MEDICAL EVALUATION OF NUTRITIONAL STATUS[1]

VIII. THE SCHOOL LUNCH AS A METHOD FOR IMPROVING DIETS OF HIGH SCHOOL STUDENTS

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IT has often been suggested that the school lunch offers an opportunity to make up some of the deficiencies in the home diet of school children and to influence their food habits. The extent to which a high school cafeteria can function with respect to these two objectives is uncertain and no experimental work in this field has come to our attention. The relative frequency and extent of deficiencies of essential nutrients in diets, it is believed, afford a reasonable guide for needed modifications in dietary habits of special groups of the population. In a previous report (1), the prevalence of diets below recommended allowances for specific food elements was presented for a high school group in New York City. This information is utilized in the present report as a basis for suggestions for improving the school lunch as a source of the food values which were most commonly deficient. In New York City, a majority of students in public high schools purchase lunch in the school cafeteria, many others who carry lunch to school purchase some supplementary food, and a small group receive free lunches. Through careful planning of food items offered for sale, and some attention to making the more nutritious items attractive, psychologically and economically, the school cafeteria has an opportunity to influence the consumption level of essential food elements.

Diet histories, obtained by interview, were available for 2,037 pupils as part of an investigation on Medical Evaluation of Nutri-

[1] This paper is the eighth of a series from a cooperative investigation by the United States Public Health Service, Division of Public Health Methods; the Cornell University Medical College, Department of Public Health and Preventive Medicine and Department of Pediatrics; the Milbank Memorial Fund; and the New York City Department of Health.

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Nutrient	Per Cent of Diets With Less Than Allowance[1]			Per Cent of Diets With Less Than Two-Thirds Allowance		
	All Pupils	Boys	Girls	All Pupils	Boys	Girls
Calories	74	78	70	21	22	20
Protein	44	40	49	5	4	6
Calcium	72	74	71	28	29	25
Iron	64	50	81	17	7	29
Vitamin A	65	66	63	38	38	39
Thiamin (B_1)	53	60	44	14	18	8
Riboflavin (B_2)	70	80	59	25	33	16
Ascorbic Acid	58	62	54	29	31	26
Number of Pupils	2,037	1,104	933			

[1]*See* Footnote 2.

Table 1. Percentages of pupils whose average daily intake of various nutrients was less than recommended allowances and percentages less than two-thirds of allowances for specific nutrients among a high school group in New York City.

tional Status, which was a cooperative study conducted by the Cornell University Medical College, the New York City Department of Health, the United States Public Health Service, and the Milbank Memorial Fund, with assistance from the WPA. Children in the Study were all attending a large public high school on the lower East Side of Manhattan. The method of collecting the diet records and of determining nutritive values has been described in detail (1). For each pupil, the average daily amount of calories, protein, calcium, iron, vitamin A, thiamin (B_1), riboflavin (B_2), and ascorbic acid (vitamin C), furnished by the foods reported was calculated from records of all food consumed on three or on four days.

The proportions of the pupil diets which were below recommended allowances [2] for each nutrient are summarized in Table 1. There is shown also the percentages of pupils who received less than two-thirds of these allowances, a level which probably is a minimum requirement for these nutrients.

The diets of nearly three-fourths of the pupils furnished less than

[2] Allowances recommended by the Committee on Food and Nutrition of the National Research Council were used for all food elements except calories. Individual estimates of caloric requirements were determined on the basis of sex, age, surface area, and activity.

the estimated calorie needs and almost as many were below the recommended allowances for calcium and riboflavin. The other nutrients ranked in frequency, in descending order, as follows: Vitamin A, iron, ascorbic acid, thiamin, protein.

When a deficiency of more than one-third of the recommended allowance is considered, the order of frequency of diets deficient in the different food elements is somewhat changed. Thus, vitamin A was the most common deficiency and 38 per cent of the pupils had less than two-thirds of the recommended allowance. Diets were deficient by more than one-third of allowance in other nutrients in the following order of frequency: Ascorbic acid, calcium, riboflavin, calories, iron, thiamin, and protein.

Food Values of Lunches

A special analysis was made of the food values of lunches eaten by boys and girls on school days. For this purpose, dietary histories obtained from the pupil relating to two school days were selected for boys and girls who bought lunch and who carried lunch from home. Dietary histories for either one or two days for pupils who received a free lunch at school were tabulated because of the small number of records which included two days on which the free school lunch was eaten. The average total daily intake of specific nutrients and the average quantities furnished by lunches are shown in Table 2. The average luncheon values were related to the average daily allowances for each group of boys and girls and the percentages of the total allowance [8] furnished by lunch are given in Table 2 for each nutrient.

The children most affected by the lunches served in the school obviously are those who bought lunch and those who received the free lunch, although many children who carried lunch also bought some food at school. The calorie value of the free lunches eaten by

[8] If the recommended daily allowance for a nutrient differed by age for boys or girls, the allowance used in computing these percentages was an average weighted in proportion to the age distribution of pupils in the specific type of lunch group.

Nutrient	Boys			Girls		
	Lunch Bought	Lunch Carried	Free Lunch	Lunch Bought	Lunch Carried	Free Lunch
	AVERAGE TOTAL AMOUNT PER DAY					
Calories—Number	2,811	2,920	2,602	2,169	2,001	1,895
Vitamin A—Int. Units	9,088	6,479	3,723	5,532	3,983	5,481
Calcium—Grams	1.28	1.19	1.21	0.99	0.83	0.96
Ascorbic Acid—Mgs.	92.5	96.5	67.2	83.0	72.5	72.5
Vitamin B_2—Sherman Units	1,072	929	798	756	711	928
Vitamin B_1—Int. Units	670	666	542	534	452	415
Iron—Mgs.	17.1	15.7	13.9	12.1	11.2	11.0
Protein—Grams	107.7	110.4	95.0	78.2	76.4	66.5
	AVERAGE AMOUNT PER DAY IN LUNCH					
Calories—Number	771	812	681	581	565	584
Vitamin A—Int. Units	3,446	991	1,067	1,034	782	995
Calcium—Grams	0.33	0.22	0.42	0.26	0.15	0.36
Ascorbic Acid—Mgs.	19.5	20.5	8.1	10.5	17.5	9.3
Vitamin B_2—Sherman Units	215	181	234	150	137	186
Vitamin B_1—Int. Units	159	159	139	102	98	114
Iron—Mgs.	4.35	3.69	3.97	2.73	2.53	3.36
Protein—Grams	27.6	29.5	27.5	19.3	20.6	22.5
	PER CENT OF DAILY ALLOWANCE FURNISHED BY LUNCH					
Calories—Number	24.4	25.8	21.7	23.4	24.0	24.3
Vitamin A—Int. Units	63.0	18.1	19.9	20.6	15.6	19.8
Calcium—Grams	23.9	15.9	29.7	23.7	13.6	30.0
Ascorbic Acid—Mgs.	20.5	21.6	8.6	13.1	21.9	11.9
Vitamin B_2—Sherman Units	19.9	16.8	22.3	20.0	18.3	24.2
Vitamin B_1—Int. Units	26.5	26.5	23.9	24.0	23.1	25.9
Iron—Mgs.	29.0	24.6	26.5	18.2	16.9	22.4
Protein—Grams	29.8	31.9	30.4	25.1	26.7	28.8
Number of Pupils	64	54	27	47	58	24
Number of Daily Reports	128	108	38	94	116	37

Table 2. Average amounts of various nutrients furnished by lunches and the percentages of total daily allowances for boys and girls classified according to type of school lunch.

girls was about equal to that in lunches eaten by the other girls, but boys receiving the free lunch had fewer calories than either of the other groups of boys. For all groups, except the boys with free lunches, the average lunch furnished about one-fourth of the calo-

ries required for one day. There was considerable variation in the percentages of recommended daily allowances which were furnished by the average lunches, but with a few exceptions the lunches contributed a smaller proportion of the allowances for those nutrients in which we have noted the largest numbers of children were deficient than of the allowances for nutrients less frequently deficient in the diets. The principal exception to this general situation is found for children who received free lunches and who, as a result of the milk included in the free lunch, received relatively large proportions of their requirements for calcium and riboflavin. The boys who bought lunch had a very high average value for vitamin A, but the average lunch of other groups furnished from 15.6 to 20.6 per cent of the daily allowance of vitamin A. The ascorbic acid content of the free lunch was extremely low; girls who purchased lunch also received very little ascorbic acid from their luncheon foods; and each of the other groups obtained about one-fifth of their daily allowance for ascorbic acid at lunch.

Since vitamin values and calcium are low in the home diets of such a large number of children from low-income families, it seems desirable to emphasize foods in the school cafeteria which would increase the consumption of foods rich in these nutrients. Some methods for doing this are discussed in the following section.

Suggestions for Increasing the Nutritive Values of the School Lunch

It is apparent that these deficiencies cannot all be made up by the lunch. They can, however, be greatly lessened by giving special attention to the noon meal. The purpose of this discussion is to consider how the nutritive values of food eaten at lunch time could be improved so that they would help to insure adequate, balanced diets. The foregoing information on specific deficiencies in the diets of pupils in this school and some observations made at the high school cafeteria are used as a basis for suggestions for making

the school lunches a better supplement to the home diet. The suggestions made are general, and all are not necessarily applicable to the school where this Study was made.

The emphasis in the following discussion is on measures for improving nutritive values in the school lunch. This is only one aspect of the problem and an effective program must give equal attention to education for influencing dietary habits and to the economic aspect of furnishing more of the protective foods in a school cafeteria.

It is important to keep in mind the financial background which influences the menus and food portions that can be served in a high school cafeteria. In the school where this Study was made, the cafeteria was operated on a maintenance basis, that is, without profit. About 62 per cent of the income of the cafeteria was spent for food and the non-food costs were 38 per cent of the income. At the time of this Study, surplus commodities were not available to the cafeteria and the only contributions to it were for free lunches, namely, a bottle of milk and an allowance of 6¼ cents per lunch. The cafeteria was used daily by from 2,000 to 2,500 pupils, including those who brought all or most of their lunch from home. Considerable service is required for operation of a cafeteria of this size and costs must be met for such items as refrigeration, gas and electricity, equipment, and replacement of broken china and glassware.

The purchasing power of the pupils must determine the price of food items and this, in turn, governs the types of foods and amounts offered for sale. In this school the student body is drawn from families of low income, and only about one-eighth of the pupils were from families in which the reported weekly per capita income was $10 or more. The average food check was only 6 to 7 cents, and the children who purchased all their lunch seldom spent more than 15 or 20 cents. A 10-cent hot plate was available as well as individual items, such as sandwiches, vegetables, and desserts. Most individual items sold for 5 cents a portion. Where all children have a very limited amount of money to spend, and many have only a few cents

for supplementing food brought from home, it is essential that a cafeteria provide single items at low cost. In other words, increases in the size of single portions or in the nutritive content of food items which are accompanied by higher prices per serving may reduce the number of children purchasing the more nutritious items.

It is apparent that the problem of providing lunches of high nutritive value is complex. The educational and the economic problems involved cannot be discussed in detail. However, it is believed that a consideration of foods and food values in relation to specific dietary needs can contribute toward a better understanding of the school lunch program.

A deficiency in total calories was the most frequent deficiency of any degree in the pupil diets analyzed. To increase total calories means to increase the amounts of other nutrients. Our first consideration, therefore, is suggestions primarily concerned with total calories which will also affect other dietary deficiencies.

Sandwiches are eaten by so many pupils that they provide the most consistent source of food at lunch. The kinds of sandwiches sold in the cafeteria, namely, meat, salmon, tuna fish, cream cheese and chopped egg, are all good sources of essential nutrients. They were made with rye bread, which provides definitely more value than white bread. However, the amount of filling in these sandwiches was limited. Sandwiches were secured at three different times during a period of a year and a half, and the fillings weighed. These weights were averaged and are listed below. They are compared with the weight of filling in what may be considered an average homemade sandwich of the same kind.

Kind of Sandwich	Weight of Filling Served at School	Weight of Filling in An Average Homemade Sandwich
Meat and Lettuce	20.6 Grams (¾ Oz.)	85.2 Grams (3 Oz.)
Tuna Fish	20.0 " (⅔ ")	56.8 " (2 ")
Cream Cheese and Jam	21.2 " (¾ ")	56.8 " (2 ")
Chopped Egg	25.0 " (⅞ ")	49.7 " (1¾ ")
American Cheese	36.2 " (1¼ ")	37.9 " (1⅓ ")

The American cheese filling is the only one which is comparable to the amount estimated for an average homemade sandwich. An increase in other sandwich fillings not only would improve their caloric value but also would raise other nutritive values.

When evaluating the cooked foods that may be served in a school cafeteria, the size of a portion is important. The suggestion is offered, therefore, that care be taken to see that cheaper dishes are more generously portioned than others. One food that comes to mind because it is consistently inexpensive is spaghetti with tomato sauce. A portion of spaghetti can be two or three times the size of a portion of green vegetables, and cost no more. This is also true of Spanish rice, macaroni and cheese, baked beans, and cooked lentils. One in charge of a school cafeteria should not overlook the opportunities offered by inexpensive, yet nourishing, hot dishes to provide pupils with increased calories and the accompanying increase of other essential elements. A "hot plate" might be planned to include a large portion of one of the foods named above, and a smaller portion of one or two "green" or "yellow" vegetables that may be too expensive to serve in quantity, but which will furnish an excellent source of protective vitamins.

Any increase in the consumption of milk at lunch would add significantly not only to calories but also to calcium and riboflavin values. Milk would contribute also to the vitamin A and vitamin B_1 intake. Pint bottles might be sold instead of only half-pint bottles, as at present, and the price per glass be reduced slightly. Since taking the diet records on which this analysis is based, the price of milk sold in the cafeteria has been changed from 5 cents per bottle to 1 cent in cooperation with the Surplus Marketing Administration. As a result, the average daily consumption increased from 800 bottles to 2,000 bottles of milk. This shows conclusively that many pupils will drink milk if it is inexpensive and that some will drink two glasses of milk.

Pupils who carried lunch from home often bought some addi-

tional food. A study was made of the purchases of these pupils, and it was found that of the 112 pupils, 79 bought something. Over a period of 158 school days, 154 purchases were made by the 79 pupils. The cost was 5 cents each for 122 of the purchases, while 32 cost 4 cents or less. Thus, 79 per cent of the purchases made by pupils who carried lunch were 5-cent purchases, and 21 per cent were 4 cents or less. Further analysis of these purchases shows that 80 per cent of those costing 5 cents were for milk, cocoa, and ice cream; 15 per cent were for candy and cake; 2 per cent were for orangeade, and 3 per cent were miscellaneous items. All of the purchases of 4 cents or less were for candy. The majority of pupils who could spend 5 cents preferred milk, cocoa, or ice cream. If these records had been taken after penny-milk was introduced into the cafeteria, it seems probable that children with only a few pennies to spend would have bought milk.

It is difficult to compare the purchases made by pupils who bought their entire lunch at school with those who purchased something to supplement a lunch carried from home. However, it is interesting to note that pupils who bought lunch spent a total of twice as much money for milk, cocoa, and ice cream as pupils who carried lunch, and four times as much for cake and candy as those who carried lunch. These figures show that while cake and candy were not the most popular food items in the cafeteria, they did form an important proportion of the purchases of pupils at lunch time.

Cakes and sweets presented for sale in a high school cafeteria should be selected carefully so that they will provide something in addition to calories. Below are listed some of the cakes and pastries that furnish appreciable amounts of vitamins, in addition to concentrated calories. Note that cakes that are combined with fruit, as short cakes, are good sources of all vitamins and are better in vitamin A and vitamin C than cakes combined with cream or custard. Nut cakes and oatmeal cookies are good sources of vitamin B_1 or riboflavin.

The values below are based on recipes such as would be used at home, or by a good chef. The weights of the pieces of cake listed are 2 to 4 ounces each.

Cake	Int. Units A	Micrograms Thiamin	Mg. Ascorbic Acid	Micrograms Riboflavin
Open Peach Cake (Fresh Yellow Peaches)	1,307	30	3	163
Peach Cake (Made with Sponge-Cake and Canned Peaches)	893	48	5	73
Banana Shortcake (Made with Sponge-Cake and Whipped Cream)	842	67	3	119
Strawberry Shortcake (Made with Sponge-Cake and Whipped Cream)	808	61	43	92
Apple Strudel	608	116	9	76
Charlotte Russe	485	18	—	53
Prune Pocket or Prune Bun	397	59	1	99
Banana Custard Tart	370	108	6	128
Cheese Cake	307	57	4	195
Boston Cream Pie	242	51	1	140
Old Fashioned Nut Loaf	195	68	—	70
Date and Nut Loaf	195	55	—	72
Cream Puff	172	30	—	75
Pecan Bun	150	47	—	75
Pineapple Upside Down Cake	147	71	7	74
Chocolate Eclair	136	40	—	75
Oatmeal Cookies Fig Newtons Fruit and Nut Cookies	are more valuable than plain cookies.			

Special comment on the free lunch seems pertinent. It has been shown that it furnished relatively less of the calorie allowance for boys and that the average total calories in diets of the group receiving free lunch was lower than the average calories of the other pupils. In the high school studied the free lunch was definitely restricted in the fall of 1939 to a bowl of soup, a bottle of milk, and the choice of a sandwich. Some restriction in the choice of foods by pupils entitled to free lunch is necessary to prevent the choice of sweets when the need for substantial food is so great. However, to allow no substitution in the above three items can easily defeat the purpose of the free lunch.

Many pupils who receive a free lunch might be able to bring a

sandwich from home. If so, the choice of some other hot dish in place of the sandwich would greatly increase luncheon food. Also, it was noted that, although soup is always provided, pupils do not always take it. Of the 51 pupils receiving free lunch, 21 did not take soup at all, 18 took soup on one day, and 12 selected soup on two days. In other words, out of 75 free-lunch records, only 42 showed that the soup available was consumed. Apparently many pupils do not like soup. If some other hot dish, or a second bottle of milk could be substituted when the pupil does not like soup, lunch values would again be increased. A study of the kinds of soup selected shows that vegetable soup was most popular; split-pea soup and cream soups were next; tomato and tomato-rice soups were third in choice. Barley soup was selected once. No other kinds were selected at all.

The free lunch has been widely advocated as an available and efficient means for improving the dietary level of children from the lowest-income families. Free lunches were given to about 8 per cent of the pupils in the Nutrition Study, although about one-third came from families having some type of public or private assistance. However, 18.5 per cent of pupils in the Study were on NYA and most of these pupils preferred to pay for their lunches. In many schools and communities, the free lunch offers the most practical method of providing a nutritious noon meal. While each school has its own problems in the financing of free lunches, it is well to remember that there are ways of providing free lunches by using the cooperative agencies set up for just such a purpose. The Surplus Marketing Administration of the United States Department of Agriculture will make available surplus food supplies to help in providing free lunches to school children. This agency, in cooperation with WPA and NYA labor, is promoting the "Community School Lunch Program." In New York City this program has recently been expanded to include high schools. Particularly in smaller communities, Business Men's Clubs, such

as Rotary, Lions, and Kiwanis; Women's Clubs; and Parent-Teacher Associations can often be interested in such a project, especially when the youth of the immediate community will reap the benefit of their interest and cooperation.

With respect to specific vitamins, a few suggestions are offered for increasing the lunch values in vitamin A and ascorbic acid. Diets of more pupils furnished less than two-thirds of the recommended allowances for those two vitamins than for any other nutrients. Calcium, the third most prevalent deficiency of this degree, is provided best by making as much milk available as possible; and riboflavin, which was almost as prevalent a deficiency as calcium and ascorbic acid, will be increased materially not only by greater use of milk but also by measures which raise vitamin A content of diets.

An increase in vitamin A content of lunches can be achieved best by a planned use of vegetables that are rich in vitamin A. These include red and green peppers, pimentos, spinach, kale, chard, broccoli, parsley, carrots, sweet potatoes, watercress, and tomatoes. These vegetables could be used in a variety of ways to increase the amount of vitamin A in foods served in the cafeteria. Some suggestions are:

(1) Add strips of red pepper, green pepper, or pimento to salads.

(2) Fresh, green spinach leaves, or generous sprays of parsley or watercress could be substituted for lettuce in salads.

(3) The amounts of fresh tomato now used on salads could be increased.

(4) Sweet potatoes could be served two or three times a week in place of white potatoes.

(5) Broccoli, kale, or chard could be served on days when spinach is not served. One green vegetable always should be available in addition to cooked carrots or stewed or scalloped tomatoes.

(6) Add generous sprays of parsley or watercress to the meat and fish sandwiches.

(7) Add chopped cooked spinach or fresh green peppers to the chopped egg sandwich.

(8) Add chopped green or red peppers, or pimento, to the cream cheese sandwiches.

Sandwiches are a popular lunch item. Liverwurst is rich not only in vitamin A but also in riboflavin and thiamin. It could be served in sandwiches several times a week. Egg sandwiches and egg salads should be served frequently.

Citrus fruits are the best source of vitamin C. Four ounces of fresh orange juice would furnish about 55 mg. of ascorbic acid which is from two-thirds to slightly more than one-half of the total daily allowance for high school children. The orange drink served in the cafeteria was tested on several days for its ascorbic acid content, and an 8-ounce glass was found to contain an average of 17 mg. of ascorbic acid. This is the content of average orangeade. Other good sources of Vitamin C are canned grapefruit juice and tomato juice; and these are not too expensive if bought in large quantities. Fresh sliced pineapple, in season, could be served. Although it is difficult to provide good sources of vitamin C at low cost, it is not impossible to do so. A real effort should be made to replace purchases of orangeade and bottled drinks with fruit juices.

It is recognized that the availability in a cafeteria of foods rich in vitamins and minerals is not all that is required to materially lessen the deficiencies so frequently found in pupil diets. Free lunches are sufficiently controlled to make it possible to predict, quite closely, what effect any changes would make in dietary deficiencies. Pupils who have free choice of purchase must be guided to select the foods they most need, and a good educational program should be a part of any plan for improving diets. One rather obvious way of encouraging the selection of foods most needed by the average pupil is to feature them at special prices from time to time, playing on the ever-present desire to purchase as much as possible for a limited amount of money.

Again let us repeat that the writers are not unaware of the many practical difficulties that confront every school cafeteria. We also

appreciate that these difficulties are not identical, but that they vary with the locality and size of each school and with the economic status and the cultural background of the homes of the pupils. However, the problem does not seem insurmountable, if menus are planned with the advice of trained dietitians and, where necessary, community resources for various types of aid are utilized to the fullest. Dietary requirements for the high school child are high and the noon-day lunch should contribute an appreciable share of the essential nutrients.

References

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