EFFECT OF FAMILY VERSUS CAFETERIA STYLE SCHOOL LUNCH SERVICE ON STUDENTS' FOOD PREFERENCES AND NUTRIENT INTAKES

by

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TABLE OF CONTENTS

Page

INTRODUCTION 1

REVIEW OF LITERATURE 3

Historical Background and Legislation 3

Food Delivery Systems 7

Serving Styles 8

Students' Food Preferences 10

Dietary Assessment of Elementary School Age Children 17

Methods of Assessment 17

Dietary Quality Scores 21

Scores Based on Food Groups 22

Scores Based on Nutrients 25

Dietary Studies of Elementary Children 30

National Studies 30

Other Studies 33

METHODOLOGY 41

School Selection 41

Approval and Consent 42

Menu Selection 43

Food Preference 45

Development of Instrument 45

Pilot Testing 45

Data Collection 45

Twenty-four Hour Dietary Recall Interviews 46

Selection of Equipment and Materials 46

Page

Development of Dietary Recall Procedures and Recording Forms 47

Interview Training 47

Data Collection 47

Data Analysis 49

Food Preference Evaluation 49

Twenty-four Hour Dietary Recall Interviews 49

RESULTS AND OISCUSSION 53

School Lunch Participation and Paying Status of Students 53

Food Preference 56

School Differences 56

School by Grade Differences 56

School by Sex Differences 60

School by Paying Status Differences 60

Twenty-four Hour Dietary Recall Interviews 62

Characteristics of Students 62

Percentages of Students Consuming and Not Consuming Meals 66

Sources of Meals 66

Energy and Nutrient Intakes 69

Percentages of the RDAs--School Differences 69

Total Day 69

Breakfast 74

Lunch 74

Dinner 78

Snacks 78

Summary of the Percentages of the RDAs--School Differences 78

Page

Percentages of the RDAs--School by Sex Differences 81

Total Day 81

Breakfast 85

Lunch 85

Dinner 85

Snacks 90

Summary of the Percentages of the RDAs--School by Sex Differences 90

Percentage of Kilocalories from Fat 90

Evaluation of Dietary Quality 93

SUMMARY 97

REFERENCES 99

ACKNOWLEDGMENTS 108

APPENDIXES 109

A. Project Approval and Consent Correspondence 110

B. Principals' and Teachers' Letters 116

C. Procedures and Forms for Food Evaluation 131

D. Procedures and Forms for Dietary Recall Interviews 140

E. Nutrient Analysis of Dietary Intakes and Percentages of the RDAs of Students from the On-Site Cafeteria Style School 155

F. Nutrient Analysis of Dietary Intakes of Students from the Satellite Family and Cafeteria Style Schools 165

LIST OF TABLES

Table		Page
1.	Schedule of Data Collection at Schools with Family Style and Cafeteria Style Food Service	44
2.	School Lunch Participation and Paying Status of Students with Family or Cafeteria Style Food Service on the Days of Data Collection	54
3.	Full Price Lunches and Approved Applications for Free and Reduced Priced School Lunches in Schools with Family Style and Cafeteria Style Food Service	55
4.	Analysis of Variance for Preference of School Lunch Items at Schools with Family or Cafeteria Style Food Service	57
5.	Least Square Means and Standard Errors for Preference Scores for School Lunch Items at Schools with Family or Cafeteria Style Service	59
6.	School Lunch Paying Status of Students at Schools with Family or Cafeteria Style Food Service Who Participated in Food Preference Evaluations and 24-Hour Dietary Recall Interviews	63
7.	Characteristics of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews	64
8.	Percentage of Students in Satellite Family Style Service and Cafeteria Style Service Schools Consuming Breakfast, Lunch, Dinner, Snacks, and Supplements on the Day of 24-Hour Dietary Recall Interviews	67
9.	Sources of Meals of Students in Satellite Family Style Service and Cafeteria Style Service Schools Who Participated in the 24-Hour Dietary Recall Interviews	68
10.	Recommended Dietary Allowances, 1980	70
11.	Means, Standard Errors and Coefficients of Variation for Percentages of Recommended Dietary Allowances for Total Day's Energy and Nutrient Intake, Excluding Supplements, of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews	71

Table Page

12. Means, Standard Errors and Coefficients of Variation for Percentages of Recommended Dietary Allowances for Total Day's Energy and Nutrient Intake, Including Supplements, of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews 72

13. Means, Standard Errors and Coefficients of Variation for Percentages of Recommended Dietary Allowances from Breakfast of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews 75

14. Means, Standard Errors and Coefficients of Variation for Percentages of Recommended Dietary Allowances from Lunch of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews 77

15. Means, Standard Errors and Coefficients of Variation for Percentages of Recommended Dietary Allowances from Dinner of Students at School with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews 79

16. Means, Standard Errors and Coefficients of Variation for Percentages of Recommended Dietary Allowances from Snacks of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews 80

17. Least Square Means and Standard Errors for Percentages of Recommended Dietary Allowances for Total Day by Sex of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews 82

18. Least Square Means and Standard Errors for Percentages of Recommended Dietary Allowances from Breakfast by Sex of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews 86

19. Least Square Means and Standard Errors for Percentages of Recommended Dietary Allowances from Lunch by Sex of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews 87

Table | Page

2D. Least Square Means and Standard Errors for Percentages of Recommended Dietary Allowances from Dinner by Sex of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews 88

21. Least Square Means and Standard Errors for Percentages of Recommended Dietary Allowances from Snacks by Sex of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews 91

22. Least Square Means, Standard Errors, and Coefficients of Variation for Percent Fat in Total Day's and Lunch Energy Intake by Sex of Students, Individual and Combined, at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews 92

23. Means, Standard Errors, and Coefficients of Variation of Mean Adequacy Ratios (MARs), Including and Excluding Supplements, by Sex of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews 94

24. Percentages of Students at Schools with Satellite Family or Cafeteria Style Food Service in Selected Ranges of Mean Adequacy Ratios (MARs) 96

25. Characteristics of Students at School with On-Site Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews 156

26. Percentage of Students at School with On-Site Cafeteria Style Food Service Consuming Breakfast, Lunch, Dinner, Snacks, and Supplements on Day of 24-Hour Dietary Recall Interviews 157

27. Sources of Meals of Students at School with On-Site Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews 158

28. Means, Standard Errors and Coefficients of Variation of Energy and Nutrient Intake for Total Day (Including and Excluding Supplements), Breakfast, Lunch, Dinner, and Snacks of Students at School with Dn-Site Cafeteria Style Food Preparation Who Participated in the 24-Hour Dietary Recall Interviews Including Menu 3 159

Table Page

29. Least Square Means and Standard Errors for Energy and Nutrient Intake for Total Day (Including and Excluding Supplement), Breakfast, Lunch, Dinner, and Snacks by Sex of Students at School with On-Site Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews Including Menu 3 160

3D. Means, Standard Errors and Coefficients of Variation for Percentage of the Recommended Dietary Allowance for Total Day (Including and Excluding Supplement) and by Meal for Students at School with Cafeteria Style, On-Site Food Preparation Who Participated in the 24-Hour Dietary Recall Interviews Including Menu 3 161

31. Least Square Means and Standard Errors for Percentages of the Recommended Dietary Allowances for Total Day (Including and Excluding Supplement) and by Meal and for Girls and Boys at School with On-Site Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews Including Menu 3 162

32. Least Square Means, Standard Errors and Coefficients of Variation for Percent Fat in Total Day's and Lunch Energy Intake by Sex of Students, Individual and Combined, at On-Site Cafeteria Style Food Service Who Participated in 24-Hour Dietary Recall Interviews 163

33. Means, Standard Errors and Coefficients of Variation of Mean Adequacy Ratios (MARs) and Percentages of Students in Selected MAR Ranges of Students at the On-Site Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews 164

34. Means, Standard Errors and Coefficients of Variation of Total Day's Energy and Nutrient Intake, Excluding Supplements, of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews 166

35. Means, Standard Errors and Coefficients of Variation of Total Day's Energy and Nutrient Intake, Including Supplements, of Students at School with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews 167

36. Means, Standard Errors and Coefficients of Variation of Energy and Nutrient Intake from Breakfast of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews 168

Table | Page

37. Means, Standard Errors and Coefficients of Variation of Energy and Nutrient Intake from Lunch of Students at Schools with Satellite Family and Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews 169

38. Means, Standard Errors and Coefficients of Variation of Energy and Nutrient Intake from Dinner of Students at Schools with Satellite Family and Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews 170

39. Means, Standard Errors and Coefficients of Variation of Energy and Nutrient Intake from Snacks of Students at Schools with Satellite Family and Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews 171

4D. Least Square Means and Standard Errors for Energy and Nutrient Intake, Including and Excluding Supplements, for the Total Day by Sex of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews 172

41. Least Square Means and Standard Errors for Energy and Nutrient Intake for Breakfast by Sex of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews 176

42. Least Square Means and Standard Errors for Energy and Nutrient Intake for Lunch by Sex of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews 178

43. Least Square Means and Standard Errors for Energy and Nutrient Intake for Dinner by Sex of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews 180

44. Least Square Means and Standard Errors for Energy and Nutrient Intake for Snacks by Sex of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews 182

INTRODUCTION

Identification of malnutrition among the armed forces during World War II and its possible threat to national security did much to bring the importance of good nutritious food for our Nation's children to the attention of the legislature (1). In 1946, President Harry S. Truman signed into law the National School Lunch Act as legislated by the 79th Congress (2). The philosophy and purposes behind the law, as a measure of national security, were to safeguard the health and well-being of the Nation's children and to encourage the domestic consumption of nutritious agricultural commodities (2). The National School Lunch Program faced few major changes in the first 20 years of its existence, however, school food services became highly visible during the seventies as plate waste made headlines in the mass media as well as in professional journals (1, 3, 4). The visibility of the plate waste problem initiated an avalanche of changes such as offering more choices and variety; improving food quality; authorizing new meal patterns that allow for portions to be varied according to the age of the child; and changing attitudes of food service management to consider children as customers (1).

In order to further counter the plate waste issue, Congress mandated an "offer vs. serve" provision in 1975 whereby high school students are offered rather than served the lunch, as had previously been the case (5). In 1977 the offer vs. serve option was expanded to include students in junior high and middle schools and to elementary students in 1982. Critics (6) of this legislation argued that the full lunch barely met the goal of providing students with one-third of the Recommended Dietary Allowances (RDA) (7) and that refusal by the student to be served a portion of the school lunch would provide a much less than desirable nutrient intake.

Others (4, 6) argued that a served complete lunch could not be counted as intake if it ended up in the garbage can.

On the local level, schools have used a variety of marketing techniques as well as a number of serving styles in efforts to cut down on plate waste yet entice students to eat (8-14). Some studies have shown that students prefer self-serve, buffet style or family style service over the more traditional cafeteria style service and that they want more control over their food choices (8, 15, 16). Even though these recent innovations reportedly have resulted in plate waste reduction and better student acceptance some nutritionists (17, 18, 19) ask the question "how well are our children eating?"

In an attempt to answer this question the effect of serving style on food-related behavior of elementary children was investigated in a two-part study. Food consumption and attitudes of students were measured in one part of the study and food acceptability and daily nutrient intake were assessed in another. The objectives of this component of the two-part study were:

a) to compare first through sixth grade students' acceptability of menu items served cafeteria style vs. family style.

b) to compare daily nutrient intakes of fourth, fifth, and sixth grade students who eat school lunch served cafeteria style vs. family style.

REVIEW OF LITERATURE

Historical Background and Legislation

The first school lunch program in the United States dates back to 1853 when the Children's Aid Society of New York City opened the first of its vocational schools to the poor and served free meals to all who attended. In the early 1900s school lunch feeding was provided primarily by volunteer groups. Shortly after the turn of the century, Robert Hunter (20) and John Spargo (21) directed attention to the folly of a society assuming the responsibility for education of the young, without considering their fitness to receive that education. They emphasized the importance of the nutritional well being of children, particularly the economically deprived, and pointed out that in Europe the problem had been attacked through school feeding programs (4). Shortly after their publications, school lunches were served in many more schools all over the United States. By 1918, lunch of some type was being provided in schools in approximately one-quarter of the larger cities (1).

The years of the depression were important to the expansion of school lunch programs, and marked the beginning of legislation that put the lunch program on firmer grounds by allocating funds to it. The first Federal funds came as early as 1932 and 1933 from the Reconstruction Finance Corporation (1, 4, 22, 5), which paid labor costs for preparing school lunches in several towns in the southwestern part of Missouri. By 1934 the funding had expanded to 39 States under the Civil Work Administration and Federal Emergency Relief Administration (1, 5). In the years following the stock market crash of 1929, a huge agricultural surplus developed in a country with millions of hungry children. In the 1930s when there was

high unemployment and little money for buying food, Congress found it necessary to give Federal assistance to support agriculture, provide employment, furnish lunches for children at school, and aid the general economy. In 1935 Congress passed a bill (23) which initiated purchase and distribution of excess commodity foods to school lunch programs. With the passage of this law the Department of Agriculture became the overseer of the program, a position it still occupies today (1, 4). The Works Progress Administration (WPA) was created in 1935, and women in needy areas were assigned jobs in school lunch programs. This resulted in the school lunch programs being relatively organized and supervised by each State. Standardization of menus, recipes and bookkeeping procedures followed. In 1941 the program was operating in all States, the District of Columbia, and Puerto Rico.

By 1943 the program reached 92,916 schools serving 6 million children and employed many people but the effects of World War II were felt by every part of the economy and especially by school lunch. The number of schools serving lunch decreased to 34,064 schools, hardly a third. Federal assistance was cut and commodities were no longer available. WPA workers were not available for school lunch, because they were employed to produce war supplies. However, Congress amended Section 32 of the Agricultural Act of 1935 to make money available for maintaining the school lunch and special milk program in the form of cash for 1944 (24). The school lunch program had become so much a part of the child's school day that it was not destroyed but temporarily halted (1).

Following World War II, the National School Lunch Act (2) was passed and by 1947 all states once again had programs and soon thereafter they all had State financial support. Lunches served by participating schools

were required to meet the nutritional requirements defined by the Secretary of Agriculture. Three types of lunch were authorized: Type A, Type B and Type C. The Type A lunch was developed to meet one-third to one-half of the minimum daily requirement of a child 10 to 12 years of age; certain adjustments in the meal could be made to meet the requirements of children of different ages. The Type B lunch provided a supplementary lunch in those schools where adequate facilities were not available to provide the Type A lunch. One-half pint of whole milk constituted the Type C lunch (5).

The Child Nutrition Act of 1966 (25) provided funds to initiate new programs, one of which was the pilot breakfast programs. Other legislative decisions included the "offer vs. serve" provision for senior high school students in 1975 (26), for students in junior high and middle school in 1977 (27) and finally for elementary students in 1982 (28).

The National School Lunch Act (2) passed in 1946 directed local school authorities to serve lunches without cost or at a reduced price to children who were unable to pay the full cost as determined by school authorities. The law further stated that there was to be no physical segregation or discrimination against any child who was unable to pay for his lunch. The first significant change in the school lunch program occurred in 1962 (29) and dealt with the apportionment of funds to the states. Previous allocation was based on number of children in the state without regard to actual participation in the school lunch program or the assistance need rate. Under the new law, allocation of funds was to be based on participation rates for the state and the need as determined by state per capita income. In 1970 the law was changed to require that the Secretary of Agriculture establish uniform national eligibility guidelines

for free and reduced price lunches (30). The Census Bureau's existing poverty guidelines, with some variations for household size, were used to develop the uniform national eligibility guidelines. Eligibility determinations for the program were to be made on the basis of an affidavit by the student's family. In 1971 uncertainty as to whether the poverty guidelines were to be the minimum or maximum requirement in determining eligibility for free meals led to passage of Public Law 92-153 (31) that established the poverty guidelines as the minimum requirement. Under legislation enacted during 1975, states were required by law for the first time to offer reduced price lunches to children from families with incomes of 195 percent of the Secretary's poverty guidelines (26). Prior to this legislation, the reduced price segment of the school lunch program was at the option of the state and eligiblity guidelines were flexible. This act also expanded the definition of "school" to include any public or licensed nonprofit private residential child care institution which encompassed orphanages and homes for the mentally retarded. In 1978, Congress set the income eligibility criteria for free lunches at 125 percent of the poverty guidelines set by the Secretary (32). In attempts to cut down on government spending, the Omnibus Reconciliation Act (33), which reduced eligibility for free and reduced price lunches, was passed in 1980. The Omnibus Budget Reconciliation Act of 1981 (28) set the income eligibility standards for free lunches at the same level as the gross income eligibility standard required to receive food stamps. This Act set the eligibility for free lunches at 130 percent of poverty and reduced price lunch eligibility at 185 percent of poverty. Numerous other regulations (5) have affected the availability of free and reduced price

lunches throughout the history of the program but to a lesser extent than those described above.

The Type A Pattern lasted 35 years with only three changes. In the early 1970s nutritionists suggested that the pattern was out-of-date and not keeping pace with current eating practices and life styles. In 1977 changes in the meal pattern and other regulations were proposed. After field testing and public comment the Department of Agriculture published the regulations in two steps--the first issued in August of 1979 (34) and in May, 1980 the final regulations (35), which included dropping the "Type A" name and simply calling the new patterns School Lunch Meal Patterns, were released.

Food Delivery Systems

Numerous changes in the Nation's economic and social structure have been reflected by changes within the operation of school food service systems. Tighter budgets in a period of rising costs have forced administrators to seek out and implement the most cost efficient food service system in order to provide students with nutritious and appealing meals. The on-site preparation system consists of a self-contained unit in which food is prepared and served for students on-site. Advantages of conventional on-site food services include more flexibility in the type of menu offered, greater variety of foods, better quality control, minimal distribution costs, and greater ability to integrate nutrition education within the school (36).

The satellite operation, sometimes called central commissary operation, has centralized food production with distribution of the prepared foods to several remote areas for final preparation and service to students. A

satellite base kitchen, sometimes referred to as a central kitchen, refers to an existing kitchen adapted for quantity food production. The satellite serving unit is any facility to which centrally prepared food is delivered for service to students (1). Advantages of a satellite delivery system include large volume purchasing, elimination of the need to duplicate expensive equipment, employment of fewer supervisory and trained personnel, and standardization of recipes for quality control (1, 37). Menu items processed in the commissary may either be held in bulk or portioned. Alternatives to holding foods following production include: frozen, chilled or hot-held (1, 37).

A study conducted by a research team from Colorado State University (38) to evaluate different food delivery systems in school lunch programs showed that variations in nutrient levels associated with type of delivery system rarely were significant. Those results suggested that all delivery systems were capable of placing food with comparable nutritional value on the serving line. Other studies conducted on food delivery systems used in school lunch programs (37, 39) have shown that students prefer food prepared in the conventional on-site system.

Serving Styles

In spite of the many recent changes, most schools still use the cafeteria style service where students walk through a lunch line to receive a plate or tray of food (1). Alternate serving styles include a la carte where students select from preportioned food items from a lunch line, buffet style in which they serve themselves from large bowls of food held on buffet tables, and the scramble system where they move freely between color coded food dispensing units to make menu selections

(1, 13, 15, 16). These alternate serving styles are preferred by students because they allow them to make their own food choice (12, 13, 15, 16). The alternate patterns are gaining popularity among school food service personnel because plate-waste reportedly decreases when students take only what they want to eat (11-16, 40-42). Buffet, a la carte, and scramble system styles of service are being implemented in many schools on the junior and senior high school levels (8, 10, 12-14, 16).

The serving style gaining favor in elementary schools in recent years has been the family style of service (11, 15, 40-43). The family style service ranges from rooms of students remaining in the classroom to eat school lunch as a family unit (1) to lunchrooms with tables draped with linens already set with dishes, flatware, napkins and baskets of rolls (40). Many claims (11, 40-42) have been made that the family style service reduces plate waste and improves eating habits but few studies have included statistically analyzed data. Heimberg (15) conducted a study with third, fourth and fifth grades in which she used four serving styles: self-serve (buffet), family style, portion size (offer vs. serve) and standard cafeteria style to determine their effects on plate waste and students' preferences. Statistical analysis of the data showed that family and self-serve styles resulted in significantly less plate waste than standard cafeteria style and offer vs. serve. Nonsignificant differences in plate waste and student's preferences were found between self-serve and family style services. They both reduced plate waste and were more popular with students than standard cafeteria and offer vs. serve styles of service.

In another study (41) of a family style eating program at two elementary schools in Denver, Colorado it was reported that aggregate plate waste was reduced and that students displayed better table manners,

were more polite, and had a greater sense of responsibility than students who ate in a conventional cafeteria style service. However, students participating in the program also received special nutrition education focusing on the plate waste issue, which may have influenced the findings. Family-style feeding was instituted in elementary schools in Tuscon, Arizona (42) on a limited basis. The program also included nutrition education and efforts to improve eating habits. According to the Director of Food Services, the program improved the health and learning level of students because of proper nutrition, provided social education through understanding of good individual and group dining habits, improved the dining environment, established a learning laboratory for an on-going nutrition education program, improved school and community relations, provided menu flexibility and virtually eliminated plate waste.

Students' Food Preferences

Food acceptance and food preference are the results of complex interactions of biological, economic, psychological and cultural variables. Food acceptance refers to foods that a person will eat or at least try, even if these foods are not preferred (44). Food preference refers to the degree of like or dislike for food (45). Pilgrim (46) refers to consumption as the operational definition of food acceptance, and preference as consumption with pleasure. Food preferences and acceptances affect what is actually eaten and, therefore, have a direct effect upon nutritional status. When developing plans to nourish children and before any attention to the nutritional quality of a menu can be considered, food acceptances and preferences of the target student group must be considered (45, 47-49). Some foods are preferred more by boys or girls,

which may further vary with age or grade level (45). Also it has been observed that different student populations may rate the same items differently (44, 47).

The paying status of students eating school lunch also has an influence upon the acceptability of and participation in the lunch program. A study of North Carolina elementary and secondary students was conducted (50) to determine the effects of race and paying status on attitudes toward school lunch. The authors reported that at both grade levels the students who received free lunches had more positive attitudes toward school lunch than those who paid full price and that black students recorded more positive responses than white students. In studies conducted by Wheelock and Warren (51), Akin et al. (52), and Keyser et al. (53) it was shown that the number of free and reduced priced meals had a significant positive influence on school lunch participation rates.

Assessing food preferences and acceptances is essential to serving the nutritional needs of a group of students. Because food is tied to so many interrelated factors, identification and measurement of its acceptance and degree of preference is difficult. Price (44) stated that food preferences are an outgrowth of attitudes and should be studied by applying valid and reliable techniques used in attitude studies. Lachance (45) said that the purpose of acceptance testing--technically referred to as organoleptic evaluation--is to determine the overall degree of like or dislike for a food. Acceptance testing also makes it possible to determine variation in preference or lack of preference. He cautioned that food quality and monotonous repetition of foods served may influence the results of a food preference assessment. Peryam and Pilgrim (54) differentiated between use of the hedonic scale for rating a list of

foods, presented by item name, and for rating foods actually served. In the first usage, the scale is a measure of attitude. In the latter case, where food items and not just food names are the stimulus, the scale becomes a sensory test. Both pertain to the affective realm.

Baker and Ehlers (55) studied several factors that influenced food acceptance by students in rural, suburban, and urban schools. They found that competition among foods offered influenced acceptance; as would be expected, the smaller the number of foods to select from, the higher the percent acceptance for the test dish. Appearance was one of the chief factors affecting the initial acceptance of foods. Foods with low acceptance could, in many cases, be greatly increased by making the dish more appealing to the eye by simply adding a garnish. Even the name of the dish influenced selection. When the menu read "creamed eggs on biscuit" only nine percent of the students selected it, but this was increased five-fold when the menu read "eggs a la king on a biscuit." These researchers found it desirable not to serve the same dish more often than once in two or three weeks, depending on student preference for the dish. They noted that previous acceptance of a food affected selection. The first time a test dish was served, the selection was often low because students were slow to accept something new. After the first time, acceptance was greater or less, depending on how well it was liked the first time and how much students had discussed the test dish. Teacher influence had a large impact on students' acceptance of foods. If the teachers accepted and consumed a food so did the students. The lack of knowledge of nutrient values of foods also influenced food acceptance and often led to unbalanced meals. Nutrition education has been effective in countering the latter problem (56-59).

From about 1950 to 1970, the nine-point hedonic scale, developed by the Quartermaster Food and Container Institute (54), was the major tool for measuring food acceptability. This scale is similar to the category scale that psychologists have long used to measure attitudes (60). The scale includes nine categories which range from "dislike extremely" to "neutral" to "like extremely." Judgmental biases tend to alter the findings of all hedonic scales, particularly the larger nine-point scales. Researchers (61, 62) have shown that judges tend to avoid using the extreme categories at both ends of these scales. A common criticism of the hedonic scale is that respondents are confined to the scale and are therefore unable to communicate the extent of like or dislike for an item (63). Ratios sensitive to an individual's true perceptions of a stimuli cannot be assessed within these confines. An alternative to the hedonic scale is the magnitude scale where respondents assign numbers to stimuli in proportion to the perceived intensity of his sensations (63). Because the respondent is unconstrained as to the range and size of the numbers used the scale has the true properties of a ratio scale of magnitude. The size of the numbers from this assessment are disregarded and only their ratio to one another are considered. Moskowitz and Sidel (63) studied the interchangeability of the hedonic and magnitude scales to measure acceptability. They found that the results of the two scales resembled each other and could be used interchangeably if the decision to be made was to accept or reject a food item. The magnitude scale has the unique ability to measure how much more acceptable one food is than another.

In 1961 Pilgrim (64) assessed food preferences of American enlisted military personnel using the nine-point hedonic scale and found that grilled steak, ice cream, French fried potatoes, and hot biscuits were

among the best liked foods. Among the least liked foods were iced coffee, mashed turnips, broccoli, asparagus, cauliflower, and several other vegetables. Actually few vegetables were liked and adding cream sauces did not improve their acceptance. Most meats were well accepted, but lamb and fish were low preference items.

In recent studies, the nine-point hedonic scale has been shortened to four (65), or more popularly, five (4, 37, 45, 48, 49, 66-70) categories for assessing food preferences in elementary children. Jansen et al. (48) used a five-point hedonic scale to study food preferences of children in the fifth and 10th grades and found that milk beverages received the highest ratings, followed by starches, baked goods, and entrees. Salads and vegetables were at the low end of the rating scale. Students preferred individual foods rather than combinations with the major exceptions of ethnic foods such as tacos, pizza, and lasagna. Beef was rated higher and was more readily consumed than turkey and pork. Sandwiches were well-liked, particularly those served on a bun. Universally vegetables were consumed poorly, but corn and green beans were more acceptable than green leafy vegetables.

In studies of elementary students' food preferences conducted by Head et al. (66-68) milk and desserts received the highest rating on a five point hedonic scale followed by entrees. In both secondary and elementary schools, males rated entrees higher than females. Black students rated entrees higher than white students, and students who received free lunches rated items higher than those who paid full price. The effects of sex, race and paying status were significant ($p \leq 0.05$). Fruits received next to the lowest acceptability ratings, and vegetables the lowest. When the effects of sex, race and paying status were examined

the data indicated that boys rated fruits and vegetables higher than girls, and that elementary black students rated fruits and vegetables higher than white students. Raw fruits generally were preferred to those that had been processed. When two vegetables were combined, the rating was similar to that of the less popular item in the combination. Yeast breads were more popular than quick breads; among the quick breads, biscuits were preferred to cornbread. The favorite dessert was ice cream followed by cakes.

Head et al.(70) investigated the effectiveness of a hedonic scale to predict food acceptability by comparing students' hedonic scale evaluation of foods with a scale estimating the amount of each food they had eaten and with the results of a plate waste study. The hedonic scale (HED) consisted of five points as follows: great, good, OK, bad, and terrible. The amount consumed scale (AMT) also had five responses: all, most, about half, just tried it and none. Plate waste was collected by a trained team of researchers. The data showed that the AMT scores were more influenced by food quality than the HED scores. Elementary students' scores on both scales were related positively to food consumption but lacked precision. Large standard deviations in hedonic scores were found in and among schools where students were from a variety of ethnic and economic backgrounds. The researchers cautioned that food consumption and acceptability ratings from one school should not be used to predict these same factors in another school.

When eliciting information on food acceptability from students, particularly younger students, communicating the researcher's wants and providing a consistent means of expression for the student can be a challenge (71). Methods to overcome this communication barrier have been developed which utilize the facial hedonic or "smiley" faces on rating

scales (37, 45, 49, 65). The expressions on the "smiley" faces are regarded as more universally understood than words or numbers (76, 80). McConnell and Shaw (49) used a facial hedonic scale to measure the food preferences and frequency of preference for components of lunch menus. Students showed definite food preferences and frequencies of preference from which standard menus were planned.

Another method of studying food preferences is the frequency survey. In a study conducted by Breckenridge (73) at a summer camp for five to 12 year old children, meat, ice cream, potatoes, bread and crackers, milk, raw fruits, and cereals were rated high in popularity. Fat meat, fish, cooked vegetables, cheese, meat mixtures, eggs, and cooked or canned fruit were less popular. A food preference study (74) conducted among a nationally representative sample of 1,051 children, ages two to 12, indicated that children's favorite foods were ice cream, doughnuts, chocolate chip cookies, french fries, corn-on-the-cob and chicken noodle soup.

Food preference data were collected by Price (69) through the use of a game in which children indicated preferences for fifty-eight different foods. She stressed that generalizations about food preferences are misleading because they fail to express the preferences of cultural and ethnic groups. Price found a wide variation among these groups and the data showed that foods rejected by one group were most preferred by another. Cottage cheese was favored by white children but not very acceptable to black children. Black children favored turnip greens that were rejected by white students.

Dietary Assessment of Elementary School Age Children

Methods of Assessment

Evaluations of nutritional status are conducted to identify individuals at risk, that is people or groups of people whose nutritional status should be improved. The findings from these studies can provide a basis for decisions and lead to the development of programs by nutritionists at the local, state and national level, to improve nutritional status of individuals and groups (75, 76). The techniques used commonly for the assessment of nutritional status include clinical evaluation, anthropometric measurements, biochemical evaluation and investigation of dietary intake. Dietary studies are used to determine the sources and amounts of nutrients consumed and they also can indicate general food patterns. Methods used to collect dietary data are generally one of two types: a) records that estimate food purchases and food waste of families or other large groups and b) records or recalls of food intake of individuals over a specified period of time (77). Food records of families or groups require the cooperation of the person in charge of preparing and serving of the food and disposing of the waste. Individual intakes usually are not recorded.

Food intake records from individuals vary from a qualitative type of food habit survey to quantitative food records and include the following (77, 78):

a) A recall by an individual of food intake during the previous 24 hours or longer.

b) Records of food eaten by an individual expressed in weights, household measures or estimated quantities over a period of time.

c) A self-administered questionnaire or interview, to obtain general dietary data on the frequency of foods consumed.

d) Diet history which is usually obtained by a trained interviewer to determine the usual food intake pattern over a long period of time.

e) Laboratory studies in which duplicate samples of food are weighed and analyzed for nutrient composition.

The food record and weighed intake methods are more time consuming and costly to implement than the dietary recall method. Food frequencies generally are considered to be a descriptive, qualitative assessment tool (79).

It is generally agreed by researchers (77, 78, 80, 81) that the 24-hour recall provides valid information on usual nutrient intakes of groups and requires less time, money, subject cooperation, and professional personnel to obtain the information. Young et al. (80) compared the accuracy of seven-day food records and 24-hour dietary recalls. They concluded that for assessing the nutrient intake of an individual, the shorter 24-hour dietary recall could not be substituted for the seven-day record but that the two could be used interchangeably when groups of individuals were studied. Chalmers et al. (81) compared data from one-, seven-, 14-, and 28-day dietary records and found that the one-day record could estimate the mean intake for a group as accurately as the other three time periods. They also stated that since people tend to eat better when a one-day record is used, the 24-hour dietary recall interview might provide a more accurate dietary assessment.

The technique of collecting dietary information by 24-hour recall interviews has been widely used and tested. In 1948 Bransby et al. (82) studied the dietary intake of fifty boys ages 10 to 15 years. High correlation coefficients were found between nutrient values obtained by weighing/household measures and 24-hour recalls from boys living at home. Information on food intake obtained by 24-hour recalls from boys in

residence halls agreed well with information obtained from the food intake records kept at the residence halls. This was true whether or not memory aids were used during the interviews. They also found that nutritive values of daily intakes calculated from food composition data exceeded the levels obtained by chemical analyses for calories, fat, carbohydrate, and calcium but underestimated iron. These authors concluded that children, ages 10 to 15, appeared able to give information on their previous day's intake as accurate as that obtained from weighed records or records in household measures.

Bosley (83) found that children nine to 11 years of age were able to recall easily the foods eaten over a 24-hour period and seemed to enjoy determining the quantity eaten. This age group was spontaneously curious, honest and, therefore, more likely to answer truthfully than older children. She stated that children over eleven years of age had acquired enough information about foods to answer as they thought they should whether or not this information actually influenced their eating habits.

Emmons and Hayes (84) conducted 24-hour dietary recall interviews with children in grades one through four to assess the effectiveness of school feeding programs on their nutritional status. The children were interviewed by nutritionists or nutrition students on Tuesday through Friday so that a school lunch was included in each day's meals. Spoons, cups, and different size servings of food were provided to assist the children in determining quantities of food consumed. Mothers were later interviewed by phone to obtain their recall of the child's diet for the same 24-hour period as reported by the child. There were more significant correlations between the nutritive levels calculated from the child's recall of lunch and the lunch actually eaten than between those calculated

from the mother's and child's recalls of the child's diet. The ability to recall correctly foods eaten at home and during school lunch improved with age from the first through fourth grades. Emmons and Hayes concluded that young children can provide information on their diet as accurately or more accurately than their mothers and that those above the second grade can give comprehensive dietary information.

The Bogalusa Heart Study (85) was initiated to investigate the relationship between the American diet and coronary artery diseases. In the early stages of the project the researchers looked for a technique to assess and characterize the dietary intake of children that would yield reproducible dietary data, allow a child to serve as his own respondent, and that could be administered by a small staff. The researchers stated that while chemical analysis of food actually eaten is the most accurate method for assessing diets, it is not practical for large nutrition surveys. They developed a detailed 24-hour dietary recall protocol for training interviewers that outlined both the verbal and written communications involved in the interview. The technique also included specific methods for identification, qualification and quantification of food items. The instrument was pilot tested on 76 students, ages 10 to 16 years, by trained interviewers. Some students were interviewed twice by different interviewers within the same 24-hour period to assess the reliability of the instrument and variability among interviewers. Training sessions and the standardized interview technique helped to reduce variability among interviewers. They found that the children remembered eating times logically and clearly, could usually recall brand names of foods eaten and were quite aware of what they had eaten for school lunch, although they remembered the menu items in much simpler terms than those used by

the school lunch personnel. The researchers concluded that 24-hour dietary recalls provided an accurate assessment of nutrient intake when a written protocol for interviews was used, probing questions were asked, and school lunches were monitored. The technique was used later in interviews with children to investigate factors contributing to and possibly initiating serious cardiovascular diseases (86).

Christakis et al. (87) used the 24-hour dietary recall method to study the nutrient intake of 643 students in New York. This age group was considered mature enough to follow instructions, answer interview questions with an acceptable degree of accuracy and to have acquired fairly stable dietary patterns. The interviews, which were conducted by four public health nutritionists, lasted approximately 20 minutes and were designed to determine the number of servings from major food groups, indicate meal patterns including snacks, document the place where the noon meal was eaten, record the use of nutrient supplements and categorize food likes and dislikes. Language barriers, memory failure, and lack of complete comprehension by the children decreased the accuracy of the data. The dietary results were interpreted with caution because dietary intakes were not validated by weighing, the interviews were brief and necessitated arbitrary categorization of foods, portion sizes were not assessed in great detail, and nutrient analysis was based upon food composition tables rather than actual analysis of the food.

Dietary Quality Scores

The demands of modern society have decreased the time spent preparing meals and supervising children's eating habits in the home and increased meal skipping and consumption of meals outside the home. Thus the problems of obtaining a balanced diet have been increased. Despite food

fortification, nutrition labeling and the expansion of food assistance and nutrition education programs, many people remain unaware of the nutritional quality of their diets. Implementing programs with the goal of increasing nutritional adequacy of diets necessitates the development of methods to evaluate their impact. Detailed nutritional analysis of diets is often time consuming and may be impossible for large groups. Therefore, simpler valid methods of assessing dietary quality have been investigated.

Scores Based on Food Groups. In 1954 Thomas et al. (88) responded to the lack of simple methods of assessing dietary quality by developing and testing a technique for evaluating food intakes from seven day or 24-hour dietary records. The purpose of the study was to determine qualitative differences in dietary intakes of black and white women living in Detroit and to identify extreme levels of intake rather than obtain precise individual nutrient intakes. The system was based on 14 food groups with points allotted for each group. The maximum scores were adjusted to meet the RDA for energy and eight nutrients for non-pregnant, pregnant and lactating women. The researchers found this scoring system to be a simple and reliable method for assessing dietary quality of women, especially those from lower socioeconomic levels, who may have been poor candidates for the more accurate, costly and time consuming methods of assessment. Hinton et al. (89) used the scoring system developed by Thomas et al. (88) to investigate the relationship of certain psychological, sociological and physiological aspects of eating behavior of Iowa girls ages 12 to 14 years.

Schorr et al. (90) used a Guttman scale or scalogram (91) to investigate factors affecting teenage food habits. The Guttman scale is cumulative; food items within a given scale step include all foods contained in

preceding steps. The scale uniquely measures dietary complexity and is especially useful for large groups of people consuming many different food items. Schorr et al. (90) used a seven step version of the Guttman scale to study teenage food habits. The scale steps included the following seven groups of food: whole milk, breads and rolls, beef, sweet foods and snack foods, fruits, orange juice, dark-green leafy and deep-yellow vegetables. Foods in the first four steps of the scale were consumed by over 90 percent of the teenagers. The next three steps were a more discriminating reflection of the different levels of dietary complexity within this adolescent population. The percentage of students included in each scale step decreased as the level of dietary complexity increased. Data analysis also showed that increased dietary complexity was positively correlated with intakes of calcium, iron, ascorbic acid, and vitamin A.

Sabry et al. (92) examined the appropriateness of scaling for the assessment of the adequacy of dietary patterns of Canadian preschool children. Three types of dietary assessment were used. A food frequency questionnaire was administered to obtain data for development of the food scale, a subjective assessment by the mother of the adequacy of her child's diet was obtained, and a food record for a three-day period was evaluated in terms of nutrient intake. The latter assessment was used as the standard for comparison of the other two types. The results indicated that the scalogram analysis did not provide a reliable estimate of dietary adequacy.

The USDA Basic Four Food Guide (93), which suggests a minimum number of servings from the four food groups to provide a foundation for an adequate diet, also has been used to score dietary quality. Bowering et al. (94) recognized that assessment based on nutrient intake was cumbersome

and did not yield information on food consumption practices. In a study of low-income pregnant women they compared a method of assessment of dietary quality based on food groups with a method requiring calculations of nutrient intake. The authors concluded that for the purpose of assessing initial dietary status and studying the effects of the Expanded Food and Nutrition Education Program (EFNEP) on participants, the method based on food groups was adequate although potentially limited by differences in nutrient content of foods in a group which "scored equally."

In a study of university men and women Guthrie and Scheer (95) used 24-hour dietary food records to compare the validity of a quality score based on the Basic Four Food Guide with that of a score based on 12 nutrients. Four points were assigned to each of the four food groups for a total of 16 points possible. The most significant finding was that dietary scores of 16 were accompanied by greater than 78 percent of the RDA for all 12 nutrients investigated. They concluded that the simple dietary score can be substituted for the more time-consuming dietary analysis when the objective is to evaluate program effectiveness.

Studies in which scores have been used to assess the quality of diets of elementary children are limited. Fanslow et al. (96) developed a food assessment device for use with third through sixth grade students that was administered and scored by classroom teachers, and provided quantitative information on the children's intake of common foods representing the Four Food Groups and "other" foods. The device consisted of a pegboard with four copies of picture cards of each of 40 foods commonly eaten by elementary school students and a board with a pictorial representation of the day (morning, noon, and night). Teacher instructions and recording forms also were included. The students indicated what they usually ate

and drank during one day by placing food cards on the pictorial representation of the day. When students had completed the food selection for one day, the cards were turned over. The back of each food card specified the contribution that a serving of food made to a food group. The teacher sorted the cards by food group and totaled the servings for each group. The meal patterns of the children were found to be similar to those reported by Pao (97), who used 24-hour dietary recall interviews to study children's food consumption. Fanslow et al. (96) concluded that the children were indeed selecting what they normally ate and that the device could be useful in the classroom to identify instances of under- or over-consumption. They suggested that a student who appeared to have a dietary problem might require further evaluation by using actual dietary records and nutrient analysis of foods consumed. Because elementary school teachers typically lack nutrition counseling expertise, they stated that students in need of this service should be referred to a nutrition specialist.

Scores Based on Nutrients. The Recommended Dietary Allowances are intended to serve as goals for planning food supplies and guides in evaluating the intakes of population groups. Many researchers use the RDAs as a standard for measuring nutritional adequacy but caution must be used in drawing conclusions from these comparisons (98). The failure of individuals to achieve these levels of intake is not necessarily indicative of nutritional risk. The USDA has established two-thirds of the RDA as the standard for identifying subjects at possible nutritional risk (99).

Several different scoring systems for assessing nutrient adequacy, based on the RDA, have been developed and tested but very few have involved elementary students. Howe and Vaden (100) used a method developed by

Cosper (101) to compare differences in nutrient adequacy of secondary school students participating and not participating in the school lunch program. From data collected during 24-hour dietary recall interviews, percentages of the RDA were calculated for protein, calcium, iron, vitamin A, thiamin, riboflavin, niacin and ascorbic acid. If intakes were equal to or greater than 100 percent of the RDA for all eight nutrients, the diets were classified as "excellent." The diets were rated as "good" if intakes were equal to or greater than 66.7 percent, "fair" if equal to or greater than 50 percent, and "poor" if less than 50 percent of the ROA.

Schafer (102) studied the effect of self-concept on dietary quality of young married women using a method developed by Yetley (103). Oata were collected through 24-hour dietary recall interviews and daily intakes of protein, calcium, iron, vitamin A, thiamin, and ascorbic acid were calculated. A diet that met or exceeded the ROA for all six nutrients was assigned a score of three and rated "excellent," "good" diets were represented by two points for 67 to 99 percent of the RDA and "poor" diets by one point for less than 67 percent of the ROA.

Gilbert et al. (104) modified the method used by Schafer (102) to rate the 24-hour dietary intakes of about 1,300 Kansas fifth grade students. The daily intakes of protein, calcium, iron, vitamin A, thiamin, and ascorbic acid were calculated and a four point system was applied to each nutrient. Four points were assigned to intakes equal to or greater than 100 percent of the ROA. Scores of three, two, or one were given to intakes of 66 to less than 100 percent, from 50 to less than 66 percent and less than 50 percent of the RDA, respectively. If a diet met or exceeded 100 percent of the ROA for all six nutrients a score of 24 points was assigned.

A minimum score of six indicated that less than 50 percent of the RDA for all six nutrients had been consumed.

In 1973 Hansen (105) observed that 30 percent of food consumed by the American public provided kilocalories with very little nutrient value. As a result of this observation he developed an Index of Nutritional Quality (INQ) to describe the nutrient density of foods. The index ensured that high quality foods received higher scores than those of lesser quality, in relation to energy content, and was calculated as follows:

$$INQ = \frac{\text{nutrients in a food quantity that contains X number of kilocalories}}{\text{RDA for those nutrients based on X number of kilocalories}}$$

Madden and Yoder (106) used the nutrient adequacy ratio (NAR) which is the percentage of the RDA for a single nutrient according to the subjects sex and age to evaluate the effectiveness of food distribution programs in rural Pennsylvania. Madden and associates (107) later used mean adequacy ratios (MARs) to compare the validity of 24-hour dietary recalls conducted with elderly subjects with their food intakes recorded by trained observers. MAR values are generated by totaling NAR values and computing a mean value. All NAR values exceeding 100 percent are truncated to 100 to prevent intakes in excess of the RDA for one nutrient compensating for inadequacies of others.

Aitken (108) developed a system of evaluating the quality of Kansas fifth grade students' eating patterns by combining the methods of scoring diets by nutrients and by food groups. NAR values were calculated from 24-hour dietary recalls conducted with students for energy, protein, vitamin A, ascorbic acid, thiamin, riboflavin, vitamin B_6, calcium,

magnesium and iron. To judge overall dietary quality, mean adequacy ratios (MARs) were calculated. The MAR values were computed by sex, including and excluding supplements, for 633 girls and 609 boys. The MAR values were grouped into four ranges as follows:

90 to 100
75 to <90
66 to <75
<66

When an average value such as MAR is used it is possible that a number of high values may compensate for low values resulting in an "acceptable" MAR even though the NAR values are all truncated to 100. For this reason the cutoff point for nutrient adequacy may need to be higher. Since two-thirds of the RDA has been used routinely in group assessments for signifying nutrient adequacy (93), this value was selected as a starting point for establishing the ranges. Foods from the 24-hour dietary recalls were divided into 49 groups on the basis of similar composition. These food groups were then collapsed into 11 food categories; 10 for foods and one for nutrient supplements. Food frequencies expressed as percentages were generated for the 11 food categories, which enabled the eating patterns of the students to be examined. For each of the four ranges of MAR values, including and excluding supplements, average values for frequency of consumption of foods in the 11 categories were calculated. Values for boys and girls were compiled separately to examine possible sex differences.

Johnson et al. (109) developed and tested a computerized Nutrient Adequacy Reporting System (NARS) for use by extension home economists as a means of assessing the effectiveness of EFNEP. Foods were divided into sixteen groups and the weighted means, standard deviations, and coefficients of variation were calculated. Standard deviations as percentages of the

RDA also were determined for 12 nutrients in each of the food groups. A recording form was provided on which women were asked to shade boxes by each food group that represented the number of portions consumed from the group. Nutrient consumption was calculated by multiplying the number of portions eaten from a food group by the mean nutrient value contributed by the group. The researchers concluded that the NARS method provides reasonably reliable and accurate information for groups of people and has the same limitations as other dietary methods.

In 1978 Abdel-Ghany (110) reviewed some of the methods used for assessing dietary quality. Even with the truncating of NAR values to 100 percent, he stated that the MARs still did not completely avoid the problem of high nutrient intakes compensating for low intakes. Nor did the MAR values indicate the nutrient density of the food consumed. As a result of these observations, this researcher chose to evaluate the quality of dietary intakes of 676 North Carolina households by calculating the index of nutritional quality from data collected during 24-hour dietary recall interviews. Index of Nutritional Quality scores were calculated for protein, thiamin, riboflavin, niacin, iron, calcium, vitamin A, and ascorbic acid. A score of less than one indicated that the diet had a less than proportional content of the nutrient in relation to its caloric content. Abdel-Ghany (110) concluded that the INQ was useful in evaluating the quality of household diets because it showed the balance (or lack of it) of different nutrients in the diet. A major disadvantage of the method is that it is limited to people consuming enough kilocalories to meet the RDA.

Dietary Studies of Elementary Children

National Studies. In 1978 Habicht and associates (76) addressed the issue of surveillance of the nutritional status of the U.S. population. They stated that the purpose of surveillance is to provide ongoing information about the nutritional conditions of the population and factors that influence them. This information provides a basis for decisions to be made by those responsible for policy, planning, and the management of programs related to improvement of food consumption patterns and nutritional status. Several groups conduct research to assess nutritional behavior, however, the United States Department of Agriculture (USDA), the National Center for Health Statistics (NCHS) within the Department of Health, Education and Welfare (DHEW), the Department of Defense and the Veterans Administration are responsible for most of the studies conducted at the national level.

In 1965 the USDA Household Food Consumption Survey (111) showed that children from infancy through eight years of age generally had good diets, with the exception of iron intakes. Teenagers, as a group, had the highest prevalence of unsatisfactory diets compared to the other age groups studied. The dietary patterns of teenagers typically resulted in low intakes of calcium, iron, and thiamin. Boys, ages nine to 11, had good food consumption habits except for a small decrease in milk consumption that resulted in a slightly low calcium intake. Girls of this age group were already exhibiting dietary patterns typical of teenagers.

The 1968-70 Ten State Nutrition Survey (112) was conducted to determine the extent of malnutrition in the U.S. and its influence upon health-related illnesses. The lower quartiles of five high income ratio (HIR) states (California, Massachusetts, Michigan, New York, and Washington) and

five low income ratio (LIR) states (Kentucky, Louisiana, South Carolina, Texas, and West Virginia) were selected for the survey. Clinical examination data and anthropometric measurements were obtained from 40,000 individuals and biochemical and dietary data were collected from a subsample of this group. The clinical examinations revealed very few signs of malnutrition in children. Biochemical and dietary evaluations showed iron deficient values for children from both the LIR and HIR states. Children in the HIR states had higher energy intakes than those from the LIR states. Mean dietary intakes of all nutrients, except iron, were above the recommended standards. Calcium intakes were adequate except in the 10 to 16 year old age group in which 20 to 54 percent had intakes below the standard.

The Health and Nutrition Examination Survey (HANESI) conducted during 1971-72 (113) provided data for nutritional evaluation of U.S. citizens, ages one to 74 years. Twenty-four hour dietary recalls indicated that energy intakes were higher for upper income and white children than for black children and those in lower income categories. Mean intakes of protein, calcium, vitamin A, and ascorbic acid were above the standards. However, there was a wide variation in vitamin A intakes with some children consuming two times the standard and others with intakes below the standard.

The 1977-78 Nationwide Food Consumption Survey (114) included data collected by 24-hour dietary recall from a sample representing all ages of individuals in the 48 continental states. Girls and boys, aged nine to 11 years, had low intakes of energy, calcium, magnesium, and vitamin B_6. Boys of this age slightly exceeded the RDA for iron and girls consumed slightly less than the standard. Both sexes consumed large amounts of protein (boys 205 and girls 181 percent of the RDA) and vitamin C (boys 176

and girls 186 percent of the RDA). Over 100 percent of the RDA for phosphorous, vitamin A, thiamin, riboflavin, preformed niacin, and vitamin B_{12} was provided by the foods consumed by girls and boys in this age group. Boys and girls, 12 to 14 years, had dietary intakes very similar to those of nine to 11 year olds, but they tended to consume a higher percentage of the RDA for energy and a lower percentage of the nutrients.

In 1983 the Food and Nutrition Service (FNS) of the U.S. Department of Agriculture issued the final report of the National Evaluation of School Nutrition Programs (National School Lunch, School Breakfast, and Special Milk Program) (115). The major objectives of the evaluation were to:

a) identify and synthesize existing research and evaluation data on the school nutrition programs.

b) identify the determinants of participation in the school nutrition programs and develop statistical models for use in forecasting participation rates.

c) determine the impact of the school nutrition programs upon students and their families.

d) determine whether existing benefit levels are appropriate for participants' needs.

Data from this research collected by 24-hour dietary recall interviews showed that students who participated in school lunch had higher intakes of energy and consumed more nutrients than students who did not participate in any of the school nutrition programs. Vitamins A and B_6, calcium and magnesium are typically low in diets of school age children, however, this study showed that children who participated in the school lunch program had superior intakes of these four nutrients compared to those of non-participants. Students who participated in the school lunch program not only had higher lunch intakes of energy and nutrients than nonparticipants but their 24-hour intakes were higher than those eating lunch from another

source. The differences in nutrient intakes were accounted for mainly by the higher nutritional value of the school lunches compared to the lunches eaten by nonparticipants.

Other Studies. A statewide nutrition survey of 8D,DOO Massachusetts public school children (116) showed that the participation rate in the Type A lunch was 64 percent of the returned survey forms. Dnly 53 percent of the children in the study sample consumed a satisfactory or good lunch on the day of the survey. However, almost three-fourths of those children, who ate school lunch on the study day, had diets rated as satisfactory or good. Of the children buying a la carte items in school or buying lunch in a neighborhood store, over three-fourths consumed a lunch evaluated as inadequate by the researchers.

Lai et al. (117) conducted a study on 932 students in elementary, junior high, and senior high school classes that represented seven regional districts in the state of Hawaii. Data from 24-hour dietary recall interviews showed that protein was consumed in more than adequate amounts, but large proportions of all age and sex groups reported consumption of less than two-thirds of the RDA for vitamin A, thiamin, and calcium. Less than two-thirds of the RDA for niacin and vitamin C was consumed by elementary students, but the incidence of inadequate intakes was not as high as that reported for vitamin A, thiamin, and calcium. A higher percentage of the RDA for calcium was consumed by elementary students than by the other two groups. The average energy intake of elementary students was 86 percent of the RDA and the energy from fat ranged from 35 to 37 percent.

In the Bogalusa Heart Study (86) 194 children, approximately 1D years old, were interviewed in an effort to describe the early natural history

of arteriosclerosis. They found that white girls ingested fewer calories and less protein, fat, cholesterol, carbohydrate, and sodium than white boys or black girls and boys. Mean protein intakes for white and black girls were approximately 10 g. lower than their male counterparts. Calcium intakes were lower for girls than boys with mean intakes of 748 and 920 mg., respectively. White boys had higher fat and energy intakes than white girls or black girls and boys, but black boys ingested more cholesterol-rich protein sources than the other three groups. Boys generally had slightly higher intakes than girls for energy, protein, thiamin, riboflavin, niacin, and calcium but not for vitamin A and ascorbic acid. More black boys than white boys were in the lower quartiles for calories, protein, vitamin A, iron, calcium, and thiamin, but the reverse was true for girls. Nineteen percent of the boys and 25 percent of the girls consumed less than two-thirds of the RDA for energy; a more than adequate daily protein intake was observed for almost all boys and girls. Riboflavin and iron intakes also were consumed in adequate amounts by most of the children, however, at least one-third of all children did not achieve two-thirds of the RDA for vitamin A, ascorbic acid, and niacin.

In a comprehensive study of school food delivery programs in the state of Washington, Price et al. (19) calculated nutrient intakes of 728 school children, aged eight to 12 years, from three, 24-hour recalls from each child. Intakes of all nutrients increased with age and females tended to have lower intakes of all nutrients than males except for vitamin C. Larger children, as measured by height, had higher intakes of calcium and phosphorous than smaller children. Students whose weights were over 100 percent of the standard for age had higher intakes of energy and protein than other children. They also found that children who were full

participants in the school lunch program had significantly higher intakes of protein, calcium, phosphorous, vitamin A, and riboflavin than non-participants.

Head and Weeks (118) determined the nutrient intake of North Carolina students consuming the Type A lunch by recording plate waste and analyzing the nutrient content of the lunch. The study sample included 75 students in each of twelve elementary schools, three junior high schools and seven high schools. All age groups consumed protein in the highest amounts relative to the RDA, with fifth and seventh grade students consuming twice the goal (one-third or more of the RDA) for the lunch meal. Energy intakes were less than one-third of the RDA for children included in this study. Energy consumption was not considered a cause for concern as much as low intakes of some other nutrients because most school children snack on high calorie foods. The high consumption of milk, approximately 93 percent of milk served, assured an adequate riboflavin intake. Vitamin A also was consumed by all age groups in adequate amounts. Younger students consumed adequate amounts of iron and calcium. The ascorbic acid intake for fifth and seventh grade students was the least satisfactory of all age groups. Significant regional differences in intakes of vitamin A and ascorbic acid were observed. Vegetables that provided these nutrients were better accepted and consumed by elementary students in the eastern region of the state than by those in the western region.

Akin and associates (119) utilized data collected during the Nationwide Food Consumption Survey to determine the impact of school lunch participation on the nutrient intakes of children, ages six to 18. Over a 24-hour period six to 11 year old children who ate school lunch had higher intakes of energy, protein, vitamins A and C, thiamin, riboflavin, niacin,

vitamins B_6 and B_{12}, calcium, phosphorous, magnesium, and iron than children who ate lunches of other types. During a 24-hour period, children who ate non-school lunches consumed more energy, carbohydrates, fat and vitamin C but less vitamin A and vitamin B_{12} than those who skipped lunch. Children, ages eight and 13, did not consume 100 percent of the RDA for energy even when school lunch was consumed. Regardless of the type of lunch, iron intakes of eight year old children in this study exceeded 100 percent of the RDA, but school lunch participants had higher iron intakes than nonparticipants. Thirteen year old boys and girls did not consume 100 percent of the RDA for iron regardless of the meal source.

Tseng and associates (120) collected dietary food records of all foods consumed during school hours by fourth, eighth, and 11th graders in a random sample of 279 schools in California. Analysis of these data revealed that protein, vitamin C, and riboflavin were the nutrients consumed in greatest quantities by all students during school hours. Protein intakes of fourth and eighth graders exceeded two-thirds of the RDA. Fourth grade students generally met or exceeded the standard of one-third of the RDA for energy, protein, vitamins A and C, thiamin, riboflavin, niacin, calcium and iron during school hours, but eighth and 11th grade students, especially females, fell far below the recommended levels for vitamin A and iron.

In another part of the study, Tseng et al. (18) conducted 24-hour dietary recall interviews with fourth, eighth and 11th grade students in 84 randomly selected northern and southern California public schools in order to determine their intakes. They found that protein, vitamins A and C, thiamin, riboflavin, niacin, and calcium were consumed by all grade levels of students in amounts that were equal to or exceeded the

RDA for the 24-hour period. The average male student consumed greater quantities of most nutrients than did female students. Protein and vitamin C were consumed in greater amounts relative to the RDA than other nutrients. With the exception of 11th grade boys, the mean intakes for energy were slightly below the RDA. The observed intakes of iron ranged from 120 percent of the RDA for fourth graders to as low as 60 percent of the RDA for 11th grade girls. Iron intakes relative to the RDA were low for both boys and girls in the eighth and 11th grades.

Gilbert et al. (104) evaluated the diets of 1,309 Kansas fifth grade students from data collected during 24-hour dietary recall interviews. The dietary analysis showed that the mean intake of protein was 194 percent of the RDA with the highest consumption reported during the dinner meal (75 percent) followed by lunch (64 percent). The mean intakes of vitamin A, ascorbic acid, thiamin, riboflavin, niacin, calcium, and phosphorous, with and without supplements, exceeded the Recommended Dietary Allowances. Among the students interviewed, 43.8 percent reported consuming supplements. Mean vitamin B_6 intake was 94 percent of the RDA and increased to 110 percent with supplements. The mean percentage of magnesium consumed was approximately half of the recommended allowance and mean iron consumption was about three-fourths of the RDA. The use of supplements increased the intakes of vitamins A and C, the B vitamins, calcium and iron but did not change the intakes of protein, phosphorous or magnesium. Energy consumption from fat in the total day's diet was 39 percent. A significant difference was observed between girls' and boys' total day's intake (with and without supplements) of energy and all nutrients except ascorbic acid. Intakes of protein, fat, carbohydrate,

vitamin A, thiamin, riboflavin, niacin, vitamin B_6, calcium, phosphorous, magnesium, and iron were higher ($p \leq 0.001$) for boys than girls.

The nutrient contribution of each meal (breakfast, lunch, dinner, snacks and supplements) to the total day's intake also was investigated by Gilbert et al. (104). They found that each meal contributed one-third to one-half of the allowances for vitamin A, thiamin, riboflavin, and phosphorous. Breakfast provided more than three-fourths of the RDA for ascorbic acid. Lunch contributed the greatest amounts of calcium, phosphorous, and riboflavin, which the researchers attributed to the high consumption of milk at school. Mean percentages of the RDAs supplied by snacks ranged from nine percent for iron and magnesium to 40 percent for ascorbic acid. Energy supplied by school lunch was slightly less than the recommended one-third of the daily allowance. The researchers did not consider this a cause for concern because of the relatively high level of energy supplied by snacks and other meals. Students' intakes of vitamin B_6, magnesium, and iron were less than one-third of the RDAs regardless of the source of lunch. Students who ate school lunch had significantly higher intakes of vitamin B_6 and iron than those eating lunch from other sources. However, magnesium intakes were lower for school lunch participants than for nonparticipants.

Gilbert et al. (104) also evaluated the quality of the Kansas fifth grade students' diets by classifying the daily energy and nutrient intakes into the following five categories: intake of $\geq$125 percent of the RDA, 100 to <125 percent, 66 to <100 percent, 50 to <66 percent and <50 percent. The percentages of students with dietary intakes in each of the RDA levels were determined. More than 80 percent of the girls and boys interviewed met or exceeded two-thirds of the RDA for energy; only four

percent of the girls and two percent of the boys had intakes below 50 percent of the RDA. Protein intakes of these students were very high with 85 percent of the girls and 94 percent of the boys exceeding 125 percent of the RDA; only two percent of the girls and none of the boys had intakes below 66 percent. More than two-thirds of the students consumed 100 percent or greater of the allowance for vitamin A. Approximately 15 percent of the girls and boys had intakes below 66 percent of the RDA for this nutrient. About three-fourths of the students had intakes of ascorbic acid that were equal to or greater than 125 percent of the recommended allowance; 12 to 14 percent of the girls and boys consumed less than 66 percent of the RDA for this vitamin. More students had lower intakes of niacin and vitamin B_6 than of riboflavin and thiamin. Some girls and boys reported low intakes of preformed niacin, but the researchers suggested that the high intake of protein probably met the niacin needs of these students. More boys than girls had intakes of calcium and phosphorous that exceeded 125 percent of the RDA, but 20 percent of the girls and 13 percent of the boys consumed less than 66 percent of the RDA for this nutrient. Forty percent of the girls had iron intakes below 66 percent of the RDA; only one-third met or exceeded the RDA. Almost half of the boys had iron intakes above 100 percent; however, 24 percent reported intakes below 66 percent of the allowance.

Gilbert et al. (104) computed a diet rating index to measure the overall quality of the diets of Kansas fifth grade students. Boys' diets rated significantly higher than those of girls for the total day's nutrient intake, both with and without supplements. Also, the diet ratings of students who ate school lunch were higher than those of students who consumed lunch from other sources.

Using the dietary data collected by Gilbert et al. (104) Aitken (108) investigated the food consumption patterns and quality of diets of the Kansas fifth grade students. She determined the frequency of consumption of foods in designated food categories and the effect of their consumption on dietary quality as assessed by calculating mean adequacy ratios (MARs). She found that boys had better diets and consumed milk or milk products and high protein foods more often than girls. Fruits, fats and nutrient supplements were consumed more frequently by females than males. MAR values grouped into four ranges (90 to 100, 75 to <90, 66 to <75, and <66) showed that boys and girls with MAR values between 90 and 100 consumed foods from the milk and vegetable categories more frequently than those with MAR values less than 66, who drank non-sugary beverages more often.

METHODOLOGY

School Selection

The study was conducted in three elementary schools in the same school district in a medium-sized midwestern city. The school lunch program served grades one through six on a regular basis and also some kindergarten students, who qualified for free or reduced priced lunches. The school food service director was responsible for overall administration and coordination of the district school food services. Centrally-planned, non-cyclical menus were written one month in advance of service for all on-site and base kitchen food preparation units.

The schools selected included one with family style school lunch service and two with cafeteria style food service. A satellite delivery system, in which food was received from the senior high school base kitchen, was used in one of the schools with cafeteria style service and in the school with family style service. In the other school with cafeteria style service, food was prepared on-site. The schools were similar in enrollment and lunchroom facilities.

In the school with family style food service, students were served during two, 30 minute periods. The lunchroom was furnished with colorful, portable round tables at a height designed for elementary students. Eight to 12 students of various grade levels were assigned to each table. Flatware, napkins, and plates were picked up from a cart by students upon entering the lunchroom. Two fifth or sixth grade students, designated by the principal, served as hosts or hostesses at each table and submitted the orders for milk and lunches for their table to the food service personnel. Food was served from the kitchen in bowls or on platters and plates

according to the number of students at the table. The hosts or hostesses delivered the dishes of food on trays to their table. The foods were passed around the table and students served themselves. Any remaining food items were offered to students by adult floor supervisors before removal from the table. The supervisors also passed leftovers from table to table and delivered removed food serving dishes to the kitchen dish return. After students finished eating they took their plates to the dish return and the hosts or hostesses cleaned the tables.

Both schools with cafeteria style service, one with satellite food delivery and the other with on-site food preparation, served lunches by classes at predesignated intervals. Students were allowed about 20 minutes to eat lunch. Foods were served by food service personnel on rectangular compartmentalized trays with quantity adjustment on some items according to grade level. No seconds were served. Students stood in line to pick up the served trays and were seated at rectangular tables with side seating. Seating positions were designated at the school with cafeteria, on-site food preparation, while students selected their seating position at the school with cafeteria, satellite service. Students at both schools returned their trays to the dish return after eating and table cleanup was completed by food service personnel.

Approval and Consent

Prior to data collection, approval for this study was obtained from subcommittees on research involving human subjects from the Colleges of Home Economics and Education. The district school food service director secured initial approval for the research from the school district superintendent and also from the principals of the study schools (Appendix A).

Introductory letters (Appendix B) were sent to the principals and subsequent planning meetings were scheduled that included the researchers, principals, and the district food service director. The principals, in turn, elicited approval of the study from their teachers and other school personnel. Information packets (parental/student consent form, classroom instruments and instructions, and a tentative schedule of study dates) and letters (Appendix B) describing the teachers' role in the project were formulated by the researchers and distributed by the principals.

Duplicate copies of the parent and student letter describing the project with participation consent forms included (Appendix A) were distributed to the students by the classroom teacher, who also collected the completed forms. Rosters of participating students were developed from the returned consent forms and class rosters secured from the principals. Four digit identification (ID) numbers were assigned to each participating student. The first of the four digits identified the school, the second referred to the grade and the last two indicated the class and the individual student.

Menu Selection

Two menus for the study in the family and cafeteria style food service schools with satellite delivery systems were selected in cooperation with the district food service director and included popular and less popular food items (Table 1). Both menus were served within the same week with Menu 2 served two to three days later than Menu 1. Each menu was served on two study days for a total of four days. Because of differences in food preparation and constraints of time and money, data collection for the food preference evaluation in the on-site cafeteria style food service

Table 1. Schedule of Data Collection at Schools with Family Style and Cafeteria Style Food Service

Menu	Day and Date	School	Data Collected	
			Food Preference Evaluation	24-Hour Dietary Recall Interviews
Menu 1[1]				
Day 1	Tues., Nov. 8, 1983	Family style, satellite	X	
	Tues., Nov. 29, 1983	Cafeteria style, satellite	X	
	Tues., Nov. 8, 1983	Cafeteria style, on-site	X	
Day 2	Tues., Nov. 29, 1983	Family style, satellite	X	X
	Tues., Dec. 13, 1983	Cafeteria style, satellite	X	X
Menu 2[2]				
Day 1	Thurs., Nov. 10, 1983	Family style, satellite	X	
	Thurs., Dec. 1, 1983	Cafeteria style, satellite	X	
	Thurs., Nov. 10, 1983	Cafeteria style, on-site	X	
Day 2	Thurs., Dec. 1, 1983	Family style, satellite	X	X
	Fri., Dec. 16, 1983	Cafeteria style, satellite	X	X
Menu 3[3]	Tues., Nov. 15, 1983	Cafeteria style, on-site		X

[1]Menu 1 = macaroni/ground beef and tomato, green beans, coleslaw, cinnamon roll, mixed fruit cup, milk.

[2]Menu 2 = glazed ham, broccoli, carrot sticks, dinner roll, cherry crisp, milk.

[3]Menu 3 = sausage patty, spaghetti/sauce, tossed salad, peach slices, dinner roll, milk.

school was limited to one day each of Menus 1 and 2. The 24-hour dietary recalls in this school included Menu 3.

Food Preference

Development of Instrument

The hedonic rating scale consisting of a facial, five point scale (Appendix C) was adapted from scales used in previous studies (37, 49, 65). Scale points were labeled as follows: great, good, so-so, bad, and awful. The "smiley face" is universally recognized by people of all ages or languages and five point rating scale requires less decision making from a younger child as compared to a seven or nine point rating scale and, therefore, causes less confusion (4, 37).

Pilot Testing

The food preference instrument was pilot tested with one class each of first, second and third graders. It was reasoned that if grades one through three could understand the directions and complete the form, it should present no problems for grades four through six. The researchers included a comment sheet (Appendix C) for the teachers' suggestions following the administration of the food preference instrument. They indicated that the instrument required 10 to 15 minutes to complete, but no changes in the instrument or the instruction were suggested.

Data Collection

Data were collected from all students, grades one through six, who had returned signed consent forms to participate according to the schedule listed in Table 1. The food preference evaluation forms were dated by the researcher and the school lunch menu items were typed in the proper spaces on the form. The student's ID number was listed on each form and on a

paper tab stapled to the top left-hand corner which also included the student's name. The tabs with the names facilitated distribution of the forms by the teachers and provided for confidentiality since students were told that they could remove the tab if they so desired. The food preference evaluation forms and the teacher/student narrative instructions for each class for each day of data collection were enclosed in a manila envelope. The envelopes were delivered to the school offices in the morning of the study days prior to the beginning of classes along with posters to assist the teachers in data collection. The posters were enlarged copies of the food evaluation form. All of the evaluation forms, instructions for administration, and posters were printed on ivory-colored paper.

The teachers were instructed to administer the food preference forms immediately following the students' return to the classroom after lunch. The teacher instructions (Appendix C) were typed in small letters. The capital letter script was a narrative instruction to be read to the students. The narrative script was adapted from that used by Johnson (37) and eliminated the necessity for teachers to create instructions while at the same time ensured consistency of data collection among classes and between schools. Teachers were instructed to place the completed forms in the manila envelope and return it with the poster to the office for pick-up by the researchers at the end of the school day.

Twenty-four Hour Dietary Recall Interviews

Selection of Equipment and Materials

One dimension, life-size food models developed by the National Dairy Council were dry mounted on three, 14"×22" poster boards according to food

groups (Appendix D) and laminated for use during the dietary recall interviews. Standard aluminum measuring cups and spoons, a 12" clear plastic ruler and various sizes of clear plastic glasses (5 oz., 8 oz., 10 oz., 12 oz., 16 oz., and 20 oz.) were used to assist students in estimating amounts of foods eaten and beverages consumed. Each interviewer was provided with a portfolio for the food models and a plastic drawstring bag for the small equipment.

Development of Dietary Recall Procedures and Recording Forms

A 24-hour dietary recall recording form (Appendix D) was adapted from those used in related studies (85, 100, 104, 117). The form included space for recording demographic data. Probing questions and procedures for interviews (Appendix D) were modified from those used by Gilbert et al. (104) and Howe and Vaden (100).

Interview Training

Two training sessions for the four interviewers were conducted prior to the study. During the first session, the procedures for the recall interviews, and use of the list of probing questions and visual aids were explained. During this session interviewers practiced on each other to become familiar with the procedures and the form. In the second sessions, each interviewer conducted two dietary interviews with fourth and fifth grade students from non-study schools.

Data Collection

Forty-eight 24-hour dietary recall interviews (16 students from each of the fourth, fifth and sixth grades) were conducted in each of the family style and cafeteria style, satellite food services on the second day when Menus 1 and 2 were served (Table 1). On the day of the data collection a sign-up sheet for students intending to eat school lunch on that day was

delivered to the school office with the food preference forms for teachers of classes involved in the dietary recall interviews. The teachers were instructed to pass around the sign-up sheet during lunch count (Appendix D). The sign up sheet was returned to the office with the lunch count and collected by the researcher for randomization of students by class to participate in the 24-hour dietary recalls. Boys and girls were randomized separately to obtain an equal number of each sex. Following randomization the researcher prepared, in triplicate, a list of those students selected to participate in the interviews and indicated an approximate time when the interviews would be conducted. One copy of the list was given to the principal, another to the classroom teacher and one copy was retained by the researcher to be used during the interviews. Randomization and the preparation of lists were completed prior to lunch. The interviews were conducted in the afternoons immediately following the food preference data collection. Interviews were conducted with students one class at a time to minimize classroom disruption. Dietary recall interviews with students at the cafeteria style, on-site food preparation school differed from those in the other study schools. It was not possible to schedule the interviews on the day that the other data were collected. Interviews were conducted in the morning and the 24-hour period included the school lunch served on the previous day. The dietary interview sign-up sheet for students and the instructions to teachers were modified accordingly (Appendix D).

Four interviewers conducted the dietary recalls at separate stations set up in empty classrooms or in hallways. Each station included two folding chairs, a table or TV tray, and a set of posters and visual aids. The recall form was secured to a clipboard to facilitate recording of the

dietary information. A fifth person on the interview team acted as a runner. This person was responsible for calling students out of the classroom, escorting them to the interview stations in the order specified, and seeing that all students returned to the classroom following the interview.

Data Analysis

Percentage school lunch participation was calculated for each school on study days by dividing the number of students eating school lunch by the number attending school times 100. School lunch participation rates and frequencies of full priced, free and reduced priced meals were compiled.

Food Preference Evaluation

A general linear model analysis of variance was used to determine food evaluation differences attributable to serving style. Grade, sex and school lunch paying status were included as factors in the model.

Twenty-four Hour Dietary Recall Interviews

Frequency distributions were compiled for characteristics of the students at each school, sources of their meals and the number consuming or not consuming breakfast, lunch, dinner, snacks and supplements.

The data base used to develop a program to convert food intake data into nutrient values by meal was a combination of the United States Department of Agriculture (USDA) Handbook 456 (121) and the newer USDA Handbooks 8-1 through 8-9 (122-130). The food composition values from these sources were merged into one data base. Food codes were assigned to the recall foods from the data base and an amount code was calculated as a multiple of the amount of the food specified in the data base; i.e.,

if the child reported consuming one and one-half cups milk and the nutrient analysis on the data base was for one cup quantity, the amount code entered into the computer was 1.50. Some food items were added to the USDA data base from the DIETCHECK data base developed by the University of Nebraska Extension Service. Other nutrient values for food items were obtained from a previous study conducted at Kansas State (104). Food nutrient values for selected menu items served on study days were acquired from the district school food service director.

Supplements were coded as a separate meal to permit analysis of nutrient intake by meal and for the total day with or without nutrient supplements. A list of supplements was added to the data base. Since students interviewed frequently were not aware of the brand, the value of a standard supplement[1] was used for recording the nutrients consumed unless a specific type or brand was reported. Data on supplements were secured from local pharmacies.

The general linear models analysis of variance was used to analyze energy and nutrient intake for the combined sexes and for girls and boys separately for the total day (with and without supplements), and for breakfast, lunch, dinner and snacks. In between meal snacks were combined and reported as a meal. Means, standard errors and coefficients of variation were computed for energy and 13 nutrients (protein, total fat, carbohydrate, vitamin A, ascorbic acid, thiamin, riboflavin, niacin, vitamin B_6, calcium, phosphorous, magnesium and iron). Because food composition data were incomplete for folic acid, vitamin B_{12}, pantothenic acid, vitamin E and fatty acids those analyses are not presented.

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[1]Miles Laboratory, "One A Day" brand.

Percentages of the Recommended Dietary Allowances (RDA) (7) were computed by using the same analyses for energy and 11 nutrients. Carbohydrates and total day's fat were omitted because recommended allowances have not been established for those nutrients. Percentage of total day's energy from fat was determined and analyzed for differences among schools because of current interest in reducing fat in the diet (7). Also, because of federal regulations (131) recommending decreasing fat in school lunches, fat content of lunches consumed by students was analyzed.

The birth date reported during the dietary recall interview was used to calculate each child's age in years and months. The age in years was determined by subtracting a child's year of birth from the year of the study. The age in months also was computed and included the period from the most recent birthday to the date of the interview. A period of time shorter than one month but 15 days or greater was counted as one month. Less than 15 days was not considered a month. A child's age in months was divided by the total months in a year and expressed as a decimal figure; e.g., the age of a 10 year-seven month old child was entered into the computer as 10.58. The decision was made to apply the RDAs for 11- to 14-year olds to all students 10.50 years and above because their nutrients needs more closely resembled those of children in this age group than the seven- to 10-year age group.

To judge overall dietary quality of the students interviewed, mean adequacy ratios (MARs) (106) were calculated. MAR values were generated by totaling nutrient adequacy ratio (NAR) values and computing a mean value. Nutrient adequacy ratio refers to the percentage of the RDA for a single nutrient. All NAR values exceeding 100 percent were truncated to 100 to prevent intakes in excess of the RDA for one nutrient compensating

for inadequacies of others. The MAR values were obtained by using the following formula:

$$MAR = \sum_{i=1}^{k} \chi_{i/k} \text{ where } \chi_i = NAR \text{ if } NAR \leq 100$$
$$= 100 \text{ if } NAR > 100$$

Two MAR values, with and without supplement, for each of the two sexes were calculated. The general linear model of variance was used to determine MAR differences attributable to serving styles. Because two-thirds of the RDA has been used routinely in group assessment for signifying nutrient adequacy, that value was used as a starting point for establishing ranges of MAR values. The MAR values were grouped into four ranges as follows:

90 to 100
75 to <90
66 to <75
<66

RESULTS AND DISCUSSION

School Lunch Participation and Paying Status of Students

Percentage participation was computed as the ratio of students eating the school lunch on the days of the study in relation to the number of students in attendance. The family style school participation rate ranged from 55 to 60 percent, the satellite cafeteria style school from 74 to 88 percent, and the on-site cafeteria style school from 59 to 64 percent (Table 2). The satellite cafeteria style school had the highest participation rate and also the highest percentage of free and reduced priced meals (31 to 32 percent) as compared to the satellite family style school (21 to 23 percent) and the on-site cafeteria style school (15 to 16 percent) (Table 2).

Percentages of approved applications for free and reduced price lunches in the three schools are listed in Table 3. The satellite cafeteria style school had the highest percentage of free and reduced-price meals of the three schools (Table 3). Percentage of students qualifying for free and reduced priced meals (52, 53) and family style school food service (11, 40, 41) have been reported to increase school lunch participation. Based on these studies, it was expected that the participation rates would be similar in satellite cafeteria style and the satellite family style school lunch programs. In our study, however, it appeared that free and reduced priced meals had a greater effect on participation rate than either type of meal service or food delivery system.

Table 2. School Lunch Participation and Paying Status of Students with Family or Cafeteria Style Food Service on the Oays of Data Collection

	Family Style, Satellite (N[1] = 290-295)				Cafeteria Style, Satellite (N = 312-317)				Cafeteria Style, On-Site (N = 322)			
	Day 1		Oay 2		Oay 1		Day 2		Oay 1		Oay 2	
	N[2]	%	N	%	N	%	N	%	N	%	N	%
Menu 1[3]												
Full price	102	35	107	37	161	52	155	49	142	44	-	-
Free	56	19	56	19	78	25	76	24	31	10	-	-
Reduced price	12	4	10	3	22	7	23	7	16	5	-	-
Total	170	58	173	60	261	84	254	80	189	59	-	-
Menu 2[4]												
Full price	100	34	112	38	133	42	171	55	151	47	-	-
Free	53	18	52	18	77	25	78	25	32	10	-	-
Reduced price	10	3	8	3	22	7	25	8	16	5	-	-
Total	163	55	172	59	232	74	274	88	199	62	-	-
Menu 3[5]												
Full price	-	-	-	-	-	-	-	-	153	48	-	-
Free	-	-	-	-	-	-	-	-	35	11	-	-
Reduced price	-	-	-	-	-	-	-	-	17	5	-	-
Total	-	-	-	-	-	-	-	-	205	64	-	-

[1]Student attendance varied because of daily absences and families moving (included grades one to six only).

[2]Refers to the total number of school lunches served to grades one to six.

[3]Menu 1 = macaroni/ground beef and tomato, green beans, coleslaw, cinnamon roll, mixed fruit cup, milk.

[4]Menu 2 = glazed ham, broccoli, carrot sticks, dinner roll, cherry crisp, milk.

[5]Menu 3 = sausage patty, spaghetti/sauce, tossed salad, peach slices, dinner roll, milk.

Table 3. Full Price Lunches and Approved Applications for Free and Reduced Priced School Lunches in Schools with Family Style and Cafeteria Style Food Service

	Family Style, Satellite (N^1 = 288)	Cafeteria Style, Satellite (N = 322)	Cafeteria Style, On-Site (N = 323)
	%		
Full price	70	58	84
Free	21	29	11
Reduced price	9	13	5

[1]Total enrollment of first through sixth grade students as of September 15, 1983.

Food Preference

School Differences

The analysis of variance of the food preference data is summarized in Table 4. Least square means and standard errors for significant differences ($p \leq 0.05$) between schools for specific menu items are listed in Table 5. There were significant differences in food preferences of students between the satellite family and satellite cafeteria style schools and also between the satellite family and the on-site cafeteria style schools. Students in the satellite cafeteria style school rated the macaroni/ground beef and tomato on day 2 of Menu 1 higher than students in the satellite family style school (Table 5). The satellite cafeteria style students as well as the on-site cafeteria style students rated the milk on day 1 of Menu 2 higher than did students in the satellite family style school (Table 5). The dinner roll and milk on day 2 of Menu 2 were rated higher by the satellite cafeteria style students than by those in the satellite family style school. There was also a significant difference ($p \leq 0.05$) between schools in the acceptance of broccoli on day 1 of Menu 2 with a school by grade interaction. There was a tendency for the satellite cafeteria style students to rate the dinner roll on day 1 of Menu 2 higher than those students in the satellite family style school. There were no significant differences in food preferences of students in the satellite cafeteria style and on-site cafeteria style schools.

School by Grade Differences

Significant differences ($p \leq 0.05$) were found in the acceptance of broccoli and ham on day 1 of Menu 2. Students in grades one, two, four, five and six in the satellite cafeteria style school rated broccoli higher than those in grades one, two, and three in the satellite family style

Table 4. Analysis of Variance for Preference of School Lunch Items at Schools with Family or Cafeteria Style Food Service

Source of Variation	df	Mean Squares					
		Main Oish	Vegetables	Salad	Roll	Oessert	Milk
Menu 1,[1] Day 1							
School	2	0.78	1.39	4.36	0.47	3.13	3.36
Grade	5	2.54	2.81	4.51	0.16	2.16	1.99
Sex	1	0.36	5.61	1.87	0.64	0.53	4.00
Paying status	2	0.55	3.24	5.19	0.20	8.27**	3.08
School × grade	10	1.84	1.49	1.15	0.83	1.92	1.92
School × sex	2	0.77	0.51	0.27	0.10	1.81	4.26
School × paying status	4	0.86	1.01	2.99	0.40	0.71	1.20
Grade × sex	5	1.23	1.98	2.39	0.15	2.84	1.65
Grade × paying status	10	2.63	1.26	1.53	0.41	0.88	1.33
Sex × paying status	2	4.90*	6.86*	3.69	0.77	0.76	1.47
Error		1.54 (295)[2]	2.15 (296)	2.22 (291)	0.48 (296)	1.68 (293)	1.47 (294)
Menu 1, Oay 2							
School	1	8.60*	2.96	5.89	0.32	2.10	1.75
Grade	5	1.77	0.61	4.64	1.64*	2.32	1.19
Sex	1	4.82	1.41	4.07	7.64***	0.09	0.01
Paying status	2	1.58	1.06	0.18	2.95*	4.56	0.42
School × grade	5	0.98	1.44	2.71	0.91	0.71	0.74
School × sex	1	4.84	0.94	0.33	0.06	4.18	0.14
School × paying status	2	2.58	0.17	3.24	2.05*	0.82	0.69
Grade × sex	5	1.20	2.86	1.38	0.79	3.53	1.07
Grade × paying status	10	2.13	2.23	2.02	0.64	1.82	0.80
Sex × paying status	2	0.51	0.14	0.69	2.84*	0.69	0.54
Error		1.82 (179)	2.07 (176)	2.26 (176)	0.65 (178)	1.92 (176)	1.24 (178)

Table 4. (continued)

Source of Variation	df	Mean Squares					
		Main Dish	Vegetables	Salad	Roll	Dessert	Milk
Menu 2,[3] Day 1							
School	2	2.40	7.54*	0.32	2.39	0.01	6.29*
Grade	5	1.52	1.53	3.02	1.10	0.56	2.16
Sex	1	1.25	3.68	0.23	0.22	7.69*	3.08
Paying status	2	0.36	2.13	0.10	3.11*	0.04	0.51
School × grade	10	1.92*	4.64*	1.63	0.38	1.74	2.37
School × sex	2	0.58	1.87	1.10	0.94	3.78	0.92
School × paying status	4	0.14	1.65	1.01	0.43	1.86	0.79
Grade × sex	5	0.73	3.30	0.68	0.89	0.40	0.54
Grade × paying status	10	0.91	2.94	1.25	0.57	1.60	1.15
Sex × paying status	2	0.03	1.85	1.84	0.56	0.20	3.97
Error		1.02	2.10	1.66	0.83	1.67	1.47
		(317)	(313)	(312)	(316)	(315)	(312)
Menu 2, Day 2							
School	1	2.19	4.37	0.12	4.47*	1.00	7.37*
Grade	5	0.53	2.45	0.28	0.88	0.79	1.76
Sex	1	0.00	0.35	0.64	1.76	1.05	0.22
Paying status	2	1.28	3.15	0.01	1.29	1.69	0.24
School × grade	5	0.65	2.33	0.74	1.24	1.24	0.48
School × sex	1	0.63	7.97	0.33	1.19	1.30	4.85
School × paying status	2	0.04	2.11	0.71	0.66	7.70*	0.41
Grade × sex	5	1.09	2.24	3.21	0.19	1.40	1.66
Grade × paying status	10	1.39	1.59	1.07	0.62	2.25	1.23
Sex × paying status	2	3.16*	2.92	0.94	0.32	1.46	1.02
Error		1.03	2.37	1.69	0.86	1.98	1.62
		(188)	(186)	(186)	(189)	(189)	(186)

* $\leq$ 0.05 ** $\leq$ 0.01 *** $\leq$ 0.001.

[1]Menu 1 = macaroni/ground beef and tomato, green beans, coleslaw, cinnamon roll, mixed fruit cup, milk.

[2]Error df.

[3]Menu 2 = glazed ham, broccoli, carrot sticks, dinner roll, cherry crisp, milk.

Table 5. Least Square Means and Standard Errors for Preference Scores for School Lunch Items at Schools with Family or Cafeteria Style Service

	Serving Style					
	Family, Satellite		Cafeteria, Satellite		Cafeteria, On-Site	
	mean[1]	S.E.[2]	mean	S.E.	mean	S.E.
Menu 1[3]						
Day 2						
Main dish	3.08[1]	0.27	3.76[2]	0.16	-	-
Menu 2[4]						
Day 1						
Milk	3.50[1]	0.22	4.18[2]	0.20	4.29[2]	0.15
Day 2						
Roll	4.09[1]	0.21	4.62[2]	0.10	-	-
Milk	3.54[2]	0.28	4.22[2]	0.14	-	-

[1]Where superscripts (1, 2) on means differ horizontally, means differ significantly ($p \leq 0.05$) from each other. Means based on a scale of: 5 = great, 4 = good, 3 = so-so, 2 = bad, 1 = awful.

[2]S.E. = standard error.

[3]Menu 1 = macaroni/ground beef and tomato, green beans, coleslaw, cinnamon roll, mixed fruit cup, milk.

[4]Menu 2 = glazed ham, broccoli, carrot sticks, dinner roll, cherry crisp, milk.

school. Second, fourth, fifth and sixth graders in the satellite cafeteria style school rated broccoli higher than did second and fourth graders in the on-site cafeteria style school. Students in grades one and three in the on-site cafeteria style school rated broccoli higher than did those in grade three in the satellite cafeteria style school. First, second, third, and sixth graders in the satellite cafeteria style school rated ham higher than did second, fourth and sixth graders in the on-site cafeteria style school.

School by Sex Differences

There were no significant ($p \leq 0.05$) school by sex differences, however, there was a tendency for boys and girls in the satellite cafeteria style school to rate the milk on day 1 of Menu 1 higher than did boys at both on-site cafeteria and satellite family style schools. Also, the girls in the on-site cafeteria style school tended to rate the milk higher than did boys in the satellite family style school. There was a tendency for the boys in the satellite cafeteria style school to rate the broccoli on day 2 of Menu 2 higher than did boys in the satellite family style service.

School by Paying Status Differences

Significant differences ($p \leq 0.05$) were observed between the satellite cafeteria style and satellite family style schools when paying status was a factor in the analysis (Table 4). The satellite cafeteria style students paying full price for meals indicated they liked the cinnamon roll on day 2 of Menu 1 better than both the students paying full price and those qualifying for free meals at the satellite family style school. The satellite cafeteria style students qualifying for free meals rated the cinnamon roll higher than the satellite family style students

qualifying for free meals. The students qualifying for reduced price meals at the satellite family style school rated the cherry crisp on day 2 of Menu 2 higher than did the students qualifying for reduced price meals at the satellite cafeteria style school.

Other factors in the model of analysis of variance such as grade, sex, paying status, and sex by paying status (Table 4) indicated significant differences ($p \leq 0.05$). These results are not discussed because school differences could not be determined.

An examination of each menu item on the completed food preference forms showed that students tended to rate ham, cinnamon roll, dinner roll, and cherry crisp higher than other foods. The scores for macaroni/ground beef and tomato, green beans, carrot sticks, and milk were intermediate and the ratings were lowest for broccoli and coleslaw. The mixed fruit cup was rated higher than the broccoli and coleslaw but lower than the foods with intermediate ratings. These findings are similar to those of Jansen et al. (48) who found that students gave the highest ratings to milk, starches, baked foods, and entrees. Salads and vegetables received the lowest rating although corn and green beans were more acceptable than green leafy vegetables. Students preferred individual foods rather than combinations with the exceptions of tacos, pizza and lasagna. Similarly, students in our study rated ham above the macaroni/ground beef and tomato entree.

There was a greater number of high scores for menu items in the satellite cafeteria style school than in the satellite family or on-site cafeteria style schools. A possible explanation for the students in the satellite cafeteria style school to rate menu items higher than did students in the satellite family style school is that there was a higher

percentage of students in the study sample, who ate free and reduced priced meals in the former than in the latter school (Table 6). Studies (50, 66) have shown that students qualifying for free and reduced priced meals tend to rate foods higher than do students who pay full price for meals. The higher food ratings in the on-site cafeteria style school than in the satellite family style school may be attributed to the type of food delivery system. Johnson (37) found that students at on-site food preparation schools rated food higher than did students at satellite food delivery schools.

Twenty-four Hour Dietary Recall Interviews

As reported in the methodology section, 24-hour dietary recalls were conducted at the satellite family and cafeteria style schools in the afternoons on the second day when Menus 1 and 2 were served (Table 1). Because of time and money constraints data collection at the on-site cafeteria style school was limited to one day of each menu. Twenty-four hour dietary recalls at that school were conducted one morning during the week following the other data collection and included Menu 3. Because the dietary recalls included a different menu than the recalls in the other two schools dietary data could not be compared. Twenty-four hour dietary recall data for the on-site cafeteria school is located in Appendix E.

Characteristics of Students

Characteristics of students at the satellite family and cafeteria style schools who participated in the 24-hour dietary recall interviews are summarized in Table 7. Participating fourth, fifth and sixth grade students were divided approximately equally between males and females.

Table 6. School Lunch Paying Status of Students at Schools with Family or Cafeteria Style Food Service Who Participated in Food Preference Evaluations and 24-Hour Dietary Recall Interviews

	Family Style, Satellite				Cafeteria Style, Satellite				Cafeteria Style, On-Site			
	Food Preference Evaluations		24-Hour Dietary Recall Interviews		Food Preference Evaluations		24-Hour Dietary Recall Interviews		Food Preference Evaluations		24-Hour Dietary Recall Interviews	
	N	%	N	%	N	%	N	%	N	%	N	%
Menu 1[1]												
Day 1												
Full price	124	85	-	-	124	73	-	-	190	88	-	-
Free	16	11	-	-	29	17	-	-	18	8	-	-
Reduced price	6	4	-	-	15	10	-	-	8	4	-	-
Day 2												
Full price	121	85	14	74	126	73	14	67	-	-	-	-
Free	16	11	4	21	30	18	5	24	-	-	-	-
Reduced price	5	4	1	5	15	9	2	9	-	-	-	-
Menu 2[2]												
Day 1												
Full price	126	84	-	-	128	73	-	-	189	87	-	-
Free	16	11	-	-	31	17	-	-	19	9	-	-
Reduced price	7	5	-	-	17	10	-	-	8	4	-	-
Day 2												
Full price	122	85	15	60	128	71	24	86	-	-	-	-
Free	17	12	9	36	33	18	1	3	-	-	-	-
Reduced price	5	3	1	4	19	11	3	11	-	-	-	-
Menu 3[3]												
Day 1												
Full price	-	-	-	-	-	-	-	-	-	-	22	85
Free	-	-	-	-	-	-	-	-	-	-	2	8
Reduced price	-	-	-	-	-	-	-	-	-	-	2	7

[1]Menu 1 = macaroni/ground beef and tomato, green beans, coleslaw, cinnamon roll, mixed fruit cup, milk.

[2]Menu 2 = glazed ham, broccoli, carrot sticks, dinner roll, cherry crisp, milk.

[3]Menu 3 = sausage patty, spaghetti/sauce, tossed salad, peach slices, dinner roll, milk.

Table 7. Characteristics of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews

Characteristics	Family Style		Cafeteria Style	
	Menu 1[1] (N = 19)	Menu 2[2] (N = 25)	Menu 1 (N = 21)	Menu 2 (N = 28)
	%			
Sex				
Girl	42.1	56.0	57.1	42.9
Boy	57.7	44.0	42.9	57.1
Ethnic group				
Caucasian	73.7	60.0	81.0	96.4
Black	26.3	36.0	14.3	-
Other	-	4.0	4.7	3.6
Take supplement				
Yes	31.6	64.0	52.4	50.0
No	68.4	36.0	47.6	50.0
Number of supplements taken				
1 daily	26.3	36.0	38.1	28.6
2 daily	5.3	16.0	4.7	14.3
3 or more daily	-	4.0	9.5	3.6
Days per week supplement taken				
6-7 days/week	31.6	56.0	52.4	46.4
4-5 days/week	-	4.0	-	3.6
$\leq$ 3 days/week	-	4.0	-	-

[1]Menu 1 = macaroni/ground beef and tomato, green beans, coleslaw, cinnamon roll, mixed fruit cup, milk.

[2]Menu 2 = glazed ham, broccoli, carrot sticks, dinner roll, cherry crisp, milk.

The majority of these students were caucasian ranging from 60.0 to 73.7 percent in the satellite family style school and 81.0 to 96.4 percent in the satellite family style school. The percentage of black students in the satellite family style school ranged from 26.3 to 36.0 and 0.0 to 14.3 percent in the satellite cafeteria style school. All other races were combined into one category and comprised 0.0 to 4.0 percent of the study sample in the satellite family style school and 3.6 to 4.7 percent in the satellite cafeteria style study sample.

Among those students interviewed in the satellite family style school 31.6 to 64.0 percent reported consumption of vitamin and/or mineral supplements (Table 7). In the satellite cafeteria style school 50.0 to 52.4 percent reported they were taking a supplement. The percentage of students consuming supplements in this study was similar to the findings of Gilbert et al. (104) in a study of Kansas fifth graders in which 43.8 percent of the students were taking a supplement. Of those students who reported taking supplements in the satellite family and cafeteria style schools, the majority reported taking one supplement daily; a small percentage consumed two or more supplements daily; and a few reported taking supplements less frequently than 6 days per week. These results also were similar to those reported by Gilbert et al. (104) who found that over three-fourths of the students consumed one supplement daily.

Ages of the students ranged from 8.83 to 13.42 years with a mean age of 10.74 years. The majority of the fourth graders were 9.25 to 9.50 years old. Most of the fifth graders were 10.25 to 10.58 years old and a major portion of the sixth graders were aged 11.83 to 12.17 years.

Characteristics of the students from the 24-hour dietary recall interviews conducted in the on-site cafeteria style school are reported

in Appendix E (Table 25). Student characteristics of students in that school were similar to those in the other two schools.

Percentage of Students Consuming and Not Consuming Meals

The percentages of the students consuming breakfast, lunch, dinner, snacks and supplements on the day of the 24-hour dietary recall are listed in Table 8. Meal skipping was infrequent among the students interviewed. On the average, 90 to 93 percent of the students in the satellite family and cafeteria style schools, respectively, reported eating breakfast. All students had eaten school lunch, because that was the criterion for selection for 24-hour dietary recall interviews, and all students reported that they ate dinner. Morning snacking was not common among students; slightly less than two-thirds of the students consumed an afternoon snack and from one-third to one-half of the students reported eating an evening snack. Snacking patterns of students in this study were similar to those reported by Gilbert et al. (104). Percentages of students consuming and not consuming meals in the on-site cafeteria style school are reported in Appendix E (Table 26).

Sources of Meals

Meal sources of students on the day of the 24-hour dietary recall interview are listed in Table 9. The majority of students had eaten breakfast at home; a few had participated in the school breakfast program; and all students had eaten lunch at school. Dinner had been consumed at home by an average of 77 to 87 percent of the students at the family and cafeteria style schools, respectively, with the remainder eating dinner elsewhere. Morning snacks were consumed at the satellite cafeteria style school because of birthday parties in some of the classes. Afternoon snacks were eaten mainly at home with other sources reported by some

Table 8. Percentage of Students in Satellite Family Style Service and Cafeteria Style Service Schools Consuming Breakfast, Lunch, Dinner, Snacks, and Supplements on the Day of 24-Hour Dietary Recall Interviews

	Family Style			Cafeteria Style		
	N	Those Consuming	Those Not Consuming	N	Those Consuming	Those Not Consuming
		%	%		%	%
Menu 1[1]	19			21		
Breakfast		84	16		90	10
Morning snack		0	100		14	86
Lunch		100	0		100	0
Afternoon snack		42	58		62	38
Dinner		100	0		100	0
Evening snack		47	53		67	33
Supplement		32	68		52	48
Menu 2[2]	25			28		
Breakfast		96	4		96	4
Morning snack		0	100		14	86
Lunch		100	0		100	0
Afternoon snack		76	24		64	36
Dinner		100	0		100	0
Evening snack		32	68		50	50
Supplement		72	28		50	50

[1]Menu 1 = macaroni/ground beef and tomato, green beans, coleslaw, cinnamon roll, mixed fruit cup, milk.

[2]Menu 2 = glazed ham, broccoli, carrot sticks, dinner roll, cherry crisp, milk.

Table 9. Sources of Meals of Students in Satellite Family Style Service and Cafeteria Style Service Schools Who Participated in the 24-Hour Dietary Recall Interviews

Type of Food Service and Meal	N	Source of Meals					
		School	Home	Other Home	Fast Food	Restaurant	Other
		%					
Menu 1[1]							
Family style	19						
Breakfast		-	84	-	-	-	-
Morning snack		-	-	-	-	-	-
Lunch		100	-	-	-	-	-
Afternoon snack		-	42	-	-	-	-
Dinner		-	74	11	5	10	-
Evening snack		-	47	-	-	-	-
Cafeteria	21						
Breakfast		19	67	-	-	5	-
Morning snack		-	-	-	-	-	14
Lunch		100	-	-	-	-	-
Afternoon snack		-	48	-	5	5	5
Dinner		-	81	-	10	5	4
Evening snack		-	67	-	-	-	-
Menu 2[2]							
Family style	25						
Breakfast		4	92	-	-	-	-
Morning snack		-	-	-	-	-	-
Lunch		100	-	-	-	-	-
Afternoon snack		-	72	-	-	-	4
Dinner		-	80	-	8	4	8
Evening snack		-	28	-	-	-	4
Cafeteria	28						
Breakfast		4	93	-	-	-	-
Morning snack		-	-	-	-	-	14
Lunch		100	-	-	-	-	-
Afternoon snack		-	61	4	-	-	-
Dinner		-	93	-	3	4	-
Evening snack		-	50	-	-	-	-

[1]Menu 1 = macaroni/ground beef, green beans, coleslaw, cinnamon roll, mixed fruit cup, milk.

[2]Menu 2 = glazed ham, broccoli, carrot sticks, dinner roll, cherry crisp, milk.

students, and evening snacks were eaten almost exclusively at home. These results were similar to those reported by Gilbert (132) where the majority of the fifth graders in her study had eaten breakfast, dinner, and afternoon and evening snacks at home. The sources of meals of the students at the on-site cafeteria style school are listed in Appendix E (Table 27).

Energy and Nutrient Intakes

The means, standard errors and coefficients of variation for energy and nutrient intakes for the total day (with and without supplements) and from breakfast, lunch, dinner and snacks for students at the satellite family style and cafeteria style schools are located in Appendix F (Tables 33-44). These data will not be discussed. The same information for students in the on-site cafeteria style school is included in Appendix E (Tables 28-29).

Percentages of the RDAs--School Differences

The Recommended Dietary Allowances for children, seven through 10 years, and boys and girls, 11 through 14 years are listed in Table 10 and were used for converting students' intakes into percentages of the RDAs.

Total Day. There were no significant differences ($p \leq 0.05$) between the satellite family style and cafeteria style schools for students' total day's energy and nutrient intakes, with or without supplements (Tables 11 and 12). With the exceptions of energy, vitamin B_6, and magnesium, the mean RDAs for the nutrients were over 100 percent. Protein intake ranged from 211.9 to 239.8 percent of the RDA (Table 11). Vitamin A, ascorbic acid, thiamin, and riboflavin all were greater than two times the RDA without supplements. The students' iron intakes were greater than the RDA and ranged from 123.28 to 159.74 percent of the RDA without supplements. Supplements increased the intake of all nutrients, especially

Table 10. Recommended Dietary Allowances, 1980[1]

	Females and Males	Females	Males
Age, years	7-10	11-14	11-14
Weight			
Kg.	28	46	45
Lb.	62	101	99
Height			
Cm.	132	157	157
In.	52	62	62
Energy, kcal.	2,400	2,200	2,700
Protein, gm.	34	46	45
Fat-soluble vitamins			
Vitamin A, I.U.	3,500	4,000	5,000
Water-soluble vitamins			
Vitamin C, mg.	45	50	50
Thiamin, mg.	1.2	1.1	1.4
Riboflavin, mg.	1.4	1.3	1.6
Niacin, N.E.	16	15	18
Vitamin B_6, mg.	1.6	1.8	1.8
Minerals			
Calcium, mg.	800	1,200	1,200
Phosphorus, mg.	800	1,200	1,200
Magnesium, mg.	250	300	350
Iron, mg.	10	18	18

[1]Source: Food and Nutr. Board, Natl. Res. Council. 1980. Recommended dietary allowances. 9th ed. Washington, DC: Natl. Acad. of Sci.

Table 11. Means, Standard Errors and Coefficients of Variation for Percentages of Recommended Dietary Allowances for Total Day's Energy and Nutrient Intake, Excluding Supplements, of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews

	Total Day's Meals Excluding Supplements							
	Family Style				Cafeteria Style			
	N	Mean	S.E.[1]	C.V.[2]	N	Mean	S.E.	C.V.
				%				%
Menu 1[3]	19				21			
Energy		98	6	29		99	6	29
Protein		239.8	18.2	34		228.9	17.3	34
Vitamin A		163	25	65		141	24	65
Ascorbic acid		267.2	51.9	81		313.7	49.3	81
Thiamin		217.85	20.78	46		192.20	19.72	46
Riboflavin		205.41	20.66	46		196.16	19.61	46
Niacin		177.8	18.2	53		143.2	17.3	53
Vitamin B_6		49.8	10.9	96		39.2	10.3	96
Calcium		109	14	49		136	13	49
Phosphorous		150	15	40		172	14	40
Magnesium		39.2	6.0	67		42.4	5.7	67
Iron		158.74	20.74	67		144.32	19.69	67
Menu 2[4]	25				28			
Energy		103	6	29		89	5	29
Protein		224.5	15.8	34		211.9	15.0	34
Vitamin A		196	22	65		157	20	65
Ascorbic acid		288.4	45.0	81		264.4	42.7	81
Thiamin		181.00	18.02	46		188.47	17.08	46
Riboflavin		192.12	17.92	46		196.01	16.98	46
Niacin		138.0	15.8	53		151.5	14.9	53
Vitamin B_6		45.9	9.4	96		54.5	8.9	96
Calcium		119	12	49		112	11	49
Phosphorous		154	13	40		156	12	40
Magnesium		31.6	5.2	67		37.9	4.9	67
Iron		123.28	17.99	67		127.20	17.05	67

[1]S.E. = standard error.

[2]C.V. = coefficient of variation.

[3]Menu 1 = macaroni/ground beef and tomato, green beans, coleslaw, cinnamon roll, mixed fruit cup, milk.

[4]Menu 2 = glazed ham, broccoli, carrot sticks, dinner roll, cherry crisp, milk.

Table 12. Means, Standard Errors and Coefficients of Variation for Percentages of Recommended Dietary Allowances for Total Day's Energy and Nutrient Intake, Including Supplements, of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews

	Total Day's Meals Including Supplements							
	Family Style				Cafeteria Style			
	N	Mean	S.E.[1]	C.V.[2]	N	Mean	S.E.	C.V.
				%				%
Menu 1[3]	19				21			
Energy		98	6	29		99	6	29
Protein		239.8	18.3	34		229.7	17.3	34
Vitamin A		206	30	56		210	28	56
Ascorbic acid		307.3	73.2	79		453.1	69.4	79
Thiamin		256.91	28.58	47		260.85	27.13	47
Riboflavin		243.25	26.45	44		263.31	25.10	44
Niacin		216.7	24.5	50		209.2	23.2	50
Vitamin B_6		87.2	17.4	70		106.5	16.5	70
Calcium		110	14	48		138	13	48
Phosphorous		151	15	40		174	14	40
Magnesium		39.6	6.4	68		48.4	6.1	68
Iron		166.92	24.90	68		188.49	23.64	68
Menu 2[4]	25				28			
Energy		103	6	29		89	5	29
Protein		224.9	15.8	34		211.9	15.0	34
Vitamin A		283	26	56		214	25	56
Ascorbic acid		439.3	63.4	79		401.1	60.1	79
Thiamin		287.80	24.79	47		244.69	23.49	47
Riboflavin		289.37	22.94	44		250.71	21.74	44
Niacin		233.8	21.2	50		207.7	20.1	50
Vitamin B_6		123.4	15.0	70		107.1	14.3	70
Calcium		120	12	48		118	11	48
Phosphorous		156	13	40		157	12	40
Magnesium		34.8	5.6	68		39.9	5.3	68
Iron		155.74	21.60	68		150.74	20.47	68

[1] S.E. = standard error.

[2] C.V. = coefficient of variation.

[3] Menu 1 = macaroni/ground beef and tomato, green beans, coleslaw, cinnamon roll, mixed fruit cup, milk.

[4] Menu 2 = glazed ham, broccoli, carrot sticks, dinner roll, cherry crisp, milk.

intakes of vitamin A, ascorbic acid and four B vitamins--thiamin, riboflavin, niacin and B_6. The reported energy intakes were slightly below the RDA and ranged from 89 to 103 percent. Vitamin B_6 and magnesium intakes were less than 66 percent of the RDAs but caution should be exercised in drawing conclusions from these data because the low values may be attributable, in part, to the lack of food nutrient composition data for those nutrients for some of the school lunch menu items. Supplements improved the mean intake of vitamin B_6 but did not affect magnesium intakes appreciably.

Our findings are similar to those reported by other researchers. Gilbert et al. (104) reported that the intake of protein of Kansas fifth graders exceeded the RDA by 194.2 percent. She also found that the students' total day's intake (without supplements) of vitamin A exceeded the RDA by 137 percent and that the intake for ascorbic acid was double the RDA. Mean intakes of thiamin, riboflavin, niacin, calcium, and phosphorous all exceeded the RDA without supplements. Similar to our findings, she reported that magnesium and vitamin B_6 intakes were low among fifth graders. The mean iron intakes excluding supplements of students in our study (123.28 to 159.74 percent of the RDA) were higher than those reported by Gilbert et al. (104) (75.14 percent of the RDA).

Tseng et al. (18) in a study of California students, grades four, eight, and 11, found that, mean consumption of kilocalories, protein, vitamin A, ascorbic acid, thiamin, riboflavin, niacin, and calcium were at levels very near to or exceeding the RDA. Their iron intakes were similar to those reported by Gilbert et al. (104). Diets of fourth grade students were better than those of eighth and eleventh graders.

An analysis of kindergarten through grade 12 students' diets by Lai et al. (117) in the state of Hawaii showed that protein consumption was not a problem, but that many students in all age and sex groups consumed less than two-thirds of the RDA for vitamin A, thiamin, and calcium. Energy intakes were slightly less than the RDA.

Breakfast. Breakfasts of students at the satellite family style and cafeteria style schools provided an average of 30 percent or more of the RDA for all nutrients except energy and magnesium (Table 13). The iron intakes from breakfast ranged from 33.03 to 53.61 percent of the RDA, which may be explained by the high consumption of fortified ready-to-eat cereals by the students in the study sample. There was a significant difference ($p \leq D.D5$) between the phosphorous intakes of the students at the two schools with means ranging from 49 to 56 percent of the RDA for students in the cafeteria style school compared to 31 to 34 percent for students in the family style school. There was also a tendency for the calcium intakes of the students from the cafeteria style school to be higher than those from the family style school on the day Menu 1 was served.

Gilbert et al. (1D4) in a study of Kansas fifth graders found that breakfast provided 2D percent of the RDA for energy. This meal contributed slightly over one-third of the RDA for protein and 78 percent of the recommended allowance for ascorbic acid. The breakfast meal provided between 28 and 40 percent of the RDA for vitamin A, thiamin, riboflavin, vitamin B_6, calcium, and phosphorous, but lower amounts of niacin, magnesium, and iron (21, 17, and 18 percent of the RDA, respectively).

Lunch. According to the nutrient goal recommended by the USDA, school lunch should provide approximately one-third of the RDA for 1D to 12

Table 13. Means, Standard Errors and Coefficients of Variation for Percentages of Recommended Dietary Allowances from Breakfast of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews

	Breakfast							
	Family Style				Cafeteria Style			
	N	Mean[1]	S.E.[2]	C.V.[3]	N	Mean	S.E.	C.V.
				%				%
Menu 1[4]	16				19			
Energy		19	3	52		26	3	52
Protein		36.7	6.9	60		54.8	6.3	60
Vitamin A		34	11	105		43	10	105
Ascorbic acid		112.4	36.3	121		136.7	33.1	121
Thiamin		57.10	16.20	95		60.31	14.77	95
Riboflavin		56.96	14.12	85		71.22	12.87	85
Niacin		35.2	12.2	115		37.1	11.1	115
Vitamin B_6		31.9	9.1	116		25.8	8.3	116
Calcium		27	6	71		48	6	71
Phosphorous		34[1]	7	66		56[2]	6	66
Magnesium		17.6	4.4	105		19.7	4.0	105
Iron		33.03	11.02	101		49.54	10.04	101
Menu 2[5]	24				27			
Energy		20	2	52		24	2	52
Protein		36.4	5.6	60		50.6	5.4	60
Vitamin A		42	9	105		49	8	105
Ascorbic acid		103.8	29.5	121		118.4	28.2	121
Thiamin		56.19	13.17	95		83.76	12.59	95
Riboflavin		56.24	11.48	85		86.16	10.97	85
Niacin		36.9	9.9	115		62.2	9.5	115
Vitamin B_6		28.3	7.4	116		39.6	7.1	116
Calcium		28	5	71		37	5	71
Phosphorous		31[1]	6	66		49[2]	5	66
Magnesium		11.3	3.6	105		19.2	3.4	105
Iron		40.02	8.95	101		53.61	8.6	101

[1]Where superscripts (1, 2) on means differ horizontally, means differ significantly ($p < 0.05$) from each other. Means in a row without superscripts do not differ significantly.

[2]S.E. = standard error.

[3]C.V. = coefficient of variation.

[4]Menu 1 = macaroni/ground beef and tomato, green beans, coleslaw, cinnamon roll, mixed fruit cup, milk.

[5]Menu 2 = glazed ham, broccoli, carrot sticks, dinner roll, cherry crisp, milk.

year old children (34). The school lunches consumed by students in this study provided mean nutrient values that met or exceeded the goal with the exceptions of energy, vitamin B_6, and magnesium. Menu 1 provided students with higher percentages of ROAs of ascorbic acid, thiamin, riboflavin, niacin, and iron than did Menu 2 (Table 14). Similar to the findings of Gilbert et al. (104), less than one-third of the RDAs for energy, magnesium and vitamin B_6 were provided by Menu 1 and Menu 2. Again, lack of food nutrient composition data for vitamin B_6 and magnesium may have contributed to the low values. In the National Evaluation of School Lunch Programs, Radzikowski (115) stated that vitamins A and B_6, calcium and magnesium are typically deficient in the diet of school aged children.

When both menus were served there were significant differences in energy and nutrient intakes of students in the satellite family and cafeteria style schools. When Menu 1 was served, students in the family style school consumed more ($p \leq 0.05$) protein, thaimin, riboflavin, niacin and iron than did students in the satellite cafeteria style school (Table 14). Energy intakes of the students in the family style school were greater than those of students in the satellite cafeteria style school on the day that Menu 2 was served (30 percent and 22 percent of the RDA, respectively). On that day there was also a tendency for the students in the family style school to consume more vitamin A than those at the cafeteria style school.

In our study the percentages of the RDAs from the lunch meal were consistently high for students in both schools and may be the consequence of interviewing school lunch participants exclusively. Gilbert (132) found that students who ate school lunch had significantly higher intakes

Table 14. Means, Standard Errors and Coefficients of Variation for Percentages of Recommended Dietary Allowances from Lunch of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews

	Lunch							
	Family Style				Cafeteria Style			
	N	Mean[1]	S.E.[2]	C.V.[3]	N	Mean	S.E.	C.V.
				%				%
Menu 1[4]	19				21			
Energy		26	2	36		22	2	36
Protein		73.0[1]	5.8	39		56.3[2]	5.5	39
Vitamin A		56	8	60		42	8	60
Ascorbic acid		118.2	16.3	90		118.4	15.4	90
Thiamin		94.35[1]	7.11	50		66.66[2]	6.75	50
Riboflavin		69.19[1]	4.60	36		53.97[2]	4.36	36
Niacin		69.2[1]	5.5	58		47.3[2]	5.2	58
Vitamin B_6		5.8	0.8	46		5.6	0.7	46
Calcium		33	3	39		31	3	39
Phosphorous		40	4	36		34	3	36
Magnesium		10.0	1.0	38		9.6	0.9	38
Iron		55.21[1]	4.87	60		40.06[2]	4.6	60
Menu 2[5]	25				28			
Energy		30[1]	2	36		22[2]	2	36
Protein		71.9	5.0	39		66.3	4.7	39
Vitamin A		73	7	60		54	6	60
Ascorbic acid		67.5	14.1	90		49.1	13.4	90
Thiamin		53.48	6.17	50		50.51	5.84	50
Riboflavin		60.56	3.99	36		49.95	3.78	36
Niacin		35.1	4.8	58		31.6	4.50	58
Vitamin B_6		5.5	0.7	46		4.8	0.6	46
Calcium		38	2	39		30	2	39
Phosphorous		50	3	36		42	3	36
Magnesium		10.7	0.8	38		8.9	0.8	38
Iron		32.68	4.22	60		26.68	4.00	60

[1]Where superscripts (1, 2) on means differ horizontally, means differ significantly ($p \leq 0.05$) from each other. Means in a row without superscripts do not differ significantly.

[2]S.E. = standard error.

[3]C.V. = coefficient of variation.

[4]Menu 1 = macaroni/ground beef and tomato, green beans, coleslaw, cinnamon roll, mixed fruit cup, milk.

[5]Menu 2 = glazed ham, broccoli, carrot sticks, dinner roll, cherry crisp, milk.

of protein, vitamin A, ascorbic acid, riboflavin, calcium, phosphorous, vitamin B_6 and iron than those eating lunch from another source. Radzikowski (115) reported that students who participated in school lunch had higher intakes of energy and nutrients than students who did not participate. The lunch program was superior not only when participants' nutrient intake from the noon meal was compared to that of nonparticipants, but also when their 24-hour nutrient intakes were compared. The differences in energy and nutrient intakes were accounted for mainly by the higher nutritional value of school lunches compared with lunches eaten by nonparticipants. The nutrients for which school lunch participants showed superior intakes (vitamins A and B_6, calcium and magnesium) were those that are typically deficient in diets of school age children.

Dinner. There was a significant difference between the energy intakes from dinner of the students at the satellite family and cafeteria style schools on the day that Menu 1 was served (Table 15). Students at the family style school had a higher mean energy intake than those at the cafeteria style school (46 and 35 percent of the RDA, respectively). Students' nutrient intakes did not differ significantly between the two schools. Dinner meals tended to provide higher mean intakes of energy, protein, niacin, calcium, and phosphorous and lower intakes of thiamin and riboflavin than the lunch meals.

Snacks. Energy and nutrient intakes from snacks by students at the two schools did not differ significantly (Table 16). The morning, afternoon and evening snacks combined provided a wide range of percentages of the RDAs for energy and nutrients.

Summary of the Percentages of the RDAs--School Differences. In general, students from these two schools had good diets as evidenced by

Table 15. Means, Standard Errors and Coefficients of Variation for Percentages of Recommended Dietary Allowances from Dinner of Students at School with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews

	Dinner							
	Family Style				Cafeteria Style			
	N	Mean[1]	S.E.[2]	C.V.[3]	N	Mean	S.E.	C.V.
				%				%
Menu 1[4]	19				21			
Energy		46[1]	4	44		35[2]	4	44
Protein		118.1	10.4	45		96.1	9.9	45
Vitamin A		58	16	128		45	15	128
Ascorbic acid		28.9	18.5	143		47.0	17.6	143
Thiamin		58.81	8.75	72		54.81	8.30	72
Riboflavin		65.19	6.58	51		52.42	6.24	51
Niacin		60.7	7.3	59		51.2	6.9	59
Vitamin B_6		4.8	1.9	148		4.8	1.8	148
Calcium		41	7	72		38	6	72
Phosphorous		65	6	47		58	6	47
Magnesium		9.7	2.6	168		6.3	2.5	168
Iron		48.36	6.93	68		45.27	6.58	68
Menu 2[5]	25				28			
Energy		36	3	44		28	3	44
Protein		98.2	9.1	45		76.0	8.6	45
Vitamin A		68	14	128		45	13	128
Ascorbic acid		78.5	16.1	143		54.9	15.2	143
Thiamin		50.02	7.59	72		40.80	7.19	72
Riboflavin		57.00	5.70	51		44.19	5.41	51
Niacin		54.2	6.3	59		41.6	6.0	59
Vitamin B_6		8.2	1.6	148		4.6	1.6	148
Calcium		42	6	72		33	6	72
Phosphorous		60	6	47		47	5	47
Magnesium		7.9	2.3	168		5.9	2.1	168
Iron		41.57	6.0	68		35.65	5.69	68

[1]Where superscripts (1, 2) on means differ horizontally, means differ significantly ($p < 0.05$) from each other. Means in a row without superscripts do not differ significantly.

[2]S.E. = standard error.

[3]C.V. = coefficient of variation.

[4]Menu 1 = macaroni/ground beef and tomato, green beans, coleslaw, cinnamon roll, mixed fruit cup, milk.

[5]Menu 2 = glazed ham, broccoli, carrot sticks, dinner roll, cherry crisp, milk.

Table 16. Means, Standard Errors and Coefficients of Variation for Percentages of Recommended Dietary Allowances from Snacks of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews

	Snacks							
	Family Style				Cafeteria Style			
	N	Mean	S.E.[1]	C.V.[2]	N	Mean	S.E.	C.V.
				%				%
Menu 1[3]	6				11			
Energy		15	5	92		22	4	92
Protein		25.5	9.3	126		30.4	7.7	126
Vitamin A		32	10	185		18	9	185
Ascorbic acid		35.8	20.0	181		28.1	16.6	181
Thiamin		23.26	8.68	133		18.61	7.22	133
Riboflavin		32.26	11.72	153		30.02	9.75	153
Niacin		25.5	10.2	204		13.2	8.5	204
Vitamin B_6		17.1	7.3	308		5.7	6.0	308
Calcium		18	9	154		27	7	154
Phosphorous		24	9	133		33	7	133
Magnesium		6.6	2.9	162		9.6	2.4	162
Iron		38.72	13.11	253		14.97	10.91	253
Menu 2[4]	18				14			
Energy		21	4	92		17	4	92
Protein		24.4	7.6	126		23.0	6.6	126
Vitamin A		22	9	185		11	7	185
Ascorbic acid		65.7	16.4	181		52.1	14.1	181
Thiamin		29.39	7.14	133		18.91	6.13	133
Riboflavin		26.69	9.64	153		20.99	8.28	153
Niacin		17.0	8.4	204		20.6	7.2	204
Vitamin B_6		6.7	6.0	308		6.9	5.1	308
Calcium		16	7	154		14	6	154
Phosphorous		18	7	133		21	6	133
Magnesium		3.0	2.4	162		5.0	2.1	162
Iron		13.70	10.78	253		15.22	9.27	253

[1]S.E. = standard error.

[2]C.V. = coefficient of variation.

[3]Menu 1 = macaroni/ground beef and tomato, green beans, coleslaw, cinnamon roll, mixed fruit cup, milk.

[4]Menu 2 = glazed ham, broccoli, carrot sticks, dinner roll, cherry crisp, milk.

mean intakes for the total day greater than 100 percent of the RDAs with the exceptions of energy, vitamin B_6, and magnesium. There was a tendency for the calcium intakes of the students in the cafeteria style school to be higher than those in the family style school. Significant differences in intakes of some nutrients from lunch among students at the family and cafeteria style schools were observed. On the day that Menu 1 was served, students in the family style school consumed more protein, thiamin, riboflavin, niacin and iron than did students in the satellite cafeteria style school. Energy intakes of the students in the family style school were greater than those of students in the satellite cafeteria style school on the day that Menu 2 was served and, on this day, there was a tendency for students in the family style school to consume more vitamin A than those at the cafeteria style school. Students at the family style school had higher mean intakes of energy than students at the cafeteria style school for the dinner meal but no significant differences among students from the two schools for energy and nutrient intakes were observed from snacks.

Percentages of RDAs--School by Sex Differences

Least square means and standard errors for percentages of the RDA for total day (including and excluding supplements) and for each meal for the satellite family and cafeteria schools are located in Tables 17 to 21. The same data for the on-site cafeteria style school are listed in Table 31 in Appendix E.

Total Day. There were no significant school by sex differences in the total day's energy and nutrient intakes in the family and cafeteria style schools (Table 17). On the day that Menu 1 was served, boys in the cafeteria style school tended to have higher magnesium intakes (excluding

Table 17. Least Square Means and Standard Errors for Percentages of Recommended Dietary Allowances for Total Day by Sex of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews

	Total Day's Meals							
	Family Style				Cafeteria Style			
	Excluding Supplement		Including Supplement		Excluding Supplement		Including Supplement	
	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
Menu 1[1]	(N=8)	(N=11)	(N=8)	(N=11)	(N=12)	(N=9)	(N=12)	(N=9)
Energy	102 ±10	95 ±8	102 ±10	95 ±8	94 ±8	104 ±9	94 ±8	104 ±9
Protein	209.3 ±27.7	270.3 ±23.6	209.3 ±27.8	270.3 ±23.7	192.4 ±22.6	265.4 ±26.2	192.4 ±22.7	267.1 ±26.2
Vitamin A	171 ±38	156 ±32	204 ±46	207 ±39	131 ±31	151 ±36	187 ±37	232 ±43
Ascorbic acid	242.3 ±79.0	292.2 ±67.4	274.0 ±111.4	340.6 ±95.0	293.4 ±64.5	334.1 ±74.5	481.0 ±90.9	425.2 ±105.0
Thiamin	200.87 ±31.62	234.83 ±26.96	233.54 ±43.50	280.29 ±37.10	183.25 ±25.81	201.14 ±29.81	237.23 ±35.52	284.5 ±41.0
Riboflavin	187.06 ±31.45	223.76 ±26.82	218.59 ±40.26	267.92 ±34.33	188.20 ±25.68	204.13 ±29.65	240.35 ±32.87	286.27 ±37.96
Niacin	178.2 ±27.7	177.4 ±23.6	210.5 ±37.2	222.9 ±31.7	135.1 ±22.6	151.2 ±26.1	188.6 ±30.4	229.9 ±35.1
Vitamin B_6	33.8 ±16.5	65.7 ±14.0	63.3 ±26.4	111.2 ±22.5	31.0 ±13.5	47.4 ±15.6	80.8 ±21.6	132.3 ±24.9

Table 17. (continued)

	Total Day's Meals							
	Family Style				Cafeteria Style			
	Excluding Supplement		Including Supplement		Excluding Supplement		Including Supplement	
	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
Calcium	81 ±21	138 ±18	81 ±21	139 ±18	122 ±17	150 ±20	122 ±17	155 ±20
Phosphorous	121 ±22	180 ±19	121 ±23	181 ±19	154 ±18	190 ±21	154 ±18	194 ±21
Magnesium	32.7 ±9.1	45.8 ±7.8	32.7 ±9.8	46.5 ±8.4	38.1 ±7.4	46.6 ±8.6	38.1 ±8.0	58.7 ±9.2
Iron	115.56 ±31.57	201.93 ±26.92	115.56 ±37.90	218.29 ±32.32	112.02 ±25.78	176.62 ±29.76	127.02 ±30.94	249.95 ±35.73
Menu 2[2]	(N=14)	(N=11)	(N=14)	(N=11)	(N=12)	(N=16)	(N=12)	(N=16)
Energy	118 ±8	B7 ±8	I18 ±8	87 ±8	84 ±8	94 ±7	84 ±8	94 ±7
Protein	219.8 ±21.0	229.2 ±23.7	220.6 ±21.0	229.2 ±23.7	179.7 ±22.6	244.0 ±19.6	179.7 ±22.7	244.0 ±I9.6
Vitamin A	212 ±28	181 ±32	300 ±34	266 ±39	114 ±31	200 ±27	176 ±37	252 ±32
Ascorbic acid	241.5 ±59.7	335.3 ±67.4	387.4 ±84.2	491.3 ±95.0	265.3 ±64.5	263.4 ±55.9	421.2 ±90.9	380.9 ±78.7

Table 17. (continued)

	Total Day's Meals							
	Family Style				Cafeteria Style			
	Excluding Supplement		Including Supplement		Excluding Supplement		Including Supplement	
	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
Thiamin	203.60 ±23.90	158.40 ±26.96	288.94 ±32.88	286.65 ±37.10	191.01 ±25.82	185.94 ±22.36	253.22 ±35.52	236.16 ±30.76
Riboflavin	226.25 ±23.77	158.00 ±26.82	301.83 ±30.43	276.90 ±34.33	182.13 ±25.68	209.89 ±22.24	242.20 ±32.87	259.22 ±28.47
Niacin	154.5 ±20.9	121.4 ±23.6	231.2 ±28.1	236.3 ±31.7	141.9 ±22.6	161.1 ±19.6	203.1 ±30.4	212.3 ±26.3
Vitamin B_6	54.8 ±12.5	36.9 ±14.1	120.3 ±20.0	126.6 ±22.5	34.7 ±13.5	74.2 ±11.7	88.8 ±21.6	125.4 ±18.7
Calcium	134 ±16	105 ±18	136 ±16	105 ±18	91 ±17	133 ±15	99 ±17	136 ±15
Phosphorous	164 ±17	144 ±19	168 ±17	144 ±19	128 ±18	185 ±16	130 ±18	185 ±16
Magnesium	41.1 ±6.9	22.1 ±7.8	45.2 ±7.4	24.4 ±8.4	29.5 ±7.4	46.3 ±6.4	33.4 ±8.0	46.3 ±6.9
Iron	116.36 ±23.86	130.19 ±26.92	166.15 ±28.65	145.34 ±32.32	115.42 ±25.78	138.97 ±22.32	151.26 ±30.94	150.22 ±26.80

[1]Menu 1 = macaroni/ground beef and tomato, green beans, coleslaw, cinnamon roll, mixed fruit cup, milk.
[2]Menu 2 = glazed ham, broccoli, carrot sticks, dinner roll, cherry crisp, milk.

supplements) than girls or boys in the family style school. When Menu 2 was served in the cafeteria style school, boys tended to have a higher mean intake of magnesium than girls.

Breakfast. There were significant differences ($p \leq 0.05$) for intakes of just one nutrient by students at the two schools for the breakfast meal (Table 18) on the day that Menu 2 was served. The boys in the cafeteria style school had a higher percentage mean intake of vitamin B_6 (60.0 percent) than did the girls at the same school (19.3 percent) or the boys at the family style school (18.8 percent)

Lunch. There were no significant school by sex differences between the two schools for the lunch meal (Table 19). Magnesium intakes tended to be higher for girls at the family style school (11.3 percent) and boys at the cafeteria style school (10.7 percent) than for girls at the cafeteria style school (7.1 percent) on the day that Menu 2 was served.

Dinner. There were significant differences ($p \leq 0.05$) in the intakes of energy and some nutrients from the dinner meals by boys and girls in the satellite family and cafeteria style schools on the days of data collection (Table 20). On the day Menu 1 was served girls in the cafeteria style school had a significantly lower intake of energy compared to girls in the family style school. Girls in the cafeteria style school also had a significantly lower intake of riboflavin compared to that of boys in the same school as well as girls and boys in the family style school. Calcium and phosphorous intakes of girls in the cafeteria style school also were significantly lower than those of boys in either school. In the cafeteria style school, boys tended to have a higher energy intake than girls on the day Menu 1 was served. Boys in the cafeteria style school also tended to have higher calcium intakes than girls in the family style school.

Table 18. Least Square Means and Standard Errors for Percentages of Recommended Dietary Allowances from Breakfast by Sex of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews

	Breakfast							
	Family Style				Cafeteria Style			
	Girls		Boys		Girls		Boys	
	Mean[1]	S.E.[2]	Mean	S.E.	Mean	S.E.	Mean	S.E.
Menu 1[3]	(N=7)		(N=9)		(N=10)		(N=9)	
Energy	18	4	21	4	26	4	26	4
Protein	25.3	10.4	48.1	9.2	52.2	8.7	57.5	9.2
Vitamin A	32	16	35	15	49	14	36	15
Ascorbic acid	94.5	54.4	130.2	48.0	147.3	45.5	126.1	48.0
Thiamin	50.68	24.30	63.52	21.43	66.10	20.33	54.52	21.43
Riboflavin	53.90	21.18	60.01	18.68	86.47	17.72	55.96	18.68
Niacin	35.1	18.3	35.2	16.1	46.7	15.3	27.5	16.2
Vitamin B_6	28.3	13.6	35.5	12.0	23.9	11.4	27.8	12.0
Calcium	21	9	34	8	53	8	44	8
Phosphorous	26	10	41	9	55	9	57	9
Magnesium	13.4	6.6	21.8	5.8	17.6	5.6	21.8	5.8
Iron	18.92	16.52	47.15	14.57	40.25	13.82	58.84	14.57
Menu 2[4]	(N=13)		(N=11)		(N=11)		(N=16)	
Energy	20	3	20	4	23	4	25	3
Protein	33.9	7.6	38.9	8.3	42.3	8.3	59.0	6.9
Vitamin A	57	12	26	13	28	13	70	11
Ascorbic acid	135.9	39.9	71.6	43.4	131.0	43.4	105.8	36.0
Thiamin	62.48	17.83	49.90	19.38	87.63	19.38	79.89	16.07
Riboflavin	70.29	15.54	42.19	16.90	79.47	16.90	92.84	14.01
Niacin	48.2	13.4	25.6	14.6	60.3	14.6	64.2	12.1
Vitamin B_6	37.8[1,2]	10.0	18.8[1]	10.9	19.3[1]	10.9	60.0[2]	9.0
Calcium	32	7	25	8	29	8	46	6
Phosphorous	36	8	26	8	40	8	58	7
Magnesium	17.4	4.9	5.1	5.3	12.9	5.3	25.5	4.4
Iron	37.77	12.12	42.28	13.18	57.31	13.18	49.91	10.93

[1]Where superscripts (1, 2) on means differ horizontally, means differ significantly ($p \leq 0.05$) from each other. Means in a row without superscripts do not differ significantly.

[2]S.E. = standard error.

[3]Menu 1 = macaroni/ground beef and tomato, green beans, coleslaw, cinnamon roll, mixed fruit cup, milk.

[4]Menu 2 = glazed ham, broccoli, carrot sticks, dinner roll, cherry crisp, milk.

Table 19. Least Square Means and Standard Errors for Percentages of Recommended Dietary Allowances from Lunch by Sex of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews

	Lunch							
	Family Style				Cafeteria Style			
	Girls		Boys		Girls		Boys	
	Mean	S.E.[1]	Mean	S.E.	Mean	S.E.	Mean	S.E.
Menu 1[2]	(N=8)		(N=11)		(N=12)		(N=9)	
Energy	27	3	25	3	21	2	23	3
Protein	65.7	8.8	80.3	7.5	48.1	7.2	64.4	8.2
Vitamin A	54	12	58	10	37	10	47	11
Ascorbic acid	126.1	24.8	110.4	21.1	100.8	20.2	136.0	23.3
Thiamin	96.70	10.82	92.00	9.23	58.04	8.84	75.29	10.20
Riboflavin	69.71	7.00	68.66	5.97	52.60	5.71	55.34	6.60
Niacin	69.9	8.3	68.6	7.1	38.6	6.8	56.0	7.9
Vitamin B_6	5.6	1.2	6.0	1.0	6.1	0.9	5.1	1.1
Calcium	28	4	37	4	33	4	29	4
Phosphorous	36	5	45	4	33	4	36	5
Magnesium	9.5	1.4	10.4	1.2	11.2	1.2	8.0	1.4
Iron	45.82	7.41	64.60	6.32	30.52	6.05	49.59	6.99
Menu 2[3]	(N=14)		(N=11)		(N=12)		(N=16)	
Energy	34	2	27	3	22	2	23	2
Protein	68.5	6.6	75.3	7.5	61.8	7.2	70.7	6.2
Vitamin A	73	9	73	10	43	10	66	8
Ascorbic acid	57.0	18.7	77.9	21.1	39.6	20.2	58.6	17.5
Thiamin	56.93	8.18	50.02	9.23	54.10	8.84	46.91	7.65
Riboflavin	65.26	5.29	55.86	5.97	47.31	5.71	52.59	4.95
Niacin	37.0	6.3	33.2	7.1	33.3	6.8	30.0	5.9
Vitamin B_6	5.7	0.9	5.4	1.0	3.7	0.9	5.9	0.8
Calcium	37	3	38	4	22	4	37	3
Phosphorous	48	4	52	4	37	4	48	4
Magnesium	11.3	1.1	10.1	1.2	7.1	1.2	10.7	1.0
Iron	30.80	5.60	34.55	6.32	25.31	6.05	28.05	5.24

[1] S.E. = standard error.

[2] Menu 1 = macaroni/ground beef and tomato, green beans, coleslaw, cinnamon roll, mixed fruit cup, milk.

[3] Menu 2 = glazed ham, broccoli, carrot sticks, dinner roll, cherry crisp, milk.

Table 20. Least Square Means and Standard Errors for Percentages of Recommended Dietary Allowances from Oinner by Sex of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Oietary Recall Interviews

	Oinner							
	Family Style				Cafeteria Style			
	Girls		Boys		Girls		Boys	
	Mean[1]	S.E.[2]	Mean	S.E.	Mean	S.E.	Mean	S.E.
Menu 1[3]	(N=8)		(N=11)		(N=12)		(N=9)	
Energy	53[1]	6	40[1,2]	5	28[2]	5	42[1,2]	5
Protein	113.0	15.9	123.3	13.6	72.1	13.0	120.0	15.0
Vitamin A	63	24	52	20	32	20	58	23
Ascorbic acid	25.5	28.2	32.3	24.0	35.4	23.0	58.7	26.6
Thiamin	55.13	13.32	62.48	11.36	51.70	10.87	57.91	12.55
Riboflavin	63.30[1]	10.01	67.09[1]	8.54	35.56[2]	8.18	69.28[1]	9.44
Niacin	72.6	11.1	48.7	9.5	47.3	9.1	55.2	10.5
Vitamin B_6	1.8	2.9	7.7	2.4	1.4	2.3	8.1	2.7
Calcium	31[1,2]	10	50[1]	9	18[2]	8	58[1]	10
Phosphorous	56[1,2]	10	73[1]	8	40[2]	8	76[1]	9
Magnesium	10.6	4.0	8.8	3.4	3.1	3.2	9.4	3.7
Iron	46.47	10.54	50.24	8.99	32.85	8.61	57.69	9.94
Menu 2[4]	(N=14)		(N=11)		(N=12)		(N=16)	
Energy	43[1]	4	29[2]	5	24[2]	5	32[1,2]	4
Protein	96.8	12.0	99.6	13.6	54.1	13.0	97.9	11.2
Vitamin A	75	18	62	20	30	20	60	17
Ascorbic acid	47.6	21.3	109.4	24.0	27.8	23.0	81.9	19.9
Thiamin	57.88	10.06	42.15	11.36	33.78	10.87	47.81	9.42
Riboflavin	71.28[1,3,4]	7.57	42.72[2,3,4]	8.54	33.30[2,3]	8.18	55.09[1,2,4]	7.08
Niacin	56.1	8.4	52.4	9.5	32.8	9.1	50.4	7.9

Table 20. (continued)

	Dinner							
	Family Style				Cafeteria Style			
	Girls		Boys		Girls		Boys	
	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.
Vitamin B_6	8.4	2.2	8.1	2.4	3.8	2.3	5.3	2.0
Calcium	56[1]	8	28[2]	9	23[2]	8	44[1,2]	7
Phosphorous	67[1]	7	52[1,2]	8	32[2]	8	62[1]	7
Magnesium	11.0	3.0	4.8	3.4	5.7	3.2	6.1	2.8
Iron	40.08	7.97	43.06	8.99	23.07	8.61	48.23	7.46

[1]Where superscripts (1, 2 and 3, 4) on means differ horizontally, means differ significantly ($p \leq 0.05$) from each other. Means in a row without superscripts do not differ significantly.

[2]S.E. = standard error.

[3]Menu 1 = macaroni/ground beef and tomato, green beans, coleslaw, cinnamon roll, mixed fruit cup, milk.

[4]Menu 2 = glazed ham, broccoli, carrot sticks, dinner roll, cherry crisp, milk.

On the day that Menu 2 was served, girls in the family style school had significantly higher intakes of energy, riboflavin, and calcium than boys in the same school or girls in the cafeteria style school. Girls in the family style school also had a higher phosphorous intake than girls in the cafeteria style school. Significantly higher intakes of riboflavin and phosphorous were observed for boys in the cafeteria style school compared to girls in the same school. In the cafeteria style school there was a tendency for boys to have a higher calcium intake than girls.

Snacks. No significant differences in energy and nutrient intakes from snacks by girls and boys in the two schools were observed on the day that Menu 1 was served (Table 21). On the day that Menu 2 was served, boys in the family style school and girls in the cafeteria style school had higher ascorbic acid intakes than girls in the family style school and boys in the cafeteria style school.

Summary of the Percentages of RDAs--School by Sex Differences. There were no significant differences between girls and boys from the satellite family and cafeteria style schools for energy and nutrient intakes from the total day's or lunch meals. Significant but not consistent differences were observed in energy and nutrient intakes from breakfast, dinner, and snacks of girls and boys at the two schools.

Percentage of Kilocalories from Fat

The mean, standard error and coefficients of variation for percentage of kilocalories from fat in the total day's and lunch intakes of girls and boys in the satellite family and cafeteria style schools are listed in Table 22. The same information for students in the on-site cafeteria school is located in Table 32, Appendix E. There were no significant differences between schools or sexes in percent of dietary energy from

Table 21. Least Square Means and Standard Errors for Percentages of Recommended Dietary Allowances from Snacks by Sex of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews

	Snacks							
	Family Style				Cafeteria Style			
	Girls		Boys		Girls		Boys	
	Mean[1]	S.E.[2]	Mean	S.E.	Mean	S.E.	Mean	S.E.
Menu 1[3]	(N=5)		(N=8)		(N=10)		(N=8)	
Energy	11	8	19	6	29	5	16	6
Protein	13.5	14.6	37.5	11.5	34.5	10.3	26.4	11.5
Vitamin A	41	16	23	13	24	12	11	13
Ascorbic acid	12.7	31.4	59.0	24.8	41.3	22.2	14.9	24.8
Thiamin	7.50	13.62	39.02	10.77	22.12	9.63	15.10	10.77
Riboflavin	11.02	18.38	53.51	14.54	33.56	13.00	26.48	14.54
Niacin	7.9	16.1	43.1	12.7	12.3	11.4	14.0	12.7
Vitamin B_6	2.7	11.4	31.5	9.0	4.3	8.0	7.2	9.0
Calcium	5	14	31	11	32	9	21	11
Phosphorous	10	14	38	11	42	10	24	11
Magnesium	1.4	4.6	11.8	3.6	11.0	3.3	8.2	3.6
Iron	10.75	20.58	66.69	16.27	18.14	14.55	11.80	16.27
Menu 2[4]	(N=13)		(N=7)		(N=11)		(N=14)	
Energy	24	5	18	7	18	5	15	5
Protein	24.7	9.0	24.2	12.3	27.3	9.8	18.8	8.7
Vitamin A	11	10	32	14	18	11	4	10
Ascorbic acid	11.4[1]	19.5	120.0[2]	26.5	84.8[2]	21.2	19.4[1]	18.8
Thiamin	33.14	8.45	25.65	11.51	24.86	9.18	12.95	8.14
Riboflavin	26.32	11.40	27.06	15.54	31.28	12.40	10.71	10.99
Niacin	18.0	10.0	16.0	13.6	22.4	10.8	18.8	9.6
Vitamin B_6	6.0	7.1	7.3	9.6	10.3	7.7	3.4	6.8
Calcium	12	8	20	11	20	9	8	8
Phosphorous	16	9	21	12	24	10	18	8
Magnesium	2.8	2.9	3.1	3.9	5.4	3.1	4.6	2.8
Iron	11.22	12.76	16.17	17.39	15.83	13.87	14.61	12.30

[1]Where superscripts (1, 2) on means differ horizontally, means differ significantly ($p \leq 0.05$) from each other. Means in a row without superscripts do not differ significantly.

[2]S.E. = standard error.

[3]Menu 1 = macaroni/ground beef and tomato, green beans, coleslaw, cinnamon roll, mixed fruit cup, milk.

[4]Menu 2 = glazed ham, broccoli, carrot sticks, dinner roll, cherry crisp, milk.

Table 22. Least Square Means, Standard Errors, and Coefficients of Variation for Percent Fat in Total Day's and Lunch Energy Intake by Sex of Students, Individual and Combined, at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews

	Family Style			Cafeteria Style		
	Mean	S.E.[1]	C.V.[2]	Mean	S.E.	C.V.
			%			%
Menu 1[3]						
Total day's meals (excluding supplements)						
Girls	35.5	2.4	21	37.5	2.0	21
Boys	32.6	2.1	21	36.6	2.3	21
Combined	34.1	1.6	21	37.0	1.5	21
Lunch						
Girls	36.1	1.9	17	35.4	1.5	17
Boys	35.4	1.6	17	36.2	1.8	17
Combined	35.7	1.2	17	35.8	1.2	17
Menu 2[4]						
Total day's meals (excluding supplements)						
Girls	30.8	1.8	21	28.5	2.0	21
Boys	34.1	2.1	21	32.2	1.7	21
Combined	32.4	1.4	21	30.4	1.3	21
Lunch						
Girls	27.4	1.4	17	28.5	1.5	17
Boys	28.2	1.6	17	28.8	1.3	17
Combined	27.8	1.1	17	28.6	1.0	17

[1]S.E. = standard error.

[2]C.V. = coefficient of variation.

[3]Menu 1 = macaroni/ground beef and tomato, green beans, coleslaw, cinnamon roll, mixed fruit cup, milk.

[4]Menu 2 = glazed ham, broccoli, carrot sticks, dinner roll, cherry crisp, milk.

fat. The percentage of kilocalories from fat consumed in the total day's meals (excluding supplements) for both sexes ranged from 30.4 to 37.0 percent and from 27.8 to 35.8 percent for lunch. These percentages are somewhat lower than those reported by Gilbert et al. (104), who found that the mean percentage of kilocalories from fat in the total day's and lunch intakes of Kansas fifth graders was 38.7 and 39.2 percent, respectively. A study of Hawaiian school age children conducted by Lai et al. (117) showed that the percentage of energy from fat in the day's intake ranged from 35 to 37. The National Research Council (7) recommends that total fat intake, particularly in diets below 2,000 kilocalories, should not exceed 35 percent of the dietary energy. According to the U.S. Dietary Goals (133) fat intake should be no more than 30 percent of dietary energy.

Evaluation of Dietary Quality

Means, standard errors and coefficients of variation of Mean Adequacy Ratios (MARs) for students in satellite family and cafeteria style schools are listed in Table 23. Data for dietary quality of students in the on-site cafeteria school is located in Table 33 in Appendix E. There were no significant differences in the MAR values of students attributable to serving style, satellite family or cafeteria (Table 23). Significant differences ($p \leq 0.05$) were observed when school by sex comparisons of MAR values excluding supplements were made. In the cafeteria style school the mean MAR values for boys were higher ($p \leq 0.05$) than those of girls on the days Menus 1 (89 vs. 79) and 2 (89 vs. 78) were served. On the day that Menu 2 was served, girls in the satellite family style school had a higher ($p \leq 0.05$) mean MAR value (88) than girls in the cafeteria style school

Table 23. Means, Standard Errors, and Coefficients of Variation of Mean Adequacy Ratios (MARs), Including and Excluding Supplements, by Sex of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews

	Family Style				Cafeteria Style			
	N	Mean[1]	S.E.[2]	C.V.[3]	N	Mean	S.E.	C.V.
				%				%
Menu 1[4] MAR								
Excluding supplement								
Girls	8	84	3	11	12	79[3]	3	11
Boys	11	84	3	11	9	89[4]	3	11
Including supplement								
Girls	8	85	3	11	12	84	3	11
Boys	11	86	3	11	9	93	3	11
Menu 2[5] MAR								
Excluding supplement								
Girls	14	88[1]	3	11	12	78[2,3]	3	11
Boys	11	82	3	11	16	89[4]	2	11
Including supplement								
Girls	14	91	2	11	12	83	2	11
Boys	11	88	3	11	16	92	2	11

[1]Superscripts (1, 2) indicate the means differ horizontally. Superscripts (3, 4) indicate the means differ vertically within the menu supplement (excluding or including) group. Means differ significantly ($p \leq 0.05$) from each other. Means in a row horizontally or vertically without superscripts do not differ significantly.

[2]S.E. = standard error.

[3]C.V. = coefficient of variation.

[4]Menu 1 = macaroni/ground beef and tomato, green beans, coleslaw, cinnamon roll, mixed fruit cup, milk.

[5]Menu 2 = glazed ham, broccoli, carrot sticks, dinner roll, cherry crisp, milk.

(78). School and sex differences were similar, although not significantly different when MAR values included supplements.

MAR values grouped in ranges indicated that boys had better diets than girls (Table 24). With the exception of 9.1 percent of the boys in the family style school on the day that Menu 1 was served all the boys had MAR values of 75 percent or greater. More girls in the family style school had MAR values of 75 percent or above than girls in the cafeteria style school. Supplements improved the MAR values of all students.

Aitken (108) calculated MAR values for diets of a large number of Kansas fifth grade girls and boys and found that in general the quality of diets of boys was better than that of girls. Boys tended to consume milk or milk products and high protein foods more often than girls. Fruits, fats and nutrient supplements were included more frequently by girls than boys.

Table 24. Percentages of Students at Schools with Satellite Family or Cafeteria Style Food Service in Selected Ranges of Mean Adequacy Ratios (MARs)

	Family Style					Cafeteria Style				
	N	<66	66 to <75	75 to <90	90 to 100	N	<66	66 to <75	75 to <90	90 to 100
				%					%	
Menu 1[1] MARs										
Excluding supplement										
Girls	8	-	12.5	62.5	25.0	12	16.7	16.6	50.0	16.7
Boys	11	9.1	-	54.5	36.4	9	-	-	55.6	44.4
Including supplement										
Girls	8	-	12.5	50.0	37.5	12	8.3	16.7	41.7	33.3
Boys	11	9.1	-	36.4	54.5	9	-	-	33.3	66.7
Menu 2[2] MARs										
Excluding supplement										
Girls	14	-	-	71.4	28.6	12	16.7	25.0	41.7	16.6
Boys	11	-	18.2	54.5	27.3	16	-	-	56.2	43.8
Including supplement										
Girls	14	-	-	42.9	57.1	12	8.3	16.7	33.3	41.7
Boys	11	-	-	63.6	36.4	16	-	-	18.8	81.2

[1]Menu 1 = macaroni/ground beef and tomato, green beans, coleslaw, cinnamon roll, mixed fruit cup, milk.

[2]Menu 2 = glazed ham, broccoli, carrot sticks, dinner roll, cherry crisp, milk.

SUMMARY

Excessive plate waste in school lunch programs has resulted in alterations in serving styles to help counter the problem. Family style food service reportedly decreases plate waste and is well accepted by students. Because few studies with statistically analyzed data have been conducted to substantiate these claims, a study was conducted in three elementary schools, using satellite family, satellite cafeteria, or on-site cafeteria food delivery systems, to compare the effect of serving style on students' food behavior. A facial hedonic scale was used to examine food preferences of first through sixth grade students, and 24-hour dietary recall interviews were conducted with a random sample of fourth through sixth graders, who ate school lunch to assess their nutrient intakes. Dietary data were analyzed for energy and 12 nutrients and expressed as percentages of the Recommended Dietary Allowances. The percentage of energy consumed as fat also was determined, and Mean Adequacy Ratios (MARs) were calculated to assess dietary quality. Differences attributable to serving style were determined statistically.

Food preference scores for menu items were highest in the satellite cafeteria school. Comparisons of dietary data from the satellite family and cafeteria style schools on two study days showed that on one day, students in the satellite family style school consumed more protein, thiamin, riboflavin, niacin, and iron and their energy intakes were higher on the other day than those of students in the satellite cafeteria style school. Energy and nutrient intakes of boys and girls from the total day's or lunch meals did not differ significantly in either school. There were no significant differences in the percentage of dietary energy from fat attributable to serving style or sex of the student.

Serving style did not affect MAR values of students significantly. Mean MAR values for girls in the satellite family school were higher than those of their counterparts in the satellite cafeteria school on one day. The MARs grouped in ranges indicated that more girls in the family style school had MAR values in the higher ranges than girls in the cafeteria style school and that boys had better diets than girls.

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ACKNOWLEDGMENTS

Sincere appreciation and thanks are expressed to Dr. Kathleen Newell, major professor, for her guidance in literary style and professionalism as well as her time and efforts generously given toward the completion of this project. Gratitude is expressed to Dr. Beth Fryer, Department of Foods and Nutrition, for her guidance and wisdom in selecting a field of postgraduate study and to Dr. Allene Vaden, Department of Dietetics, Restaurant and Institutional Management, for her ideas and suggestions throughout this study.

Appreciation is extended to Dr. Arthur Dayton, head of Department of Statistics, for his help with designing the study and also with the statistical analysis and data interpretation. Special recognition is extended to Nedra Sylvis for her enthusiasm and help in typing this thesis.

Gratitude is also expressed to the many school personnel and students that gave their time and cooperation to make this study possible and also to Becky Lind, fellow graduate student, whose determination and friendship were greatly appreciated.

Last and probably the most vital, a deep-hearted thanks is extended to my family, especially to my husband Don and son Nathan, for their expressed interest in and support for the completion of this degree.

APPENDIXES

APPENDIX A

PROJECT APPROVAL AND CONSENT CORRESPONDENCE

September 6, 1983

TITLE: Effect of Family Versus Cafeteria Style School Lunch Service on Students' Food Preferences and Nutrient Intakes

PRINCIPAL INVESTIGATOR: G. Kathleen Newell, Ph.D.
Foods and Nutrition

This proposal has been reviewed and it conforms to University policy and Department of Health, and Human Service regulations (Subpart D 45CFR46). The proposal is recommended for approval for a period of 12 months. If this proposal extends beyond 12 months from its date of approval, the proposal must again be reviewed by the subcommittee. Request for an extension of approval is the responsibility of the principal investigator. Any substantial revision in this study relative to human subjects should be reviewed again by the college subcommittee.

Robert D. Reeves, Ph.D.
Chairman
Subcommittee on Research Involving Human Subjects

(KSU Letterhead)

September 26, 1983

Dr. James Benjamin
Superintendent of Schools
2031 Poyntz
Manhattan, KS 66502

Dear Dr. Benjamin:

In keeping with the agreement between the Manhattan Public Schools and the College of Education, we have screened the attached proposals by Ms. Becky Lind, Ms. Linda Cain, and Dr. Kathleen Newell to conduct research in the schools, and are forwarding them to you for your action. The proposals have been approved by our Committee on Research Involving Human Subjects and we see no harm arising as a result of the study.

Sincerely yours,

Jordan Utsey, Dean
College of Education

JU:llb

Enclosures (2)

bcc: L. Cain

Dear Parent or Guardian and Student:

Your school has been selected to take part in a research study comparing family style and cafeteria style school lunch service. In cooperation with the USD 383 Foodservice, the Department of Foods and Nutrition at Kansas State University will collect data on student's attitudes, food acceptance and consumption, and daily nutrient intake. The superintendent of your school district, the school principal and the District Foodservice Director have approved the study.

The administration of the school lunch questionnaire and food evaluation will be pilot tested in your school. Selected fourth, fifth, and sixth grade classes will be asked to complete a questionnaire concerning food, foodservice, and lunchroom atmosphere, which will take approximately 20 minutes of classroom time. Selected first, second, and third grade classes will be asked to complete a food evaluation. This will require approximately 15 minutes of classroom time.

Risk to the student will be minimal and involves giving information concerning food likes and dislikes. All information will be kept confidential with responses and data identified by number only. We hope that all students will take part in the study; however participation is voluntary. The student may refuse to participate or discontinue participation at any time with no penalty or loss of benefits to which the student is otherwise entitled.

Data from this study will be useful to the District Director of Foodservice USD 383 and eventually to the students in the district. The information will be helpful to other school districts in Kansas as well as to other states.

Please indicate your willingness to take part in the study on the back side of this form and return it to the classroom teacher tomorrow or a soon as possible. You may keep the second copy for your record. Parent and student must both give consent before the student can participate in the study. However, if a student is too young to understand this research project, it is not necessary for the student consent form to be signed. If you have any questions regarding the research please contact Dr. Kathleen Newell (532-5508). Thank you for your cooperation.

Sincerely,

Sue Greig
Sue Greig
District Foodservice Director,
USD 383

Kathleen Newell
Kathleen Newell
Associate Professor,
Dept. of Foods and Nutrition, KSU

Becky Lind
Becky Lind
Graduate Student, KSU

Linda Cain
Linda Cain
Graduate Student, KSU

Dear Parent or Guardian and Student:

Your school has been selected to take part in a research study comparing family style and cafeteria style school lunch service. In cooperation with the USD 383 Foodservice, the Department of Foods and Nutrition at Kansas State University will collect data on student's attitudes, food acceptance and consumption, and daily nutrient intake. The superintendent of your school district, the school principal and the District Foodservice Director have approved the study.

In each selected school the fourth, fifth and sixth grade classes will be asked to complete a questionnaire concerning food, foodservice and lunchroom atmosphere, which will take approximately 20 minutes of classroom time. Plate waste will be measured on four days to determine food consumption of randomly selected students in grades one through six. All students will be asked to complete a food evaluation on each food consumption data collection day. This will require approximately 15 minutes of classroom time each day. Randomly selected fourth, fifth and sixth grade students will be interviewed for recall of one day's diet. The dietary interview will take approximately 20 minutes and involve about 16 students per class.

Risk to the student will be minimal and involves giving information concerning food likes and dislikes. All information will be kept confidential with responses and data identified by number only. We hope that all students will take part in the study; however, participation is voluntary. The student may refuse to participate or discontinue participation at any time with no penalty or loss of benefits to which the student is otherwise entitled.

Data from this study will be useful to the District Director of Foodservice USD 383 and eventually to the students in the district. The information will be helpful to other school districts in Kansas as well as to other states.

Please indicate your willingness to take part in the study on the back side of this form and return it to the classroom teacher tomorrow or as soon as possible. You may keep the second copy for your record. Parent and student must both give consent before the student can participate in the study. However, if the student is too young to understand this research project, it is not necessary for the student consent form to be signed. If you have any questions regarding the research please contact Dr. Kathleen Newell (532-5508). Thank you for your cooperation.

Sincerely,

Sue Greig
Sue Greig
District Foodservice Director,
USD 383

Kathleen Newell
Kathleen Newell
Associate Professor,
Dept. of Foods and Nutrition, KSU

Becky Lind
Becky Lind
Graduate Student, KSU

Linda Cain
Linda Cain
Graduate Student, KSU

Parental Consent

I have read the description of the research study on the front side of this form and:

(please check one)

_____ I give permission for_____to participate in the school
(child's name)
lunch study described on the front side of this form.

_____ I do not give permission for_____to participate in the
(child's name)
school lunch study described on the front side of this form.

_____
(signature of parent or guardian)

_____
(date)

If a student is too young to understand this research project, it is not necessary for the student consent form to be signed.

Student Consent

I have read the description of the research study on the front side of this form and:

(please sign your name after one sentence)

I will take part in this study.

_____ _____
(signature of student) (date)

I will not take part in this study.

_____ _____
(signature of student) (date)

Please return one copy of these forms to your teacher tomorrow or as soon as possible. Thank you.

APPENDIX B

PRINCIPALS' AND TEACHERS' LETTERS

(KSU Letterhead)

October 6, 1983

Mr. Doyle Barnes, Principal
Theodore Roosevelt Elementary School
14th and Houston Streets
Manhattan, Kansas 66502

Dear Mr. Barnes:

The problem of excessive food waste in lunch programs has led to numerous investigations of ways to reduce that waste. One strategy that has been employed by school foodservice personnel is variations in serving style. Family style meal service is being used in a few areas of the country, including Theodore Roosevelt School, with reported reduction in food waste, but statistically designed studies with food consumption data are lacking.

In cooperation with Mrs. Sue Greig, District Director of Foodservice, we plan to collect data at Theodore Roosevelt and Lee elementary schools in order to compare the effects of family versus cafeteria style meal service on students' attitudes, food acceptance and consumption, and daily nutrient intake.

Teacher information packets accompany this letter. Instructions, sample forms and a tentative schedule are included. Parent-student information letters and consent forms will need to be distributed and collected in the classroom prior to the study. Parent and student permissions to participate are required for all students involved in the study. However, if a student is too young to understand this research project it is not necessary for the student form to be signed.

For the first part of the study your teachers will be asked to administer a school lunch questionnaire to the fourth, fifth and sixth grade students. This should take less than 20 minutes. A narrative script will be provided to assist with this data collection.

Randomly selected students from grades one through six will participate in the lunchroom plate waste portion of the study. Prior to students coming the lunchroom, we will ask your teachers to read an instruction to the students. The two days of pilot study and four days of data collection will be scheduled on Tuesdays and Thursdays. Researchers will weigh the leftover foods on selected students' plates in the lunchroom area.

In the classroom following the lunch period on the four lunchroom data collection days, your teachers will be asked to give student instructions to grades one through six for completing the food evaluation form. A narratvie script and poster will be provided to assist with the instruction. Completion of the food evaluation form will take about 10 minutes.

The study also includes 24-hour dietary recall interviews to be conducted with 48 randomly selected fourth, fifth and sixth grade students in each school. This will entail a personal interview with individual students on four selected study days. The interviews will be conducted by two trained interviewers and will require approximately 20 minutes of each participating student's time.

The narrative scripts for each student instruction are provided to simplify the teachers role and standardize the data collection procedure. In order to insure confidentiality, an identification number will be assigned from the rosters of participating students for use on all data collection forms. Student forms will be delivered to the office and collected from the office by the researchers on the data collection day.

We wish to express our appreciation in advance for your cooperation.

Sincerely,

Sue Greig
Sue Greig
District Foodservice Director,
USD 383

Becky Lind
Becky Lind
Graduate Student,
Kansas State University

Kathleen Newell
Kathleen Newell
Associate Professor,
Dept. of Foods and Nutrition
Kansas State University

Linda Cain
Linda Cain
Graduate Student,
Kansas State University

October 3, 1983

Mrs. Hinnie Smith, Principal
Lee Elementary School
Anderson and Lee Streets
Manhattan, Kansas 66502

Dear Mrs. Smith:

The problem of excessive food waste in lunch programs has led to numerous investigations of ways to reduce that waste. One strategy that has been employed by school foodservice personnel is variations in serving style. Family style meal service is being used in a few areas of the country, including Theodore Roosevelt School, with reported reduction in food waste, but statistically designed studies with food consumption are lacking.

In cooperation with Mrs. Sue Greig, District Director of Foodservice, we plan to collect data at Theodore Roosevelt and Lee elementary schools in order to compare the effects of family versus cafeteria style meal service on students' attitudes, food acceptance and consumption, and daily nutrient intake.

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For the first part of the study your teachers will be asked to administer a school lunch questionnaire to the fourth, fifth and sixth grade students. This should take less than 20 minutes. A narrative script will be provided to assist with this data collection.

Students from grades one through six will participate in the lunchroom plate waste portion of the study. Prior to students coming to the lunchroom, we will ask your teachers to distribute identification tray cards to selected students and read an instruction to the students. The two days of pilot study and four days of data collection will be scheduled on Tuesdays and Thursdays. Researchers will weigh the leftover foods on selected students' trays in the lunchroom area.

Mrs. Hinnie Smith
October 3, 1983
Page 2

In the classroom following the lunch period on four lunchroom data collection days, your teachers will be asked to give student instructions to grades one through six for completing the food evaluation form. A narrative script and poster will be provided to assist with this data collection. Completion of the food evaluation form will take about 10 minutes.

The study also includes 24-hour dietary recall interviews to be conducted with 48 randomly selected fourth, fifth and sixth grade students in each school. This will entail a personal interview with individual students on four selected study days. The interviews will be conducted by two trained interviewers and will require approximately 20 minutes of each participating student's time.

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Sincerely,

Sue Greig
Sue Greig
District Foodservice Director,
USD 383

Becky Lind
Becky Lind
Graduate Student,
Kansas State University

Kathleen Newell
Kathleen Newell
Associate Professor,
Dept. of Foods and Nutrition
Kansas State University

Linda Cain
Linda Cain
Graduate Student,
Kansas State University

November 14, 1983

Dr. Singer
Woodrow Wilson Elementary School
6th and Leavenworth
Manhattan, KS 66502

Dear Dr. Singer:

The problem of excessive food waste in lunch programs has led to numerous investigations of ways to reduce that waste. One strategy that has been employed by school foodservice personnel is variations in serving style. Family style meal service is being used in a few areas of the country, including Theodore Roosevelt School, with reported reduction in food waste, but statistically designed studies with food consumption are lacking.

In cooperation with Mrs. Sue Greig, District Director of Foodservice, we plan to collect data at Theodore Roosevelt and Woodrow Wilson elementary schools in order to compare the effects of family versus cafeteria style meal service on students' attitudes, food acceptance and comsumption, and daily nutrient intake.

Teacher information packets accompany this letter. Instructions, sample forms and a tentative schedule are included. Parent-student information letters and consent forms will need to be distributed and collected in the classroom prior to the study. Parent and student permissions to participate are required for all students involved in the study. However, if a student is too young to understand this research project it is not necessary for the student section to be signed.

For the first part of the study your teachers will be asked to administer a school lunch questionnaire to the fourth, fifth and sixth grade students. This should take less than 20 minutes. A narrative script will be provided to assist with this data collection.

Students from grades one through six will participate in the lunchroom plate waste portion of the study. Prior to students coming to the lunchroom, we will ask your teachers to distribute identification tray cards to selected students and read an instruction to the students. The one day of pilot study and four days of data collection will be scheduled scheduled on Tuesdays and Thursdays. Researchers will weigh the left-over foods on selected students' trays in the lunchroom area.

In the classroom following the lunch period on four lunchroom data collection days, your teachers will be asked to give student instructions to grades one through six for completing the food evaluation form. A narrative script and poster will be provided to assist with this data collection. Completion of the food evaluation form will take about 10 minutes.

The study also includes 24-hour dietary recall interviews to be conducted with 48 randomly selected fourth, fifth and sixth grade students in each school. This will entail a personal interview with individual students on two selected study days. The interviews will be conducted by four trained interviewers and will require approximately 20 minutes of each participating student's time.

The narrative scripts for each student instruction are provided to simplify the teacher's role and standardize the data collection procedure. In order to insure confidentiality, an identification number will be assigned from the rosters of participating students for use on all data collections. Student forms will be delivered to the office and collected from the office by the researchers on the data collection day.

We wish to express our appreciation in advance for your cooperation.

Sincerely,

Sue Greig
District Foodservice Director,
USD 383

Becky Lind
Graduate Student,
Kansas State University

Kathleen Newell
Associate Professor,
Dept. of Foods and Nutrition
Kansas State University

Linda Cain
Graduate Student,
Kansas State University

(KSU Letterhead)

(Letter to principal and teachers
at pilot study school)

October 4, 1983

Marlatt Elementary School
2715 Hobbs Drive
Manhattan, Kansas 66502

The problem of excessive food waste in lunch programs has led to numerous investigations of ways to reduce that waste. One strategy that has been employed by school foodservice personnel is variations in serving style. Family style meal service is being used in a few areas of the country, including Theodore Roosevelt School, with reported reduction in food waste, but statistically designed studies with food comsumption data are lacking.

In cooperation with Mrs. Sue Greig, District Director of Foodservice, we plan to collect data at Theodore Roosevelt and Lee elementary schools in order to compare the effects of family versus cafeteria style meal service on students' attitudes, food acceptance and consumption, and daily nutrient intake.

The administration of the school lunch questionnaire and food evaluation will be pilot tested in your school on Monday, October 10, 1983 to evaluate instructions and procedures. Teacher packets accompany this letter. Instructions and sample forms are included.

Parent-student information letters and consent forms will need to be distributed and collected in the classroom prior to the study. Parent and student permission to participate is required for all students involved in the study. However, if a student is too young to understand this research project it is not necessary for the student form to be signed. The duplicate forms will be distributed in the classroom on Wednesday, October 5, 1983 and are to be taken home by the students. Students are instructed in the letter to return the forms to their teacher tomorrow or as soon as possible. A researcher will pick up the forms on Friday, October 7, 1983 from the principal's office after school.

For the school lunch questionnaire we have asked that one teacher in each of the grades four, five and six administer the questionnaire at their convenience on Monday, October 10, 1983. This should take about 20 minutes to complete. A narrative script will be provided to assist with this data collection.

For the food evaluation we have asked that one teacher in each of the grades one, two and three show the students how to complete a food evaluation form in the classroom immediately following the lunch period on Monday, October 10, 1983. A poster and narrative script will be provided to assist with the instruction. Completion of the food evaluation form will take approximately 10 minutes.

The narrative scripts for each student instruction are provided to simplify the teachers role and standardize the data collection procedure. In order to insure confidentiality, an identification number will be assigned from the rosters of participating students for use on all data collection forms. Student forms will be delivered to the office and collected from the office by the researchers on the data collection day.

The purpose of this pilot study is to evaluate and improve the instructions and procedures; therefore, the teachers comments and suggestions are very important. An evaluation form for this purpose will be enclosed with each set of pilot study materials. Please record the actual number of minutes spent on the distribution, instruction, completion and collection of the forms on Monday, October 10, 1983. Specific questions and problems encountered and suggestions for improvement will be helpful.

We wish to express our appreciation in advance for your cooperation.

Sincerely,

Sue Greig
Sue Greig
District Foodservice Director,
USD 383

Becky Lind
Becky Lind
Graduate Student,
Kansas State University

Kathleen Newell
Kathleen Newell
Associate Professor,
Dept. of Foods and Nutrition,
Kansas State University

Linda Cain
Linda Cain
Graduate Student
Kansas State University

(KSU Letterhead)

(Letter to teachers)

October 6, 1983

Theodore Roosevelt Elementary School
14th and Houston Streets
Manhattan, Kansas 66502

The problem of excessive food waste in lunch programs has led to numerous investigations of ways to reduce that waste. One strategy that has been employed by school foodservice personnel is variations in serving style. Family style meal service is being used in a few areas of the country, including Theodore Roosevelt School, with reported reduction in food waste, but statistically designed studies with food consumption data are lacking.

In cooperation with Mrs. Sue Greig, District Director of Foodservice, we plan to collect data at Theodore Roosevelt and Lee elementary schools in order to compare the effects of family versus cafeteria style meal service on students' attitudes, food acceptance and consumption, and daily nutrient intake.

Teacher information packets accompany this letter. Instructions, sample forms and a tentative schedule are included. Parent-student information letters and consent forms will need to be distributed and collected in the classroom prior to the study. Parent and student permission to participate is required for all students involved in the study. However, if a student is too young to understand this research project it is not necessary for the student form to be signed.

For the first part of the study you will be asked to administer a school lunch questionnaire to the fourth, fifth and sixth grade students. This should take less than 20 minutes. A narrative script will be provided to assist you with this data collection.

Randomly selected students from grades one through six will participate in the lunchroom plate waste portion of the study. Prior to students coming to the lunchroom, we will ask you to read the instructions to students. The two days of pilot and four days of lunchroom data collection will be scheduled on Tuesdays and Thursdays. Researchers will weigh the leftover foods on selected students' plates in the lunchroom area.

In the classroom following the lunch period on lunchroom data collection days, you will be asked to give student instructions to grades one through six for completing the food evaluation form. A narrative script and poster will be provided to assist you with the instruction. Completion of the food evaluation form will take about 10 minutes.

The study also includes 24-hour dietary recall interviews to be conducted with 48 randomly selected fourth, fifth and sixth grade students in each school. This will entail a personal interview with individual students on four selected study days. The interviews will be conducted by two trained interviewers and will require approximately 20 minutes of each participating student's time.

The narrative scripts for each student instruction are provided to simplify your role and standardize the data collection procedure. In order to insure confidentiality, an identification number will be assigned from the rosters of participating students for use on all data collection forms. Student forms will be delivered to the office and collected from the office by the researchers on the data collection day.

We wish to express our appreciation in advance for your cooperation.

Sincerely,

Sue Greig
Sue Greig
District Foodservice Director,
USD 383

Becky Lind
Becky Lind
Graduate Student,
Kansas State University

Kathleen Newell
Kathleen Newell
Associate Professor,
Dept. of Foods and Nutrition,
Kansas State University

Linda Cain
Linda Cain
Graduate Student,
Kansas State University

Dear Teachers of Lee School:

The problem of excessive food waste in lunch programs has led to numerous investigations of ways to reduce that waste. One strategy that has been employed by school foodservice personnel is variations in serving style. Family style meal service is being used in a few areas of the country, including Theodore Roosevelt School, with reported reduction in food waste, but statistically designed studies with food consumption data are lacking.

In cooperation with Mrs. Sue Greig, District Director of Foodservice, we plan to collect data at Theodore Roosevelt and Lee Elementary Schools in order to compare the effects of family versus cafeteria style meal service on students' attitudes, food acceptance and consumption, and daily nutrient intake.

Teacher information packets accompany this letter. Instructions, sample forms and a tentative schedule are included. Parent-student information letters and consent forms will need to be distributed and collected in the classroom prior to the study. Parent and student permissions to participate are required for all students involved in the study.

For the first part of the study you will be asked to administer a school lunch questionnaire to the 4th, 5th, and 6th grade students. This should take less than 20 minutes. A narrative script will be provided to assist you with this data collection.

Students from grades one through six will participate in the lunchroom plate waste portion of the study. Prior to students coming to the lunchroom, we will ask you to distribute identification tray cards to selected students and read a brief instruction to the students. The two days of pilot study and four days of data collection will be scheduled on Tuesdays and Thursdays. Researchers will weigh the left-over foods on selected student's trays in the lunchroom area.

In the classroom following the lunch period on lunchroom data collection days, you will be asked to give student instructions to grades one through six for completing the food evaluation form. A narrative script and poster will be provided to assist you with this data collection. Completion of the food evaluation form will take about 10 minutes.

The study also includes 24-hour dietary recall interviews to be conducted with 48 randomly selected 4th, 5th, and 6th grade students in each school. This will entail a personal interview with individual students on four selected study days. The interviews will be conducted by two trained interviewers and will require approximately 20 minutes of each participating student's time.

The narrative scripts for each student instruction are provided ddd to simplify your role and standardize the data collection procedure. In order to insure confidentiality, an identification number will be assigned from the rosters of participating students for use on all data collection forms. Student forms will be delivered to the office and collected from the office by the researchers on the data collection day.

We wish to express our appreciation in advance for your cooperation.

Sincerely,

Sue Greig
District Foodservice Director,
USD 383

Becky Lind
Graduate Student,
Kansas State University

Kathleen Newell
Associate Professor,
Dept. of Foods and Nutrition,
Kansas State University

Linda Cain
Graduate Student,
Kansas State University

Dear Teachers of Woodrow Wilson School:

The problem of excessive food waste in lunch programs has led to numerous investigations of ways to reduce that waste. One strategy that has been employed by school foodservice personnel is variations in serving style. Family style meal service is being used in a few areas of the country, including Theodore Roosevelt School, with reported reduction in food waste, but statistically designed studies with food consumption data are lacking.

In cooperation with Mrs. Sue Greig, District Director of Foodservice, we plan to collect data at Theodore Roosevelt and Woodrow Wilson Elementary Schools in order to compare the effects of family versus cafeteria style meal service on students' attitudes, food acceptance and consumption, and daily nutrient intake.

Teacher information packets accompany this letter. Instructions, sample forms and a tentative schedule are included. Parent-student information letters and consent forms will need to be distributed and collected in the classroom prior to the study. Parent and student permissions to participate are required for all students involved in the study. However, if a student is too young to understand this research project it is not necessary for the student section to be signed.

For the first part of the study you will be asked to administer a school lunch questionnaire to the 4th, 5th and 6th grade students. This should take less than 20 minutes. A narrative script will be provided to assist you with this data collection.

Students from grades one through six will participate in the lunchroom plate waste portion of the study. Prior to students coming to the lunchroom, we will ask you to distribute identification tray cards to selected students and read a brief instruction to the students. The one day of pilot study and four days of data collection will be scheduled on Tuesdays and Thursdays. Researchers will weigh the left-over foods on selected student's trays in the lunchroom area.

In the classroom following the lunch period on lunchroom data collection days, you will be asked to give student instructions to grades one through six for completing the food evaluation form. A narrative script and poster will be provided to assist you with this data collection. Completion of the food evaluation form will take about 10 minutes.

The study also includes 24-hour dietary recall interviews to be conducted with 48 randomly selected 4th, 5th and 6th grade students in each school. This will entail a personal interview with individual students on two selected study days. The interviews will be conducted by four trained interviewers and will require approximately 20 minutes. of each participating student's time.

The narrative scripts for each student instruction are provided to simplify your role and standardize the data collection procedure. In order to insure confidentiality, an identification number will be assigned from the rosters of participating students for use on all data collection forms. Student forms will be delivered to the office and collected from the office by the researchers on the data collection day.

We wish to express our appreciation in advance for your cooperation.

Sincerely,

Sue Greig
Sue Greig
District Foodservice Director,
USD 383

Becky Lind
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Kathleen Newell
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Associate Professor,
Dept. of Foods and Nutrition
Kansas State University

Linda Cain
Linda Cain
Graduate Student,
Kansas State University

APPENDIX C

PROCEDURES AND FORMS FOR FOOD EVALUATION

TEACHER INSTRUCTIONS FOR ADMINISTERING THE FOOD EVALDATION
(IMMEDIATELY AFTER LUNCH)

The following instructions are written in both upper- and lowercase letters. The lowercase letters are instructions to you. Read the uppercase letter instructions aloud to the students. All food evaluation forms are ivory colored.

Hand evaluation forms out to students.

THE DEPARTMENT OF FOODS AND NUTRITION AT KANSAS STATE UNIVERSITY IS CONDUCTING A SURVEY OF FOOD LIKES AND DISLIKES. THE RESEARCHERS HOPE YOU WILL BE WILLING TO HELP THEM BY FILLING OUT THE FOOD EVALUATION FORM. THEY WOULD LIKE ALL STUDENTS TO PARTICIPATE, BUT IF YOD DO NOT WISH TO DO SO YOU SHOULD TURN IN YOUR FOOD EVALUATION FORM BLANK. YOU MAY REMOVE YOUR NAME TAB TO.ASSURE YOUR ANSWERS WILL BE KEPT CONFIDENTIAL.

Show students the ivory colored poster with faces on it.

IF YOD ATE LUNCH TODAY AT HOME OR SOMEPLACE OTHER THAN AT SCHOOL MARK IN THIS BOX.
Point to: I did not eat at school today.
IF YOU BROUGHT A PACKED LUNCH TO SCHOOL TODAY PLEASE MARK IN THIS BOX. Point to:
I brought a sack lunch today.
IF YOU ATE THE LUNCH SERVED AT SCHOOL TODAY MARK IN THIS BOX. Point to: I ace
the school lunch today.

IF YOU MARKED X IN EITHER OF THE FIRST TWO BOXES YOU HAVE COMPLETED THIS PAGE AND I WILL COLLECT YOUR FORMS WHEN THE OTHERS ARE FINISHED.

IF YOU MARKED X IN THE LAST BOX PLEASE COMPLETE THE FOLLOWING ITEMS ON THE PAGE.
Point to the faces.

I WANT YOU TO MARK THE FACE THAT SHOWS HOW MUCH YOU LIKED THE FOODS YOU ATE. PLEASE LISTEN WHILE I TELL YOD WHAT EACH FACE MEANS BEFORE YOU MARK AN X OVER ANY FACE.

IF YOU THOUGHT THE FOOD WAS GREAT, YOU SHOULD MARK AN X OVER THIS VERY HAPPY FACE.

Point to  on the poster.

IF YOU THOUGHT THE FOOD WAS GOOD, YOD SHOULD MARK AN X OVER THIS FACE.

Point to  on the poster.

IF YOU THOUGHT THE FOOD WAS SO-SO, NEITHER GOOD NOR BAD, YOU SHOULD MARK AN X OVER THIS FACE.

Point to  on the poster.

IF YOU DIDN'T LIKE THE FOOD VERY MUCH AND THOUGHT IT WAS BAD, YOU SHOULD MARK AN X OVER THIS FACE.

Point to  on the poster.

IF YOU THOUGHT THE FOOD WAS AWFUL, YOU SHOULD PUT AN X OVER THIS FACE.

Point to  on the poster.

HOW MUCH DID YOU LIKE THE POWER SOURCE BURGER? NOW MARK AN X ON THE FACE THAT SHOWS HOW MUCH YOU LIKED IT. Point to row of faces on poster that corresponds with those on the students' sheet.

HOW MUCH DID YOU LIKE THE WHOLE WHEAT BUN? NOW MARK AN X ON THE FACE THAT SHOWS HOW MUCH YOU LIKED IT. Point to appropriate space.

HOW MUCH DID YOU LIKE THE PRINT OUT POTATOES (tater tots)? NOW MARK AN X ON THE FACE THAT SHOWS HOW MUCH YOU LIKED IT. Point to appropriate space.

HOW MUCH DID YOU LIKE THE VEGETABLE CHIPS (sliced tomato, onion ring, pickle and lettuce leaf)? NOW MARK AN X ON THE FACE THAT SHOWS HOW MUCH YOU LIKED IT. Point to appropriate space.

HOW MUCH DID YOU LIKE THE APPLE BYTES (apple crisp)? NOW MARK AN X ON THE FACE THAT SHOWS HOW MUCH YOU LIKED IT. Point to appropriate space.

HOW MUCH DID YOU LIKE THE BASIC MILK? NOW MARK AN X ON THE FACE THAT SHOWS HOW MUCH YOU LIKED IT. Point to appropriate space.

WE'RE FINISHED. THE RESEARCHERS THANK YOU FOR YOUR COOPERATION. PLEASE HAND IN THIS PAGE.

Please gather the students' Food Evaluation forms and place them in the envelope provided. Returo the envelope to the office by the end of the day. A researcher will pick up all the classrooms' envelopes after dismissal of school for the day. Thank you for your cooperation.

IF YOU OIDN'T LIKE THE FOOO VERY MUCH AND THOUGHT IT WAS BAD, YOU SHOULD MARK AN X OVER THIS FACE.

Point to  on the postar.

IF YOU THOUGHT THE FOOO WAS AWFUL, YOU SHOULD PUT AN X OVER THIS FACE.

Point to  on the poster.

HOW MUCH DIO YOU LIKE THE MACARONI, BEEF AND TOMATO? NOW MARK AN X ON THE FACE THAT SHOWS HOW MUCH YOU LIKEO IT. Point to row of facas on poster that corresponds with thoae on tha students' aheet.

HOW MUCH DID YOU LIKE THE SEASONED GREEN BEANS? NOW MARK AN X ON THE FACE THAT SHOWS HOW MUCH YOU LIKED IT. Point to appropriate space.

HOW MUCH OIO YOU LIKE THE RED AND WHITE CREAMY COLESLAW? NOW MARK AN X ON THE FACE THAT SHOWS HOW MUCH YOU LIKED IT. Point to appropriate spaca.

HOW MUCH DIO YOU LIKE THE BUTTERED CINNAMON ROLL? NOW MARK AN X ON THE FACE THAT SHOWS HOW MUCH YOU LIKEO IT. Point to appropriate spaca.

HOW MUCH DID YOU LIKE THE CHILLEO MIXED FRUIT CUP? NOW MARK AN X ON THE FACE THAT SHOWS HOW MUCH YOU LIKED IT. Point to appropriate spaca.

HOW MUCH DID YOU LIKE THE MILK? NOW MARK AN X ON THE FACE THAT SHOWS HOW MUCH YOU LIKEO IT. Point to appropriate spaca.

WE'RE FINISHED. THE RESEARCHERS THANK YOU FOR YOUR COOPERATION. PLEASE HAND IN THIS PAGE.

Pleaae gathar the students' Food Eveluation forms and place them in the envelope provided. Raturn the envelope to the offica by the end of the day. A researcher will pick up all the claaarooms' envelopea aftar diamisaal of school for tha day. Thank you for your cooperation.

IF YOU DIDN'T LIKE THE FOOD VERY MUCH AND THOUGHT IT WAS BAD, YOU SHOULD MARK AN X OVER THIS FACE.

Point to  on the poster.

IF YOU THOUGHT THE FOOD WAS AWFUL, YOU SHOULD PUT AN X OVER THIS FACE.

Point to  on the poster.

HOW MUCH OID YOU LIKE THE GLAZED BAKED HAM? NOW MARK AN X ON THE FACE THAT SHOWS HOW MUCH YOU LIKED IT. Point to row of faces on poster that corresponds with those on the students' sheets.

HOW MUCH DID YOU LIKE THE BUTTERED BROCCOLI SPEARS? NOW MARK AN X ON THE FACE THAT SHOWS HOW MUCH YOU LIKED IT. Point to appropriate space.

HOW MUCH DID YOU LIKE THE CRISP CARROT RELISH? NOW MARK AN X ON THE FACE THAT SHOWS HOW MUCH YOU LIKED IT. Point to appropriate space.

HOW MUCH OIO YOU LIKE THE BUTTERED RYE ROLL? NOW MARK AN X ON THE FACE THAT SHOWS HOW MUCH YOU LIKEO IT. Point to appropriate space.

HOW MUCH OIO YOU LIKE THE CHERRY CHISP? NOW MARK AN X ON THE FACE THAT SHOWS HOW MUCH YOU LIKED IT. Point to appropriate space.

HOW MUCH DID YOU LIKE THE MILK? NOW MARK AN X ON THE FACE THAT SHOWS HOW MUCH YOU LIKED IT. Point to appropriate space.

WE'RE FINISHED. THE RESEARCHERS THANK YOU FOR YOUR COOPERATION. PLEASE HAND IN THIS PAGE.

Please gather the students' Food Eveluation forms and place them in the envelope provided. Return the envelope to the office by the end of the day. A researcher will pick up all the classrooms' envelopes after dismissal of school for the day. Thenk you for your cooperation.

(pilot study)

FOOD EVALUATION

ID NUMBER:_____ DATE:_____

☐ I did not eat at school today.

☐ I brought a sack lunch today.

☐ I ate the school lunch today.

If you ate school lunch today, mark ⊗ on the face that shows how you felt about the food served in the lunchroom.

	Great	Good	So-So	Bad	Awful
Power Source Burger					
Whole Wheat Bun					
Print out Potatoes (tater tots)					
Vegetable Chips (sliced tomato, onion ring, pickle and lettuce leaf)					
Apple Bytes (apple crisp)					
Basic Milk					

FOOD EVALUATION

ID NUMBER:_____ DATE:_____

☐ I did not eat at school today.

☐ I brought a sack lunch today.

☐ I ate the school lunch today.

If you ate school lunch today, mark ⊗ on the face that shows how you felt about the food served in the lunchroom.

Macaroni, Beef, Tomato	 Great	 Good	 So-So	 Bad	 Awful
Seasoned Green beans	 Great	 Good	 So-So	 Bad	 Awful
Red and White Creamy Coleslaw	 Great	 Good	 So-So	 Bad	 Awful
Buttered Cinnamon Roll	 Great	 Good	 So-So	 Bad	 Awful
Chilled Mixed Fruit Cup	 Great	 Good	 So-So	 Bad	 Awful
Milk	 Great	 Good	 So-So	 Bad	 Awful

FOOD EVALUATION

ID NUMBER:_____ DATE:_____

☐ I did not eat at school today.

☐ I brought a sack lunch today.

☐ I ate the school lunch today.

If you ate school lunch today, mark ⊗ on the face that shows how you felt about the food served in the lunchroom.

Glazed Baked Ham	 Great	 Good	 So-So	 Bad	 Awful
Buttered Broccoli Spears	 Great	 Good	 So-So	 Bad	 Awful
Crisp Carrot Relish	 Great	 Good	 So-So	 Bad	 Awful
Buttered Rye Roll	 Great	 Good	 So-So	 Bad	 Awful
Cherry Crisp	 Great	 Good	 So-So	 Bad	 Awful
Milk	 Great	 Good	 So-So	 Bad	 Awful

Comments and Suggestions for Improvement
of the Food Evaluation

1. How much class time did you spend on the Food Evaluation?
   _____minutes
2. Were the teachers' instructions for the Food Evaluation easy to understand? _____yes _____no Comments:_____
   _____
   _____
3. Were the narrative instructions to the students easy to present?
   _____yes _____no Comments:_____
   _____
   _____
4. Were the narrative instructions clear to the students?
   _____yes _____no Comments:_____.
   _____
   _____
5. Any other suggestions or comments concerning procedures or materials would be helpful to us._____
   _____
   _____

Thank you for your time and comments which will enable us to improve the study.

APPENDIX D

PROCEDURES AND FORMS FOR DIETARY RECALL INTERVIEWS

DIETARY RECALL INTERVIEWS

The objective of this project is to compare daily nutrient intake of fourth, fifth and sixth grade students who eat school lunch served cafeteria style vs. family style. The 24-hour dietary recall is a fact-finding mission from which we will base this comparison.

An important part of a successful interviewing technique is identifying potential sources of bias and overcoming as many of these sources as possible prior to the interview. Bias in the interview situation can lead to the securing of incorrect information. One ever present source of bias is due to the individual differences from interviewer to interviewer. This source can never be completely overcome but can be minimized by standardizing the interview so the interviewer has a limited free choice in the procedure (1). Generally, there are two types of interviews: standardized and unstandardized or, often called, structured or unstructured. The structured interview has fixed wording and sequencing of questions. Unstructured interviews are more flexible and are primarily used for exploratory devices. As measurement devices, the unstructured interview is inadequate (1).

Babbie (2) and Wakefield (3) identified other sources of bias and are summarized below:

From the interviewer

1) Inappropriate appearance or behavior. (Untidy appearance and over dressing will interfere in establishing a good rapport between interviewer and respondent. Generally the interviewer should dress in fashion similar to that of the people being interviewed.)

2) Taking liberties with questions. (This may elicit different types of responses and affect the data.)

3) Variation in the interviewers' probing technique. (Impromptu explanation of questions should be avoided, however, open-ended

probing questions may need to be used when the respondents misinterpret questions, contradict themselves or simply when more information is needed on an item. Avoid the "Do you really mean that?" tone of voice and be careful not to use suggestive probes.)

4) Attitudes of the interviewer may affect the respondent. (Facial expressions or mannerisms may convey the interviewer's dislike of the situation or the individual.)

5) Record responses exactly. (Interviewer expectations may cause a response to be interpreted and recorded improperly.)

From the respondent

1) Bias in memory of the respondent. (Food models and standard measuring devises can assist the respondent in recalling foods eaten and portion sizes.)

2) Intentional concealment of information. (Particularly a problem when very personal information is sought but also may be a problem when the respondent suspects the information may be used against him.)

3) Respondent who perceives the interview as unimportant and participates half-heartedly.

GUIDELINES FOR DIETARY RECALL INTERVIEWS

General Instructions for Interviews (4)

1) Record the foods and drinks on the 24-Hour Dietary Recall Form II as the child mentions them. Obtain specific descriptions concerning the food or drink. Do not worry about amounts until all foods are recorded. Record where meal was eaten, using appropriate code.

2) Use the Probing Questions to get complete and specific information about types of foods eaten; e.g., if the student says he/she had a sandwich find out what kind of sandwich, if it had butter or mayonnaise or salad spread in addition to the filling, or what kind of bread, and approximately how many slices of tomatoes.

3) Call attention to the posters with food models to assist students in identifying types of foods eaten.

4) Then proceed to get information on quantities consumed. Use measuring cups, spoons, and graded sizes of glasses from interview equipment kit to assist students in identifying quantities. Enter in the amount column on form.

5) Also, use posters with food models to assist in determining portions; e.g., if child has eaten the same size serving as the model then record as 1 × mdl; if child says he has eaten less or more than the model, record as a fraction or multiple of the model (½ × mdl).

Some Do's and Don'ts for Interviewers (4)

1) Do be friendly, but gently firm, when you ask your questions.

2) Do try to obtain the desired information as quickly as possible, but do not hurry the child at any time.

3) Do express confidence at all times in the information being supplied by the child. Do not show surprise verbally or by facial expressions concerning anything said or done by the child.

4) Do avoid expressing approval or disapproval of any food/beverage reported by the child.

5) Do ask general questions to help the child remember what he/she has eaten but do not ask questions that suggest specific foods eaten.

Establishing Rapport with Respondents

Since the respondents are asked to volunteer a portion of their time and to divulge personal information about themselves, they deserve the most enjoyable experience that the researcher and the interviewer can provide (2). Establishing good rapport in an interview situation puts the respondent at ease, yet maintains the authority of the interviewer. This can often be accomplished by initially talking about non-food items until the child becomes comfortable with the interviewer. A few minutes is usually long enough to establish this relationship.

Sequence of Interview

1) Follow narrative and instructions on form called Introductory Narrative for 24-Hour Dietary Recall.

2) If the interview takes place in the morning, first ask the child about foods eaten that morning, then the foods eaten on the previous day. Progress backward timewise to approximately the same time of day the interview is being conducted. This should usually include a morning, noon and evening meal plus snacks. Enter meal code in appropriate column if student identifies meal (4).

3) If the interview takes place in the afternoon, ask first about foods eaten within the past few hours, then during the morning and at home before coming to school. Proceed to the previous

day, progressing backward. Include those foods and drinks consumed within the last 24 hours (4).

Completion of Recall Data (4)

As soon as possible after the on-site visit, review forms and complete or clarify as needed. If "model," or a portion thereof, were entered as quantity, refer to List of Food Models and enter exact quantity. Using code sheet, enter Meal Code and Where Code for each food in appropriate columns on recall form. Also, determine food code and quantity code from listing of foods in data base and enter appropriate codes.

REFERENCES

1. Kidder, L. H.: Selltiz, Wrightsman, and Cook's Research Methods in Social Relations. 4th ed. Chicago: Holt, Rinehart and Winston, 1981

2. Babbie, E. R.: Survey Research Methods. Blemont, CA: Wadsworth Publishing Co., Inc., 1973

3. Wakefield, L. M.: The interview technique in research--source of bias. J. of Home Economics. 58(8):640, 1966

4. Gilbert, L.: Anthropometric measurements and nutrient intake of Kansas fifth grade students. Unpublished M.S. thesis, Kansas State University, 1981

PROBING QUESTIONS

1. Was the milk: whole, two percent, skim or chocolate?

2. Did you have sugar on your cereal? Was your cereal cooked, dry or presweetened?

3. Was your toast white, whole wheat, rye, raisin, or other? What did you put on it?

4. Were your mashed potatoes real or instant? Did you put anything on them?

5. Did you have lettuce, tomato, mayonnaise, ketchup, mustard, butter, pickles, cheese, or onions on your sandwich?

6. Did you have two slices of bread for your sandwich?

7. Did you have dressing on your salad?

8. How were the vegetables cooked? Did you have butter or sauce on your vegetables?

9. Did you put sugar or anything else in your tea or coffee?

10. What kind of juice did you have at breakfast? Did it come from a can or bottle, or powder? Was it pure juice, i.e., Minute Maid, Scotch Treat, Dewey Fresh, etc.? Was it artificial, i.e., Awake, Tang, Bright Day, etc.?

11. What kind of cookies did you eat? Were they homemade or store-bought? Do you know the brand name. Did they have chocolate chips, peanut butter, oatmeal, or anything else in them?

12. What kind of pie or cake did you have? Did it have any topping, frosting or fruit on it?

13. Did you have any fruit in your cake or jello? Was it canned, frozen or fresh?

14. Did the pop you drank come in a can or a regular or a giant size bottle? Was it diet?

15. Were your crackers saltines, whole wheat, graham or other?

16. Were your eggs fried, scrambled or poached?

(Attached to sign-up sheet
for school lunch)

We will be conducting 24-hour dietary recalls in your school today as scheduled. The recalls will be conducted from approximately 1:15 to 3:00 p.m. and will involve an estimated 15 to 20 minutes of each participating student's time. Please pass around the enclosed form and ask that only those who are eating hot lunch today sign their names. We will select from this list those students who previously returned signed consent forms. Return the form in the provided envelope and send it to the office with the class lunch count. Thank you for your cooperation.

(On-site cafeteria school)

We will be conducting 24-hour dietary recalls in your school today as scheduled. The recalls will be conducted from approximately 9:15 to 11:45 a.m. and will involve an estimated 15 to 20 minutes of each participating student's time. Please pass around the enclosed form and ask that only those who ate hot lunch yesterday sign their names. We will select from this list those students who previously returned signed consent forms. Return the form in the provided envelope and send it to the office with the class lunch count. Thank you for your cooperation.

SCHOOL:_____ TEACHER:_____

GRADE:_____ ROOM #:_____

PLEASE SIGN YOUR NAME BELOW IF YOU ARE EATING THE HOT LUNCH SERVED AT SCHOOL TODAY--

SCHOOL:_____ TEACHER:_____

GRADE:_____ ROOM #:_____

PLEASE SIGN YOUR NAME BELOW IF YOU ATE THE HOT LUNCH SERVED AT SCHOOL YESTERDAY--

INTROOUCTORY NARRATIVE FOR 24-HOUR OIETARY RECALLS

INTROOUCTION: "I am __(Interviewer's name)__. We are conducting a study of nutrient intakes of fourth, fifth and sixth grade students in two Manhattan schools. The Oepartment of Foods and Nutrition at Kansas State University, in cooperation with the USO 383 Foodservice Oivision is conducting this study."

OETERMINE ELIGIBILITY: Ask, "Are you __(Student's name)__?" If yes, record name in the proper space on the 24-Hour Oietary Recall Form I and continue the interview. If no, inquire where the right person can be located.

TAKE A FEW MINUTES TO ESTABLISH RAPPORT

OPENING STATEMENT: "You are among a group of students who are participating in this study of nutrient intakes. You will be asked a series of questions for which there are no right or wrong answers. The information will be kept confidential. Your name will not be shared with any of the teachers or other students in your school. You will not be identified individually with your answers. The information obtained from you will be a valuable contribution in the study of nutrient intakes of students in two Manhattan schools."

PROCEEO TO COMPLETE FORM I AND THEN FORM II AS OUTLINEO UNOER THE HEAOING "SEQUENCE OF INTERVIEW"

24-Hour Dietary Recall
Form I

I.D. Number:_____ Date of recall:_____

Name of subject:_____ Recall taken by:_____

Grade:_____ Time of interview:_____

Age:_____ a.m.___ p.m.___

Birthday:_____ Day of week of recall:

___T ___W ___Th ___F

Sex: ___male ___female Race: ___white ___black ___other

1. Do you take a vitamin and/or mineral supplement?

_____yes

_____no

(If answer is yes) How many per day?_____

per week?_____

2. What kind? (Insert brand name if known)

multivitamins_____

multivitamins and iron_____

multivitamins and minerals_____

vitamin C_____

vitamins A and D_____

iron_____

other_____

24-Hour Dietary Recall
Form II

I.D. No._____

food code	amt. code	meal code	where code	food item or ingredients	type of prep.	source and where eaten	amount	comments

Form II cont.

I.D. No._____

food code	amt. code	meal code	where code	food item or ingredients	type of prep.	source and where eaten	amount	comments

Is this the way you usually eat? yes_____ no_____ If no, specify_____

Thank the student for their cooperation.

LIST OF FOOD MODELS

Meat and Other Protein-Rich Foods

Bacon, ½ oz
Beans, Baked, Pork and Tomato Sauce, ½ cup
Beans, Refried, ½ cup
Beef, Roast, 3 oz edible portion
Beef Liver, 3 oz
Beef and Vegetable Stew, 1 cup
Bologna, 1 oz
Chicken, Fried, 3 oz edible portion
Chili Con Carne with Beans, 1 cup
Egg, Fried, large
Egg, Hard-Cooked, large
Egg, Scrambled, large
Frankfurter, 2 oz
Ham, Baked, 3 oz edible portion
Lima Beans, ½ cup
Meat Loaf, 3 oz
Meat Patty, 3 oz
Peanut Butter, 2 tbsp
Peanuts, Salted, ½ cup
Perch, Fried, 3 oz
Pizza, Cheese, ¼ of 14" pizza
Pork Chop, 3 oz edible portion
Sausage, 1 oz
Spaghetti, Meat Balls and Tomato Sauce, 1 cup
T-Bone Steak, 3 1/3 oz edible portion
Taco, Beef
Tuna, 3 oz

Fruit

Apple, medium
Applesauce, ½ cup
Apricots, Dried, 4 halves
Banana, medium
Cantaloupe, ¼ medium
Fruit Salad, ½ cup
Grapefruit, ½ medium
Grapes, ½ cup
Orange, medium
Orange Juice, ½ cup
Peaches, ½ cup
Pear, medium
Pineapple, large slice
Prunes, Stewed, 4 medium 2 tbsp juice
Raisins, 4½ tbsp
Strawberries, ½ cup
Watermelon, 1 cup

Breads and Cereals

Bagel
Biscuit, Baking Powder
Bread, White
Bread, Whole Wheat
Cornbread
Corn Flakes, 3/4 cup
Crackers, Graham, 2
Crackers, Saltine, 5
Hominy Grits, ½ cup
Macaroni and Cheese, ½ cup
Noodles, Egg, ½ cup
Oatmeal, ½ cup
Pancake
Rice, ½ cup
Roll, Frankfurter
Roll, Hamburger
Tortilla, Corn
Waffles, 2

Vegetables

Asparagus, 4 Spears, ½ cup
Beans, Green, ½ cup
Beets, ½ cup
Broccoli, Stalk, ½ cup
Cabbage, 1/6 head, ½ cup
Carrot Sticks
Corn, ear
Greens, ½ cup
Lettuce, 1/6 head, ½ cup
Lettuce Leaves, 2 large
Okra, 4 pods, ½ cup
Peas, Green, ½ cup
Potato, Baked, large
Potatoes, Boiled, 2 small
Potatoes, French-Fried, 20 pieces
Potatoes, Mashed, ½ cup
Potato, Sweet, ½ medium
Squash, Winter, ½ medium, ½ cup
Tomato, ½ medium
Tomato Juice, ½ cup
Tomato Soup, Creamed, 1 cup
Tossed Salad, 3/4 cup

Others

Bar, Milk Chocolate, . oz
Beer, 1½ cups
Butter, 1 tsp
Cake, Devil's-Food, 1/16 of 9" cake
Cake, Sponge, 1/12 of 10" cake
Chocolate Syrup, 2 tbsp
Coffee, 3/4 cup
Cookie, Sugar, 3" diameter
Cream, Sour, 1 tbsp
Doughnut, Cake Type
French Dressing, 1 tbsp
Gelatin Dessert, ½ cup
Jelly, 1 tbsp
Mayonnaise, 1 tbsp
Pie, Apple, 1/6 of 9" pie
Popcorn, 1 cup
Potato Chips, 10 chips
Roll, Danish Pastry
Soft Drink, 1 cup
Sugar, 1 tsp

Milk

Cheese, American, 1 oz
Cheese, Cheddar, 1 oz
Cheese, Cottage, ½ cup
Cheese, Swiss, 1 oz
Cocoa, 3/4 cup
Half-and-Half, 1 tbsp
Ice Cream, Vanilla, ½ cup, ¼ pint
Milk, 1 cup
Milk, Chocolate, 1 cup
Pudding, Chocolate, ½ cup
Yogurt, Strawberry, 1 cup

Codes and Abbreviations for 24-Hour Dietary Recalls

Meal Code

B=breakfast
am=am snack
L=lunch
pm=pm snack
D=dinner
eve=evening snack

Type of Preparation

hmd=homemade
com=commercial
cnd=canned
fr=fried
tst=toast
br=broiled
fzn=frozen
rst=roast

Amounts Abbreviations

t=teaspoon
T=tablespoon
c=cup
oz=ounce
lb=pound
mdl=model
g=gram
in=inch
l=liter

Source and Where Eaten

SL=school lunch
Cl=carried lunch from home
H=home
O=other home (friend or relative)
V=vending machine
G=grocery
FF=fast food (state name)
R=restaurant (not fast food)
Other (specify)

Abbreviations

jc=juice
ff=french fries
pot=potato
wh brd=white bread
ww brd=whole wheat bread
crm=cream
sug=sugar
frt=fruit
c̄=with
c̄o=without
veg=vegetable
crax=crackers
marg=margarine
bu=butter
chix=chicken
cof=coffee
oj=orange juice

APPENDIX E

NUTRIENT ANALYSIS OF DIETARY INTAKES AND PERCENTAGES OF THE ROAS OF STUDENTS FROM THE ON-SITE CAFETERIA STYLE SCHOOL

Table 25. Characteristics of Students at School with On-Site Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews

Characteristics	Menu 3[1] (N = 26)
	%
Sex	
Girl	46.2
Boy	53.8
Ethnic group	
Caucasian	80.8
Black	3.8
Other	15.4
Take supplement	
Yes	50.0
No	50.0
Number of supplements taken	
1 daily	26.9
2 daily	11.5
3 or more daily	3.8
Days per week supplement taken	
6-7 days/week	42.3
4-5 days/week	3.8
$\leq$ 3 days/week	3.8

[1]Menu 3 = sausage patty, spaghetti/sauce, tossed salad, peach slices, dinner roll, milk.

Table 26. Percentage of Students at School with On-Site Cafeteria Style Food Service Consuming Breakfast, Lunch, Dinner, Snacks, and Supplements on Day of 24-Hour Dietary Recall Interviews

	Those Consuming	Those Not Consuming
	%	
Menu 3[1] (N=26)		
Breakfast	96	4
Morning snack	15	85
Lunch	100	0
Afternoon snack	73	27
Dinner	100	0
Evening snack	31	69
Supplement	46	54

[1]Menu 3 = sausage patty, spaghetti/sauce, tossed salad, peach slices, dinner roll, milk.

Table 27. Sources of Meals of Students at School with On-Site Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews

Meal	Source of Meals					
	School	Home	Other Home	Fast Food	Restaurant	Other
	%					
Menu 3[1] (N=26)						
Breakfast	-	96	-	-	-	-
Morning snack	-	-	-	-	-	15
Lunch	100	-	-	-	-	-
Afternoon snack	-	65	-	-	-	8
Dinner	-	96	-	-	4	-
Evening snack	-	31	-	-	-	-

[1]Menu 3 = sausage patty, spaghetti/sauce, tossed salad, peach slices, dinner roll, milk.

Table 28. Means, Standard Errors and Coefficients of Variation of Energy and Nutrient Intake for Total Day (Including and Excluding Supplements), Breakfast, Lunch, Dinner, and Snacks of Students at School with On-Site Cafeteria Style Food Preparation Who Participated in the 24-Hour Dietary Recall Interviews Including Menu 3[1]

	N	Energy kcal.	Protein gm.	Fat gm.	Carbohydrate gm.	Vitamin A I.U.	Ascorbic Acid mg.	Thiamin mg.	Riboflavin mg.	Niacin N.E.	Vitamin B_6 mg.	Calcium mg.	Phosphorous mg.	Magnesium mg.	Iron mg.
Total day (excluding supplement)	26														
Mean		2411	92.2	90.5	313.9	6406	122.4	2.46	2.53	21.6	0.8	1273	1605	113.0	16.09
S.E.[2]		130	5.5	6.2	20.7	870	21.3	0.20	0.24	2.4	0.2	107	108	14.8	1.98
C.V.[3] (%)		28	31	36	34	66	82	44	44	52	94	44	34	67	55
Total day (including supplement)	26														
Mean		2411	92.2	90.5	313.9	8727	180.0	3.16	3.32	30.9	1.7	1282	1612	121.2	18.12
S.E.		130	5.5	6.2	20.7	1005	29.4	0.30	0.32	3.4	0.2	108	109	15.8	2.36
C.V. (%)		28	31	36	34	56	78	48	44	50	69	44	34	67	56
Breakfast	25														
Mean		565	17.3	18.8	83.8	1295	58.4	0.87	0.74	5.3	0.4	310	355	42.7	4.66
S.E.		59	2.1	2.5	11.2	350	13.9	0.15	0.15	1.5	0.1	51	58	10.3	1.45
C.V. (%)		54	59	72	67	104	121	93	82	112	117	71	68	105	115
Lunch	26														
Mean		570	21.6	20.6	76.8	2180	27.4	0.67	0.65	5.2	0.3	302	382	39.4	3.50
S.E.		42	1.8	1.7	6.0	264	6.6	0.07	0.06	0.8	0.0	21	24	22	0.48
C.V. (%)		36	36	41	38	59	90	50	36	59	46	33	30	36	52
Dinner	26														
Mean		938	45.2	37.6	105.2	2074	29.1	0.73	0.86	9.8	0.1	477	690	14.7	6.68
S.E.		76	3.4	4.1	11.7	569	7.7	0.09	0.08	1.0	0.0	54	51	6.8	0.66
C.V. (%)		44	44	57	61	132	146	72	51	60	149	67	43	169	56
Snacks	12														
Mean		410	9.6	15.8	59.9	973	11.6	0.26	0.35	1.8	0.1	210	209	19.9	1.69
S.E.		87	2.8	4.2	12.5	311	7.2	0.08	0.12	1.2	0.1	60	64	6.1	1.03
C.V. (%)		90	129	116	86	188	181	132	152	205	297	145	127	157	207

[1]Menu 3 = sausage patty, spaghetti/sauce, tossed salad, peach slices, dinner roll, milk.

[2]S.E. = standard error.

[3]C.V. = coefficient of variation.

Table 29. Least Square Means and Standard Errors for Energy and Nutrient Intake for Total Day (Including and Excluding Supplement), Breakfast, Lunch, Dinner, and Snacks by Sex of Students at School with On-Site Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews Including Menu 3[1]

	N	Energy kcal.	Protein gm.	Fat gm.	Carbohydrate gm.	Vitamin A I.U.	Ascorbic Acid mg.	Thiamin mg.	Riboflavin mg.	Niacin N.E.	Vitamin B_6 mg.	Calcium mg.	Phosphorous mg.	Magnesium mg.	Iron mg.
Total day (excluding supplement)															
Girls-Mean[2]	12	2402	85.5	86.9	327.5	7180	119.9	2.33	2.47	21.5	0.8	1189	1484	122.2	14.47
S.E.		191	8.1	9.1	30.4	1276	31.2	0.30	0.35	3.6	0.2	158	159	21.7	2.91
Boys -Mean	14	2420	99.0	94.1	300.2	5631	124.9	2.60	2.60	21.8	0.8	1357	1725	103.8	17.71
S.E.		177	7.5	8.4	28.1	1181	29.0	0.28	0.32	3.3	0.2	146	148	20.1	2.69
Total day (Including supplement)															
Girls-Mean	12	2402	85.5	86.9	327.5	9680	191.6	3.08	3.32	31.5	1.8	1189	1484	124.3	15.97
S.E.		191	8.1	9.1	30.4	1474	43.1	0.44	0.47	4.9	0.4	159	160	23.2	3.47
Boys -Mean	14	2420	99.0	94.1	300.2	7774	168.5	3.24	3.32	30.4	1.6	1376	1740	118.1	20.28
S.E.		177	7.5	8.4	28.1	1365	40.0	0.40	0.43	4.6	0.3	147	148	21.5	3.21
Breakfast															
Girls-Mean	11	534	15.7	15.0	86.9	1379	60.5	0.77	0.73	6.6	0.5	282	338	52.3	4.12
S.E.		89	3.2	3.7	16.8	524	20.8	0.23	0.23	2.3	0.2	77	87	15.5	2.17
Boys -Mean	14	595	18.9	22.6	80.8	1210	56.4	0.97	0.75	4.0	0.3	337	371	33.1	5.19
S.E.		79	2.8	3.3	14.9	464	18.5	0.20	0.20	2.0	0.2	68	77	13.7	1.92
Lunch															
Girls-Mean	12	578	20.5	21.1	79.3	2177	23.4	0.64	0.62	5.0	0.2	283	359	38.8	3.25
S.E.		61	2.6	2.4	8.8	387	9.6	0.11	0.08	1.1	0.0	31	36	3.2	0.70
Boys -Mean	14	561	22.8	20.0	74.3	2183	31.5	0.70	0.67	5.4	0.2	320	406	40.0	3.74
S.E.		57	2.4	2.3	8.1	358	8.9	0.10	0.07	1.0	0.0	29	33	3.0	0.64
Dinner															
Girls-Mean	12	860	36.7	32.3	106.5	2209	29.6	0.66	0.68	8.4	0.1	319	520	6.8	5.88
S.E.		111	5.1	6.0	17.2	835	11.3	0.13	0.12	1.5	0.0	79	74	9.9	0.96
Boys -Mean	14	1015	53.6	43.0	103.9	1940	28.6	0.80	1.03	11.2	0.1	634	861	22.7	7.47
S.E.		103	4.7	5.6	15.9	773	10.5	0.12	0.11	1.4	0.0	73	69	9.2	0.89
Snacks															
Girls-Mean	12	473	13.9	19.8	62.0	1530	11.4	0.33	0.50	1.9	0.1	328	296	28.6	1.55
S.E.		118	3.8	5.7	16.9	420	9.8	0.10	0.16	1.7	0.1	81	87	8.2	1.39
Boys -Mean	10	347	5.2	11.9	57.7	416	11.8	0.18	0.19	1.7	0.1	92	122	11.2	1.83
S.E.		129	4.2	6.3	18.5	460	10.7	0.12	0.18	1.8	0.1	89	95	9.0	1.52

[1]Menu 3 = sausage patty, spaghetti/sauce, tossed salad, peach slices, dinner roll, milk.

[2]S.E. = standard error.

Table 30. Means, Standard Errors and Coefficients of Variation for Percentage of the Recommended Dietary Allowance for Total Day (Including and Excluding Supplement) and by Meal for Students at School with Cafeteria Style, On-Site Food Preparation Who Participated in the 24-Hour Dietary Recall Interviews Including Menu 3[1]

	N	Energy kcal.	Protein gm.	Vitamin A I.U.	Ascorbic Acid mg.	Thiamin mg.	Riboflavin mg.	Niacin N.E.	Vitamin B_6 mg.	Calcium mg.	Phosphorous mg.	Magnesium mg.	Iron mg.
Total day (excluding supplement)	26												
Mean		99	231.6	160	256.8	200.87	177.73	132.5	46.9	127	160	39.1	122.02
S.E.[2]		6	15.4	21	44.0	17.59	17.50	15.4	9.2	12	12	5.1	17.56
C.V.[3] (%)		29	34	65	81	46	46	53	96	49	40	67	67
Total day (including supplement)	26												
Mean		99	231.6	221	379.9	259.05	234.19	190.6	102.2	128	161	41.9	136.18
S.E.		6	15.5	25	62.0	24.20	22.40	20.7	14.7	12	13	5.4	21.09
C.V. (%)		29	34	56	79	47	44	50	70	48	40	68	68
Breakfast	25												
Mean		23	44.8	33	122.8	71.22	52.07	33.0	24.0	32	36	15.2	36.30
S.E.		2	5.5	9	29.0	12.95	11.24	9.8	7.3	5	6	3.5	8.81
C.V. (%)		52	60	105	121	95	85	115	116	71	66	105	101
Lunch	26												
Mean		23	53.8	55	57.4	53.99	45.24	31.8	13.4	30	38	13.5	25.68
S.E.		2	4.9	7	13.8	6.02	3.89	4.6	0.6	2	3	0.8	4.12
C.V. (%)		36	39	60	90	50	36	58	46	39	36	38	60
Dinner	26												
Mean		38	112.7	51	60.9	58.98	59.42	59.5	4.8	46	68	4.4	50.67
S.E.		3	8.8	13	15.7	7.41	5.57	6.2	1.6	6	6	2.2	5.87
C.V. (%)		44	45	128	143	72	51	59	148	72	47	168	60
Snacks	12												
Mean		17	23.9	25	24.4	21.51	25.10	11.5	7.0	22	21	7.4	12.84
S.E.		4	7.0	8	15.0	6.52	8.80	7.7	5.4	6	7	2.2	9.85
C.V. (%)		92	126	185	181	133	153	204	308	154	133	162	253

[1]Menu 3 = sausage patty, spaghetti/sauce, tossed salad, peach slices, dinner roll, milk.

[2]S.E. = standard error.

[3]C.V. = coefficient of variation.

Table 31. Least Square Means and Standard Errors for Percentages of the Recommended Dietary Allowances for Total Day (Including and Excluding Supplement) and by Meal and for Girls and Boys at School with On-Site Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews Including Menu 3[1]

	N	Energy kcal.	Protein gm.	Vitamin A I.U.	Ascorbic Acid mg.	Thiamin mg.	Riboflavin mg.	Niacin N.E.	Vitamin B_6 mg.	Calcium mg.	Phosphorous mg.	Magnesium mg.	Iron mg.
Total day (excluding supplement)													
Girls-Mean[2]	12	104	217.7	189	251.6	202.15	184.13	138.3	49.5	120	152	44.6	115.58
S.E.		8	22.6	31	64.5	25.82	25.68	22.6	13.5	17	18	7.4	25.78
Boys -Mean	14	94	245.5	132	261.9	199.59	171.34	126.7	44.3	134	169	33.6	128.45
S.E.		8	21.0	28	59.7	23.90	23.77	20.9	12.5	16	17	6.9	23.86
Total day (including supplement)													
Girls-Mean	12	104	217.7	256	402.9	267.49	247.18	202.9	108.5	120	152	45.3	123.92
S.E.		8	22.7	37	90.9	35.52	32.87	30.4	21.6	17	18	8.0	30.94
Boys -Mean	14	94	245.5	187	356.9	250.61	221.21	178.3	95.9	136	171	38.5	148.45
S.E.		8	21.0	34	84.2	32.88	30.43	28.1	20.0	16	17	7.4	28.65
Breakfast													
Girls-Mean	11	23	40.8	37	126.8	66.43	53.89	42.5	28.6	29	36	19.4	32.31
S.E.		4	8.3	13	43.4	19.38	16.90	14.6	10.9	8	8	5.3	13.18
Boys -Mean	14	23	48.8	30	118.9	76.00	50.24	23.5	19.3	34	38	11.0	40.30
S.E.		3	7.3	12	38.5	17.18	14.98	13.0	9.6	7	7	4.7	11.68
Lunch													
Girls-Mean	12	25	51.6	59	49.4	55.63	46.24	32.7	13.2	28	36	13.9	25.24
S.E.		2	7.2	10	20.2	8.84	5.71	6.8	0.9	4	4	1.2	6.05
Boys -Mean	14	22	55.9	51	65.3	52.36	44.24	30.9	13.5	31	40	13.0	26.13
S.E.		2	6.6	9	18.7	8.18	5.29	6.3	0.9	3	4	1.1	5.60
Dinner													
Girls-Mean	12	37	94.3	57	61.3	57.00	51.21	54.1	3.3	31	53	2.4	50.04
S.E.		5	13.0	20	23.0	10.87	8.18	9.1	2.3	8	8	3.2	8.61
Boys -Mean	14	39	131.1	44	60.4	60.96	67.63	64.8	6.3	62	83	6.5	51.30
S.E.		4	12.0	18	21.3	10.06	7.57	8.4	2.2	8	7	3.0	7.97
Snacks													
Girls-Mean	12	21	34.3	39	24.6	28.63	37.27	12.5	6.8	34	30	10.6	10.68
S.E.		5	9.4	10	20.2	8.79	11.87	10.4	7.4	9	9	3.0	13.28
Boys -Mean	10	13	13.5	10	24.2	14.39	12.92	10.4	7.3	10	13	4.2	15.00
S.E.		6	10.3	12	22.2	9.63	13.00	11.3	8.0	10	10	3.3	14.55

[1]Menu 3 = sausage patty, spaghetti/sauce, tossed salad, peach slices, dinner roll, milk.

[2]S.E. = standard error.

Table 32. Least Square Means, Standard Errors and Coefficients of Variation for Percent Fat in Total Day's and Lunch Energy Intake by Sex of Students, Individual and Combined, at On-Site Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews

	Mean	S.E.[1]	C.V.[2]
			%
Menu 3[3]			
Total day's meals (excluding supplements)			
Girls	31.8	2.0	21
Boys	35.7	1.8	21
Combined	33.7	1.4	21
Lunch			
Girls	31.0	1.5	17
Boys	31.6	1.4	17
Combined	31.3	1.0	17

[1]S.E. = standard error.

[2]C.V. = coefficient of variation.

[3]Menu 3 = sausage patty, spaghetti/sauce, tossed salad, peach slices, dinner roll, milk.

Table 33. Means, Standard Errors, and Coefficients of Variation of Mean Adequacy Ratios (MARs) and Percentages of Students in Selected MAR Ranges of Students at the On-Site Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews

	Excluding Supplement		Including Supplement	
	Girls (N = 12)	Boys (N = 14)	Girls (N = 12)	Boys (N = 14)
Menu 3[1]				
Mean	84	84	88	88
S.E.[2]	3	3	3	2
C.V.[3]	11	11	11	11
MAR ranges:				
<66	8.3	-	8.3	-
66 to <75	16.7	7.2	16.7	7.1
75 to <90	41.7	71.4	33.3	50.0
90 to 100	33.3	21.4	41.7	42.9

[1]Menu 3 = sausage patty, spaghetti/sauce, tossed salad, peach slices, dinner roll, milk.

[2]S.E. = standard error.

[3]C.V. = coefficient of variation.

APPENDIX F

NUTRIENT ANALYSIS OF DIETARY INTAKES OF STUDENTS FROM THE SATELLITE FAMILY AND CAFETERIA STYLE SCHOOLS

Table 34. Means, Standard Errors and Coefficients of Variation of Total Day's Energy and Nutrient Intake, Excluding Supplements, of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews

	Total Day's Meals Excluding Supplements							
	Family Style				Cafeteria Style			
	N	Mean	S.E.[1]	C.V.[2]	N	Mean	S.E.	C.V.
				%				%
Menu 1[3]	19				21			
Energy, kcal.		2337	154	28		2400	146	28
Protein, gm.		95.3	6.5	31		88.7	6.2	31
Fat, gm.		88.9	7.3	36		98.4	6.9	36
Carbohydrate, gm.		296.1	24.5	34		299.0	23.2	34
Vitamin A, I.U.		6403	1027	66		5541	975	66
Ascorbic acid, mg.		126.9	25.2	82		149.1	23.9	82
Thiamin, mg.		2.61	0.24	44		2.33	0.23	44
Riboflavin, mg.		2.88	0.28	44		2.77	0.27	44
Niacin, N.E.		28.3	2.9	52		23.0	2.8	52
Vitamin B_6, mg.		0.8	0.2	94		0.7	0.2	94
Calcium, mg.		1076	127	44		1304	120	44
Phosphorous, mg.		1479	128	34		1653	122	34
Magnesium, mg.		111.6	17.5	67		120.7	16.6	67
Iron, mg.		20.64	2.34	55		19.02	2.22	55
Menu 2[4]	25				28			
Energy, kcal.		2430	133	28		2161	126	28
Protein, gm.		91.0	5.6	31		87.2	5.3	31
Fat, gm.		87.3	6.3	36		73.5	6.0	36
Carbohydrate, gm.		324.2	21.2	34		295.1	20.1	34
Vitamin A, I.U.		7901	890	66		6636	844	66
Ascorbic acid, mg.		140.4	21.8	82		129.0	20.7	82
Thiamin, mg.		2.17	0.21	44		2.30	0.20	44
Riboflavin, mg.		2.68	0.24	44		2.80	0.23	44
Niacin, N.E.		22.1	2.5	52		24.7	2.4	52
Vitamin B_6, mg.		0.8	0.2	94		0.9	0.2	94
Calcium, mg.		1204	110	44		1192	104	44
Phosphorous, mg.		1569	111	34		1634	105	34
Magnesium, mg.		92.2	15.2	67		115.0	14.4	67
Iron, mg.		17.62	2.03	55		18.73	1.92	55

[1]S.E. = standard error.

[2]C.V. = coefficient of variation.

[3]Menu 1 = macaroni/ground beef and tomato, green beans, coleslaw, cinnamon roll, mixed fruit cup, milk.

[4]Menu 2 = glazed ham, broccoli, carrot sticks, dinner roll, cherry crisp, milk.

Table 35. Means, Standard Errors and Coefficients of Variation of Total Day's Energy and Nutrient Intake, Including Supplements, of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews

	Total Day's Meals Including Supplements							
	Family Style				Cafeteria Style			
	N	Mean	S.E.[1]	C.V.[2]	N	Mean	S.E.	C.V.
				%				%
Menu 1[3]	19				21			
Energy, kcal.		2337	154	28		2400	146	28
Protein, gm.		95.3	6.5	31		88.9	6.2	31
Fat, gm.		88.9	7.3	36		98.4	7.0	36
Carbohydrate, gm.		296.1	24.5	34		299.0	23.2	34
Vitamin A, I.U.		7937	1187	56		8250	1126	56
Ascorbic acid, mg.		145.3	34.7	78		214.5	32.9	78
Thiamin, mg.		3.07	0.35	48		3.18	0.33	48
Riboflavin, mg.		3.40	0.38	44		3.74	0.36	44
Niacin, N.E.		34.5	4.0	50		33.9	3.8	50
Vitamin B_6, mg.		1.4	0.3	69		1.8	0.3	69
Calcium, mg.		1081	128	44		1327	122	44
Phosphorous, mg.		1483	128	34		1671	122	34
Magnesium, mg.		112.5	18.7	67		137.4	17.7	67
Iron, mg.		21.46	2.79	56		24.76	2.65	56
Menu 2[4]	25				28			
Energy, kcal.		2432	134	28		2161	127	28
Protein, gm.		91.1	5.6	31		87.2	5.3	31
Fat, gm.		87.7	6.4	36		73.5	6.0	36
Carbohydrate, gm.		324.4	21.2	34		295.1	20.1	34
Vitamin A, I.U.		11,433	1029	56		8875	975	56
Ascorbic acid, mg.		212.2	30.1	78		193.6	28.5	78
Thiamin, mg.		3.52	0.30	48		2.98	0.29	48
Riboflavin, mg.		4.10	0.32	44		3.58	0.31	44
Niacin, N.E.		37.9	3.4	50		33.8	3.3	50
Vitamin B_6, mg.		2.1	0.2	69		1.8	0.2	69
Calcium, mg.		1216	111	44		1247	105	44
Phosphorous, mg.		1586	111	34		1642	106	34
Magnesium, mg.		102.2	16.2	67		120.0	15.4	67
Iron, mg.		22.90	2.42	56		21.42	2.29	56

[1]S.E. = standard error.

[2]C.V. = coefficient of variation.

[3]Menu 1 = macaroni/ground beef and tomato, green beans, coleslaw, cinnamon roll, mixed fruit cup, milk.

[4]Menu 2 = glazed ham, broccoli, carrot sticks, dinner roll, cherry crisp, milk.

Table 36. Means, Standard Errors and Coefficients of Variation of Energy and Nutrient Intake from Breakfast of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews

	Breakfast Meal							
	Family Style				Cafeteria Style			
	N	Mean[1]	S.E.[2]	C.V.[3]	N	Mean	S.E.	C.V.
				%				%
Menu 1[4]	16				19			
Energy, kcal.		456	74	54		624	68	54
Protein, gm.		14.6	2.7	59		21.6	2.4	59
Fat, gm.		14.4	3.1	72		21.7	2.8	72
Carbohydrate, gm.		68.9	14.0	67		88.7	12.8	67
Vitamin A, I.U.		1294	438	104		1606	399	104
Ascorbic acid, mg.		53.3	17.4	121		64.5	15.9	121
Thiamin, mg.		0.69	0.19	93		0.72	0.18	93
Riboflavin, mg.		0.79	0.19	82		0.98	0.18	82
Niacin, N.E.		5.6	1.9	112		5.8	1.7	112
Vitamin B_6, mg.		0.5	0.2	117		0.4	0.1	117
Calcium, mg.		275	64	71		471	58	71
Phosphorous, mg.		337[1]	73	68		550[2]	66	68
Magnesium, mg.		50.1	12.9	105		55.6	0.1	105
Iron, mg.		4.35	1.81	115		7.10	1.65	115
Menu 2[5]	24				27			
Energy, kcal.		472	60	54		590	58	54
Protein, gm.		14.9	2.2	59		20.8	2.1	59
Fat, gm.		14.3	2.5	72		15.5	2.4	72
Carbohydrate, gm.		72.8	11.4	67		95.1	10.9	67
Vitamin A, I.U.		1685	356	104		2067	340	104
Ascorbic acid, mg.		50.1	14.2	121		58.4	13.5	121
Thiamin, mg.		0.66	0.16	93		1.02	0.15	93
Riboflavin, mg.		0.78	0.16	82		1.23	0.15	82
Niacin, N.E.		5.8	1.6	112		10.1	1.5	112
Vitamin B_6, mg.		0.5	0.1	117		0.7	0.1	117
Calcium, mg.		298	52	71		401	50	71
Phosphorous		331	59	68		519	56	68
Magnesium, mg.		32.9	10.5	105		58.6	10.0	105
Iron, mg.		6.06	1.47	115		8.49	1.41	115

[1]Where superscripts (1, 2) on means differ horizontally, means differ significantly ($p < 0.05$) from each other. Means in a row without superscripts do not differ significantly.

[2]S.E. = standard error.

[3]C.V. = coefficient of variation.

[4]Menu 1 = macaroni/ground beef and tomato, green beans, coleslaw, cinnamon roll, mixed fruit cup, milk.

[5]Menu 2 = glazed ham, broccoli, carrot sticks, dinner roll, cherry crisp, milk.

Table 37. Means, Standard Errors, and Coefficients of Variation of Energy and Nutrient Intake from Lunch of Students at Schools with Satellite Family and Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews

	Lunch Meal							
	Family Style				Cafeteria Style			
	N	Mean[1]	S.E.[2]	C.V.[3]	N	Mean	S.E.	C.V.
				%				%
Menu 1[4]	19				21			
Energy, kcal.		608	49	36		528	47	36
Protein, gm.		28.9[1]	2.1	36		22.0[2]	2.0	36
Fat, gm.		24.4	2.0	41		21.2	1.9	41
Carbohydrate, gm.		69.3	7.1	38		63.6	6.7	38
Vitamin A, I.U.		2176	311	59		1673	296	59
Ascorbic acid, mg.		56.4	7.7	90		56.6	7.3	90
Thiamin, mg.		1.13[1]	0.09	50		0.81[2]	0.08	50
Riboflavin, mg.		0.97[1]	0.06	36		0.76[2]	0.06	36
Niacin, N.E.		11.1[1]	0.9	59		7.7[2]	0.8	59
Vitamin B_6, mg.		0.0	0.0	46		0.1	0.0	46
Calcium, m.g.		322	25	33		304	24	33
Phosphorous, mg.		397	29	30		333	27	30
Magnesium, mg.		28.4	2.6	36		27.5	2.5	36
Iron, mg.		7.25[1]	0.56	52		5.21[2]	0.53	52
Menu 2[5]	25				28			
Energy, kcal.		722[1]	43	36		543[2]	40	36
Protein, gm.		28.8	1.8	36		27.2	1.8	36
Fat, gm.		22.2	1.7	41		17.1	1.6	41
Carbohydrate, gm.		101.4[1]	6.1	38		69.2[2]	5.8	38
Vitamin A, I.U.		2913	270	59		2297	256	59
Ascorbic acid, mg.		32.4	6.7	90		23.8	6.4	90
Thiamin, mg.		0.64	0.08	50		0.61	0.07	50
Riboflavin, mg.		0.85	0.06	36		0.71	0.05	36
Niacin, N.E.		5.6	0.8	59		5.1	0.7	59
Vitamin B_6, mg.		0.1	0.0	46		0.1	0.0	46
Calcium, mg.		372	22	33		309	20	33
Phosphorous, mg.		500	25	30		442	24	30
Magnesium, mg.		30.4	2.2	36		26.4	2.1	36
Iron, mg.		4.46	0.49	52		3.82	0.46	52

[1]Where superscripts (1, 2) on means differ horizontally, means differ significantly ($p < 0.05$) from each other. Means in a row without superscripts do not differ significantly.

[2]S.E. = standard error.

[3]C.V. = coefficient of variation.

[4]Menu 1 = macaroni/ground beef and tomato, green beans, coleslaw, cinnamon roll, mixed fruit cup, milk.

[5]Menu 2 = glazed ham, broccoli, carrot sticks, dinner roll, cherry crisp, milk.

Table 38. Means, Standard Errors, and Coefficients of Variation of Energy and Nutrient Intake from Dinner of Students at Schools with Satellite Family and Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews

	Dinner Meal							
	Family Style				Cafeteria Style			
	N	Mean[1]	S.E.[2]	C.V.[3]	N	Mean	S.E.	C.V.
				%				%
Menu 1[4]	19				21			
Energy, kcal.		1095[1]	90	44		835[2]	85	44
Protein, gm.		47.7[1]	4.1	44		36.5[2]	3.9	44
Fat, gm.		44.4	4.8	57		39.7	4.6	57
Carbohydrate, gm.		128.2	13.8	61		84.9	13.1	61
Vitamin A, I.U.		2344	672	132		1842	638	132
Ascorbic acid, mg.		14.0	9.1	146		22.2	8.6	146
Thiamin, mg.		0.70	0.11	72		0.66	0.10	72
Riboflavin, mg.		0.92	0.09	51		0.75	0.09	51
Niacin, N.E.		9.7	1.2	60		8.2	1.1	60
Vitamin 8_6, mg.		0.1	0.0	149		0.1	0.0	149
Calcium, mg.		416	64	67		353	60	67
Phosphorous, mg.		655	60	43		541	57	43
Magnesium, mg.		29.1	8.0	169		17.4	7.6	169
Iron, mg.		6.80	0.78	56		5.37	0.74	56
Menu 2[5]	25				28			
Energy, kcal.		858	78	44		689	74	44
Protein, gm.		40.0	3.5	44		31.4	3.4	44
Fat, gm.		36.5	4.2	57		27.4	4.0	57
Carbohydrate, gm.		93.5	12.0	61		80.8	11.4	61
Vitamin A, I.U.		2681	583	132		1937	552	132
Ascorbic acid, mg.		38.6	7.9	146		26.7	7.5	146
Thiamin, mg.		0.61	0.09	72		0.50	0.08	72
Riboflavin, mg.		0.79	0.08	51		0.64	0.08	51
Niacin, N.E.		8.7	1.0	60		6.8	1.0	60
Vitamin 8_6, mg.		0.1	0.0	149		0.1	0.0	149
Calcium, mg.		408	55	67		349	52	67
Phosphorous, mg.		595	52	43		489	49	43
Magnesium, mg.		23.6	6.9	169		18.2	6.6	169
Iron, mg.		5.72	0.67	56		5.10	0.64	56

[1]Where superscripts (1, 2) on means differ horizontally, means differ significantly ($p \leq 0.05$) from each other. Means in a row without superscripts do not differ significantly.

[2]S.E. = standard error.

[3]C.V. = coefficient of variation.

[4]Menu 1 = macaroni/ground beef and tomato, green beans, coleslaw, cinnamon roll, mixed fruit cup, milk.

[5]Menu 2 = glazed ham, broccoli, carrot sticks, dinner roll, cherry crisp, milk.

Table 39. Means, Standard Errors, and Coefficients of Variation of Energy and Nutrient Intake from Snacks of Students at Schools with Satellite Family and Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews

	Snacks							
	Family Style				Cafeteria Style			
	N	Mean	S.E.[1]	C.V.[2]	N	Mean	S.E.	C.V.
				%				%
Menu 1[3]	6				11			
Energy, kcal.		362	116	90		541	97	90
Protein, gm.		9.3	3.8	129		12.0	3.2	129
Fat, gm.		11.5	5.6	116		20.8	4.7	116
Carbohydrate, gm.		58.6	16.7	86		79.9	13.9	86
Vitamin A, I.U.		1194	414	188		672	345	188
Ascorbic acid, mg.		16.2	9.6	181		13.7	8.0	181
Thiamin, mg.		0.28	0.10	132		0.23	0.09	132
Riboflavin, mg.		0.45	0.16	152		0.43	0.14	152
Niacin, N.E.		4.1	1.7	205		2.2	1.4	205
Vitamin B_6, mg.		0.3	0.1	297		0.1	0.1	297
Calcium, mg.		148	80	145		257	67	145
Phosphorous, mg.		201	86	127		320	71	127
Magnesium, mg.		16.8	8.2	157		28.3	6.8	157
Iron, mg.		4.17	1.37	207		2.15	1.14	207
Menu 2[4]	18				14			
Energy, kcal.		496	96	90		402	82	90
Protein, gm.		10.5	3.1	129		9.4	2.7	129
Fat, gm.		18.7	4.6	116		15.6	4.0	116
Carbohydrate, gm.		74.4	13.7	86		59.8	11.8	86
Vitamin A, I.U.		1003	341	188		418	293	188
Ascorbic acid, mg.		32.8	7.9	181		25.0	6.8	181
Thiamin, mg.		0.36	0.08	132		0.23	0.07	132
Riboflavin, mg.		0.38	0.13	152		0.29	0.12	152
Niacin, N.E.		2.7	1.4	205		3.4	1.2	205
Vitamin B_6, mg.		0.1	0.1	297		0.1	0.1	297
Calcium, mg.		182	66	145		161	57	145
Phosphorous, mg.		204	70	127		224	61	127
Magnesium, mg.		9.5	6.7	157		15.0	5.8	157
Iron, mg.		2.07	1.13	207		1.93	0.97	207

[1] S.E. = standard error.

[2] C.V. = coefficient of variation.

[3] Menu 1 = macaroni/ground beef and tomato, green beans, coleslaw, cinnamon roll, mixed fruit cup, milk.

[4] Menu 2 = glazed ham, broccoli, carrot sticks, dinner roll, cherry crisp, milk.

Table 40. Least Square Means[1] and Standard Errors for Energy and Nutrient Intake, Including and Excluding Supplements, for the Total Oay by Sex of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Oietary Recall Interviews

	Total Oay's Meals							
	Family Style				Cafeteria Style			
	Excluding Supplement		Including Supplement		Excluding Supplement		Including Supplement	
	Girls	Boys	Girls	Boys	Girls	8oys	Girls	Boys
Menu 1[2]	(N=8)	(N=11)	(N=8)	(N=11)	(N=12)	(N=9)	(N=12)	(N=9)
Energy, kcal.	2282 ±234	2392 ±200	2282 ±234	2392 ±200	2160 ±191	2641 ±221	2160 ±191	2641 ±221
Protein, gm.	89.0 ±9.9	101.7 ±8.4	89.0 ±9.9	101.7 ±8.4	75.6 ±8.1	101.7 ±9.3	75.6 ±8.1	102.3 ±9.3
Fat, gm.	90.0 ±11.1	87.9 ±9.5	90.0 ±11.2	87.9 ±9.5	89.4 ±9.1	107.4 ±10.5	89.4 ±9.1	107.4 ±10.5
Carbohydrate, gm.	286.9 ±37.2	305.2 ±31.8	286.9 ±37.2	305.2 ±31.7	271.2 ±30.4	326.9 ±35.1	271.2 ±30.4	326.9 ±35.1
Vitamin A, I.U.	6589 ±1563	6216 ±1333	7838 ±1806	8035 ±1540	4923 ±1276	6160 ±1474	7006 ±1474	9493 ±1703
Ascorbic acid, mg.	117.6 ±38.3	136.1 ±32.7	132.6 ±52.8	158.0 ±45.0	140.5 ±31.3	157.7 ±36.1	228.0 ±43.1	201.0 ±49.7
Thiamin, mg.	2.25 ±0.37	2.97 ±0.32	2.63 ±0.53	3.52 ±0.46	2.09 ±0.30	2.57 ±0.35	2.71 ±0.44	3.66 ±0.50

Table 40. (continued)

	Total Day's Meals							
	Family Style				Cafeteria Style			
	Excluding Supplement		Including Supplement		Excluding Supplement		Including Supplement	
	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
Riboflavin, mg.	2.47 ±0.43	3.28 ±0.37	2.90 ±0.57	3.90 ±0.49	2.52 ±0.35	3.02 ±0.41	3.23 ±0.47	4.25 ±0.54
Niacin, N.E.	27.1 ±4.4	30.0 ±3.8	32.1 ±.60	36.8 ±5.2	20.7 ±3.6	25.4 ±4.2	29.0 ±4.9	38.7 ±5.7
Vitamin B_6, mg.	0.6 ±0.3	1.1 ±0.2	1.1 ±0.4	1.8 ±0.4	0.5 ±0.2	0.8 ±0.3	1.4 ±0.4	2.2 ±0.4
Calcium, mg.	886 ±193	1266 ±165	886 ±195	1275 ±166	1188 ±158	1420 ±182	1188 ±159	1466 ±184
Phosphorous, mg.	1316 ±195	1642 ±166	1316 ±196	1651 ±167	1493 ±159	1812 ±184	1493 ±160	1848 ±184
Magnesium, mg.	94.5 ±26.6	128.6 ±22.7	94.5 ±28.4	130.4 ±24.2	106.4 ±21.7	135.1 ±25.1	106.4 ±23.2	168.4 ±27.8
Iron, mg.	17.37[1,2] ±3.56	23.91[1,2] ±3.04	17.37[1] ±4.25	25.55[1,2] ±3.62	15.56[1,2] ±2.91	22.47[1,2] ±3.36	17.06[1] ±3.47	32.47[2] ±4.00
Menu 2[3]	(N=14)	(N=11)	(N=14)	(N=11)	(N=12)	(N=16)	(N=12)	(N=16)
Energy, kcal.	2642 ±177	2220 ±200	2644 ±177	2220 ±200	1897 ±191	2425 ±166	1897 ±191	2425 ±166

Table 40. (continued)

	Total Day's Meals							
	Family Style				Cafeteria Style			
	Excluding Supplement		Including Supplement		Excluding Supplement		Including Supplement	
	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
Protein, gm.	93.3 ±7.5	88.7 ±8.4	93.6 ±7.5	88.7 ±8.4	75.6 ±8.1	98.8 ±7.0	75.6 ±8.1	98.8 ±7.0
Fat, gm.	90.0 ±8.4	84.7 ±9.5	90.7 ±8.4	84.7 ±9.5	60.0 ±9.1	87.0 ±7.9	59.9 ±9.1	87.0 ±7.9
Carbohydrate, gm.	371.0 ±28.1	277.4 ±31.8	371.3 ±28.1	277.4 ±31.7	268.9 ±30.4	321.4 ±26.3	268.9 ±30.4	321.4 ±26.3
Vitamin A, I.U.	8168 ±1181	7633 ±1333	11,597 ±1365	11,270 ±1540	4442 ±1276	8830 ±1105	6734 ±1475	11,017 ±1277
Ascorbic acid, mg.	118.7 ±29.0	162.1 ±32.7	188.7 ±39.9	235.7 ±45.0	129.2 ±31.3	128.7 ±27.1	200.9 ±43.1	186.2 ±37.3
Thiamin, mg.	2.29 ±0.28	2.06 ±0.32	3.26 ±0.40	3.78 ±0.46	2.14 ±0.30	2.46 ±0.26	2.86 ±0.44	3.11 ±0.38
Riboflavin, mg.	3.00 ±0.32	2.36 ±0.37	3.99 ±0.43	4.20 ±0.49	2.40 ±0.35	3.20 ±0.30	3.21 ±0.47	3.94 ±0.40
Niacin, N.E.	23.4 ±3.3	20.7 ±3.8	35.1 ±4.6	40.7 ±5.2	21.6 ±3.6	27.8 ±3.1	31.1 ±4.9	36.5 ±4.3
Vitamin B_6, mg.	1.0 ±0.2	0.6 ±0.2	2.1 ±0.3	2.2 ±0.4	0.6 ±0.2	1.3 ±0.2	1.5 ±0.4	2.2 ±0.3

Table 40. (continued)

	Total Day's Meals							
	Family Style				Cafeteria Style			
	Excluding Supplement		Including Supplement		Excluding Supplement		Including Supplement	
	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
Calcium, mg.	1398 ±146	1009 ±165	1424 ±147	1009 ±166	1009 ±158	1375 ±136	1080 ±159	1414 ±138
Phosphorous, mg.	1756[1,2] ±148	1382[1,2] ±166	1790[1] ±148	1382[2] ±167	1373[1,2] ±159	1895[1,2] ±138	1390[2] ±160	1895[1,2] ±138
Magnesium, mg.	118.7 ±20.1	65.8 ±22.7	130.3 ±21.5	74.0 ±24.2	85.9 ±21.7	144.2 ±18.8	95.9 ±23.2	144.2 ±20.1
Iron, mg.	18.11 ±2.69	17.13 ±3.04	25.95 ±3.21	19.86 ±3.62	17.85 ±2.91	19.61 ±2.52	22.10 ±3.47	20.74 ±3.00

[1]Where superscripts (1, 2) on means differ horizontally, means differ significantly ($p \leq 0.05$) from each other. Means in a row without superscripts do not differ significantly.

[2]Menu 1 = macaroni/ground beef and tomato, green beans, coleslaw, cinnamon roll, mixed fruit cup, milk.

[3]Menu 2 = glazed ham, broccoli, carrot sticks, dinner roll, cherry crisp, milk.

Table 41. Least Square Means and Standard Errors for Energy and Nutrient Intake for Breakfast by Sex of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews

	Breakfast Meal							
	Family Style				Cafeteria Style			
	Girls		Boys		Girls		Boys	
	Mean[1]	S.E.[2]	Mean	S.E.	Mean	S.E.	Mean	S.E.
Menu 1[3]	(N=7)		(N=9)		(N=10)		(N=9)	
Energy, kcal.	392	111	520	98	590	93	658	98
Protein, gm.	11.4	4.0	17.7	3.6	20.8	3.4	22.4	3.6
Fat, gm.	11.1	4.7	17.8	4.1	23.5	3.9	19.9	4.1
Carbohydrate, gm.	64.0	21.0	73.7	18.6	75.4	17.6	102.0	18.6
Vitamin A, I.U.	1265	657	1323	579	1836	550	1376	579
Ascorbic acid, mg.	45.6	26.1	61.1	23.0	69.2	21.8	59.8	23.0
Thiamin, mg.	0.56	0.29	0.82	0.25	0.74	0.24	0.71	0.25
Riboflavin, mg.	0.71	0.29	0.88	0.26	1.15	0.24	0.82	0.26
Niacin, N.E.	5.3	2.9	5.9	2.5	7.1	2.4	4.5	2.5
Vitamin B_6, mg.	0.5	0.2	0.6	0.2	0.4	0.2	0.5	0.2
Calcium, mg.	244	96	305	85	530	81	412	85
Phosphorous, mg.	308	109	366	96	546	91	554	96
Magnesium, mg.	39	19	61	17	49.1	16.2	62.2	17.1
Iron, mg.	2.79	2.72	5.90	2.39	6.10	2.27	8.09	2.39
Menu 2[4]	(N=13)		(N=11)		(N=11)		(N=16)	
Energy, kcal.	445	82	500	89	522	89	658	74
Protein, gm.	14.7	3.0	15.1	3.2	17.9	3.2	23.8	2.7
Fat, gm.	10.4	3.4	18.2	3.7	12.1	3.7	18.8	3.1
Carbohydrate, gm.	75.8	15.4	69.7	16.8	86.6	16.8	103.6	13.9
Vitamin A, I.U.	2253[1,2]	482	1116[1]	524	1083[1]	524	3051[2]	434
Ascorbic acid, mg.	67.0	19.2	33.2	20.8	64.5	20.8	52.3	17.3

Table 41. (continued)

	Breakfast Meal							
	Family Style				Cafeteria Style			
	Girls		Boys		Girls		Boys	
	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.
Thiamin, mg.	0.69	0.21	0.63	0.23	0.97	0.23	1.06	0.19
Riboflavin, mg.	0.92	0.21	0.63	0.23	1.04	0.23	1.42	0.19
Niacin, N.E.	7.3	2.1	4.4	2.3	9.0	2.3	11.1	1.9
Vitamin B_6, mg.	$0.7^{1,2}$	0.2	0.3^{1}	0.2	0.3^{1}	0.2	1.0^{2}	0.2
Calcium, mg.	350	71	247	77	323	77	480	64
Phosphorous, mg.	397	80	264	87	434	87	604	72
Magnesium, mg.	51.0	14.2	14.8	15.5	37.7	15.5	79.4	12.8
Iron, mg.	6.39	1.99	5.73	2.17	9.70	2.17	7.28	1.80

[1]Where superscripts (1, 2) on means differ horizontally, means differ significantly ($p \leq 0.05$) from each other. Means in a row without superscripts do not differ significantly.

[2]S.E. = standard error.

[3]Menu 1 = macaroni/ground beef and tomato, green beans, coleslaw, cinnamon roll, mixed fruit cup, milk.

[4]Menu 2 = glazed ham, broccoli, carrot sticks, dinner roll, cherry crisp, milk.

Table 42. Least Square Means and Standard Errors for Energy and Nutrient Intake for Lunch by Sex of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews

	Lunch Meal							
	Family Style				Cafeteria Style			
	Girls		Boys		Girls		Boys	
	Mean[1]	S.E.[2]	Mean	S.E.	Mean	S.E.	Mean	S.E.
Menu 1[3]	(N=8)		(N=11)		(N=12)		(N=9)	
Energy, kcal.	599	75	618	64	476	61	580	71
Protein, gm.	27.6	3.2	30.1	2.8	19.4	2.6	24.7	3.1
Fat, gm.	24.0	3.0	24.8	2.6	19.0	2.4	23.3	2.8
Carbohydrate, gm.	68.9	10.7	69.7	9.2	58.1	8.8	69.1	10.1
Vitamin A, I.U.	2091	474	2260	404	1413	387	1932	447
Ascorbic acid, mg.	61.4	11.8	51.4	10.0	49.0	9.6	64.2	11.1
Thiamin, mg.	1.09	0.13	1.17	0.11	0.66	0.11	0.96	0.12
Riboflavin, mg.	0.92	0.10	1.01	0.08	0.70	0.08	0.82	0.09
Niacin, N.E.	10.7	1.4	11.5	1.2	5.9	1.1	9.4	1.3
Vitamin B_6, mg.	0.10	0.02	0.10	0.02	0.10	0.02	0.09	0.02
Calcium, mg.	303	38	341	32	326	31	282	36
Phosphorous, mg.	379	44	416	38	325	36	341	41
Magnesium, mg.	27.4	3.9	29.4	3.4	31.0	3.2	24.0	3.7
Iron, mg.	6.79	0.85	7.71	0.73	4.20	0.70	6.22	0.80
Menu 2[4]	(N=14)		(N=11)		(N=12)		(N=16)	
Energy, kcal.	762	57	683	64	499	61	587	53
Protein, gm.	28.6	2.4	28.9	2.8	26.2	2.6	28.3	2.3
Fat, gm.	23.1	2.3	21.3	2.6	15.5	2.4	18.6	2.1
Carbohydrate, gm.	109.3	8.1	93.5	9.2	62.5	8.8	76.0	7.6
Vitamin A, I.U.	2811	358	3015	404	1663	387	2931	335
Ascorbic acid, mg.	27.8	8.9	36.9	10.0	19.2	9.6	28.5	8.3

Table 42. (continued)

	Lunch Meal							
	Family Style				Cafeteria Style			
	Girls		Boys		Girls		Boys	
	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.
Thiamin, mg.	0.64	0.10	0.64	0.11	0.61	0.11	0.62	0.09
Riboflavin, mg.	0.87	0.07	0.83	0.08	0.62	0.08	0.80	0.07
Niacin, N.E.	5.6	1.0	5.6	1.2	5.1	1.1	5.1	1.0
Vitamin B_6, mg.	0.10	0.02	0.09	0.02	0.06	0.02	0.10	0.01
Calcium, mg.	383	29	361	32	247	31	371	27
Phosphorous, mg.	508	33	492	38	398	36	486	31
Magnesium	32.0[1]	3.0	28.8[1,2]	3.4	20.5[2]	3.2	32.3[1]	2.8
Iron, mg.	4.53	0.64	4.40	0.73	3.76	0.70	3.89	0.60

[1]Where superscripts (1, 2) on means differ horizontally, means differ significantly ($p \leq 0.05$) from each other. Means in a row without superscripts do not differ significantly.

[2]S.E. = standard error.

[3]Menu 1 = macaroni/ground beef and tomato, green beans, coleslaw, cinnamon roll, mixed fruit cup, milk.

[4]Menu 2 = glazed ham, broccoli, carrot sticks, dinner roll, cherry crisp, milk.

Table 43. Least Square Means and Standard Errors for Energy and Nutrient Intake for Dinner by Sex of Students at Schools with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews

	Dinner Meal							
	Family Style				Cafeteria Style			
	Girls		Boys		Girls		Boys	
	Mean[1]	S.E.[2]	Mean	S.E.	Mean	S.E.	Mean	S.E.
Menu 1[3]	(N=8)		(N=11)		(N=12)		(N=9)	
Energy, kcal.	1178[1]	136	1011[1]	116	634[2]	111	1036[1]	129
Protein, gm.	47.8	6.2	47.5	5.3	28.1	5.1	44.8	5.8
Fat, gm.	51.1	7.4	37.7	6.3	30.1	6.0	49.3	6.9
Carbohydrate, gm.	134.6	21.0	121.8	18.0	64.1	17.2	105.7	19.8
Vitamin A, I.U.	2413	1023	2275	872	1245	835	2439	964
Ascorbic acid, mg.	12.6	13.9	15.5	11.8	17.1	11.3	27.4	13.1
Thiamin, mg.	0.62	0.16	0.78	0.14	0.60	0.13	0.72	0.15
Riboflavin, mg.	0.84[1,2]	0.14	1.00[1]	0.12	0.48[2]	0.12	1.01[1]	0.14
Niacin, N.E.	11.0	1.8	8.2	1.6	7.3	1.5	9.2	1.7
Vitamin B_6, mg.	0.03	0.05	0.13	0.04	0.02	0.04	0.13	0.05
Calcium, mg.	340[1,2]	97	493[1]	82	177[2]	79	529[1]	91
Phosphorous, mg.	610[1,2]	91	701[1,2]	78	388[1]	74	695[2]	86
Magnesium, mg.	30.5	12.1	27.7	10.4	8.5	9.9	26.3	11.4
Iron, mg.	7.19	1.18	6.40	1.01	4.25	0.96	6.50	1.11
Menu 2[4]	(N=14)		(N=11)		(N=12)		(N=16)	
Energy, kcal.	969[1]	103	747[1,2]	116	539[2]	111	840[1]	96
Protein, gm.	40.6	4.7	38.4	5.3	22.9	5.1	39.9	4.4
Fat, gm.	39.1	5.6	33.8	6.3	19.9	6.0	35.0	5.2
Carbohydrate, gm.	115.4	15.9	71.5	18.0	68.4	17.2	93.2	14.9
Vitamin A, I.U.	2855	773	2507	872	1166	835	2708	723
Ascorbic acid, mg.	23.5	10.5	53.8	11.8	13.7	11.3	39.8	9.8

Table 43. (continued)

	Dinner Meal							
	Family Style				Cafeteria Style			
	Girls		Boys		Girls		Boys	
	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.
Thiamin, mg.	0.66	0.12	0.56[1,2]	0.14	0.38[2]	0.13	0.63[1]	0.11
Riboflavin, mg.	0.95[1]	0.11	0.63[1,2]	0.12	0.44[2]	0.12	0.84[1]	0.10
Niacin, N.E.	8.5	1.4	9.0	1.6	5.0	1.5	8.7	1.3
Vitamin B_6, mg.	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0
Calcium, mg.	555[1]	73	261[2]	82	253[2]	79	446[1,2]	68
Phosphorous, mg.	700[1]	69	490[2]	78	342[2]	74	637[1]	64
Magnesium, mg.	31.8	9.2	15.4	10.4	16.8	9.9	19.6	8.6
Iron, mg.	5.83	0.89	5.62	1.01	3.51	0.96	6.68	0.83

[1]Where superscripts (1, 2) on means differ horizontally, means differ significantly ($p \leq 0.05$) from each other. Means in a row without superscripts do not differ significantly.

[2]S.E. = standard error.

[3]Menu 1 = macaroni/ground beef and tomato, green beans, coleslaw, cinnamon roll, mixed fruit cup, milk.

[4]Menu 2 = glazed ham, broccoli, carrot sticks, dinner roll, cherry crisp, milk.

Table 44. Least Square Means and Standard Errors for Energy and Nutrient Intake for Snacks by Sex of Students at School with Satellite Family or Cafeteria Style Food Service Who Participated in the 24-Hour Dietary Recall Interviews

	Snacks							
	Family Style				Cafeteria Style			
	Girls		Boys		Girls		Boys	
	Mean[1]	S.E.[2]	Mean	S.E.	Mean	S.E.	Mean	S.E.
Menu 1[3]	(N=5)		(N=8)		(N=10)		(N=8)	
Energy, kcal.	260	182	464	144	670	129	412	144
Protein, gm.	5.6	6.0	13.1	4.7	12.9	4.2	11.0	4.7
Fat, gm.	8.1	8.9	14.9	7.0	24.8	6.3	16.7	7.0
Carbohydrate, gm.	43.8	26.2	73.5	20.7	103.4	18.5	56.4	20.7
Vitamin A, I.U.	1564	650	823	514	881	460	464	514
Ascorbic acid, mg.	5.9	15.1	26.5	11.9	20.2	10.7	7.2	11.9
Thiamin, mg.	0.08	0.16	0.47	0.13	0.26	0.12	0.20	0.13
Riboflavin, mg.	0.15	0.26	0.75	0.20	0.46	0.18	0.40	0.20
Niacin, N.E.	1.2	2.6	6.9	2.1	1.9	1.8	2.5	2.1
Vitamin B_6, mg.	0.0	0.2	0.5	0.1	0.1	0.1	0.1	0.1
Calcium, mg.	46	126	250	100	292	89	222	100
Phosphorous, mg.	92	135	310	106	390	95	250	106
Magnesium, mg.	3.9	12.8	29.6	10.1	31.2	9.0	25.4	10.1
Iron, mg.	1.50	2.15	6.83	1.70	2.43	1.52	1.86	1.70
Menu 2[4]	(N=13)		(N=7)		(N=11)		(N=14)	
Energy, kcal.	536	113	456	154	416	123	389	109
Protein, gm.	11.2	3.7	9.8	5.0	11.0	4.0	7.8	3.6
Fat, gm.	19.5	5.5	17.9	7.5	14.6	6.0	16.6	5.3
Carbohydrate, gm.	81.7	16.2	67.1	22.1	64.0	17.6	55.6	15.6
Vitamin A, I.U.	441	403	1564[2]	549	677[2]	438	158[1]	388
Ascorbic acid, mg.	5.6[1]	9.4	60.0[2]	12.8	40.6[2]	10.2	9.3[1]	9.0

Table 44. (continued)

	Snacks							
	Family Style				Cafeteria Style			
	Girls		Boys		Girls		Boys	
	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.
Thiamin, mg.	0.38	0.10	0.34	0.14	0.29	0.11	0.17	0.10
Riboflavin, mg.	0.34	0.16	0.42	0.22	0.42	0.17	0.16	0.15
Niacin, N.E.	2.7	1.6	2.8	2.2	3.5	1.8	3.3	1.6
Vitamin B_6, mg.	0.1	0.1	0.1	0.2	0.2	0.1	0.0	0.1
Calcium, mg.	146	78	218	106	233	85	89	75
Phosphorous, mg.	193	83	214	114	256	91	193	80
Magnesium, mg.	8.1	7.9	10.8	10.8	15.2	8.6	14.7	7.6
Iron, mg.	1.96	1.33	2.18	1.82	1.85	1.45	2.01	1.28

[1]Where superscripts (1, 2) on means differ horizontally, means differ significantly ($p \leq 0.05$) from each other. Means in a row without superscripts do not differ significantly.

[2]S.E. = standard error.

[3]Menu 1 = macaroni/ground beef and tomato, green beans, coleslaw, cinnamon roll, mixed fruit cup, milk.

[4]Menu 2 = glazed ham, broccoli, carrot sticks, dinner roll, cherry crisp, milk.

EFFECT OF FAMILY VERSUS CAFETERIA STYLE SCHOOL LUNCH SERVICE ON STUDENTS' FOOD PREFERENCES AND NUTRIENT INTAKES

by

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ABSTRACT

Excessive plate waste in school lunch programs has resulted in alterations in serving styles to help counter the problem. Family style food service reportedly decreases plate waste and is well accepted by students. Because few studies with statistically analyzed data have been conducted to substantiate these claims, a study was conducted in three elementary schools, using satellite family, satellite cafeteria, or on-site cafeteria food delivery systems, to compare the effect of serving style on students' food behavior. A facial hedonic scale was used to examine food preferences of first through sixth grade students, and 24-hour dietary recall interviews were conducted with a random sample of fourth through sixth graders, who ate school lunch to assess their nutrient intakes. Dietary data were analyzed for energy and 12 nutrients and expressed as percentages of the Recommended Dietary Allowances. The percentage of energy consumed as fat also was determined, and Mean Adequacy Ratios (MARs) were calculated to assess dietary quality. Differences attributable to serving style were determined statistically.

Food preference scores for menu items were highest in the satellite cafeteria school. Comparisons of dietary data from the satellite family and cafeteria style schools on two study days showed that on one day, students in the satellite family style school consumed more protein, thiamin, riboflavin, niacin, and iron and their energy intakes were higher on the other day than those of students in the satellite cafeteria style school. Energy and nutrient intakes of boys and girls from the total day's or lunch meals did not differ significantly in either school. There were no significant differences in the percentage of dietary energy from fat attributable to serving style or sex of the student.

Serving style did not affect MAR values of students significantly. Mean MAR values for girls in the satellite family school were higher than those of their counterparts in the satellite cafeteria school on one day. The MARs grouped in ranges indicated that more girls in the family style school had MAR values in the higher ranges than girls in the cafeteria style school and that boys had better diets than girls.