DESIGNING A COMPUTERIZED NUTRIENT DATABASE FOR INDUSTRIAL APPLICATIONS: FOOD INDUSTRY

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INTRODUCTION

Computerized nutrient analysis systems are powerful tools with a variety of applications in research, health care, academia, and the food industry. Best Foods' original computerized nutrient analysis system was developed in 1972. In 1980, its design and applications were presented at the Fifth National Nutrient Data Bank Conference hosted by Michigan State University. Our system, which consists of a database and software program, was originally developed by a consultant and is accessed by a modem through General Electric time-sharing. The system was designed as a tool to enable us to assess the nutrient profile of our products and to disseminate nutrition information on product labels, in advertising, in publicity releases, in nutrition education materials, and in cookbooks. High time-sharing costs, the inability to easily update our database, and expanding needs made it necessary to enlarge and enhance our nutrient database system. This presentation identifies the specific nutrient database and program needs of one food company, Best Foods, and describes the computer system which is currently being modified to fulfill those needs.

DATABASE NEEDS

General Needs

The primary source of nutrient data in the database is USDA's Standard Reference Data Set which includes the revised Handbook No. 8 series. These data are supplemented with information from other common references of food composition such as Bowes and Church's Food Values of Portions Commonly Used, and McCance and Widdowson's Composition of Foods. Additional sources of data include Best Foods' ingredient and product data, other manufacturers' composition data, current scientific literature values, and analytical values. The source of all nutrient values in the database is documented to allow questionable values to be easily validated. When nutrient values for an ingredient are missing, the ingredients are flagged in the printout with an asterisk to indicate that for at least one nutrient, data are unavailable; also missing values are identified with a "-1" in the database and on the computer printout to alert the user that the calculated values may be underestimated and an adjustment may be necessary. The database can be easily updated, revised, and expanded as new food items or nutrient values become available.

Specific Nutritional Components

The specific nutritional components which must be included in the database are those which are needed for nutritional labeling. They are complete proximate analyses data, and the capability of verifying that these data are equal to 100 grams, the polyunsaturated and saturated fatty acid composition, the cholesterol content, and selected micronutrient data.

The nutritional components in the database are listed below. All underlined components are needed for nutritional labeling of food products. The other components are not required for nutritional labels, but are used in other ways such as in preparing prudent menus or recipes, and to support nutrient intake studies.

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DATABASE NEEDS: SPECIFIC NUTRITIONAL COMPONENTS

Proximate	Minerals	Vitamins	Fats	Amino Acids
water	calcium	ascorbic acid	saturated fat	
energy	iron	thiamine	monounsaturated fat	
protein	magnesium	riboflavin	polyunsaturated fat	
carbohydrate	phosphorus	niacin	others	
fat	potassium	pantothenic acid	cholesterol	
crude fiber	sodium	vitamin B-6		
dietary fiber	zinc	folacin		
ash		vitamin B-12		
		vitamin A		

Wants

Some additional features of databases which we have identified as "database wants", rather than "needs" include dietary fiber values, allergy flags, nutrient values for branded products and diabetic exchanges.

PROGRAM NEEDS

General

The Best Foods' program allows food items to be entered by name or code number; household units of measure as well as gram weights are also acceptable. The printout lists each ingredient by name, corresponding code number, the amount of the ingredient used in the recipe, weight of the ingredient as grams per 100 grams, the amount and source of each nutritional component in a total recipe, per 100 grams, and in two serving sizes. The program allows the user the option of selecting and calculating individual components.

Printout for Selected Nutrients

A printout for a Peanut Butter Shake recipe would show the ingredient name, code number, amount of each ingredient used in the recipe, as well as the percent or amount each ingredient contributes by weight to 100 grams of a recipe. If the caloric value and the protein content are selected for output, the distribution of calories, and the amount each ingredient contributes to the total protein content can easily be determined. If the caloric value is too high, the ingredient responsible can be identified and the recipe can be easily modified. Note that the nutrition information per total recipe, per 100 grams, and per two serving sizes are output simultaneously. Also, the program is designed to round the appropriate nutritional components for nutrition labeling. This will be discussed in more detail later.

User Accessibility and Needs

The system can be accessed by other Best Foods' departments. The primary users are the home economists in our test kitchens, the food technologists in product development, and the publicists supporting our marketing groups. They will have "read" only capability; that is, they will be able to utilize all programs but they will not be able to make modifications to the database. Another feature is the ability to calculate subtotals; this can be useful to the home economist and to the food technologist. In menu development, the nutritive values of individual meals such as breakfast, lunch, dinner, as well as the daily total can be determined. This feature also has applications for the food technologist in product development where the nutritive values of components of products can be determined. Recipes or product formulas undergoing formulation can be stored in a recipe file and can be recalled at a later date and analyzed, revised and reanalyzed if necessary. With authorization, a recipe or product formula can be

stored in the database as a food item; the program will transfer this information directly into the database eliminating time spent and reducing errors in data entry.

A variety of reports can be generated. The most frequently generated reports are the ingredient list report, the nutritional labeling report, the approximate composition report, and the recipe nutrient density guide.

Ingredient List Report

The preparation of an ingredient list report requires listing the ingredients of a product in order of predominance by weight. This procedure may require the breakdown of complex ingredients into their simple components, combining like components together (that is, components with the same labeling term), and then ordering them according to their respective weights. The specific guidelines for labeling terms are found in the Code of Federal Regulations issued by the Food and Drug Administration. For example, let's take a hypothetical product, Seasoned Spread, where the ingredients are seasoning salt, partially hydrogenated corn oil, garlic spread, and salt. The printout shows the seasoning salt (salt, pepper, parsley, oregano) and garlic spread (partially hydrogenated corn oil, garlic, salt) broken down into their simple components. Like ingredients are combined (that is, the "salt" from the "seasoning salt" is added to the "salt" in the "garlic spread" and the "added salt") and then sorted according to weight. Appropriate labeling terms may be assigned if applicable. In this case, the term "spices" includes "pepper", "parsley" and "oregano", so the final ingredient statement would become: "partially hydrogenated corn oil, salt, spices, garlic".

Nutrition Labeling Report

The Nutrition Information Per Serving report expresses values for specific nutrients as they would appear on a nutritional label. Values for calories, protein, carbohydrate, fat, the percent of the U.S.RDA for vitamin A, protein, vitamins C, thiamine, riboflavin, niacin, and minerals calcium, iron, must be declared and are rounded by the program according to guidelines in the Code of Federal Regulations. Other nutritional components such as the fatty acid composition, sodium, and cholesterol content are optional and can be printed out as needed.

Approximate Composition Report

The approximate composition report reflects values for nutritional components in 100 grams, and in two other units of measure (e.g., in a tablespoon and in a cup). This report is more informative in that the values are not rounded as they are for nutrition labeling, and values for additional components not found on the product label are provided (for example, the moisture content, the P/S ratio, and the ash content).

Recipe Nutrient Evaluation Report

The recipe nutrient density guide is used as a tool to help (1) evaluate how well recipes and menus meet prudent dietary guidelines or (2) how they need to be modified. The guide is based on a daily caloric level of 2000 Calories and nutrient levels are based on (1) the U.S. RDA for protein, vitamins, minerals, (2) total fat at 30% of calories, (3) saturated fat and added sugars at 10% of calories, (4) cholesterol at 300 milligrams per day and (5) sodium at 2000 milligrams per day. Each of these numbers are divided by 20 to arrive at the nutrient density guide per 100 calories. These values are printed in the output along with the calculated nutrient density values of the recipe so that they may be easily compared.

CONCLUSION

The Nutrient Data Bank Directory, edited by Loretta Hoover, and the Model for Review of Nutrient Data Base System Capabilities, edited by Loretta Hoover and Betty Perloff were valuable resources in identifying and designing a computer system to meet our needs. In the Nutrient Data Bank Directory, 87 computerized nutrient analyses systems are listed along with the appropriate contact person, a description of the characteristics of each system, and its availability. Several systems were evaluated following the methodology presented by Loretta and Betty in their Model for Review of Nutrient Data Base System Capabilities. Unfortunately, none of the available systems met all of our needs and would run on available computers without considerable program modification. Most systems were designed for applications in health care, research, or for personal nutritional assessment. Therefore, a software consultant was contracted to design a specific program for us. The system is in the advanced development stage and the initial results look promising. Our upgraded system will be up and running by early summer.