VALIDATION OF A FOOD CHECKLIST FOR ONCOLOGY PATIENTS

by

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(ABSTRACT)

A Food Checklist, based on the Food Guide Pyramid, was developed and validated as a quick method to determine the adequacy of dietary energy and protein intakes in cancer patients. Food intake data were monitored for 34 hospitalized oncology patients for two days. Caloric and protein intake estimates computed using the Food Checklist were correlated 0.99 ($p < 0.0001$) with computer estimates of Nutritionist III validating the Food Checklist as an accurate, time-saving method for quickly assessing the adequacy of a cancer patient's diet. By highlighting the times during the day food intake was adequate and the food groups best tolerated by each patient, the Food Checklist could be a valuable tool for maximizing the effect of nutritional strategies.

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INTRODUCTION

No tool is currently available for quickly assessing the adequacy of a cancer patient's diet. A Food Checklist to monitor the patient's food and drink intake could quickly identify those patients with inadequate oral caloric and protein intake.

The Food Checklist could reveal the times during the day when the patient's food and drink intake is adequate and when it is inadequate, as well as which food groups are best tolerated by the patient. This information would be particularly valuable in counselling patients about food choices; potentially identifying medications or treatments that may be interfering with the patient's oral food and drink intake; and identifying the time of day prophylactic measures, such as anti-emetic medication, would be helpful. Adequate caloric and protein intake also could suggest adequate vitamin and mineral intake.

The purpose of this study was to develop and validate a Food Checklist, based on the Food Guide Pyramid (U.S. Dept. of Agriculture, Human Nutrition Information Service, 1992) and the Exchange Lists for Meal Planning (American Diabetes Association, Inc. and American Dietetic Association, 1986), as a quick method to determine the adequacy of a cancer patient's oral caloric and protein intake in order to maximize the effect of nutritional strategies. Information on food choices, meals, and vitamins and minerals help to illustrate the usefulness of the Food Checklist in a clinical setting.

REVIEW OF LITERATURE

ENERGY AND PROTEIN RECOMMENDATIONS

Energy needs in cancer patients vary from individual to individual. Knox et al. (1983) found abnormal energy metabolism in 59% of cancer patients: 26% were hypermetabolic while 33% were hypometabolic. Dempsey et al. (1984) also found abnormal energy metabolism in persons with cancer; 22% were hypermetabolic and 36% were hypometabolic. Energy and protein requirements of persons with cancer are estimated at 30-35 kcal/kg body weight and 1.5-2 g protein/kg body weight, respectively, by Blackburn et al. (1977) and at 30-45 kcal/kg body weight and 1.2-1.5 g protein/kg body weight by Chwals and Blackburn (1986). Chory and Mullen (1986) also estimated protein needs at 1-2 g protein/kg of body weight depending on whether the patient was protein depleted or not. In comparison, the Recommended Dietary Allowances (RDAs) are for healthy individuals (1989). The RDA committee recommendations for energy and protein for healthy nonpregnant adults are 30 kcal/kg body weight and 0.8 g protein/kg body weight, respectively (1989). If caloric and protein needs are met, other nutrient needs could also be met by following the recommendations of the Food Guide Pyramid (1992).

CALORIC AND PROTEIN INTAKES

Decreased food intake and altered host metabolism lead to cachexia (Fearon and Carter, 1988), a common sequela of advancing malignancy in cancer patients (Lawson et al., 1982). Numerous studies have identified weight loss as having a negative impact on response to treatment (Copeland et al., 1975; Copeland et al., 1977a; Copeland et al., 1977b) and survival (Harvey et al., 1979; Nixon et al., 1980; Dewys et al., 1980; Buzby and Steinburg, 1981; Kern and Norton, 1988). Many papers have discussed the decreased energy intake in cancer patients who have lost weight (Costa, 1977; Burke et al., 1980; Cohn et al., 1981).

Food intake of terminally ill cancer patients is poor. Waltman et al. (1991) found that terminally ill cancer patients consume less than 35% of daily caloric needs. Shils (1981) reported that oncology patients consume foods best at breakfast and eat progressively less as the day continues. Walsh et al. (1983) found that patients with advanced disease have a median intake of 1376 kcal and 44 g protein.

NUTRITIONAL SUPPLEMENTS

Researchers have demonstrated that cancer patients could increase their intake of energy, protein, and other nutrients by consuming nutritional supplements (Parkinson et al. 1987). Unflavored energy and protein supplements made from glucose polymer powder and liquid, whole protein powder, whey protein powder, and milk based protein powder were incorporated into a variety of foods to increase the food's nutrient density. On an unsupplemented day patients took in an average of 1515 kcal and 57 g protein while on a supplemented day the patients consumed 1885 kcal and 87 g protein, statistically significant differences of 420 kcal and 30 g protein. Moloney et al. (1983) also found that patients supplemented with high kcal liquid nutrition products had greater oral intakes of energy, protein, fat, iron, vitamin C, folic acid, dietary fiber, and zinc than unsupplemented patients.

ASSESSMENT OF DIETARY INTAKE

No tool is currently available for quickly assessing the adequacy of a cancer patient's diet. Most techniques require a lengthy personal interview of the patient to obtain food information plus time to compute nutrient levels. For example, Burke et al. (1980) analyzed dietary intakes of persons with cancer. The patients were interviewed for 45-60 minutes to obtain food intake for the seven days prior to the interview. Walsh et al. (1983) monitored the dietary intake of cancer patients for five days by weighing food portions served, and recording the amount eaten. Parkinson et al. (1987) weighed and recorded food intake in cancer patients over a two day period.

Nutrient intake calculated from food composition tables also requires time for gathering, recording, and computing the nutrient profiles of the foods. Cohn et al. (1981) used food tables to determine nutrient intake from four day food records and twenty-four hour dietary recalls of cancer patients. Nutrient composition of the diets of cancer patients was also calculated from food composition tables by Burke et al. (1980), Walsh et al. (1983), and Parkinson et al. (1987). Moloney et al. (1983) calculated nutrient intake from three day food records using food composition tables as well as a computer program. In contrast, a Food Checklist could be analyzed and nutrients computed for one day with food intake data from a Food Intake Form in approximately 20 minutes utilizing only a hand-held calculator.

Strohmeyer, Massey, and Davison, (1984) developed a Dietary Intake Form as a rapid assessment tool for identifying individuals with poor dietary patterns in a Planned Parenthood clinic setting. Using the four food groups, Food for Fitness (Hertzler and Anderson, 1976), as a basis for nutritional adequacy, the Dietary Intake Form for use in the clinics provided a method of quickly identifying possible nutrient deficiencies based on the exclusion of foods from specific food groups.

The most recent food guidance system, the Food Guide Pyramid (U.S. Dept. of Agriculture, Human Nutrition Information Service, 1992) based on the Dietary Guidelines for Americans (U.S. Dept. of Agriculture and U.S. Dept. of Health and Human Services, 1990), outlined a total diet (Cronin et al., 1987), as opposed to a foundation diet of

Food For Fitness (Hertzler and Anderson, 1976). Cronin et al. (1987) designed the Food Guide Pyramid as a tool for meeting 70% of the 1980 RDAs. Their analysis indicated that adult nutrient needs for energy, protein, eight vitamins, and seven minerals could be met by choosing foods from the five food categories of the food guide and the minimum suggested number of servings from each food group. These minimum recommended servings provide approximately 1600 kcal, adequate for healthy sedentary women and some older adults (U.S. Dept. of Agriculture, Human Nutrition Information Service, 1992). The maximum recommended servings would provide adequate kcal, approximately 2800, for most teenage boys and active men (U.S. Dept. of Agriculture, Human Nutrition Information Service, 1992) and should meet all other nutrient needs as well.

A Food Checklist could quickly identify patients consuming the minimum or maximum recommended number of servings. It would be an appropriate, time-saving method, when compared with a computer analysis, of determining energy and protein intake. In addition to quickly identifying those patients with inadequate energy and protein intake, a Food Checklist could highlight the times during the day when food and drink intake is adequate or when it is inadequate. The purpose of this study was to develop and validate a Food Checklist, based on the Food Guide Pyramid (U.S. Dept. of Agriculture, Human Nutrition

Information Service, 1992) and the Exchange Lists for Meal Planning (American Diabetes Association, Inc. and American Dietetic Association, 1986), as a quick method to determine the adequacy of a cancer patient's oral caloric and protein intake in order to maximize the effect of nutritional strategies. Information on food choices, meals, and vitamins and minerals help to illustrate the usefulness of the Food Checklist in a clinical setting.

METHODOLOGY

SUBJECTS

Thirty-four hematology/oncology patients admitted to the Veteran's Affairs Medical Center in Salem, Virginia, with a tissue diagnosis of neoplastic disease were the study population. Inpatients were assessed for oral intake for two days during hospitalization. Because few of the patients being treated at this facility are women and women's nutrient needs differ from men, the study population consisted only of males. Male patients admitted for greater than three days and hospitalized on the oncology ward during the months of November and December, 1992 and January, 1993 were assessed. Patients were excluded from the study if they were receiving enteral or parenteral nutrition support (tube feeding or total parenteral nutrition), or if they were NPO (no food or drink) on the days food intake was to be recorded. A maximum of eight patients were assessed per week due to staff limitations for the recording of food intake data.

The Oncology Center provides patients with a kitchen for food preparation complete with a microwave oven and snacks including liquid nutritional supplements. Meals standardized by menu and portion size are provided by Dietetic Service. In addition, the patients' families and friends are encouraged to bring favorite foods from home to offer to the patients. Given these amenities, caloric and protein intake for hospitalized patients should be representative of a patient's typical intake at the time of admission.

MATERIALS AND METHODS

FOOD INTAKE FORM

Modification of food consistency had been made for patients according to their ability to chew and swallow regular foods. For males greater than 51 years of age, regular hospital diets without snacks or supplements provide approximately 2400 kcal, 94 g protein, and greater than 100% of the RDAs for ten of the 13 selected nutrients; greater than 60% of the RDAs was provided for magnesium, zinc, and vitamin B6.

A Food Intake Form (Appendix 1) was used to record oral food and drink intake each day. The Food Intake Form was the source of the food intake data for the Food Checklist and the computer analysis. The Food Intake Form had the daily menu for each patient written on it by the researcher to facilitate accurate recording of food and drink intake. The master list of foods provided daily to each patient was listed in the cycle menus of the hospital. Standardized portions listed on the cycle menus were provided to each patient according to their diet orders. Nursing staff assigned to the oncology unit were trained by the researcher to record actual food and drink intake on the Food Intake

Form because of their daily contact with each patient and supervision during meals.

To assure that food intake data were recorded, the researcher alerted nursing staff to patients that had Food Intake Forms to be completed in several ways. A list of the patients' names, room numbers, and dates of food data collection was prominently displayed in the nurses station. The patients' meal trays were flagged by the kitchen staff in two ways on the days that food intake was recorded. First, a 1" X 3" card with the dates that food intake was to be recorded was attached to the patient's meal card, a card which listed the patient's prescribed diet and food preferences. Food preferences were honored and appropriate substitutions were provided to the patients. Second, the meal tray also had a large card with the words "calorie count" written on it. This large card stayed on the patients trays while they were eating as a reminder to the kitchen staff not to remove the tray from the patients room until nursing had recorded food intake data on the Food Intake Form.

Patients were monitored by nursing for enteral intake, excluding water, for two days. Nursing staff used the Food Intake Form to record all food and drink consumed, excluding water, during the 24 hour recording period including food not served by the hospital for meals or snacks. Servings were estimated to the nearest one-fourth portion consumed (Appendix 1) by nursing.

The researcher had no personal contact with the subjects prior to recording of the data. Nursing informed the patients that their food intake was being recorded for a calorie count. The families and friends visiting patients in the hospital also were informed of the need for food intake data and were asked to report to nursing staff any food or beverages that they provided that the patient consumed. The patients were encouraged to eat as much as they wanted--as is usual on this ward.

During a four-day pilot study with cancer patients on the oncology unit, the method described above for recording data was piloted. During the pilot study the researcher monitored meals to determine if the nursing staff was accurately recording food intake on the Food Intake Form. After completion of the pilot study, the nursing staff reported that the Food Intake Form was easy to complete. Patients reported snack foods consumed to nursing and the patients' families and friends took an active role in reporting the foods consumed. Some of the families actually recorded the types and amounts of foods and beverages the patient consumed as snacks on the Food Intake Form.

Food intake recorded in this way should be more accurate than self-reporting because of the variety of controls (Mertz, 1992) built into the study; standardized menus, portion control, nurses as objective observers and recorders of food intake, and supportive families and friends that help nurses record food intake.

FOOD CHECKLIST

The information recorded on the Food Intake Form was used to determine caloric and protein intake on the Food Checklist. The Food Checklist (Appendix 2) focused on the intakes of energy and protein as cost-effective indicators of diet adequacy and was based on the food guide in "Nutrition and Your Health: Dietary Guidelines for Americans" (U.S. Dept. of Agriculture and U.S. Dept. of Health and Human Services, 1990), now known as the Food Guide Pyramid (U.S. Dept. of Agriculture, Human Nutrition Information Service, 1992). The Food Checklist was comprised of the following five food groups of the Food Guide Pyramid: fruit; vegetable; bread, cereal, rice, and pasta; milk, yogurt, and cheese; and meat, poultry, fish, dry beans, eggs, and nuts.

The Food Checklist used the Modified Food Guide Exchange List Values (Appendix 3) for estimation of caloric and protein intake. The following adaptations of the values for kcal and protein from the Exchange Lists for Meal Planning (American Diabetes Association, Inc. and American Dietetic Association, 1986) were made for the food groups on the Food Checklist:

* all meat/meat substitutes were considered to be the medium fat meat exchange because the meat/meat substitutes consumed

by the patients ranged from lean to high fat;

* all dairy group foods were considered to be the high fat exchange because whole milk was the most consumed;
* all cheeses except Parmesan cheese and cottage cheese were considered foods of the dairy group;
* the vegetable group was separated into 2 subgroups (starchy vegetables and other vegetables);
* legumes were considered to be in the starchy vegetable group.

No weight was given to dark green and orange vegetables, whole grain choices, or quality of protein. Foods with exchanges of more than one food group, (i.e., one-half cup of ice cream is one starch and two fat exchanges for example), were entered onto the Food Checklist using the exchanges from the Exchange Lists for Meal Planning (American Diabetes Association, Inc. and American Dietetic Association, 1986). In addition to the five food groups represented on the Food Checklist, two additional sections were added: a sixth section to record servings of fat such as margarine, mayonnaise, or salad dressings and a seventh section for other foods such as liquid nutritional supplements, sweets, and syrup.

Serving sizes for the Food Checklist (Appendix 4) were based on the standard serving sizes defined by Cronin et (1987) and the Exchange Lists for Meal Planning differences between the two occur in the meat/me substitutes and dairy groups. Cronin et al. (1987) defined a serving of meat as 3 oz and a serving of cheese as 1.5-2 oz. Cheese was in the dairy group. In comparison, the Exchange Lists for Meal Planning (1986) defined a serving of meat or cheese as 1 oz in the meat/meat substitutes group. The Food Checklist was adapted to reflect a 3 oz serving of meat in the meat/meat substitutes group and a 1.5-2 oz serving of cheese in the dairy group.

To assure consistency and accuracy, all foods consumed and listed on the Food Intake Form were recorded on the Food Checklist by the researcher. A code book was maintained for consistency of recording and for reference of all coding decisions. Bowes and Church's Food Values of Portions Commonly Used (Pennington, 1989) provided caloric and protein information for all food consumed that was not listed in the Exchange Lists for Meal Planning (American Diabetes Association, Inc. and American Dietetic Association, 1986) except individually packaged liquid nutritional supplements. For the latter products, caloric and protein information available from the manufacturer was used.

The Food Checklist was completed by utilizing the food intake data from the Food Intake Form. For each food group on the Food Checklist, the number of portions consumed was multiplied by the corresponding energy and protein values from the Modified Food Guide Exchange List Values (Appendix

3). These calculations provided the total caloric and protein intake values from the fruit, vegetables, grain, dairy, meat/substitutes, and fat groups. Energy and protein values from the "other" foods were also determined. Both the caloric and protein values from the food groups and the "other" section of the Food Checklist were added together to determine caloric and protein intakes. The Food Checklist estimation of caloric and protein intakes was compared with the energy and protein intakes computed from the computer analysis.

Actual caloric and protein intakes as calculated by the Food Checklist were compared to the targeted energy and protein needs for each of the two days of food intake recording. Target caloric needs of male cancer patients were estimated at 30 kcal/kg of current body weight and protein needs were estimated at 1.2 g protein/kg of current body weight (Blackburn et al., 1977; Chwals and Blackburn, 1986).

COMPUTER ANALYSIS

Each day's total food intake was computer analyzed utilizing Nutritionist III (1985) to calculate energy, protein, vitamin, and mineral intake. The foods consumed and corresponding portions consumed listed in household measurements were entered into the computer for each 24 hour recording period. Caloric and protein intakes of each patient were computed for verification of the accuracy of the Food Checklist estimation. Vitamin and mineral estimations from the computer analysis were also used to determine if those patients meeting 100% of their targeted caloric and protein needs also met nutrient needs for vitamins A, C, B6, and B12, thiamin, riboflavin, niacin, folate, potassium, iron, zinc, magnesium, and calcium. This was accomplished by determining if the patients consumed $\geq$ 66% of the 1989 RDAs for males greater than 51 years of age for the 13 vitamins and minerals. These nutrients were chosen because of their association with energy metabolism, the completeness of the nutrient data base, and because some of these vitamins and minerals are problem nutrients in American food patterns.

STATISTICS

Means, standard deviations, and ranges of caloric and protein intakes were computed. Correlations were used to study the relationship between caloric and protein intake as determined by the two methods of computation (the Food Checklist and Nutritionist III) to determine if the Food Checklist was a valid tool for assessing caloric and protein intakes.

To describe the information available by using the Food Checklist as a quick method of determining caloric and protein intakes, the Food Checklist was analyzed for food choices and meal data. The following illustrates the information available from the Food Checklist: patients consuming less than 1 serving of each food group, patients consuming the minimum suggested number of servings from all food groups, which food groups and "other" foods were most consumed, and the intakes of energy and protein at each meal and from "other" foods. For those patients meeting targeted energy and protein needs, vitamin and mineral intake was assessed.

RESULTS

SAMPLE

Useable Food Intake Forms were completed for 34 patients for two consecutive days during a three month period beginning in November of 1992 and ending in January 1993. Food intake information was recorded for a total of 42 patients; however food intake data were missing for some meals for six of the patients and two of the patients expired during the days of food recording.

The average age of the 34 patients was 65.9 years old with a range from 49 to 87 and a median age of 66. Twenty-seven of the patients were Caucasian and 7 were African American. Six of the patients were receiving daily radiation therapy and the majority of patients were status post radiation, chemotherapy, surgery, or a combination of treatments. No one was undergoing chemotherapy during the two days of food intake recording.

The patients' illnesses had been diagnosed from four weeks to as many as 13 years prior to this study with a mean diagnosis occurring 2.6 years prior to the recording of data. Twenty-six percent (9) of the patients had lung cancer, 24% (8) had head and neck cancer, 15% (5) had prostate cancer, and the remaining 12 patients had cancers of the kidney, brain, bladder, rectum, or colon, multiple myeloma, myelofibrosis, or lymphocytic lymphoma. Fifty percent (17) of the patients had metastatic disease.

The mean percent ideal body weight (Zeman and Ney, 1988) of the 34 patients was 92% with 41% of the patients $\geq$ 90% of their ideal body weights (Appendix 5). However, only 21% were $\geq$ 90% of their usual body weights and the average percent usual body weight of the group was 82%, indicating an average weight loss of 18%.

CALORIC AND PROTEIN INTAKES

Caloric intake calculated from the Food Checklist for 68 days (2 days each for 34 patients) ranged from 0 to 3668 kcal with a mean intake of 1360 and standard deviation of 807; protein intake ranged from 0 to 148.6 g with a mean of 54 and standard deviation of 33.5 (Appendix 6). Caloric intake analyzed from Nutritionist III ranged from 0 to 3680 with a mean of 1346 and standard deviation of 810; protein intake ranged from 0 to 153.3 g with a mean of 53 and standard deviation of 33. The mean difference between the two methods of computation of kcal was 65 kcal with a standard deviation of 62; the mean difference for protein was 3.4 g with a standard deviation of 3.3. Two patients on one day each consumed nothing whereas another 2 patients on a single day each consumed greater than 3000 kcal. Caloric and protein intakes for each of the 34 patients was similar on both days of recorded intake; the correlation coefficient for energy was 0.85 and for protein, 0.79.

Correlation coefficients were computed using the Number

Cruncher Statistical System (Hintze, 1988) to compare values obtained for kcal and protein on the Food Checklist with the values obtained through computer analysis. The result was a correlation coefficient of 0.99 ($p < 0.0001$) for both energy and protein intakes.

An analysis based on the Food Checklist revealed that half of the 34 patients consumed less than 66% of their estimated energy and protein needs during each of the 2 days of food intake recording. Only 15% of the patients consumed $\geq$ 100% of their estimated energy and protein needs on both days of recorded intake.

FOOD CHECKLIST

In addition to determining caloric and protein intakes, the Food Checklist was a valuable tool for describing food intake. Table 1 shows the percentage and number of patients consuming less than one serving of each food group. Table 2 shows the percentage and number of patients consuming the minimum recommended number of servings from each food group. Only one patient on both days and one patient on one day met the minimum suggested number of servings for all food groups. On day one of food intake recording for each patient, 38%, and on day two, 35% of the patients did not meet the minimum recommended number of servings for any food group. The grain group was the food group with the most number of servings, an average of three consumed per day, followed by the dairy group with two,

TABLE 1

PERCENTAGE (NUMBER) OF ADULT MALE ONCOLOGY PATIENTS CONSUMING LESS THAN ONE SERVING PER FOOD GROUP ON THE FOOD CHECKLIST

FOOD GROUP	DAY ONE	DAY TWO
Other vegetables	65% (22)	71% (24)
Starchy vegetables	65 (22)	65 (22)
Meat/meat substitutes	59 (20)	59 (20)
Grain	24 (8)	29 (10)
Fruit	24 (8)	24 (8)
Dairy	18 (6)	24 (8)

TABLE 2

PERCENTAGE (NUMBER) OF ADULT MALE ONCOLOGY PATIENTS CONSUMING THE MINIMUM RECOMMENDED NUMBER OF SERVINGS PER FOOD GROUP ON THE FOOD CHECKLIST

	MINIMUM FOOD GROUP		SERVINGS*
		DAY 1	DAY 2
Dairy	2	53% (18)	53% (18)
Fruit	2	35 (12)	38 (13)
Starchy vegetables	1	29 (10)	32 (11)
Meat	2	21 (7)	18 (6)
Grains	6	12 (4)	18 (6)
Other vegetables	2	12 (4)	9 (3)

* U.S. Dept. of Agriculture, Human Nutrition Information Service. Home and Garden Bulletin Number 249. USDA's Food Guide Pyramid, 1992.

fruit group with one and three-fourths, meat group with one and both the starchy and other vegetable groups with an average of one-half per day. The dairy group was the largest contributor of energy of all the food groups and the meat group, closely followed by the dairy group, was the largest contributor of protein.

According to the Food Checklist, the meal at which the most energy and protein was consumed was the noon meal followed by the evening meal and then breakfast. Average caloric and protein intakes at the three meals and snacks was the following: breakfast, 380 kcal/12.7 g protein; noon meal, 485 kcal/20 g protein; evening meal, 451 kcal/19.9 g protein; and snacks, 43 kcal/1.5 g protein.

Foods recorded on the Food Checklist in the seventh section for other foods were condiments such as sugar, mustard, gravy, jelly, and syrup, desserts, milkshakes, gingerale, and liquid nutritional supplements. The only condiment that contributed > 75 kcal per serving was syrup. Large energy and protein contributors from this section were Ensure, Ensure Plus, and Delmark milkshakes. Gingerale and desserts also were large energy contributors. The contribution of energy and protein from these items ranged from 0 to 96.1% of caloric intake and from 0 to 100% of protein intake.

VITAMIN AND MINERAL INTAKES

Of the five patients consuming at least 100% of targeted energy and protein needs, all consumed an average of > 66% of the RDAs for the 13 vitamins and minerals studied with one exception. One of the five had average intakes of less than 66% of the RDAs for vitamin A, folate, and magnesium (Appendices 7,8). Of the patients not consuming targeted energy and protein needs, 23 did not meet 66% of the RDAs for magnesium, and 14 each for vitamin A, folate, and iron.

NUMBER OF SERVINGS VS. RECOMMENDATIONS

Meeting targeted energy and protein needs is not synonymous with meeting the minimum recommended number of servings from each food group on the Food Checklist. Of the five patients meeting 100% of their targeted caloric and protein needs only one met the minimum suggested number of servings in all food groups on a single day. The limiting group was the vegetable group, both starchy and other. In addition, one patient who met his targeted protein needs on both days and who had an average caloric intake equal to 93% of his targeted needs met the minimum number of servings from all food groups on both days of food intake recording. No other patient met these minimum suggested number of servings.

By not consuming a variety of foods, it is difficult to meet vitamin and mineral needs, especially for those nutrients found in fruits and vegetables. In this study, three patients on two days plus one patient on one day met the minimum recommended two servings of fruit and three servings of vegetables. An additional three patients on both days plus two patients on one day met the minimum recommendation of five servings of either fruits or vegetables by consuming greater than two servings of fruit but less than 3 servings of vegetables.

ACCURACY OF FOOD CHECKLIST

The estimates for caloric and protein intake from the Food Checklist were highly correlated with the computer analysis. The Food Checklist which combined the Food Guide Pyramid (1992) and the Exchange Lists for Meal Planning (1986) provided accurate estimates of energy and protein when compared with a computer analysis. The Food Checklist is an appropriate tool for use in determining caloric and protein intake in a group of hospitalized oncology patients.

DISCUSSION

USEFULNESS OF THE FOOD CHECKLIST

The rapid dietary screening device designed by Strohmeyer et al. (1984) for use in clinics revealed poor dietary patterns but not energy and protein intakes. Trujillo et al. (1992) assessed energy and protein intakes in AIDS patients; intake data was recorded and nutrient consumption calculated by using the Exchange Lists for Meal Planning (American Diabetes Association, Inc., and American Dietetic Association, 1986), product information, and menu analysis. Neither assessment included both nutrient intake data and descriptive information about food intake.

Previous methods of dietary assessment for cancer patients have also provided limited information. Many of the nutrient analyses required lengthy interviews or weighing of food and calculations from food tables (Table 3). In contrast, the Food Checklist is a quick, accurate method (compared to computer analysis) of determining energy and protein intakes as well as describing food intake.

RELATIONSHIP OF INADEQUATE ENERGY AND PROTEIN INTAKES TO WEIGHT LOSS

The average caloric and protein intakes from the Food Checklist, 1360 kcal and 54 g, respectively, were similar to that found by Walsh et al. (1983) and were inadequate to meet the targeted energy and protein needs computed for 29

TABLE 3

STUDIES EVALUATING FOOD INTAKE DATA
OF PERSONS WITH CANCER

STUDY	COLLECTION METHOD	COMPUTATION METHOD	INFORMATION GAINED
Burke et al.*	45-60 min. interview of past 7 day intake	Food tables	Energy Protein Fat Carbohydrate
Cohn et al.^	4 day food records and 24 hour recalls	Food tables	Energy Protein
Walsh et al.+	Weighed food portions served and amount consumed for 5 days	Food tables	Energy Protein Fat Carbohydrate Iron Calcium Fiber
Moloney et al.@	3 day food records	Food tables Computer program	Energy Protein Fat Iron Folic Acid Vitamin C Fiber

*Burke M, Bryson EI, Kark AE. Dietary Intakes, Resting Metabolic Rates, and Body Composition in Benign and Malignant Gastrointestinal Disease. Br. Med. J. Jan 26:211-215, 1980.
^Cohn SH, Gartenhaus W, Vartskey D, Sawitsky A, Zanzi I, Vaswani A, Yasumura S, Rai K, Cortes E, Ellis KJ. Body Composition and Dietary Intake in Neoplastic Disease. Am. J. Clin. Nutr. 34:1997-2004, 1981.
+Walsh TD, Bowman KB, Jackson GP. Dietary Intake of Advanced Cancer Patients. Human Nutr.:Applied Nutr. 37A:41-45, 1983.
@Moloney M, Moriarty M, Daly L. Controlled Studies of Nutritional Intake in Patients with Malignant Disease Undergoing Treatment. Human Nutr.:Applied Nutr. 37A;30-35, 1983.

patients. Inadequate energy and protein intakes lead to weight loss. Yamanaka et al. (1989) stated that as cancer progresses, weight decreases. Weight loss was evident in this study; 79% of patients, including the five with adequate intakes, had weights $\leq$ 90% of their usual body weights. Weight loss may have occurred because energy intake was inadequate to meet energy demands. This was evident because only five patients met their targeted caloric and protein needs and only one of the five met the minimum recommended number of servings from each of the food groups. Inadequate intake could explain the average weight loss of 18% of usual body weight in this group of hospitalized oncology patients.

ANALYSIS OF FOOD CHECKLIST

The Food Checklist highlighted food choices. It illustrated which food groups were well tolerated, which patients were not consuming a variety of foods, which meals or snacks contributed the most energy and protein for each patients, and nutritional supplement intake and contribution to overall energy and protein intakes. This information could help to identify medications or treatments that might be interfering with food and drink intake or to identify the time of day prophylactic measures, such as anti-emetic medication, would be helpful. It could also be used to develop strategies to increase oral nutrient intake. Non-traditional methods of feeding patients, such as ordering meals from fast-food restaurants, could also be explored (Edelstein, 1992).

Meeting the minimum recommended number of servings from the Food Guide Pyramid (U.S. Dept. of Agriculture, Human Nutrition Information Service, 1992) would ensure a diet with a variety of foods was being consumed. Not consuming adequate energy and a variety of foods could lead to nutrient deficiencies (Dreizen et al., 1990). This study demonstrated that 85% of this group of cancer patients did not consume adequate energy and protein and lacked a variety of foods from all of the food groups, especially foods from the vegetable groups.

Consumption of fruits and vegetables by these oncology patients is similar to the healthy population. Block (1991) reports that on a survey day only 10% of the population of the United States consumed five servings of fruits and vegetables. Twelve percent of this group of oncology patients met the minimum recommendations of two servings of fruit and three servings of vegetables. An additional 15% did not consume three servings of vegetables but increased fruit intake to meet a "five a day" minimum of fruit and vegetable servings.

Given the emerging importance of beta-carotene in current cancer prevention research, the lack of intake of fruits and vegetables could have deleterious effects on cancer patients. It is known that persons regularly consuming fruits and vegetables have a decreased risk of cancer compared to persons with low intake of these foods (Weisburger, 1991; Zeigler, 1991). Garewal (1991) reports that trials are underway and in the planning stages to determine if nutrients such as beta-carotene or vitamin E might decrease the incidence of second malignancies. This is important because Stich et al. (1991) found that vitamin A and beta-carotene consumption resulted in remission of leukoplakia and suppression of new leukoplakia formation within a 6 month trial period. If the intake of fruits and vegetables rich in beta-carotene is decreased in many cancer patients undergoing curative therapy, it is possible that they could unknowingly be increasing their chances of disease recurrence.

ADEQUACY OF VITAMIN AND MINERAL INTAKES

The computer program also listed the percentage of the RDAs consumed for several vitamins and minerals based on a healthy population. It should be noted, however, that optimal RDAs for patients with cancer are not known (Hoffman, 1985). The Food Checklist also revealed information about vitamin and mineral intakes. Eighty percent of the patients meeting targeted energy and protein needs met at least 66% of the RDAs for males greater than 51 years of age for eight vitamins and five minerals (Appendices 7,8).

Few other studies of cancer patients analyzed vitamin and mineral intakes. Walsh et al. (1983) found that iron intake was low but that calcium was high in advanced cancer patients. Moloney et al. (1983) also found that iron as well as folic acid intakes were below recommended intakes but that vitamin C intake was adequate. Consumption of other vitamins and minerals was not assessed. Inadequate vitamin and mineral intake highlights the need for promoting the inclusion of a variety of nutrient dense foods in the diet.

ADVANTAGES OF QUICKLY DETERMINING CALORIC AND PROTEIN INTAKE

The Food Checklist was a quick, low technology method of determining energy and protein intake. Time and money could be saved through the calculation and interpretation of caloric and protein intakes using the Food Checklist instead of computer analysis. Hertzler and McAnge (1986) found that an iron checklist based on the food intake of one day on a food checklist was cost-effective when compared with the costs of technology to support a computer program. The arguments for the Food Checklist in this study are the same.

The Food Checklist can be completed in less than 20 minutes with the information from a Food Intake Form or other list of foods consumed. It requires a copy of the Food Checklist and a writing instrument--colored pencils or markers are needed if intake at particular meals or snacks needs to be highlighted. A calculator speeds up the mathematical computations. Computing food intake via computer requires approximately twice as much time and more equipment. It requires time for coding the data, a computer for entering the data, time for entering the data, a computer program for analysis of the data, and a printer to retrieve the data. The use of a Food Checklist which could be completed and analyzed in approximately twenty minutes saves valuable resources such as staff time and is an appropriate low technology method for analyzing caloric and protein intakes in a hospital setting.

CONCLUSION

The Food Checklist is an appropriate tool for use in quickly determining caloric and protein intake in a group of hospitalized oncology patients. It can reveal at what meals or snacks during the day that food intake is good and those when it is poor as well as patients not consuming a variety of foods or meeting the minimum recommended servings of the Food Guide Pyramid (U.S. Dept. of Agriculture, Human Nutrition Information Service, 1992). By highlighting which food groups and nutritional supplements are best tolerated by each patient appropriate strategies for maximizing oral intake could be developed and shared with the patient through counselling sessions. The Food Checklist is a quick, accurate method of determining caloric and protein intake, could be a valuable tool for improving patient care, could be used for other hospitalized patients, and could be adapted to nutritional education strategies outside of a hospital setting.

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APPENDIX 1

FOOD INTAKE FORM

NAME______________________ DAY_______________ DATE___________

PORTION CONSUMED

BREAKFAST	ALL	3/4	1/2	1/4	0
NOON MEAL					
EVENING MEAL					
SNACKS					

FOOD CHECKLIST

FRUIT

VEGETABLES:
(STARCHY)

(OTHER)

GRAINS

DAIRY

MEAT/
SUBSTITUTES

FAT

OTHER

APPENDIX 3

MODIFIED FOOD GUIDE EXCHANGE LIST VALUES

FOOD GROUP	KCALORIES*	PROTEIN*
FRUIT	60	0
STARCHY VEGETABLE	80	3
OTHER VEGETABLE	25	2
GRAINS	80	3
DAIRY	150	8
MEAT/MEAT SUBSTITUTE	225	21
FAT	45	0
OTHER	***	***

* Per 1 serving as defined in Appendix 4

** Values are based on the American Diabetes Association, Inc. and the American Dietetic Association "Exchange Lists for Meal Planning" 1986.

*** Values from Bowes and Church's Food Values of Portions Commonly Used (Pennington, 1989) and manufacturer's information.

APPENDIX 4

SERVING SIZES
FOR
MODIFIED FOOD GUIDE EXCHANGE LIST VALUES

FRUIT: Average piece of whole fruit, melon wedge, 4 oz. juice, 1/2 cup berries or sliced or cooked or canned fruit, 1/4 cup dried fruit

VEGETABLES:
STARCHY: 1/2 cup corn, lima beans, potatoes, dried beans or peas
OTHER: 1/2 cup cooked or 1 cup raw vegetable

GRAIN: 1 slice bread, 4 crackers, 1/2 cup cooked cereal or rice or pasta, 1 oz. ready-to-eat cereal, 1 small roll or muffin or biscuit (a whole English muffin or bagel or hamburger/hot dog bun or large roll = 2 servings)

DAIRY: 1 cup milk, 8 oz. yogurt, 1.5-2 oz cheese (except cottage cheese and Parmesan cheese)

MEAT/MEAT SUBSTITUTE: 3 eggs, 3 oz. meat or fish or poultry, 2-3 tablespoons peanut butter, 3/4 cup cottage cheese, 6 tablespoons grated Parmesan cheese

FAT: 1 teaspoon margarine/butter/oil or mayonnaise, 1 tablespoon salad dressing, 1 tablespoon cream cheese, 2 tablespoons sour cream, 1 slice bacon

OTHER: serving size based on amount consumed of syrup, liquid nutritional supplements, gelatin, etc.

APPENDIX 5

CURRENT WEIGHT, USUAL BODY WEIGHT, IDEAL BODY WEIGHT, AND HEIGHT OF ADULT MALE ONCOLOGY PATIENTS

PT.	CURRENT WEIGHT (LBS)	USUAL WEIGHT (LBS)	IDEAL WEIGHT (LBS)	HEIGHT (IN)
1	201.0	215	196	75.0
2	228.0	240	178	72.0
3	125.5	160	166	70.0
4	134.0	185	166	70.0
5	108.4	143	151	67.5
6	181.0	205	178	72.0
7	121.0	165	142	66.0
8	153.0	200	172	71.0
9	140.0	157	178	72.0
10	98.4	137	169	70.5
11	117.0	168	172	71.0
12	114.5	175	160	69.0
13	128.0	175	154	68.0
14	130.0	175	148	67.0
15	134.0	170	142	66.0
16	114.0	155	184	73.0
17	184.0	215	160	69.0
18	137.0	160	172	71.0
19	110.0	160	142	66.0
20	307.7	350	175	71.5
21	138.0	252	172	71.0
22	148.0	170	178	72.0
23	205.5	200	190	74.0
24	95.0	118	136	65.0
25	156.0	185	172	71.0
26	118.0	160	148	67.0
27	176.0	200	190	74.0
28	130.0	155	148	67.0
29	121.5	150	148	67.0
30	164.0	168	148	67.0
31	215.0	215	178	72.0
32	176.0	185	178	72.0
33	182.5	210	160	69.0
34	193.0	200	160	69.0

APPENDIX 6

ENERGY AND PROTEIN INTAKES COMPUTED
FROM THE FOOD CHECKLIST

PT.	ENERGY INTAKE DAY 1	ENERGY INTAKE DAY 2	PROTEIN INTAKE DAY 1	PROTEIN INTAKE DAY 2	
1	1365.00	1432.50	64.50	68.25	
2	1135.00	1251.50	46.50	51.00	
3	943.75	853.50	40.75	28.50	
4*	2532.50	2576.50	95.50	108.45	^
5	507.50	833.50	23.55	28.95	@
6	2261.25	1898.25	93.95	71.37	
7	828.75	936.50	32.15	18.58	
8	517.00	810.00	18.45	26.40	@
9	1589.25	1595.50	54.30	56.10	
10	481.25	280.00	24.75	12.00	@
11	963.00	1225.00	44.10	65.85	
12*	1681.25	1552.25	86.55	85.75	
13	650.25	314.95	28.85	9.50	@
14	372.00	926.75	16.30	40.60	+
15	747.50	766.25	27.60	30.85	^
16	565.00	806.25	17.75	29.75	+
17*	3110.50	2511.50	103.90	102.70	
18	1867.75	1920.00	73.55	68.65	
19	928.75	971.50	40.85	43.30	^
20	00.00	333.75	00.00	11.25	+
21	941.25	730.00	33.25	22.50	+
22	613.75	1107.50	26.00	48.00	@
23	1458.75	1817.25	43.50	74.25	
24*	2076.00	3667.50	92.10	148.55	
25	00.00	340.00	00.00	6.00	
26	1358.75	1107.50	53.75	46.15	
27	1129.50	1563.75	44.90	45.55	
28*	2861.75	2798.75	116.55	102.40	
29	1451.00	1405.00	66.35	40.80	
30	2222.00	580.00	67.50	11.80	
31	2582.00	2319.75	74.25	92.10	
32	2261.25	2187.50	111.75	116.00	
33	2402.25	2078.75	101.00	74.90	
34	1320.00	1190.00	64.50	59.75	

* Pts. meeting targeted energy and protein needs
@ Expired within ten days of food intake recording
^ Expired within 11-20 days of food intake recording
\+ Expired within 21-30 days of food intake recording

APPENDIX 7

TWO DAY AVERAGE INTAKE OF SELECTED VITAMINS^
FOR ADULT MALE ONCOLOGY PATIENTS

Pt.	VIT A (IU)	THI (mg)	NIA (mg)	FOL (ug)	VIT B6 (mg)	RIB B12 (mg)	VIT (mg)	VIT C (ug)
1	7612	1.2	14.3	225.7	94.7	2.1	1.5	4.0
2	2933	1.0	8.5	305.1	76.1	1.5	1.6	2.7
3	1721	0.5	4.2	56.7	24.4	2.3	0.4	2.6
4*	12718	3.9	21.0	254.5	144.8	2.7	1.7	5.6
5	3684	0.6	6.3	92.7	35.5	0.9	0.6	5.6
6	8795	3.2	15.5	130.9	115.9	2.3	1.4	18.8
7	4636	1.0	9.2	174.9	84.3	1.3	2.3	9.5
8	1607	1.0	12.1	237.5	115.3	1.0	1.2	3.8
9	3545	2.2	25.6	539.5	236.1	2.3	2.5	8.2
10	3015	0.2	2.7	69.1	40.0	0.6	0.4	1.5
11	4291	0.8	6.1	123.2	78.3	1.6	0.8	4.0
12*	2364	1.1	14.5	129.3	59.5	2.2	1.5	5.9
13	638	0.3	2.7	70.7	61.4	0.6	0.3	1.4
14	4013	0.7	7.7	121.5	68.4	0.8	0.7	2.7
15	1693	1.1	10.7	268.5	126.1	1.3	1.2	4.1
16	1125	0.5	2.7	56.8	27.8	0.9	0.4	2.1
17*	4451	1.8	18.2	236.5	168.8	2.7	1.8	6.4
18	3847	1.6	14.5	227.1	90.0	2.3	1.7	3.2
19	2085	1.0	10.3	216.0	112.9	1.6	1.2	4.6
20	160	0.1	0.4	4.9	8.9	0.2	0.1	0.5
21	1898	0.4	2.1	26.9	14.1	1.1	0.3	2.1
22	4028	0.5	4.0	91.6	42.4	1.2	0.4	2.5
23	2829	1.1	9.1	106.4	91.4	1.9	0.8	3.5
24*	8767	3.2	33.0	432.0	204.9	3.7	2.4	22.6
25	272	0.0	0.1	1.5	0.4	0.2	0.0	0.3
26	3353	1.0	9.5	171.5	42.5	2.0	0.8	4.2
27	3242	1.7	18.3	333.0	156.3	1.8	1.6	4.7
28*	8022	3.1	32.0	603.6	221.3	3.9	3.0	10.5
29	4899	1.2	11.1	159.3	79.6	1.2	0.7	2.3
30	3274	0.8	7.5	109.4	74.4	1.5	0.8	3.2
31	3971	1.9	17.6	235.4	160.0	2.7	1.5	5.2
32	18479	2.8	19.0	335.2	125.1	3.1	1.7	5.9
33	9695	1.9	18.8	276.1	101.7	2.4	1.4	5.4
34	4065	1.4	10.9	155.0	75.2	2.0	1.1	4.1

^ 1989 RDAs for males 51+: 5000 IU Vit A, 1.2 mg THI, 15 mg NIA, 200 ug FOL, 60 mg Vit C, 1.4 mg RIB, 2 mg Vit B6, 2 ug B12

* Pts. meeting targeted energy and protein needs

APPENDIX 8

TWO DAY AVERAGE INTAKE OF SELECTED MINERALS^ FOR ADULT MALE ONCOLOGY PATIENTS

Pt.	IRON (mg)	MAGNESIUM (mg)	ZINC (mg)	CALCIUM (mg)	POTASSIUM (mg)
1	11.2	233.9	8.8	1133	2800
2	7.0	142.2	9.6	830	1721
3	4.2	103.0	4.3	708	1178
4*	19.0	285.8	13.0	1221	3483
5	3.2	93.3	4.6	443	998
6	12.4	254.2	10.8	1219	3225
7	9.4	126.6	4.9	524	1551
8	5.5	124.9	6.8	344	1094
9	12.3	275.0	14.7	816	2197
10	2.1	77.9	2.8	357	887
11	5.3	179.4	7.0	991	2149
12*	8.9	179.5	11.8	1069	2363
13	2.4	67.0	2.7	374	1047
14	4.5	108.9	5.3	363	1078
15	4.8	150.0	6.9	590	1418
16	2.7	118.0	3.5	569	944
17*	16.2	247.5	13.6	1299	2996
18	10.1	215.6	7.4	1057	2485
19	6.2	165.0	8.0	831	1777
20	0.3	20.4	0.7	163	226
21	2.4	112.8	3.5	701	1185
22	4.3	131.1	4.4	743	1968
23	8.6	185.7	7.8	1073	2207
24*	21.1	351.1	18.6	1870	3880
25	0.1	9.0	0.7	88	129
26	9.4	163.1	6.4	1058	1809
27	9.3	179.0	8.8	660	1897
28*	23.2	409.3	18.4	1794	3793
29	9.4	125.7	4.2	542	1332
30	9.1	149.7	5.1	848	1638
31	15.7	252.0	9.8	1203	3169
32	17.3	353.3	11.4	1631	3711
33	17.1	267.3	10.4	1155	2984
34	10.2	163.2	7.1	990	2499

^1989 RDAs for males 51+: 10 mg iron, 350 mg magnesium, 15 mg zinc, 800 mg calcium, estimated minimum requirement for potassium is 2000 mg

* Pts. meeting targeted energy and protein needs

RESUME

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