we found that compounds with a reduced C2-C3 double bond, such as taxifolin (dihydroquercetin), were inactive as inhibitors of histamine release. Likewise the rharnnonsylglucoside of quercetin, rutin, also lacked activity as an inhibitor, perhaps by virtue of steric hindrance produced by the glycoside group. Certain other flavonoids also lacked activity if their chemical structure did not include certain basic features, namely, hydroxylation in the B-ring, double bond at C2-C3 and a keto group at C4.

Subsequent experiments were performed to find out whether selected flavonoids had an effect on histamine release from basophils stimulated by other secretogogues including anti-IgE, concanavalin A, the chemoattractant peptide f-met-leu-phe, tetradecanoyl phorbol acetate (TPA) (activates protein kinase C directly), and the calcium ionophore A23187. It was found that there were flavonoids that totally lacked activity against these various secretogogues but there were others that showed good activity as inhibitors of histamine release stimulated by these various secretogogues. The concentration-effect curves of flavonoids such as quercetin against eachone of these secretogogues did differ, however. It is possible that these differences in concentration-effect relationships represent differences in the signal transduction mechanism employed by the basophil for each of the different secretogogues and shows differential sensitivity to the effects of the flavonoids.

The effect of TPA to cause basophil histamine release suggested that activation of protein kinase C was a necessary step in the secretary process. To study this further we prepared a partially purified protein kinase C preparation from rat brain and studied the effects of flavonoids on protein kinase C activation by TPA. Fisetin, quercetin and luteolin were all very active at (50 uM) and a number of other compounds were less active and some totally lacked activity. Interestingly, the most active inhibitors of protein kinase C were also the most active inhibitors of TPA-induced basophil histamine release. Further kinetic studies with the rat brain preparation indicated that fisetin and quercetin caused inhibition of protein kinase C by virtue of blocking the ATP binding site in the catalytic portion of the enzyme.

The eosinophil participates in inflammatory reactions of various sorts including bronchial asthma, allergic rhinoconjunctivitis, inflammatory bowel disease, and certain dermatoses, to mention a few. The granulesof eosinophils contain several very toxic proteins that contribute to the pathogenesis of these clinical disorders. The eosinophil, like the mast cell and basophil, is a secretary cell and, therefore, we were interested to find out if quercetin and taxifolin had any effect on the secretion of eosinophil cationic protein and Charcot-Leyden crystal protein from the granules of partially purified eosinophils. The results clearly indicated that quercetin (10-50 uM) caused 70-90% inhibition of eosinophil cationic protein secretion while taxifolin had a negligible effect. Essentially similar results were found with the effects of quercetin and taxifolin on the secretion of Charcot-Leyden crystal protein. The stimulus for the release of these toxic granular proteins was the calcium ionophore A23187. Thus the secretary function of eosinophils, like that of mast cells and basophils, can be inhibited by quercetin.

The development of an inflammatory process must begin by trapping leukocytes in the vascular system of the tissue that is becoming inflammed. That is, activation of endothelial cells within the capillaries and venules of the tissue, (for example, the lung in asthma), must take place in order for leukocytes to adhere to the endothelium and then to undergo diapedesis into the inflammatory focus within the tissue. The proteins involved in the business of making leukocytes stick to endothelium are called adhesion molecules. There are many adhesion molecules now recognized. Some are present on the surface of endothelial cells and others, called counter receptors, are present on the membranes of leukocytes.

We were interested to know whether or not quercetin would inhibit the expression of one particular endothelial cell adhesion molecule known as intracellular adhesion molecule-1 following stimulation of the endothelial cells with endotoxin. Interestingly, quercetin caused a concentration-dependent inhibition of the expression of ICAM-1 in endotoxin-stimulated endothelial cells. The cells which we studied were human umbilical vein endothelial cells (HUVEC) in tissue culture. The possible importance of this observation with respect to diet and inflammation must be obvious.

Other cells are also involved in immune function and effects of flavonoids on these cells will be briefly described. The macrophage/monocyte is a cell critical to the initiation of the immune response. These cells take up antigen and partially digest it and present iton the cell surface so that it can interact with the T cell receptor to initiate an immune response. Some investigations have indicated that the process of antigen presentation can be inhibited in these cells by quercetin. T and B lymphocytes are essential cells involved in immune function. Certain flavonoids can inhibit lymphocyte mitogenesis stimulated by phytomitogens such as phytohemaglutinin and concanavalin A. Also, certain flavonoids, depending on structure, can inhibit the generation of cytotoxic lymphocytes in murine mixed spleen cell cultures. This observation clearly indicates that flavonoids can have an effect on cell-cell interactions and relates to the issue of adhesion molecules mentioned above. The B cell is the precursor of the plasma cell which is the principal antibody-producing cell of the immune system. Activation of the B cell antigen receptor causes B cell activation with accompanying phosphorylation of tyrosine residues in several proteins within the B cell. This process can be inhibited by the isoflavone genestein. Other experiments showed that B cell precursors stimulated with recombinant human IL-7 also resulted in phosphorylation of tyrosine residues in several proteins within the precursor B cell and this was accompanied by phosphytidyl inositol turnover with increased production of inositol trisphosphate. It was also found that genistein inhibited these effects. Phosphatidyl inositol turnover is a vital process in transmembrane signal transduction and a key enzyme involved in this process is phosphatidyl inositol kinase (PI 4-kinase). This kinase turns out to be inhabitable by the isoflavone orobol, and by quercetin and fisetin. The epidermal growth factor-induced phosphatidyl turnover in epidermoid carcinoma cells (A231 cells) is inhibited by the isoflavone psi-tectorigenin). The effects of flavonoids onantibody formation has also been studied. A unique flavonoid called plantagoside (a flavanone glucoside and an alpha mannosidase inhibitor) caused a concentration-dependent inhibition of mouse spleen cell antibody response to sheep red blood cells (antigen). Finally, cell mediated immunity or delayed-type hypersensitivity reactions can also be affected by certain flavonoids. As noted, the related phenomenon of mitogenesis stimulated by PHA or conA is inhabitable by certain flavonoids.

Flavonoids also affect platelet function. The platelet is now appreciated as a participant in inflammatory processes and it is of interest, therefore, the platelet aggregation and release reaction can be inhibited by certain flavonoids as can calcium mobilization and the adhesion of platelets to collagen. The latter observation once again points to the effect of flavonoids on adhesion molecules-dependent interactions.

It is now widely recognized that diets rich in fruits and vegetables appear to be associated with a reduced frequency of cancer of various organ systems. Clearly there must be substances in fruits and vegetables which have anticancer effects. The flavonoids are known to possess a number anticancer activities which can be briefly described at this point. Actually there are eight different mechanisms by which flavonoids may affect cancer.

Certain flavonoids exert anticarcinogenic activity. This can take place by induction of enzymes affecting carcinogen metabolism. Also, certain flavonoids actually inhibit adduct formation between carcinogens and DNA and finally certain flavonoids inhibit in vivo experimental carcinogenesis. A good example of the latter is an experiment where female rats that developed mammary carcinoma in response to a particular carcinogen were found to have a 50% reduction in the number of tumors as compared to control when they consumed a diet containing 5% quercetin.

In addition, certain flavonoids possess antitumor-promotor activity in which case the flavonoids inhibit the various activities of tumor promoters that are involved in the process of carcinogenesis. Moreover, antitumor activity in flavonoids has been described with a number of different hormone-dependent tumors. Also, certain flavonoids turn out to be very active antiproliferative agents inhibiting cancer cell proliferationin in vitro. Moreover, a rather extraordinary process stimulated by certain flavonoids is a prodifferentiation effect; that is, certain flavonoids can actually stimulate a malignant cell to develop into a mature phenotype. Also, inhibitory effects of certain flavonoids on the expression of the multi-drug resistance gene has been described. And, certain flavonoids affect topoisomerase activity which can be associated with reduced cancer growth. Finally, through teffects on adhesion molecule expression and function certain flavonoids can have an antimetastatic activity and reduce the development of metastases.

In summary then, some biochemical properties of the flavonoids include alteration of enzyme activity, antioxidant activity, vitamin C sparing activity, chelation of metal cations, inhibition of lipid peroxidation, radical scavenging activity and effects on protein phosphorylation. Some basic life processes that are affected by flavonoids include immune mechanisms, inflammation, cellular differentiation, heat shock protein synthesis, cancer, atherosclerosis, metabolism and perhaps even aging.

It seems reasonable to consider seriously the possibility that dietary flavonoids may be very important disease-preventing and health-promoting substances. Further research is definitely warranted.

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The interested reader will find an extensive bibliography regarding the contents of this article in: Middleton, E., Jr. and Kandaswami, C. (1993). The impact of plant flavonoids on mammalian biology: implications for immunity, inflammation and cancer, Harborne, J.B., 619-652, Chapman & Hall, New York.

New Food Ingredients and Pharmaceutical Foods

by Eric A. Decker, Associate Professor, Department of Food Science, Chenoweth Lab, University of Massachusetts

Abstract

Food can be designed to possess unique functional properties to meet the nutritional needs of a wide range of consumers. Original examples of such functional or pharmaceutical foods include Vitamin D fortified milk, enriched breads and iodized salt. Today, ingredients are commonly used to alter the nutritional composition of food products to decrease or replace fats, sugar and sodium or to supplement foods with minerals, fiber and unsaturated fatty acids. More recently, numerous biologically active components, endogenous to foods, have been proposed to be used as food ingredients. These compounds include antioxidants such as phenolics, dipeptides and carotenoids and anticarcinogens such as conjugated linoleic acid and thiosulfinates. Aspects of the practicality of designing foods/diets high in these biologically active compounds including labeling/regulatory restrictions, incorporation and stability in food products and interactions with other dietary components will be discussed.

Introduction

Pharmaceutical foods, hyperfoods, designer foods, functional foods and nutraceuticals are all terms designed to describe the concept of altering raw food composition or formulating processed foods to provide maximal nutritional benefits to consumers. While the use of these terms is relatively recent, the concept of functional foods has actually been a reality in the food industry for decades as products such as flour, bread, breakfast cereal and even salt have been fortified with essential vitamins and minerals. The Food and Drug Administration currently considers fortification appropriate to prevent widespread nutrient deficiency (e.g. iodine in salt); restore nutrients lost in processing (e.g. enriched flour and rice); balance the total nutritional profile with energy content (e.g. breakfast cereals); and to assure that substitute foods are nutritionally similar to the foods they replace (e.g. Vitamin A supplementation of margarine). Food such as candies, carbonated beverages and snack foods are not deemed as appropriate for fortification by the FDA.

The concept of functional or pharmaceutical foods describes foods which go beyond the practice of fortification to meet daily nutritional requirements. Functional foods would contain either large amounts of vitamins or minerals or elevated levels of nonessential dietary components which are believed to possess health benefits. Functional foods are already widespread and popular in Japan where foods and beverages containing compounds such as ginkgo leaves, oyster extract, oligosaccharides, peptides and ginseng. Functional foods supplemented with compounds such as fiber, polyunsaturated fatty acids, isotonic mixtures of sugars and minerals and live yogurt cultures are common in the U.S.. Even foods designed to be lower in fat, sodium and cholesterol could be considered functional foods. Unfortunately, the origin of many functional foods in the U.S. market is the direct result of the newest health fads and often the nutritional benefits of these foods is unknown.

Current interest in functional foods has concentrated on food components which have the potential to inhibit the development of common diseases. One such example is calcium supplementation of breads and orange juice to provide nutritional defense against osteoporosis. While vitamin and essential mineral supplementation has a long history, recent interest in functional foods has concentrated on many nonessential food components which have been shown to decrease the risk of cancer, heart disease and intestinal disorders. The purpose of this review will be to explore several classes food components which possess biological activity. Problems associated with the production of functional foods in relation to food processing, nutritional, biochemical and regulatory issues will also be discussed.

Phenolics

Phenolic compounds in foods include simple phenols and phenolic acids, hydroxycinnamic acid derivatives and the flavonoids (Ho, 1992). These phenolic classes contain numerous compounds which are widely distributed in plant foods (Table 1). Since phenolics are found in virtually all plant foods often at very high concentrations, these compounds are consumed in quantities of up to a gram per day (Huang and Ferraro, 1992). Phenolic compounds influence the quality, acceptability and stability of foods by acting as flavorants, colorants and antioxidants. The presence of conjugated ring structures and hydroxyl groups allows phenolics (Figure 1) to act as antioxidants (Graf, 1992; Shahidi et al., 1992). In addition to the ability of phenolic compounds to inhibit lipid oxidation in biological systems, pure phenolic compounds and crude extracts from rosemary and green tea can inhibit oxidative reactions in processed foods (Shahidi et al., 1992). However, flavors associated with these extracts often limits their utilization as food additives. Phenolic compounds exhibit anticarcinogenic activity in numerous animal models (for review see Huang and Ferraro, 1992). The antioxidant activity of phenolics is thought to be involved in their anticarcinogenic properties. However, phenolic compounds could also be anticarcinogenic due to their ability to reduce the bioavailability of carcinogens, inhibit the metabolic activation of carcinogens, inhibit arachidonic acid metabolism, and inhibit of protein kinase C activity (Huang Ferraro, 1992).

The anticarcinogenic activity of phenolics has been correlated with inhibition of colon, esophagus, lung, liver, mammary, and skin cancer. Several examples of phenolic compounds which inhibit carcinogenesis include curcumin, quercetin, coumarins, caffeic acid, ellagic acid and catechin derivatives (Ho, 1992). The catechin derivatives, epigallocatechin, epigallocatechin gallate, epicatechin, epicatechin-3-gallate and gallocatechin are found in concentrations as high as 10.0% of the dry weight of green tea leaves (Balentine, 1992). In addition to catechins, green tea contains gallic acid, coumaric acid, caffeic acid and quercetin which also have antioxidant and anticarcinogenic properties. The positive antioxidant and anticarcinogenic profile of the molecular components of green tea has prompted extensive research on the health benefits of green tea extracts. Topical or oral administration of green tea extracts has been reported to inhibit mouse skin (Katiyar et al., 1993) and mouse forestomach and lung (Wang et al., 1992) cancer. While the majority of research indicates that green tea extracts exhibit anticarcinogenic activity, Hirose and coworkers (1992) found that green tea extracts can simultaneously inhibit small intestine and promote liver cancer in a rat multi-organ carcinogenesis model. This research along with reports of the carcinogenic activity of caffeic acid in rat forestomach epithelium and kidney, sesamol in rat forestomach, and catechol in rat stomach (Ito et al., 1992) suggest that substantially increasing the consumption of phenolic compounds may not be prudent until the anti- and pro-carcinogenic activities are better understood.

Phenolic compounds have also been associated with the inhibition of atherosclerosis. The association of dietary phenolics (especially in the form of red wine) and coronary heart disease (CHD) was observed in segments of the French population who have similar atherogenic risk factors (saturated fat intake and plasma cholesterol levels) as segments of the U.S. population but have much lower incidence of CHD (Renaud and de Lorgeril, 1992). The positive effect of red wine on CHD could be due to the effects of ethanol and/or the ability of phenolic compounds to inhibit lipid oxidation (Kinsella et al., 1993).

Oxidation of low density lipoprotein (LDL) is thought to result in increased accumulation of LDL into foam cells resulting in the acceleration of atherosclerotic plaque formation (Steinberg et al., 1989). Antioxidant nutrients (vitamins C and E, ß-carotene and selenium) have been postulated to decrease the oxidation of LDL and thus decrease the risk of atherosclerosis (for review see Esterbauer et al., 1992). Phenolic compounds from red wine inhibit the oxidation of LDL more effectively than a-tocopherol suggesting that red wine could decrease oxidation-induced atherosclerosis (Frankel et al., 1993; Kanner et al., 1994). Phenolic compounds in red wine which inhibit oxidative reactions include catechins, flavonols, anthocyanins and tannins. Since these phenolics are also found in a large number of other fruits and vegetables, these nonessential antioxidants could be partially responsible for the positive effects of fruit and vegetable consumption on CHD. Unfortunately, limited absorption data is available on dietary phenolic compounds.

Conjugated Linoleic Acid

Conjugated linoleic acid (CLA) is a term given to a group of linoleic acid (18:2 n-6) isomers in which the double bonds are conjugated instead of in the typical methylene interrupted configuration. Nine different positional and geometric isomers of CLA have been reported as minor components of a variety of food products (Ha et al., 1989). Interestingly, food lipids originating from ruminant animals (beef, dairy and lamb) contain high levels of CLA of which the 9-cis, 11-trans isomer predominates. CLA concentrations in dairy products range from 2.9 - 11.3 mg/g fat of which the 9-cis, 11-trans isomer makes up 73 - 93% of the total CLA while beef fat contains 3.1 - 8.5 mg/g fat with the 9-cis, 11-trans isomer contributing to 57 - 85% of the total CLA (Chin et al., 1992; Shantha and Decker, 1993; Shantha et al., 1993). CLA concentrations in fats from nonruminants and vegetable oils typically ranges from 0.6-0.9 mg/g fat; Chin et al., 1992). The high proportion of 9-cis, 11-trans CLA in fats from ruminants is believed to be due to a specific geometric and positional bioisomerization of linoleic acid by ruminal bacteria (Kepler et al., 1966).

CLA has been shown to inhibit the development of mouse epidermal (Ha et al., 1987), mouse forestomach (Ha et al., 1990), and rat mammary cancer (Ip et al., 1991; Ip et al., 1994). The anticarcinogenic mechanism of CLA is not well understood, however, CLA has been found to be an effective antioxidant *in vitro* (Ha et al., 1990). Further research is needed to elucidate the antioxidant mechanism of CLA and to determine if CLA's antioxidant activity plays a role in its ability to inhibit cancer and atherosclerosis.

Interestingly, feeding mice (Ha et al., 1990) and rats (Ip et al., 1991) a mixture of CLA isomers results in the preferential incorporation of the 9-cis, 11-trans CLA into membrane phospholipids suggesting that 9-cis, 11-trans CLA is the biologically active isomer. Extrapolation of dietary CLA concentrations which are effective in animal models indicates that equivalent CLA concentrations in a 70 kg human would be in the order of 1.5 - 3.0 g of CLA per day which is significantly higher than the estimated consumption of approximately several hundred mg/person/day in the U.S. (Ip et al., 1991). It is possible that CLA concentrations could be increased by manipulation of the nutritional regimes of livestock or by food processing technology. However, foods high in CLA are also high in fat therefore one must weigh the benefits of dietary CLA with the deleterious effects of fat consumption.

Histidine-Containing Dipeptides

Carnosine (ß-alanyl-L-histidine) and anserine (ß-alanyl-L-1-methyl-histidine) (Fig. 2) are dipeptides found in skeletal muscle. The predominance of carnosine and anserine in skeletal muscle is species dependent (Crush, 1970; Table 2). For example, there is essentially no anserine in human muscle. In pigs, beef, goat and turkey, carnosine concentrations are higher than anserine. However, in salmon, rabbit and chicken skeletal muscle, anserine is predominant. Boldyrev and his co-workers (1987) were the first to report that carnosine and anserine inhibit the oxidation of lipid membranes. Since then, other researchers found that carnosine was capable of inhibiting lipid oxidation catalyzed by a variety of oxidation catalysts in numerous lipid systems with significant antioxidant activity occurring at concentrations comparable with those in skeletal muscle tissues (for review see Chan and Decker, 1994).

Carnosine is absorbed intact in the jejunum of the small intestine by a specific active transport system in brush border membranes (Ferraris et al., 1988). Carnosine and anserine are dispersed into the blood where they were transported to kidney, liver and skeletal muscle (Abe, 1991). Absorbed carnosine is either utilized by peripheral tissue or is hydrolyzed into ß-Ala and His by carnosinase, which is present in the blood, kidney and liver (Wolos et al., 1982). The kidney seems to be the main organ responsible for the catabolism and excretion of the dipeptides. Even though 0.05 - 0.25 g of carnosine are consumed daily (based on diet containing 100 g pork, beef or chicken/day) very little data is available on the dynamics of carnosine absorption, transport and catabolism.

Endogenous skeletal muscle carnosine concentrations can be affected by diet. Dietary histidine deficiency in rats reduced skeletal muscle carnosine concentrations (Tamaki et al., 1984). Increases in skeletal muscle carnosine concentrations (2.8 fold) have been observed in rats supplemented with 5% histidine (Tamaki et al., 1984). Dietary supplementation of carnosine also influences skeletal muscle carnosine concentrations. Low dietary carnosine supplementation (0.9%) did not significantly increase carnosine concentrations in skeletal muscle of rat while elevated dietary carnosine concentrations (5%) doubled skeletal muscle carnosine concentrations (Tamaki et al., 1984). Even though carnosine is incapable of regenerating the a-tocopherol radical (Gobunov and Erin, 1991) an indirect relationship between carnosine and a-tocopherol seems to exist *in vivo* as evidenced by a-tocopherol deficiency resulting in decreased rabbit skeletal muscle carnosine concentrations (McManus, 1960).

Carnosine (2 mM) is capable of inhibiting copper-catalyzed oxidation of LDL suggesting that it could inhibit the development of atherosclerosis (Bogardus et al., 1993). In addition, dietary carnosine (0.825%, calculated to be equivalent to a 25% beef diet) is capable of inhibiting 7,12-dimethylbenz[a]anthracene-induced breast cancer in vitamin E deficient rats (Boissonneault et al., 1994; Fig 3.). Dietary carnosine extended the time to 50% incidence of palpable tumors from 12.7 weeks for the control (no supplemented carnosine or a-tocopherol acetate) to 18.9 weeks. The time to 50% tumor bearing animals with carnosine supplemented treatment was also greater than a-tocopherol acetate (50 ppm) or a-tocopherol acetate + carnosine supplemented animals. Whether the antioxidant properties of carnosine is involved in its anticarcinogenic properties has yet to be determined.

Garlic

Both fresh and processed garlic (*Allium sativum*) have been used as food flavorants and medicinal aids as long ago as 1500 BC. Louis Pasteur and Albert Schweitzer described antibacterial and antiparasitic properties of garlic in the 1800's and more recently garlic juice has been found to be potent antimicrobial agents inhibiting the growth of bacteria, fungi and yeasts (for review see Block, 1985). In addition to antimicrobial properties, garlic is thought to have positive influence against cardiovascular disease by inhibiting blood clotting and lowering blood cholesterol and lipid concentrations (Lin, 1992). Garlic has also been found to possess anticarcinogenic activity inhibiting the formation of colon, skin, esophageal, liver and forestomach cancers (Wargovich, 1994).

The medicinal properties of garlic is closely related to its flavor components. Studies over the past 150 years has revealed that the fresh odor of garlic produced upon cutting or crushing is the result of the sulfur containing compound, (+)-S-allyl-L-cysteine sulfoxide or alliin being enzymically converted by allinase to an unstable compound known as allicin. Allicin can degrade into various mono-, di-, and trisulfide thioesters or three molecules can condense into a compound known as ajoene (Block, 1985). These strong smelling volatile compounds, several nonvolatile components (mostly derivatives of cysteine) as well as whole, extracted and deodorized garlic products have been reported to inhibit cancer (Wargovich, 1992) and cardiovascular disease (Lin, 1994). The anticarcinogenic activity of garlic has been attributed to the allicin breakdown products which contain allyl side chains. The anticarcinogenic activity of diallyl sulfide, the most active of these compounds, is thought to involve its ability to inhibit bioactivation of carcinogens. The ability of garlic to inhibit cardiovascular disease involves several potential mechanisms. Garlic derivatives have been found to lower blood cholesterol and lipid levels in chickens and rats presumably by blocking hepatic cholesterol and fatty acid synthesis (Qureshi, 1990; Lin, 1994).

Garlic also has the ability to inhibit blood clotting and cause vasodilation (Lin, 1987; Block, 1985). While preliminary research on the biological activity of dietary garlic is promising, little information is available on the ability of humans to absorb dietary sources of these phytochemicals. Therefore, before dietary recommendations can be made, the nutritional significance of garlic must be more thoroughly investigated.

Lactic Acid Bacteria

Consumption of live lactic acid cultures has long been promoted as beneficial to health. Lactic acid cultures are traditionally used in fermented dairy and meat products including yogurt, cheeses, buttermilk and fermented sausage. Use of lactic acid fermentations originally developed from the desire to improve the flavor, texture and shelf-life of foods, however, live lactic acid cultures are also added to nonfermented foods for their potential health benefits. Such an example of a nonfermented food containing live lactic acid bacteria cultures is acidophilus milk. The ability of dairy products to buffer stomach pH is believed to allow passage of live organisms into the lower gastrointestinal (GI) tract. Recently, addition of lactic acid cultures to other foods such as orange juice has been proposed (O'Donnell, 1994), however, it is unknown whether the bacteria will survive the conditions present in these foods or whether these types of products will allow passage of live organisms into the lower GI. Unfortunately, substantial research evidence on the health benefits of lactic acid bacteria is often lacking for many of the health claims currently being promoted.

Consumption of live lactic acid bacteria has been suggested to positively influence health problems such as lactose intolerance, diarrhea, hypercholesteremia, cancer, immune system stimulation, constipation and vaginitis (Sanders, 1994). Of these proposed benefits, only alleviation of lactose intolerance by lactic acid bacteria is supported by strong experimental evidence in human subjects. Fermented dairy products containing live lactic acid cultures and high lactose loads can often be consumed by lactose intolerant individuals without development of adverse symptoms. Lactase associated with the bacteria is thought to aid the digestion of lactose in the intestine. Sonication of the lactic acid bacteria can increase the rate of lactose digestion in the GI presumably by increasing the ability of lactase to reach its substrate. The ability of yogurt to aid the digestion of lactose is diminished by heat treatments. It is unclear whether this is due to reduced cell viability or heat inactivation of lactase (McDonough et al., 1987). Live dairy cultures are not capable of aiding the digestion of lactose in excess to that normally present in dairy products.

Lactic acid cultures have also been suggested to have a positive influence on immune system response presumably by stimulating gut associated lymphatic tissue. Consumption of live lactic acid cultures could provide an important immuno stimulant for individuals exposed to extensive or prolonged antibiotic treatments. Anticarcinogenic activity has also been related to lactic acid bacteria. Bacterial populations in the colon can cause the formation of carcinogenic or mutagenic compounds such as nitrosoamines, phenols, cresols, idole, aglycones and secondary bile acids (Tomomatsu, 1994). These compounds are produced by bacteria including *Escherichia coli, Streptococcus faecalis*, and clostridia which contain high activity of the enzymes azoreductase, nitroreductase and ß-glucuronidase. Reducing the population of these potentially harmful bacteria in the GI is thought to decrease the risk of colon cancer. Lactic acid bacteria have been found to decrease the activity of azoreductase, nitroreductase and ß-glucuronidase in feces. The mechanism of reduced enzyme activity by lactic acid bacteria is not clear but has been postulated to be due to a lowering of bowel pH by bacterial acid production or by out competing the putrefactive bacteria (Sanders, 1994).

Oligosaccharides

Several oligosaccharides have been reported to possess unique physiological properties. These bioactive carbohydrates are generally short chained polysaccharides which are not digestible by human enzymes but are consumed by intestinal bacteria such as bifidobacteria and lactic acid bacteria. Most physiologically relevant oligosaccharides contain fructose, glucose and galactose which are linked through nondigestible ß 1-4, a 1-3 and ß 1-2 bonds (Oku, 1994; Tomomatsu, 1994). These polysaccharides can either be natural (e.g. raffinose and stachyose), synthetically produced from monosaccharides or derived from the hydrolysis of natural polysaccharide sources such as soybeans. Most oligosaccharides exhibit good solubility in water, low viscosity, and low to moderate sweetness.

Consumption of oligosaccharides results in an increase in beneficial bacterial populations and a reduction in the growth of putrefactive bacteria in the lower GI thereby decreasing the production of toxic and carcinogenic compounds associated with these bacteria. Selection of a more beneficial intestinal bacterial population by oligosaccharides has been suggested to decrease the risk of colon cancer, decrease pathogenic diarrhea, and protect liver function by decreasing formation of toxins such as ammonia in the GI (Tomomatsu, 1994). Oligosaccharides have also been suggested to be used as a sugar substitute which does not affect insulin secretion (monosaccharides are not produced) and does not promote dental caries (Oku, 1994).

Use of oligosaccharides in foods is easier than use of live bacteria cultures which often can not survive processing operations, storage and/or the acid conditions of the stomach. Oligosaccharides are also easier to use in foods than dietary fiber since they are water soluble and do not influence the viscosity or water binding properties of foods. An additional advantage of oligosaccharides is that they exhibit beneficial effects at concentrations as low as 3 g/day (Oku, 1994). However, oligosaccharides can cause diarrhea at high concentrations and can produce flatulence under certain circumstances. Several products containing oligosaccharides are currently available and are recognized by the FDA as "generally recognized as safe" food ingredients. These food additives have been extremely popular in Japan but have yet to gain widespread acceptance in North America.

Challenges Facing the Future of Functional Foods

The production of functional, pharmaceutical or designer foods which have the potential to prevent or treat diseases has great consumer appeal. This interest will only increase with increases in experimental data on the physiological benefits of food components and with increases in the average age of the U.S. population and health care costs. While functional foods are a reality in countries such as Japan, several major problems and hurdles exist before these products can become a reality in the U.S. food market.

The major hurdle facing the future of functional foods is current labeling regulations. The Nutrition Labeling and Education Act of 1990 allows food manufacturers to relate the consumption of selected nutrients to different health claims. These claims include: calcium and osteoporosis; fat and cancer; saturated fat and cholesterol and coronary heart disease; fruit, vegetable and grain products and cancer; fruit, vegetable and grain products (soluble fiber) and coronary heart disease; and sodium and hypertension (Mermelstein, 1993). While food manufacturers are allowed to make statements about the relationship between these nutrients and diseases, no degree of risk reduction can be stated and only "might" or "may" can be used when discussing the relationship (e.g. diets low in sodium may reduce the risk of hypertension).

Another problem with the production of functional foods is the ability of food companies to patent natural food components. Without the guarantee that product rights are protected, a company is unlikely to spend the estimated $200 million to support the research necessary to confirm a health benefit (O'Donnell, 1994). Since labeling regulations can restrict the ability of a manufacturer to make health claims directly on their products, other routes of promoting health claims such as the use of magazine articles, advertising, and physician educational programs are commonly used to tout the nutritional benefits of food components.

In addition to problems with labeling regulations, incorporation of bioactive compounds into foods faces several challenges to the food processor. Incorporation of certain bioactive compounds could cause problems with the sensory quality of foods since these compounds would impart flavor (e.g. garlic and the astringency of phenolics) and color (e.g. phenolics). Incorporation could also be difficult due to solubility, stability and detrimental effects on other food components. Solubility differences would be a major problem in the incorporation of fat soluble bioactive compounds (e.g. garlic derivatives, conjugated linoleic acid and certain phenolics) into low fat products. Stability of the compound must also be considered since many bioactive components such as lactic acid bacteria might not be able to survive the expected shelf-life of the product. Phenolics could also decrease the stability of other food components such as proteins and lipids since phenolics are known to cause protein precipitation and high concentrations of phenolics can accelerate the oxidation of lipids. These problems will limit the incorporation of many bioactive compounds into a wide variety of food products.

Before the challenges presented by current regulatory and food manufacturing issues can be fully addressed, more research is needed on the relationship between bioactive compounds and disease prevention, human safety, and the bioavailabilty of other nutrients. Most studies using bioactive compounds have centered on experimental animal models where extremely high does are studied. Very little is actually known about the effectiveness or even the absorption of bioactive compounds in humans. An additional problem with promoting bioactive compounds is their ability to prevent disease in one tissue while promoting disease in another such as the ability of green tea extracts to inhibit small intestine and promote liver cancer, simultaneously. Safety problems also exist since many bioactive compounds are in the form of extracts which could contain toxic as well as beneficial compounds. Caution should also be used since bioactive components can influence the bioavailability of other nutrients. For instance, phenolics decrease the absorption of proteins and minerals such as calcium and iron. Therefore their addition to food could actually have a negative impact on the nutrition of numerous populations. Since the scientific community has really only begun gathering evidence on the biological effect of bioactive compounds over the last 15-20 years, it is obvious that much more research is needed before the nutritional implications of these compounds is understood. While it may not be wise to dramatically increase the level of nonessential bioactive compounds in our diets, eating a well balanced diet containing a wide variety of food will naturally provide many of these potentially beneficial compounds.

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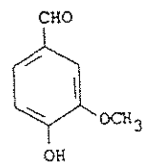
Figure 1: Chemical Structures of Several
Phenolic Antioxidants



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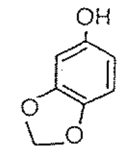

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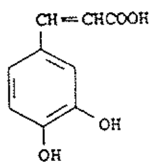

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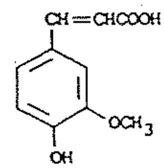

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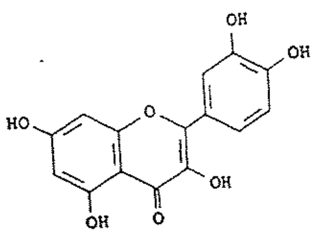

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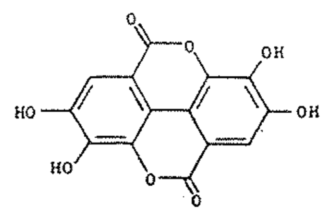

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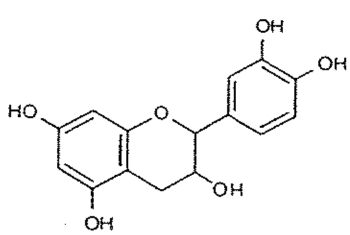
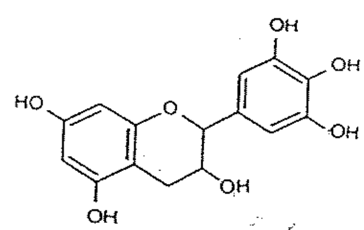
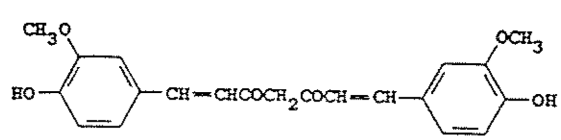


Epicatechin

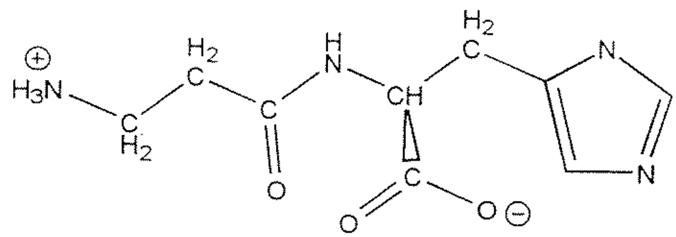


Epigallocatechin

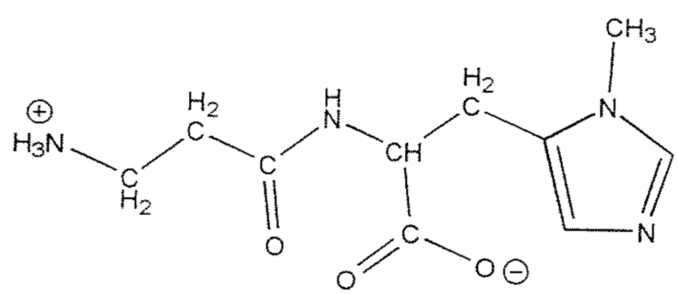


Curcumin

Figure 2: Chemical Structures of Carnosine and Anserine



CARNOSINE



ANSERINE

Figure 3: The Formation of Palpable 7,12-Dimethylbenz[a]anthracene (DMBA)-Induced Breast Cancer Tumors in Rats Fed Control Diets (No Supplements; -E,-C) or Diets Supplemented with a-Tocopherol Acetate (50 ppm; -E,-C), Carnosine (0.0875%; -E,+C) or Carnosine and a-Tocopherol (+E,+C).

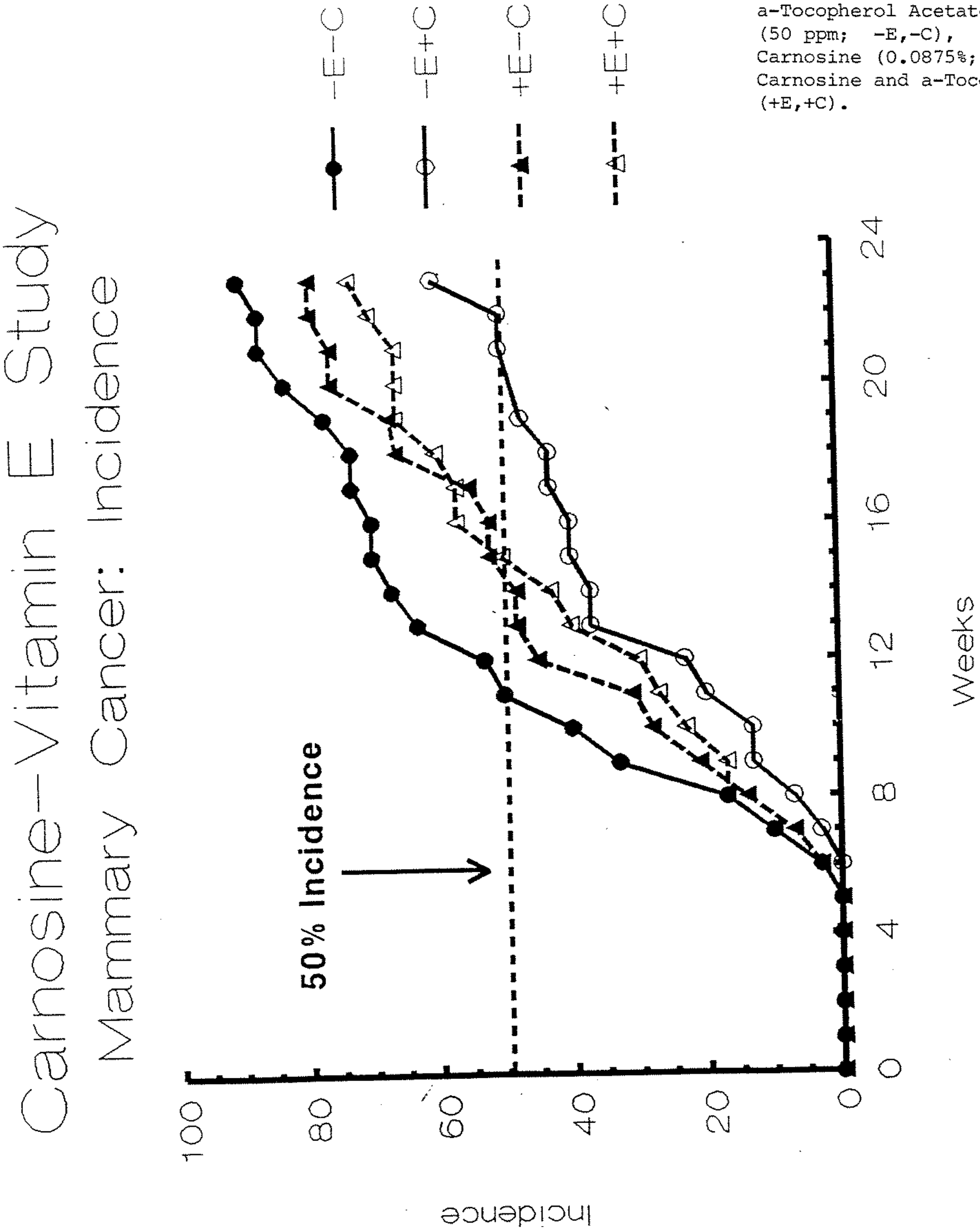


Table 1. Examples of phenolic compounds in foods.

Compound	Occurence
Vanillin	Vanilla beans, Cloves
Sesamol	Seseame Seeds
Caffeic Acid	Oats, Soybeans, Blueberries, Prunes, Grapes
Ferulic Acid	Oats, Soybeans, Blueberries, Prunes, Grapes
Quercetin	Tea, Coffee, Cereal Grains, Onions, Grapefruit
Epicatechin	Tea Leaves
Epigallocatechin	Tea Leaves
Ellagic Acid	Grapes, Strawberries, Raspberries
Curcumin	Tumeric, Mustard

Table 2. Carnosine and anserine concentrations in various skeletal muscles (Crush, 1970).

SOURCE	MUSCLE	CARNOSINE mg/100 g tissue (mM)	ANSERINE mg/100 g tissue (mM)
Chicken *Gallus gallus*	Leg	50 (2.9)	167 (9.3)
	Pectoral	278 (16.4)	983 (54.6)
Rabbit *Oryctolagus cuniculus*	Leg	70 (4.1)	400 (22.2)
Atlantic Salmon *Salmo salar*		0	400 (22.2)
Beef *Bos taurus*	Leg	150 (8.8)	50 (2.8)
Swine *Sus sp.*	Shoulder	276 (9.2)	20 (1.1)
Human	Quadriceps	362 (21.3)	0

The Impact of NLEA on Food Composition Databases

Presented by:

Roy S. Lyon, PhD.
National Food Processors Association

20th National Nutrient Databank Conference
Buffalo, New York
June 13, 1995

NFPA

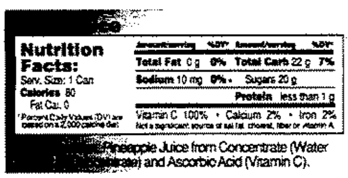
Why Food Labeling Databases

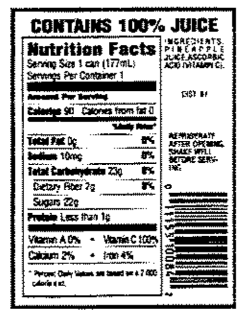
- **Ability to label reformulated or new products quickly.**
  - ➜ After development - cost effective
  - ➜ Help in product formulation development
  - ➜ Shorten leadtime in label development

NFPA

Why Food Labeling Databases

- Ability to label reformulated or new products quickly.
- Unified label for commodity type products.
  - ➧ Reduces consumer confusion





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Why Food Labeling Databases

- Ability to label reformulated or new products quickly.
- Unified label for commodity type products.
  - ➧ Reduces consumer confusion
  - ➧ Enhances competitiveness in the private label market

NFPA

Current NFPA Databases

- Apple Juice
- Applesauce (sweeten)
- Applesauce (unsweetened)
- Asparagus (brine pack)
- Asparagus (water pack)
- Beets (Regular pack)
- Carrots (water pack)
- Carrots (brine pack)
- Corn (brine pack)
- Corn (water pack)
- Green snap beans (brine pack)
- Green snap beans (water pack)
- Yellow snap beans (Brine pack)
- Yellow snap beans(water pack)
- Lima Beans (brine pack)
- Potatoes (Brine pack)
- Peas (brine pack)
- Peas (water pack)
- Peaches (light Syrup)
- Peaches (Heavy Syrup)
- Pinto beans (brine pack)
- Tomatoes (puree, 1.060)
- Tomatoes (puree, 1.045)
- Tomatoes (stewed)
- Tomatoes (whole and diced)
- Tomatoes (paste)
- Tomatoes (crushed)

NFPA

Why Food Labeling Databases

- Ability to label reformulated or new products quickly.
- Unified label for commodity type products.
- More realistic nutrient values.
  - ➔ Representative sampling
  - ➔ Large sampling reduces uncertainty

NFPA

Why Food Labeling Databases

- Ability to label reformulated or new products quickly.
- Unified label for commodity type products.
- More realistic nutrient values.
- Possible "safe harbor" for labeled products.

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Overview of Agencies Guidelines on Databases

- USDA
  - "Safe Harbor" with products labeled with databases
  - Most sources of databases are "OK" until proven otherwise.
    - Handbook #8
    - Commercial Databases
  - Label using mean nutrient values

NFPA

Overview of Agencies Guidelines on Databases

- USDA
- FDA
  - "Safe Harbor" for labels using approved databases.
  - Compliance Focus (80-120 rule)
    - Statistical adjustment on small databases
    - Label with means when nutrient values meet criteria
  - Commodity databases best chance of success
    - Prior approval recommended.
    - Handbook # 8 by itself not adequate

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Aspects to Consider in Labeling Database Development.

- Availability of published studies.

NFPA

Aspects to Consider in Labeling Database Development.

- Availability of published studies.
- Quality of information.
  - ➜ Product History
  - ➜ Sampling protocol
  - ➜ Analytical testing issues
    - > methodology
    - > accuracy and precision

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Aspects to Consider in Labeling Database Development.

- Availability of published studies.
- Quality of information.
- Scope and representativeness of nutrient data.
  - ➜ Growing Region
  - ➜ Growing Season
  - ➜ Cultivar
  - ➜ Shelf life of product
  - ➜ Container
  - ➜ Industry trends in manufacturing

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Aspects to Consider in Labeling Database Development.

- **Availability of published studies.**
- **Quality of information.**
- **Scope and representativeness of nutrient data.**
- **Investigate statistically important variables.**

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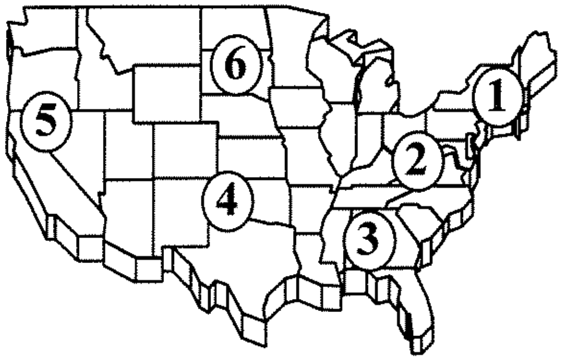
Geographical Regions



KEY	Region
1	Northeast
2	Mid-Atlantic
3	Southeast
4	Southwest
5	Pacific
6	Midwest
0	Unknown

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Geographical Evaluation

	Least-Squares Mean (per 100 g)				
	1	2	4	5	6
Calories, cal	17.5	18.1	18.1	17.9	17.1
Protein, g	0.82	0.87	0.75	0.90	0.80
Fat, g	0.11	0.11	0.20	0.13	0.09
TDF, g	1.43	1.29	1.73	1.49	1.35
Carbohydrate, g	3.36	3.39	3.14	3.28	3.36
Sugars, g	1.08	0.79	1.06	1.30	0.98
Iron, mg	0.75	0.83	0.57	1.25	0.97
Calcium, mg	27.4	30.2	30.9	24.8	25.7
Vitamin C, mg	3.11	1.01	1.56	3.99	3.09
Vitamin A, IU	190	253	249	204	209

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Site of Sampling Evaluation

	Least-Squares Mean (per 100 g)	
	Production	Retail
Calories, cal	17.6	16.2
Protein, g	0.83	0.71
Fat, g	0.12	0.15
TDF, g	1.44	1.28
Carbohydrate, g	3.35	2.87
Sugars, g	1.02	1.25
Iron, mg	0.89	0.75
Calcium, mg	27.0	22.8
Vitamin C, mg	2.80	1.67
Vitamin A, IU	210	146

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Aspects to Consider in Labeling Database Development.

- **Availability of published studies.**
- **Quality of information.**
- **Scope and representativeness of nutrient data.**
- **Statistically important variables.**
- **Database expansion and maintenance**
  - ➔ **Initial investment spread out over several years**
  - ➔ **Ongoing commitment to keeping up to date**

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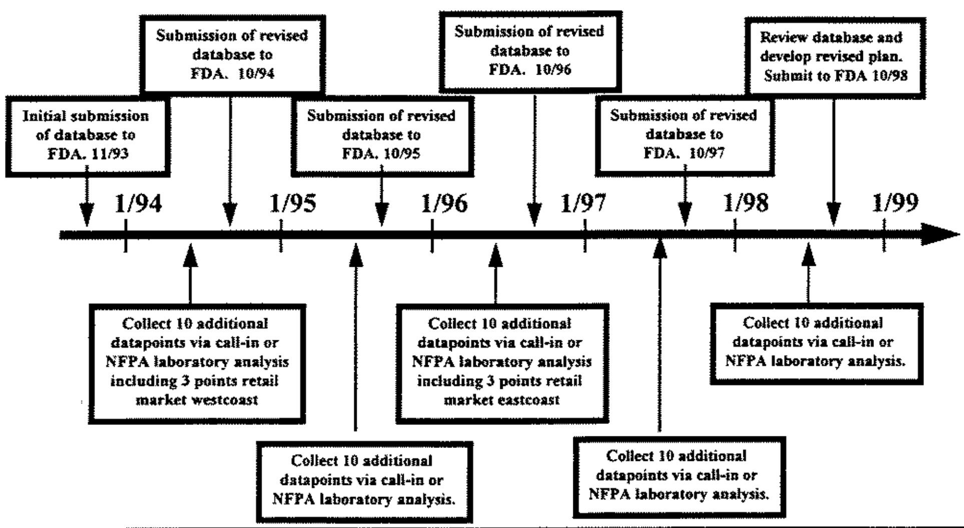
Continuing Effort



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Summary

- **NLEA has driven the development of labeling databases.**
- **More and better nutrient data will be available for databases because of NLEA.**

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National Food Processors Association

"The principle scientific and technical trade association representing the processed food industry."

Impact of NLEA on Food Composition Databases

by Cindy Schweitzer, Ph.D., Director of Research/Meat Science Information, National Live Stock and Meat Board

It's a pleasure to be here and to share information from a meat perspective on nutrition labeling initiatives. As I was preparing this talk, I realized that the topic was very much like the old question, which came first, the chicken or the egg? This is because the meat industry, the species of beef, pork, lamb and veal which I represent, were very proactive in obtaining current nutrient composition data before the enactment of NLEA in 1990.

In my presentation today, I'll be looking at nutrition labeling and meat nutrient data bases before and after NLEA. I'll describe the current status of meat labeling and future initiatives.

Nutrition labeling is not new to the meat industry. In 1985, the National Live Stock and Meat Board, the American Meat Institute and the Food Marketing Institute collaboratively created Meat Nutri-Facts; a point-of-purchase, nutrient labeling program designed to provide consumers with information in the retail/grocery store meat case. The data were presented for cooked and trimmed, three-ounce portions to demonstrate this nutritional profile of meats to the health-conscious consumer. All of the nutrient data for beef, pork, lamb and veal, the original Meat Nutri-Facts, were obtained from USDA's Handbook 8. The program was national and consisted of posters, brochures and rail cards to be placed in the meat department like those shown here.

At about the same time, the beef industry recognized that the amount of fat on beef cuts in the retail case was much less than the one-half inch fat trim level reflected in the Handbook 8 (1) data. For the many uses of Handbook data, (including national consumption studies and nutrient intakes) it became imperative to demonstrate a more realistic nutrient profile for beef. This prompted the beef industry to fund the Beef Market Basket Study, an analysis of beef products at the retail level, to document the reduced fat beef products that consumers were actually buying. In fact, the average fat trim level of all beef cuts was one-eighth inch and more than 40% of all beef cuts in the meat case had no external fat trim (2). In the total product mix, fresh beef cuts in the meat case had 27% less fat than the USDA data presented in Handbook 8. Working closely with USDA's Human Nutrition Information Service, the results from this study led to the revision of Handbook 8-13 in 1990 which included beef cuts with 0-inch and ¼-inch external fat trim levels (3).

Current nutrient data were lacking for veal and lamb also, and these species also funded studies (4,5) during the late 1980s to obtain better, current data and update the information in Handbook 8. Handbook 8-17 (6) for lamb and veal was revised in 1989 to reflect these new data.

A Pork Market Basket Study (7) completed in the early '90s confirmed that producer changes in feeding practices and genetic pig selection as well as fat trimming of pork cuts produced a 31% fat reduction in fresh pork products. This study documented the fat trim level of individual pork cuts and found that the average fat trim level for fresh pork cuts was less than one-tenth inch. The information in Handbook 8-10 (8), revised in 1993, reflected current pork products that consumers would find in the grocery store.

So, before NLEA came into existence, the meat industry had spent more than one-half million dollars to obtain the nutrient content of fresh meat products available to consumers. This resulted in updated USDA nutrient databases to reflect current fresh meat cuts.

What has happened since NLEA?

As you all are well aware, meat products are indirectly affected by NLEA because they are regulated by USDA, not FDA. However, in an effort towards harmonization of labels for the consumer, many of USDA requirements are similar or identical to FDA regulations.

For both government organizations, there are two distinct labeling programs for the variety of foods available today: a voluntary program of requirements for raw, single ingredient foods (like a steak or carrots) and a mandatory program for processed, multi-ingredient products such as hot dogs. The challenge for the meat industry to meet the requirements of the voluntary and mandatory labeling programs was to make sure the nutrient data were current, available and usable by the consumer.

Voluntary Labeling

Since Meat Nutri-Facts already had been developed and was similar in format to the new requirements, a revised Nutri-Facts was presented as a model to use in meeting the voluntary labeling requirements. Nutrient information of 45 cuts of beef, pork, lamb, veal, and poultry products must be visible in the meat department. As in the original Meat Nutri-Facts, the data are provided on posters and brochures. I would like to point out that focus groups were conducted to determine the format most effective in providing the information.

Because of all the previous data gathered by the meat industry, you might think it would be a simple matter to revise Meat Nutri-Facts. However, there were several important issues that complicated the process. One issue of concern was presenting the nutrient data on meat cuts with all fat removed (separable lean only) or data that included both lean and fat. Obviously for some meat cuts, there could be a great difference in fat intake if the meat was totally trimmed of fat or not before eating. (Table 1)

In addition, several surveys, like this one from FMI (Table 2) (9) demonstrated that most consumers did trim meat fat. A Meat Board study to measure actual behavior found similar results. However, since all consumers do not trim all fat from meat before eating it, the nutrient information on Nutri-Facts required the nutrient data for meat cuts with separable lean and fat, as well as for poultry with skin. Yet, because the research clearly showed that many Americans do trim some fat from meats and there is a significant reduction in fat intake when all visible fat is removed from meat cuts, USDA allowed the option of including separable lean data (in addition to lean and fat data) in the Nutri-Facts program.

Table 1		**Table 2**
Impact of Trimming Fat from Meat 3 ounce small rib roast		**FMI *Shopping For Health*, 1992**
With Fat	23 g Fat	87% Trim Fat Before Consumption
Trimmed, Lean Only	9.8 g Fat	76% Trim Fat Before Cooking

With the requirement to report nutrient data including both lean and fat, a new question arose as to which fat trim level would provide appropriate information. Although the Beef Market Basket Study showed that the average fat trim on beef cuts was one-eighth inch, the revised Handbook 8-13 contained information on zero and one-quarter inch external fat trim. The Pork Market Basket Study methodology was different from the Beef Market Basket Study and the revised pork data reflects the actual fat trim level of individual fresh pork cuts (on average, less than one-tenth inch). The Handbook data on veal also reflected actual fat trim level, especially because there is very little external fat on fresh veal cuts. It was concluded that one-eighth inch fat trim level was the industry standard for fresh meat cuts currently available in the grocery store, and data reflecting this level would be appropriate for use in Nutri-Facts.

As progressive as the beef industry was to get up-to-date nutrient composition prior to NLEA, it missed the mark on fat trim level. All previous beef composition data had been collected and analyzed by Texas A&M University, so it was possible to use the data from these previous studies to calculate the nutrient composition of one-eighth inch fat level beef cuts (10) for in use the revised Nutri-Facts. Likewise for beef, one-eighth inch fat trim for lamb nutrient content also were calculated from previously collected data. Again by working closely with USDA, accurate data were generated and updated in USDA's nutrient database for beef and lamb.

The success of the original Meat Nutri-Facts program is evident in that the program has expanded to include poultry, fish and seafood, and fresh fruits and vegetables. This was one way to assist the grocer in making available to the consumer uniform nutrition information in various sections of the grocery store. The current Nutri-Facts program has several partners in addition to the original three including National Grocers Association, National American Wholesale Grocers' Association, and the American Dietetic Association and others.

Implementation of the revised Nutri-Facts program will be tested when USDA's audit which was scheduled to begin on June 12, 1995, is completed and evaluated. Successful implementation will keep this voluntary program from becoming a mandatory one.

Mandatory Labeling

On-package nutrition information is required for processed meat products just like that found on a can of beans. Because of the very high costs associated with lab analyses of every product, there was great incentive by the meat industry to find a way to utilize database information for the mandatory labeling requirements like that used for the voluntary requirements. Many new products (often with reduced fat) are entering the market place and must have accurate nutritional information. The use of databases for mandatory labeling offered these benefits: 1) significant cost savings, 2) reduced turn-around time and 3) an accelerated timetable to launch new products.

In 1992, the National Live Stock and Meat Board hosted a round-table discussion with participants from government, academia, meat industry and software suppliers to determine an efficient model for database use for processed meat products. The discussion centered on recipe calculations using data from lean and fat trimmings such that the nutrient database for the individual ingredients would be used to determine the nutrient profile of the multi-ingredient product. Following the round-table meeting, USDA published the *FSIS Manual on use of Databases for Nutrition Labeling* (11). This document establishes the standards on how to use existing databases, such that for virtually any new or existing meat product, an accurate nutrient profile could be generated by using the USDA database.

For both voluntary and mandatory labeling requirements of meat spawned from the enactment of NLEA, the meat industry has enjoyed a constructive working relationship with USDA to provide current nutrient information to the consumer.

What is the future of meat nutrient labeling?

Nutrient databases must continue to be updated to reflect the current food supply. New data already collected but not yet available include ground beef data with fat contents ranging from 30% to 5%; additional beef cuts such as skirt steak (commonly used in fajitas), tri-tip steak, and pork arm and picnic data. A study to determine the nutrient content of two new veal cuts, the shank, used in osso bucco, a popular Italian dish, and the veal breast is ongoing as I speak. It will be a challenge to maintain a nutrient database of new reduced fat meat products, but equally important as these products rapidly are coming into the market place.

In summary, the meat industry took a proactive stance to obtain nutrient composition that reflected what consumers were buying before NLEA was initiated.

With a constructive working relationship with USDA, it has been possible to update the National Nutrient Databank with current fresh meat product information. The advent of NLEA and USDA labeling initiatives have fostered continuous enhancement of databases to reflect a changing food supply.

Accessibility of the information also is critical to success of the voluntary and mandatory programs. With the renewed use of Nutri-Facts for voluntary labeling, and allowance of database calculations for mandatory requirements, the nutrient content of most meat products is available to the consumer.

The question still exists on which came first, the chicken or the egg, but database coordination among producers of food, processors, software suppliers and government is more important than ever before.

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Biotechnology and Food Composition

by Don Beermann, Department of Animal Science, Cornell University

Consumer interest in food composition has remained at a high level for the past ten to fifteen years in response to many health-related issues. Key nutritional concerns include level of fat intake, proportion of fat intake as saturated fat, and cholesterol content of foods. One of the more recent issues involves the role of naturally occurring antioxidants in foods and their role in prevention of certain cardiovascular diseases and cancers.

Our understanding of the linkages between human nutrition and health has expanded dramatically during this time, as has our application of biotechnology in research. This knowledge led to development of the "Dietary Guidelines", the Food Guide Pyramid" and expanded food labeling requirements. All were designed to help consumers make informed choices at the point of purchase and in food consumption patterns.

Similarly, application of biotechnology in food production and manufacture is expanding at a rapid rate. We now have chymosin that is produced by recombinant DNA technology being used in cottage cheese manufacture. We have the genetically altered Flavor-Saver® tomato, and many other agronomic examples of use of biotechnology. The tremendous diversity of food products available today and the detailed nutritional information provided with them, I believe, has led consumers to believe that food composition can be altered at will. Can application of biotechnology really provide us that capability, the capability to design foods and food products that have improved nutritional composition and are of acceptable "quality" and "safe"? The answer is yes, but there are many qualifications that need to shared along with that answer.

In reality, application of biotechnology to alter food composition is in its infancy, for foods of both plant and of animal origin. Much greater effort and progress has been made in using biotechnology to alter agronomic traits of plants and food producing animals, than for altering their composition. Among the reasons for this is the simple economic impact of the former as compared with the latter. Extending the shelf life of fresh fruit and vegetables, making plants more resistant to pests and drought or severe climatic conditions all have marked impact on the economics of production. Likewise, improving the efficiency with which animals convert feeds to milk and meat has greater impact on the cost and economy of production than would altering the composition of these foods. However, there are a few exciting examples that depict the potential for what may be achieved, and some to the results are quite dramatic.

A dramatic example in which biotechnology can be used to alter composition of food is found in several approaches that can be taken to reduce the fat content of meat. Although food products from animals have been a mainstay in the American diet, contributing between one-third to nearly all of many important nutrients, they are also a major source of fat, saturated fat and cholesterol. In the U.S. red meats and poultry contribute approximately 33% of total fat in our diets, while milk and dairy products contribute another 11% (National Research Council, 1988). Muscle foods also contribute approximately 40% of total saturated fatty acids and 40% of total cholesterol intake.

In response to consumer demand for leaner, low-fat foods, total fat content of fresh meat has been reduced 25 to 30% in the last 10 years (USDA, 1990, Buege, et al., 1991). Most of this reduction resulted from trimming more of the fat from fresh retail cuts of meat sold in the supermarkets, although a smaller but significant reduction was also achieved by genetic selection of the animals.

For several reasons, however, continued improvement has been slow. Market animals still contain approximately 25% carcass fat, much of which is trimmed away at various points along the distribution chain. This is true not only for beef, pork and lamb, but for poultry as well. Removing unwanted fat post harvest represents inefficiencies in both production and in processing, both of which are costly. Cost of feeding these animals represents approximately 60 to 70% of the total cost of production. Producing leaner animals is more efficient because less feed is required per pound of gain as muscle as compared with the greater amount of feed required per pound of gain as fat. Increased economic return to the producer, increased efficiency of carcass cooling, reduced time trimming fat and decreased volume of fat rendered by the packer will result from production of leaner animals. How can this be achieved?

Modification of metabolism of growing animals to redirect use of absorbed nutrients toward greater rates of skeletal muscle growth and less fat synthesis and deposition can be achieved by altering the endocrine status of the animal. Increasing the concentration of somatotropin, or growth hormone, in the blood increases protein synthesis rate in muscle and reduces fat synthesis and deposition in adipose tissue during growth. This can be achieved by direct administration of the recombinantly-derived hormone, or by administration of the hormone which stimulates synthesis and secretion of somatotropin in the anterior pituitary gland at the base of the brain. Growth hormone releasing-factor (GRF) action can also be altered through immunological approaches.

Administration of porcine somatotropin (pST) to growing pigs being raised for pork provides a good illustration of the multiple effects and benefits of this technology. Several studies were conducted at Cornell University and elsewhere, to investigate the regulation of nutrient use by food-producing animals, with particular emphasis on somatotropin (Beermann et al., 1990a,b; Krick et al., 1992; Thiel et al., 1993). Somatotropin administration causes dose-dependent 40 to 80% decreases in lipid accretion rates and 35 to 75% lower fat content of the carcass, and 20 to 35% reductions in the amount of feed consumed per pound of live weight gain (see figure 1). Rates of protein deposition in the carcass are increased by 40 to 70%, resulting in 25 to 38% increases in skeletal muscle mass at the same live weight as control animals. A detailed description of the relative magnitudes of individual responses for average daily weight gain and amount of feed consumed, and of changes in bone and skin growth are presented in table 1. These improvements in carcass composition and growth performance are unprecedented.

Table 1: Dose Response Relationships for Porcine Somatotropin Effects on Growth Performance and Dissected Carcass Tissue Weights on Growing Swine[1]

	pST Dose, $\mu g \cdot kg^{-1} BW \cdot d^{-1}$				
Observation	0	50	100	150	200
Number of Animals	10	10	10	10	10
Growth Performance		Percentage Difference from Controls (%)			
Average Daily Gain, kg	.904	+8.0*	+13.1*	+13.3*	+13.3*
Daily Feed Intake, kg/d	2.90	-14.8*	-18.6*	-22.1**	-26.9**
Feed:Gain	3.22	-21.1*	-28.0**	-31.4**	-35.1**
Carcass Yield and Composition					
Muscle Mass, kg	30.92	+27.9**	+30.3**	+32.7**	+37.6**
Adipose Mass, kg	22.78	-35.7**	-54.6**	-65.7**	-74.1**
Bone Mass, kg	7.28	+10.2*	+14.3**	+16.2**	+17.3**
Skin Mass, kg	3.66	+14.8*	+36.1**	+35.0**	+38.3**

[1]Somatotropin was administered by daily injections and adjusted biweekly to increased live weight. Growth performance data were analyzed by analysis of variance using live weight as the covariate, (Krick and Boyd, unpublished data). Carcass data are summarized from Thiel et al. (1990).
*(P<.05) vs. control
**(P<.01) vs. control

Lipid content of skeletal muscle, also called marbling, is also reduced in step-wise fashion with incremental dose of pST administration. Results from a study in which effects of pST administration on different genotypes and genders of pigs were compared following treatment from 45 to 90 kg live weight are shown in table 2. Longissimus muscles in control animals from the unselected strain and lean strain barrows (castrate males) contained approximately 3.4% lipid, while the intact lean strain male pigs (boars) contained only 2.6% lipid on a wet-weight basis. Both genotypes and both genders exhibited large reductions in lipid concentration of the longissimus with pST administration, to levels far below those observed in most market weight pigs (0.5 to 1.3%). Protein and moisture concentrations averaged 22% and 73%, respectively, in control pig longissimus muscles and were each increased one percentage point with pST administration, regardless of dose. Ash concentration was unchanged. Analysis of other muscles and muscle groups in various carcass locations exhibited similar magnitude of change in proximate composition. Contrary to what consumers may expect, there was not change in cholesterol concentration in the longissimus muscles from pigs that received pST treatments (table 2). These data clearly demonstrate and confirm the relationship known for over thirty years, that changes in neutral lipid concentration in skeletal muscle tissue are independent of variation in cholesterol concentration.

This is explained by the primary location of the cholesterol being in membranes of cells, and not in the cytoplasm where the triglycerides are stored. It is interesting to note that no differences were observed in cholesterol concentration between genotypes or genders.

Table 2: Effects of Pst on Longissimus Lipid and Cholesterol Concentration - Genotype and Gender Effects

	Longissimus Lipid Concentration (%)				
	pST Dose, $\mu g \cdot kg^{-1} BW \cdot d^{-1}$				
Group	0	50	100	150	200
Fat Strain Barrows	3.43	2.50	1.77	2.60	1.32
Lean Strain Barrows	3.38	1.54	1.49	1.20	.77
Lean Strain Boars	2.57	1.54	1.03	1.01	.49

S = .96; n = 10; pST = P<.001; Genotype = P<.002; Sex = P<.08

	Cholesterol Concentration,(mg/100g)				
	pST Dose, $\mu g \cdot kg^{-1} BW \cdot d^{-1}$				
Group	0	50	100	150	200
Fat Strain Barrows	56.0	58.9	55.4	62.2	57.2
Lean Strain Barrows	56.4	58.9	59.0	57.4	61.2
Lean Strain Boars	55.4	55.7	54.0	55.9	57.1

Pooled S = 7.06

Marked change in proximate composition of adipose tissue was also observed with increasing dose of pST administration (see table 3). Linear reduction in adipose tissue mass was accompanied by linear decreases in lipid concentration and linear increases in protein and moisture concentrations of adipose tissue. Ash concentrations were not affected by pST administration.

With such large reductions in lipid concentration, treatment differences in fatty acid concentrations would also be expected. Analysis of lipid extracted from the longissimus muscle for fatty acid composition did show that the percentage of C18:2 (linoleic acid) was increased approximately three percentage points with pST administration (see table 4). These differences explained the significant increase observed in percentage of polyunsaturated fatty acids. Percentage of C16:1 (palmitoleic) and C18:1 (oleic acid) were decreased, resulting in a significant decrease in total monounsaturated fatty acid percentage. The only other significant change observed was a small decrease in percentage of C14:0 (myristic acid).

Table 3: Dose-Dependent Effects of Porcine Somatotropin on Adipose Tissue Distribution and Proximate Composition[1]

	Daily somatotropin dose, $\mu g \cdot kg^{-1} BW \cdot d^{-1}$				
	0	50	100	150	200
Adipose Tissue					
Weight, g	2285[a]	1773[a]	757[b]	467[b]	362[b]
Protein, %	4.4[a]	7.2[b]	8.7[b,c]	9.9[c]	14.3[d]
Water, %	19.1[a]	26.9[b]	31.3[b]	38.2[c]	49.1[d]
Lipid, %	76.0[a]	65.2[b]	58.9[b]	50.8[c]	36.1[d]
Ash, %	0.1	0.5	0.8	0.5	0.3

[1]Least square means represent 10 pigs per pST dose; data are expressed on a wet-weight basis.
[a,b,c,d] Means within a row with different superscripts differ (P<.05).

Table 4: Dose-Dependent Effects of Somatotropin on Fatty Acid Composition of Longissimus Intramuscular Lipid in 90 kg Barrows and Boars[1]

	Daily somatotropin dose, $\mu g \cdot kg^{-1} BW \cdot d^{-1}$		
	0	50	100
Number of pigs	20	20	20
C14:0 (myristic)	1.45[a]	1.13[b]	1.22[b]
C16:0 (palmitic)	24.86[a,b]	24.24[a]	25.42[b]
C16:1 (palmitoleic)	3.80[a]	3.28[b]	3.43[a,b]
C18:0 (stearic)	11.66	12.38	11.69
C18:1 (oleic)	45.78[a]	43.47[b]	42.61[b]
C18:2 (linoleic)	12.62[a]	15.80[b]	15.50[b]
Total saturated	37.96	37.77	38.34
Total monounsaturated	49.57[a]	46.75[b]	46.04[b]
Total polyunsaturated	12.62[a]	15.80[b]	15.50[b]

[1]Data are expressed as percentages of the total lipid. The following fatty acid concentrations were below the level of detection: C12:0, C14:1, C18:3, C20:0, C20:1, C20:2, C20:4, C22:0, C22:1, C22:6, C24:0, C24:1. No sex effects were observed (P>.05).
[a,b] Means within a row with different superscripts differ (P<.05).

Administration of somatotropin in growing ruminants (cattle and sheep) produces similar effects on carcass and tissue composition, but of smaller magnitude than observed in pigs (Beermann and DeVol, 1991). Subsequent studies have shown that response to ST administration is constrained if adequate supply and proper amino acid balance are not provided in the diet. Administration of ST does not increase nutrient requirements per se, but the basic principles of nutrition must be adhered to for optimum efficiency of nutrient use for growth, as is required in both average and superior genotypes.

Other approaches to achieve the results demonstrated with exogenous administration of somatotropin include administration of growth hormone releasing factor (GRF), or a somatotropin secretagogue, and immunological manipulation of the somatotropin axis to enhance the normal metabolic effects of somatotropin (Beermann et al., 1990; Beermann and DeVol, 1991). The striking difference between direct administration of ST and GRF (or other ST secretagogues) is that a more frequent administration of GRF is required. This is because the transient increase in ST secretion lasts only 45 to 60 minutes after a single sc injection of GRF, whereas a single sc injection of ST will elevate ST concentrations for up to 8 to 12 hours. Slow-release forms of ST are now available which preclude the need for daily administration, and developing delivery technologies may eventually lead to more practical systems for use of peptide materials that cannot be orally administered.

Another class of metabolic modifiers has received intensive investigation in recent years, in anticipation that their use may also improve composition of gain and nutrient composition of carcasses and meat from beef cattle, pigs and sheep. This class of orally active catecholamine-like compounds, known as b-adrenergic agonists, have effects on protein accretion and lipid deposition as those observed with somatotropin administration in growing animals (see reviews by Beermann, 1993, 1994). Although time-course of responses and mechanisms of action are clearly different, the b-adrenergic agonists markedly increase the rate of skeletal muscle growth and concurrently reduce rates of lipid synthesis and deposition in cattle, sheep and pigs. Unlike bovine somatotropin, the b-agonists do not increase nutrient use for milk synthesis and secretion in lactating dairy cows. These compounds do appear to be more efficacious in cattle and sheep than in pigs, but generalizations are difficult because marked differences exist in pharmacological characteristics of these compounds, including their rates of absorption, half-life in circulation, receptor specificity and metabolism. Because the effects are similar in magnitude to those observed with somatotropin, much interest in determining mode of action still exists, even though very few of these compounds may ever be reviewed by the FDA for approval for commercial use in food-producing animals.

In summary, opportunities for altering composition of foods through application of various biotechnologies do exist. Molecular approaches to alter the gene compliments of bacteria are in use for producing compounds which through their ability to alter metabolism in growing animals, do reduce lipid synthesis, deposition and lipid content of skeletal muscle and adipose tissue. Transgenic animals have been produced which exhibit increased expression of inserted homologous or heterologous genes for somatotropin and somatotropin secretagogues. The practical application of the latter technology is still years away from implementation on a commercial scale. Likewise, although transgenic flaxseed and cotton seed may be released to producers within the next year or so, emphasis will remain on agronomic traits rather than on altering composition (Karen Marshall, personal communication). Economic incentives remain the dominant influence in directing use of current biotechnologies for enhancing food and fiber production systems. It appears that plants with altered composition, or which produce seed with altered composition may not be commercially available until around the turn of the century.

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pST Enhances Carcass Composition and Growth Efficiency of Pigs

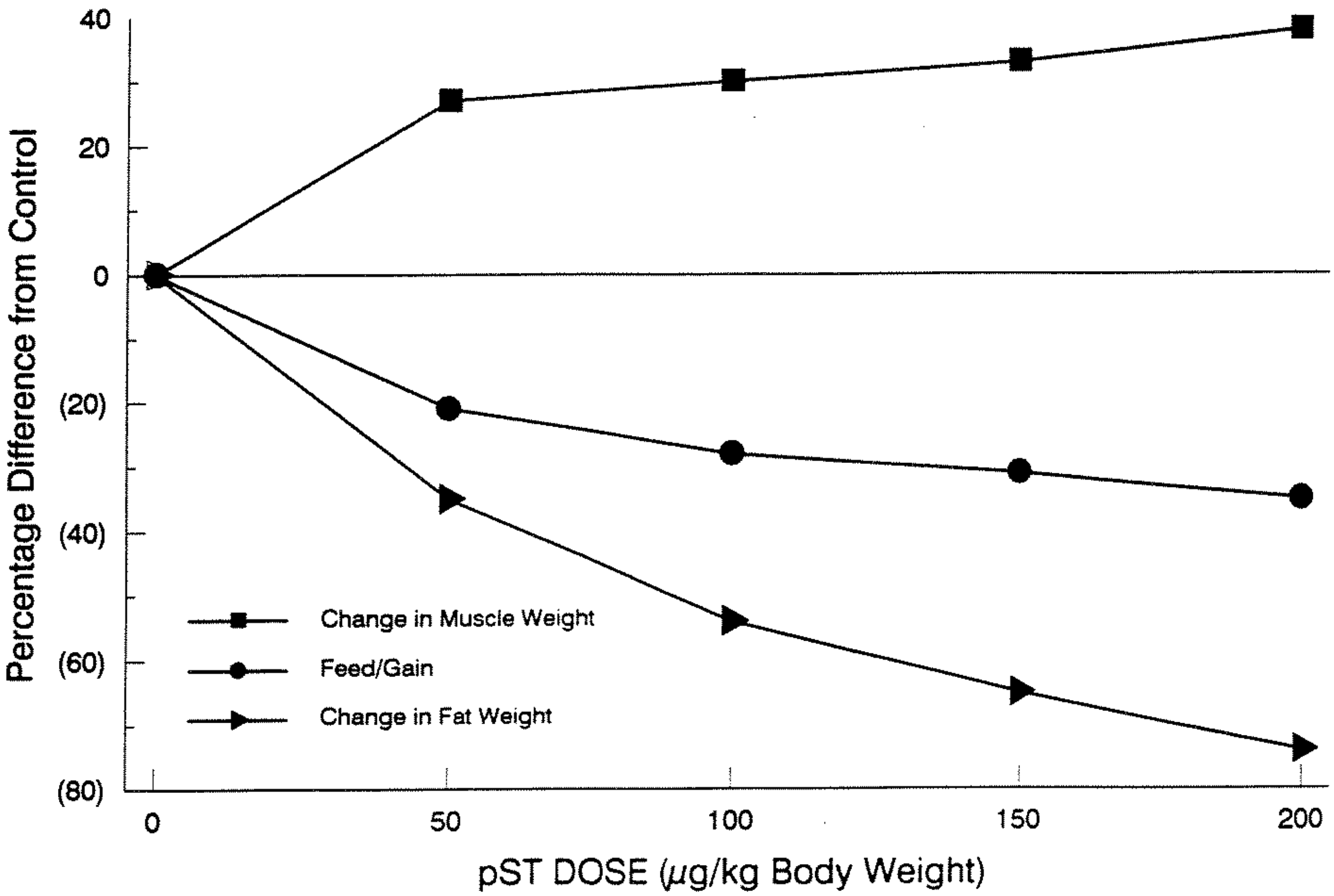

Figure 1: Daily administration of porcine somatotropin increases total muscle mass, decreases total carcass fat mass and reduces the amount of feed required per unit of body weight gain in a dose-dependent manner in market pigs.

System Drift and Dietary Data Analysis

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Introduction

It is widely known that there are many potential sources of error in dietary data. In fact, it is unlikely that dietary intake can be estimated without error (Beaton, 1994). It is important, therefore, to understand the nature and magnitude of the error so that we are able to improve our analysis and interpretation of dietary intake data. Error in dietary data can be partitioned into three major potential sources: participants, interviewers, and the database itself. Participant errors include such pitfalls as memory problems, inability to accurately estimate portion size or frequency of consumption, and unwillingness to disclose actual food consumption (Smiciklas-Wright, 1994; Thompson and Byers, 1994; Willett, 1990). Interviewer errors may be introduced if the interviewers are not properly trained, if they use leading questions during the interview, or if they do not use standardized procedures for probing and coding dietary intake information (Willett, 1990). In addition to errors introduced by participants and interviewers, there are potential sources of error in the databases themselves. Sampling practices, analytical techniques, laboratory quality control, seasonal variability, estimation, and missing data all play a part in the accuracy of nutrient values in food composition databases.

This paper is devoted to a discussion of another type of database error, namely system drift. Researchers need to be able to assess dietary changes without confounding due to artifactual database changes (Buzzard, 1991). Therefore, system drift is of importance to researchers who use the Minnesota Nutrition Data System (NDS) and other dietary analysis programs. System drift refers to the underlying database changes that occur with each new database release. These changes are due to improvements that are made in the underlying databases. Since improvements are made with each new release of a food composition database, significant differences may be detectable over time.

Food composition databases are used by a variety of researchers for a diverse group of research objectives. System drift is a potential factor in only a few types of studies, namely surveys interested in monitoring changes in food consumption patterns over time and epidemiological studies that follow subjects longitudinally. System drift is not a factor in case-control studies, where dietary measures at a point in time in one group are compared to dietary measures at the same point in time in another group. Likewise, system drift is not really an issue for ecological or correlational studies where disease rates in populations are compared with per capita consumption of foods based on disappearance data.

Sources of System Drift in Dietary Data

There are two broad categories of "improvements" in food composition databases that have the potential to impact system drift: actual changes in the marketplace and better data for foods that have not really changed (Table 1). Let's look at each of these in more detail.

The food marketplace is very dynamic. New foods are constantly being introduced. Other products are reformulated, package sizes are changed, serving sizes are altered, items are removed from the market, and consumers change their preferences in food preparation and cooking methods. All of these marketplace changes have the potential for affecting the information contained in our food composition databases.

Addition of new foods to the marketplace poses an interesting problem for maintenance of food composition databases and monitoring system drift. The reason new foods pose a problem in analyzing system drift is that people who collect the dietary records may come up with their own creative solutions when entering new foods into the computer system. For example, they may make a judgment about the new food that may or may not accurately reflect its nutrient composition. Recently, Post introduced a new cereal called Blueberry Morning. If Post Blueberry Morning cereal was reported on a dietary intake record or recall, the interviewer may make an incorrect judgment about it. Perhaps the interviewer decides that Blueberry Morning Cereal is similar to Raisin Bran and calculates nutrients for the dietary record using Raisin Bran. Later, when Blueberry Morning Cereal is available in the database, the dietary record is edited and updated, and a new nutrient profile is generated. The difference between the two records could erroneously be interpreted as system drift.

Many food products are reformulated without changing the food name. Some of these changes can significantly affect the nutrient profile of the food. Fleischmann's Egg Beaters is a good example. In 1992, 1/4 c of Egg Beaters had 25 kcal, 5 g protein, 1 g carbohydrate, and no fat. Egg Beaters supplied 10% of the US RDA for riboflavin. In 1994, the product was reformulated with more protein and, therefore, more kcal per serving. In addition, more riboflavin was added so that the product then provided 60% of the US RDA for riboflavin. Without making these changes in the database, riboflavin, protein and total calories could be underestimated in dietary intake records containing Egg Beaters.

Manufacturer changes to packages or portion sizes may also affect nutrient values for a food. Orville Redenbacher's Gourmet Light Butter Flavored Microwave Popping Corn has changed in serving size in recent years. One serving in 1992 contained 70 kcal, 3 g fat and 3 g fiber. In 1994, the serving size was changed so that one serving contained 114 kcal, 4 g fat and 5 g fiber. A more confusing example is that of McDonald's french fries. In 1991, the available package sizes were small, medium and large. These package sizes now go by the names small, large and supersize. Since the word large has different meanings depending on the year, re-analysis of older dietary records to track system drift could produce different gram weights and nutrient values for so-called large fries.

Another marketplace change that affects food composition databases is removal of foods from the market. Examples of discontinued products include Space Sticks, Tofulicious non-dairy imitation ice cream, Sara Lee Lights carrot cake and Libby's fruit float. Databases should be "improved" so that these products cannot be chosen once they are no longer available in the marketplace. However, they should not be removed from the database so that nutrients can be assigned to them, even if the record is re-analyzed years later.

Consumers have also changed preferences in food preparation and cooking methods. Less fat is left on meat cuts after trimming in response to consumer demand. Consumers are using less fat in recipes, and asking for options to lower fat in commonly prepared foods. Also, the use of non-stick cookware has increased. All of these factors can contribute to reductions in dietary fat that may or may not be reflected in food composition databases in a timely manner. These changes may also affect interpretation of system drift in dietary data.

In addition to the marketplace changes discussed above, better data for foods may result in changes in food composition databases. These changes can be of several types. New information may be provided for recipe yields, densities and conversion factors. Analytical methods may be improved. Coding rules for entering and calculating nutrient values may change over time. The specificity of the database may change. Finally, new nutrient values may be added to food composition databases.

Changes in recipes, yields, density data and conversion factors may affect interpretation of system drift analysis of dietary data. For example, in the Nutrition Coordinating Center's databases, the recipe for chicken salad made with mayonnaise was changed in 1994. The new recipe resulted in a change in fat from 21.2 g per cup to 16.3 g per cup. A change in the recipe for French toast resulted in a reduction in fat from 10.4 g per serving in 1991 to 3.8 g per serving in 1994. This change was the result of a recipe that used less fat in frying. An example of a density change occurred in 1994 when fish and seafood densities were updated to reflect new density data from the USDA survey database.

Examples of improved analytical methods that may affect interpretation of system drift include revised nutrient values for eggs (American Dietetic Association, 1989) and individual carotenoids. Most food composition tables quantify total carotenoids rather than individual carotenoid values. Most of these values were obtained using methods similar to the official Association of Official Analytical Chemists (AOAC) methods, which tended overestimate total carotenoid values. It is now possible to analyze individual carotenoids in foods using high-performance liquid chromatography (Khachik et al., 1992). Improvement in analytical methods could result in identical dietary records yielding different nutrient values when analyzed using old and updated databases.

Another potential source for system drift is coding rule changes. At the Nutrition Coordinating Center, fast food entrees were formerly coded by individual constituents, such as hamburger plus bun plus dressing, etc., in amounts reported by the study participant. Now they are coded by name (e.g., McDonald's Big Mac) using quantities provided by the manufacturer. Similarly, zucchini bread and other quick breads were formerly coded by individual ingredient (e.g., flour plus sugar plus egg, etc.) in amounts reported by study participants. Now they are coded by recipe name using standard amounts from commonly used recipes. Medium rich ice cream was formerly coded as containing 16% fat; now it is coded as containing 10% fat because of coding rule changes from USDA.

Foods formerly grouped together because of similar characteristics are separated as other nutrients of interest are identified. For example, Rice Krispies, Corn Flakes, Kicks, Cheerios and Wheaties once shared a database code at the Nutrition Coordinating Center because they did not differ substantially in nutrients that were of interest: calories, fat and cholesterol. When more researchers began to look at fortification levels of vitamins and minerals, it became clear that these cereals needed to be separated. However, dietary records analyzed when these foods shared a code would get the nutrients for Rice Krispies, even though the subject may have eaten one of the other cereals. Changes in the specificity of the databases also affect foods such as cookies, crackers, cheeses and vegetables. For example, vegetables used to be grouped together regardless of whether they were frozen or canned. Now they are separated because of differences in sodium levels.

Adding new nutrient values has the potential to affect drift in the system because nutrient values for new nutrients would not be available for dietary data collected at an earlier point in time. The Nutrition Coordinating Center is in the process of adding the following nutrient values to the database in response to requests from researchers: individual carotenoids, *trans* fatty acids, oxalates and phytates.

The Minnesota Heart Survey

Two potential sources of system drift in dietary data, marketplace changes and changes that reflect better data about foods, have now been examined. An example of the effects of system drift on dietary data can be seen using data from a longitudinal study, the Minnesota Heart Survey.

The purpose of the Minnesota Heart Survey (MHS) is to examine trends in risk factors, hospitalization, and mortality for coronary heart disease and stroke in Minnesota populations. Surveys have been conducted in 1980-82, 1985-87, and 1990-92. A fourth survey period is underway for 1995-97. Detailed descriptions of the methods have been published elsewhere (Luepker et al., 1985; Sprafka et al., 1990), but a brief description follows.

To identify possible participants, the seven county Twin Cities metropolitan area was divided into 704 clusters of approximately 1,000 households each. Of these, forty clusters were randomly selected for surveillance, and approximately 5 to 10 percent of the households within these clusters were randomly selected for participation. Eligible individuals were asked to complete a 20-minute home interview to determine various socio-demographic characteristics, health attitudes and beliefs, medication use, and a brief medical history. Home interviews were followed by a field clinic visit where dietary and physiological assessments were made.

Dietary information was collected using 24-hour recalls from 50% of all clinic visit participants. Food models were used to assist with estimation of portion size. Non-dietitian interviewers conducted the interviews and were trained and certified by the Nutrition Coordinating Center. Every six months, interviewers were recertified to insure data quality and standardization of methods. Particular emphasis was paid to information regarding foods and food preparation methods that would affect fat, cholesterol, and sodium intake. Coding of the recall, quality control, and maintenance of the nutrient database were the responsibility of the Nutrition Coordinating Center.

MHS chose to monitor quality control using 74 records randomly selected from the first survey period. There was still some variation when these records were blindly sent back to Nutrition Coordinating Center for recoding. This variation was due to problems with poorly documented foods in the original records. To overcome this limitation, the original records were unambiguously documented to eliminate the potential for coder variation when the records were subsequently recoded.

Examples of some of the changes that were made to standardize the records can be seen in Table 2. For example, the original record documented a 5½ to 6 inch hot dog, 1 inch in diameter. The standard further specified the hot dog to be a pork and beef hot dog 5¾ inch long and 1 inch in diameter. A 1¼ by 5 inch wedge of watermelon is somewhat difficult to quantify, so the standard specified watermelon to be 1 cup of watermelon chunks. An average size frozen chicken wing from Banquet was further specified as 1 ounce of frozen, pre-breaded and fried, commercially prepared chicken wing in which the person ate skin and breading. It is not important that the standard reflect exactly what the subject ate. It is important that the standard be unambiguously documented so that judgment error in coding is removed from the investigation of the effect of system drift on dietary data in this long-term study.

The mean values for total kcal from the 74 quality control samples in 1983, '85, '86, '88, '90 and '93 can be seen in Figure 1. The upper line represents the original, unaltered dietary data. The lower line represents the dietary record standards (unambiguously documented records) coded in 1983 and 1993 only. The original records were analyzed using ANOVA, and were not found to be statistically different in the different years (mean = 2121 kcal ± 27.5; range = 2074 to 2149 kcal). The standards were analyzed using mixed model regression to take into account changes over time in repeated analysis, and were also found to have no drift over the last decade (2047 kcal in 1983 and 2051 kcal in 1993).

Unfortunately, this is not the case with dietary fat (Figure 2). Again, there were no statistically significant differences in total fat calculated from the original, unaltered records (mean = 92.3 g ± 2.0; range = 89.6 to 94.4 g), but the standards told a different story. Mixed model regression showed a small but significant decrease in total fat calculated from the standard dietary records over the last decade from 89.8 g to 86.9 g.

Looking back through the list of potential sources of system drift, it is difficult to pinpoint the exact cause of the drift (refer to Table 1). At least the list of possibilities can be narrowed. Because the same records were used in 1983 and 1993, addition and removal of foods from the marketplace are not factors. Also, package sizes should not be an issue because the standards carefully documented package sizes and amounts. Therefore, the marketplace changes that could affect the MHS data include product reformulations and changes in the database that reflect changes in food preparation and cooking methods.

It is not so easy to eliminate changes to the database that reflect better data for foods. Updates or "improvements" made to reflect changes in recipe yields, densities and conversion factors, coding rule changes and changes in the specificity of the database may all play a part in the system drift for total fat. In this case, improved analytical methods did not affect the data because the same nutrient database was used in both time periods.

Now that system drift has been identified, what can be done with this information? MHS plans to use results from the system drift analysis to more accurately interpret dietary data collected in recent years of the survey. They will expand their investigation to evaluate system drift in other nutrients of interest. They also plan to continue to use the standard, unambiguously documented records as quality control standards in the future. Finally, they are planning to move away from hand coding to the NDS automated interview system for the next survey period and will use the standards to monitor any affect due to that transition.

Summary and Conclusions

To summarize, system drift can be caused by many factors, including marketplace changes and better data for foods that have not changed. System drift can have significant impact on interpretation of dietary data from longitudinal studies. Finally, system drift can and should be monitored for proper interpretation of dietary data.

These results indicate the necessity for monitoring and characterizing system drift in long-term studies of dietary intake. Several research opportunities present themselves. First, additional research needs to be done to explore our ability to partition system drift. Specifically, is there a way to separate system drift due to changes in the marketplace from drift due to improvements in analytical methods? Also, within each of these broader categories, can we attribute drift to any specific change? Secondly, what impact does a time-related database have on system drift? With the National Health and Examination Survey, NHANES III, finishing data collection in October, 1995, we are in a unique position to use data from this survey to further explore the issue of system drift in dietary data. Finally, what statistical methods are most appropriate for assessing or monitoring system drift in dietary data? Obviously, we get very different results using mixed model regression versus ANOVA. Is mixed model regression really the best tool? Hopefully, we can continue to explore causes and effects of system drift in dietary data until we are able to answer these questions.

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Table 1: Potential Sources of System Drift in Dietary Data

Potential Source of System Drift	Examples
Changes in the Marketplace	•Addition of new foods •Product reformulations •Package or size changes •Removal of items from the market • Changes in food preparation and cooking methods
Better Data for Existing Foods	• Changes in recipe yields, density data, or conversion factors •Improved analytical methods •Coding rule changes •Changes in the specificity of the database •Addition of new nutrient values

Table 2: Examples of Differences Between Original MHS Quality Control Records and Unambiguously Documented Standards.

Food	Original	Standard
Hot dog	5 1/2 - 6 inch long 1 inch diameter	pork and beef hot dog 5 3/4 inch long 1 inch diameter
Watermelon	1 1/4 inch by 5 inch wedge	1 cup chunks
Chicken wing	average size, frozen, Banquet; person ate skin	1 ounce, frozen, pre-breaded and fried, commercially prepared; person ate skin and breading

Figure 1. System Drift in Total Kcal, 1983-1993

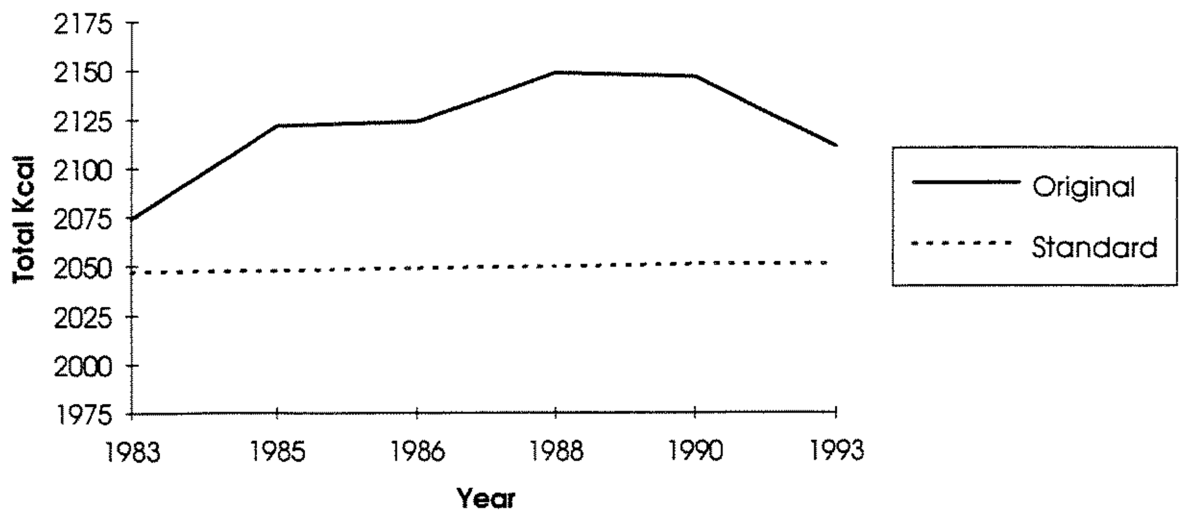
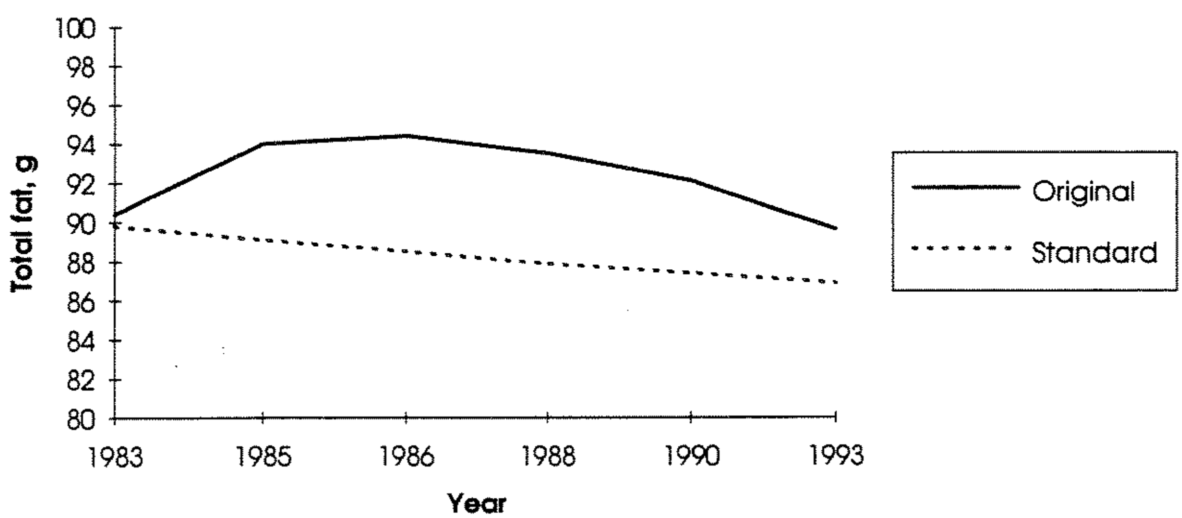


Figure 2. System Drift in Total Fat, 1983-1993



Development of a Key Foods List for Establishing Priorities in Food Composition Research

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Introduction

The mission of the Nutrient Data Laboratory (NDL), Agricultural Research Service (ARS) is to acquire, evaluate, compile and disseminate nutrient data and to maintain authoritative nutrient data bases (e.g. USDA Nutrient Data Base for Standard Reference) for foods and food components in the US food supply. These data bases support nutrition research, nutrition monitoring, policy development, monitoring of specific populations, product development, and food plans for health care situations. They also support the USDA Nationwide Food Consumption Surveys and USDHHS' National Health and Nutrition Examination Surveys. The NDL's equally important responsibility is to update Agriculture Handbook No. 8.

Timely monitoring and updating of nutrient profiles for over 5,000 foods in these data bases is expensive; complete analysis of the nutrients in a single sample of food costs approximately $2,000. Clearly, it is not possible to establish an analytical nutrient profile in a timely way for every food that would account for modifications in methods of analysis, frequent formulation changes, and foods new to the marketplace. Industry provides some of the needed analytical data. However, with changes resulting from the Nutrition Labeling and Education Act (NLEA) and the new labeling practices, industry no longer generates data for many nutrients removed from the nutrition labels but which still exist in NDL data bases. In addition, verification of the industry data through independent analysis in conjunction with quality control checks is necessary. Many users of these data, including ARS researchers, are interested in a concise, readily accessible summary capturing the most important contributors to nutrient intakes in the US diet. Targeting these demands with the need for cost control prompted the development of the concept of a Key Foods List in the mid-1980s (Hepburn, 1987). These lists were used to determine foods to be analyzed in contracts during the late 1980s and early 1990s. Development of a Key Foods List has become a viable way to identify critical nutrient information efficiently and effectively. The initial Key Foods List, developed using food consumption data from the 1985 Continuing Survey of Food Intakes by Individuals (CSFII) and the 1987-88 Nationwide Food Consumption Survey, included 30 nutrients currently listed in the Primary Nutrient Data Set or PDS (USDA, 1994a and b). Foods and food components from mixtures were included with single-ingredient foods until their cumulative contribution reached 80% of the total nutrient intakes (Hepburn, 1987). Food mixtures were not reported as eaten but were broken down into the individual foods or ingredients. Then and today, many of the commodity-level ingredients such as flour and salt are foods consumed only as part of a food mixture--not by themselves as a food. This method of

[1]Deceased.

assessing mixtures in Key Foods offers no indication of the types of food mixtures--entrees, desserts, etc., that make important contributions to nutrient intakes in the United States. Current objectives are to identify important contributors of nutrients, including food mixtures, to build the most reliable and comprehensive nutrient data base possible.

Methods

Figure 1 (Haytowitz et al, 1995) depicts Key Foods as an integral part of the data bases currently maintained by USDA. Nutrient values in the Standard Reference data base and limited data from industry support the PDS. The PDS in turn is used to develop the USDA Survey Nutrient Database and includes approximately 5200 foods and 30 nutrients. The Survey Recipe File includes all items reported in the surveys as a recipe; even single-ingredient foods are included as a recipe. To assess whole-food nutrient contributions, multi-ingredient recipes or food mixtures must represent the nutrient profiles of all its ingredients. Mixtures must be processed through the recipe program, which generates a nutrient profile for the entire food mixture based on the proportion and nutrient composition of each ingredient in the mixture (Perloff, 1985).

The nutrient values obtained from the Survey Recipe File result in the USDA Survey Nutrient Database. Intake data from the CSFII 1989-91, multiplied by the nutrient profiles from the Survey Nutrient Database, yields total nutrient intakes. Other researchers with the Agricultural Research Service have used the Nationwide Food Surveys to develop lists of key contributors to nutrients (Schubert et al, 1987; Lurie et al, 1989; Chug-Ahuja et al, 1993). This method expands on previous work to include multi-ingredient foods, broken down into their component parts. The current Key Foods List includes food intake data from the CSFII 1989-91, the most recently published survey for which data are available (USDA, 1994a). The CSFII 1989-91 includes dietary data for 3 consecutive days for 15,128 individuals in the 48 conterminous states and is weighted to represent the intakes of the US population.

In 1994, a NDL committee streamlined and more clearly defined the Key Foods selection process. Its effort reduced the number of nutrients from 30 to a smaller number and included food mixtures in the Key Foods List.

The committee used the report "Nutrition Monitoring in the United States - An Update Report on Nutrition Monitoring" (LSRO, 1989) to identify nutrients of public health concern. This publication is a review of the health and nutritional status of the US population and the factors affecting it. The Expert Panel on Nutrition Monitoring (EPONM) involved in this project identified 17 nutrients as those of public health or potential public health significance (Table 1). The Key Foods Committee within NDL elected to adopt 14 of these nutrients as selection criteria for the development of the Key Foods List. Alcohol and fluoride were not included in the Key Foods selection process because of their limited appearance in foods and lack of reliable data. Folate was not included as a criteria nutrient because of poor methodology and because reliable data are limited.

All foods reported in the CSFII 1989-91 were recorded as either a single-ingredient recipe (e.g., milk, fruit, vegetable, etc.) or as a multi-ingredient recipe (e.g., casserole) with defined proportions for each ingredient. Both recipe types are processed through the survey recipe program, picking up the appropriate single nutrient profiles for single-ingredient recipes and, in predefined proportions, the nutrient profiles, retention and yield factors for component foods of food mixtures. Foods, starting with the most important contributors to each of the 14 nutrients, and including ingredient or component foods, were selected until 80% of the total nutrient intake

Table 1. Classification of Food Components by Monitoring Priority (LSRO, 1989)

Current public health concern	Potential public health concern: further study needed	
Food energy	Dietary fiber	Vitamin C
Fat	Vitamin A	Potassium
Saturated fat	Carotenes	Zinc
Cholesterol	Folate[1]	Fluoride[1]
Alcohol[1]	Vitamin B6	
Iron		
Calcium		
Sodium		

[1] excluded in selection criteria for Key Foods because of lack of reliable data.

was reached. In some cases, the raw version of a food typically eaten cooked qualifies as a Key Food because it is included in a to-be-cooked survey recipe i.e., raw legumes and meats. To identify food mixtures for Key Foods, the nutrient contributions of the ingredients or component foods were pulled out, recombined and summed for each food mixture. Those food mixtures contributing 2% or more to the total nutrient intake of any of the 14 nutrients were included as Key Foods. Smaller percent contributions were explored but yielded an unwieldy number of foods.

Whole milk is identified as a Key Food. It was reported consumed in the survey as a single-item food, a beverage, and as an ingredient in many food mixtures. Reported consumption of whole milk as a beverage was around 60.3 million grams. The nutrients per 100 grams for whole milk would then be multiplied by 60.3 million to determine the contribution of this food to the 14 total nutrient intakes.

There are two kinds of food mixtures in the recipe file--not further specified or NFS items and true recipes. The process for determining the amount of nutrient contributions from food mixtures was reviewed earlier at the International Dietary Assessment Conference in Boston in January (Haytowitz, 1995). NFS foods, which are weighted averages or composites of types of similar foods, reflect consumption patterns and are a way of addressing nonspecific reporting in the survey. For example, when an individual goes out for a meal and is uncertain of the specific characteristics of a food, it will be recorded as a composite of variations of that food type. NFS items and recipes are included in the most recent Key Foods list if the sum of the nutrient contributions from the ingredients contributed at least 2% of any of the selected nutrients to the total intake of that nutrient--an example is milk, NFS. Whole milk, using 1989-91 weighted market data, was approximately 39% of total fluid milk consumption in the United States. Whole milk consumption by respondents from the NFS category is calculated as 1.4 million grams, 39% of the total reported NFS milk consumption of 3.5 million grams. The amount of the component food consumed is calculated by multiplying the percentage contribution of each component food by the total amount of the NFS food reported consumed. Food specialists must regularly update the weighting of component parts of the composite or NFS food so that it reflects current market distribution. This is repeated for all NFS foods in the survey recipe file, with a total of 14 meeting the most recent criteria for Key Foods selection. The component parts of NFS foods are treated as individual foods and are used in assessing nutrient contributions and in developing lists for contract analysis.

Nutrient contributions from multi-ingredient recipes such as entrees or desserts are also determined. These foods are broken down into their ingredients; the nutrient contributions from each are determined and are included in the total nutrient intake. In general, multi-ingredient recipes were broken down to a level where a nutrient profile could be generated, but not necessarily to the commodity level. For example, fried chicken is broken down to specific chicken parts, breading, and oil. The breading is not broken down further because a nutrient profile for that food already exists.

Another example of a multi-ingredient recipe is macaroni and cheese, which contains as its primary ingredients cooked macaroni, cheese, flour, salt, and whole milk. Approximately 2.9 million grams of whole milk as an ingredient of macaroni and cheese were reported consumed by respondents. Adding to the 1.4 million grams whole milk from milk, NFS the whole milk from all other reported food mixtures, a total of 18.2 million grams of whole milk were reported consumed by survey respondents from food mixtures. The amount of each ingredient across all recipes is summed to assess the total amount consumed for that food. This is repeated across all reported foods. The 18.2 million grams of whole milk from food mixtures plus 60.3 million grams of whole milk reported consumed as a beverage total 78.5 million grams of whole milk consumed.

Multiplying this value by the corresponding nutrient value for each food yields the grams consumed for each nutrient across foods. The top two contributors of fat in the U.S. diet, according to 1989-91 market distribution and nutrient information, are margarine and whole milk. The fat for whole milk, 3.3%, is multiplied by the total grams of whole milk reported consumed, 78.5 million grams, yielding a contribution by whole milk of 2.6 million grams of fat or 5.4% of the total fat intake of respondents. Its contribution is exceeded only by margarine at 7.1% of the total fat intake. Cumulatively, margarine and whole milk contribute 12.6% of the total fat intake when these values are summed in descending order by amount of the nutrient contributed (Table 2).

Table 2. Fat Contributions by Weighted Grams Consumed: Examples[1] from CSFII 1989-91[2]

Food (NDB no.)	g fat per 100 g food	g food consumed x 10^6	g fat consumed x 10^6	% of total nutrient intake	Cum %
Margarine, regular, 80% fat (04132)	80.5	4.284	3.449	7.13	7.13
Milk, whole, 3.34 % fat (01077)	3.3	78.476	2.621	5.42	12.55

[1] Top two contributors of fat.
[2] USDA Continuing Survey of Food Intakes by Individuals, 1989-91.

The percent contribution to each nutrient from all foods and from all components of food mixtures is added cumulatively until 80% of the total nutrient intake is reached. For some nutrients such as vitamin A, relatively few foods together contribute 80% of the nutrient (62 foods), but for other nutrients (such as zinc), the number of foods contributing 80% of the nutrient is extensive (213 foods). We looked for dramatic dropoffs in the cumulative percents as a way to more precisely define by nutrient a specific or constant number of Key Foods. However, with the most recent data dramatic dropoffs were not apparent. Until the next set of survey data is available, the 80% cutoff will be retained.

Results

The current Key Foods and the nutrients in each which meet the 80% total intake criteria are listed in the appendix. Using this method, 527 out of 3349 (15.7%) PDS foods (USDA, 1994a) are identified as Key Foods. This total includes 463 single-ingredient foods and 78 food mixtures. Fourteen of the 78 food mixtures are NFS items or composites which are not included in the final Key Foods List except as their components; the remaining 64 food mixtures are true recipes and are included under their seven-digit recipe ID number in the final list (Appendix). The foods on the Key Foods List contribute significantly to at least one of the criteria nutrients. However, their contributions to the remaining nutrients are included in the cumulative intake totals so that they actually provide closer to 90% of the intakes of the 14 criteria nutrients.

Of the 463 single-ingredient foods, about 26% of the Key Foods contributed significantly to the intake of only one nutrient (Table 4), around 66% contributed to several nutrient intakes, and 7% contributed significantly to 10 or more nutrient intakes. Therefore, almost 75% of the Key Foods are important contributors to at least several nutrients.

Table 4. Single-Ingredient Key Foods[1]: Number of Nutrient Contributions

Number of contributions	Percent of foods
1	26.5
2 - 9	66.2
10 or more	7.3

[1] From USDA Continuing Survey of Food Intakes by Individuals, 1989-91.

Whole milk contributed to the most nutrient intakes. Whole milk made significant contributions to the total reported intake of 14 nutrients or food components: food energy, fat, saturated fat, cholesterol, zinc, vitamin A, carotene, potassium, vitamin B6, calcium, iron, sodium, and vitamin C. It is important to realize that a food may not be a concentrated, or even a moderate source of a nutrient, but may become a major contributor to total nutrient intake because it is consumed in such large quantities by the survey population.

As another example, Table 5 lists the top contributors of sodium in the diet. Naturally, table salt far surpasses other sources by contributing over 27% of the total sodium intake. Whole milk, at 49 mg sodium per 100 g, is not considered an obvious recognizable source of sodium but appears in the top ten contributors because of the volume consumed. Also included are plain and toasted white bread, rolls and buns. The contribution to sodium comes from the volume consumed of these baked products, not from their being concentrated sources of sodium. In fact, if contributions to sodium intake from white bread plain and toasted are added, they contribute almost 4% of the total sodium intake. The contribution from white bread to sodium intake would then be second only to table salt. Of course, as is true of some other Key Foods such as baking soda, table salt is not consumed by itself but only as part of a recipe; table salt added at the table was not quantified in the CSFII 1989-91.

Table 5. Top Contributors to Sodium Intake: CSFII 1989-91

Food	% sodium contributed
Salt, table	27.46
Cheese, American, processed	3.24
Bread, white	2.50[1]
Rolls and buns	2.20
Margarine	1.84
Milk, whole	1.75
Tomato sauce	1.44
Milk, lowfat, 2% fat	1.33
Ham	1.26
Bread, white, toasted	1.23[1]

[1] White bread plain + toasted = 3.73% of sodium intake.

Discussion

The increasing complexity of our food supply, the cost of analysis, and the demand for information on the connection between diet and health, necessitate establishing priorities for the determination of nutrient profiles in foods. The Key Foods List is a cost-effective tool in establishing priorities for research and analysis.

The Key Foods list will always be in a dynamic state. In the future, we will reinforce this list with information from other sources such as the Nielsen reports (Nielsen, 1994), the Core Foods list from FDA's market basket studies (Pennington, 1992), and other market data from food distributors. This review will ensure foods that consumed in large amounts are accounted for in the Key Foods selection process. In addition, we are looking at data from other large scale surveys such as Hispanic HANES as part of a larger effort to include highly consumed ethnic foods meeting the same nutrient contribution criteria. Eventually, when data become available, we hope to establish adjunct Key Foods lists for other ethnic populations. The Key Foods will shift to a certain degree from survey to survey, but the list is expected to retain a constant core of foods and a relatively constant number that contribute significantly to nutrient intakes. These foods will continue to be the focus of contracts for nutrient analysis; the criteria nutrients will reflect those targeted in research of relationships between diet and health. With the pending publication of the Third Report on Nutrition Monitoring, additional nutrients may be defined to be of current or potential public health significance and will be considered in the selection criteria. Analyses of Key Food lipid components--fat, fatty acids--including geometric isomers, sterols (including cholesterol) and carbohydrate fractions, will be an integral part of NDL contracts.

The 1994-96 CSFII reflects changes in the survey coding system, the recipe file, and in the interview format (e.g., expanded probes). These changes improve the accuracy of incoming consumption data. Changes in the food supply will be addressed to reflect reformulations, the addition of new products to the marketplace, and the disappearance of others. A team of food specialists within NDL will annually review the Key Foods List to ensure all changes in the food supply and in consumption patterns have been included.

The Nutrient Data Laboratory will make Key Foods information available through the online Nutrient Data Bank Bulletin Board. These efforts will provide consumers, members of the medical and scientific communities, and industry, with a useful and timely pool of nutrient information for important food sources of nutrients.

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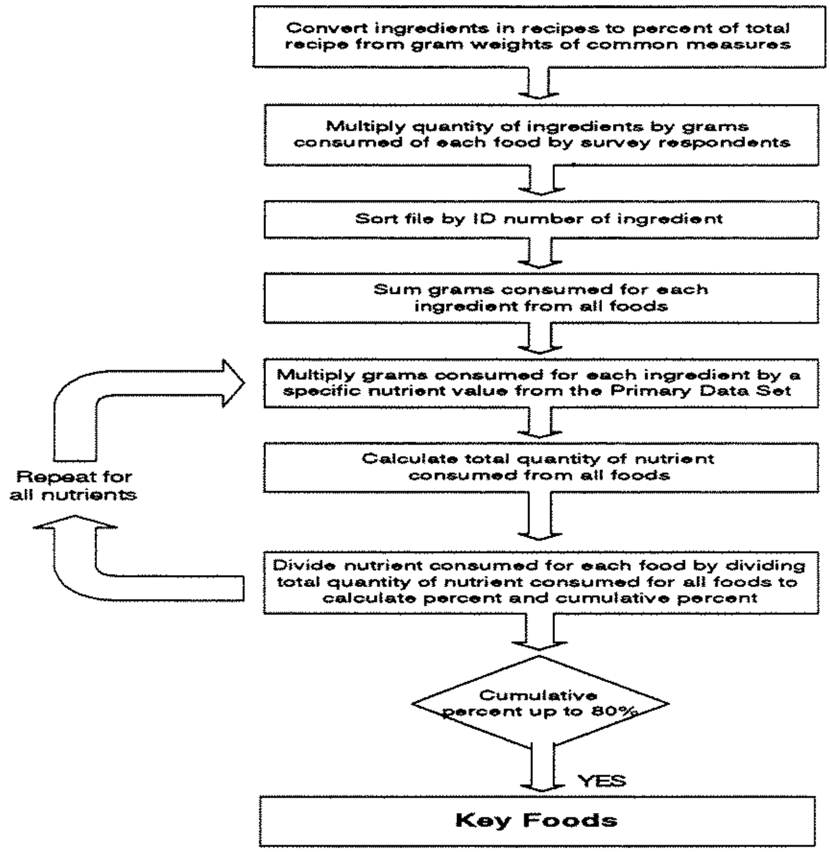
Figure 1. Overview of Procedure for Developing Key Foods List[1]



[1] Haytowitz et al (1995)

Appendix - Key Foods Based on Nutrients of Public Health Significance; CSFII 1989-91[1]

ID[2]	Description[3]	Food Energy	Fat	Saturated fat	Cholesterol	Iron	Calcium	Sodium	Dietary fiber	Vitamin A	Carotene	Vitamin B_6	Vitamin C	Potassium	Zinc
	Baby Foods														
03803	Enfamil®, with iron			✔		✔									✔
03194	Rice cereal, baby food, dry					✔									
03850	Similac®, with iron	✔	✔	✔		✔	✔						✔		✔
	Baked Products														
18012	Biscuit dough, commercial, chilled, in cans	✔				✔		✔							
18010	Biscuit mix	✔	✔			✔	✔	✔							
18079	Breadcrumbs, dry	✔				✔	✔	✔	✔					✔	✔
42011	Breading for chicken							✔							
18080	Breadsticks					✔									
18081	Breadstuffing mix, dry	✔				✔		✔	✔						
5310426	Cake, carrot, with frosting	N/A													
5311600	Cake, pound	N/A													
5310526	Cake, chocolate, with frosting	N/A													
18159	Chocolate chip cookies, commercial	✔	✔	✔		✔		✔	✔						
18363	Tortillas, corn	✔				✔	✔		✔			✔			
5220206	Cornbread, from home recipe	N/A													
18022	Cornbread mix, dry	✔							✔						
5220100	Cornbread, prepared from mix	N/A													
18026	Cracked wheat/wheat bread, toasted	✔	✔			✔	✔	✔	✔			✔		✔	✔
18025	Cracked wheat/wheat bread	✔	✔	✔		✔	✔	✔	✔			✔		✔	✔
18244	Danish pastry	✔	✔	✔		✔									
18248	Doughnuts, cake, plain	✔	✔	✔		✔		✔							
18255	Doughnuts, raised (includes plain and glazed)	✔	✔	✔		✔			✔						✔
18364	Tortillas, flour	✔	✔			✔	✔	✔	✔					✔	✔
5530100	French toast (includes home-prepared and commercial)	N/A													
18030	French or Vienna bread, toasted	✔				✔									

18029	French or Vienna bread	✔	✔			✔	✔	✔	✔					✔	✔
18173	Graham crackers, plain	✔				✔									
18353	Hard rolls	✔				✔		✔							✔
18033	Italian bread	✔				✔			✔						
5118602	Muffins, English, plain, toasted	----------N/A----------													
5230201	Muffins, fruit and or nut	----------N/A----------													
5230401	Muffins, bran (includes wheat bran and oat bran)	----------N/A----------													
18291	Pancake/waffle mix, dry	✔				✔	✔	✔	✔					✔	✔
5510100	Pancakes, plain	----------N/A----------													
18215	Peanut butter-cheese sandwich crackers	✔	✔			✔									
5330100	Pie, apple	----------N/A----------													
5334700	Pie, pumpkin	----------N/A----------													
18342	Plain pan rolls	✔	✔	✔		✔	✔	✔	✔			✔		✔	✔
18060	Rye bread	✔				✔		✔	✔						
18061	Rye bread, toasted								✔						
18228	Saltines	✔	✔			✔		✔	✔						
78290	Sandwich cookies (includes chocolate and vanilla)	✔	✔	✔		✔		✔	✔						
18229	Snack-type crackers (oil-sprayed)	✔	✔			✔									
18356	Sweet rolls	✔	✔			✔	✔								
18360	Taco shells	✔							✔						
18362	Toaster pastries, fruit	✔				✔	✔					✔			
18212	Vanilla wafers	✔													
5520100	Waffles, plain	----------N/A----------													
18066	Wheat bran bread											✔			
18070	White bread, toasted	✔	✔	✔		✔	✔	✔	✔			✔		✔	✔
18069	White bread	✔	✔	✔		✔	✔	✔	✔			✔		✔	✔
18076	Whole wheat bread, toasted	✔				✔			✔						✔
18075	Whole wheat bread	✔				✔		✔	✔					✔	✔
	Beverages														
	Alcoholic														
14003	Beer	✔					✔		✔			✔		✔	
14006	Beer, light	✔										✔		✔	
14550	Gin, rum, vodka, whiskey, 86 proof	✔													
14037	Gin, rum, vodka, whiskey, 80 proof	✔													
14084	Wine, table	✔				✔						✔		✔	
	Non-alcoholic														

14262	Citrus fruit juice drink, frozen concentrate					✔									
14209	Coffee, brewed	✔				✔	✔							✔	✔
14214	Coffee, instant, powder					✔								✔	
14400	Cola, sweetened	✔				✔	✔	✔							✔
14242	Cranberry juice cocktail												✔		
14238	Cranberry-apple juice drink												✔		
14416	Diet cola					✔	✔								✔
43068	Fruit drink, artificially sweetened												✔		
14265	Fruit punch drink, powder	✔					✔						✔		
14267	Fruit punch drink, canned												✔		
42144	Fruit drink	✔													
14145	Lemon-lime soda, sweetened	✔				✔									✔
14292	Lemonade, frozen concentrate	✔													
14407	Orange flavor drink, breakfast type, powder									✔	✔		✔		
14323	Orange drink, canned	✔											✔		
14157	Root beer, sweetened	✔													
14355	Tea, brewed					✔								✔	✔
14368	Tea, instant, unsweetened, powder													✔	
14429	Water, municipal					✔	✔								
	Breakfast Cereals														
	Ready-to-eat														
08001	All-Bran®, Kellogg's®					✔			✔			✔			✔
08002	Alpha-Bits®											✔			
08003	Apple Jacks®, Kellogg's®					✔						✔			✔
43531	Apple-Cinnamon Cheerios®					✔						✔			
08029	Bran flakes, Post®					✔									
08028	Bran flakes®, Kellogg's®					✔			✔			✔			✔
08006	Bran Chex, Multi-Bran CHEX®					✔									
08010	Cap'n Crunch®					✔						✔			✔
08013	Cheerios®	✔				✔	✔	✔	✔	✔		✔	✔	✔	✔
44290	Clusters®					✔						✔			
43229	Cocoa Puffs®					✔						✔			
43230	Corn TOTAL®					✔						✔			
08068	Corn Pops®, Kellogg's®											✔			
08019	Corn CHEX®					✔									
43232	Cracklin' Oat Bran®, Kellogg's®					✔			✔			✔			✔
43361	Fiber One®					✔			✔			✔			
08030	Froot Loops®, Kellogg's®	✔				✔				✔		✔	✔		✔

08031	Frosted Mini-Wheats®											✔			
08034	Fruity Pebbles®											✔			
08035	Golden Grahams®					✔						✔			
08037	Granola, homemade								✔						
08039	Grape Nuts Flakes®					✔						✔			
08038	Grape Nuts®	✔				✔		✔	✔	✔		✔		✔	✔
43570	Honey Bunches of Oats®					✔						✔			
08045	Honey Nut Cheerios®					✔				✔		✔			
43298	Just Right® with Fiber Nuggets, Kellogg's®					✔						✔			✔
08020	Kellogg's Corn Flakes®	✔				✔		✔	✔	✔		✔	✔		
08069	Kellogg's Frosted Flakes®	✔				✔		✔	✔	✔		✔	✔		
08048	Kix®					✔						✔			
08049	Life®					✔									
08050	Lucky Charms®					✔				✔		✔			
43481	Mueslix®					✔			✔			✔			✔
44291	Oatmeal Raisin Crisp®					✔									
08076	Post Toasties®											✔			
08058	Product 19®, Kellogg's®					✔						✔			✔
44289	Quaker Oat Squares™					✔				✔		✔			✔
08062	Raisin Bran, Ralston Purina®					✔									
08061	Raisin Bran, Post®	✔				✔			✔	✔		✔		✔	✔
08060	Raisin Bran, Kellogg's®	✔				✔		✔	✔	✔		✔		✔	✔
43416	Raisin Nut Bran®					✔									
08065	Rice Krispies®, Kellogg's®	✔				✔		✔		✔		✔	✔		
08064	Rice CHEX®					✔									
08071	Smacks®, Kellogg's®											✔			
08067	Special K®, Kellogg's®					✔						✔			✔
43547	TOTAL® Raisin Bran					✔						✔			✔
08077	TOTAL®					✔	✔		✔	✔		✔	✔		✔
42114	Triples®											✔			
08078	Trix®					✔						✔			
08148	Wheat, shredded								✔						
08082	Wheat CHEX®					✔						✔			
08089	Wheaties®					✔			✔	✔		✔			
	To-be-cooked														
08091	Corn grits, white, regular or quick, cooked	✔				✔									
08109	Cream of Wheat®, Mix'n Eat, instant, plain, prepared with water					✔						✔			

08105	Cream of Wheat®, quick, cooked in water					✔									
08103	Cream of Wheat®, regular, cooked in water					✔									
08102	Cream of Wheat®, regular, dry					✔									
08121	Oats, regular or quick, cooked in water	✔				✔			✔			✔		✔	✔
08123	Oats, instant, fortified, plain, prepared with water	✔				✔	✔	✔	✔	✔		✔		✔	✔
08120	Oats, regular or quick, dry								✔						
	Cereal Grains and Pastas														
20081	All-purpose flour, enriched	✔	✔			✔	✔		✔			✔		✔	✔
20083	Bread flour, enriched	✔				✔			✔					✔	✔
42016	Cake or pastry flour, enriched					✔									
20084	Cake flour, enriched	✔				✔									
20022	Cornmeal, yellow, degermed, enriched	✔				✔			✔			✔			
20100	Macaroni, enriched, cooked	✔				✔			✔			✔		✔	✔
20110	Noodles, egg, enriched, cooked	✔	✔		✔	✔			✔			✔			✔
20033	Oat bran								✔						
20047	Rice, white, long grain, enriched, parboiled, cooked	✔				✔									
20345	Rice, white, long grain, enriched, cooked, added salt	✔				✔		✔				✔			✔
20045	Rice, white, long grain, enriched, cooked	✔				✔	✔		✔			✔		✔	✔
20044	Rice, white, long grain, enriched, raw	✔				✔									
20049	Rice, white, long grain, enriched, instant, prepared	✔				✔									
20121	Spaghetti, enriched, cooked	✔				✔			✔			✔		✔	✔
20077	Wheat bran								✔						
20080	Whole wheat flour	✔				✔			✔			✔			✔
	Dairy Products														
01001	Butter, salted	✔	✔	✔	✔			✔		✔					
	Cheese, natural														
01009	Cheddar cheese	✔	✔	✔	✔	✔	✔	✔		✔		✔		✔	✔
01011	Colby cheese	✔	✔	✔			✔								✔
01012	Cottage cheese, creamed, 4% fat	✔		✔				✔							
01017	Cream cheese	✔	✔	✔	✔					✔					
01025	Monterey cheese			✔			✔								
01029	Mozzarella cheese, part skim milk, low moisture	✔	✔	✔	✔		✔	✔		✔		✔		✔	✔
01028	Mozzarella cheese, part skim milk			✔			✔								✔

01032	Parmesan cheese	✔	✔	✔	✔		✔	✔							✔
01035	Provolone cheese						✔								
01036	Ricotta cheese, whole milk	✔	✔	✔	✔		✔								✔
01040	Swiss cheese	✔	✔	✔	✔		✔								✔
	<u>Cheese, processed</u>														
01042	American cheese	✔	✔	✔	✔	✔	✔	✔		✔	✔	✔		✔	✔
01048	American cheese spread	✔	✔	✔			✔	✔							✔
	<u>Cream and cream products</u>														
01069	Cream substitute, nondairy powder	✔	✔	✔										✔	
01049	Half and half	✔	✔	✔			✔								
01053	Heavy whipping cream			✔											
01050	Light cream		✔	✔											
01056	Sour cream	✔	✔	✔	✔		✔			✔					
	<u>Milk</u>														
01088	Buttermilk, cultured, nonfat						✔								
01103	Chocolate milk, commercial, lowfat, 2% fat	✔		✔			✔		✔					✔	✔
01102	Chocolate milk, commercial, whole	✔	✔	✔			✔		✔			✔		✔	✔
01096	Evaporated milk						✔								
01082	Lowfat milk, 1% fat	✔	✔	✔	✔	✔	✔	✔		✔		✔		✔	✔
01079	Lowfat milk, 2% fat	✔	✔	✔	✔	✔	✔	✔		✔		✔	✔	✔	✔
01092	Nonfat dry milk, instant						✔							✔	
01091	Nonfat dry milk, regular, without added vitamin A						✔							✔	✔
01085	Skim milk	✔		✔	✔	✔	✔	✔		✔		✔	✔	✔	✔
01077	Whole milk	✔	✔	✔	✔	✔	✔	✔		✔	✔	✔	✔	✔	✔
	<u>Other Dairy</u>														
43207	Meal replacement, milk base, powder	✔				✔	✔			✔		✔	✔	✔	✔
14347	Shake, vanilla						✔								
14346	Shake, chocolate						✔							✔	
01118	Yogurt, nonfat, plain						✔								
01119	Yogurt, lowfat, flavored						✔								
01117	Yogurt, lowfat, plain						✔							✔	✔
01121	Yogurt, lowfat, fruit	✔					✔							✔	✔
	Eggs														
01133	Dried whole egg				✔										
3210300	Egg salad	------------------------------N/A------------------------------													
01125	Egg yolk, raw				✔										
01128	Fried egg				✔										
01129	Hard cooked egg	✔	✔	✔	✔	✔				✔		✔		✔	✔

3210495	Omelet, plain, no fat added	----------N/A----------													
01130	Omelet, plain	✔	✔	✔	✔	✔									✔
3210490	Omelet/scrambled eggs	----------N/A----------													
3210501	Omelet with cheese	----------N/A----------													
01123	Whole egg, raw	✔	✔	✔	✔	✔	✔	✔		✔		✔		✔	✔
	Fats and Oils														
04001	Beef tallow	✔	✔	✔											
04539	Blue cheese dressing	✔	✔	✔				✔							
04137	Butter oil	✔	✔	✔											
04047	Coconut oil			✔											
04518	Corn oil	✔	✔	✔											
04120	French dressing	✔	✔	✔				✔							
04114	Italian dressing	✔	✔	✔				✔							
04002	Lard	✔	✔	✔											
43213	Margarine-like spread, stick or tub, 60% fat,		✔												
04128	Margarine, imitation, unspecified oils, 40% fat	✔	✔	✔				✔		✔					
04132	Margarine, regular, unspecified oils, 80% fat	✔	✔	✔			✔	✔		✔	✔			✔	
04130	Margarine, soft, unspecified oils, 80% fat	✔	✔	✔				✔		✔					
04018	Mayonnaise-type dressing	✔	✔	✔				✔							
04025	Mayonnaise	✔	✔	✔	✔	✔		✔		✔		✔			
04053	Olive oil	✔	✔	✔											
43018	Ranch dressing		✔												
04031	Shortening, household	✔	✔	✔											
04044	Soybean oil	✔	✔	✔											
04543	Soybean oil (hydrogenated) and cottonseed oil			✔											
04034	Soybean oil (hydrogenated)	✔	✔	✔											
04017	Thousand island dressing	✔	✔												
	Fast Foods														
2751031	Cheeseburger with tomatoes and/or catsup, bun	----------N/A----------													
2751031	Cheeseburger, 1/4 lb, with mayonnaise and tomatoes, bun	----------N/A----------													
21037	Chicken nuggets	✔	✔	✔	✔	✔		✔				✔		✔	✔
2751030	Double cheeseburger (2 patties), mayonnaise, double decker bun	----------N/A----------													
21136	French fries, in beef tallow	✔	✔	✔					✔			✔		✔	

21138	French fries, in vegetable oil	✔	✔	✔		✔		✔	✔			✔	✔	✔	✔
2751056	Hamburger, 1/4 lb, with mayonnaise and tomatoes, bun	---N/A---													
2751051	Hamburger, with tomato and/or catsup, bun	---N/A---													
	Fish and Shellfish														
	Finfish														
15234	Catfish, farmed, raw	✔	✔		✔							✔		✔	
2610714	Catfish, floured or breaded, fried	---N/A---													
15015	Cod, Atlantic, raw				✔							✔		✔	
15028	Flounder/sole, raw	✔			✔							✔		✔	
15033	Haddock, raw											✔			
2612714	Perch, floured or breaded, fried	---N/A---													
15240	Trout, rainbow, farmed, raw											✔			
15121	Tuna, light, canned in water, drained solids	✔			✔	✔		✔				✔		✔	✔
15119	Tuna, light, canned in oil, drained solids	✔				✔									
	Shellfish														
15160	Clams, canned, drained solids					✔									
15157	Clams, raw					✔									
15140	Crab, blue, steamed				✔										✔
15167	Oyster, eastern, raw					✔									✔
15170	Oyster, eastern, canned														✔
2631914	Shrimp, floured or breaded, fried	---N/A---													
15152	Shrimp, canned				✔	✔									
15149	Shrimp, raw				✔	✔									✔
	Fruit and Fruit Juices														
09016	Apple juice	✔				✔						✔		✔	
09003	Apples with skin	✔				✔			✔			✔	✔	✔	
09020	Applesauce, sweetened, canned	✔				✔			✔						
09019	Applesauce, unsweetened, canned								✔						
09037	Avocados, all varieties											✔		✔	
09040	Bananas	✔				✔			✔			✔	✔	✔	✔
09181	Cantaloupe								✔	✔	✔	✔	✔	✔	
09135	Grape juice, bottled or canned	✔										✔		✔	
09111	Grapefruit, pink, red, or white								✔			✔	✔	✔	
09123	Grapefruit juice, canned												✔	✔	
09132	Grapes	✔							✔			✔	✔	✔	
09215	Orange juice, frozen concentrate, diluted	✔				✔	✔		✔	✔	✔	✔	✔	✔	✔

09207	Orange juice, canned												✔	✔	
09206	Orange juice	✔				✔			✔			✔	✔	✔	
09200	Oranges	✔					✔		✔			✔	✔	✔	
09236	Peaches								✔					✔	
09252	Pears								✔					✔	
09273	Pineapple juice, canned											✔		✔	
09298	Raisins	✔				✔			✔			✔		✔	
09316	Strawberries								✔				✔	✔	
09326	Watermelon											✔	✔	✔	
	Legumes and Nuts														
16008	Baked beans with franks, canned								✔						
16010	Baked beans with pork and sweet sauce, canned								✔						
16011	Baked beans with pork and tomato sauce, canned	✔				✔		✔	✔					✔	✔
16014	Black beans, raw								✔						
16063	Black-eyed peas (cowpeas), cooked					✔			✔						
43112	Chili (barbecue, ranch style), cooked					✔		✔	✔			✔		✔	✔
16033	Kidney beans, red, cooked					✔			✔					✔	
16034	Kidney beans, red, canned	✔				✔		✔	✔					✔	✔
16072	Lima beans, large, cooked					✔			✔			✔		✔	✔
12098	Peanut butter	✔	✔	✔		✔		✔	✔			✔		✔	✔
16089	Peanuts, oil-roasted, salted	✔	✔						✔						✔
16043	Pinto beans, cooked	✔				✔			✔			✔		✔	✔
16042	Pinto beans, raw	✔				✔			✔			✔		✔	✔
12155	Walnuts, English		✔												
16049	White beans, raw	✔				✔			✔			✔		✔	✔
16050	White beans, cooked					✔			✔					✔	✔
	Meat[a] and Game														
13262	Beef, short loin, 1/4 " trim, broiled, separable lean and fat		✔	✔								✔			✔
13220	Beef, top round, choice, 1/4" trim, pan-fried, separable lean	✔	✔		✔	✔						✔		✔	✔
13270	Beef, short loin, 1/4 " trim, broiled, separable lean	✔			✔	✔						✔		✔	✔
13287	Beef, top sirloin, 1/4" trim, broiled, separable lean														✔
13288	Beef, top sirloin, choice, 1/4 " trim, raw, separable lean														✔
13217	Beef, top round, 1/4 " trim, broiled, separable lean	✔			✔	✔						✔		✔	✔

13208	Beef, top round, 1/4" trim, broiled, separable lean and fat					✔						✔			✔
13184	Beef, eye of round, 1/4" trim, roasted, separable lean											✔			✔
13176	Beef, eye of round, 1/4" trim, roasted, separable lean and fat														✔
13192	Beef, round tip, 1/4" trim, roasted, separable lean and fat														✔
13196	Beef, round tip, select, 1/4 " trim, roasted, separable lean and fat														✔
13200	Beef, round tip, 1/4" trim, roasted, separable lean					✔						✔			✔
13290	Beef, top sirloin, choice, 1/4" trim, pan-fried, separable lean	✔	✔	✔	✔	✔						✔		✔	✔
13385	Beef, rib, large end, 0" trim, roasted, separable lean and fat														✔
13428	Beef, top round, 0" trim, braised, separable lean and fat					✔									✔
13424	Beef, round tip, 0" trim, roasted, separable lean														✔
13445	Beef, short loin, 0" fat, broiled, separable lean and fat											✔			✔
13448	Beef, short loin, 0" trim, broiled, separable lean					✔						✔		✔	✔
13454	Beef, top sirloin, 0" trim, broiled, separable lean														✔
13421	Beef, round tip, 0" trim, roasted, separable lean and fat														✔
13418	Beef, eye of round, 0" trim, roasted, separable lean														✔
13388	Beef, rib, large end, 0" trim, roasted, separable lean					✔									✔
13391	Beef, rib, small end, 0" trim, broiled, separable lean and fat														✔
13394	Beef, rib, small end, 0" trim, broiled, separable lean											✔			✔
13415	Beef, eye of round, 0" trim, roasted, separable lean and fat														✔
13043	Beef, chuck roast, choice, raw, separable lean	✔	✔		✔	✔						✔		✔	✔
13156	Beef, round, choice, 1/4 " trim, broiled, separable lean	✔	✔	✔	✔	✔						✔		✔	✔
13058	Beef, chuck blade roast, 1/4" trim, braised, separable lean														✔
13050	Beef, chuck blade roast, 1/4 " trim, braised, separable lean and fat														✔
13044	Beef, chuck roast, choice, 1/4" trim, braised, separable lean					✔									✔

13155	Beef, round, choice, raw, separable lean					✔						✔			✔
13379	Beef, chuck blade roast, 0" trim, braised, separable lean and fat														✔
13364	Beef, composite, trimmed cuts, braised, separable lean														✔
13382	Beef, chuck blade roast, 0" trim, braised, separable lean														✔
13327	Beef liver, pan-fried				✔	✔				✔		✔			✔
13088	Beef, rib, whole, choice, 1/4" trim, roasted, separable lean														✔
13143	Beef, rib, small end, select, 1/4 " trim, roasted, separable lean					✔						✔		✔	✔
13150	Beef, shortribs, choice, braised, separable lean														✔
13136	Beef, rib, small end, 1/4" trim, broiled, separable lean					✔						✔			✔
13124	Beef, rib, small end, 1/4" trim, broiled, separable lean and fat			✔											✔
13101	Beef, rib, large end, 1/4" trim, roasted, separable lean and fat		✔	✔											✔
13113	Beef, rib, large end,1/4" trim, roasted, separable lean					✔									✔
13347	Beef, corned beef, brisket, cooked														✔
13305	Ground beef, lean, broiled, medium	✔	✔	✔	✔	✔						✔		✔	✔
13312	Ground beef, regular, broiled, medium	✔	✔	✔	✔	✔		✔				✔		✔	✔
13313	Ground beef, regular, broiled, well done	✔	✔	✔	✔	✔						✔		✔	✔
13302	Ground beef, lean, raw	✔	✔	✔	✔	✔						✔		✔	✔
13300	Ground beef, extra lean, pan-fried, medium														✔
13295	Ground beef, extra lean, raw														✔
13298	Ground beef, extra lean, broiled, medium	✔	✔	✔	✔	✔						✔		✔	✔
13314	Ground beef, regular, pan-fried, medium	✔	✔	✔	✔	✔						✔		✔	✔
17164	Venison, raw				✔	✔						✔			✔
	Pork														
10227	Pork, composite, loin and shoulder, cooked, separable lean and fat		✔									✔			✔
10176	Pork, loin, center, pan-fried, separable lean											✔			
10022	Pork, loin, whole, broiled, separable lean and fat	✔	✔	✔	✔							✔		✔	✔
10179	Pork, loin, center, broiled, separable lean and fat	✔	✔	✔	✔							✔		✔	✔

10023	Pork, loin, whole, roasted, separable lean and fat											✔			✔
10026	Pork, loin, whole, broiled, separable lean	✔			✔							✔		✔	✔
10027	Pork, loin, whole, broiled, separable lean											✔		✔	✔
10075	Pork, shoulder, braised, separable lean and fat														✔
10089	Pork, spareribs, braised, separable lean and fat	✔	✔	✔	✔	✔						✔			✔
	Poultry														
	Chicken[5]														
42006	Chicken, thigh, meat, fried	✔	✔	✔	✔	✔						✔		✔	✔
05013	Chicken, light and dark meat, roasted	✔	✔	✔	✔	✔						✔		✔	✔
05011	Chicken, light and dark meat, raw											✔			
42007	Chicken, wing, meat, fried	✔			✔							✔			✔
05103	Chicken, wing, meat and skin, roasted											✔			
42010	Chicken skin, fried	✔	✔	✔	✔	✔									✔
05027	Chicken liver				✔	✔				✔					
05014	Chicken, light and dark meat, stewed	✔	✔		✔	✔						✔		✔	✔
05009	Chicken, light and dark meat and skin, roasted	✔	✔	✔	✔	✔						✔		✔	✔
05069	Chicken, drumstick, meat and skin, roasted														✔
05060	Chicken, breast, meat and skin, roasted	✔	✔	✔	✔	✔						✔		✔	✔
05064	Chicken, breast, meat, roasted	✔	✔		✔	✔						✔		✔	✔
42005	Chicken, drumstick, meat, fried	✔	✔		✔	✔						✔		✔	✔
05082	Chicken, leg, meat, roasted											✔			✔
05006	Chicken, light and dark meat and skin, raw											✔			
05078	Chicken, leg, meat and skin, roasted	✔	✔	✔	✔	✔						✔		✔	✔
42004	Chicken, breast, meat, fried	✔	✔	✔	✔	✔						✔		✔	✔
	Turkey														
05166	Turkey, light and dark meat and skin, roasted	✔	✔		✔	✔						✔		✔	✔
05194	Turkey, leg, meat and skin, roasted														✔
05186	Turkey, light meat, roasted	✔			✔	✔						✔		✔	✔
05182	Turkey, light meat and skin, roasted	✔	✔	✔	✔	✔						✔		✔	✔
	Sausages, Cured Meats, and Luncheon Meats														
10124	Bacon, broiled or pan-fried	✔	✔	✔	✔	✔		✔				✔	✔	✔	✔
07008	Bologna, beef and pork	✔	✔	✔	✔	✔		✔				✔			✔
07007	Bologna, beef	✔	✔	✔	✔	✔		✔				✔			✔

07014	Braunschweiger					✔				✔					
07022	Frankfurters, all beef	✔	✔	✔	✔	✔		✔				✔	✔	✔	✔
07025	Frankfurters, turkey														✔
07023	Frankfurters, beef and pork	✔	✔	✔	✔	✔		✔				✔	✔	✔	✔
10183	Ham, extra lean and regular, roasted	✔	✔	✔	✔	✔		✔				✔	✔	✔	✔
10153	Ham, whole, fully cooked, roasted, separable lean							✔				✔			✔
10134	Ham, extra lean, roasted					✔		✔				✔		✔	✔
10182	Ham, extra lean and regular, unheated	✔	✔	✔	✔	✔		✔				✔	✔	✔	✔
07037	Kielbasa/kolbassy	✔	✔	✔				✔							✔
13355	Pastrami														✔
07057	Pepperoni	✔	✔	✔	✔			✔				✔		✔	✔
07069	Salami, beef or pork			✔		✔									
10165	Salt pork, raw	✔	✔	✔				✔							
07064	Sausage, pork, cooked	✔	✔	✔	✔	✔		✔				✔		✔	✔
07065	Sausage, pork and beef, fresh, cooked	✔	✔	✔				✔							✔
07074	Smoked sausage, pork	✔	✔	✔				✔				✔			✔
07080	Turkey ham					✔									✔
	Snacks														
19003	Corn chips	✔	✔						✔			✔			
19008	Corn puffs, cheese flavor	✔	✔												
19034	Popcorn, air-popped								✔						✔
19035	Popcorn, oil-popped	✔	✔	✔		✔		✔	✔			✔		✔	✔
19042	Potato chips, barbecue flavor	✔	✔									✔		✔	
19411	Potato chips	✔	✔	✔		✔		✔	✔			✔	✔	✔	✔
19047	Pretzels, salted	✔				✔		✔							
19056	Tortilla chips	✔	✔	✔		✔	✔	✔	✔			✔		✔	✔
	Soups, Sauces and Gravies														
06150	Barbecue sauce					✔		✔	✔					✔	
06116	Beef gravy, canned					✔		✔							✔
06413	Chicken broth							✔							
06119	Chicken gravy, canned		✔					✔							✔
02046	Mustard, prepared					✔		✔	✔						✔
06164	Salsa, commercial								✔					✔	
7565606	Soup, vegetable beef, chunky style	N/A													
06471	Soup, vegetable beef					✔		✔		✔	✔			✔	✔
06472	Soup, vegetable with beef broth							✔		✔	✔				
06559	Soup, tomato					✔		✔					✔		
06419	Soup, chicken noodle	✔				✔		✔	✔	✔	✔				✔

06070	Soup, beef, chunky					✔		✔							✔
06404	Soup, bean soup with pork								✔						
06015	Soup, chicken, chunky					✔		✔							
06043	Soup, cream of mushroom, condensed		✔					✔							
06449	Soup, green pea							✔							
92871	Tomato chili sauce							✔	✔					✔	
06166	White sauce, medium	✔	✔	✔											
	Sweets														
19141	"M&M's"® Plain Chocolate Candies			✔											
19078	Baking chocolate			✔											
19334	Brown sugar	✔													
19166	Cocoa, powder, processed with alkali					✔			✔					✔	✔
19349	Dark corn syrup	✔													
19296	Honey	✔													
19095	Ice cream, vanilla	✔	✔	✔	✔		✔	✔		✔		✔		✔	✔
19300	Jellies	✔													
19353	Maple syrup														✔
19120	Milk chocolate	✔	✔	✔											
19304	Molasses													✔	
19150	REESE'S® Peanut Butter Cups			✔											
19155	SNICKERS® Bar	✔	✔	✔											
19335	Sugar, granulated	✔													
19336	Sugar, powdered	✔													
19360	Table blend pancake syrup, 2% maple	✔													
	Vegetables														
11091	Broccoli, cooked	✔				✔	✔		✔	✔	✔	✔	✔	✔	✔
11090	Broccoli, raw												✔		
11109	Cabbage, raw					✔			✔			✔	✔	✔	
11110	Cabbage, cooked								✔				✔	✔	
11655	Carrot juice, canned									✔	✔				
11125	Carrots, cooked	✔				✔	✔		✔	✔	✔	✔		✔	✔
11131	Carrots, frozen, cooked									✔	✔				
11124	Carrots, raw	✔				✔			✔	✔	✔	✔	✔	✔	
11935	Catsup	✔				✔		✔	✔	✔	✔	✔	✔	✔	
11136	Cauliflower, cooked												✔		
11143	Celery, raw					✔	✔		✔			✔		✔	
11162	Collards, cooked									✔					
11901	Corn, sweet, white, cooked								✔						
11174	Corn, sweet, yellow, cream style, canned								✔					✔	

11168	Corn, sweet, yellow, cooked	✔	✔			✔			✔			✔	✔	✔	✔
11192	Cowpeas, cooked								✔					✔	
11206	Cucumber, pared													✔	
11404	French fried potatoes, frozen, restaurant prepared in oil	✔	✔	✔					✔			✔		✔	
11403	French fried potatoes, oven-heated from frozen	✔	✔	✔		✔			✔			✔		✔	
11670	Hot chili peppers									✔			✔		
11252	Lettuce, iceberg	✔				✔	✔		✔	✔	✔	✔	✔	✔	✔
11032	Lima beans, cooked								✔					✔	
11584	Mixed vegetables, frozen, cooked					✔			✔	✔	✔			✔	
11260	Mushrooms, raw													✔	
11261	Mushrooms, cooked													✔	
11282	Onions, raw	✔				✔	✔		✔			✔	✔	✔	✔
11283	Onions, cooked								✔			✔		✔	
11305	Peas, green, cooked	✔				✔	✔		✔	✔	✔	✔	✔	✔	✔
11323	Peas and carrots, frozen, cooked									✔	✔				
11333	Peppers, sweet, green, raw								✔			✔	✔	✔	
11334	Peppers, sweet, green, cooked												✔		
11937	Pickles, cucumber, dill							✔	✔					✔	
11399	Potato puffs, frozen, prepared	✔	✔	✔		✔		✔	✔			✔		✔	
7160301	Potato salad	---------------N/A---------------													
11378	Potato flakes, instant, dry	✔							✔			✔	✔	✔	
7170101	Potato salad with egg	---------------N/A---------------													
11363	Potatoes, baked, flesh	✔				✔			✔			✔	✔	✔	✔
11674	Potatoes, baked, flesh and skin	✔				✔			✔			✔	✔	✔	✔
11365	Potatoes, boiled in skin, flesh	✔				✔			✔			✔	✔	✔	✔
11391	Potatoes, hashed brown, frozen, prepared													✔	
11370	Potatoes, hashed brown, home-prepared	✔	✔	✔					✔			✔		✔	
7150100	Potatoes, mashed	---------------N/A---------------													
7150103	Potatoes, mashed from fresh, with fat	---------------N/A---------------													
7150104	Potatoes, mashed, from dry with milk and fat	---------------N/A---------------													
7150102	Potatoes, mashed from fresh, with milk and fat	---------------N/A---------------													
11352	Potatoes, pared, raw	✔				✔			✔			✔	✔	✔	✔
11367	Potatoes, pared, boiled	✔				✔	✔		✔			✔	✔	✔	✔
7130501	Potatoes, scalloped	---------------N/A---------------													
11424	Pumpkin, canned									✔	✔				

11053	Snap beans, cooked	✔				✔	✔		✔	✔	✔	✔	✔	✔	✔
11458	Spinach, cooked					✔	✔		✔	✔	✔	✔		✔	✔
11642	Summer squash, cooked								✔					✔	
7340900	Sweetpotato casserole or mashed	N/A													
7340600	Sweetpotatoes, candied	N/A													
11510	Sweetpotatoes, cooked in skin									✔	✔				
11508	Sweetpotatoes, baked in skin									✔	✔				
11645	Sweetpotatoes, canned in syrup, solids and liquid									✔	✔				
11887	Tomato paste, with salt, canned					✔		✔	✔	✔	✔	✔	✔	✔	✔
11540	Tomato juice, canned							✔				✔	✔	✔	
11547	Tomato puree, canned					✔			✔	✔	✔	✔	✔	✔	
11546	Tomato paste, canned					✔			✔	✔		✔	✔	✔	
11549	Tomato sauce, canned	✔				✔		✔	✔	✔	✔	✔	✔	✔	✔
11529	Tomatoes, raw	✔				✔			✔	✔	✔	✔	✔	✔	✔
11660	Tomatoes, stewed	✔				✔		✔	✔			✔	✔	✔	✔
11531	Tomatoes, whole, canned	✔				✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
11569	Turnip greens, cooked									✔	✔				
11578	Vegetable juice cocktail, canned							✔				✔	✔	✔	
11644	Winter squash, baked									✔				✔	
	Entrees and Sidedishes														
2721210	Beef and noodles with tomato-based sauce	N/A													
2711100	Beef with tomato sauce	N/A													
2721110	Beef stew with potatoes and tomato-based sauce	N/A													
2731141	Beef stew with potatoes, carrots, onion, peas, gravy	N/A													
2731131	Beef stew with potatoes, carrots, onion, peas, tomatoes	N/A													
2721410	Beef loaf	N/A													
2734710	Chicken or turkey pot pie	N/A													
2711141	Chili con carne with beans	N/A													
3220201	Egg, cheese, ham with English muffin	N/A													
3210503	Egg omelet with ham	N/A													
3210508	Egg omelet/scrambled egg with cheese and ham/bacon	N/A													
5815031	Fried rice with meat	N/A													
5813001	Lasagna	N/A													
5814511	Macaroni and cheese	N/A													
2835531	Oyster stew	N/A													

5810672	Pizza with meat and vegetables, thin crust	----N/A----													
5810673	Pizza with meat and vegetables, thick crust	----N/A----													
5810652	Pizza with meat, thin crust	----N/A----													
5810651	Pizza with meat, unspecified crust	----N/A----													
5810653	Pizza with meat, thick crust	----N/A----													
5810622	Pizza, cheese, thin crust	----N/A----													
5810621	Pizza with cheese, unspecified crust	----N/A----													
4120501	Refried beans	----N/A----													
7440401	Spaghetti sauce	----N/A----													
2711105	Spaghetti sauce with meat, homemade	----N/A----													
5813231	Spaghetti with tomato sauce and meatballs	----N/A----													
5813211	Spaghetti/noodles with tomato sauce	----N/A----													
5816341	Spanish rice	----N/A----													
5810132	Taco or tostado with beef, cheese, lettuce, tomato, salsa	----N/A----													
	Other														
18372	Baking soda							✔							
18369	Baking powder, double-acting. household						✔	✔							
43158	Saccharin													✔	
02047	Salt, table							✔							
16123	Soy sauce							✔							
Total number of foods		222	125	110	72	235	72	104	135	67	31	204	68	178	213

1. In some cases, the raw version of a food typically eaten cooked qualifies as a Key Food because it is included in a to-be-cooked survey recipe.

2 . 5-digit numbers denote items from the Primary Nutrient Data Set; 7-digit numbers denote items from the USDA Nutrient Database for Individual Food Intake Surveys, Release 7 (USDA, 1994b). Checkmarks indicate contribution by the food to 80% of total nutrient intake. Because of the way they were added, this information could not be determined for foods with 7-digit IDs.

3 . The names appearing in this list have been changed from those in the source database to reflect common usage. For the complete description, see the source database using the same ID number.

4 . To reflect changes in marketing practices, 0" and 1/4" trim meats were combined in the survey files in appropriate proportions. The listed items were not necessarily consumed separately.

5 . In some cases, flesh and skin are separated to facilitate combining them in the survey files to make up various portions.

Data Quality Issues

Activities of the NNDC Organizing Committee on Data Quality
Suzanne Murphy, PhD, University of California at Berkeley

Activities of the NNDC Subcommittee on Letters to Legislators
Judith Douglass, Technical Assessment Systems
Roberta Markel, DINE Foundation

The Future of the National Nutrient Databank
Joanne Holden, ARS, USDA

Activities of the National Nutrient Databank Conference Organizing Committee on Data Quality

by Suzanne P. Murphy, Chair, Department of Nutritional Sciences, University of California, Berkeley

A. Background

Attendees at the 19th National Nutrient Databank Conference (held in May, 1994) asked that a committee be formed to address issues surrounding nutrient data quality. The importance of this topic was emphasized in a session on data quality at the 19th conference, which focused in part on a recent report from the General Accounting Office (1).

In response to these discussions, the Steering Committee of the National Nutrient Databank Conference formed an Organizing Committee on Data Quality, with myself as chair. Over the past year we have formed five subcommittees to address specific aspects of nutrient data quality, each with two co-chairs:

Quality Codes (Joanne Holden and Loretta Hoover)
Clearinghouse for Industry Data (Jean Pennington and Jack Smith)
Letters to Legislators (Roberta Markel and Judi Douglass)
Letters to Editors (Phyllis Stumbo and Jean Hankin)
Setting Priorities for Analysis (Margaret McDowell and Sue Gebhardt)

A Committee meeting was held, and a brief presentation on the Committee organization and objectives was made at the Dietary Assessment Conference in Boston (1/95).

The American Institute of Nutrition has developed a white paper on food composition data needs. A copy of this paper was distributed to conference attendees (see appendix).

B. General Needs Identified at the 1994 Conference

- Although the GAO report made many suggestions, it overlooked a number of issues of importance to nutrient database users; these should not be overlooked when setting priorities for improving data quality.
- Conference participants would like to find ways to work with USDA to facilitate improvement in nutrient data quality.
- The staff at USDA would like a mechanism to solicit feedback from users.

C. Specific Needs Identified at the 1994 Conference

- Data quality is not a binary variable; users would prefer to have an estimate of the quality rather than have "poorer" quality data omitted from national databases.
- The food processing industry has a wealth of information on food composition, but ways to compile these data centrally have not been identified.
- USDA's Nutrient Data Laboratory (formerly HNIS) and Food Composition Laboratory must be adequately funded if the U.S. is to have a high quality national nutrient database.

• Since funding will never allow comprehensive analyses of all nutrients in all foods, priorities for analyses should be set based on: nutrients which are of public health importance, foods which are good sources of these nutrients, and gaps in our knowledge.

D. Subcommittee Reports

Quality Codes

Co-chairs: Joanne Holden (USDA/NDL) and Loretta Hoover (Univ of Missouri).

The Quality Codes Subcommittee convened for an initial meeting on June 13, 1995. The volunteer and invited participants and guests at the meeting were: Alison Eldridge, Bonnie Sherr, Bonita Hoverson, Margaret McDowell, and Lena Bergstrom. A variety of issues were identified and subsequently grouped into the following seven categories:

- Rationale

How will quality codes be used?
What do they represent? (e.g., quality of data vs confidence in data)
How do source codes, data derivation codes and quality codes differ?

- Criteria

Constructed to minimize bias introduced when assigned
Flexible, especially relative to state-of-the-art considerations

- Specification

What should they be? (e.g., numeric, alphanumeric, etc.)
Should they be nutrient/component specific?
What process/procedure will be used to determine quality codes?
What are the major sources of variation that should be reflected in quality codes?

- Implementation

Should assignment of the quality codes be centralized?
How will quality codes be assigned for non-analytical data? (e.g., imputed values)
How will quality codes be determined for mixed dishes calculated from recipes?
How will quality codes be manipulated? (probably will require statistical consultation)
How will missing values for quality codes be handled?

- Priorities

Which foods should be addressed initially?
Which nutrients/components should be addressed initially?

- Storage/Maintenance

What data structure will be used for transfer and storage of quality codes?

What data elements are necessary to permit automated recalculation of quality codes when better information or better data become available? (i.e., quality codes are dynamic, perishable, and subject to information available at a given point in time.)
What strategy will be used to provide a trend analysis or history of changes in quality codes? (i.e., which quality code should be used at a specific point in time?)
How will users demonstrate their accountability in maintaining a nutrient database in an up-to-date status relative to quality codes?

- Education

  How will developers of data bases be educated relative to the incorporation and maintenance of quality codes in their products?
  How will end users be educated to interpret and make appropriate use of quality codes?

International Data Quality Committee Meeting

The minutes from the NDBC Quality Codes Subcommittee Meeting were submitted to the International Data Quality Committee Meeting convened by the International Union of Nutrition Scientists (IUNS) in Riverdale, Maryland during June 14-15, 1995. Representatives included Gary Beecher, (chairperson)(USDA), Joanne Holden, (USDA), Barbara Burlingame (INFOODS), Prapasiri Puwastien (ASEAN FOODS), Lilia Masson (Latin Foods), and Lillian Marovatsanga (AFRO Foods). The Eurofoods representative was not available to attend the Riverdale meeting. The discussion focused on the needs for the assessment of data quality, the relevant parameters, the types of food composition data requiring quality indicators, and the possible formats of indicators. Representatives agreed that data quality indicators for analytical and derived (calculated and selected impute) values would be desirable. Representatives accepted in concept, the following parameters for assessing analytical data quality: analytical method, analytical quality control, sampling plan, sample handling, and statistical characteristics of the data. A rating scale pertaining to individual data sources and parameters was discussed. The need for a summary indicator for a single food and component was considered. The discussants recognized the importance of having good quality analytical data as the basis of calculated or imputed values. Algorithms and factors (e.g. 6.25 for N to protein conversion) used to determine estimates for food components should be reviewed for chemical and biochemical validity and updated, as necessary.

Representatives of the IUNS committee will continue to interact with their colleagues at the Regional and National level to identify and discuss data quality issue and to provide input to the IUNS Committee. The USDA Nutrient Data Laboratory has begun to define appropriate data quality indicators to be included in the USDA Nutrient Database for Standard Reference and will continue to develop the process and system. Representatives to the NDBC subcommittee on Data Quality Indicators will be asked to continue to play an important role in this development during the next year.

Joanne Holden, Suzanne Murphy, Gary Beecher, and other U.S. and Canada representatives attended the 2nd International Food Database Conference in Lahti, Finland during August 28-31, 1995. Both Joanne Holden and Barbara Burlingame reported on the discussion and outcome of the IUNS Committee meeting. Joanne Holden spoke on the Determination of Food Composition Data Quality. Comments from participants indicate support for the determination of food composition data quality and the need for data quality indicators which are available to data users. The Eurofoods COST 99 project recently funded by the European Union Conducted three workshops at the Lahti Meeting for COST 99 participants and invited expert observers. One of those workshops address the topic of Food Composition Data Quality and will continue to address this topic during the next three years.

Clearinghouse for Industry Data

Co-chairs: Jack Smith (Univ of Delaware) and Jean Pennington (FDA).

The Subcommittee has had relatively little activity during the past year. The reasons for this include the organizational changes within USDA, the Nutrient Data Lab's moving and the activity of IFDA in creating the Data Transfer Standard.

There are several challenges for the Subcommittee in the coming year. These include:

- Establishment of a Partner Relationship between NNDBC, USDA/NDL and industry.
- Enhancing the dialog between these partners and other interested parties.
- Define the function, contributions and context of a clearinghouse.
- Address the real and perceived concerns of all parties related to the sharing of data.
- Evaluate acceptable mechanisms for imputing data not available from analysis.

The Subcommittee needs a number of volunteers from data providers, data users and those maintaining the data.

Letters to Legislators

Co-chairs: Roberta Markel (DINE) and Judi Douglass (TAS).

The Subcommittee has drafted several letters to legislators which were distributed to attendees of the conference and are included here as an appendix. The availability of these letters also was posted on both the food-comp and nutepi listservs, and subscribers were invited to request electronic copies.

Letters to Editors

Co-Chairs: Phyllis Stumbo (Univ of Iowa) and Jean Hankin (Univ of Hawaii).

The Subcommittee identified factors critical to maintaining the high quality of USDA nutrient data. Since some nutrient data is gleaned from published literature, independent investigators could lessen criticisms of the published tables by using internal standards in their analytical work, describing their quality control procedures when they publish and indicating measures of variability when reporting nutrient data. Thus when data are taken from the published literature they would include the quality control information considered essential by the GAO report (1). These issues, along with pleas for stronger funding for nutrient composition activities, are recommended content for letters to the editors.

Setting Priorities for Analyses

Co-chairs: Margaret McDowell (CDC/NCHS) and Sue Gebhardt (USDA/NDL).

1. Background from NCHS

NCHS has used the USDA Survey Nutrient Data Base (SNDB) to code foods and estimate nutrient intakes for HANES surveys since 1982, beginning with Hispanic HANES, 1982-84 and most recently with NHANES III, 1988-94.
Hispanic population subgroups were specifically oversampled in recent surveys; ARS analyzed a number of ethnic foods, primarily Hispanic and Asian foods, at NCHS's request during NHANES III.

2. Background from USDA/ARS

Maintaining food composition data bases has been an important activity at USDA for many years. In recent years, this responsibility has become increasingly complicated and challenging. The reasons have been mentioned many times during this Conference.

- The food supply has become more complex. The number of food products is ever increasing. Although some items are discontinued there are many more that are being introduced. Foods are being modified to address public health concerns, providing varieties of foods such as low fat, high fiber, low sodium, and fat replacements.
- The population is becoming more diverse, introducing new foods and combinations of foods that are being consumed.
- Data for more nutrients and food components are being requested by researchers, for example carbohydrate fractions, selenium and vitamin K.

Because the cost for food analyses is very high and resources are not available to analyze all foods for all nutrients, establishing criteria for setting priorities for food analysis is essential.

3. Looking to the Future

The goal of this Subcommittee is to recommend procedures for identifying those foods that are of highest priority for nutrient analysis. To do this, it is necessary to identify key foods as described by Pamela Pehrsson in the session on "Trends and Changes in the Food Supply" at this conference. This concept has been evolving at the Nutrient Data Lab at USDA to help identify those foods that are the main contributors of nutrients in the US diet and therefore the ones for which the quality of the data would have the greatest impact. The Subcommittee will be using this paper and list of foods as our starting point.

It is also important to anticipate changes in the composition of key foods over time, and to have the capability to identify these foods and reanalyze them as necessary. Examples include flour products and breakfast cereals.

Finally, we need to anticipate an increase in the need for information about ethnic foods and be able to identify priorities for analysis of key foods consumed by ethnic subgroups.

Requests for analyses of key foods may require funding from data users.

The following individuals have signed up to be on the Subcommittee:

Shirley Gerrior, Center for Nutrition Policy and Promotion, USDA
Bonita Hoverson, Grand Forks Human Nutrition Center, USDA
Li-Ching Lyu, Cancer Research Center of Hawaii
Betty Perloff, Survey Systems/Food Consumption Lab, USDA
Laura Sampson, Harvard School of Public Health

E. Closing Comments

Attendees of the 20th Conference were urged to become involved in these issues, and were invited to sign up to participate in the work of one or more of the subcommittees. The need for additional subcommittees was discussed and a subcommittee on analytic methodology was suggested.
As a users group with representatives from government, industry, and academia, we can be an effective voice in promoting the development of high quality nutrient data.

Reference

1. General Accounting Office. Better Guidance Needed to Improve Reliability of USDA's Food Composition Data. October, 1993.

Activities of the NNDC Subcommittee on Letters to Legislators

by Judith Douglass, Technical Assessment Systems
and Roberta Markel, DINE Foundation

Dear Colleague:

Thank you for your interest in the Nutrient Data Bank Conference Letters to Legislators Campaign. This campaign was initiated as an effort to maintain or increase funding for USDA agencies involved in generation of food composition data.

The House and Senate Appropriations Subcommittees responsible for USDA funding will be meeting this month to consider the budget for Fiscal Year 1996. We urge you to write to members of these Subcommittees as soon as possible, focusing on any members representing your state. You may also wish to write to congressional representatives and senators who are not on one of the Subcommittees.

When writing to legislators, you should follow these guidelines:

- State your purpose for writing in the first sentence (only one issue should be addressed)
- Use examples to support your position
- Be courteous
- Keep letters brief, if possible to one page

Letters should be addressed to "The Honorable <full name>" and should begin "Dear Senator <last name>:" or "Dear Congressman or Congresswoman <last name>:".

Four sample letters follow. Please feel free to customize or "mix and match" pieces from these letters, but to keep letters looking original (a better guarantee that they will be read), please do not use any sample letter in its entirety. We have also included an American Institute of Nutrition statement entitled "Importance of Research in Food Composition" to give you some additional ideas for statements to put in your letters.

Addresses, phone numbers, and fax numbers for House and Senate Appropriations Subcommittee members follow the sample letters. If you need information for contacting legislators who are not on one of the Subcommittees, please write to Judi Douglass at douglass@clark.net with the names of the legislators and/or your state and congressional district number. Your request will be answered as soon as possible. Please feel free to contact us with any additional questions.

Thank you for your support of USDA food composition activities.

Sincerely,
Judi Douglass
douglass@clark.net

Roberta Markel
72303.1532@compuserve.com

Sample Letters

Dear Congressman/Senator <   >:

As the House Appropriations Subcommittee on Agriculture begins to consider USDA funding for FY 1996, I urge you to give careful consideration and full support for the portion of the President's budget proposed for nutrition monitoring and food composition programs.

I am a nutrition educator at the University of <   >. In addition to teaching nutrition classes, I supervise and conduct clinical research on <   >. In this work, I must estimate daily intake of several key nutrients by study subjects, and accuracy in this work is essential if we want to understand relationships between diet and health. I use nutrient composition data published electronically by USDA, and also draw on the expertise of individual researchers at the Agricultural Research Service Nutrient Data Laboratory and Nutrient Composition Laboratory to provide me with guidance in using these data. Unfortunately, these agencies have not had the resources to keep fully up-to-date on composition of foods in the food supply.

Current, accurate food composition data are needed not only by nutrition researchers in academia, but also by agencies within the federal and state governments, as I'm sure you know. Researchers at the National Institutes of Health, epidemiologists at the Center for Disease Control, administrators of feeding programs at the federal and state levels . . . these are just a very few of the types of people depending on accurate food composition data.

Please vote to fund USDA nutrient monitoring and food composition activities at the level proposed in the President's budget for FY 1996. Thank you very much.

Sincerely,

Dear Congressman/Senator <   >:

I am writing to urge you, in your role as a member of the House Appropriations Subcommittee on Agriculture, to support the President's proposed budget for USDA nutrition monitoring and food composition activities.

I am a nutritionist working in private industry. I am employed by a consulting firm which is small in size, but which serves a wide variety of clients, including food companies, chemical companies, trade organizations, professional societies, and the federal government. We use the food composition data generated by USDA in many of the projects we conduct for our clients. We rely on those data being current and accurate. However, our food supply is ever-evolving, with new processed foods and new crop varieties appearing daily, and it takes substantial resources to provide food composition data current and accurate enough for use in research. In the 1993 GAO report, "Food Nutrition: Better Guidance Needed to Improve Reliability of USDA's Food Composition Data," increases in funding for food composition research were strongly recommended.

Please give your support to full funding of USDA nutrition monitoring and food composition activities. Thank you very much.

Sincerely,

Dear Congressman/Senator <   >:

As funding considerations draw near, I urge you to support increased funding for USDA food composition activities in the next fiscal year.

I am part of a small business that develops nutrient analysis software. Our customers include dietitians, health and nutrition educators, and consumers interested in improving their diets. Our customers rely on our food database to analyze their patients' diets or analyze their own diets in a fast and efficient manner. Accurate and reliable food composition data are essential to our customers to help identify the role of diet and disease - during rehabilitation and even more importantly for prevention.

Our food environment is constantly changing, with new food products being developed and put on the market at a rapid pace. In order to update our database, we need an accurate and comprehensive source of information. We have relied on the USDA's nutrient databank for much of our information, however, over the years, it has not been able to keep up with the innovations in the food marketplace.

Please give your support to full funding of USDA nutrition monitoring and food composition activities. Consumers and nutrition professionals alike will be grateful for your efforts.

Sincerely,

Dear Congressman/Senator <   >:

In this era of budget-cutting, I am writing to ask you to support increased funding for USDA food composition activities in the next fiscal year.

I am a dietitian. In the past, I have used nutrient data in developing materials to enable my patients to control their diseases, especially with children with inborn errors of metabolism. It seems that new products are now appearing at such a fast pace that it is impossible to keep our materials updated. We need more complete and up-to-date information for the consumer.

In your upcoming Subcommittee work on the USDA budget, please stress the importance of greatly increased funding for food composition activities. Thousands of dietitians around the country will be grateful for your efforts.

Sincerely,

Importance of Research in Food Composition

The public needs reliable information on the composition of food products. Food composition data are used in studies of diet and disease, animal experimental and human intervention studies, dietary surveys of populations, meal planning in hospitals, nursing homes and schools, and food labeling, to name a few areas. Accurate and reliable food composition data are essential to help identify the role of diet in learning about the causes of diseases, and to learn about the prevention of diet-related diseases, such as cancer, coronary heart disease, and osteoporosis.

The U.S. Department of Agriculture (USDA) is the nation's primary source of food composition data. This federal department publishes food composition data in USDA's Agriculture Handbook No. 8 (Composition of Foods, Raw...Processed...Prepared). This annually revised resource yields information on approximately 5,300 food items and 70 nutrients, as well as other dietary components. Food industries, scientific literature, and contracts with universities and food testing laboratories are the sources for the USDA Agriculture Handbook. The USDA's Nutrient Composition Laboratory also conducts research studies to develop improved methods to analyze components such as dietary fiber, vitamin E, and particular food items.

Researchers need enhanced documentation of the data published in food composition tables. The number and source of samples, sampling and analytical procedures, and variability of nutrient values are crucial to their work to understand food composition. One example: if a dietary survey is conducted in Alaska, Hawaii, or a Pacific island, it is important to know whether the vitamin and mineral values of fruits and vegetables are representative of the growing conditions in their areas; this would determine whether further analyses of local foods are needed for computation of dietary intakes.

Laboratory data on the components of dietary fiber, sugars, fatty acids, phytoestrogens, carotenoids, tocopherols, and others are essential to answer several proposed dietary assumptions regarding the role of diet in causing various cancers. More information is also needed to answer unknowns such as heterocyclic amines produced during cooking of red meats at high temperatures. Still, the problem of missing values for various nutrients needs to be resolved.

While it is neither practical nor possible to perform analyses of all missing variables, users need guidance on when it is acceptable to impute values and what food items should be used as references. These research challenges can be resolved with the expertise of many food composition researchers and greater financial resources to develop reliable food composition data to identify the specific role of dietary factors in the causation of diseases.

Prepared by the American Institute of Nutrition, 1995

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The Future of the National Nutrient Data Bank

by Joanne M. Holden, Acting Research Leader, Nutrient Data Laboratory

The increased and widespread awareness of consumers about food components (e.g. trans fatty acids, vitamin B6, cholesterol, antioxidants) and their possible positive or negative effects on human health emphasize the important role of food composition data in society today. The scientific community, including representatives of the food industry, academia, and government agencies use food composition data for a variety of purposes to maintain an adequate, varied and safe food supply. The USDA National Nutrient Databank provides for the nation the foundation of high quality food composition data. The National Nutrient Databank is developed and maintained by The Nutrient Data Laboratory (NDL).

During the period of 1994 - 1995 the Nutrient Data Laboratory has undergone significant changes. The Laboratory was moved from the former Human Nutrition Information Service, Nutrition Monitoring Division to the Agricultural Research Service, Beltsville Human Nutrition Research Center (BHNRC). BHNRC is one of five human nutrition centers within ARS which emphasize human nutrition research. The Centers are located in Beltsville, MD, San Francisco, CA, Houston, TX, Boston, MA and Grand Forks, ND. Laboratories within the BHNRC conduct clinical, metabolic, and epidemiological human nutrition research, as well as conducting the USDA nationwide food consumption surveys of dietary intakes, and surveys of diet and health knowledge. In addition the Food Composition Laboratory evaluates, modifies and develops chemical methods for the analysis of components in foods. With this reorganization USDA's food composition research has been consolidated in BHNRC.

The Nutrient Data Laboratory has physically moved from its previous location in Hyattsville, Maryland to a new location in Riverdale, Maryland near the College Park Metro station. The new address is:

4700 River Road, Unit #89
Riverdale, Maryland 20737
Phone: 301-734-8491 Fax: 301-734-8498

The new number for the USDA bulletin board is 301-734-5078. The internet address (info-12@info.umd.edu) has not changed.

USDA has been involved in the generation of food composition data since W.O. Atwater and C.D. Woods generated the first chemical data for protein, fat, and carbohydrate for a variety of foods, During the 1920's - 30's tables were published on the proximate content of beef, fruits, and vegetables. In 1940 food composition tables for eleven nutrients for a number of foods were published to assure an adequate food supply for the military and civilian populations. The well known "red book" or USDA Agriculture Handbook 8, "Composition of Foods", Revision 1963 represented the expansion of the tables to 20 components and 2483 foods. These data were released at the same time as punch cards and represented the first available computerized version of food composition data.

Between 1976 and 1993 the Agriculture Handbook No. 8 was revised by food group to provide 21 volumes of information. Subsequent updates of data for selected foods and components are available. The primary database product of the NDL is the Nutrient Database for Standard Reference. It contains composition data for more than 5,000 raw and cooked foods and up to 82 components, including proximates, minerals, vitamins, fatty acids, and dietary fiber. The database identification number, short and long food descriptions, and information about household weights and weights of refuse are included. Version 10 of the Nutrient Database for Standard Reference has been available since 1993. Version 11 will be released early in 1996 and will be available on the USDA bulletin board and the Internet. Many printed volumes for various food groups are no longer available. The USDA is currently evaluating the need for the release of printed food composition materials and would appreciate user input.

Food composition data are obtained from USDA contracts, from the food industry, and from laboratory reports from other federal research laboratories. Literature sources provide an important addition to the database. In the future food industry data will be acquired electronically. NDL has participated with representatives of the International Food Service Distributors Association in the development of the expanded IFDA Standard Format for Data Exchange. The release of Version 3.0 of the IFDA format includes record formats for documentation of analytical methods, quality control procedures, sampling methods, and sample handling procedures. Development of a standard format is the first step in the development of a national clearinghouse for food composition data.

Other NDL products include the Primary Data set, (PDS) a database of food composition data for approximately 2500 entries for items used as foods or as food ingredients. The PDS is used to calculate the Survey Nutrient Database, the food composition database containing approximately 7000 foods and 30 nutrients used to estimate the intake of nutrients in the USDA food consumption surveys conducted by the Survey Systems/Food Consumption Laboratory (SS/FCL), and to develop the food composition database for the National Health and Nutrition Examination Surveys (NHANES). The PDS for the Continuing Survey of Food Intakes by Individuals 1994 will be released at the end of 1995.

The National Nutrient Database for Child Nutrition Programs is a new database product developed in collaboration with the SS/FCL at the request of the Food and Consumer Service (FCS) to support a new nutrient-based approach to the USDA school lunch program. Special purpose data files have been generated for food components such as sugars (1987), vitamin K (1993), vitamin D(1991), selenium (1993), and trans fatty acids (1995). The data may be more limited in the numbers of foods or numbers of samples analyzed but represent the results of studies to provide good quality food composition data for specific components or groups of foods.

The NDL will continue to provide leadership in the development of factors and standard definitions for the determination of derived values for food components. In the past USDA scientists were responsible for developing factors such as those for calculating the protein level from the nitrogen content of a food or for the retention of nutrients after foods were cooked or processed. As newer analytical methods are introduced and as new foods and preparation methods are used the NDL will reevaluate the existing factors and the possible needs for new research in this area. Also, NDL staff will assess the statistical characteristics of data sets for components and foods in order to improve estimates of component levels in the food supply.

The NDL has maintained a frequent dialogue with nutrition scientists from other regions and countries of the world concerning the development and use of food composition data. Many developed and developing nations are directing more fiscal and scientific resources to the expansion of food composition databases due to the increased complexity of the global food supply, the importance of international food trade, and the recognition of the important relationship between dietary intake and health status. Scientists within NDL will continue to participate in the global activity concerning the improvement of data quality. During the last few years representatives of the NDL have participated in international and regional food composition discussions concerning the assessment of data quality, the improvement of food composition data for developing countries, the development of a standardized approach to food description, terminology, and nomenclature and other topics. These meetings have been organized by the INFOODS (International Network of Food Data Systems), in collaboration with the Food and Agriculture Organization (FAO), and the International Union of Nutritional Sciences (IUNS). The "globalization" of the food supply and the recognition of common research issues regarding food composition requires that NDL continue to participate in this forum.

To date USDA food composition data have been disseminated in the form of printed tables and pamphlets to meet the needs of professional and non-professional users. As previously mentioned many of the 21 volumes of USDA Composition of Foods: Raw, Processed, and Prepared are out-of-print. Since 1990 data have been distributed electronically on the USDA Bulletin Board and, more recently, they have become available on the internet. (The reader is referred to the manuscript in this publication by David Haytowitz entitled "Using Internet and Electronic Bulletin Boards for Food Composition Data.") NDL will continue to emphasize the electronic release of data for all users. The USDA National Nutrient Databank is currently maintained on the USDA mainframe system in Kansas City, Missouri. The Databank System was first developed in 1975 and was updated in 1984. However, in view of the technological advances in computer hardware and data management software the Databank System does not meet the needs of USDA food composition specialists or data users. Plans for a complete re-design of the Nutrient Databank System are being developed to permit more effective management of USDA food composition data in the near future.

NDL will continue to acquire data from USDA contracts, as resources permit. Data will also be collected from other scientific literature and government sources. However, the food industry generates and maintains a large amount of food composition data for brand name products and, to a certain extent, for food ingredients. NDL will continue to work with the food industry to acquire high quality analytical and calculated data for inclusion in the National Nutrient Databank. Efforts will focus on the accession of electronic data streams from the food industry in view of the important role of processed and prepared food products in the American diet.

Development of USDA contracts for food analysis will be based on the Key Foods approach developed by nutritionists at the NDL. (The reader is referred to the manuscript in this publication by Pamela Pehrsson entitled "Development of a Key Foods List for Establishing Priorities in Food Composition Research") Use of the Key Foods Approach to set priorities for foods to be analyzed will make the best use of scarce resources.

In the continuous updating of food composition data, NDL staff must assess the quality of data. NDL will continue to develop specific criteria pertaining to the sampling plan, sample handling, analytical method, analytical quality control, and statistical characteristics of the data set, to evaluate the quality of data in the National Nutrient Databank, and will provide data quality indicators so that data users can select those data which are suitable for a specific use.

In summary the Nutrient Data Laboratory recognizes that the food supply is dynamic. Foods will continue to change. As we learn more about the relationships between food intake and health status public health priorities will change. In order to meet future challenges the NDL will continue to compile, evaluate, and disseminate food composition data to provide accurate and representative estimates for components in foods. Short and long term priorities will be based on sound scientific approaches to address food composition issues.

Addendum

Update on Activities at the National Center for Health Statistics (NCHS), Centers for Disease Control and Prevention
Margaret McDowell, M.P.H., R.D., CDC-NCHS

20th National Nutrient Databank Conference Laboratory Updates
Beltsville Human Nutrition Research Center

Update on Activities at the National Center for Health Statistics (NCHS), Centers for Disease Control and Prevention

by Margaret A. McDowell, M.P.H., R.D.

Introduction

The objectives of this year's NCHS update are to summarize health survey activities, and to describe NCHS's role in the National Nutrition Monitoring and Related Research Program (NNMRRP) and Year 2000 Health Objectives projects. Plans for disseminating and reporting data from the third National Health and Nutrition Examination Survey (NHANES III) are described. NCHS published several new reports during the past year which are included in a bibliography.

Background

The National Center for Health Statistics (NCHS) is the Federal Government's principal vital and health statistics agency. NCHS data systems include data on vital events as well as information on health status, lifestyle, the onset and diagnosis of illness and disability, and health care utilization. NCHS works closely with other Federal agencies as well as researchers and academicians to meet priority needs for public health information.
NCHS is a part of the Centers for Disease Control and Prevention within the Public Health Service, U.S. Department of Health and Human Services. NCHS is located in Hyattsville, Maryland, with offices in Research Triangle Park, North Carolina and Atlanta, Georgia. Dr. Manning Feinleib left NCHS in January after serving as Center Director for more than twelve years. A search committee is presently recruiting for a new Center Director.

Major Data Collection Systems

Some of the NCHS data systems and surveys are annual systems while others are conducted periodically. A comprehensive list of NCHS survey programs is included in the Databank Conference materials. The Center has two major types of data systems: systems based on populations, containing data collected through personal interviews or health examinations, and systems which are based on records, containing data collected from vital and medical records. The population-based surveys include:

- National Health and Nutrition Examination Survey
- National Health Interview Survey
- National Survey of Family Growth
- NHANES I Epidemiologic Followup Study

1. The National Health and Nutrition Examination Survey (NHANES) Program

Health and Nutrition Examination Surveys (HANES) are conducted to assess the health and nutritional status of the U.S. population. Data from these periodic surveys are obtained by means of interview and examination methods. Three national or "NHANES" were completed between 1971 and 1994: NHANES I (1971-75); NHANES II (1976-80); NHANES III (1988-94). Hispanic HANES, a special survey of three Hispanic subgroups, was conducted from 1982-84 to provide comprehensive health and nutrition data on three major Hispanic subgroups--Mexican Americans, Cuban Americans, and Puerto Ricans. HANES findings are published in Series 11 of the *Vital and Health Statistics* series, *Advance Data from Vital and Health Statistics*, and in peer-reviewed journals.

NHANES data are used to estimate the prevalence of selected diseases and risk factors, to prepare reference data for a wide range of nutrition and health parameters, to examine secular trends in the prevalences of disease, nutritional status, and health risk factors, and to collect data which are needed to study the etiology of chronic diseases. The most recent survey, NHANES III, 1988-94 was conducted in two phases. Each three year phase constitutes a national sample, and data for the entire six year period may also be combined to form a larger national sample. The NHANES III sample design, interview and examination components and methods, and operational aspects of the study were described at the 1989-94 National Nutrient Databank Conferences. NCHS published a manual in 1994 entitled, *Plan and Operation of the Third National Health and Nutrition Examination Survey, 1988-94*. A brief description of the nutrition assessment component, and a list of published reports based on findings from NHANES III follows.

The NHANES III Nutritional Assessment Component

NHANES III data are used to estimate the prevalences of nutrition-related risk factors such as overweight and poor diet, to provide data to examine the relationship between diet, nutritional status, and health, and to provide baseline data to relate long-term dietary practices to chronic diseases. The Survey's dietary assessment component included 24-hr dietary recall and food frequency interviews. The NHANES III food frequency instrument was targeted to collect information on dietary sources of calcium, caffeine, and vitamins A and C. Sample Persons 12 years of age and older were eligible for the food frequency interview. A separate infant food frequency questionnaire was administered to a proxy respondent during the household interview. Questionnaire data on the use of vitamin and mineral supplements, medications, alcohol, drinking water, and salt were collected. A standardized set of questions on food insufficiency was administered during the household and dietary interviews.

All NHANES III examinees were eligible for the 24-hr dietary recall interview. Dietary recalls were collected in mobile examination centers (MEC) by trained, bilingual dietary interviewers. Proxy respondents reported for infants and young children and respondents who are unable to report for themselves. A detailed description of the dietary interview protocol is provided in the NHANES III dietary interviewer's training manual.

NHANES III Dietary Activities

NCHS published two *Advance Data from Vital and Health Statistics* reports in 1994 which provided U.S. population reference data on diet for NHANES III, 1988-91. Mean and median intakes of macronutrients, vitamins, minerals, and fiber were based on 1-day 24-h dietary recall data. Dietary recall and food frequency files for NHANES III, 1991-94 are in preparation as are the food files for both phases of the Survey.

Current dietary assessment research activities will identify dietary indicators using food frequency and 24-h recall data. In addition, intakes of foods which are rich in certain nutrients will be compared with selected health risk factors (e.g., intake of calcium-rich foods and hypertension). Reported frequencies of consumption (such as "never consumed" and "consumed daily") from food frequency interviews will be compared with 24-h recall data. Interagency activities co-sponsored by NCHS including the HHS-USDA Workshop "Dietary Survey Data Requirements of Federal Users" held in August, 1994 solicited ideas to plan future dietary survey data systems. More activities of this type anticipated.

NHANES III Data Release Activities

The NCHS Division of Health Examination Statistics is responsible for data editing, documentation, and preparation of all NHANES III public release data files. NHANES III data editing and preparation has been the top priority project for all Division staff since the Survey ended in October, 1994. NCHS postponed plans to release an interim Phase 1 data file in 1994 due to staff and resource constraints. Division staff are currently working with contractors at Westat, Inc. to complete data editing and release for both phases of the Survey by the end of 1995.

Plans for Future NHANES

NHANES 1997 was originally scheduled to begin in mid-1997. However, planning for the next NHANES was delayed for a year due to budget constraints. Additional funds have been earmarked for an NHANES-type study which would begin in 1998. Several proposals to define the scope of future NHANES are under review. Recent directives to reduce the size of the Federal Government and to consolidate programs have impacted on NCHS survey planning and data release efforts and program priorities.

2. The National Health Interview Survey (NHIS) Program

The NHIS is an important source of information on the health of the civilian noninstitutionalized U.S. population. The survey has been conducted continuously since 1957. NHIS data are based on household interviews conducted annually in approximately 50,000 households. Each year, the NHIS includes a basic or "core" set of health, socioeconomic, and demographic questions. Additionally, one or more special questionnaires are administered to obtain more detailed information on current health issues.

NHIS findings are published in NCHS Vital and Health Statistics Series 10 reports as well as *Advance Data From Vital and Health Statistics*. The Survey provides data on the incidence of acute conditions, episodes of personal injury, prevalence of chronic conditions and impairments, persons limited in activity due to chronic conditions and impairments, restriction in activity due to impairment or health problems, respondent-assessed health status, utilization of health care services involving physician care and short-stay hospitalization, and other special health topics. NHIS surveys examine the relationship between demographic, socioeconomic characteristics and health characteristics.

Questionnaires pertaining to special health topics are included each year. Questions on AIDS knowledge and attitudes have been included annually as a special health topic since 1987. The special topics studied in the 1992 NHIS also included immunization, family resources (including health insurance), cancer control and cancer epidemiology, and the Youth Risk Behavior Survey. The NHIS special health topic on disability began in 1994 and will continue through 1995.

Targeted Population Studies Which are Linked to the NHIS

In 1984, NCHS initiated the development of Targeted Population Studies which are linked to the NHIS. Persons or families are selected from NHIS participants. Additional health-related information is obtained from recontacts or through linkage to other health records containing information about NHIS participants. This approach facilitates the collection of detailed information from the target population in a longitudinal framework and also may be used for studies which require more detailed information. Linkage to the NHIS minimizes sampling costs and maximizes the initial database available for research. The program is designed to be a collaborative effort between NCHS and organizations outside NCHS. The first targeted study is the Longitudinal Study of Aging which is based on the 1984 Supplement on Aging, a joint project with NCHS and the National Institute on Aging.

3. National Survey of Family Growth

Data obtained through household interviews with women of childbearing age are used to monitor reproductive health and nutritional practices such as breast-feeding as well as changes in childbearing practices. The first two cycles were each conducted on approximately 10,000 "ever married" women 15-44 years of age. All women of childbearing age regardless of marital status were represented in the samples for the 1982 and 1988 cycles--Cycles 3 and 4, respectively. The Cycle 4 respondents were reinterviewed by telephone in 1990. Survey findings are published in Series 23 of the *Vital and Health Statistics Series* as well as *Advance Data From Vital and Health Statistics*.

4. The NHANES I Epidemiologic Followup Study (NHEFS)

The NHANES I Epidemiologic Followup Study (NHEFS) is a national longitudinal study designed to investigate the relationships between clinical, nutritional, and behavioral factors assessed at baseline during NHANES I, and subsequent morbidity, mortality, and institutionalization. The NHEFS population includes the 14,407 participants who were 25-74 years of age when first examined in NHANES I (1971-75). NHEFS is a collaborative project involving NCHS and other Centers at CDC, and agencies at the National Institutes of Health. NHEFS provides data on mortality, morbidity, and hospital utilization as well as changes in risk factors, functional limitation, and institutionalization between NHANES I and the followup recontacts.

The first wave of data collection was conducted in 1982-84 for all members of the NHEFS cohort. Continued followups of the NHEFS population were conducted in 1986, 1987, and 1992 using the same design and data collection procedures as those developed for the 1982-84 NHEFS, with the exception that a 30-minute computer-assisted telephone interview was administered rather than a personal interview, and no physical measurements were taken. NHEFS public-use data tapes and documentation are available from the National Technical Information Service. A set of four data tapes containing information on vital and tracing status, subject and proxy interviews, health care facility stays in hospitals and nursing homes, and mortality data from death certificates is available for each NHEFS followup wave. All NHEFS public-use data tapes can be linked to the NHANES I public-use data tapes. Descriptions of the NHEFS study methodologies and survey instruments are available in the NCHS Vital and Health Statistics Series 1. The statistical issues to consider when analyzing NHEFS data are addressed in Series 2 reports.

Special Activities Involving NCHS Staff

1. National Nutrition Monitoring and Related Research Program Activities

NCHS plays a major role in monitoring the nutritional and related health status of the U.S. population. NCHS Nutrition Monitoring (NM) staff provide the leadership role within the Department of Health and Human Services (HHS) for the preparation of the Third Report on Nutrition Monitoring (TRONM) under a contract with the Life Sciences Research Office. The TRONM will be available later this year. The NM staff represent NCHS on several interagency nutrition committees such as the Interagency Board for Nutrition Monitoring and Related Research (IBNMRR), and provide technical reviews and assistance on issues related to nutrition monitoring (e.g., Year 2000 Nutrition Objectives), nutrition policy (e.g., folate food fortification issues and use of HANES and NCHS nutrition-related data), and nutrition-related research.

In 1994, interagency efforts to coordinate and implement high-priority activities in the Ten-Year Comprehensive Plan for the National Nutrition Monitoring and Related Research Program continued. These activities included co-chairing an interagency working group on food security and co-sponsoring a Food Security Workshop with the USDA Food and Consumer Service to develop a measurement tool to assess hunger in national surveys. In addition, there have been interagency collaborative efforts to improve survey comparability and interpretation of nutrition and health status assessments.

NCHS sponsored or co-sponsored several workshops during the past year including an NCHS Growth Chart workshop and analyses of topics of public health concern--overweight in adolescents and adults, dietary intake, folate status of women of child-bearing age, and progress in meeting Year 2000 nutrition and health objectives. A report entitled *Consensus Workshop on Dietary Assessment: Nutrition Monitoring and Tracking the Year 2000 Objectives* provides recommendations for improving the comparability of dietary data collected at the national and state/local levels for tracking Year 2000 progress and for future nutrition monitoring.

2. Healthy People 2000

In September 1990, the Department of Health and Human Services released *Healthy People 2000: National Health Promotion and Disease Prevention Objectives* which defines specific

measurable objectives for improving the health of Americans by the end of this century. *Healthy People 2000* contains over 500 measurable objectives and subobjectives which are grouped into 22 priority areas. The first 21 areas pertain to health promotion, health protection, and preventive services. Area 22, dealing with surveillance and data systems, addresses the development of an infrastructure to track these objectives and to identify and evaluate emerging public health issues at the national, state, and local levels.
NCHS is responsible for monitoring the Nation's progress toward achieving the objectives, using NCHS and other data sources. Progress reports are published annually in the *Healthy People 2000 Review* series. Although the objectives are national in scope, their achievement will be accomplished primarily through state and local efforts. NCHS provides training, technical assistance, software products, and some funding to support state and local health agencies.

How to obtain NCHS publications

1.Catalogs and listings of NCHS publications and periodicals such as the Monthly Vital Statistics Report and Advance Data Reports are free of charge. Requests for National Center for Health Statistics (NCHS) information and/or products should be referred to:

Data Dissemination Branch
National Center for Health Statistics
Centers for Disease Control and Prevention
6525 Belcrest Road, Room 1064
Hyattsville, Maryland 20782
Telephone (301) 436-8500
E-mail: nchsquery@nch10a.em.cdc.gov

Printed copies of other publications, including *Vital Statistics of the United States, Vital and Health Statistics Series Reports*, and most miscellaneous reports, are free to libraries and selected institutions. Others may purchase these reports from the U.S. Government Printing Office (GPO) or the National Technical Information Service (NTIS). To order reports write, call or fax to the following addresses:

Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402-9325
Telephone (202) 783-3238

To order reports from the NTIS contact:

NTIS
5285 Port Royal Road
Springfield, VA 22161
(703) 487-4650
Rush service: 1-800-553-NTIS
(703) 321-8547 (fax)

2.Descriptive survey information, recent reports, and a list of publications are available on the Internet through the Centers for Disease Control and Prevention Home Page: http://www.cdc/gov/nchswww/nchshome.htm

3.Information about NCHS' role in nutrition monitoring can be obtained by written request to:

Nutrition Monitoring Office
Division of Health Examination Statistics
National Center for Health Statistics
Centers for Disease Control and Prevention
6525 Belcrest Road, Room 1000
Hyattsville, Maryland 20782

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Health, United States, 1993. 301 pp. (PHS) 94-1232. GPO stock number 017-022-01252-9. price $19.00

Health, United States, 1993, Chartbook. 92 pp. PHS) 94-1232-1.

Healthy People 2000 Review, 1993. 171 pp. (PHS) 94-1232-1.

Selected NCHS Reports Published During 1994

Series 2 Publications: Data Evaluation and Methods Research

No. 119Investigation of Nonresponse Bias: Hispanic Health and Nutrition Examination Survey. 75 pp. (PHS) 94-1393. G.P.O. stock number 017-022-01243-0 price $5.50. NTIS order number PB94-134996 price code PC A04 MF A01

No. 120Evaluation of National Health Interview Survey Diagnostic Reporting. 116 pp. (PHS) 94-1394. GPO stock number 017-022-01244-8 price $7.50. NTIS order number PB94-151214 price code PC A06 MF A02

No. 121Statistical Issues in Analyzing the NHANES I Epidemiologic Followup Study. 30 pp. (PHS) 94-1395 GPO stock number 017-022-01258-8 price $2.75

Series 6 Publications: Cognition and Survey Measurement

No. 7Cognitive Aspects of Reporting Cancer Prevention Examinations and Tests. 161 pp. (PHS) 94-1082 GPO stock number 017-022-01275-8. price $12.00

NHEFS Publications

Statistical Issues in Analyzing the NHANES I Epidemiologic Followup Study. 30 pp. (PHS) 94-1395. GPO stock number 017-022-01258-8 price $2.75

NHIS Publications

No. 188Prevalence and Characteristics of Persons With Hearing Trouble: United States, 1990-91. 75 pp. (PHS) 94-1516. GPO stock number 017-022-01251-1. price $5.50. NTIS order number PB94-156601. price code PC A05 MF A01

No. 189Current Estimates from the National Health Interview Survey, 1992. 269 pp. (PHS) 94-1517. GPO stock number 017-022-01242-1. price $17.00. NTIS order number PB94 135811. price code PC A13 MF A03

No. 191Health of our nation's children. 61pp. (PHS) 95-1519. GPO stock number 017-022-01277-4. price $4.75.

Beltsville Human Nutrition Research Center

20th National Nutrient Databank Conference Laboratory Updates

Nutrient Data Laboratory

Shortly after our meeting last year, the Nutrient Data Laboratory (formerly the Nutrient Data Research Branch) and the Survey Systems/Food Consumption Laboratory (formerly the Survey Systems Branch and the Food Consumption Research Branch) were transferred to the Beltsville Human Nutrition Research Center of the Agricultural Research Service.
The Nutrient Data Lab has moved to new quarters. The address is:

Nutrient Data Lab
River Road, Unit 89
Riverdale, MD 20737
Tel. 301-734-8491
FAX: 301-734-5643

Laboratory staff can be reached in the new offices by replacing the 436 prefix in the old telephone numbers with a 734 prefix. The last four digits remain the same.
The new number for the Nutrient Data Bank Bulletin Board is:

301-734-5078

To access the data on the Bulletin Board over the Internet type:

telnet info.umd.edu

at your system prompt and select the following items from the menu:

Educational Resources
Academic Resources by Topics
Agriculture and Environment Resources
Department of Agriculture
USDA Food Composition Data

For those of you using World Wide Web Browsers, the following URL is available:

http://www.inform.umd.edu/EdRes/Topic/AgrEnv/USDA/USDAFoodCompositionData

Progress

The Primary Nutrient Data Set for Nationwide Food Surveys (PDS) was updated for the 1994 CSFII and will be released soon after the data from that survey are made available. Data on 19 individual fatty acids were added for all foods in the PDS. As part of the revision a new format has been adopted. This format adopts a relational structure and divides the information into several files.

The next release of the USDA Nutrient Database for Standard Reference will also adopt a relational structure similar to that of the Primary Data Set. This release will also add data from the 1992 Supplement to AH-8, data on vitamin E expressed in terms of milligrams of alpha-tocopherol equivalents, additional dietary fiber data, and other data from contracts sponsored by the Lab and other sources.

Progress in NDL since last year includes development of additional data quality control procedures and development of the Key Foods list. Two contracts on ethnic foods are generating needed data on content of vitamins, minerals, proximates and lipid components.

The National Nutrient Database for Child Nutrition Programs has been updated. Release 2 of this database will be available shortly on the Bulletin Board.

The Lab is working with the International Food Service Distributors Association (IFDA) to establish procedures whereby data produced by food companies using the IFDA format can be accessed electronically and evaluated for use in the National Nutrient Databank.

Survey Systems/Food Consumption Laboratory

Continuing Survey of Food Intakes by Individuals (CSFII)/ Diet and Health Knowledge Survey (DHKS) 1994-96

Data collection for 1994 was very successful. The year yielded 10,900 completed intake questionnaires and more than 1800 DHKS participants. Over 80% of eligible individuals provided at least one day of food recall data and 77% provided two days of data. Data collection for 1995 began in January 1995 and will continue through February 1996. Information about the survey has been carried by the Associated Press, resulting in articles in several newspapers, including the New York Times.

Data Releases

The 1994 CSFII/DHKS data tape, along with the 1994 Survey Nutrient Data Base, will be available to the public in 1995.

The 1989-91 CSFII/DHKS data are on CD-ROM which has been made available as a "test" set to individuals who have been using magnetic tapes or to others who have requested the data on CD-ROM. Contact Alanna Moshfegh, Research Leader, for information on obtaining 1989-91 data on CD-ROM.

Two statistical reports from the 1989-91 surveys have been completed and are in press. One provides 1-day food and nutrient intake data from the CSFII and the second provides information from the DHKS.

A series of Fact Sheets on USDA survey-related activities and publications has been placed on the Internet. To access the information, enter: gopher.nalusda.gov. Select the following items from the menu:

NAL Information Centers
Food and Nutrition Information Center
Agricultural Research Service/USDA--Nutrition Information
Survey Systems/Food Consumption Laboratory

New Location

The Survey Systems/Food Consumption Laboratory has moved. Our new address and telephone number are:

USDA, ARS
River Road, Unit 83
Riverdale, MD 20737
743-8457

Laboratory staff can be reached in the new offices by replacing the 436 prefix in the old telephone numbers with a 734 prefix. The last four digits remain the same.

Center for Nutrition Policy and Promotion

The Nutrition Education units of the former HNIS now comprise the Center for Nutrition Policy and Promotion and report to the Undersecretary for Food and Consumer Services. Their address is:

Center for Nutrition Policy and Promotion
20th Street, NW
Suite 200, North Lobby
Washington, DC 20036
Tel: 202-418-2312
FAX: 202-208-2321

Appendices

Poster Abstracts
Conference Exhibitors
Conference Committees
Participants

Poster Abstracts

Poster 1
Recoding of Foods Data for Food Patterns Identification

by Monica E. Yamamoto, DrPH, RD, Geoffrey D. Block, MD, Marlan B. Olson, MS, Fran L. Jones, MPH, Depts of Epidemiology (Graduate School of Public Health), Medicine and Pathology (School of Medicine), University of Pittsburgh

Food patterns information has become increasingly important for both nutrition policy and practice. Patterns of food choices result in nutrient intakes and possibly in food contaminant exposures. Our ability to alter such intakes or exposures is constrained by our understanding of existing food intake patterns. Attempts to characterize habitual food patterns has been hampered by complexities of the food marketplace. A growing number of food items and combinations are available to consumers. Approaches to handling foods data for patterns analysis are important and needed.
We present work with the U.S. National Food Consumption Survey's (1977-80) foods data on infants (n=542). An important step in generating food patterns is the reduction of this vast food repertoire to a manageable set of food categories. This set should be large enough to capture food choice variability but small enough to generate relevant policy and/or practice findings. An additional step might be the identification of important dimensions of food choices such as food market characteristics ("home cooked", "pre-prepared", "processed"). A set of 21 combined food groupings based on infant usage characteristics were created from the 77 USDA standard food groups. Food market characteristics were identified. Categorization and recoding techniques along with conceptual backgrounds are illustrated and discussed.

Poster 2
Evaluation of Nutrient Intakes of Selected Rural Elderly: I. Comparison By Meals and Snacks

by C. J. Lee, S. Templeton, M. Marlette and C. Wang. Human Nutrition Research Program, Kentucky State University, Frankfort, KY

Nutrient intakes of 184 elderly volunteers (60 yrs or older) residing in 10 rural counties of Kentucky were evaluated in relation to meals and snacks. Information collected by interview included questions related to sociodemography, health status, nutritional knowledge, attitudes and practices. Food intake data on two non-consecutive days were collected by 24-hr recall using plastic food models and measuring utensils. The food recall data were processed by using Nutritionist IV (N-Squared Company) for nutrient consumption. 72.8% of elderly participants indicated that they eat meals alone and the proportions were higher among lower income ($p<0.0001$) and education ($p<0.01$) groups. Overall, the mean intakes were low for dietary energy (67% RDA), calcium (64% RDA), and dietary fiber (47% DRV). Lunch and evening meals provided about equal portion of calories (33% each) and of the majority of nutrients studied. Breakfast supplied 23% of the total calories. Sugar and caffeine intakes were provided most by breakfast. Consumption of carbohydrates, iron, calcium and magnesium were evenly distributed among the three meals. Snacks provided 12% of the total calories and higher proportions of sugar (19%) and caffeine (17%) than those for other nutrients studied. Among snacks, those consumed before bedtime contributed more than half of calories and all nutrients studied, followed by the afternoon snack; the morning snack contributed least. The present study suggests rural elderly need to be guided to make better food selections to improve the overall nutrient intakes and particularly timing and selection of snacks. (Supported by USDA/ CSREES/ KY.X-50-91-10H and RR6)

Poster 3

Evaluation of Nutrient Intakes of Selected Rural Elderly: II Dietary Fibers.

by C. J. Lee, M. Marlette, S. Templeton, and C. Wang. Human Nutrition Research Program, Kentucky State University, Frankfort, KY

Dietary fiber intakes of 184 rural elderly (60 yrs and older, mean 72.1 ± 7.1) residing in Kentucky were evaluated in relation to the quantity consumed and food sources. Food intake data were collected by 24-hr recall methods for two non-consecutive days. Plastic food models and measuring utensils were used throughout survey to maintain uniformity in serving size. Nutritionist IV software was used to compute the nutrient intakes. The mean dietary fiber intake was 11.8 ± 5.7 g, constituting only 47% of Daily Reference Value. Lunch and dinner provided 35% each of the total daily fiber intakes while breakfast and snacks provided 21.4% and 8.5%, respectively. When the fiber intakes were evaluated by food groups, the vegetable group provided the most fiber intakes (4.1 g) followed by bread/grains/cereals (3.9 g), fruits (1.7 g), legumes/nuts (1.2 g), snacks/desserts (0.5 g), and mixed dishes (0.2 g). Among the bread/cereal group, whole grain bread contributed the most fiber followed by wheat bran cereals, white bread, corn bread and wheat based cereals. Potatoes were consumed most and contributed the most fiber among vegetables, followed by green beans, tomatoes, corn and peas. Among the fruits, bananas contributed most to the rural elderly's diet, followed by apples (80% with skin and 20% peeled), citrus fruits/juices, melons and peaches. ANOVA revealed that the dietary fiber intakes were not significantly impacted by age, family income level or whether the elderly consumed meals alone or not. However, the fiber intakes were significantly different due to ethnicity (whites > blacks, $p<0.04$), gender (male > female, $p<0.04$), and level of schooling (more schooling > less schooling, $p< 0.02$). More intensive guidance is suggested to promote increase in dietary fiber intakes among the rural elderly. (Supported by USDA/ CSREES/ KY.X-50-91-10H and RR6)

Poster 4
Estimating Nutrient Contributions from the Fat and Residual Components of Fluid Milks in the U. S. Food Supply Series

by Shirley Gerrior, Ph.D., R.D. and Claire Zizza, M.S., R.D., U.S. Department of Agriculture, Center for Nutrition Policy and Promotion, Washington, DC 20036

The U.S. Food Supply is a historical series that measures the amount of food available for human consumption in the United States. It includes per capita estimates on several hundred foods and the nutrients available in these foods. The basic source of nutrient data used to calculate nutrient per capita values is the Primary Nutrient Data Set (PDS) from USDA's National Nutrient Data Bank. To more accurately reflect the nutrient contributions associated with the market shift from whole to low fat and skim milks, adjustments have been made to the nutrient databases used to calculate nutrient per capita values. Both fluid milk and milks with solids added are broken down into a milk-fat portion and a residual portion based on milk-fat content. Milk-fat content has been estimated using production and sales data from the Economic Research Service and the Agricultural Marketing Service, as well as from criteria outlined in the Code of Federal Regulations. In this way, food supply estimates of milk fat uniquely reflect year-to-year changes in nutrient contributions from specific milk components. A conversion factor for each milk product has been calculated and applied to the PDS nutrient values assigned to a particular milk product. This process generates the nutrient contributions from the milk-fat portion and residual portion separately. This application is appropriate for other milk products, such as creams, frozen desserts, and yogurt. The results of this process will be illustrated using 1970 and 1990 food supply estimates for selected fluid milks.

Poster 5
Analysis of the Nutritional Intake of Villagers of Tipling, Nepal

by Mabel M. Chan, PhD, Department of Nutrition and Food Studies, New York University, New York, NY

The purpose of this pilot study is to assess the nutritional intake of Nepalese residing in a hilly village, Tipling in Nepal. With the assistance of interpreter, the investigator recorded 24-h food recall of 43 villagers (21 male and 22 female). The interviews were conducted at the homes of the villagers or during their visits to the clinic. The mean age of the group was 33 yr with mean BMI of 22.1. The food pattern of these villagers was limited to a total of 32 different food and beverage items. The top six most commonly consumed food items were potato, corn flour, millet, unpopped popcorn, green chilies and radish leaves. Using available food composition tables for Indian and East Asia, nutrient intake was estimated. The mean Kcal intake is 2276 ± 1260. Carbohydrate, protein and fat intake were 75, 12 and 12 %Kcal respectively. The analysis also showed that their diet was low in vitamins A, B-12 and zinc. It is recommended that nutrition education on food and agricultural practices is needed to improve the food intake of this group.

Poster 6
Quality Review of Intake Data from the Continuing Survey of Food Intakes by Individuals (CSFII) 1994-96

by Amy L. Green, Mark Steinwandel, Rhonda Sebastian, Martha Berlin, and Sharon Mickle, Westat, Inc. and USDA-ARS, Maryland

The quality of 24-hour recall data is of critical importance in the Continuing Survey of Food Intakes by Individuals 1994-96 (CSFII 1994-96), which is conducted by Westat, Inc., under contract to the U.S. Department of Agriculture (USDA). One quality control procedure involves a complete review of food intakes collected by interviewers. The Intake Review is conducted by trained food coders and includes three levels of edits: a scan edit to check for minimum criteria of completeness, a detailed edit of the description and amount for each reported food, and a general edit to check for common interviewer recording errors. An automated system was designed to facilitate the review and to provide interviewers with timely feedback on the quality of the Intake data. All 10,912 Intakes collected in the CSFII '94 were reviewed within a few days of receipt at Westat's home office, and summary reports of interviewer performance were supplied to field management staff. The Intake Review enhanced quality control efforts because it provided a systematic approach to monitoring interviewer work, a database that revealed interviewer performance problems, and a timely mechanism for providing interviewers with feedback on their performance.

Poster 7
Nutritional Profile of Louisiana School Lunch--Implications for Project 2001: Nutrition for a New Century.

by N.B. Baker, B.E. Dileo, and C.M. Champagne, Pennington Biomedical Research Center, Louisiana State University, Baton Rouge, Louisiana.

The purpose of this study was to characterize and compare nutrient content of current Louisiana school lunch menus with the goals of *Project 2001: Nutrition for a New Century* and with the Recommended Daily Allowances (RDAs). We examined the question, "Is school food service moving in the right direction in order to meet the nutrition objectives of *Project 2001*?" One week of lunch menus from each of seven different school districts were analyzed using Moore's Extended Nutrient (MENu) database, formerly the Extended Table of Nutrient Values (ETNV). Under *Project 2001*, schools incorporate new health guidelines into meal planning. Criteria include offering a fresh fruit or vegetable and whole-grain products daily and dry beans/peas weekly. Unmodified processed meats and high-fat menu items are limited to one time per week. Salt and butter are not available on cafeteria tables and 1% lowfat and skim milks are available; however, 2% milk is selected by most students. With respect to sodium, only two schools had acceptable menus. In terms of high fat offerings, 63% offered more than one high fat item. Percentage of kilocalories from total fat and saturated fat exceeded the limits by 3%. When compared with current health recommendations, menu averages were on target for dietary fiber and cholesterol. Menus met at least 1/3 of the RDA for protein, calcium, iron, and vitamins A and C. The kilocalories for males 11-14 yr was 30% below the guidelines for suggested energy intake for meal planning. Suggestions for accomplishing the goals of *Project 2001* were provided. Additional monitoring of menus and recipes through nutritional analysis and increased training of food service staff will make the goals of *Project 2001* attainable. In implementing these health initiatives, continued monitoring is essential.

Poster 8
Establishing A Pyramid Database: Issues And Possibilities

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The release of the USDA's Food Guide Pyramid as the latest food guidance system creates a new standard against which daily intake can be compared. The purpose of this project was to establish a food database which allows for comparison of daily intake to the food guide pyramid recommendations. Plans for validation of this process will be presented.

To analyze a diet in terms of the Food Guide Pyramid, it was first necessary to classify which pyramid group a food belonged to, and second, to determine the pyramid serving for each food consumed. The pyramid group and the serving size was straightforward for single item foods, however, other foods were not easily classified. Assigning the portions of a pyramid serving for mixed foods was most difficult. Mixed foods account for the majority of food intake, so a mixed food group was added for ease of identification by the user. Pyramid servings for this group were based on the food's ingredients, its nutrient profile, or both.

To create a food database for a computerized program based upon the Food Guide Pyramid, common foods were chosen from a master database, a composite nutrient value was calculated for each food, and pyramid groups and serving sizes were assigned. Actual size food photos were included to assist users in entering the amounts they ate.

Additions to the pyramid database will have pyramid servings calculated by algorithms based on nutrient values of a given food. These algorithms could also serve as a useful tool for classifying the many processed and engineered foods in the marketplace which have non-traditional nutrient profiles.

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