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Paula A. Quatromoni

Richard A. Cook

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School of Human Development
Division of Human Nutrition and Foods
University of Maine
Orono, ME 04469

Maine Agricultural Experiment Station
University of Maine
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ABSTRACT

In an initial effort to devise a rapid assessment alternative that would provide a reliable estimate of an individual's usual dietary pattern, a Predicted Food List (an estimated, abbreviated food frequency), an Actual Food List (a recorded, truncated food frequency), and a Typical Diet Day (foods perceived as commonly consumed in a 24-hour period) were compared with a 75-day food record. Overall, the Predicted Food List appeared to be the best tool for depicting an individual's usual food intake. Analysis of an Actual Food List was shown more likely to underestimate energy and nutrient levels while the Typical Diet Day was shown more likely to overestimate energy and nutrient levels for the individual under investigation. It was concluded that a shortened list of food items characterizing an individual's normal nutrient intake level may be a useful instrument allowing rapid screening of selected "at risk" nutrients.

INTRODUCTION

Diet intake evaluation is an important component of nutritional status assessment because it aids the professional in assessing relationships among diet, health, and disease (8). The information obtained by diet assessment techniques has proven valuable for depicting food preferences and habits, nutrient intake levels, available food supplies, commonly consumed food sources of high nutrient density, cultural and ethnic dietary patterns, and dietary inadequacies. At the same time, diet assessment methodologies are the focus of a great deal of controversy in the literature due to their inability to provide data which are as precise as that derived from anthropometric, biochemical, or clinical assessments.

Traditional methods for gathering diet intake data include a diet history, food frequency, diet intake record, or 24-hour recall (8). Use of the 24-hour recall for individual, rather than group, diet assessment is becoming more and more common in institutional settings. This is particularly the case in federally funded food assistance programs, because of time and cost constraints, despite the fact that research has consistently indicated that the 24-hour recall is not a reliable estimate of any one individual's usual food intake (1,5,7,13). Although the 24-hour recall is an acceptable method for use in assessing group intakes (4,5) researchers have found that use of this technique results in an overestimation of individual nutrient intake levels (6,3,10). Also, recall data are considered to be less characteristic of an individual's usual food intake since they are less sensitive to daily variations in nutrient levels as compared to data collected in the form of three-day or seven-day food records (12).

Since other more accurate traditional methods are not favorable for use by the professionals previously described, alternative, reliable methods need to be developed for collecting and assessing individual diet intake data. Rapid and inexpensive screening techniques would serve as valuable tools for use in clinical settings. The development of such alternatives would enable the identification of individuals considered to be at risk of nutritional deficiency or excess.

METHODS

Sample

This research was concerned with the determination of non-traditional diet assessment methodologies which would be appropriate for use with individual subjects. The senior author served as the subject and performed the data analyses for this initial pilot investigation of alternative diet assessment strategies. At the time of data collection, she had recently completed her second year of college as a Food and Nutrition Major. The primary investigator (the second author) instructed the subject to keep detailed diet records over a period of 75 days during the months of May through August, 1983 to characterize her usual dietary pattern.

Data Collection

Complete and descriptive food records were kept, in a meal-by-meal format, for the duration of the 75-day period. The subject recorded intake in an honest and thorough manner immediately following the consumption of each meal or snack. Food intake was measured in household units (cups, ounces, tablespoons, etc.) and estimated when direct measurement was not feasible.

In an effort to simulate a typical field condition the subject, unaware of the following research methods, was asked to compose a "Predicted Food List" (PFL) one month following the completion of the recording phase. The Predicted Food List consisted of a short list of foods believed to be the most commonly consumed items in the diet related to the experimental period. The PFL resulted in a total of 15 foods for which usual portion size and frequency of consumption were estimated and converted to amounts consumed on a daily basis (Table 1). The subject was also asked to outline a "Typical Diet Day" (TDD), describing characteristic foods she felt were most usually consumed over a 24-hour period.

Then, the diet records were examined to calculate the frequency with which each individual food item was consumed over the 75-day period. This procedure enabled the determination of the actual 15 foods most commonly consumed, and was labeled the "Actual Food List" (AFL) (Table 1). In some instances in the

Table 1
Most Frequently Consumed Foods

Predicted food list Item	Amount/day		Actual food list Item	Amount/day	
whole milk	610 gm	(2.5 cups)	whole milk	410 gm	(1.68 cups)
white bread	75 gm	(3.0 slices)	bread	59 gm	(2.38 slices)
orange juice	311 gm	(1.25 cups)	or. juice	276 gm	(1.11 cups)
Raisin Bran	28 gm	(0.57 cup)	cereal	28 gm	(0.70 cup)
tuna fish	18 gm	(0.65 ounce)	bacon	5 gm	(0.68 slice)
oatmeal cookies	18 gm	(1.42 cookies)	cookies	10 gm	(0.79 cookies)
frosted danish	37 gm	(0.57 pastry)	pastries	29 gm	(0.44 pastry)
mayonnaise	7 gm	(0.50 T)	mayo.	8 gm	(0.54 T)
margarine	7 gm	(0.50 T)	margarine	4 gm	(0.30 T)
hamburger	35 gm	(0.43 patty)	syrup/jam	23 gm	(1.15 T)
fried egg	20 gm	(0.43 egg)	egg	14 gm	(0.31 egg)
reg. ice cream	39 gm	(0.29 cup)	ice cream	23 gm	(0.17 cup)
peanut butter	14 gm	(0.86 T)	p-nut butter	8 gm	(0.48 T)
Amer. cheese	24 gm	(0.86 slice)	Amer. cheese	12 gm	(0.43 slice)
tossed salad	47 gm	(0.43 cup)	fr. toast	18 gm	(0.31 slice)

formation of the AFL, specific food items were grouped together and categorized under a general heading. For example, the bread category consisted of 31% white bread, 25% whole wheat bread, 18% bagels, 15% soft rolls, and 10% hard rolls. This was done in hopes of increasing accuracy by including more comprehensive food groupings. Also, non-calorie foods, such as tea, were omitted from this frequency list.

Data Analysis

All diet records and food lists were coded exclusively by the senior author in an effort to reduce coder variability and subjective judgment. In this way, the author was able to base coding decisions on personal knowledge of dietary habits and food selection patterns. The data were coded by the use of a 5000 food nutrient data bank (11) accessed via an Apple microcomputer. Food files were checked for errors by a computerized software program which identified invalid food codes and unusually large portion sizes which may have been entered incorrectly. In addition, the food file data were manually cross-checked by another researcher. Once all necessary corrections had been made and validated, the food files were processed for calculation of intake levels of total calories and 20 nutrients (carbohydrate, protein, total fat, saturated fat, cholesterol, vitamin A, thiamin, riboflavin, niacin, pyridoxine, vitamin B_{12}, folate, vitamin C, calcium, iron, magnesium, phosphorus, potassium, sodium, and zinc).

Energy and nutrient levels generated through analysis of the PFL, AFL, and TDD were compared, on a percent basis, to those representing the 75-day means in order to identify similarities and differences among the assessment strategies. A one-way Analysis of Variance (2) was implemented to determine whether energy and nutrient levels estimated by analysis of the Predicted Food List were significantly different from those estimated by analysis of the complete diet records. This entailed returning to the original 75 diet records and, this time, coding only for those foods which were included in the Predicted Food List. All other foods were excluded from this analysis.

RESULTS AND DISCUSSION

A comparison of the 75-day mean energy and nutrient levels with the estimated levels generated by analysis of the two food lists and typical diet day is represented in Table 2. Estimated levels were compared as percent of mean intake.

Analysis of the Predicted Food List indicated that it was useful in predicting intake levels for 14 of 21 nutritive components examined, to within ±10% of the 75-day nutrient means (protein, total fat, saturated fat, cholesterol, thiamin, riboflavin, pyridoxine, vitamin C, calcium, iron, magnesium, phosphorus, potassium, and zinc). Levels of sodium and vitamin B_{12} showed the largest discrepancies by representing 65% and 136% of the mean, respectively. In addition to sodium, total calories and levels of carbohydrate, vitamin A, niacin, and folate were also underestimated by the PFL (<90% of the mean). Vitamin B_{12} was the only nutrient for which an overestimate was observed (>110% of the mean). All nutrient and energy levels estimated by the PFL were significantly different ($p \leq 0.01$) from levels estimated by analysis of all food components in the 75 complete diet days (Table 3).

The Actual Food List grossly underestimated intake levels of energy and all 20 nutrients examined (Table 2). Based on this observation, the AFL was expanded in an effort to determine the appropriate number of food items needed to increase its ability to more closely predict normal intake, since the original list of 15 foods did not accomplish this objective. However, even when the list was expanded to 20, 25, and finally 30 foods, nutrient levels did not rapidly approach 90% of mean intake, as the predicted food list had done. Thus, this alternative was abandoned as a viable method for further study.

The Typical Diet Day predicted three nutrients within ±10% of the 75-day mean (carbohydrate, cholesterol, and vitamin C). Energy and 17 additional nutrient levels were overestimated by this technique (Table 2). This finding indicates a general overestimation of individual dietary intake as is also reported for the 24-hour recall method (3,6,10). Thus, both of these assessment approaches are inappropriate for use with individuals.

Table 2

Comparison of Actual Energy and Nutrient Levels
With Estimated Levels From Food Lists and Typical Diet Day

Dependent variable	Mean[a]±SD (N=75)	PFL[b]		AFL[c]		TDD[d]	
		Total	% Mean	Total	% Mean	Total	% Mean
Energy (kcal)	1949 ± 346	1534	79%	1175	60%	2480	127%
Carb. (gm)	237 ± 52	167	70%	155	65%	248	105%
Protein (gm)	69 ± 15	62	90%	37	54%	98	142%
Tot. Fat (gm)	76 ± 21	72	95%	47	62%	127	167%
Sat. Fat (gm)	31 ± 11	34	110%	20	65%	44	142%
Chol. (mg)	311 ± 176	293	94%	213	68%	283	91%
Vit. A (IU)	5214 ± 3362	3711	71%	2729	52%	5880	113%
Thiamin (mg)	1.5 ± 0.29	1.4	93%	1.2	80%	2.2	147%
Riboflavin (mg)	2.1 ± 0.50	2.1	100%	1.5	71%	3.0	143%
Niacin (mg)	19.1 ± 4.7	15.6	82%	9.9	52%	30.4	159%
Pyridoxine (mg)	1.2 ± 0.40	1.1	92%	0.8	67%	1.8	150%
Vit. B_{12} (µg)	3.6 ± 1.6	4.9	136%	2.7	75%	7.4	205%
Folate (µg)	218 ± 73	194	89%	141	65%	336	154%
Vit. C (mg)	178 ± 61	163	92%	146	82%	187	105%

(*table continues*)

Table 2 concluded

Dependent variable	Mean[a] ± SD (N=75)	PFL[b]		AFL[c]		TDD[d]	
		Total	% Mean	Total	% Mean	Total	% Mean
Calcium (mg)	1043 ± 328	1141	109%	763	73%	1455	139%
Iron (mg)	11 ± 3.1	10	91%	6	55%	19	173%
Magnesium (mg)	226 ± 64	219	97%	145	64%	328	145%
Phosphorus (mg)	1292 ± 306	1278	99%	808	63%	1755	136%
Potassium (mg)	2581 ± 583	2346	91%	1521	59%	3388	131%
Sodium (mg)	2490 ± 738	1613	65%	1418	57%	3291	132%
Zinc (mg)	8.6 ± 2.9	8.7	101%	4.9	57%	15.2	177%

[a] Mean ± Standard Deviation, as calculated using the Large Data Base

[b] PFL= Predicted Food List

[c] AFL= Actual Food List

[d] TDD= Typical Diet Day

Table 3

One Way ANOVA Comparing Mean Energy and Nutrient Levels
Estimated by the Predicted Food List and Complete Diet Records

Dependent variable	Mean[a] ± SD (N=75)	PFL mean[b] ± SD (N=75)	F-Ratio*
Energy (kcal)	1949 ± 3346	1017 ± 298	312
Carbohydrate gm)	237 ± 52	116 ± 39	264
Protein (gm)	69 ± 15	39 ± 14	160
Total Fat (gm)	76 ± 21	46 ± 17	112
Saturated Fat (gm)	31 ± 11	20 ± 9	47
Cholesterol (mg)	311 ± 176	169 ± 132	31
Vitamin A (IU)	5214 ± 3362	2244 ± 1008	54
Thiamin (mg)	1.5 ± 0.29	0.9 ± 0.34	131
Riboflavin (mg)	2.1 ± 0.50	1.3 ± 0.48	111
Niacin (mg)	19.1 ± 4.7	8.8 ± 4.7	179
Pyridoxine (mg)	1.2 ± 0.40	0.6 ± 0.32	125
Vitamin B_{12} (µg)	3.6 ± 1.6	2.5 ± 1.4	22
Folate (µg)	218 ± 73	110 ± 61	98

(table continues)

Table 3 concluded

Dependent variable	Mean[a] ± SD (N=75)	PFL Mean[b] ± SD (N=75)	F-Ratio*
Vitamin C (mg)	178 ± 61	143 ± 65	11
Calcium (mg)	1043 ± 328	737 ± 314	34
Iron (mg)	11 ± 3.1	5 ± 3.2	109
Magnesium (mg)	226 ± 64	132 ± 56	93
Phosphorus (mg)	1292 ± 306	767 ± 301	112
Potassium (mg)	2581 ± 583	1552 ± 471	141
Sodium (mg)	2490 ± 738	1120 ± 395	201
Zinc (mg)	8.6 ± 2.9	4.6 ± 2.9	71

[a] Mean ± Standard Deviation for 75 complete diet days

[b] Mean ± Standard Deviation for Predicted Food List items only

* $p \leq 0.01$ for all comparisons

The greater utility of the Predicted Food List was most likely due to the ability of the subject to predict commonly consumed nutrient dense foods. The success of this technique may rely on the subject's knowledge and awareness of personal dietary habits. However, researchers have documented that foods which are often major components of a meal are estimated with a greater degree of accuracy than are auxiliary items (9). In other words, the subject often will be more concerned about reporting major nutrient or calorie contributors when listing common food choices and will tend to overlook foods considered to be less significant dietary components.

It was concluded that a shortened list of foods predicted by an individual to represent usual dietary intake may be a valuable screening tool for rapid assessment of selected nutrients. By attempting to identify individuals at nutritional risk, a predicted food list could prove to be an integral component of the complete nutrition screening process. Future studies incorporating this assessment alternative for evaluating diets of various population groups are planned for further refinement and clarification of the uses of predicted food lists in diet assessment studies.

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