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ABSTRACT

Highlights of a study of foods sold in the public schools of California are presented in this summary report. The research examined types of food available, nutritional quality of available foods, eating patterns and nutrient intake of students during school hours, and total nutrient intake of students during a 24-hour period. Additionally, relationships were investigated among the foods available on campus, the nutrient intake of students, and the following factors: school size, socioeconomic status of students, ethnic distribution of students, and rural/suburban/urban location of the schools. The study involved inquiry and observations of fourth-, eighth-, and eleventh-grade students at 299 randomly selected schools. Various methods, such as pretested questionnaires and on-site visits, were used to gather data. Methods and results of the study are discussed, and recommendations derived from the research effort are presented. (RH)

EATING HABITS OF STUDENTS IN CALIFORNIA PUBLIC SCHOOLS

OFFICE OF CHILD NUTRITION SERVICES

A Summary of a Study of the Nutritional Quality of Food Available and the Eating Habits of Students in California Public Schools

A Report Prepared for
The Office of Child Nutrition Services
California State Department of Education.

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Preface

Various surveys and studies regarding the nutrition of children have indicated that foods available in schools, including those provided under the school food service program, do not meet established nutritional standards. This deficiency can contribute to the occurrence of health and learning problems among children, and a consequent need existed to study the foods for sale in schools to determine their nutritional quality. To this end, under a mandate established by California State Senate Bill 654 (Chapter 1003, Statutes of 1977, Appendix I), the Department of Education contracted with the Nutrition, Foods, and Dietetics Department at San Jose State University to conduct a study of the foods sold in the public schools of California.

The study, entitled "A Study of the Nutritional Quality of Food Available and the Eating Habits of Students in California Public Schools," has been completed; and the information and data thus obtained have been presented in a detailed final report. The highlights of that report are presented in this summary volume.

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PART I

Introduction

The provision of appropriate and adequate nutrition to children is a matter of major concern in view of the cumulative effects of nutrition on a child's later life. Studies dealing with specific population groups have shown that deficiencies in nutrient intake exist in certain areas and among certain populations of children. They have also shown that a balanced diet is especially necessary to enable children to learn, to grow, and to maintain good health.

Clearly, therefore, foods served at school should contribute significantly to the health, growth, and well-being of children. The research described in this report, namely, "A Study of the Nutritional Quality of Food Available and the Eating Habits of Students in California Public Schools," is an endeavor to determine whether foods served and eaten in California's public schools meet the standards required to achieve such contribution.

To achieve the foregoing purpose, the study effort was directed toward examining the following major areas:

1. Types of food items available in California public schools
2. Nutritional quality of foods available in the sample schools
3. Eating patterns and nutrient intake of students during school hours
4. Total nutrient intake of students during a 24-hour period
5. Relationships among the foods available on campus, the nutrient intake of students, and the following factors: school size, socioeconomic status of students, ethnic distribution of students, and rural-suburban-urban location of the schools.

The study involved inquiry and observations at 299 randomly selected schools representing approximately 5 percent of the public schools in California. Samplings of students in the fourth, eighth, and eleventh grades, representing elementary, intermediate, and high schools, respectively, were studied. The distribution of this sampling is shown in Tables I-1 and I-2.

The methodology employed to achieve the study objectives, the information and data thus obtained, and a pertinent discussion of such results are highlighted in Part II of this summary report.

The findings and recommendations derived from the research effort are presented in Part III.

TABLE I-1

Number of Schools That Participated in the Study, by School Level

School level	*Number of California public schools*[a]	*Number of schools participating in study*[b]
Elementary	5,015	206
Intermediate	887	49
High school	850	44
Total	6,752	299

[a]These 1979 figures do not include schools maintained by the county superintendent of schools or continuation schools.

[b]Schools which responded to at least one of the questionnaires mailed to them.

TABLE I-2

Distribution of Sample Schools by Enrollment, AFDC, and Ethnic Background

Demographic variables	*Percent of students*[a]	
	In the state of California	*In schools participating in study*
AFDC[b]	9.5	8.3
Ethnicity		
American Indian	0.9	1.1
Asian	3.5	2.7
Filipino	1.2	0.9
Black	10.1	4.5
Spanish surname	20.8	18.9
White and other	63.5	72.0

[a]These percents are based on K-12 enrollment figures of 4,041,598 for the state and 178,446 in the participating schools.

[b]Aid to Families with Dependent Children (AFDC) is determined for each California public school by the percentage of the enrollment in the school that is from families receiving AFDC payments.

PART II

Methodology, Results, and Discussion

This part of the report includes the methodology employed in the study, the data obtained, and the pertinent discussion. This information and the related data are summarized for each of the following major aspects of the study:

- Food Available to Students at School
- Eating Patterns of Students at School
- Eating Patterns During a 24-Hour Period

Food Available to Students at School

Pretested questionnaires and on-site visits were used to determine which types of foods are sold in schools, what times of the day foods are available, and from which types of food services they are obtained. Two questionnaires were developed: one was designed to be answered by the person in charge of the individual school's food service, and the second was directed to the respective principals of the 299 sample schools that participated.

Methodology for Studying Food Availability

On-site visits were made to 86 selected sample schools subsequent to the mailing of the questionnaires. An observer form, which included a food checklist and questions for the principal and food service manager, was also developed and used to record data from each visit.

The *Statistical Package for the Social Sciences* (SPSS, Nie, et al., 1975) was used to analyze data from the questionnaires and the on-site visits. A separate computer program was designed and used to develop the food analysis from which the nutritional ratings for each school was determined. These ratings were then used to assess differences among the quality of foods available at various food services at specific times of the school day. The nutritional rating of each school was calculated by means of the following formula:

$$\text{Nutritional rating of each school} = \frac{\text{Sum (Nutritional rating of the individual food} \times \text{Availability)}}{\text{Sum (Availability of the individual food)}}$$

Availability is defined as the summation of the number of places at which the food was available in the five time periods sampled.

The basic procedure for determining the nutritional quality of foods served involved compiling a list of foods available in each school on a "typical" day. For each food to be analyzed, an Index of Nutritional Quality (INQ) for each of ten nutrients (protein, thiamin, riboflavin, niacin, iron, calcium, vitamin C, vitamin A, folacin, and crude fiber) was then calculated as follows:

$$\text{INQ} = \frac{\text{Amount of nutrient in a food} \div \text{United States Recommended Daily Allowance of the nutrient}}{\text{Amount of calories in the food} \div \text{United States Recommended Daily Allowance for total calories}}$$

The INQ thus provided the basic working formula for evaluating nutrient levels of foods.

Further, a standard for each nutrient was set on the basis of the concept of nutrient density (a nutrient-to-calorie ratio) using the data presented in Table II-1. Data in this table show six major food groups, together with the percentages of calories and of the eight major nutrients contributed by each food group. In most cases, a standard was calculated by selecting the three food groups which were the major contributors of each nutrient. In every case, a total nutrient contribution of more than 85 percent was achieved. A Standard Nutrient Indicator (SNI) was calculated by dividing the total nutrient percentage from the three major groups by total caloric contribution of these groups as follows:

$$\text{SNI} = \frac{\text{Percent of a nutrient contributed by three food groups}}{\text{Percent of calories contributed by three food groups}}$$

A nutrient to calorie ratio, presented as a percentage of the SNI, therefore resulted in a relative nutrient contribution. These data are summarized in Table II-2.

Recommendations for limiting intake of sodium, saturated fat, and refined sugar (sucrose), as suggested by the U.S. Dietary Goals, were also taken into consideration. For refined sugar and saturated fat, the suggested maximum allowance of 10 percent total energy intake from each source resulted in a base standard of 0.025 gm/calorie for sugar and 0.011 gm/calorie for saturated fat.

On the basis of an analysis of commonly eaten food sources of each nutrient and the determination of the

TABLE II-1

Caloric and Nutrient Contribution of the Six Major Food Groups

Food groups	Percent of contribution								
	Calorie	Protein	Vitamin A	Vitamin C	Thiamin	Niacin	Riboflavin	Calcium	Iron
Meat and eggs	21.8	47.4	27.9	1.1	27.9	45.3	28.8	6.2	35.6
Dairy products	11.1	22.0	13.0	3.9	8.6	1.4	39.0	74.6	2.5
Fats and oils	18.1	0.2	8.3	0	0	0	1.0	0.4	0
Fruits and vegetables (excluding nuts, soy flour, and grits)	11.7	12.2	48.3	91.4	21.4	21.8	10.5	12.5	25.1
	(8.6)	(7.0)	(48.3)	(91.4)	(16.4)	(15.0)	(8.7)	(9.6)	(18.9)
Cereal products	19.2	17.6	0.4	0	41.6	27.9	21.0	3.4	27.9
Miscellaneous	18.0	0.4	2.2	3.6	0.1	3.5	0.6	0.8	2.2

Adapted from. R. Marston and B. Friend, "Nutrient Content of the National Food Supply," *National Food Review* (1978), NFR-1, p 15

TABLE II-2

The Relative Nutrient Contribution of the U.S. Recommended Daily Allowances Presented as a Percent of the Standard Nutrient Indicator(SNI)

Nutrient	US_RDA	Percent of SNI
Protein	65.0 gm	1.7
Vitamin A	1000.0 RE	5.6
Vitamin C	60.0 mg	10.6
Thiamin	1.5 mg	1.7
Riboflavin	1.7 mg	1.7
Niacin	20.0 mg	1.8
Folacin	0.4 mg	1.8
Calcium	1000.0 mg	2.1
Iron	18.0 mg	1.7
Fiber	7.0 gm	3.2
Calories	2300.0 cal	

distribution of each nutrient throughout the national dietary, factors were assigned to describe foods that contain excessive levels of these food constituents. A multiple of two was selected for saturated fat. A multiple of three was assigned to the base standard for refined sugar.

Because an intrinsic relationship does not exist between sodium and calories and because the U.S. Dietary Goals recommendation is not expressed in terms of calories, determination of a sodium standard was devised in relation to the total weight of food consumed. A base standard for sodium of 1.6 milligrams per gram of food was calculated, and a distribution factor of two was chosen to describe those foods containing an excessive level of this food constituent. Data in Table II-3 contain a summary of the calculations.

Judgment criteria were expressed in six food classes, ranging from high nutrient benefit (class 6) to low nutrient benefit (class 1). Data in Table II-4 show that a food was placed in the highest eligible class on the basis of either a single nutrient score or its cumulative score from all ten nutrients. If the food contained amounts of sodium, saturated fat, and/or refined

TABLE II-3

Summary of Calculated Negative Nutrient Values of Sugar, Fat, and Sodium

Nutrient	Amount based on U.S. Dietary Goals	Distribution factor	Standard used
Refined sugar	0.025 gm/cal	3	0.075 gm/cal
Saturated fat	0.011 gm/cal	2	0.022 gm/cal
Sodium	1.600 mg/gm food	2	3.200 mg/gm food

TABLE II-4

Criteria for Determining Food Class, Based on Percentage of Standard Nutrient Indicator[a]

Level of nutrient benefit	Food class	Cumulative nutrients	Single nutrient
High	6	≥375	≥200
↑	5	≥300 and <375	≥150 and <200
	4	≥225 and <300	≥100 and <150
	3	≥150 and <225	≥50 and <100
↓	2	≥75 and <150	≥25 and <50
Low	1	<75	<25

[a]Foods flagged for negative nutrients are lowered one class for each flag.

sugar that exceeded the standards, it was flagged and demoted one class for each flag. Table II-5 shows an example of the calculations.

Results and Discussion of Study of Food Availability

This portion of the report includes data on all schools that responded to at least one questionnaire or that received an on-site visit.

Classification of Foods and Beverages by Nutritional Rating. In accordance with the aforementioned method, individual foods and beverages were placed into one of the six nutritional classes on the basis of (1) their relative nutrient density; and (2) their levels of refined sugar, saturated fat, and sodium. The kinds of foods included within each class are as follows:

Class 6—Largely fresh fruits and vegetables, some low-fat dairy products, low-fat protein-rich foods, and two cereal products

Class 5—Mostly protein-rich foods with high nutrient scores that were flagged for excessive amounts of either sodium or saturated fat

Class 4—Primarily meat or bean-based entrees flagged for both excessive sodium and saturated fat content

Class 3—Mostly dessert foods, canned fruits, and fruit juices or drinks flagged for excessive sugar content

Class 2—Half desserts or sweet baked items and half nonsweet snacks

Class 1—Desserts and sweet baked items, candies, and sugar-sweetened and diet drinks

Overall, the system does identify foods of relatively high and low nutritional quality. It also helps to identify nutrient dilution occurring in a food, such as when salt and fat have been added. However, the density of nutrients is determined in relation to the food's caloric contribution. Consequently, nutrient density can either magnify or mask the nutrient dimensions of a food, depending on the food's caloric content. Some nutritional ratings, therefore, may have been affected by this inherent situation.

TABLE II-5

Calculation of Nutrient Values for Apple and Apple Pie, with Cumulative Scores

		Apple		*Apple pie*	
Nutrient	*SNI*	*INQ*	*Percent of SNI*[a]	*INQ*	*Percent of SNI*[a]
Protein	1.7	0.1	7.2	0.3	15.2
Vitamin A	5.6	0.4	6.4	0.2	2.8
Vitamin C	10.6	2.6	24.9	0.4	3.3
Thiamin	1.7	0.7	41.5	0.1	5.5
Riboflavin	1.7	0.5	27.4	0.2	9.7
Niacin	1.8	0.1	7.3	0.5	29.2
Folacin	1.8	0.2	11.0	0.1	3.9
Calcium	2.1	0.3	12.6	0.1	4.3
Iron	1.7	0.6	34.6	0.3	16.0
Fiber	3.2	5.7	177.0	0.2	6.3
Cumulative score			349.9		96.2

Negative factor	*Standard (max. level)*	*Food level for apple*	*Food level for apple pie*
Refined sugar (gm/cal)	0.075	0.000	0.033
Saturated fat (gm/cal)	0.022	0.000	0.010
Sodium (mg/gm food)	3.200	0.010	4.530*[b]

[a]The formula for percentage of SNI is INQ/SNI × 100.

[b]The symbol (*) indicates excess level of negative factor.

Nutritional Rating of Foods and Beverages. Table II-6 contains the nutritional rating distribution of foods and beverages available in elementary, intermediate, and high schools. In general, over half the foods available in elementary schools were rated high nutritionally (classes 5 and 6). In intermediate and high schools, slightly less than half the foods were from these classes. However, for foods with low nutritional ratings (classes 1 and 2), high schools had the highest percentage, followed by intermediate and elementary schools.

The nutritional rating distribution of foods and beverages available at lunch from various food services is shown in Table II-7. The highest percentage of foods and beverages in both intermediate and high schools (rated high nutritionally as class 5 or 6) was found in the cafeteria. The next highest percentage was in snack bars, with student stores and vending machines following. Conversely, the majority of low nutritionally rated foods (classes 1 and 2) available in intermediate schools and high schools (and in regional occupational programs in high schools) were from vending machines, followed by student stores and snack bars. Data from elementary schools do not

TABLE II-6

Nutritional Rating of Foods and Beverages Available in Schools Studied, by Grade Level

Nutritional rating	Percent of foods with nutritional rating		
	Elementary N=180 (1,105 foods)	Intermediate N=47 (920 foods)	High N=41 (1,351 foods)
1	1.7	5.6	10.6
2	11.8	17.4	18.1
3	11.9	10.3	10.8
4	13.5	17.9	16.0
5	32.1	26.6	24.5
6	29.0	22.2	20.0
Total	100.0	100.0	100.0

NOTE. Each food was counted once for each school at which it was served

TABLE II-7

Nutritional Rating Distribution of Foods and Beverages Available at Lunch at Various Food Services

Nutritional rating	Intermediate Schools (N=47)				
	Percent of foods served with nutritional rating, by food service location				
	Cafeteria (594 foods)	Snack bar (364 foods)	Student store (29 foods)	Vending machine (5 foods)	Regional occupational program
1	2.7	7.1	27.6	40.0	0
2	12.1	24.7	20.7	20.0	0
3	12.1	8.5	6.9	0	0
4	20.0	15.7	3.4	20.0	0
5	28.0	23.9	27.6	0	0
6	25.1	20.1	13.8	20.0	0
Total	100.0	100.0	100.0	100.0	0

Nutritional rating	High Schools (N=41)				
	Percent of foods served with nutritional rating, by food service location				
	Cafeteria (781 foods)	Snack bar (568 foods)	Student store (88 foods)	Vending machine (115 foods)	Regional occupational program (5 foods)
1	5.5	9.9	31.8	43.5	20.0
2	14.8	20.4	21.6	16.5	40.0
3	11.3	9.1	11.4	11.3	20.0
4	17.7	18.0	1.1	0	0
5	27.8	25.5	21.6	8.7	0
6	22.9	17.1	12.5	20.0	20.0
Total	100.0	100.0	100.0	100.0	100.0

appear in Table II-7, because nearly all foods in such schools are served from the cafeteria at lunchtime.

A nutritional rating score for each school at each level was calculated, using the nutritional ratings of foods and their availabilty. On an overall basis, elementary schools received the highest nutritional rating scores; intermediate schools were second; and high schools followed.

Nutritional ratings were also compared with school location and socioeconomic status. A significant relationship was not found between the nutritional ratings of any school and either its geographic location or socioeconomic status.

One-Week Food Frequency Record. The frequency with which individual foods and beverages were served at all three grade levels was tallied and compared. In the elementary schools, the lettuce-and-tomato tossed salad was the item served most often. At the intermediate and high schools, however, cookies/brownies and candy, respectively, were the most frequently offered foods. Items served frequently at all three levels include milk, hamburgers, french fries, white bread, and salads. More sandwiches and snack items were available at high schools than at either elementary schools or intermediate schools.

In both elementary schools and intermediate schools, the highest percentages of foods were offered during lunchtime. Only the high schools provided a great variety of foods available at times other than at lunchtime.

Foods were also offered by a larger variety of food services in high schools than at the other two levels. Elementary schools offered nearly all their foods through the cafeteria. Intermediate schools also served most of their foods from the cafeteria, although snack bars were an alternate source for a small percentage of foods available.

Use of Vending Machines. Vending machines were found predominantly at the high school level, with only two intermediate schools reporting the availability of vending machines. Reports from elementary schools did not indicate the availability of vending machines at that level.

Foods available from vending machines consisted primarily of desserts, nonsweet snacks, candy, and soft drinks. Because the sample was small and most machines were not related to the school food service, a comparison could not be made between food-service-operated machines and those operated by other sources.

On-Campus Food Sales. On-campus food sales sponsored by groups other than food services were most frequent in high schools. In order of frequency, the types of foods and beverages sold on campus at all three levels were: (1) cookies, cakes, and candy; (2) soft drinks and punch; (3) hot dogs and hamburgers; and (4) nuts, seeds, and fruit. Other foods sold included ice cream, popcorn, fruit juice bars, and special dinners.

Eating Patterns of Students at School

Information on student eating patterns at the fourth, eighth, and eleventh grade levels was obtained from validated questionnaires from 279 sample schools. Data analysis of food and beverage items was made utilzing the Ohio State Nutritional Data Base (1978) Program NUTRIENT, a computer program capable of analyzing approximately 6,000 foods for 63 nutrients. For those foods that were a combination of food items (e.g., tacos) and foods reported in terms too general for analysis (e.g., sandwiches), standard recipes and definitions were established.

Methodology for Studying Eating Patterns

Dietary intake data were tallied by individual school by time of day at which food was eaten (before school, morning snack, lunch, and afternoon snack) and by food sources. For elementary schools, these sources were designated as school, home, and other; and for intermediate and high schools, they were designated as cafeteria, snack bar, vending machine, home, and other. The term school or cafeteria was used to identify the source where a Type A (or reimbursable) lunch was usually served

Food items and beverages were analyzed for calories and eight major nutrients (protein, vitamin A, vitamin C, thiamin, riboflavin, niacin, calcium, and iron). Foods were also analyzed for sodium, saturated fat, and sucrose (refined sugar). Nutritional data were reported in percentages of the Recommended Dietary Allowances (RDA) for calories and nutrients and by weight (grams) for sodium, saturated fat, and sucrose. The average student intake during school hours was also related to school size, socioeconomic status, and location.

Results and Discussion of Study of Eating Patterns

Questionnaires from schools with a total enrollment of 10,866 students were analyzed. The breakdown by grade, school, and sex was as follows:

		Number of students		
Grade level	Schools	Males	Females	Total
Fourth	192	—	—	7,306
Eighth	47	855	1,067	1,922
Eleventh	40	768	870	1,638
Total	279			10,866

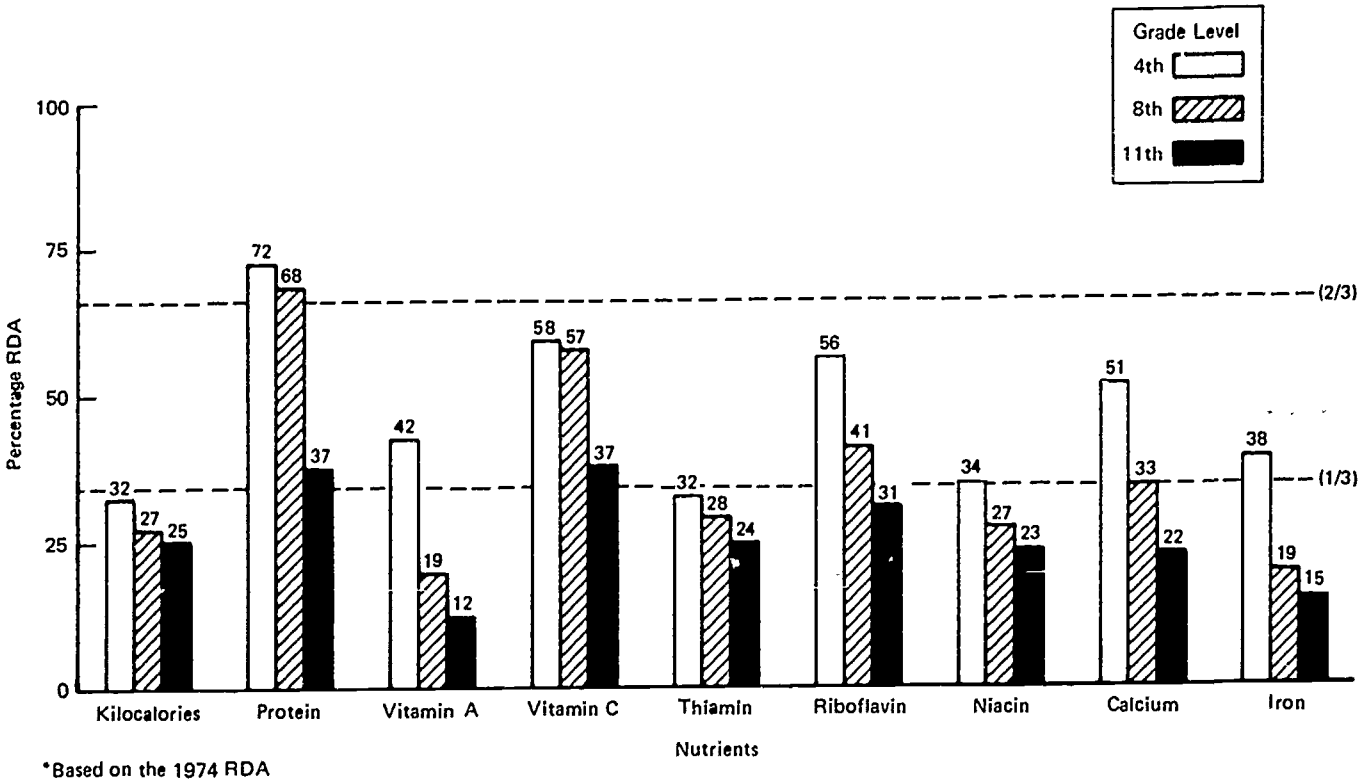
Data for male and female students were not reported separately for fourth grade because, unlike eighth and eleventh grades, the RDA are identical for this group of students.

Student Intake of Calories and Eight Nutrients. Student intake was analyzed by school and summarized by school level. Average nutrient intake for each school was calculated by dividing total nutrients consumed at each time of the school day and from each food source by the number of completed questionnaires. A level of one-third of the RDA was used to evaluate nutrient adequacy during school hours.

The total nutrient intake during school hours at the three grade levels is illustrated in Figure II-1. The average nutrient intake of males and females was used for each grade. For each nutrient shown, fourth-grade students had the highest intake, followed by eighth-grade and eleventh-grade students. Only protein intake exceeded two-thirds of the RDA (fourth and eighth grades). The lowest intakes were for vitamin A and iron (eighth and eleventh grades). Eighth-grade students consumed less than one-fifth their recommended daily allowance of iron and vitamin A during school hours; whereas eleventh-grade students consumed less than one-sixth their recommended daily allowance of vitamin A and iron during school hours.

The high percentage of protein, riboflavin, and calcium and the low percentages of iron can be accounted for by the high intake of milk and other dairy products reported on the questionnaires. The low percentages of vitamin A are a reflection of the low intake of carotene-rich vegetables and organ meats; whereas the high percentages of vitamin C indicate a high intake of citrus fruits and juices (or drinks fortified with vitamin C).

Times of Food Consumption. The data in Tables II-8, II-9, and II-10 show that, at all grade levels, students consumed the highest amounts of nutrients at lunch. Fourth-grade students consumed almost two-thirds of the RDA for protein and one-half of the RDA for vitamin C and riboflavin at lunch. The intake of calories and the remaining nutrients approached or exceeded the suggested one-third RDA level. Morning snacks contributed between 2 and 4 percent of the RDA for calories and for all eight nutrients. Vitamin C was the highest nutrient consumed before class time and at the afternoon snack (3 to 4 percent of the RDA, respectively).



*Based on the 1974 RDA

Fig. II-1. Average Caloric and Nutrient Intake by Fourth-, Eighth-, and Eleventh-Grade Students During School Hours (Reported in Percentages of RDA*)

For eighth-grade students at lunch, only protein, vitamin C, and riboflavin intakes were one-third or more of the RDA. The lowest intakes at lunch for both sexes were vitamin A and iron. Vitamin C and protein were consumed in the highest amounts during all four time periods, consumption of vitamin A and iron was the lowest. Male eighth-grade students generally consumed more than female students. The largest differences were for intake of protein and calcium.

At the eleventh-grade level at lunch, only protein met the suggested one-third RDA level, with the remaining seven nutrients ranging between 8 and 26 percent of the RDA. The lowest intakes at lunch for both sexes were vitamin A and iron. The nutrient intake between male and female students varied considerably, with male students consuming much higher amounts of protein, vitamin C, and calcium. Total vitamin A intake for the school day was very low (12

TABLE II-8

Average Caloric and Nutrient Intake by Fourth-Grade Students at Various Times During School Hours (Reported in Percentages of RDA) N=192 schools

	Percent of the Recommended Daily Allowance[a]								
Time	*KCal*[b]	*Protein*	*Vit. A*	*Vit. C*	*Thiamin*	*Riboflavin*	*Niacin*	*Calcium*	*Iron*
Before class	1.15	2.55	0.94	3.15	1.44	2.33	1.21	2.12	1.25
A.m. snack	2.77	4.24	2.31	3.59	2.14	3.77	1.68	3.71	2.55
Lunch	27.69	64.50	38.57	48.80	28.10	49.06	30.30	44.71	33.63
P m. snack	0.80	0.80	0.63	2.60	0.55	0.64	0.43	0.58	0.75
Total	32 41	72.09	42.45	58.14	32.23	55.80	33.62	51.12	38.18

[a]Based on the 1974 RDA

[b]Kilocalories

NOTE. Data for males and females are not reported separately, because the RDA are identical in this age group.

TABLE II-9

Average Caloric and Nutrient Intake by Eighth-Grade Students at Various Times During School Hours (Reported in Percentages of RDA) N=47 schools

	Percent of the Recommended Daily Allowance[a]								
Time	*KCal*[b]	*Protein*	*Vit. A*	*Vit. C*	*Thiamin*	*Riboflavin*	*Niacin*	*Calcium*	*Iron*
Males									
Before class	1.83	4.15	1.14	8.06	3.29	2.86	1.71	2.52	1.60
A.m. snack	2.72	5.09	1.55	7.72	2.77	3.37	1.66	2.97	1.71
Lunch	20.26	60.57	14.26	39.63	20.32	33.23	22.64	28.98	15.89
P m snack	1 75	3.14	0.80	1.89	1.30	1.72	1.35	1.43	1.13
Total	26.56	72.95	17.75	57.30	27.68	41.18	27.36	35.90	20.33
Females									
Before class	1.25	2.32	0.53	2.76	1.54	1.74	0.83	1.44	0.75
A.m. snack	2.60	3.98	1.52	7.86	3.09	2.23	1.74	1.79	1.57
Lunch	22.22	54.27	16.91	43.50	22.54	34.82	22.82	26.08	14.77
P.m snack	1.63	2.17	0.70	1.59	1.34	1.09	1.13	1.02	0.76
Total	27.70	62.74	19.66	55.71	28.51	39.88	26.52	30.33	17.85

[a]Based on the 1974 RDA.

[b]Kilocalories

TABLE II-10

Average Caloric and Nutrient Intake by Eleventh-Grade Students at Various Times During School Hours (Reported in Percentages of RDA) N=40 schools

Time	Percent of the Recommended Daily Allowance[a]								
	KCal.[b]	Protein	Vit. A	Vit. C	Thiamin	Riboflavin	Niacin	Calcium	Iron
Males									
Before class	1.65	2.48	0.80	5.68	1.48	2.72	1.10	2.30	0.93
A.m. snack	5.18	7.17	2.94	10.19	5.14	7.11	3.01	5.69	2.89
Lunch	18.93	32.46	8.03	25.78	19.54	24.76	19.11	19.94	13.33
P.m. snack	1.81	2.09	0.39	2.23	2.54	1.20	1.54	1.06	1.21
Total	27.57	44.20	12.16	43.88	28.70	35.79	24.76	28.99	18.36
Females									
Before class	1.04	1.29	0.68	4.46	1.20	1.51	0.77	1.05	0.51
A.m. snack	4.08	4.12	2.07	6.45	3.32	3.80	2.71	2.16	1.75
Lunch	14.76	21.95	8.56	18.24	13.78	18.79	15.80	11.79	7.69
P.m. snack	1.96	1.83	0.42	1.92	1.63	1.33	1.76	0.94	0.80
Total	21.84	29.19	11.73	31.07	19.93	25.43	21.04	15.94	10.75

[a]Based on the 1974 RDA.

[b]Kilocalories

percent RDA, compared to the suggested one-third RDA) for both male and female students; whereas iron intake was very low for females (11 percent RDA).

Sources of Foods and Beverages. The data obtained regarding sources of foods and beverages, calculated in percentage of RDA, does not indicate the nutritional adequacy of a food source. It identifies the proportion of student intake from that source compared to the total student intake during school hours.

Data in Table II-11 show that, for fourth-grade students, the school provided the highest proportion of nutrients, followed by home and other. From school as a source of nutrients, the intake for five of the eight nutrients and for calories equaled or exceeded one-third of the RDA; protein and riboflavin were particularly high. This consumption could be attributed to meats or meat alternates and milk, which are components of the Type A lunch.

From home as a source, the nutrients provided to fourth-grade students in the highest amounts were protein and vitamin C. This consumption could be attributed to the peanut butter and meat sandwiches and citrus fruits, juices, and fortified drinks brought from home.

TABLE II-11

Average Caloric and Nutrient Intake by Fourth-Grade Students from Various Sources During School Hours (Reported in Percentages of RDA) N=192 schools

Food source	Percent of the Recommended Daily Allowance[a]								
	KCal	Protein	Vit. A	Vit. C	Thiamin	Riboflavin	Niacin	Calcium	Iron
School	19.93	51.90	33.95	38.11	19.30	42.28	20.14	39.90	22.43
Home	11.56	19.05	7.78	18.44	12.24	12.83	12.87	10.60	14.83
Other	0.87	1.09	0.64	1.56	0.65	0.67	0.59	0.60	0.88
Total	32.36	72.04	42.37	58.11	32.19	55.78	33.60	51.10	38.14

[a]Based on the 1974 RDA.

NOTE: Data for males and females are not reported separately, because the RDA are identical in this age group.

Data in Table II-12 show that both male and female eighth-grade students also received the largest proportion of nutrients from the cafeteria. For males, the next highest sources were generally snack bar, home, other, and vending machines. For females, the next highest sources were usually the snack bar, other, and vending machines.

The cafeteria provided approximately one-third of the RDA for protein, vitamin C, and riboflavin. Iron and vitamin A intake were the lowest nutrients ingested from this source. Protein and vitamin C were also the highest nutrients obtained from all other sources. This finding could be attributed to the meat, meat alternate, fruit/vegetable, and milk components of the Type A lunch.

Vending machines contributed only a small percentage to nutrient intake at the eighth-grade level with the exception of a high vitamin C intake by female students. This variation reflected data from one intermediate school where female students reported a high consumption of fruit juices and frozen juice bars from vending machines.

Data in Table II-13 show, for both sexes at the eleventh-grade level, that the largest proportion of nutrients was obtained from the cafeteria, followed by home, snack bar, other, and vending machine. Five of the nutrient intake totals from all sources met approximately one-third of the RDA requirement. However, no one food source provided as much as one-third of the RDA for any of the nutrients. The categories "vending machines" and "other" contributed only a small proportion of nutrients for both sexes at the eleventh-grade level.

Comparison of Student Intake Among Grade Levels. The following are results of comparing student intake on the basis of sex, school size, socioeconomic status, and school location.

In general, male intake was higher than female intake, with the greatest differences being found at the eleventh-grade level. Eighth-grade male intake surpassed female intake for all nutrients except calories, vitamin A, and thiamin. The greatest differences were for protein, with males consuming a higher amount.

Within each school grade level, generally little variation was noted in RDA percentages by school size. Those students who did show intakes of higher percentages of the RDA were generally in small-size elementary and intermediate schools and medium-size high schools.

TABLE II-12

Average Caloric and Nutrient Intake by Eighth-Grade Students from Various Sources During School Hours (Reported in Percentages of RDA) N=47 schools

Food source	Percent of the Recommended Daily Allowance[a]								
	KCal	Protein	Vit A	Vit. C	Thiamin	Riboflavin	Niacin	Calcium	Iron
Males									
Cafeteria	14.50	46.81	12.65	37.91	14.91	28.20	15.37	25.47	11.18
Snack bar	5.17	11.48	2.20	9.00	4.17	6.63	3.53	5.72	3.21
Vending machine	0.24	0.49	0.02	0.52	0.30	0.20	0.26	0.08	0.21
Home	4.89	11.09	2.33	7.67	5.44	4.53	6.55	3.22	4.34
Other	1.76	3.10	0.56	2.20	2.87	1.62	1.67	1.43	1.39
Total	26.56	72.97	17.76	57.30	27.69	41.18	27.38	35.92	20.33
Females									
Cafeteria	14.71	40.05	13.93	32.00	15.18	27.15	14.48	20.94	9.95
Snack bar	5.57	9.47	2.45	9.69	4.23	6.31	3.59	4.82	2.69
Vending machine	0.53	0.79	0.29	3.99	0.55	0.58	0.37	0.37	0.25
Home	5.41	10.34	2.63	8.41	6.65	4.83	7.00	3.20	4.09
Other	1.48	2.09	0.36	1.62	1.89	1.03	1.06	0.98	0.89
Total	27 70	62.74	19.66	55.71	28.50	39.90	26.50	30.31	17.87

[a]Based on the 1974 RDA.

TABLE II-13

Average Caloric and Nutrient Intake by Eleventh-Grade Students from Various Sources During School Hours (Reported in Percentages of RDA) N=40 schools

Food source	Percent of the Recommended Daily Allowance[a]								
	KCal.	Protein	Vit. A	Vit. C	Thiamin	Riboflavin	Niacin	Calcium	Iron
Males									
Cafeteria	11.63	20.91	6.72	21.10	10.69	18.69	9.93	15.69	7.36
Snack bar	4.43	6.29	1.51	8.52	3.53	5.59	2.88	5.02	2.54
Vending machine	0.58	0.42	0.10	0.47	0.25	0.21	0.29	0.20	0.23
Home	6.78	9.91	2.95	8.68	7.82	7.19	6.94	5.24	4.77
Other	4.14	6.68	0.88	5.11	6.36	4.10	4.73	2.84	3.46
Total	27.56	44.21	12.16	43.88	28.70	35.78	24.77	28.99	18.36
Females									
Cafeteria	8.83	13.76	6.75	11.96	7.88	12.75	8.27	7.78	4.30
Snack bar	3.75	4.90	1.33	6.57	3.21	4.43	3.81	2.76	1.84
Vending machine	0.78	0.52	0.16	0.57	0.28	0.47	0.36	0.34	0.18
Home	4.27	5.49	2.71	8.93	5.15	4.53	5.26	2.66	2.64
Other	4.22	4.54	0.79	3.05	3.41	3.35	3.32	2.46	1.78
Total	21.85	29.21	11.74	31.08	19.93	25.53	21.02	16.00	10.74

[a]Based on the 1974 RDA.

The percentage of student enrollment from families receiving Aid to Families with Dependent Children (AFDC) was the basis for comparing intake among grade levels with respect to socioeconomic status. No significant differences ($P > 0.05$) were found in RDA percentages at any socioeconomic level.

At the elementary level, data from rural schools indicated the highest percentages of the RDA for all nutrients except vitamin C, which was highest in urban schools. Although intermediate schools showed some variation, all but three schools at this level were suburban. No large RDA percentage differences were experienced between rural and suburban high schools.

Students Intake of Sodium, Saturated Fat, and Sucrose. Dietary intake of sodium, saturated fat, and sucrose (refined sugar) was reported for fourth, eighth, and eleventh grades. Comparisons between food sources and student intake were made.

At each grade level, the school or cafeteria was the main source of sodium, with home ranked as second. Eighth and eleventh-grade snack bars also provided a substantial amount of sodium; whereas vending machines contributed the least amount.

A comparison among grade levels showed that fourth-grade students consumed the largest amount of sodium during school hours. This consumption was equivalent to two-thirds of 1800 mg, the 1980 RDA maximum for daily intake of sodium for fourth-grade students. Eighth and eleventh-grade students, however, consumed during school hours slightly less than one-third of 2700 mg, the 1980 RDA maximum for sodium for such age levels.

This relatively large intake by fourth-grade students, combined with their high intakes of protein, calcium, and riboflavin, indicates that much of the sodium came from meat and dairy products. However, the amounts of sodium obtained from home for fourth-grade students was proportionately higher, compared to school as a source, than the amounts of other nutrients obtained from home. This comparison indicates that fourth-grade students obtained from home a larger proportion of salty foods, such as potato chips and processed meats.

Although eighth- and eleventh-grade students did not exceed one-third of their RDA recommended maximum levels for sodium, sources other than the cafeteria provided proportionately more sodium than other nutrients. Information on questionnaires revealed that large amounts of french fries, potato and corn chips, and processed meats were obtained from home, snack bar, vending machine, and other.

At each grade level, the cafeteria contributed the highest percentages of saturated fat. This indicates consumption of meats, whole milk, and other dairy products as components of the Type A lunch.

A comparison of total saturated fat intake among students at different grades showed that eighth-grade males had the highest consumption level, whereas eleventh-grade females had the lowest. This contrast can be attributed to the high meat intake by eighth-grade males and the low milk and meat intake by eleventh-grade females.

The patterns of sucrose consumption during school hours varied at each grade level. Home contributed the highest percentage of sucrose for fourth-grade students; whereas snack bars contributed the highest percentage for eighth and eleventh-grade students.

Vending machines and other sources provided a relatively large proportion of sucrose compared to the percentages of RDA that they provided for other nutrients. The main sources of sucrose from vending machines were reported as candy, cakes, cookies, sweetened beverages, and other desserts.

The U.S. Dietary Goals recommend that the maximum intake of saturated fat or refined sugar (sucrose) fall within 10 percent of total daily calories. At all three grade levels, the saturated fat intake by both males and females exceeded this goal. For sucrose, only the intake by eleventh-grade females was found to exceed the recommended 10 percent. These data are summarized in Table II-14.

The consumption of sodium, saturated fat, and sucrose in relation to socioeconomic status was analyzed. Although some variations existed among each of the food constituents and grade levels, significant relationships ($P > 0.05$) were not found.

Eating Patterns During a 24-hour Period

Twenty-four hour dietary recall interviews were used to determine the daily food intake and the total nutrient consumption of students during school hours and those obtained during the remainder of the 24-hour period (home hours). On-site visits were conducted at 30 elementary schools, 27 intermedite schools, and 27 high schools. Whenever possible, a sample of ten students from the fourth, eighth, and eleventh grades, respectively, was interviewed.

Methodology for Studying Eating Patterns

The data collected were classified by location of food consumption (school or home), school attended, sex, and ethnic background. The amount of food consumed by each student during school and home hours was recorded separately by weight (gm). Mean values for total calories and eight major nutrients were calculated. Data on male and female nutrient intakes were reported separately for all grade levels.

The Ohio State Nutritional Data Base (1978) Program NUTRIENT was used for nutrient intake analysis. The average daily consumption in RDA percentages for calories and eight nutrients (protein, vitamin A, vitamin C, thiamin, riboflavin, niacin, calcium, and iron) was determined. The average daily consumption of sodium, saturated fat, and sucrose (refined sugar) was also computed and compared to levels suggested by the U.S. Dietary Goals and the 1980 RDA.

TABLE II-14

Comparison of Calories from Saturated Fat and Sucrose to Total Calories Consumed by Students During School Hours

Grade level and sex	*Average total KCal.*	*Average KCal. saturated fat*	*Percent of total KCal.*	*Average KCal. sucrose*	*Percent of total KCal.*
Fourth grade					
Male and female[a]	776.64	107.73	13.87	59.12	7.61
Eighth grade					
Male	743.68	116.73	15.70	56.20	7.56
Female	664.80	96.84	14.57	58.96	8.87
Average	705.38	106.83	15.15	57.60	8.17
Eleventh grade					
Male	826.80	103.77	12.55	74.20	8.97
Female	458.85	55.71	12.14	56.12	12.23
Average	630.11	79.74	12.65	65.16	10.34

[a]Males and females are not reported separately for fourth grade, because the RDA are identical in this age group.

TABLE II-15

Distribution of Students According to Grade Level, Sex, and Ethnic Background

Grade level	Number of schools	Sex			Number of students, by ethnic background							
		Male	Female	Total	White	Spanish surname	Black	Asian	Filipino	American Indian	Unclassified	Total
Fourth	30	143	153	296	205	46	11	6	1	0	27	296
Eighth	27	112	143	255	154	65	13	8	1	0	14	255
Eleventh	27	107	118	225	169	27	5	4	0	1	19	225
Total	84	362	414	776	528	138	29	18	2	1	60	776
Ethnic Composition (percent)												
24-hour recall study		46.6	53.4	100	68.9	16.7	3.8	2.3	0.3	0.1	7.8	99.9
Students in California public schools		—	—	—	63.5	20.8	10.1	3.5	1.2	0.9	—	100
Students in sample schools participating in study		—	—	—	72.0	18.9	4.5	2.7	0.9	1.1	—	100

Results and Discussion of the Study of Eating Patterns

This section is based on the results of on-site interviews with 776 students. The distribution by grade level, sex, and ethnic background of the students interviewed is summarized in Table II-15.

Ethnic background was determined by interviewer judgment, because this information was not available from the questionnaires. If there was uncertainty as to a student's ethnic background, the student was placed in the unclassified category.

Comparisons of calories and the eight nutrients consumed by students at all three levels were used to identify student nutrient consumption patterns. Intake levels of sodium, saturated fat, and sucrose were also computed and compared to suggested levels.

Nutrient Intake Comparison for All Students by Sex, Grade Level, and Location. Consumption values for calories and each of the eight major nutrients for all three grade levels are compared in Figure II-2. Although variations were found among individual nutrient intakes, only the average nutrient intake is presented.

For 24-hour recall calculations, a consumption level of 100 percent RDA was used for calories and each nutrient to evaluate intake. One-third of the RDA was used as a basis for evaluating school-hour intake.

Calories and all nutrients except iron were consumed by fourth-, eighth-, and eleventh-grade students at levels approaching or exceeding the RDA for the 24-hour period. Iron intake was particularly low for eighth- and eleventh-grade females. Data in Figure II-2 for the 24-hour period show that males consumed more of each nutrient than did females at each grade level. The sole exception was the eighth-grade male consumption of vitamin A. The greatest consumption by males and females for each grade was for protein and vitamin C.

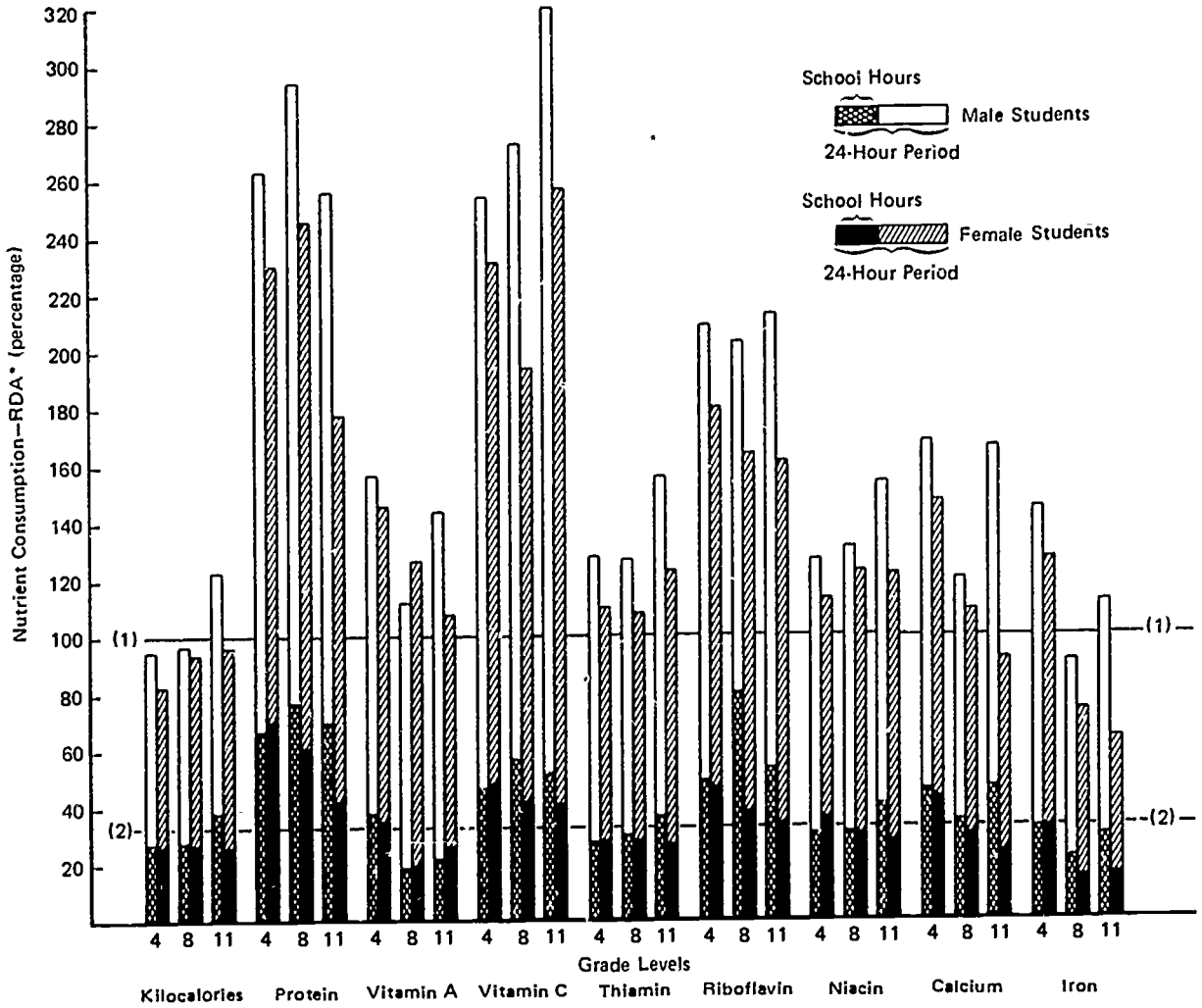
At school, the ingestion of iron was low for both sexes at the eighth-grade and eleventh-grade levels, with female students consuming less than male students. Total consumption of most nutrients, as expressed in percentages of RDA, was highest for fourth-grade students and lowest for eleventh-grade students.

Nutrient Intake Comparison by Grade Level for Different Ethnic Groups. The ethnic composition of students was representative of the California population, except for the black ethnic group. However, the sampling of Asian, Filipino, and American Indian students, as well as that for black students, was too small to permit statistical analysis. Only the results of nutrient consumption for white and Spanish surname students were, therefore, included in the following comparisons.

Data in Figure II-3 show that white students generally consumed higher percentages of calories and nutrients at each grade level than Spanish surname students did. Although the consumption of all nutrients by all grade levels approached or exceeded 100 percent RDA for a 24-hour period, the intake of iron by the eighth-grade white and Spanish surname groups and the eleventh-grade Spanish surname group were much lower than the RDA. Students in both ethnic groups at all grade levels consumed protein and vitamin C in amounts 200 percent or more above the RDA.

At school, the eighth- and eleventh-grade white and Spanish surname students consumed iron in amounts below the suggested one-third RDA. Vitamin A intake by eighth-grade white and Spanish surname students was lowest among the three grade levels during school hours.

Student Consumption of Sodium, Saturated Fat, and Sucrose. Maximum daily consumption levels of sodium for different age groups have been recommended by the 1980 RDA. The U.S. Dietary Goals suggest that a maximum of 10 percent each of the total calories consumed be derived from saturated fat and sucrose. Analysis of intake for these food constituents included the total for the 24-hour period, as well as percentages consumed at school and at home, respectively.



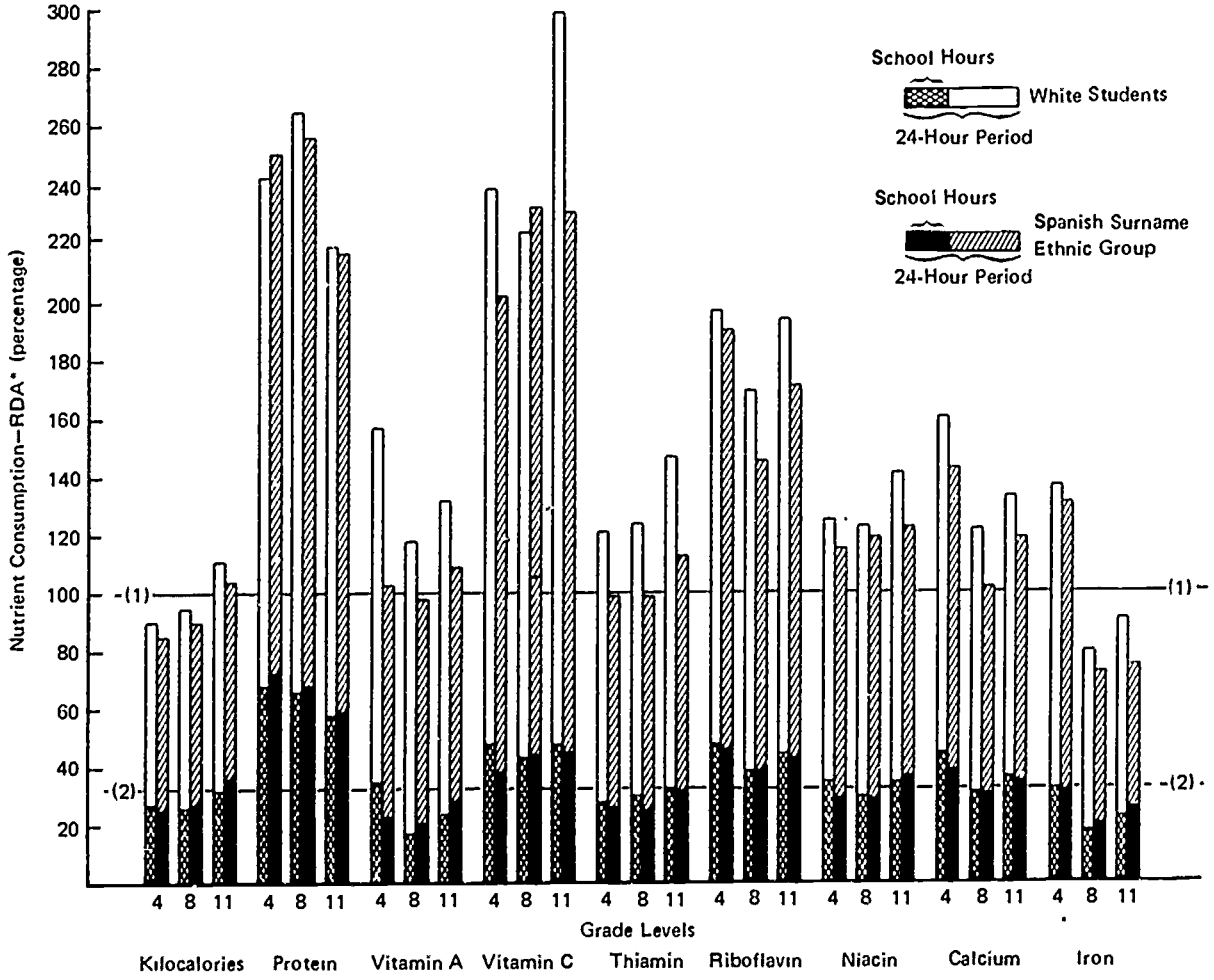
*Based on 1974 RDA
(1) 24-hour period—100 percent RDA.
(2) School Hours—33 percent RDA.

Fig. II-2. Average Nutrient Consumption of Students During 24-Hour Period

Sodium consumption by students during a 24-hour period is summarized in Figure II-4. The sodium intake of male and female students for all three grade levels exceeded the maximum level suggested by the 1980 RDA. Fourth-, eighth-, and eleventh-grade male students consumed greater amounts of sodium than female students did for each grade level. The sodium intake was highest for eleventh-grade male students and lowest for eleventh-grade female students. At school, eleventh-grade male students had the highest level of sodium consumption.

The percentage of saturated fat to calories in a 24-hour period and during school hours is shown in Figure II-5. During the 24-hour period, the saturated fat intake exceeded, at all grade levels, the suggested 10 percent maximum level. The amount of saturated fat consumed did not vary significantly by grade level or sex. Only nominal variation was seen in saturated fat intake during school hours when compared to consumption over the 24-hour period.

The percentage of sucrose to calories in a 24-hour period and during school hours is shown in Figure II-6. For all students, the intake of sucrose ranged from 7 to 11 percent of total calories. Eighth-grade males and eleventh-grade females consumed the highest percentages of calories from sucrose during the 24-hour period.



*Based on 1974 RDA

(1) 24-hour period—100 percent RDA.

(2) School Hours—33 percent RDA.

Fig. II-3. Average Nutrient Consumption by Ethnic Background During 24-Hour Period

At school, sucrose consumption varied by grade level and by sex. Fourth grade consumption by males was one-half of the recommended maximum of 10 percent of total calories. Eleventh-grade females showed the highest percentage of total calories; this intake was slightly higher than the suggested maximum level for refined sugar.

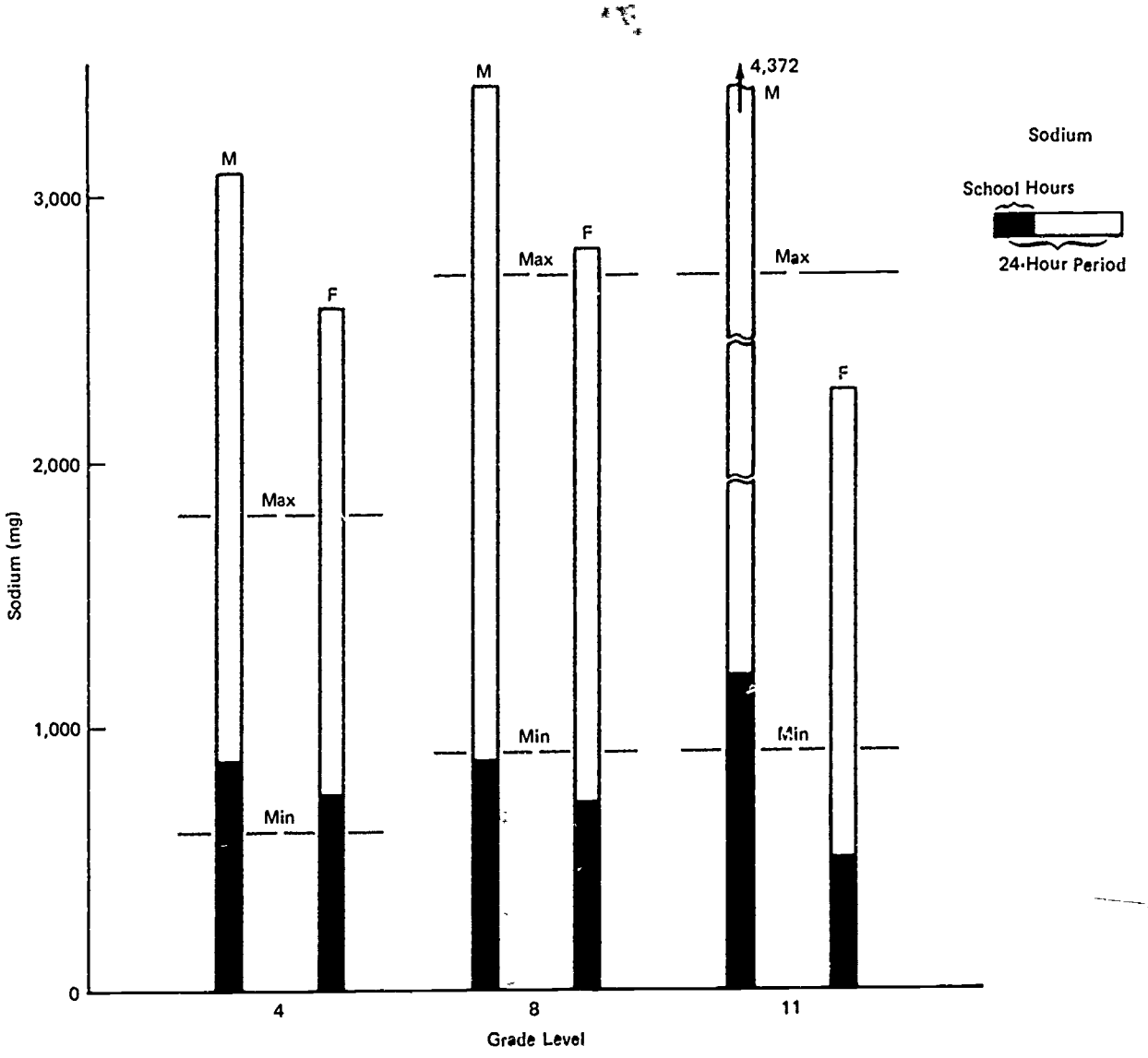
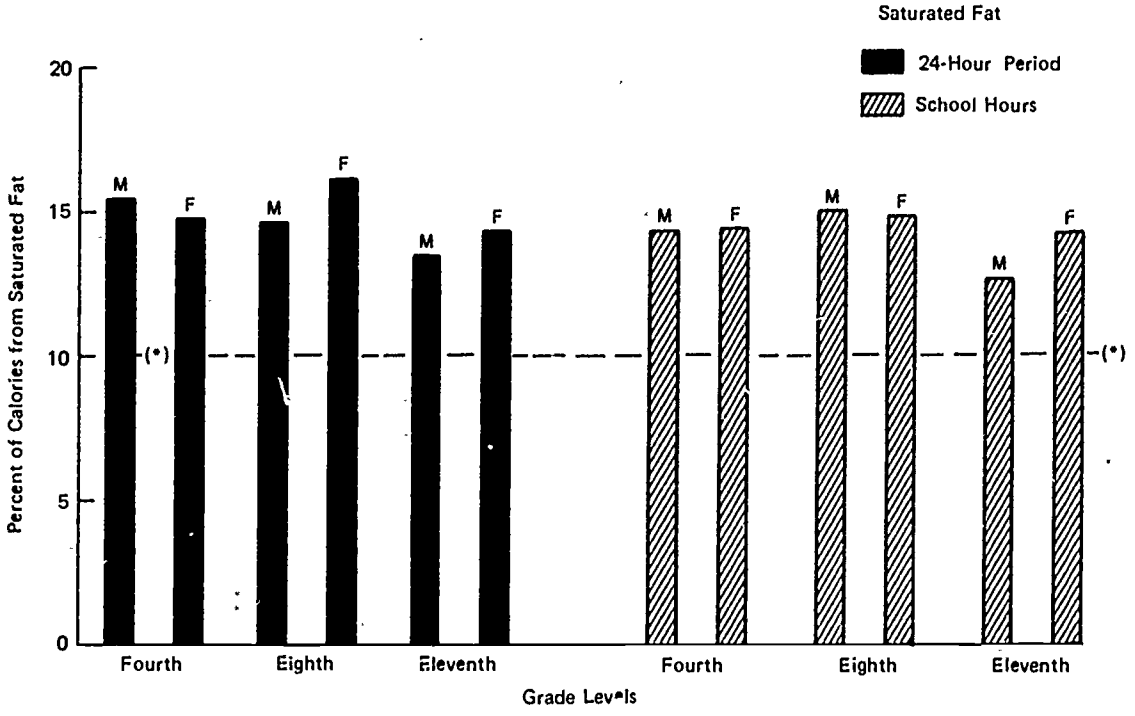
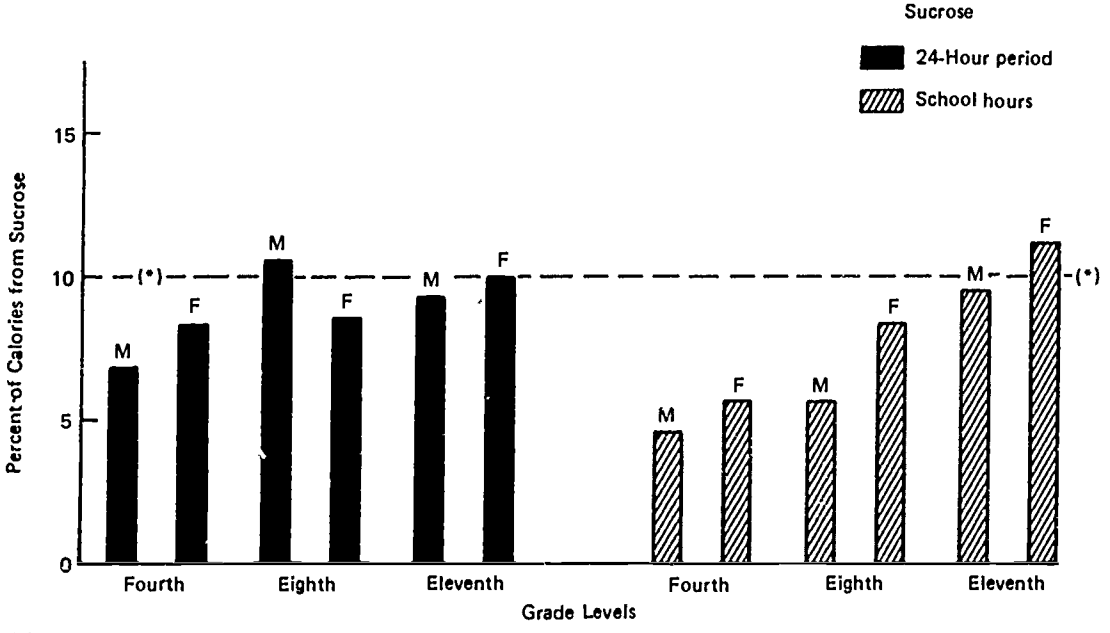


Fig. II-4. Sodium Intake for Students During 24-Hour Period



(*) Suggested Percentage of Calories from Saturated Fat (U.S. Congress, 1977).

Fig. II-5. Percentage of Saturated Fat to Calories in a 24-Hour Period and During School Hours



(*) Suggested Percentage of Calories from Sucrose (U.S. Congress, 1977).

Fig. II-6. Percentage of Sucrose to Calories in a 24-Hour Period and During School Hours

PART III

Findings and Recommendations

The following is based on the findings of this study for determining the quality of foods served to students at California public schools. The three areas investigated were: (1) food items available to students at school; (2) eating patterns of students at school; and (3) the eating patterns of students during a 24-hour period.

Findings of the Study

Food Items Available to Students at School

This portion of the summary represents one of the first attempts to examine foods that are available to students, the nutritional quality of those foods, and the locations at which, and the times during which, such foods are served. It also relates these data to school location, socioeconomic status, school size, and student ethnic background.

Types of Food Served. Determination of the types of foods served was based on a one-day sampling of food items available at each school. A total of 298 different food and beverage items was found to be available to students.

Nutritional Ratings. According to the nutritional rating system developed for this study, the foods available to students during school hours generally are of good nutritional quality. Those in elementary schools were rated the highest, followed by those in intermediate schools and then those in high schools. These same results were obtained when the nutritional ratings of foods in each school were weighted by the number of times they were served. Significant relationships were not found among nutritional ratings of schools and school location, socioeconomic status, or ethnic background of students.

Places Where Food Is Served. Foods were served by school food services, snack bars, student stores, vending machines, and regional occupational programs. Over 99 percent of all foods in elementary schools, over 90 percent of all foods in intermediate schools, and over 75 percent of all foods in high schools were served by the school food service. At the intermediate and high school levels, foods were also provided by student stores and vending machines. Only in high schools was a small percentage of the food served by regional occupational programs.

Over 50 percent of the high schools sampled had vending machines, almost all of which were unrelated to the school food service. Foods from vending machines had low nutritional ratings, because such machines frequently offered only soft drinks and candy.

Times When Food Is Served. Over 90 percent of all foods served in elementary schools were provided during lunchtime; 70 percent, in intermediate schools; and 52 percent, in high schools. Morning hours represented the most significant times, other than lunch, during which foods were served, with afternoons providing only small percentages.

One-Week Food Frequency Record. Foods available at elementary schools were basically only those served as components of the Type A (or reimbursable) lunch. At the intermediate school level, the variety increased and included candy, soft drinks, chips, ice cream, and other snack items. The largest variety of foods was offered in high schools. More sandwiches, "fast" foods, and snack items were served at high schools than were served at the other school levels.

Some Limitations. The primary concern in this study was the nutritional quality of foods served in the sample schools. Other quality considerations, such as freshness, taste, appearance, attractiveness of service, and the general atmosphere in which food is presented to the student, are at least as important in determining student acceptance and consumption. These factors were beyond the scope of this study, but they warrant formal investigation in their own right.

Basic recipes were used in most cases for calculating a reported food's nutritional rating. It was, therefore, impossible to consider any special methods or recipe modifications that might have been used to increase a food's nutritional value.

No implication is made, nor intended to be made, that foods should or should not be included in a child's diet. The attempt was only to rate individual foods on a relative scale of nutritional value.

Eating Patterns of Students During School Hours

The eating patterns of students in fourth, eighth, and eleventh grades were sampled as representative of elementary, intermediate, and high schools. Two areas of information were analyzed: (1) times when foods were eaten; and (2) sources of foods.

At all levels, lunchtime provided the largest majority of nutrients. Snacks, particularly morning snacks, also contributed significantly to student diets.

The school cafeteria, where the Type A (or reimbursable) lunch was usually served, was the main source of nutrients at all levels. Home and snack bars, respectively, were the next important sources of nutrients. Because of the limited number of vending machines found to be available and the generally low nutritional quality of foods provided by them, this source contributed little to student intake.

Nutritional Adequacy of Student Intake During School Hours. Based on the same standard as the Type A (or reimbursable) lunch, the nutritional adequacy of student intake during school hours was evaluated. In general, as grade level increased, nutritional adequacy declined.

Comparison Among Grade Levels. Elementary students consumed about one-third or more of the RDA for calories and the eight nutrients studied. Intermediate students met this standard for four of the eight nutrients: protein, vitamin C, riboflavin, and calcium. Only protein, vitamin C, and riboflavin approached or exceeded one-third of the RDA for high school students.

Comparative Levels of Nutrient Intake. Protein, vitamin C, and riboflavin were the nutrients consumed in the greatest quantities at all levels. Vitamin A and iron were the lowest nutrients for intermediate and high school students. Calorie, vitamin A, thiamin, and iron intakes were found to be less than one-third of the RDA for intermediate and high school students. Iron and vitamin A intakes were less than half of the suggested RDA for high school students.

Comparison of Male and Female Student Intake. Among intermediate and high school students, nutrient intake by male students during school hours was generally higher than that of female students. Compared to all other students, female high school students had the lowest calorie, iron, and vitamin A intakes.

Student Intake of Sodium, Saturated Fat, and Sucrose. For school hours, the intake of sodium for fourth-grade students was over two-thirds of the suggested RDA (1980) maximum daily level. Eighth- and eleventh-grade students consumed less than one-third of the recommended maximum daily amount. The average percentage of total calories from saturated fat at all levels exceeded that recommended by the U.S. Dietary Goals. The highest percentage of total calories from sucrose, which also exceeded the maximum recommended by the U.S. Dietary Goals, was consumed by female high school students, who also ingested the least amount of calories.

Demographic Correlations. The study did not indicate any significant relationships between student eating patterns and school size, socioeconomic status, or school location. However, this finding may have been influenced by the predominantly suburban, middle-class character of the students comprising the sample.

Eating Patterns of Students During a 24-Hour Period

The nutrient intake data were obtained from a sampling of students by the 24-hour recall interview method. Three categories of information were analyzed: (1) consumption by sex and grade level; (2) consumption by ethnic group; and (3) intake of sodium, saturated fat, and sucrose.

Student Nutrient Consumption by Sex and Grade Level. A summary of low and high nutrient intake by grade level is shown in Table III-1. With the exception of vitamin A for eighth-grade male and female students, the total consumption of calories and eight nutrients at all grade levels by male students was greater than that for female students. All nutrients were consumed in amounts approaching or exceeding the RDA, except for iron intake, by both eighth-grade male and female students and eleventh-grade female students. Both male and female students consumed protein and vitamin C in amounts approaching or exceeding 200 percent of the RDA.

Student Nutrient Consumption by Ethnic Group. Data in Table III-2 show the summary of low and high average nutrient intakes by grade level and ethnic background. In general, at each grade level those with Spanish surnames had a lower nutrient intake during the 24-hour period than white students did.

Student Intake of Sodium, Saturated Fat, and Sucrose. Sodium intake for all students, except eleventh-grade females, was greater than the 1980 RDA maximum for a 24-hour period. All male students consumed more sodium than female students did. At all levels the average percentage of saturated fat intake exceeded the maximum recommended by the U.S. Dietary Goals. Sucrose intake by all students approached the maximum recommended by the U.S. Dietary

TABLE III-1

Summary of Low (L) and High (H) Nutrient Intake, by Grade Level[a]

	Fourth grade				Eighth grade				Eleventh grade			
	Male		Female		Male		Female		Male		Female	
Nutrient	S[b]	T[c]	S	T	S	T	S	T	S	T	S	T
Kilocalories	L[d]		L									
Protein	H[e]	H[f]	H	H	H	H	H	H	H	H		
Vitamin A					L		L		L		L	
Vitamin C		H		H		H		H		H		H
Thiamin												
Riboflavin		H			H	H				H		
Niacin												
Calcium											L	
Iron					L		L	L[g]			L	L

[a]Based on 1974 RDA.
[b]S = school hours—33 percent RDA.
[c]T = 24-hour period—100 percent RDA.
[d]L = Low—approximately <25 percent RDA.
[e]H = High—approximately >60 percent RDA.
[f]H = High—approximately >200 percent RDA.
[g]L = Low—approximately <80 percent RDA.

TABLE III-2

Summary of Low (L) and High (H) Nutrient Intake, by Grade Level and Ethnic Background[a]

	Fourth grade				Eighth grade				Eleventh grade			
	White		Spanish surname		White		Spanish surname		White		Spanish surname	
Nutrient	S[b]	T[c]	S	T	S	T	S	T	S	T	S	T
Kilocalories	L[d]		L		L		L					
Protein	H[e]	H[f]	H	H	H	H	H	H	H	H	H	H
Vitamin A			L		L		L		L		L	
Vitamin C		H		H		H		H		H		H
Thiamin							L					
Riboflavin		H		H								
Niacin												
Calcium												
Iron					L	L[g]	L	L	L		L	L

[a]Based on 1974 RDA.
[b]S = school hours—33 percent RDA.
[c]T = 24-hour period—100 percent RDA.
[d]L = Low—approximately <25 percent RDA.
[e]H = High—approximately >60 percent RDA.
[f]H = High—approximately >200 percent RDA.
[g]L = Low—approximately <80 percent RDA.

Goals, with eighth-grade males and eleventh-grade females consuming the highest amounts. Eleventh-grade females, who consumed the least number of calories, exceeded the maximum intake of sucrose as recommended by the U.S. Dietary Goals.

Some Limitations. Further studies of this depth and scope are recommended to obtain more extensive data regarding student total daily food intake—again employing the 24-hour dietary recall interview technique. To increase the accuracy of nutrient consumption analysis, a greater number of students from each grade level, including a balance of ethnic groups, should be sampled and interviewed. The ethnic background of students should be provided to the researchers.

Recommendations from the Study

The results of this study point toward the desirability of fulfilling the following recommendations:

1. **Continue the support and improvement of the Type A (reimbursable) school lunch program.** The cafeteria Type A lunch was found to be the most nutritious source of food on campus at every school level. It should have increased support from all segments of the state and local school community. This objective could be attained through student participation in menu planning committees and other forms of student involvement, programs bringing food service personnel and students together in joint classroom discussions, and better training of food service personnel to ensure the preparation and serving of high-quality, attractive food.

2. **Provide nutritious foods at alternate food services.** In view of changing eating patterns by students and the popularity of alternate food services on campus, a higher proportion of nutritious foods should be made available from snack bars, vending machines, and student stores, and during special food sales on campus than are now being made available. It is imperative that nutrition professionals define more clearly the term *nutritious foods,* develop practical guidelines related to this definition, and disseminate this information to food service managers. In addition, the alternate food services should be monitored frequently to ensure that a majority of the foods available from these sources are nutritious. Such sources should not be used to replace the school lunch but should offer similarly nutritious food choices for students who do not eat in the cafeteria.

Since snacks have been found to contribute significantly to student intake at school, they should include a large proportion of nutritious foods. Consideration should also be given to timing the morning snack so that lunchtime food consumption is not affected.

3. **Provide nutrition education at all school levels.** Creative approaches to nutrition education are needed to effectively teach students and parents the important relationships among nutrition, health, and general well-being and to aid students and parents in making wise food choices. Such orientation and learning is especially important at the high school level, where peer pressure and other sociological factors are often opposed to sound nutritional practices.

4. **Initiate further study.** Additional research using a larger sample regarding foods available on campus and student eating patterns is needed to provide further data that will be more truly representative of all California public schoolchildren. Such a sample should ensure the inclusion and participation of more large urban school districts. More comprehensive studies also could include other factors affecting food quality and acceptance by students. Typical of such elements are physical properties of foods served, characteristics of school eating environments, and chemical analysis of the nutrient content of foods available to students.

5. **Determine the relationship between foods available and health status.** Further study should be conducted to determine the relationship between the nutritional quality of foods served in schools and the nutritional and health status of students.

APPENDIX I

Senate Bill Requiring the Study of the Nutritional Value of Food Served in the Public Schools

Senate Bill No. 654

CHAPTER 1003

An act relating to school food.

[Approved by Governor September 22, 1977. Filed with Secretary of State September 23, 1977.]

LEGISLATIVE COUNSEL'S DIGEST

SB 654, Mills. School food: nutrition.

There is no requirement, under existing law, that the Department of Education conduct a study of the nutritional value of food served in public schools.

This bill would require the Department of Education to do so, with the cooperation of the State Department of Health, and report thereon, after review and approval by the State Board of Education, to the Legislature by February 1, 1979.

The people of the State of California do enact as follows:

SECTION 1. The Legislature finds and declares that the proper nutrition of children leads to better health and educational attainment and fewer behavior problems. Proper nutritional habits are learned in the home and in the school. It is important that learning be reinforced by good nutritional practices and that the food available to children in the schools offer the best nutritional values.

There are indications that the foods available for sale in many school districts, including the school food program, do not meet adequate nutritional standards and contribute to the development of health problems, such as dental disease, obesity, hyperactivity, and other chronically debilitating diseases. These conditions have a lasting impact on both physical and social functioning.

Consequently, there is a need to study the foods offered for sale in the schools to determine the nutritional quality of these foods and their influence on the current and future health of California's children. The study shall place special emphasis on the need to identify and eliminate low nutritional food, and shall use United States Department of Agriculture guidelines to assess nutrient food values.

SEC. 2. The Department of Education shall conduct a statewide study of foods available to children in the public schools which shall include: (a) foods available for sale on school campuses, including the school food program, and (b) eating habits of students during the schoolday. The study shall include a review of available research regarding the relationship between nutrition and student achievement, behavior, and health conducted within the state and elsewhere. The Department of Education shall recommend to the Legislature appropriate measures to ensure proper nutritional practices in the public schools. The Child Nutrition Advisory Council shall review and comment upon the design and conduct of the study and make recommendations, where appropriate, to the State Board of Education.

SEC. 3. The Department of Education shall submit its report to the Legislature by February 1, 1979. The Department of Education shall submit its report to the State Board of Education for review and approval prior to submission to the Legislature.

SEC. 4. The State Department of Health shall cooperate in this study and furnish such information as requested by the Department of Education.

Other Publications Available from the Department of Education

A Summary of the Study of the Nutritional Quality of Food Available and the Eating Habits of Students in California Public Schools is one of approximately 450 publications that are available from the California State Department of Education. Some of the more recent publications or those most widely used are the following:

Accounting Procedures for Student Organizations (1979)	$1.50
Bilingual Program, Policy, and Assessment Issues (1980)	3.25
California Private School Directory	5.00
California Public School Directory	11.00
California Public Schools Selected Statistics	1.50
California School Accounting Manual (1981)	2.50
California Schools Beyond Serrano (1979)	.85
California's Demonstration Programs in Reading and Mathematics (1980)	2.00
Discussion Guide for the California School Improvement Program (1978)	1.50*†
District Master Plan for School Improvement (1979)	1.50*
Education of Gifted and Talented Pupils (1979)	2.50
Establishing School Site Councils: The California School Improvement Program (1977)	1.50*†
Foreign Language Framework for California Public Schools (1980)	2.50
Guide to California Private Postsecondary Career Education (1980)	5.00
Guide to School and Community Action (1981)	1.75
Guidelines and Procedures for Meeting the Specialized Health Care Needs of Students (1980)	2.50
Guidelines for School-Based Alcohol and Drug Abuse Programs (1981)	1.00
Handbook for Planning an Effective Reading Program (1979)	1.50*
History—Social Science Framework for California Public Schools (1981)	2.25
Improving the Human Environment of Schools (1979)	2.50
Instructional Materials Approved for Legal Compliance (1981)	3.50
Interim Guidelines for Evaluation of Instructional Materials with Respect to Social Content (1981)	1.50
Manual of First Aid Practices for School Bus Drivers (1980)	1.25
Monograph on Staff Development (1980)	1.50
New Era in Special Education: California's Master Plan in Action (1980)	2.00
Pedestrian Rules of the Road in California—Primary Edition (1980)	1.50
Physical Performance Test for California, Revised Edition (1981)	1.50
Planning for Multicultural Education as a Part of School Improvement (1979)	1.25*
Planning Handbook (1978)	1.50*
Proficiency Assessment in California: A Status Report (1980)	2.00
Proficiency Skill Development Kit (1980)	7.50
Putting It Together with Parents (1979)	.85†
Reading Framework for California Public Schools (1980)	1.75
Relationship Between Nutrition and Student Achievement, Behavior, and Health (1980)	4.00
Science Framework for California Public Schools (1978)	1.65
School Improvement: Making California Education Better (brochure) (1981)	NC*
Student Achievement in California Schools	1.25
Students' Rights and Responsibilities Handbook (1980)	1.50†
Teaching About Sexually Transmitted Diseases (1980)	1.65
Toward More Human Schools (1981)	1.75

Orders should be directed to:

California State Department of Education
P.O. Box 271
Sacramento, CA 95802

Remittance or purchase order must accompany order. Purchase orders without checks are accepted only from government agencies in California. Sales tax should be added to all orders from California purchasers.

A complete list of publications available from the Department may be obtained by writing to the address listed above.

†Also available in Spanish, at the price indicated.
*Developed for implementation of School Improvement.

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