USDA'S DIETARY ANALYSIS PROGRAM FOR THE PERSONAL COMPUTER

Alyson Escobar, M.S., R.D.

OVERVIEW

USDA's Dietary Analysis Program is a user-friendly software package developed by Human Nutrition Information Service in cooperation with Extension Service for use with consumers. The program performs dietary analyses for food energy and 27 nutrients and food components using up to 3 days of reported food intakes.

For this program, approximately 850 foods were drawn from those commonly reported in the USDA Nationwide Food Consumption Surveys. The program uses a menu-entry approach for individuals to select foods for analysis. Foods are grouped in commonly recognized food groups, considering both nutrient composition and use in meals. Quantities of foods are selected from screens that list common household measures and serving units typically reported in USDA surveys.

The dietary analysis program produces: 1) a complete listing of foods and reported quantities; 2) bar graphs showing the percentage of user's RDA for 15 nutrients; 3) total quantities of fat, fatty acids, cholesterol, fiber, sodium, potassium, and copper; and 4) percent of calories from protein, carbohydrate, fat, and alcohol. In addition, the program can report data for any single nutrient or food component, listing the total quantity and the amount provided by each food reported. Users are able to assess the effects of changes they might want to make in their current diet because the program allows for the addition, deletion, and change in quantity of reported foods.

Objectives

USDA's Dietary Analysis Program was designed to provide a relatively rapid and easy-to-use nutritional assessment of a reported diet. The user-friendly system was developed for use with Extension Service clients--primarily homemakers interested in evaluating the nutritional adequacy of their own diets or the diets of other family members.

In addition to showing dietary analyses on the screen, the program can produce a printed copy of the results. This permits the user or Extension agent to document dietary changes over time.

The program can also serve as a useful educational tool. For example, single-nutrient analysis can be used to point out major sources of any selected nutrient or food component in a particular diet. In addition, the capacity to add, delete, or change quantities of foods permits users to examine the effects of alternative selections on their current nutrient intake. To do this, the user simply makes changes in foods or quantities selected and reanalyzes the diet.

SYSTEM CHARACTERISTICS AND FEATURES

The approximately 850 foods used in the dietary analysis program were drawn from over 4,000 foods reported in USDA Nationwide Food Consumption Surveys. In order to select foods that we hoped were familiar, we looked at those foods that were reported most frequently. To keep the number of foods at a workable size, we gave particular attention to foods that would be representative of other items similar in nutrient composition and use in meals. We selected foods in their prepared, ready-to-eat forms. In the future, we hope to add raw ingredients in a supplementary data base to provide the capability of analyzing recipes. Although a number of combination dishes are included, most items are represented in their simplest prepared form (cooked plain vegetables, for example). Users need to enter prepared sauces, condiments and dressings, etc. separately. We included a wide variety of food items to ensure that reasonable substitutes were available for items that were not included. Infant formulas and infant foods are

not included, however.

Nutrient Composition Data

Nutrient values for foods used in the dietary analysis program were taken from the 1986 USDA Nutrient Data Base for Individual Food Intake Surveys. The program is, therefore, capable of analyzing diets for food energy and 27 nutrients and food components:

food energy (kilocalories)	thiamin
protein	riboflavin
total fat	preformed niacin
saturated fatty acids	Vitamin B_6
monounsaturated fatty acids	Vitamin B_{12}
polyunsaturated fatty acids	folacin
carbohydrate	calcium
dietary fiber	phosphorus
cholesterol	magnesium
Vitamin A (IU and RE)	iron
carotenes	potassium
Vitamin E	sodium
ascorbic acid	zinc
alcohol	copper

Of these nutrients and food components, sodium, potassium, zinc, copper, folacin, cholesterol, fatty acids (polyunsaturated, monounsaturated, and saturated), Vitamin A (as retinol equivalents), carotene, Vitamin E, dietary fiber, and alcohol have been added to this USDA nutrient data base since the 1977-78 Nationwide Food Consumption Survey. Food composition data supporting the nutrient values are stronger for some nutrients than for others. The USDA Nutrient Data Base for Individual Food Intake Surveys contains no missing values because nutrient values were imputed for foods for which no data were available. Thus, we believe that the nutrient data used in the dietary analysis program are the best available.

DIETARY STANDARDS

The dietary standards used to evaluate the nutritional adequacy of diets are the 1480 Recommended Dietary Allowances (RDA) for the following nutrients: protein, Vitamin A, Vitamin E, ascorbic acid, thiamin, riboflavin, niacin, vitamin B_6, vitamin B_{12}, folacin, calcium, phosphorus, magnesium, iron, and zinc. Estimated Safe and Adequate Daily Dietary Intakes of sodium, potassium, and copper are listed for comparison with intakes. For the remaining nutrients and food components, totals are reported and interpretive materials are being developed to help the user evaluate the adequacy of his or her diet.

OPERATIONAL FEATURES

Selecting Foods

Users have two options in entering foods. One option is the "direct-entry" approach, used in a number of other dietary analysis programs. This approach requires that users look up food items in a complete listing of the data base that accompanies the software. Users then enter the food using an identification number or code that corresponds to the particular item. The second option is the "menu-entry" approach developed for this dietary analysis program. This approach eliminates the need to use food item identification numbers. Instead, users find the desired food

item by using a progression of food classification screens.

Our primary objective in structuring the food group classification system was to allow the user to locate specific foods quickly and easily. The main classification groups are:

1. Meat, Poultry, Fish, and Mixed Dishes
2. Dry Beans and Peas, Nuts and Seeds, and Eggs
3. Breads and Baked Goods, Crackers, and Snacks
4. Cereals, Pasta, Rice, and Mixed Dishes
5. Fruits
6. Potatoes, Vegetables, Salads, and Salad Bar Items
7. Dairy Products
8. Desserts and Candies
9. Beverages
10. Fast Food Sandwiches
11. Fats and Oils, Salad Dressings, and Spreads
12. Sugars and Syrups, Dessert Toppings, and Sweet Spreads
13. Soups, Sauces, Gravies, and Condiments

The user works through a series of menu screens which become more and more specific until the food group is small enough to list all individual items in the group on the screen. The user then selects the desired food.

When grouping foods, we considered in which food group a user might look for the item, as well as the food's nutrient composition and its use in meals. Food items were also listed under more than one food group heading if we felt it was likely that a user might look for them in more than one place. For example, fluid milk is listed under dairy products as well as under beverages, since users might conceivably look in either category.

Estimating Serving Sizes

After selecting a specific food item, the user enters the quantity consumed from serving unit options listed on the screen. For most foods, quantities can be estimated in terms of several serving units. Decisions about which serving units to include in the system were made for each individual food item. Therefore, the serving unit options are not the same for all foods. Common household weights and measures are options for most food items. However, these units were excluded where we felt users could not reasonably be expected to use them accurately (for example, "cups" is not used for meat items and most desserts). In addition to weights and volume units, we gave some foods other commonly used units, for example, a slice of bread or a medium piece of fruit.

MAKING SUBSTITUTIONS

Users may have to select alternative items when reporting foods not included in the program's data base. For single items, the best option is to select the most similar item available. For example, havarti cheese is not included in the data base, but brick and muenster cheeses are. Users can look at all the available substitutions for havarti cheese and select the one which they believe is most similar.

For combination dishes that are not in the data base, users have two options. They can select the most similar food item or they can enter component foods individually. The decision on which option to use for a particular combination dish can be determined by considering: 1) how many foods are involved (time factor), 2) whether all foods in the combination item are included as individual items in the data base, and 3) how large a quantity of the item was eaten. If some food components are not included in the data base, or if small quantities of the food

were eaten, selecting the single closest alternative food available may be the best option.

PROGRAM OUTPUT

Standard Output

The standard output includes those results of the individual's dietary analysis that we thought would be of greatest benefit and interest to the consumer.

The standard output components are:

1. background information about the user (name, age, sex);
2. a complete listing of foods being analyzed, including food description, serving unit, and serving quantity selected;
3 bar graphs showing the percentage of the user's RDA provided in the diet for each nutrient that has an RDA;
4. total quantities of selected nutrients and food components provided by the diet, including calories, total fat, saturated fatty acids, mono-unsaturated fatty acids, polyunsaturated fatty acids, cholesterol, sodium, and dietary fiber;
5. percentages of total calories from protein, carbohydrate, fat, and alcohol in the reported diet; and
6. total quantities of copper, sodium, and potassium and their corresponding Estimated Safe and Adequate Daily Dietary Intakes.

Standard output can be generated for a single meal or for up to a 3-day intake. It can be generated on the screen for the user to examine or printed for the user to keep. Figures 1 and 2 show a sample 1-day food record and accompanying standard output.

Single Nutrient Analyses

In addition to the standard output components, the program is designed to provide single nutrient analyses for user-selected nutrients. For each nutrient included in the data base, a report can be generated showing:

1. a complete listing of all reported foods included in the analysis, including item descriptions, serving units, and serving quantities;
2. amount of the nutrient contributed by each food item;
3. the total amount of the nutrient in the reported foods; and
4. the RDA for the nutrient (where applicable).

Figure 3 shows single nutrient analyses for fat and iron using the same sample 1-day food record analyzed in the standard output.

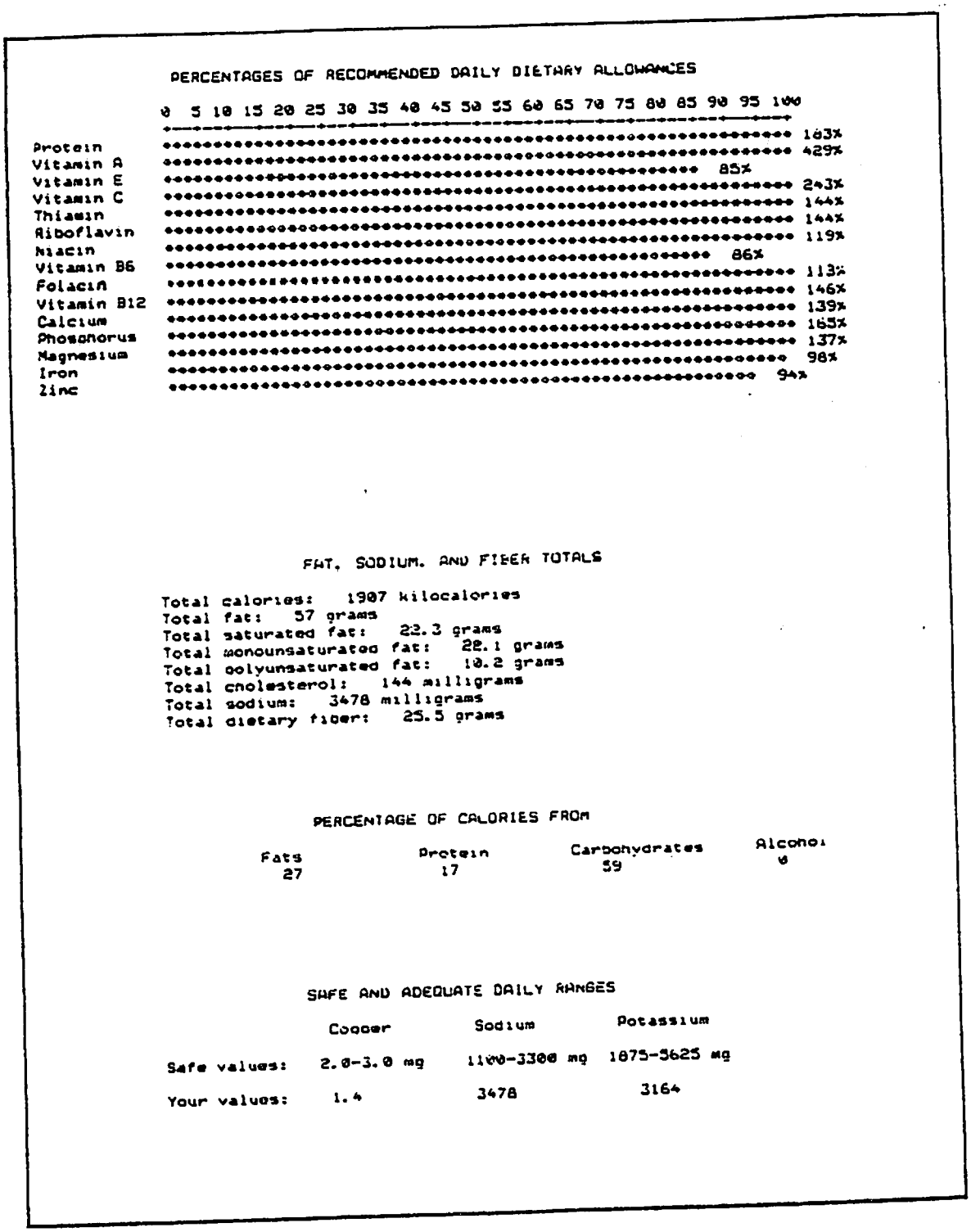
Pilot Testing

Plans are currently being finalized with Extension Service to pilot test the dietary analysis software package at four Extension locations. At least 50 participants at each testing site will evaluate the software for the following characteristics: ease and speed of use, clarity of instructions (on screen and in the user manual), usefulness of analysis output components, and additional features or information desired.

We want suggestions for improving the system. Extension professionals will be asked about anticipated uses of the software. For example, Extension personnel and other professionals may want to be able to store data for later use. Possible uses of stored records include evaluating nutrition education programs' effectiveness in promoting dietary change and surveying food and nutrient intakes in the user population.

	Food	Amount
1.	grapefruit	(1) 1/2 medium
2.	whole wheat cereal	(2) 1/2 cup
3.	sugar, brown	(2) one teaspoon
4.	milk, fresh, lowfat (1 percent)	(1) 1 cup
5.	frankfurter, all-beef	(1) one frankfurter
6.	roll, hotdog/hamburger	(1) one roll
7.	mustard	(1) 1 teaspoon
8.	baked beans with tomato sauce	(1) 1/2 cup
9.	cabbage, green	(1) 1/2 cup, chopped
10.	carrots	(.5) small carrot
11.	pepper, sweet, green	(.25) 1/2 cup, chopped
12.	salad dressing, mayonnaise-type	(3) one teaspoon
13.	cola	(1) 1 can (12 fluid ounce)
14.	roast, lean	(1) 3 ounces, boneless
15.	rice, white, instant	(2) 1/2 cup
16.	spinach	(1) 1/2 cup
17.	corn, yellow	(1) 1/2 cup
18.	roll, white, soft (dinner)	(1) one roll
19.	margarine, soft, tub	(2) one teaspoon
20.	banana	(1) medium banana
21.	tea, brewed, plain	(2) 6 fluid ounces
22.	lemon juice	(1) 1 teaspoon
23.	crackers, saltines	(4) one saltine
24.	cheese, swiss	(1.5) 1 ounce

Figure 1. Sample 1-day food record to be analyzed



PERCENTAGES OF RECOMMENDED DAILY DIETARY ALLOWANCES

0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100

Protein	183%
Vitamin A	429%
Vitamin E	85%
Vitamin C	243%
Thiamin	144%
Riboflavin	144%
Niacin	119%
Vitamin B6	86%
Folacin	113%
Vitamin B12	146%
Calcium	139%
Phosphorus	165%
Magnesium	137%
Iron	98%
Zinc	94%

FAT, SODIUM, AND FIBER TOTALS

Total calories: 1907 kilocalories
Total fat: 57 grams
Total saturated fat: 22.3 grams
Total monounsaturated fat: 22.1 grams
Total polyunsaturated fat: 10.2 grams
Total cholesterol: 144 milligrams
Total sodium: 3478 milligrams
Total dietary fiber: 25.5 grams

PERCENTAGE OF CALORIES FROM

Fats	Protein	Carbohydrates	Alcohol
27	17	59	0

SAFE AND ADEQUATE DAILY RANGES

	Copper	Sodium	Potassium
Safe values:	2.0-3.0 mg	1100-3300 mg	1875-5625 mg
Your values:	1.4	3478	3164

Figure 2. Standard output for sample 1-day record

Food	Amount		Total fat g
grapefruit	(1)	1/2 medium	0.1
whole wheat cereal	(2)	1/2 cup	1.0
sugar, brown	(2)	one teaspoon	0.0
milk, fresh, lowfat (1 percent)	(1)	1 cup	2.4
frankfurter, all-beef	(1)	one frankfurter	13.6
roll, hotdog/hamburger	(1)	one roll	2.4
mustard	(1)	1 teaspoon	0.2
baked beans with tomato sauce	(1)	1/2 cup	0.7
cabbage, green	(1)	1/2 cup, chopped	0.1
carrots	(.5)	small carrot	0.0
pepper, sweet, green	(.25)	1/2 cup, chopped	0.1
salad dressing, mayonnaise-type	(3)	one teaspoon	5.0
cola	(1)	1 can (12 fluid ounce)	0.0
roast, lean	(1)	3 ounces, boneless	7.1
rice, white, instant	(2)	1/2 cup	0.0
spinach	(1)	1/2 cup	0.2
corn, yellow	(1)	1/2 cup	1.0
roll, white, soft (dinner)	(1)	one roll	1.6
margarine, soft, tub	(2)	one teaspoon	8.0
banana	(1)	medium banana	0.3
tea, brewed, plain	(2)	6 fluid ounces	0.0
lemon juice	(1)	1 teaspoon	0.0
crackers, saltines	(4)	one saltine	1.4
cheese, swiss	(1.5)	1 ounce	11.5
TOTAL			57.2 g
RDA VALUE			*

Food	Amount		Iron mg
grapefruit	(1)	1/2 medium	0.1
whole wheat cereal	(2)	1/2 cup	1.5
sugar, brown	(2)	one teaspoon	0.2
milk, fresh, lowfat (1 percent)	(1)	1 cup	0.1
frankfurter, all-beef	(1)	one frankfurter	0.6
roll, hotdog/hamburger	(1)	one roll	1.2
mustard	(1)	1 teaspoon	0.1
baked beans with tomato sauce	(1)	1/2 cup	2.7
cabbage, green	(1)	1/2 cup, chopped	0.2
carrots	(.5)	small carrot	0.1
pepper, sweet, green	(.25)	1/2 cup, chopped	0.2
salad dressing, mayonnaise-type	(3)	one teaspoon	0.0
cola	(1)	1 can (12 fluid ounce)	0.0
roast, lean	(1)	3 ounces, boneless	2.4
rice, white, instant	(2)	1/2 cup	2.2
spinach	(1)	1/2 cup	3.4
corn, yellow	(1)	1/2 cup	0.5
roll, white, soft (dinner)	(1)	one roll	0.8
margarine, soft, tub	(2)	one teaspoon	0.0
banana	(1)	medium banana	0.4
tea, brewed, plain	(2)	6 fluid ounces	0.0
lemon juice	(1)	1 teaspoon	0.0
crackers, saltines	(4)	one saltine	0.6
cheese, swiss	(1.5)	1 ounce	0.1
TOTAL			17.6 mg
RDA VALUE			18.0mg

Figure 3. Single nutrient analyses (fat, iron) for sample 1-day food record

USING RELIABILITY CODES

Joanne M. Holden, M.S.

Nutrient Composition Laboratory
Beltsville Human Nutrition Research Center
Agricultural Research Service
U.S. Department of Agriculture

The accuracy and precision of nutrient composition data have a significant impact upon the assessment of nutrient intake and the evaluation of relationships between intake and the incidence of certain disease states (1). Many users of nutrient data assume that a value which appears in print or in a data tape is of the highest quality and absolutely correct. However, the quality of an individual data point in a database or table is dependent upon several factors and merely represents an estimate made from available sources. For a single nutrient, the values for some foods may be accurate and precise; for other foods the values may be of poor quality due to the limitations of the source(s) from which the value was taken. Quality indicators of nutrient composition data quality could provide users of such data with information to determine the reliability of estimates of nutrient intake. In generic terms, such quality indicators could be called "reliability codes".

As mentioned above, a nutrient value for a specific food represents the compilation of values for that nutrient and food taken from various sources. Therefore, the quality of each tabular value is dependent upon the quality of those individual values. Furthermore, a published study may contain nutrient composition data which may be appropriate in its original context but may not be suitable for use in a nutrient data bank. For example, the primary objective of a study may be to develop analytical methodology and may include nutrient composition data as an example of methodological performance. For such a study, the selection of samples may be limited. Similarly, the objective of a study may be to test the effects of a new feeding regime on the level of a particular nutrient which results in the animal consuming that diet or to evaluate a new crop variety not currently marketed. Each of these situations would produce nonrepresentative data and would not be appropriate for use in assessments of nutrient intake by population groups.

In addition to the lack of representativeness of a particular value, the accuracy and precision of a nutrient value for a specific food taken from a single source is dependent upon several other factors. One factor concerns the appropriateness of the analytical method used, including its validation by reference materials or by another definitive method. Furthermore, the evidence of analytical quality control, satisfactory execution of the method on a day-to-day basis, is necessary for determining the quality of a single value. In addition, the sampling plan which had been used for selecting the samples should be fully documented and appropriate. Finally, sample handling techniques and the number of samples analyzed must be known in order to determine the soundness of the estimate.

A system for evaluating published data for these various factors or categories and for quantifying the degree to which each of these requirements has been met has been developed by the Nutrient Composition Laboratory (NCL) for the evaluation of selenium (Se) data (2,3) and, more recently, modified for the evaluation of copper data (4). For illustrative purposes, Table 1 contains a portion of the information presented in the article by Schubert et al. (3). This system provides detailed documentation of the data which have been compiled from various published sources to yield a single nutrient (e.g., Se) mean for a given food product. In addition to the mean selenium value, the table includes the references for acceptable studies, that is, studies whose mean values have been included in the computation of the grand mean. Also, the numbers