1981

Food intake assessment of elementary children

Janis Bennington Van Buren

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Food intake assessment of elementary children

by

Janis Bennington Van Buren

A Dissertation Submitted to the Graduate Faculty in Partial Fulfillment of the Requirements for the Degree of DOCTOR OF PHILOSOPHY

Major: Home Economics Education

Approved:

Signature was redacted for privacy. Members of the Committee:

In Charge of Major Work

Signature was redacted for privacy.

For the Major Department

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For the Graduate College

Iowa State University
Ames, Iowa

1981
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INTRODUCTION

Nutrition education is recommended by nutrition professionals for most population segments but especially school-age children. The White House Conference on Food, Nutrition, and Health (1970) included a recommendation that "a comprehensive and sequential program of nutrition be included as an integral part of the curriculum of every school in the United States and its territories."

Several major surveys authorized by the U.S. Congress have provided evidence of the need for improved nutritional practices among Americans. These studies were the 1968-1970 Ten-State Nutrition Survey, the 1971-1972 Health and Nutrition Examination Survey (HANES), and the Nationwide Food Consumption Survey (NFCS) of 1977-1978. Areas where children's nutritional status could be improved were identified in each survey.

The Ten-State Nutrition Survey (U.S. Department of Health, Education, and Welfare (USDHEW), 1972) dealt primarily with people living in low-income areas. Results of this survey indicated that the difference between food intakes of well-fed children and those with malnutrition was the amount of food eaten rather than the type of food eaten. Low intakes of iron, vitamin A, and riboflavin were noted among children.

Data from HANES (USDHEW, 1973) indicated that children in the lower income groups had consistently low-mean intakes for calories and protein. Evidence of anemia in children and adolescents was supported by low hemoglobin and hematocrit values.
According to the Nationwide Food Consumption Survey (U.S. Department of Agriculture (USDA), 1980), calcium, iron, magnesium, and vitamin B₆ were the nutrients determined to be most often lacking for children 9-14 years old. Sugar consumption is increasing among children and they are ingesting a larger percentage of fat than is recommended.

Each of these studies utilized several methods to collect dietary intake information. These methods included food records, 24-hour dietary recalls, and dietary histories and have been used mainly with adults. Each method has advantages and disadvantages.

Food records consist of recording present intake either in household measures or more precisely by weighing. These food records do not rely on memory and can be completed during or immediately after eating. Marr (1971) concluded that errors in estimation of portion size are a disadvantage of dietary record keeping.

A 24-hour dietary recall is a simple, rapid method of obtaining food intake data either through a personal interview or a self-completion questionnaire. A check list may be used to aid in the interviews. The memory of the subject must be relied upon and accuracy for the recall varies according to Fidanza (1974).

Dietary histories are based upon food frequencies and differ from recalls as questions asked are about general food patterns and habits for a period of up to one year. The dietary history allows for seasonal variation in food intake and does not change the normal diet. Taking a
diet history, according to Marr, is time consuming, and the skill of
the interviewer is extremely important.

Marr (1971) stated that these methods do not work well with children
because of their failure to accurately recall foods eaten or of their
inability to estimate portion sizes. Presently, easily used devices
for assessing food intake of elementary students are not available.
Need for devices to evaluate elementary students' food behavior is
provided by Cooper and Go (1976) who conducted an analysis of elementary
and secondary nutrition guides. They found a lack of evaluative
procedures to inform teachers of their successes and to identify
instructional needs of students.

To meet this need, an evaluation tool was developed as a performance
device enabling third to sixth grade students to select foods they would
eat in a typical day. The device, called What I Usually Eat (National
Dairy Council and Iowa State University, 1980), is a board featuring
40 different foods each illustrated on a separate card. Each food is
represented in multiples of four cards. After the students select the
food choices they would make for one day, adequacy of these choices is
evaluated using the Basic Four Food Groups as a standard. The device
was created as a part of a National Dairy Council (NDC) and Iowa
State University (ISU) project, Food Behavior Inventories for Elementary
Pupils: Final Report (Fanslow, 1981). The device has not been
validated against actual food choices of children.

The purposes of this research were to:

1. describe the dietary intake of children, and
2. provide evidence of criterion-related validity for What I Usually Eat.

A limitation of this study was that participants were from only one geographic area of the United States and responded during February and March of 1981. Results are not generalizable on a nationwide basis or beyond this time frame. It was assumed that all students would be familiar with each of the foods represented in the food intake performance device.

Definitions used in the research project are listed below.

Food choice behavior: an observable action related to present food intake.

Food intake performance device: an instrument designed to assess the probable 1-day food intake of an elementary student.

The Iowa State University Committee on the Use of Human Subjects in Research reviewed this project and concluded that the rights and welfare of the human subjects were adequately protected, that risks were outweighed by the potential benefits and expected value of the knowledge sought, that confidentiality of data was assured, and that informed consent was obtained by appropriate procedures.

Explanation of Dissertation Format

The dissertation format used for the presentation of this research has been approved by the Iowa State University Graduate Faculty. This format presents the research in manuscript form. The manuscripts meet the criteria for publication in professional journals. Section I is a manuscript describing the dietary intake of children by meal.
The children's nutrient intake is compared to the **Recommended Dietary Allowances** (RDA) formulated by a committee of the Food and Nutrition Board (FNB) of the National Research Council, National Academy of Sciences (1980). Section II is written for a nutrition education journal. This section explains the device and the procedure used to validate the device.

Authorship for both sections was shared by the doctoral candidate and Alyce M. Fanslow, major professor for the dissertation and director for the research project, "Food Behavior Inventories for Elementary Students," of which this research was a part. The research project was funded by the National Dairy Council and Iowa State University.

Overall findings and summary of the total research are presented in the final chapter. Suggestions for future research are included in this chapter.
REVIEW OF LITERATURE

Nutrition educators are becoming increasingly aware of the need for improved nutritional practices in the United States. Children, low-income persons, and the elderly are groups frequently found to be suffering from nutritional deficiencies. Food intake assessment techniques vary in their ability to determine what people actually eat.

There is a need to ascertain what children are eating and to develop relevant nutrition education materials and aids. The review of literature is organized into three areas: nutritional status of children, actual food intake of children, and food intake assessment of children.

Nutritional Status of Children

Evidence of the need for improved nutritional practices among children is strong. Three of the studies that provided this evidence were the 1968-1970 Ten-State Nutrition Survey, the 1971-1972 Health and Nutrition Examination Survey (HANES), and the Nationwide Food Consumption Survey (NFCS) of 1977-1978. Although these surveys included all age groups, this review summarizes primarily those results obtained with children.

The Ten-State Nutrition Survey was the first comprehensive attempt to assess the nutritional status of selected segments of the United States population (USDHEW, 1972). Early in 1967 Congressional hearings pointed to the probability of existence of serious hunger and malnutrition in certain segments of the population.
In early 1968, ten states were purposively selected to provide a population representative of the target groups assumed to have a high prevalence of malnutrition. These special groups within the poverty population included Spanish-speaking Americans in the Southwest, inner-city residents of major urban centers, and residents of industrial states who had moved from the South during the last 10 to 20 years. Emphasis was given to groups considered most vulnerable to nutritional stress. These groups were infants, pregnant and lactating women, children and adolescents, and the elderly.

Geographic, economic, and sociocultural diversity were reflected in the selection of states. States chosen for the survey were California, Kentucky, Louisiana, Massachusetts, Michigan, New York, South Carolina, Texas, Washington, and West Virginia.

Data were collected using a variety of techniques. Nutritional status was assessed on the basis of physical and anthropometric examinations, biochemical determinations, and dental examinations. Dietary evaluation was based on intake level and sources of nutrients, food habits, food preparation practices, and attitudes about foods.

The sample was mainly white but included Blacks and Spanish-speaking Americans. The data were treated to show effects of economic factors on nutritional status.

Few severe nutritional deficiencies were identified clinically in the Ten-State Nutrition Survey. There was more evidence of unsatisfactory nutritional status among children and adolescents, ages 10 to 16 years old, than in other age groups. Low levels of hemoglobin
indicated widespread iron-deficiency anemia. Many households had low intakes of iron. Children and adolescents had a high incidence of low vitamin A levels. There was evidence of poor riboflavin status among Blacks and children and adolescents of all ethnic groups. The survey emphasized the need for supporting information to confirm clinical impressions before nutritional status diagnoses can be made.

The 1971-1972 Health and Nutrition Examination Survey (HANES) was the first nutrition survey in the United States sampling people at all stages in the life cycle. Approximately 20,000 people between the ages of one and 74 were selected for the sample.

The program was designed to study the adequacy of dietary intake and utilization of nutrients. Dietary intakes in the 1971-1972 survey were obtained by interviews using the 24-hour recall method. Additional questions about food consumption during the preceding three months were included.

Evaluation of nutritional status was based on anthropometric measurements, biochemical tests, and clinical examinations. Selected demographic data were collected.

Selected findings from the study were:

1. The dietary intake data in the age groups 6 to 17 years showed consistently lower mean intakes for calories and protein in the lower income groups regardless of race. Growth retardation was found among children from poverty groups.

2. Low hemoglobin and hematocrit values indicated low-iron intake in children. Anemia was more prevalent among Blacks than among whites.
and at low-income levels.

3. Blacks showed generally higher prevalence rates than did whites for clinical signs, indicating possible dietary deficiencies at all ages and income levels. These nutrients included vitamins A, C, and D, thiamin, calcium, and iodine.

4. Children in the income groups above poverty level were generally taller, heavier, and had larger median skinfolds than those in the income group below poverty level.

HANES provided evidence of low-serum vitamin A, serum protein, hemoglobin, and hematocrit values in children. Other possible dietary deficiencies among children included vitamins C and D, thiamin, and calcium.

Recent changes in kinds and quantities of foods used by individuals and households in the United States from 1965-1977 are reported in the Nationwide Food Consumption Survey (NFCS). The 1977-1978 NFCS is the sixth food consumption survey conducted by the U.S. Department of Agriculture since 1936. From April 1977 to March 1978, a stratified probability sample of households was surveyed. Information was obtained from approximately 15,000 households in the 48-contiguous states. About 34,000 individuals representing these households were interviewed. The person interviewed was identified as the one most often responsible for food planning and preparation.

Households were contacted at a minimum of 7 days prior to the interview and were asked to keep informal notes to aid them in recalling the food used during the 7-day period. This procedure
differed from previous surveys. An aided recall schedule was used by trained interviewers to obtain the kind, the form, the quantity, and the cost, if purchased, of each food and beverage used in the household during 7 days prior to the interview.

The survey provided detailed information on food used by households. Using this information, the nutritional quality of household food supplies was estimated. Data on home production of food, household income, participation in food programs, and education and employment of household heads were obtained.

The nutritive value of household diets was compared with recommended amounts of nutrients for persons eating in each household. The standard used was the Recommended Dietary Allowances (RDA) published in 1974 by the Food and Nutrition Board National Research Council, National Academy of Sciences. The RDA are not requirements but are recommendations for intakes of nutrients judged to be adequate for maintaining good nutrition in essentially all healthy persons in the United States. The nutritive value of the food used is calculated for the edible portion of food as brought into the household. The vitamin values were adjusted for cooking loss. Nutritive values of household food eaten and edible food not eaten are included. Nutrient energy levels of foods eaten in many households may be slightly overestimated.

According to Nationwide Food Consumption Survey 1977-1978, Preliminary Report No. 3 (USDA, 1981), only 3% of the households consumed food that failed to provide the RDA for protein. The RDA for phosphorus,
riboflavin, and ascorbic acid was not provided in fewer than 10% of the households.

The nutrients most often found to be below allowances for household food supplies were calcium and vitamin B₆. About one-third of the households used food that provided less than RDA for these two nutrients.

Regional differences in the percentage of households meeting the allowances for food energy and nutrients were small. Generally, a slightly greater percentage of households used food that met allowances at each successively higher level of income. It is possible that diets of some individual household members may not meet their RDA even though the household diet as calculated met the RDA.

The average nutrient levels for households in the lowest income group had generally improved more from 1965 to 1977 than those in other income levels. There appeared to be more uniformity in nutrient levels and in quantities of food used across the various income levels in 1977 than in 1965.

Nationwide Food Consumption Survey 1977-1978, Preliminary Report No. 2 (USDA, 1980) provided information about food and nutrient intakes of individuals for one day in Spring 1977. The data were based on 9,620 24-hour dietary recalls obtained during the first quarter of the survey, April-June 1977. Nutrient intake evaluations are based on 1980 Recommended Dietary Allowances.

Males 9 to 14 years old were below the RDA for iron. Females, in the same age group, were below the RDA for iron, calcium, phosphorus,
magnesium, and vitamin $B_6$.

Data from the 1977-1978 NFCS indicated that individuals, including children, are ingesting a larger percentage of fat than is recommended. Soft drinks are being consumed more frequently than in 1965 resulting in increased sugar consumption. Protein, riboflavin, niacin, and vitamin C intakes for children met the RDA. Calcium, iron, magnesium, and vitamin $B_6$ intakes were most frequently below the RDA.

Several smaller studies within the United States and its territories have identified similar nutrient deficiencies. According to Latham (1973), iron-deficiency anemia has been found to be a major problem of children in the District of Columbia. Latham emphasized that undernutrition is a concern in the American military establishment, particularly among the families of those with low rank. In an investigation of migrant workers and their families in Palm Beach County, Florida, Kelsay (1969) discovered one case of kwashiorkor, several children with nutritional marasmus, and other children with stunted growth.

Another group of neglected Americans is made up of native Americans and the natives of Alaska (Latham, 1973). Their nutritional deficiencies appeared to parallel those of the larger surveys. Low intakes of iron, calcium, vitamin A, and vitamin C were indicated as problems when biochemical assays of urine and blood were done. Latham cited evidence of nutritional deficiencies among children and adults in Puerto Rico and the Virgin Islands. These deficiencies were related to low protein, riboflavin, and vitamin C intakes.
These smaller, more specialized studies and the three larger surveys provided evidence in areas where nutritional status of children could be improved. Children's excessive fat, sugar, and sweetener intake, coupled with certain vitamin and mineral deficiencies, indicated the need for development of strategies and devices to help children select foods that contribute to a healthful diet.

Actual Food Intake of Children

Few reports were available that discussed what children eat, when they actually eat certain foods, and the nutrients obtained at these times. Data from the Nationwide Food Consumption Survey (NFCS) provided the most complete information, and it is summarized in the following section.

During Spring 1977, 2,787 children participated in the NFCS (Pao & Mickle, Note 1). Children's ages ranged from 3 to 18 years. Dietary information was collected on children for 3 days. Data were reported by a family member responsible for food purchase and preparation. The data that follow were based on the first-day 24-hour recalls.

Eating occasions were identified as breakfast, lunch including brunch, dinner, supper, and snacks. Thirty-six percent of the children ate three times in one day; 32% four times; and 25% five or more times.

Over 95% of the children ate breakfast. Breakfast provided about one-fifth of the day's food energy for those eating that meal. Pao (in press) reported that breakfast eaters ate the following foods in decreasing order of frequency: milk, ready-to-eat cereals, bread and biscuits, sugar and sweet spreads, fruit juice, eggs, and fats and oils.
About 50% of the children under 12 years of age had ready-to-eat cereal, and 77% had milk. Cooked cereals were much less popular. Nearly 33% of the children reported a bread item. At least one quick-bread was listed by 10% of the respondents. About 20% of the children ate eggs and breakfast meats such as ham, bacon, and sausage. Nearly one-third drank fruit juice, while a smaller portion consumed fruit drinks and fruit-flavored drinks.

Approximately 85% of the children ate lunch. Some midday meals were called dinner. There was a greater variety among lunch items than breakfast items. Meat items, including some fillings for sandwiches, were popular with 12 to 14 year olds. The younger children used peanut butter more often for lunch than did the teenagers. This was also true for sugar and sweet spreads. Eggs and legumes were the least commonly used of the protein-rich foods. Vegetables were more popular than fruit. Only about 20% of the children reported having a dessert, with cake and cookies being more popular than milk desserts.

Milk was consumed by slightly less than one-half of the children. Other beverages included soft drinks, milk-flavored drinks, fruitades, and coffee or tea.

Nearly one-half of the children reported having a dinner meal. This indicated a larger meal, and it was usually served in the evening rather than at midday. About 45% of the children reported having supper, meaning a lighter evening meal.

Data indicated that most dinners had at least one protein-rich food. Meat, fish, or poultry were mentioned as a food eaten by 85%
of the children. About one-third of the children had potatoes for dinner, and over one-half had a second vegetable. Vegetables were eaten more often than fruit. Nearly one-half of the children ate bread or a cooked cereal product, with rice being most frequently eaten. Bakery products were more popular than ice cream desserts. Milk was the selected beverage for approximately one-third of the children.

Legumes were more frequently eaten for supper than for other meals. Less dessert and fruit were served at supper than at dinner. Milk was the most popular supper beverage.

Snacks were eaten by two-thirds of the children. Frequency of snacks per day varied from one to five or more times. Most snacking occurred in late afternoon and in the evening. Favorite snacks for girls and boys included soft drinks, milk, milk desserts, cookies, fruit, salty snacks, candy, meat, and bread.

The survey results indicated that food patterns of meals vary from food patterns for snacks. Protein-rich foods and vegetables were eaten frequently at meals but rarely for snacks. Four of the most popular snack items contained substantial amounts of sugar. Milk and bread were popular for meals and snacks.

Children's eating patterns varied somewhat as they matured into adolescence. Females tended to skip breakfast more frequently, and males increased the number of daily snacks.

Brown, Bergan, and Murgo (1979) studied the food habits of approximately 300 junior high students. The students kept a 10-day dietary
record. They found most frequently eaten breakfast foods to be milk, cereal, fruit juice, toast, and eggs. These breakfast foods were identical to those found in the NFCS (Pao & Mickle, Note 2).

Typical lunches of the junior high students contained a sandwich, a dessert, and milk purchased at school. Most frequently reported sandwich fillings were peanut butter and jelly, tuna fish, and bologna. Desserts included cookies, cake, pie, fruit, or ice cream sandwiches. Lunches were similar to those reported in the NFCS with the exception of vegetable consumption being noted in the nationwide survey.

The junior high students' evening meal consisted of meat or fish; vegetables; potatoes, rice, spaghetti, or noodles; and frequently a salad and dessert. Milk was the beverage most often consumed. Carbonated beverages, fruit juices, and powdered fruit-flavored drinks were often a part of the evening meal. Popular snack foods for this age group were carbonated beverages, milk, candy, fruit, and ice cream. These dinner and snack patterns are very similar to the ones reported in the NFCS (Pao & Mickle, Note 2).

National studies and area-specific research have provided information about possible trends in children's eating patterns and behaviors. Children's eating behaviors vary somewhat according to socioeconomic status, region of the country where residing, age, and sex.

Food Intake Assessment of Children

According to Cosper, Hayslip, and Foree (1977); Lovett, Barker, and Marcus (1970); Smith and James (1980); and Smith and Justice (1979),
nutrition education has a positive influence on children's eating behaviors. Some type of device is needed that will enable teachers to obtain a valid group measure of what their students are eating in a typical day. This will enable them to direct their nutrition units to the needs of the class as a group.

Various techniques have been utilized to obtain information about individual's or group's food intake. Different types of dietary surveys include food records, 24-hour dietary recalls, and dietary histories. These methods have been used primarily with adults. The purpose of dietary surveys is to discover what the sample group is in the habit of eating. Ideally, the diets should be freely chosen and typical of what is usually eaten. Each of these methods has advantages and disadvantages.

Food records consist of recording present intake either in household measures or more precisely by weighing. Weighing requires close supervision and added expense to the data collection process. Marr (1971) stressed that not every individual is willing or able to carry out a weighed inventory dietary survey. Weighing is not suitable for meals eaten away from home.

A substitute for precise weighing is recording intake in common household measures. There is a higher degree of cooperation among adult subjects using this method. No special equipment is needed and direct supervision is unnecessary. Marr recommended a detailed interview prior to record keeping to establish the quantities and size of helpings served. Errors in estimation of portion size are probably
the largest source of inaccuracies in diet record keeping according to Marr. O'Hanlon and Kohrs (1978) discovered that the percentage of subjects who cooperate decreases as the number of recording days increases.

The maximum length for record keeping is 1 or 2 weeks. Fidanza (1974) stated that more accurate estimates of mean intake can be obtained by taking records from a number of weeks selected independently at random rather than from a single period of the same total duration.

A 24-hour dietary recall is a simple, rapid method of obtaining food intake data either through a personal interview or a self-completion questionnaire. The memory of the subject must be relied upon. Subjects may recall portion size in household measures, compare size of helping with food models, or recall the menu with no quantities. A checklist may be used to aid in the interviews. Day-to-day variation of food eaten is high, and a single 24-hour record may not be typical of long-term intake. A tendency to underestimate the number of calories consumed was observed by O'Hanlon and Kohrs. Fidanza recognized the problem of suppression or distortion of memory in regard to that not considered socially acceptable. According to Madden, Goodman, and Guthrie (1976), a 24-hour recall would underestimate food intake as compared to a 7-day food record.

Dietary histories are based upon food frequencies and differ from recalls as questions asked are about general food patterns and habits for a period of time up to 1 year. The diet history method is a common
technique for estimating usual dietary intake. A diet history allows for seasonal variation in food intake and does not change the normal diet. Taking a diet history is time consuming and the skill of the interviewer is extremely important. Marr (1971) stated that a diet history conducted by the interview technique was a reasonable approximation of the truth.

Having children collect their own dietary intake data appeared to present problems. Only a limited number of studies discussing children keeping their own dietary intake data was found. Each assessment technique had limitations when used by children.

A 24-hour dietary recall presented special problems for children according to Young, Hagan, Tucker, and Foster (1952). Children may not recall what they ate in a previous day. The size of the serving is often difficult to remember and estimate, particularly as intake fluctuates.

Huenemann and Turner (1942) arranged for 25 children ranging in age from 6 to 16 years to complete a diet history that was followed by three weighed records. The diet histories frequently did not agree with the actual records. No diet history was found to agree with the diet record within 20% for respondents. Later Becker, Indik, and Beeuwkes (1960) extensively examined the data. They concluded that the two methods when applied to these individual children were not measuring the same thing and that there was no evidence that either of the methods was valid.
When comparing diet histories to the results of 7-day food records kept by elementary and junior high students, Young et al. found that the history considerably overestimated the intake. The researchers concluded that children not previously trained in keeping dietary histories or in estimating their food intake should not be considered as reliable sources for reporting their own food intake. Beal (1967) agreed that with few exceptions upper elementary and junior high students are not likely to give reliable nutrition histories. Marr concluded that attempts to validate diet histories kept by children against a weighed method have resulted in large discrepancies.

Data collected by each of these methods may be subjected to different guidelines to determine if dietary intake is nutritionally adequate. One guide is the Recommended Dietary Allowances (1980) developed by the Food and Nutrition Board. These are recommendations for the average daily amounts of nutrients that population groups should consume over a period of time and they are established for healthy populations. The allowances are estimated to exceed the requirements of most individuals and thus insure that the needs of nearly all of the population are met. To meet the RDA requirements, a variety of foods is suggested. Nutrient requirements are provided by age, weight, and sex groups. When estimating dietary adequacy with use of the RDA, it is suggested that intakes of nutrients be averaged over a 5- to 8-day period.

Another guideline is the U.S. Department of Agriculture (USDA) Daily Food Guide, commonly known in abbreviated form as the Basic Four Food Groups. First published in 1956, the guide always has
recommended selecting a variety of different foods, including specific food sources of vitamins A and C, using whole grain or enriched cereal products, and adding other food items to meet greater energy needs. The USDA Daily Food Guide of 1979 offers recommendations for the kinds and amounts of food that should be selected daily in order to provide the foundation for a nutritious diet and to approach recommended nutrient needs. The Basic Four Food Group Guide provides a useful framework for developing daily menus. Daily intake recommendations for children include the following food groups and servings: milk, three or more; meat, two or more; fruit/vegetable, four or more; and bread/cereal, four or more.

Other recently developed dietary guides include the Dietary Goals for the United States proposed by the U.S. Senate Select Committee on Nutrition and Human Needs (1977), Healthy People, The Surgeon General's Report on Health Promotion and Disease Prevention (USDHEW, 1979), and the 1980 USDA/USDHEW dietary guidelines for Americans entitled Nutrition and Your Health - Dietary Guidelines for Americans. According to Basic Nutrition Facts (Michigan Department of Public Health, 1980), each plan has some worthwhile concepts; but each, also, has shortcomings that limit the extent to which it is applicable for the general population.

Dietary Goals for the United States and Healthy People, The Surgeon General's Report on Health Promotion and Disease Prevention are directed to adults to eliminate excesses in dietary practices. Reductions in fat and sugar and limitations on salt are suggested.
Methods for selecting food to meet the RDA are not discussed and no information on meal planning is provided. Both guides assume that poor eating habits exist for the majority of the population and that change is necessary.

Guidelines for most already-healthy Americans are given in *Nutrition and Your Health - Dietary Guidelines for Americans*. The guide suggested eating a variety of foods, maintaining ideal weight, and avoiding too much fat, sugar, and sodium. Information on meal planning is not included. The weight section and concepts to eliminate excesses in dietary practices that may be harmful to health are directed to adults but not to children.

When collecting any type of food intake data, the question arises as to how those being studied differ from the remainder of the population. The fact that they are willing to participate in a study suggests that they are not typical of their associates.

Madden, Goodman, and Guthrie (1976) asserted that many food intake measurements have been assessed for reliability, but few have been tested for validity. According to Marr, validity and reliability have not been demonstrated for any method measuring dietary intake of "free living" individuals.

Because nutrition education has been shown to make a difference in children's food intake behaviors, some method to determine their intake is needed. A review of past studies shows that most available dietary data on children have been collected by adults. A problem of obtaining dietary intake information on children is that parents may
not be willing to keep records. Traditional dietary intake methods have rarely been successfully used with children. Because there are limited research studies on food intake of children and little validation of their food choices, a need exists for an easily administered and scorable device to assess children's food intake behaviors.

A recently developed performance device to be used by teachers to assess the food intake of elementary students is What I Usually Eat (National Dairy Council and Iowa State University, 1980). Visual aids are used to simulate the experience of selecting the foods to be eaten throughout a day. Forty commonly eaten foods are displayed on cards on a board. Students respond to the device by selecting the cards representative of what they would typically eat and drink in 1 day. The food cards are placed on the pictorial representation of a day to indicate approximate time of day the food is eaten. These selections are compared to the Basic Four Food Group guidelines for nutritional adequacy.

Fitzpatrick and Morrison (1971) defined a performance test as having a high degree of realism. In a performance test, some criterion situation is simulated to a much greater degree than is represented by a typical paper-and-pencil test. A performance test may be a real-life situation. Well-developed simulation devices are measurable and scorable. The simulation activity provides stimuli that influence the performance of a participant. The What I Usually Eat device meets these criteria.

The purposes of the present study were to describe the nutrient intake of the students by age and sex and to demonstrate criterion-related
validity of the performance device. Data were collected from 67 elementary school children in southwestern Michigan to achieve these purposes.
DIETARY INTAKE OF UPPER ELEMENTARY STUDENTS

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RÉSUMÉ

Seven-day food records of 67 children were kept by their parents. Record keeping procedures were explained during parent interviews. Previous dietary studies of children often have been based on 24-hour recalls or 3-day records. These data supplied detailed information about children's 7-day dietary intake. Carbohydrate, iron, and calcium were the nutrients most often found below the 1980 RDA. Intakes of thiamin, niacin, and riboflavin were 67% of the RDA or greater. Individual RDA for protein and Vitamin A were over 100% for all subjects. High-content sugar foods were popular snack selections.
INTRODUCTION

Nutritional status of individuals in the United States is of concern because of its relationship to long-term health. Of particular concern is the nutritional status of children due to the impact of past dietary intake on future health.

Several major nutritional status surveys have been authorized by the U.S. Congress. Among the surveys were the Ten-State Nutrition Survey (U.S. Department of Health, Education, and Welfare (USDHEW), 1972), Health and Nutrition Examination Survey (USDHEW, 1973), and the Nationwide Food Consumption Survey (U.S. Department of Agriculture (USDA), 1980). All age groups were included in the surveys. Limited data on children were provided. Only those results obtained with children are presented here as the nutritional status of children is the focus of this study.

The major emphasis in the Ten-State Nutrition Survey was to determine the degree of malnutrition among the poor. A 24-hour recall was the primary source of dietary data. Low intakes of iron, vitamin A, and riboflavin were noted among children.

Dietary intakes for the Health and Nutrition Examination Survey (HANES) were obtained by interviews using the 24-hour recall method. Data from HANES indicated that children in the lower income groups had consistently low mean intakes for calories and protein. Evidence of anemia in children was supported by low hemoglobin and hematocrit values.
The dietary data provided by the Nationwide Food Consumption Survey (NFCS) of 1977-1978 were based upon 24-hour recalls obtained from information reported by a family member responsible for food purchase and preparation. These data indicated that children are consuming soft drinks more frequently than in 1965, resulting in increased sugar consumption. Protein, riboflavin, niacin, and vitamin C met the Recommended Dietary Allowances (RDA) formulated by the Food and Nutrition Board, National Research Council (1980) according to the USDA (1980) report on the 24-hour recall data.

Food intake data collected on elementary children for periods longer than 24 hours have been limited to the noon meal at school. These data were collected during the week either through observation or child report (Smith & James, 1930; Smith & Justice, 1979; and Yperman & Vermeersch, 1979). Low milk and vegetable consumption was noted in those studies.

Inspection of procedures used in those studies reveals dietary data were based on 24-hour food recalls or a partial intake for several days. Current concerns for children's nutritional status emphasize the need for collecting longer term dietary intake data.

Because only limited information exists on upper elementary students' longer term dietary intake, the major purpose of this study was to provide information on the nutrient intakes by age and sex of fourth and sixth grade students from three elementary schools in southwestern Michigan. The secondary purpose was to describe foods commonly eaten by meal.
METHOD

Seven-day food records on the 67 children participating in the study were kept by a parent from each family during Winter 1981. The children were from three elementary schools all located in an urban area. Approximately 67% of the students were white and 33% were minorities. Fifty-five percent of the students were female. The students ranged in age from 9 years and 2 months to 13 years and 3 months. Students' families included low, middle, and high economic status. Families were from differing multi-racial backgrounds.

Data Collection

Letters explaining the study were sent home with 110 fourth and 163 sixth graders. Each of the 79 parents who agreed to keep a 7-day record of the child's dietary intake was contacted by telephone. An interview was arranged and conducted either at home or at the child's elementary school according to parental preference. The child's school was selected as the interview site by 42% of the parents.

Each parent interview took approximately 1 hour. Directions for recording each child's food intake by meal and a completed 1-day sample record were discussed and given to each parent. Parents were asked to prepare and serve meals and snacks as they typically did. All unusual eating patterns that might occur such as a birthday party or illness were to be noted.

Parents were asked to measure servings when possible and to keep a set of measuring spoons and cups and a ruler readily available for
this purpose. If mixtures were served, the recipe was to be included and the total amount the child ate recorded. Approximately 50% of the completed food records contained information with this degree of specificity.

A set of food models was shown to each parent in an attempt to improve quantitative data. These models were constructed after guidelines by Moore, Judlin, and Kennemur (1967).

Volumes of foods were represented by the various models. Cooked food was represented by piles of rice molded together with paraffin; models representing one-half, three-fourths, one, and one and one-half cups were used. Liquid food was represented using glasses in graduated sizes of one-half, one, and one and one-half cups. Plaster of Paris was used to illustrate these liquid amounts in the glasses. Cooked hamburger patties (3-oz.), cheese slices (1-oz.), and butter (1 pat) were represented by styrofoam models. An apple (medium-sized) was used to illustrate the size of a variety of fresh fruits and vegetables.

Parents were given a set of blank-food record forms and were asked to record their child's intake by meal for 7 days. Information requested included food item and description, amount eaten, time of day, and selected demographic data. A self-addressed, stamped envelope was provided for use in returning completed food records. Follow-up telephone calls were made if completed food records were not received in 12 days after the interview. Upon receipt of the food records, the incentive gift (a cookbook) shown during the interview was mailed to each participating family.
Data Analysis

Several types of dietary information provided by the food records were summarized. Average daily intakes of calories, protein, fat, carbohydrates, calcium, iron, vitamin A, thiamin, riboflavin, niacin, and vitamin C were calculated for three age-sex groups. These groups were children, 7-10 years; males, 11-14 years; and females, 11-14 years. Nutrient values for foods were those shown in the Home and Garden Bulletin No. 72 (U.S. Department of Agriculture (USDA), Agricultural Research Service, 1977); calculations were made using the computer program associated with this bulletin.

Nutrient intakes by age-sex group were compared to the 1980 Recommended Dietary Allowances (RDA). Three percentage categories were used for comparison. These categories were percentage of subjects with intakes of 100% or greater, intakes between 67% and 100%, and intakes less than 67% of the RDA's.

Frequencies of selected foods eaten by meal by age-sex group were tabulated. These frequencies were converted to percentages.
RESULTS AND DISCUSSION

Adequacy of nutrient intake is discussed using the 1980 RDA as the standard. A description of foods commonly eaten by meal is provided.

The RDA were devised as guides to serve as a goal for good nutrition for various age-sex groups. Individual differences in requirements resulting from normal variability within a population are taken into account when the allowances are set. Diets in this study were considered low if they contained less than 67% of the RDA for that nutrient.

Carbohydrate and fat do not have an RDA but suggested portions of energy that should be supplied by these nutrients have been recommended (see Table 1). Carbohydrate was the energy nutrient that had the largest number of students receiving less than the suggested proportion of energy. Fat intake was in an acceptable range for this sample. Protein intake was over 100% for all groups and helped provide energy to compensate for the low carbohydrate intake.

Insert Table 1 about here.

The students had the following distribution of total calories among the energy nutrients: carbohydrates, 48%; fat, 36%; and protein, 16%. This approximation was determined by using the mean grams of carbohydrate, fat, and protein consumed and multiplying by 4, 9, and
4 calories per gram, respectively. To convert the calories for each energy-nutrient group to a percentage, the calories were divided by total calorie consumption and multiplied by 100.

The Food and Nutrition Board (FNB) suggests that fat should not provide more than 35% of dietary energy, particularly in diets below 2,000 calories. At a time when many Americans are ingesting too much fat, this sample is close to the FNB recommendation. This is contrary to data from the NFCS that indicated individuals, including children, are ingesting a larger percentage of fat than is recommended.

The two minerals, iron and calcium, had more subjects in the less than 67% RDA category than did any of the vitamins and minerals. Only 3% of the children (7-10 years), but 27% males (11-14 years) and 21% females (11-14 years) were in this category for calcium. Calcium mean intake for children, males, and females, respectively, was 1,125.7 mg, 1,187.6 mg, and 1,023.9 mg (Table 2). Low calcium intake may be a potential problem as calcium is needed for skeletal development during the rapid growth period that characterizes preadolescence and adolescence.

Forty-two percent of the females and 36% of the males were receiving less than 67% of the RDA for iron. Their mean iron intakes respectively were 12.4 mg and 14.3 mg. This is similar to the NFCS that found females and males below the RDA for iron. Because these females and males are in a period of rapid growth and at a time in the life cycle when iron intake is frequently inadequate according to the Food and
Nutrition Board, selection of iron-rich foods is recommended. These foods include green leafy vegetables, potatoes, and enriched breads and cereals. Selection of these foods would also increase carbohydrate intake. Additional protein sources, also rich in iron, are not needed for this sample that consumed over 100% of the RDA for protein. The females may also be experiencing menstrual iron losses. All children had 67% or greater RDA iron intake.

All subjects had intakes of thiamin, riboflavin, and niacin in the 67% RDA or above category providing intakes within an acceptable range (see Table 1). The amount of protein above 100% of the RDA will provide tryptophan that can be converted to niacin to bring the total for niacin and niacin equivalents closer to 100% of the RDA. When 60 mg of ingested tryptophan are metabolized, about 1 mg of niacin will be provided according to the FNB.

For vitamin C intake, only 8% of the children and none of the males and females were in the category of intake less than 67% of the RDA. Mean intakes for vitamin C were greater than twice the RDA for each age-sex group. The RDA for vitamin C was met for children participating in the NFCS. It was noted in the NFCS that children are drinking more vitamin C enriched beverages than previously. This is contradictory to HANES data that indicated possible vitamin C deficiencies among children.
No children, females, or males were deficient in protein, vitamin A, thiamin, riboflavin, and niacin when adequacy is defined as ≤ 67% RDA. All children had adequate iron consumption, while males and females had adequate vitamin C intake.

Each age-sex group is using protein for calories. Nutrition educators should emphasize that while protein consumption is important, carbohydrate and fat are needed in the diet. Further carbohydrates supply a cheaper source for energy than protein so nutrition educators could promote carbohydrate consumption.

Some students in each age-sex group were deficient in calcium intake. Approximately 25% of males and females had low iron consumption. Lessons emphasizing bodily functions of iron and calcium and how to obtain these nutrients in the diet should be included in nutrition units.

Foods Children Eat

Because there is limited information on foods elementary students actually eat, foods eaten during the 7-day recording period are summarized. Eating occasions are identified as breakfast, lunch, dinner, and snacks.

Foods eaten at breakfast by 20% or more of the sample listed in decreasing order were: milk (73%); ready-to-eat cereals (57%); bread, usually toasted (52%); fruit (50%); sweeteners, either jam, jelly, sugar, or syrup (41%); butter or margarine (30%); and eggs (20%). The fruit most often chosen was orange juice. Ready-to-eat cereals were served ten times more frequently than hot cereals.
There was greater variety among lunch items than breakfast items, particularly in selection of a protein source, vegetables, and fruit. Meat-group foods included eggs, cheese, peanut butter, dried beans, beef, pork, poultry, and fish. Vegetables selected included potatoes, carrots, corn, celery, green beans, lettuce, tomatoes, cauliflower, cabbage, and turnip greens. Lunch foods selected in decreasing order were: a protein source (97%), vegetables (82%), bread (66%), fruit (61%), milk (57%), fats and oils (30%), and desserts (28%). Meat mixtures were served more often at lunch than at dinner. Bread was often eaten as a sandwich. Apples and oranges were the fruit most frequently selected. Cookies were the most popular dessert item.

These lunches were similar to those reported by Brown, Bergan, and Murgo (1979) when junior high students kept their own 10-day food records. The junior high students' vegetable consumption in that study was lower than the elementary students in this study.

The dinner food most often selected was vegetables. Nearly one-half of the students ate two vegetables for dinner. Vegetable and protein sources were similar to those selected for lunch. Dinner foods eaten by 20% or more of the students were: vegetables (100%), a protein source (100%), bread (59%), milk (51%), fats and oils (37%), fruit (33%), and pasta and rice (22%). Less fruit was selected for dinner than for breakfast or lunch. Vegetables were selected more often than fruit by this sample and by the children in the NFCS.

Snack foods most often selected by 20% or more of the students were: desserts (37%), fruit (35%), and milk (20%). Milk desserts,
particularly ice cream, were selected more often than bakery products. Apples and oranges were the fruit most frequently selected, possibly due to availability.

Meal patterns varied from snack patterns. More protein-rich foods, milk, bread, and fruit were consumed at meals. Desserts, candy, and beverages other than milk were eaten by more children for snacks. These snack items contain substantial amounts of sugar. The snack patterns that emerged from this study were similar to those reported by Brown, Bergan, and Murgo, and by Pao and Mickle (Note 1).
SUMMARY

Nutrient intake and foods most frequently selected for meals and snacks by 67 upper elementary children in southwestern Michigan were determined from 7-day food records kept by these students' parents. Nutrient intakes were divided into three percentage categories. These categories were percentage of subjects with intakes of 100% or greater, intakes between 67% and 100%, and intakes less than 67% of the RDA's. Diets were considered low in a particular nutrient if they contained less than 67% of the 1980 RDA for that nutrient. When comparing subjects by age-sex groups, more females (11-14 years) were obtaining less than 67% of the RDA for iron and calcium than males (11-14 years) and children (7-10 years). Females' intake of the B vitamins and vitamin C was higher than males and children. The mean vitamin C intake for all age-sex groups was over twice the RDA. All subjects had over 100% of the RDA for protein and vitamin A intake.

The types of food the children ate were similar to those reported in other studies. More children drank milk at breakfast than at other meals; cereals were most frequently eaten for this meal. Vegetables and protein-rich food were more often consumed at lunch or dinner than other foods. Vegetables were more frequently eaten than fruit. Bread was chosen by approximately 60% of the students for each meal. Snacks were selected from all food groups but sweetened items tended to predominate.

These data supplied detailed information about children's 7-day dietary intake rather than information based on 24-hour food recalls.
or 3-day food records often reported in other studies. This information provides one useful benchmark in nutritional adequacy studies.
REFERENCE NOTES

REFERENCES


Table 1. Percentage of RDA consumed by age-sex group

<table>
<thead>
<tr>
<th>Group</th>
<th>Energy 100%</th>
<th>Protein</th>
<th>Fat</th>
<th>Carbohydrate</th>
<th>Calcium</th>
<th>Iron</th>
<th>Vitamin A</th>
<th>Thiamin</th>
<th>Riboflavin</th>
<th>Niacin</th>
<th>Vitamin C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of subjects with intakes 100% of the RDA or greater</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Children, 7-10 years</td>
<td>19</td>
<td>100</td>
<td>21</td>
<td>5</td>
<td>84</td>
<td>73</td>
<td>100</td>
<td>76</td>
<td>97</td>
<td>57</td>
<td>81</td>
</tr>
<tr>
<td>Males, 11-14 years</td>
<td>18</td>
<td>100</td>
<td>36</td>
<td>9</td>
<td>55</td>
<td>18</td>
<td>100</td>
<td>64</td>
<td>82</td>
<td>55</td>
<td>91</td>
</tr>
<tr>
<td>Females, 11-14 years</td>
<td>21</td>
<td>100</td>
<td>26</td>
<td>16</td>
<td>26</td>
<td>0</td>
<td>100</td>
<td>89</td>
<td>100</td>
<td>74</td>
<td>95</td>
</tr>
<tr>
<td>Percentage of subjects with intakes between 67% and 100% of the RDA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Children, 7-10 years</td>
<td>65</td>
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<td>65</td>
<td>32</td>
<td>13</td>
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<td>24</td>
<td>3</td>
<td>43</td>
<td>11</td>
</tr>
<tr>
<td>Males, 11-14 years</td>
<td>55</td>
<td>0</td>
<td>37</td>
<td>55</td>
<td>18</td>
<td>46</td>
<td>0</td>
<td>36</td>
<td>18</td>
<td>45</td>
<td>9</td>
</tr>
<tr>
<td>Females, 11-14 years</td>
<td>79</td>
<td>0</td>
<td>74</td>
<td>58</td>
<td>53</td>
<td>58</td>
<td>0</td>
<td>11</td>
<td>0</td>
<td>26</td>
<td>5</td>
</tr>
<tr>
<td>Percentage of subjects with intakes less than 67% of the RDA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Children, 7-10 years</td>
<td>16</td>
<td>0</td>
<td>14</td>
<td>63</td>
<td>3</td>
<td>3</td>
<td>0</td>
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<td>0</td>
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<td>Males, 11-14 years</td>
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<td>0</td>
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<td>0</td>
</tr>
<tr>
<td>Females, 11-14 years</td>
<td>0</td>
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<td>0</td>
<td>26</td>
<td>21</td>
<td>42</td>
<td>0</td>
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</table>

*Sample size for age-sex groups is as follows: children, n = 37; males, n = 11, females, n = 19.*

bThe Food and Nutrition Board suggests that no more than 35% of total dietary energy be obtained from fat, 12-15% from protein, and the remainder from carbohydrates.
Table 2. Mean nutrient intake by age-sex group

<table>
<thead>
<tr>
<th>Energy and nutrients</th>
<th>Units</th>
<th>Children, 7-10 years ( n = 37 )</th>
<th>Males, 11-14 years ( n = 11 )</th>
<th>Females, 11-14 years ( n = 19 )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Energy</td>
<td>Kcal</td>
<td>2,016.4</td>
<td>499.3</td>
<td>2,371.9</td>
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<tr>
<td>Protein</td>
<td>g</td>
<td>80.5</td>
<td>21.0</td>
<td>92.9</td>
</tr>
<tr>
<td>Fat</td>
<td>g</td>
<td>82.9</td>
<td>25.5</td>
<td>95.5</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>g</td>
<td>244.0</td>
<td>63.4</td>
<td>295.2</td>
</tr>
<tr>
<td>Calcium</td>
<td>mg</td>
<td>1,125.7</td>
<td>434.0</td>
<td>1,187.6</td>
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<tr>
<td>Iron</td>
<td>mg</td>
<td>12.0</td>
<td>2.9</td>
<td>14.3</td>
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<tr>
<td>Vitamin A</td>
<td>IU</td>
<td>5,916.4</td>
<td>3,574.6</td>
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<tr>
<td>Thiamin</td>
<td>mg</td>
<td>1.5</td>
<td>.4</td>
<td>1.7</td>
</tr>
<tr>
<td>Riboflavin</td>
<td>mg</td>
<td>2.3</td>
<td>.7</td>
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<tr>
<td>Niacin</td>
<td>mg</td>
<td>17.6</td>
<td>4.0</td>
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<td>Vitamin C</td>
<td>mg</td>
<td>96.2</td>
<td>56.2</td>
<td>135.0</td>
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</table>
VALIDATION OF ELEMENTARY STUDENTS’ FOOD INTAKE PERFORMANCE DEVICE

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ABSTRACT

Need for devices to evaluate elementary children's food behaviors has been documented. A performance device, What I Usually Eat (National Dairy Council and Iowa State University, 1980), has been developed to assess children's food intake. The objective of this study was to establish criterion-related validity for the device. The standard used to determine dietary adequacy was the Basic Four Food Groups. Sample consisted of 67 fourth and sixth grade students and their parents. Use of orthogonal comparisons calculated by t-tests revealed a significant difference between parent-child means for the fruit/vegetable group. Orthogonal comparisons between parent and child device scores and parent-child/reported intake scores showed that children were more accurate than their parents when using the device. The fact that foods selected on the performance device reflected reported food consumption patterns provided evidence of criterion-related validity. The device provides one report of what children eat. It is quickly administered and scored and more economical to use than other intake assessment methods. Through use of this evaluation device as a measure of group food intake, teachers can plan instructional strategies to influence children's eating behavior.
INTRODUCTION.

Nutrition educators are becoming increasingly aware of the need for improved nutritional practices in the United States. Three major surveys authorized by the U.S. Congress have provided evidence of this need. The surveys were the 1968-1970 Ten-State Nutrition Survey (U.S. Department of Health, Education, and Welfare (USDHEW), 1972), the 1971-1972 Health and Nutrition Examination Survey (HANES) (USDHEW, 1973), and the Nationwide Food Consumption Survey (NFCS) of 1977-1978 (U.S. Department of Agriculture (USDA), 1980).

Findings of nutrient insufficiencies in children varied with each survey. Results of the Ten-State Nutrition Survey, based primarily on a low income sample, indicated low iron, vitamin A, vitamin C, and riboflavin intakes. HANES provided evidence of possible protein, iron, vitamins A, C, and D, thiamin, calcium, phosphorus, and iodine deficiencies, particularly among Black and Spanish-speaking American populations. The NFCS provided evidence that many age-sex groups, including children 9 to 14 years old, were below the 1980 Recommended Dietary Allowances (RDA) for calcium, iron, magnesium, and vitamin B₆. These dietary allowances were formulated by the Food and Nutrition Board of the National Research Council.

According to Latham (1973), smaller studies of specific population groups indicated similar nutrient deficiencies. Most frequently noted deficiencies were low intake of protein, iron, vitamins A and C, and riboflavin.
Nutrition professionals have recognized the relationship of diet to health and disease. Health maintenance is important and disease-related nutrient deficiencies have been found in certain segments of our population, including school-age children. Health professionals, therefore, are recommending nutrition education for children. One of the current barriers preventing the provision of pertinent food guidance to children is lack of easily used methods to assess their food intake.

A review of past studies shows that most available dietary data on children have been collected by adults. Marr (1971) stated that the traditionally used 24-hour recalls, food records, and diet histories do not work well with children. The children fail to accurately recall foods eaten or are unable to estimate portion sizes. Other studies substantiate this failure to remember all foods eaten. More complete 24-hour food recalls will be provided when telling children in advance when the recalls will be done according to Beal (1967). The recall will then become more than a test of memory.

In a comparison of dietary intake methods that included upper elementary students, Young, Hagan, Tucker, and Foster (1952) found the 7-day food record and the 24-hour recall tended to give approximately the same estimates for dietary intake of most nutrients. This conclusion was based upon a group of roughly 50 persons allowing for an error of 10%.

Because most dietary data on children have been collected by adults, often through use of expensive and time consuming methods,
there is a need for a more economical, efficient, and accurate method
to collect children's food intake data. Devices to be used by children
to determine their own food intake are lacking according to Cooper
and Go (1976), who conducted an analysis of elementary and secondary
school nutrition guides. They found a need for evaluation procedures
to inform teachers of their success and to identify instructional
needs of children.

To meet this need, an evaluation tool was developed as a performance
device. The performance device, named What I Usually Eat (National
Dairy Council (NDC) and Iowa State University (ISU), 1980), allows
third to sixth grade students to select foods they would eat in a
typical day.

In earlier testing of the device (NDC and ISU, 1980), it was
found that children selected foods reflecting typical menu patterns
in the United States. Caloric consumption for the foods selected by
these children was within the range suggested for their age-sex
groups defined in the RDA. This evidence suggested that the children
were selecting the foods they actually eat when responding to the
device.

A more rigorous validation was needed to determine if there were
differences between device scores and actual food consumption based
upon the mean intake scores from 7-day food records. Therefore, the
purpose of this study was to compare fourth and sixth grade students'
device scores, their parents' device scores, and the 7-day mean intake
scores and to use these results if not significant for evidence of the criterion-related validity of the device.
Validity indicates the degree to which a device is capable of measuring what it was designed to measure. Criterion-related validity is evaluated by determining the extent to which device scores reflect a similar performance on some external measure. A procedure for investigation of criterion-related validity is to compare device scores with actual behavior. Evidence of the validity of What I Usually Eat was obtained by comparing student and parent responses to the performance device and by comparing these responses to 7-day food records kept by each parent.

A total of 273 letters explaining the study was sent home with students in selected fourth and sixth grades in each of three elementary schools in southwestern Michigan. The 79 parents who agreed to keep the 7-day food record of their children's food intake were contacted by telephone. Personal interviews were scheduled during the week their children responded to the device.

All students whose parents agreed to participate in the study responded to What I Usually Eat at school. The device utilized visual aids to simulate the experience of selecting the foods to be eaten throughout a day. Eight foods representing each of the Basic Four Food Groups plus eight foods not contributing significantly to any of the four food groups were selected for display on the cards. The foods not making significant nutrient contributions were designated as other. The students responded to the device by selecting from the 40 food cards displayed on a pegged board those foods that were
representative of what they would typically eat and drink in one day (Figure 1). They placed the food cards on the pictorial representation of a day to indicate approximate time of day the food was eaten.

The cards were turned over and sorted by groups according to the food group label on the back of each card. Size of serving for each food is also printed there. The number of servings per food groups was totaled. Each student's score was recorded on individual score sheets.

Dietary adequacy was determined using the Daily Food Guide (USDA, 1979) as the standard. The Daily Food Guide, commonly known in abbreviated form as the Basic Four Food Groups, offers recommendations for the kinds and amounts of food that should be selected daily in order to provide the foundation for a nutritious diet and to approach recommended nutrient needs. The pattern defined by the students' total scores for each food group was then compared to the Basic Four Food Group recommendations for nutritional adequacy.

Sample

Age range of the 67 students who participated in the study was from 9 years and 2 months to 13 years and 3 months. Forty-five percent of the students were male. Multi-racial backgrounds were
represented; 33% of the students were minorities and 67% were white. Families represented low, middle, and high economic levels.

One parent of each student participated in an interview that took approximately 1 hour. These interviews were conducted either at home or at the child's elementary school according to parental preference. Children's schools were selected as the interview site by 42% of the parents.

During the interview, the device was explained and the parents were asked to select the foods their children would eat in a typical day. A set of directions for recording the child's food intake by meal and a completed 1-day sample food record were discussed and given to each parent. Parents were encouraged to prepare and serve meals and snacks as they ordinarily did. Atypical eating patterns that might occur, such as when a friend stays overnight, were to be recorded.

Food models, constructed after guidelines described by Moore, Judlin, and Kennemur (1967), were shown to each parent. These models were used in an attempt to improve quantitative data.

Food volume was represented by selected models. Liquids in glasses were represented by plaster of Paris in amounts of one-half, one, and one and one-half cups. Cooked food amounts were illustrated by piles of rice molded together with paraffin; models representing one-half, three-fourths, one, and one and one-half cups were used. Sugar, other sweeteners, and fats were illustrated by uncooked grits molded together with paraffin; models representing a level and a heaped teaspoon and tablespoon were used. A 3-ounce hamburger patty,
a 1-ounce slice of cheese, and a pat of butter were presented as styrofoam models. An average-sized serving of fresh fruits and vegetables was represented by a medium-sized apple.

Parents were asked to keep a 7-day record of their children's food intake by meal. Blank forms that included space for recording food item and description, amount eaten, and time of day the food was eaten were given to each parent. To facilitate return of the food records, each family was provided with a stamped, self-addressed envelope. If completed food records were not received within 12 days after the interview, follow-up telephone calls were made. The incentive gift, a cookbook, shown to the parents during the interviews, was mailed to each participating family when the completed food records were received.

**Data Analysis**

The reported mean dietary intake of each child was calculated by food group from the individual 7-day food records. The standard used was the Basic Four Food Groups. Daily intake recommendations for children include the following food groups and servings: milk, three or more; meat, two or more; fruit/vegetables, four or more; and bread/cereal, four or more.

Using these intake scores and the students' and parents' device scores as sources of variance, a randomized-block analysis of variance (ANOVA) was calculated by food group. Sources of variance were block (individual children) and respondent type (parent, child, reported). This design was selected to eliminate differences in food consumption
by individual children from the sources of variance of primary interest (respondent type).

Orthogonal comparisons were made between parent response and child response and between parent-child response and reported intake. These comparisons were calculated using t-tests.

The frequency of students' and parents' selections for each food on the device was tabulated. These frequencies were converted to percentages.
FINDINGS AND DISCUSSION

Evidence of criterion-related validity for What I Usually Eat was evaluated by studying the F-ratios for respondent type (Table 3). Examination of the F-ratios revealed a significant difference only for the fruit/vegetable food group.

Sources of differences were identified by inspecting the t-test values. Significant differences were found for the t-tests on parent-child/reported comparisons for milk, meat, fruit/vegetable, grain, and other. Examination of mean scores in Table 4 revealed that child scores on the device were closer to reported intake scores than parent device scores. While not significantly different, a comparison of the means indicated that children's device selections are in agreement with reports of what they ate.

What I Usually Eat provides information about the food intake of children. Children were low in fruit/vegetable intake, and this was reflected by their device scores. The children were more accurate in estimating reported intake than their parents in the critical areas of fruit/vegetable and milk consumption.
Collectively, these results demonstrate that for assessment of groups of children, responses to What I Usually Eat represent reported food intake of children. Hence, What I Usually Eat has the desired measurement characteristic of criterion-related validity.

A preliminary criterion-related validation of the device was conducted with third through sixth grade students by Fanslow, Pease, Njus, and Brun (Note 1). Device selections were compared with foods traditionally eaten in the United States and reflected typical food consumption patterns. Mean caloric values of foods selected on the device were compared to the RDA caloric recommendations by age-sex groups. Caloric consumption was in the recommended range but lower than mean RDA. These findings augment the Fanslow et al. study by demonstrating more rigorously that the device does have criterion-related validity.

Food Selections on Performance Device

Parents' device selections differed somewhat from the selections of their children as shown in Table 5. Only those foods that were reported by 20% or more of the students and/or parents for each meal are presented.

Insert Table 5 about here.
Breakfast choices were identical and varied only in percentage of selection. More parents than children selected meat-group foods for lunch and dinner. Children favored potato chips more heavily for lunch and snacks than did parents. Fruit was selected frequently for breakfast, lunch, and snacks, but not for dinner. Vegetables were selected more often for dinner than any other meal.

Parents' device selections reflected more nutrient-dense snack foods than their children's selections. Children's selections contain more sweeteners.

Because the meal patterns that emerged from both children's and parents' device selections are similar to other research (Pao & Mickle, Note 2; and Brown, Bergan, & Murgo, 1979), it appears that respondents were truthful in their selections. The fact that these device selections reflect typical food consumption patterns provided additional evidence of validity.
SUMMARY

What I Usually Eat provides one quickly, efficiently administered report of what elementary children eat. Further, this study demonstrates that the device has the measurement characteristic of criterion-related validity; a characteristic that is seldom validated for performance devices.

Because the device can be used to assess food intake behavior for groups of children, teachers can discover what groups of food are eaten less frequently than is recommended. Classroom activities stressing these foods and the body’s need for them can be provided. Teaching to these needs can improve the nutritional status and future health of children.


Table 3. F-ratios and t-tests by food group

<table>
<thead>
<tr>
<th>Food group</th>
<th>F-ratio</th>
<th>Parent-child</th>
<th>t-tests</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Respondent type</td>
<td></td>
<td>Parent-child/report</td>
</tr>
<tr>
<td>Milk</td>
<td>2.82</td>
<td>1.70</td>
<td>4.42*</td>
</tr>
<tr>
<td>Meat</td>
<td>2.32</td>
<td>.30</td>
<td>4.53*</td>
</tr>
<tr>
<td>Fruits/vegetables</td>
<td>3.14*</td>
<td>3.59*</td>
<td>3.76*</td>
</tr>
<tr>
<td>Grain</td>
<td>1.99</td>
<td>1.15</td>
<td>2.56*</td>
</tr>
<tr>
<td>Other</td>
<td>1.31</td>
<td>1.69</td>
<td>4.66*</td>
</tr>
</tbody>
</table>

*aSample size per group for parent, child/report: n = 67.

*p < .05.
Table 4. Mean servings by food group and response type<sup>a</sup>

<table>
<thead>
<tr>
<th>Food group</th>
<th>Child Mean</th>
<th>Child SD</th>
<th>Parent Mean</th>
<th>Parent SD</th>
<th>Report Mean</th>
<th>Report SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk</td>
<td>2.9</td>
<td>1.2</td>
<td>3.1</td>
<td>1.1</td>
<td>2.4</td>
<td>1.0</td>
</tr>
<tr>
<td>Meat</td>
<td>2.0</td>
<td>0.7</td>
<td>2.0</td>
<td>0.7</td>
<td>2.4</td>
<td>0.7</td>
</tr>
<tr>
<td>Fruits/vegetables</td>
<td>3.6</td>
<td>1.6</td>
<td>4.3</td>
<td>1.4</td>
<td>3.3</td>
<td>1.4</td>
</tr>
<tr>
<td>Grain</td>
<td>4.4</td>
<td>1.4</td>
<td>4.1</td>
<td>1.2</td>
<td>4.7</td>
<td>1.5</td>
</tr>
<tr>
<td>Other</td>
<td>3.6</td>
<td>2.0</td>
<td>3.1</td>
<td>1.8</td>
<td>4.6</td>
<td>1.8</td>
</tr>
</tbody>
</table>

<sup>a</sup><sub>n = 67 per response type.</sub>
Table 5. Foods most commonly selected by meal and by percentage of children and parents

<table>
<thead>
<tr>
<th>Food</th>
<th>Breakfast</th>
<th>Lunch</th>
<th>Dinner</th>
<th>Snacks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Child</td>
<td>Parent</td>
<td>Child</td>
<td>Parent</td>
</tr>
<tr>
<td>Apple</td>
<td>--</td>
<td>--</td>
<td>30b</td>
<td>43</td>
</tr>
<tr>
<td>Bread</td>
<td>57</td>
<td>58</td>
<td>64</td>
<td>55</td>
</tr>
<tr>
<td>Broccoli</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Butter</td>
<td>33</td>
<td>34</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Candy bar</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Carrots</td>
<td>--</td>
<td>--</td>
<td>24</td>
<td>20</td>
</tr>
<tr>
<td>Cheese</td>
<td>--</td>
<td>--</td>
<td>12</td>
<td>21</td>
</tr>
<tr>
<td>Chicken</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Cookies</td>
<td>--</td>
<td>--</td>
<td>13</td>
<td>24</td>
</tr>
<tr>
<td>Egg</td>
<td>31</td>
<td>24</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Green beans</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Ham</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Hamburger</td>
<td>--</td>
<td>--</td>
<td>21</td>
<td>27</td>
</tr>
<tr>
<td>Ice cream</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Milk</td>
<td>55</td>
<td>63</td>
<td>48</td>
<td>61</td>
</tr>
<tr>
<td>Orange juice</td>
<td>70</td>
<td>66</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Peanut butter</td>
<td>--</td>
<td>--</td>
<td>19</td>
<td>25</td>
</tr>
<tr>
<td>Popcorn</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Potato</td>
<td>--</td>
<td>--</td>
<td>40</td>
<td>28</td>
</tr>
<tr>
<td>Potato chips</td>
<td>--</td>
<td>--</td>
<td>40</td>
<td>28</td>
</tr>
<tr>
<td>Ready-to-eat cereal</td>
<td>66</td>
<td>57</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Roll</td>
<td>--</td>
<td>--</td>
<td>25</td>
<td>19</td>
</tr>
<tr>
<td>Soda pop</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

Numbers in this table are percentages of the total sample of children (n = 67) and of parents (n = 67).

Only foods selected by 20% or more of the children and/or parents for a meal are reported.
Figure 1. Illustration of performance device
SUMMARY AND RECOMMENDATIONS

Summary

Implementation of this study was organized around two major purposes. These purposes were to (1) describe nutrient intake of upper elementary children by age and sex and (2) validate the performance device, What I Usually Eat. This device was developed as an alternative method for estimating children's food intake.

Most food intake data on children have been collected by adults according to a review of previous studies. Parents are not always willing to keep records on children's food intake for use at school. Food records, 24-hour food recalls, and diet histories frequently have been unsuccessful when used with children. Because it is difficult to obtain information on children's food intake, a need existed for a device that is efficiently used and scored to assess children's food intake behaviors.

What I Usually Eat was designed to meet this need. The device contains 40 commonly eaten foods displayed on cards on a board. Students are asked to select from these cards, representing foods from each of the Basic Four Food Groups and a group of low-nutrient density foods, what they eat in a typical day. These food cards are placed on a pictorial representation of a day indicating the approximate time the food is eaten. Serving sizes indicated on the back of each card are totaled by food group, and these selections are compared to the Basic Four Food Group recommendations for nutritional adequacy.
In order to determine usability and clarity of data gathering methods, a pilot test (Appendix A) was conducted in Fall 1980. Results of the pilot test showed the data collecting methods were usable but that some parents were uncomfortable with home interviews. Therefore, parents participating in the study were given the option of a home or school interview site.

Field testing began during February 1981 in two elementary schools located in southwestern Michigan. A letter explaining the project and permission slips (Appendix B) were sent home with 110 fourth and 163 sixth graders. After parental permission was received, the performance device was administered to the 67 participating children at their schools. Two-thirds of the students were white and one-third were minorities. Fifty-five percent of the students were female.

Parents were contacted by telephone and an interview was arranged. The child's elementary school was selected as the interview site by 42% of the parents.

During the 1-hour parental interview, directions for recording each child's food by meal and a completed 1-day sample record (Appendix C) were given to each parent. In an attempt to improve quantitative data, a set of food models was shown to every parent. The importance of accurate measuring and reporting of food eaten was emphasized.

A set of blank food record forms shown in Appendix C was given to each parent. Parents were asked to record their children's intake by meal for 7 days including name of food item and description, amount eaten, time of day, and selected demographic data. Parents were
given a stamped, self-addressed envelope for use in returning completed
food records.

Dietary information provided by the food records was summarized. Average daily intakes of the following nutrients were calculated for three age-sex groups: calories, protein, fat, carbohydrate, calcium, iron, vitamin A, thiamin, riboflavin, niacin, and vitamin C. The age-sex groups were composed of children, 7-10 years; females, 11-14 years; and males, 11-14 years. The 1980 Recommended Dietary Allowances were used as the standard when evaluating nutrient intakes for each age-sex group.

Using the individual 7-day food records, the mean dietary intake of each child was calculated by food group from the individual 7-day food records. The standard used was the Basic Four Food Groups.

A two-way ANOVA was calculated by food group using number of food group servings. Sources of variance were: respondents and respondent types (parent response, child response, reported food intake). Orthogonal comparisons were calculated by t-test between parent-child scores and parent-child/reported intake scores.

Students' and parents' device selections for each food were computed. The totals were converted to percentages.

Analysis of 7-day food intake records showed that most students had an adequate diet. When assessing adequacy of the students' nutrient intake, diets were considered low if they contained less than 67% of the RDA for that nutrient. Carbohydrate, iron, and calcium were the nutrients with the largest number of students in the less than 67% of
the RDA category. All students had intakes of the B vitamins in the 67% of the RDA or above category. Only 8% of the children were in the less than 67% of the RDA category for vitamin C intake. Each subject was obtaining 100% of the RDA for protein and vitamin A.

Analysis of the foods eaten during the 7-day recording period indicated that meal patterns differ from snack patterns. During meals more meat-group foods, milk, bread, and fruit were consumed. Snack items mainly consisted of dessert, candy, and a beverage other than milk. Substantial amounts of sugar are found in these snack items.

The children's 7-day dietary intake data are more detailed than most other studies. One useful benchmark in nutritional studies is provided from this information.

Validation of What I Usually Eat was based on comparison of the means from 7-day food intake reports and parent and student device scores. Using t-test calculations, parent and child device scores were in agreement for the milk, meat, grain, and other food groups.

Significant differences were found between parent-child/reported for all food groups. A comparison of the means indicated that children's device selections, though not significantly different, are similar to reports of what they ate. These results demonstrated that the device has the desired measurement characteristic of criterion-related validity.

Parents and children selected identical foods from the device for breakfast. Foods selected by both groups were similar for lunch, dinner, and snacks. Parental selections tended toward more nutrient-dense foods than the children's selections.
The performance device is quickly administered and easily scored. It is more efficient and economical to use in the classroom than other intake assessment methods. The device provides a basic food intake pattern for a group of children. Assessment of this pattern will enable teachers to plan nutrition units compatible with student needs.

Recommendations

Recommendations based on the results of the study are organized into two categories: changes to be made if the study were replicated and suggestions for further studies. The recommendations related to these topics follow.

Several changes could be made in a study of this type, particularly if more funds and data collecting resources were available. One change would be to increase sample size using more fourth and sixth grade students and/or to sample third and fifth grade students. It was more difficult to obtain cooperation from sixth grade students than from fourth grade students. A total of 163 letters was sent home with six sections of sixth graders in order to obtain 30 students and parents willing to participate. Only four sections of fourth graders were used with a total of 110 letters sent home.

Collecting data during different seasons of the year might indicate if there are actually seasonal changes in food intake behaviors. One food group where consumption might be altered is the fruit/vegetable group.

Another change would be to provide each parent with an inexpensive gram scale to weigh portion sizes. This would increase uniformity
when determining actual serving sizes, particularly for meat, fish, and poultry.

Based on the findings of the present study, the following types of studies are recommended. Previous studies suggested that certain social factors may influence what is reported during food intake data collection. These social factors were not identified. A study to determine what factors influenced respondents to select higher values on the device for milk and fruit/vegetable intake than actual intake could provide insight into food intake record keeping.

New or previously collected 7-day food intake data could be used to determine if respondents fabricate the food intake rather than record actual intake toward the end of the recording period. Identification of the time when fabricating begins would indicate when record keeping becomes ineffective.
REFERENCE NOTES


REFERENCES


ACKNOWLEDGEMENTS

I wish to express my appreciation to Dr. Alyce Fanslow, my major professor, for her continual encouragement, rapid responses, and constructive guidance during my doctoral program. Appreciation is also expressed to Dr. Jerelyn Schultz, Dr. Damaris Pease, Dr. Anton Netusil, and Dr. William S. Runyan, who have each contributed in their own special way to the completion of my doctoral program, while serving as members of my committee.

I want to express a special and appreciative thank you to my husband, Jim, who has offered long-term patience, support, and encouragement in numerous ways. He also served as my private consultant and assisted in the reproduction of the data collection materials.

Diane, Andrew, and Jill, my three children, have provided skills and energy in the operation of our household. Gratitude is expressed to them.

It is impossible to list all members of my family and my friends who have contributed to my attainment of this goal. I do want to recognize my parents, Glen and Mildred Bennington, and my friends, Margaret and Jim Torrie, for their continual support of my educational endeavors.
APPENDIX A. DATA COLLECTION METHODS: AN EXPLANATION

This study has been conducted in conjunction with an Iowa State University and National Dairy Council study. The Dairy Council of Michigan is an affiliate of the National Dairy Council. In early September 1980, the Dairy Council of Michigan area representative was contacted as a resource person to provide names of elementary principals who might be willing to have their students participate in the pilot or field testing for a study validating the food intake device, What I Usually Eat, and collecting food intake data on children. The names of principals and their schools were provided as needed during the study.

One elementary school near Kalamazoo, Michigan, was selected to be used for pilot testing in early October. Tentative selection of two other Kalamazoo elementary schools to be used in the field test was made in late December 1980. Teachers in these schools had received in-service training in the use of Food ... Your Choice: A Nutrition Learning System (National Dairy Council, 1977). Food ... Your Choice is a major curricular work designed to provide information to elementary students that will enable and encourage them in the establishment and maintenance of lifelong healthful dietary habits.

A meeting was arranged with the elementary principal in late September prior to the pilot testing. During this meeting, the basic objectives of the study were explained. One objective of the study was to describe the nutrient intake of the students by age and sex. The second purpose was to validate a performance device, What I
**Usually Eat**, to be used as an alternative method by teachers to assess the food intake of elementary students. The device was demonstrated to the principal during this meeting.

The extent of teacher, student, and parent involvement in the study was discussed. Teacher cooperation was needed in two areas. One area was handing out the parental cover letters and permission slips (Appendix B) and encouraging the students to return them. The second responsibility was selecting a time during class when the students could respond to the performance device that was administered by the researcher.

There were two major areas of student participation. The first was to take home and return the cover letter and permission slip. If the parents granted permission for their child to participate in the study, approximately 20 minutes of the child's time was needed when the device was administered.

Participating in a 1-hour interview was the first commitment of each parent. The second commitment was keeping a 7-day food intake record on the child.

After the principal decided the fourth grade students could participate in the study, the project was explained to the teacher. Dates for delivering the cover letter and permission slip were set. At the time the permission slips were picked up from the teacher, arrangements were made to administer the device to the students.

Twenty-four letters were sent home. Eight parents signed the permission slips and agreed to participate in the study.
Parent interviews were arranged by telephone and were scheduled as closely as possible to the time the children were participating in the study at school. Parents appeared more likely to keep their scheduled appointments if the children had completed the device prior to the interview. All pilot test interviews with the parents were conducted at their homes.

A basic interview schedule was developed and followed. After preliminary getting acquainted remarks, which included something positive about the child, the parent was asked to select from the performance device foods the child would eat in a typical day. While the device scores were being recorded, the parent looked at the incentive gift, a cookbook, that would be mailed to the family after the 7-day food records were returned.

Each parent received a set of directions (see Appendix C) with suggestions for recording the child's food intake. These directions were discussed and questions were answered. The need for accuracy was emphasized.

Food models were shown to each parent in an attempt to improve quantitative data. These models were constructed after guidelines by Moore, Judlin, and Kennemur (1967).

Volume of foods was represented by various models. Cooked food was represented by piles of rice molded together with paraffin; models representing one-half, three-fourths, one, and one and one-half cups were used. Liquid food was represented using glasses in graduated sizes; one-half, one, and one and one-half cups were used. Plaster of
Paris was used to illustrate these liquid amounts in the glasses. Cooked hamburger patties (3-oz.), cheese slices (1-oz.), and butter (1 pat) were represented by styrofoam models. An apple (medium-sized) was used to illustrate the size of a variety of fresh fruits and vegetables. Sugar, other sweeteners, and fats were illustrated by uncooked grits molded together with paraffin; models representing a level and a heaped teaspoon and tablespoon were used.

A completed food record form was used to illustrate how the records were to be kept. Ten blank record forms, as shown in Appendix C, were given to each parent. They were asked to record the child's name, the day and date, the food eaten with a brief description, the amount of food eaten, and the time of day the food was eaten. Parents were encouraged to continue keeping records even if they missed one or two days of recording. Each parent was given a stamped, self-addressed envelope to be used for returning the completed 7-day food records. Before the conclusion of the interview, each parent was given the opportunity to ask additional questions.

During the pilot test, 50% of the parents commented that they would have preferred to come to the child's school for the interviews. These parents stated they would have felt more comfortable at the school because they were concerned the interviewer might be judgmental about their home environment. As a result of these comments, parents who participated in the field testing were given the option of home or school site interviews.
Preliminary steps for field testing began in early January 1981. A letter written by the researcher explaining the project and seeking consent to conduct the study was sent to the Director of Special Projects in the Kalamazoo School District. (See Appendix D.) Two elementary school principals were contacted by telephone and arrangements were made to meet each principal at his convenience and explain the study.

After the study was described, each principal selected a fourth and sixth grade teacher whom they believed would be cooperative, had an interest in nutrition, and who had taught units in nutrition education. The study was explained to each teacher and their agreement to cooperate was obtained.

In order to obtain the desired number of subjects, a minimum of 30 per grade, cooperation was later sought from five other teachers before the study was completed. A total of 110 letters was sent to four sections of fourth graders; 163 letters were sent home with six sections of sixth graders. From this number, 79 parents agreed to participate in the study. The device was administered to the first group of students in early February.

The fourth grade children were particularly enthusiastic and encouraged their parents to participate. In five cases, the parents signed the permission slip so the child could participate at school when the device was administered, and then refused to be interviewed.

Parent interviews were arranged by telephone and conducted using the format described during pilot testing. These interviews began in
early February. The 42% of the parents who preferred home interviews often had preschool children or were baby-sitting. In several cases they didn't have a car or other transportation to the school.

The principals selected a room in their schools that could be used for the interviews. Location of this site was explained in the cover letter. Parents who selected the school interview site were often on their way to or from work.

Three interviews were conducted at the parents' place of work and two were conducted at a fast-food restaurant near their homes. Four fathers and 75 mothers were interviewed. Most interviews were conducted during the work week from 9 a.m. to 5 p.m. Because many mothers worked outside the home, some Saturday and evening interviews were scheduled.

Approximately one-fifth of the interviews had to be rescheduled. Reasons for rescheduling included school cancellations due to snow, sick children at home, parental illness, and parental forgetfulness.

Follow-up telephone calls were made if completed food records were not received in 12 days after the interview. These calls were made in 60% of the cases. A second call was necessary in 20% of the cases. Several food records were picked up directly from the parent when it appeared the records were not going to be mailed. Their incentive gift, a cookbook, was delivered at the time the food records were picked up. Other cookbooks were mailed within two days after the food records were received. All food records were received by early April.
As the food records were returned, the foods eaten by the children were coded according to Home and Garden Bulletin No. 72 (U.S. Department of Agriculture, Agricultural Research Service, 1977). Daily intake by food group was determined and the 7-day reported mean intake was calculated.

All participating teachers, school assistants, and principals who cooperated in the study received a cookbook. Thank you telephone calls were made to the principals after all data were collected.
APPENDIX B. COVER LETTER AND PERMISSION SLIP
March, 1981

Dear Parent/Guardian:

Your daughter/son will soon have the opportunity to play a nutrition game. The game, called "What I Usually Eat", allows a child to select types of food actually eaten in a typical day. Approximately twenty minutes of your child's time will be required during one school day. Information obtained from the game will help teachers determine what children need to know to select healthful foods.

During the week your child completes the game, we would like to personally interview you. At that time we would like you to respond to the game, to provide some information about your family, and to receive instructions for keeping a food intake record on your child. This involves recording everything your child eats and drinks for a week. The interview takes about one hour.

After the completed food record is received, a copy of the American Dairy Association's cookbook, Mealtime Mastery, will be mailed to you. This cookbook contains many delicious recipes and has numerous pictures of attractively photographed foods.

Responses for you and your child will be kept anonymous and confidential. While your child is under no obligations to participate, we urge you to grant permission because there will be opportunities to learn about food selection as it contributes to health. We have found that the game is so much fun, children who do not have the opportunity to play feel left out. The development of the game is sponsored by the National Dairy Council and Iowa State University. The Dairy Council of Michigan is assisting with the project. Janis Van Buren is coordinating the project in the Kalamazoo area. If you have any questions concerning the project, please call Janis at 731-5710.

Please have your child return the enclosed permission slip to the teacher by Friday. Your child will then be able to participate in this fun, exciting, and educational project! If you wish to participate, please include your phone number and the time(s) it would be most convenient for you to receive a phone call for the purpose of arranging the interview. I will come to your home for the interview, or if you prefer, I will meet you at the Media Center at Northeastern Elementary School, at your convenience during the day.

Sincerely,

Joan Baber,  
Senior Program Director

Janis Van Buren, Project Coordinator

Enclosure (1)
Permission Slip

__________________________________________ may respond to "What I
Child's Name
Usually Eat" and one parent/guardian will complete the interview and
child's food records.

__________________________________________
Signature of Parent/Guardian

__________________________________________
Home Phone Number

The best time(s) to call is ________________________________
(Date and Time)

__________________________________________
(Date and Time)
APPENDIX C. MATERIALS FOR RECORDING FOOD INTAKE
89

DIRECTIONS FOR RECORDING CHILD'S

FOOD INTAKE

1. PLEASE PREPARE AND SERVE MEALS AND SNACKS AS YOU DO ORDINARILY.

2. Write down everything the child eats and drinks each day for one week. Be sure to include snacks. If child eats school lunch, it may be necessary to ask child what was served and the estimated amount eaten.

Use the food intake record forms provided. Write down child's name, the day, and date, and other information requested on each sheet.

Please make a note on the food record form if anything unusual, such as illness or an accident, occurs influencing child's eating pattern and continue to record.

Your completed food intake for each daily record should look like the sample copy if properly done.

3. Describe foods eaten as accurately as you can. Use brand names to clarify descriptions. For example:

Fruit juice: Orange, grape, tomato, grapefruit, V-8; frozen and reconstituted, canned (Hi-C), fresh, reconstituted powder (Tang)
Cereal: Oatmeal, wheaties, cheerios; cooked, dry, ready-to-eat; with sugar added, granulated, brown; with milk
Bread or toast: White, whole wheat, cracked wheat, rye, special brand (Roman Meal), or homemade; dry or with butter, margarine (stick or soft), jam or jelly (grape, cherry, apricot; homemade or purchased)
Milk: Whole, skim, 2 percent, reconstituted nonfat dry milk, buttermilk.
Coffee or tea: Black, with cream (half and half, Coffee Mate) or sugar.
Mixed dishes: Give name of dish or casserole (chicken salad, vegetable beef soup, etc.) and ingredients used in the recipe (cubed chicken, diced celery, pickle relish, salad dressing) or if purchased. Indicate if condensed soup was diluted with milk or water.
Fruits and vegetables: Raw or fresh, canned, frozen; plain or with butter, margarine, white or cheese sauce.
Meats: Fried, breaded, broiled, baked.
4. Estimate amounts eaten as carefully as you can and record amounts in household measures as suggested below. (Food models may help you estimate amounts eaten.)

<table>
<thead>
<tr>
<th>Household Measures</th>
<th>Abbreviations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beverages (fruitjuice, milk, cocoa, tea, coffee, etc.)</td>
<td>cups (measuring cup)</td>
</tr>
<tr>
<td>Breakfast cereals (cornflakes, cheerios, etc.)</td>
<td>&quot;</td>
</tr>
<tr>
<td>Cooked vegetables, canned fruits</td>
<td>&quot;</td>
</tr>
<tr>
<td>Carbonated drinks (coca-cola, 7-up, etc.) in bottles</td>
<td>8-ounce; 12-ounce; 16-ounce</td>
</tr>
<tr>
<td>Meats, cheese</td>
<td>ounces</td>
</tr>
<tr>
<td>Packaged sliced luncheon meats or cheese</td>
<td>&quot; (1 slice = 1 ounce)</td>
</tr>
<tr>
<td>Sugar, gravy in small amount</td>
<td>teaspoon</td>
</tr>
<tr>
<td>Margarine, butter</td>
<td>teaspoon</td>
</tr>
<tr>
<td>(1 pat = 1 teaspoon)</td>
<td>tablespoon</td>
</tr>
<tr>
<td>Grated cheese vegetables, canned fruits in small amounts</td>
<td>&quot;</td>
</tr>
<tr>
<td>Bread</td>
<td>slices</td>
</tr>
<tr>
<td>Rolls, cookies, crackers</td>
<td>small</td>
</tr>
<tr>
<td>medium</td>
<td>med.</td>
</tr>
<tr>
<td>large</td>
<td>lge.</td>
</tr>
<tr>
<td>Fresh fruits (apples, oranges, peas, etc.)</td>
<td>small, medium</td>
</tr>
<tr>
<td>large</td>
<td>&quot;</td>
</tr>
<tr>
<td>Boiled potato or sweet potato</td>
<td>&quot;</td>
</tr>
<tr>
<td>Cake</td>
<td>Inches</td>
</tr>
<tr>
<td>Example: 2 inches by 2 inches by 1\frac{1}{2} inches</td>
<td>&quot;</td>
</tr>
</tbody>
</table>
5. Record time of day when meal or snack was eaten.
6. If child is taking any vitamin or mineral pills, write down the kind taken and how often the child takes them.
7. Other tips for recording food intake include the following:
   a. Keep a set of measuring cups, measuring spoons, and a ruler handy.
   b. Measure amount of liquid the glasses and cups you use daily hold. This will help to eliminate measuring milk, juices, and other beverages each time they are served.
   c. Measure a teaspoon of butter or margarine and spread it on bread or toast. This will give you an idea of how much is actually used.
   d. When serving cake, measure length, width, and height of piece served.
   e. When serving pie, indicate number of wedges cut per pie and the size of the pie tin.
   f. When serving a mixture such as soup or a casserole, write the recipe if possible and indicate what portion of the mixture the child ate.
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<tr>
<td>(22-23)</td>
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<td></td>
</tr>
<tr>
<td>(24)</td>
<td>(25-30)</td>
<td>(31-34)</td>
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(RDA Group) (35-36)
<table>
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</tbody>
</table>

Is this typical of your normal eating pattern?  yes  no  (Specify)  
Has your diet changed recently?  yes  no  (Specify)  
Are you taking vitamins or minerals?  yes  no  (Specify kind and amount)
<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>22-23</td>
<td></td>
<td>(35-36)</td>
<td></td>
<td></td>
<td>orange juice, frozen, reconstituted</td>
<td>1/2 c.</td>
<td>7:00 a.m.</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>corn flakes</td>
<td>3/4 c.</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>with sugar, granulated</td>
<td>2 tsp.</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>milky, 2%</td>
<td>4 c.</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>toast, whole wheat</td>
<td>1 slice</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>with margarine, stick</td>
<td>1 tsp.</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>jelly, grape, bought</td>
<td>2 tsp.</td>
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</tr>
<tr>
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<td></td>
<td></td>
<td>milky, 2%</td>
<td>1 c.</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>tacos</td>
<td>1/2 shell</td>
<td>11:30 a.m.</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>with hamburger</td>
<td>1 oz.</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>cheddar cheese</td>
<td>1/2 oz.</td>
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<td></td>
<td></td>
<td>lettuce, shredded</td>
<td>2 tsp.</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>taco sauce</td>
<td>1 tsp.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>peach half canned</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>milky chocolate</td>
<td>1 c.</td>
<td></td>
</tr>
</tbody>
</table>

(OVER)
<table>
<thead>
<tr>
<th>Day Meal Code</th>
<th>Food Code</th>
<th>Size Code</th>
<th>Food Item and Description/Ingredients</th>
<th>Amount Eaten</th>
<th>Time of Day</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>apple crisp</td>
<td>1/2 c.</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>apple pie filling</td>
<td>3/4 c.</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>oatmeal, quick cooking</td>
<td>1/2 tsp.</td>
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<td></td>
<td></td>
<td></td>
<td>margarine</td>
<td>1 tsp.</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>sugar, granulated</td>
<td>1 tsp.</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>peanut butter cookies, homemade</td>
<td>2 oz.</td>
<td>4:00 p.m.</td>
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<td></td>
<td></td>
<td></td>
<td>milk</td>
<td>1 c.</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>chicken thigh &amp; drumstick</td>
<td>1</td>
<td>6:00 p.m.</td>
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<td></td>
<td></td>
<td></td>
<td>with barbecue sauce, bottled</td>
<td>3 thps.</td>
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<td></td>
<td></td>
<td></td>
<td>baked potato, medium</td>
<td>1</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>with chive dressing</td>
<td>2 thps.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>carrot, frozen &amp; cooked</td>
<td>1/2 c.</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>with margarine</td>
<td>1 tsp.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>lettuce, shredded</td>
<td>1/2 c.</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>olive oil, vinegar dressing, bottled</td>
<td>2 thps.</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>ice cream, vanilla</td>
<td>1 c.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>milk</td>
<td>1 c.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>potato chips</td>
<td>15 chips</td>
<td>8:30 p.m.</td>
</tr>
</tbody>
</table>

Is this typical of your normal eating pattern?  yes  no (Specify)
Has your diet changed recently?  yes  no (Specify)
Are you taking vitamins or minerals?  yes  no (Specify kind and amount)
I

6425 N. 37th Street
Richland, Michigan  49083
January 6, 1981

Mr. Henry Goodyn
Director of Special Projects
Kalamazoo Public Schools
1220 Howard Street
Kalamazoo, Michigan  49008

Dear Mr. Goodyn:

In response to our telephone conversation on January 5, 1981, I have prepared a brief description of the game that I will be asking the fourth and sixth grade students to play. The game called, What I Usually Eat, has been designed to determine a typical day's food intake of children in grades third through sixth. This game is a board showing 40 different foods, eight examples from each of the Basic Four Good Groups and eight from the "other" group, representing empty calories. The foods are represented by pictures drawn on small cards. Children respond by indicating the food choices they would make for one day by selecting the food cards and placing them on a place mat depicting morning, noon, and night. Student responses will be recorded and compared with parent responses to the game and to the food records the parent keeps of child's actual food intake. For the purposes of this research, children's and parents' responses will not be discussed or evaluated in their presence nor will the responses be discussed with anyone. It is our intent to make this a positive experience for all participants.

Pending your approval of this research, Mr. Christenson (Westwood) and Mr. Hill (Northeastern) have agreed to let me explain the project to them. It appears likely they will allow me to work in their schools. The objective is to have participation from 15 fourth and 15 sixth graders and their parents/guardians in each school for a total of 60 involved families.

I have enclosed a copy of the letter and permission slip to be sent home with the children explaining the project. If you have further questions, please call me at 731-5710.

Thank you for your assistance.

Sincerely,

Janis B. Van Buren, Coordinator