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An Automated Process for Grouping Food Consumption Data

HNIS has under development a modular Food Grouping System that will automate the processes required to link foods reported in USDA's food consumption surveys to recipes for those foods, separate each food into its ingredients, and regroup its ingredients by selected characteristics for analysis. The system can be used to estimate consumption of specific foods, ingredients, or agricultural commodities.

The Food Grouping System will encompass the process of systematically defining, extracting (selecting, converting, linking, combining) verifying, and tracking food and nutrient data at different levels of detail as required for specific research objectives. It will have three distinct functions: aggregation, disaggregation, and normalization. Aggregation draws together into groups; disaggregation separates food groups into components or composite foods and mixtures into their ingredients; and normalization converts data to comparable units. Food grouping is an interdependent and far-reaching process which permeates activities from the defining of food codes to the organization of data for research and reporting.

The HNIS Automated Food Grouping capability will (a) translate intake data on food mixtures into data on ingredients for analyses, tracking, and reporting, (b) facilitate the grouping of food and nutrient intake data from the Nationwide Food Consumption Surveys and (c) accommodate relevant data on survey respondents, such as age, sex and income.

The Effects of A Computerized Nutrition Program for Senior Citizens¹

The purpose of the study was to determine the effects of a microcomputerized nutrition program upon the nutrient intake of senior citizens living in residential centers and whether or not hands-on microcomputer interaction improved program satisfaction and compliance motivation. Thirty-one senior citizens between ages 61 and 85 were divided into two experimental groups and a control group. The experimental groups included seniors who attended a nutrition program with hands-on microcomputer interaction (Group 1), and seniors who attended a nutrition program without hands-on microcomputer interaction (Group 2). The control group consisted of senior who did not attend the program. The senior in all groups completed

three-day food records at pretest and one month following the program for analysis of their nutrient intake. The seniors in the two experimental groups completed a program satisfaction questionnaire and focus interviews at follow-up. The expected outcomes were that the seniors in Group 1 and Group 2 would have better nutrient intakes than those who were in the control group; and the seniors in Group 1 would be more satisfied with the program and motivated to eat better than the seniors in Group 2. Analysis of variance and t-tests were used to determine differences in nutrient intake and satisfaction/motivation scores. The findings indicated that the nutrition program had a significant effect on the intake of saturated fat at follow-up for both experimental groups. The seniors in Group 1 were more satisfied with the program than the seniors in Group 2. Nutrient analysis methodology, if integrated properly, personalizes nutrition education programs, improves participant satisfaction, and enhances motivation to comply.

¹ Funded, in part, by the National Institute on Aging, R 43, 44AG 06269-02A2 Computerized Nutrition Program for Senior Citizens, May 1990

From a Nutrient Data Base to a Food Guide

USDA's research-based food guidance system is based on what foods Americans eat, what nutrients are in these foods, and how to make the best food choices. The food guidance system provides a basis for a total diet that contains the nutrients needed but not too many calories or too much fat, saturated fat, cholesterol, sugar, sodium, or alcohol.

The food guidance system is supported by a framework or core of major groups of nutrient-bearing foods with suggested ranges of servings from each group. The objectives for the system specified a range of food energy and nutrient levels, moderate levels of fat, cholesterol, sweeteners, and sodium, and adequate levels of complex carbohydrate. Patterns for diets at specific calorie level using this framework of suggested servings from the major food groups and subgroups were defined to meet a range of energy levels. Ability of the patterns to meet nutrient objectives was evaluated using food composites for each group and subgroup. These composites were based on typical selections of foods in each group as reported by individuals in the 1977-78 Nationwide Food Consumption Survey. For example, a food chosen more frequently was represented as a greater proportion of the composite. For the purpose of this evaluation,

foods in the composites were generally considered to be in their leanest forms, such as nonfat milk, meats trimmed of all fat, poultry without skin, and fruits and vegetables without added fat(s) or sweetener(s).

Nutrient content of each composite was determined using the Nutrient Data Base for Individual Food Intake Surveys, Release 4.0. Nutrient content of the foods in a pattern was calculated by multiplying the number of servings of each composite and then obtaining a total amount of each nutrient. Nutrient levels in the patterns were compared to Recommended Dietary Allowances for the sex-age groups whose energy needs fit the calorie level of the pattern to assess nutrient adequacy of the patterns.

Computer-Assisted Diet Analysis in an Introductory Nutrition Course

We compared computer-assisted and manual calculation methods of diet analysis in an introductory nutrition course. A blind crossover design grouped students by order of exposure to method (COMPFIRST OR HANDFIRST). Nutrition knowledge was assessed after completion of the first diet analysis assignment. In order to assess attitudes, students were permitted to select their preferred method of analysis to evaluate their own diets, and were grouped (CHOSECOMP OR CHOSEHAND) according to the method chosen. Comparisons of the COMPFIRST (n=43) and HANDFIRST (n=51) groups by Student's t-test revealed no significant differences in nutrition knowledge as measured by exam scores following the first assignment. Students in both the CHOSECOMP (n=41) and CHOSEHAND (n=48) groups were significantly more likely ($p < .0001$) in the CHOSECOMP group. Both teacher and students reported the computer method saved time. Student selection of the manual calculation (CHOSEHAND) method was related to flexibility in scheduling work place and time and not to any educational differences between methods.

The Critical Evaluation of Values of Carotenoids for Foods

The inverse association between the dietary intakes of fruits and vegetables and the risk of certain cancers rests, in part, on the biological model of carotenoids as anti-oxidants. However, the test of the association between the dietary intake of specific carotenoids and cancer incidence requires the availability of a carotenoid food composition database. The authors com-

pared values for alpha-carotene, beta-carotene, beta-cryptoxanthin, lutei+zeaxanthin, and lycopene in foods from over 100 published and selected unpublished sources. An expert system was developed to rate each value on the basis of 1) analytical method, 2) quality control procedures, 3) sampling plan, 4) sample handling, and 5) number of samples analyzed. Following the evaluation of data, acceptable values for each carotenoid and food were combined to generate the CAREX database which contains more than 250 foods. The database includes the food description, the mean value for each carotenoid, the number of acceptable values, acceptable references used, and a confidence code. The confidence code is derived from the ratings and is an indicator of the reliability of a specific carotenoid value for a food. This database is a useful tool for the evaluation of the intake of specific carotenoids in epidemiological studies of cancer incidence.

The Estimation of Censored Data Points in Small Data Sets

The accurate estimation of low levels of components in foods is difficult due to the censoring of a distribution at the lower end or "left-censoring" as a result of the quantitation limitation of analytical methods. Several techniques using constant values as well as conditional maximum likelihood estimators were evaluated in samples of 5, 10, and 20 observations taken from simulated populations. Samples from normal, log-normal, and square-root distributions were considered. In all cases, percent bias and the coefficient of variation for standard errors of the data set means were smaller when conditional maximum likelihood estimators were used.

Nutrient Density of Minerals and Trace Elements in Diets of Men and Women

Healthy, free-living men and women (n=107), 20 to 59 years of age, who were not taking medication or dietary supplements were studied to determine whether the nutrient density of minerals and trace elements of foods consumed varied by age and sex. Nutrient intakes were estimated from 3-day food records. Mean (\pm SD) caloric intake was 1731 ± 358 for women and 2420 ± 517 for men. Women consumed 25.8 ± 7.9 kcal per kg body weight which was significantly less than men who consumed 30.0 ± 8.4 kcal per kg body weight ($p < 0.01$). The body mass index did not differ between groups (26 ± 6 vs 27 ± 5 kg/m², respectively). Mineral

and trace element intakes follow:

	Mg/Day		Mg/1000 Kcal		Mg/kg Body Wt	
	Women	Men	Women	Men	Women	Men
Ca	787±272	945±425*	464±147	389±145*	11.7±5.0	11.7±5.6
Cu	1.0±0.2	1.3±0.4**	0.6±0.2	0.5±0.1**	0.02±0.01	0.02±0.01
Fe	12.8±5.7	14.9±5.2*	7.6±3.2	6.3±2.0**	0.2±0.1	0.2±0.1
Mg	263±64	316±88**	156±39	133±36**	3.9±1.1	3.9±1.3
P	1190±310	1477±424**	696±139	614±138**	17.6±5.7	18.2±5.4
Zn	9.9±3.0	12.4±3.2**	5.8±1.6	5.2±1.2*	0.2±0.1	0.2±0.1

*p>0.05

**p<0.01

Age did not affect intakes of minerals and trace elements for men or women. Dietary intakes of all nutrients were greater for men than women, however, nutrient densities (mg/1000kcal) were greater for women. Nutrient intakes/kg body weight were similar for men and women. Thus, the women reported diets that were more concentrated in minerals and trace elements, resulting in nutrient intakes/kg body weight remarkably similar to those of the men.

International Interface Standard for Food Databases

A database interface protocol incorporating LANGUAL as the coding scheme and retrieval methodology will be developed to allow easy access to and convenient international exchange of food consumption data. LANGUAL is an indexing language which allows for computerized retrieval of food names (and the data associated with these foods) from databases relative to 13 characteristics that affect the safety and/or nutritional quality of foods. The past 19 years of work on this system have included the development of a thesaurus (with terms, definitions, and scope notes), a hierarchical tree structure of terms, and a manual that explains the factors, factor terms, and factoring rules to indexers and searchers.

The first step in this project will be to develop, refine, and implement a schema for an international interface standard for food databases. The second step will be to develop a repertoire of personal computer programs for retrieval of food data using LANGUAL and the standard interface. The resulting system will be usable on a range of personal computers. The results of the efforts of this project will be disseminated to the widest possible international audience through demonstration projects for international symposia and pilot tests for actual scientific application.

Missing Food Coding Details in a Long-Term, Multicentered Clinical Trial: The First Two Years' Experience

The Modification of Diet in Renal Disease (MDRD) Study, a multicenter, five-year clinical trial, is sponsored by the National Institutes of Health and the Health Care Financing Administration and is designed to determine whether controlled dietary protein and phosphorus intake and/or control of blood pressure will alter the progression of chronic renal disease. Completeness of dietary data is a complex quality control challenge in such long duration, collaborative studies. Since dietary assessments depend on the completeness of intake information, the identification and alleviation of missing diet detail problems is key.

To examine patterns of problems in dietary data completeness, we reviewed the first two years of NCC clarification requests ("queries") for missing food record details. Clarification requests increased from 14.6% of 6,287 recorded days in 1989 to 25.4% of 8,687 days in 1990. Some improvements in quantity descriptions were noted. Overall, however, similar levels and types of problems for specific foods continued over the two years. For example, missing details on bakery goods, poultry and supplements. The rise in clarification requests was predictable, in some items; in the volume of food records for fixed staff levels and in proportion which was follow-up data. In long-term studies, reviews such as this provide valuable insights into needed support for patients and dietitians' work with research diet data.