THE CONTRIBUTION OF THE NURSERY SCHOOL LUNCH TO RECOMMENDED NUTRIENT ALLOWANCES OF TWENTY-ONE PRESCHOOL CHILDREN AT THE UNIVERSITY OF ARIZONA

by

Aniela Senkowska Pelch

A Thesis Submitted to the faculty of the School of Home Economics in partial fulfillment of the requirements for the degree of MASTER OF SCIENCE in the Graduate College, University of Arizona

1954

Approved: , Date

Director of Thesis
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ACKNOWLEDGMENT

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INTRODUCTION

Normal growth of children occurs only when needed amounts and kinds of calories, protein, minerals, and vitamins are supplied daily. In the well planned dietary each meal provides approximately one-third of the total calorie requirement. Other nutrients should be fairly evenly distributed throughout the day. The contribution of the nursery school lunch to daily nutrient requirement of preschool children has been the basis of a number of dietary studies in colder climates. Studies such as those of Tasso at Utah State Agricultural College in 1933, Harper at the University of Tennessee in 1948, and Peterson at Cornell University in 1950, report fewer morning hours spent in the out-of-doors, it would seem, than those at the nursery school of the University of Arizona. Lunches consumed in those nursery schools contributed less of certain essential nutrients than the desired one-third of daily Recommended Allowances of the Food and Nutrition Board of the National Research Council.

The climate of Tucson is favorable many months of the year for out-of-door play for children. The kind of play engaged in out-of-doors usually involves greater activity hence greater expenditure of energy than that of in-door. Appetite should be thereby increased.

Therefore it seemed desirable to study the nutrient content of the lunch as served to the children of the nursery school at the University of Arizona and its contribution to their total needs. The present study of twenty-one children covered a period of two weeks...
during November of 1952 and again in March of 1953, with five school days in each week and a total of ten each session. The lunch menus were planned by the investigator which were similar to menus served previously. At the time of serving the investigator weighed individual foods to an accuracy of one gram, and size of first servings for each child was kept approximately the same as before. Second servings or more were weighed as requested by the children. Using commonly accepted tables of food composition, ten nutrients together with calories in each food were then calculated and totaled for each lunch and the average taken for each of the ten lunches in each session. Percentage contribution of each nutrient in the average lunch of each child to total recommended daily was thereby determined.

Mothers of the children assisted in obtaining estimates of the day's total intake by recording each day of the study carefully measured amounts of all foods eaten away from the nursery school. They had previously been instructed individually concerning accurate use of household measures and completion of mimeographed forms. The estimated nutrient intake at home together with that of the school represented the day's total intake. The percentage contribution of the day's total intake to the Recommended Allowances of the National Research Council was determined and also of the lunch to the day's total as actually consumed.

It was found that the nursery school lunch consumed by these children contributes on the average only one-fourth of total calorie, protein, calcium, iron, thiamine, and niacin requirements as recommended by the Food and Nutrition Board of the National Research
Council. Vitamin A and riboflavin were found to be high and ascorbic acid low. Greater out-of-door activity did not seem to influence the appetite of these children to the extent that for most nutrients it would bring the content of the lunch up to the desired one-third of that recommended. However, the day's total food intake contributed ninety per cent or more of the National Recommended Allowances during both sessions, for protein, Vitamin A, riboflavin, and ascorbic acid.

In the evaluation of the contribution of the lunch it was compared to the day's total intake. By this comparison it was found that only one-third of the children who attended both sessions received one-third or more of their total intake of calcium, iron, vitamin A, and riboflavin in their lunch.

Previous Studies

The food intake of preschool children was studied by investigators in this country as early as 1921. In a series of five papers in that year, Holt and Fales were concerned with the requirements for calories, protein, fat, carbohydrate, and percentage distribution of calories. They recommended a distribution of fifteen to seventeen per cent calories from protein, about forty-nine per cent from carbohydrate, and thirty-four per cent from fat. Bray, Hawks, and Dye concluded that the child's total calorie intake increases with increasing age and that boys have slightly more calories than girls. Their preschool children received an average of 1399 calories. However, Beal et al. found little difference between calorie intake of boys and girls until approximately five years of age. McKay and Patton made a very detailed study of day-by-day fluctuations in calorie
intake of preschool children at different seasons of the year with the conclusion that calorie intakes of individual children vary to a greater extent from day to day within each week than from season to season or from year to year. The factors in general which they suggested might influence a child's calorie intake were (1) the type of food served, (2) the onset of colds or excitement and emotional strain, (3) the time of the week, the first part seeming to be more conducive to high calorie intake than later, and (4) the season, calorie intakes from day to day during summer and autumn being less varied than at other times.

In 1935, Daniels et al. recommended 1.5 grams of protein per pound or 3.2 per kilogram of body weight. Previously 1.0 gram per pound had been accepted as the standard. This was in agreement with Holt and Fales' recommendation of 3.15 to 3.80 grams per kilogram. However, Winters found that the intake of children studied by him averaged 2.62 grams per kilogram for boys and 2.36 for girls. In studying the interrelationship of calcium, phosphorus, and nitrogen in the metabolism of the preschool child, Hawks, Bray, Wilde and Dye compared diets containing, in turn, 3.0 and 4.0 grams of protein per kilogram. The higher protein produced an increase in both absorption and retention of nitrogen but had no effect on calcium absorption or retention. Although it caused a decrease in absorption of phosphorus it resulted in better utilization of the amount available. Weight gains were greater on 4.0 grams than on 3.0 and represented different types of tissue growth.

Sherman and Hawley studied calcium metabolism in children for
nine consecutive days on varying amounts of milk. On an ordinary daily mixed diet containing 750 grams of milk they found that it furnished a total of 0.74 to 1.02 grams of calcium per day for children three to thirteen years of age. Daniels et al.\textsuperscript{9} found that 45 to 50 mg. of calcium per kilogram is sufficient for the age group three to six years, provided the calcium is available and sufficient vitamin D is allowed. Outhouse and Kinsman\textsuperscript{10} studied the calcium metabolism of preschool children at different levels of calcium intake. They found that a daily intake of about 0.6 gram per day was sufficient to provide maximal retention of calcium. On an intake three times as high the children retained no more calcium. In an extensive study of children's diets in England, Widdowson\textsuperscript{11} in 1947, reported data of significance to American investigators. He found that his children who were below five years of age received, on the average, less than 0.5 gram of calcium per day. Milk was the chief source of calcium which provided more than seventy per cent of the total amount in their diet.

The iron requirement was studied by Rose et al.\textsuperscript{12} who recommended 8.50 mg. per day for early childhood. Leichsenring and Flor\textsuperscript{13} recommended similar amounts of 8.23 mg. per day. To meet maintenance and growth needs of normal children, ages 3 to 6 years, Daniels and Wright\textsuperscript{14} concluded that 0.60 mg. per kilogram would suffice. Ascham's study of iron metabolism of preschool children demonstrated iron intakes of 0.55 to 0.64 mg. per kilogram. The latest study, by Porter\textsuperscript{16} in 1941, reported that children on a freely chosen mixed diet received an iron content per child as low as 5.64 mg. or 0.31 mg.
per kilogram.

Hess, Lewis and Barenberg believe that although the demand for vitamin A is greater during early childhood than later the usual diet meets the child's need except when vagaries of diet occur or absorption is deficient. Widdowson found that liver constituted the chief source of vitamin A for all of his children, other foods being milk and butter. Tompkins and Scoular analyzed the content of vitamin A, carotene, and ascorbic acid of their nursery school lunches. They found total vitamin A values which greatly exceeded recommended allowances, and correspondingly high values of ascorbic acid.

Everson and Daniels, studying ascorbic acid intake of preschool boys, reported intake levels of 50 to 214 mg. They concluded that 6.0 to 7.5 mg. per kilogram would give optimal retention. Hathaway and Meyer found that daily intakes of 31 mg. of ascorbic acid were marginal levels in tissue saturation of four preschool children. In Widdowson's study citrus fruit, the main source of ascorbic acid for the young children, provided two-thirds of their vitamin C.

Oldham et al. reported liberal thiamine and riboflavin requirements of 0.50 mg. per 1000 calories for each vitamin for this age group. At one year of age Widdowson found an average intake of 0.50 mg. per 1000 calories of both vitamins which fell to 0.35 mg. at ten years.

On the basis of studies such as the above the Food and Nutrition Board of the National Research Council (N.R.C.) recommended daily dietary allowances. The first were issued in 1943 and the final
revision in 1953. Because it is desirable to obtain maximal storage
of nutrients for maximal growth, nutrient requirements are commonly
expressed in terms of recommended allowances. For preschool children
they are as follows:

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<th>Riboflavin</th>
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Plan of Study

Subjects included eleven girls and ten boys with ages ranging from 33 to 53 months, averaging 42 months. These children came from families of moderate to high socio-economic status. Health records signed by pediatricians and submitted by the parents indicated that all the children were healthy and normal. One girl was allergic to eggs and another to milk. Physical data will be found in Table I. Heights and weights were recorded at the beginning of the first session and at the end of the second. As indicated in this table, ten children participated in the entire study, a total of sixteen in the first part and fifteen in the second.

Following the usual routine of the nursery school they arrived at 9:30 A.M., and went to the playground where they had two consecutive hours of play until 11:30 A.M. A brief period of reading and resting preceded lunch which was served at noon. There was no midmorning feeding.

The lunch menus were planned by the investigator which were similar to those which had been previously served. They included a meat or meat substitute, one or two cooked vegetables, a raw fruit or vegetable, whole wheat bread and margarine, dessert, and milk. Because the preparation and weighing of all food was done by the investigator with only the regular assistance of one cook and the occasional assistance of the major professor, one week's menu was
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repeated for each week of the study. See Appendix I. Appendix II shows substitutions used for the children who were allergic to eggs and milk.

Procedure of Work

A number of individual foods were prepared the evening before each day. Bread or crackers with margarine were weighed separately, prepared as sandwiches, wrapped in wax paper, and stored for the following day's use. Raw vegetables, such as carrots and celery, were also weighed, wrapped, and stored in the refrigerator. Raw apples were cut and weighed just before serving. Certain desserts which could be stored overnight were weighed in advance and stored in the refrigerator. Plates were labeled with name tags that were scotch-taped to the bottom of the plate.

In preparing mixed dishes the weight of each ingredient was taken before adding another ingredient, with the total weight recorded before and after cooking. Each vegetable was weighed before and after cooking, and after margarine was added.

The daily procedure of work before serving was as follows: (a) sandwiches, celery and carrots unwrapped and placed on the plates in the kitchen, (b) extra sandwiches, celery and carrots in wax paper, with weight indicated, placed on side shelves in the dining room, (c) first desserts with weight indicated, and previously recorded for each child, on side shelves in the dining room, (d) extra desserts with weight indicated placed on side shelves, (e) a small glass containing four ounces of milk, with a colored pencil identification mark on the bottom, at each child's place.
At the time of serving, individual foods were weighed to an accuracy of one gram and first servings kept at approximately the same size for each child as before the beginning of the study. Weight of each plate with sandwich, raw apple or vegetable was recorded after the child's name on the data sheet. The main dish was placed on the plate and the increase in weight noted again on the data sheet. The cooked vegetable was then placed on the plate and the increase in weight recorded. It was then placed at the corresponding child's place in the dining room. Lunch was promptly announced and the children took their seats.

The director of the nursery school and three students, in turn, in the child development course ate with the children, one at each table. These adults were instructed before the beginning of the study to follow the procedure as noted on Appendix III. The adult at each table used a data sheet to record the time meal began, the measure and weights of second or more servings of milk, sandwiches, and dessert, and the time the meal ended. For second servings of the main dish the plate was returned to the kitchen, weighed before and after adding the food and returned to the child.

After the lunch period, the plate together with the leftover foods was weighed and the individual foods removed one by one and weights recorded. Name tags were removed from the plates before each washing. Amount of milk left in each glass was deducted from the total amount originally recorded.

Calculation and Evaluation of Data

Ten nutrients and calories in each food were calculated using
Watt and Merrill, Composition of Foods. Rose's Laboratory Handbook for Dietetics was used as a supplementary table.

The calculated daily totals of eight specific nutrients and calories which are included in the N.R.C. were averaged for each child, omitting carbohydrate and fat, and compared with these standards.

Since subjects in this study ranged in age from thirty-three to fifty-three months, adjusted allowances for each nutrient in the N.R.C. were used for the appropriate age.
RESULTS

In Table II will be found the nutrient consumption of the twenty-one children in the study for the lunch and day's total intake in terms of quantitative measurement for boys and girls during the first and second sessions, respectively.

In Table III, and in Figures I through VI, will be found the percentage contribution of the lunch and of the day's total intake to N.R.C. for calories, protein, calcium, iron, vitamin A, thiamine, riboflavin, niacin, and ascorbic acid.

The average of the percentage contributions of the lunches to N.R.C., Table III, during the first and second sessions, respectively, are: calories, 24.6 and 22.6; protein, 27.7 and 27.0; calcium 24.6 and 24.2; iron, 37.9 and 20.1; vitamin A, 81.4 and 77.4; thiamine, 25.3 and 22.2; riboflavin, 40.7 and 42.8; niacin, 22.0 and 23.8; and ascorbic acid, 19.4 and 15.0.

The average of the percentage contributions of the day's total intake to N.R.C., Table III, during the first and second sessions, respectively, are: calories, 90.6 and 82.6; protein, 110.4 and 97.5; calcium, 114.3 and 79.9; iron, 112.3 and 78.3; vitamin A, 213.6 and 173.8; thiamine, 104.6 and 82.4; riboflavin, 131.9 and 125.6; niacin, 91.4 and 82.1; and ascorbic acid, 147.5 and 149.7.

In evaluating the lunches in terms of N.R.C. those which contained a nutrient content of 33 per cent or more have been classified as being optimal, between 32 per cent and 25 per cent adequate to
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### Nutrient Consumption of the Twenty-One Children

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## Table III
Percentage Contribution of the Lunch and of the Day’s Total Intake to N.H.O.

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<tr>
<th>Calories</th>
<th>Protein</th>
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<tr>
<td>1. H.K.</td>
<td>23.3</td>
<td>82.5</td>
</tr>
<tr>
<td>2. B.D.</td>
<td>23.7</td>
<td>61.1</td>
</tr>
<tr>
<td>3. M.M.</td>
<td>20.9</td>
<td>89.9</td>
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<tr>
<td>4. C.B.</td>
<td>30.1</td>
<td>76.5</td>
</tr>
<tr>
<td>5. A.P.</td>
<td>24.5</td>
<td>91.6</td>
</tr>
<tr>
<td>6. J.K.</td>
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</tr>
<tr>
<td>7. F.O.</td>
<td>28.3</td>
<td>6.5</td>
</tr>
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<td>8. A.K.</td>
<td>24.8</td>
<td>16.8</td>
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<tr>
<td>9. R.H.</td>
<td>21.2</td>
<td>25.8</td>
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<td>10. L.A.</td>
<td>14.4</td>
<td>11.8</td>
</tr>
<tr>
<td>One Session</td>
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<tr>
<td>11. P.L.</td>
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<td>98.1</td>
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<td>16. G.N.</td>
<td>29.8</td>
<td>96.6</td>
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<td>17. M.K.</td>
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<td>18. B.D.</td>
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<tr>
<td>19. M.M.</td>
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<td>20. C.B.</td>
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<td>21. S.F.</td>
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<td>88.4</td>
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<tr>
<td>Average</td>
<td>24.6</td>
<td>22.6</td>
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| Riboflavin | | |
|-----------|---|---|---|---|---|---|---|
| Both Sessions | | | | | | | |
| 1. H.K. | 23.3 | 82.5 | 23.4 | 103.3 | 20.1 | 57.5 | |
| 2. B.D. | 23.7 | 61.1 | 28.6 | 82.3 | 29.7 | 82.5 | |
| 3. M.M. | 20.9 | 89.9 | 32.9 | 131.7 | 35.6 | 121.7 | |
| 4. C.B. | 30.1 | 76.5 | 32.8 | 84.3 | 32.7 | 82.2 | |
| 5. A.P. | 24.5 | 91.6 | 71.7 | 85.4 | 28.9 | 37.5 | |
| 6. J.K. | 24.5 | 91.6 | 71.7 | 85.4 | 28.9 | 37.5 | |
| 7. F.O. | 28.3 | 6.5 | 106.6 | 28.0 | 187.1 | 18.6 | 70.4 | |
| 8. A.K. | 24.8 | 16.8 | 98.3 | 29.1 | 120.9 | 30.2 | 97.0 | |
| 9. R.H. | 21.2 | 25.8 | 82.5 | 28.0 | 131.5 | 95.0 | 17.5 | 80.8 | 80.1 |
| 10. L.A. | 14.4 | 11.8 | 78.6 | 17.0 | 14.2 | 89.7 | 28.6 | 21.3 | 106.4 | 91.4 |
| One Session | | | | | | | |
| 11. P.L. | 34.5 | 91.9 | 27.5 | 112.0 | 24.4 | 92.3 | |
| 12. S.N. | 37.8 | 90.0 | 37.6 | 110.6 | 27.9 | 97.1 | |
| 13. A.P. | 24.8 | 96.1 | 28.1 | 120.9 | 31.6 | 81.7 | |
| 14. A.L. | 25.5 | 72.2 | 22.3 | 70.0 | 19.4 | 53.6 | |
| 15. H.C. | 24.9 | 98.1 | 28.9 | 115.5 | 34.3 | 98.2 | |
| 16. G.N. | 29.8 | 96.6 | 34.4 | 116.0 | 24.8 | 79.0 | |
| 17. M.K. | 23.3 | 82.5 | 23.4 | 103.3 | 20.1 | 57.5 | |
| 18. B.D. | 23.7 | 61.1 | 28.6 | 82.3 | 29.7 | 82.5 | |
| 19. M.M. | 20.9 | 89.9 | 32.9 | 131.7 | 35.6 | 121.7 | |
| 20. C.B. | 30.1 | 76.5 | 32.8 | 84.3 | 32.7 | 82.2 | |
| 21. S.F. | 8.7 | 88.4 | 11.6 | 180.2 | 13.4 | 21.5 | |
| Average | 24.6 | 22.6 | 90.6 | 107.1 | 27.7 | 27.0 | 110.4 | 97.5 | 24.6 | 24.2 | 114.3 | 79.9 |
FIGURE 1 - CONTRIBUTION OF LUNCH AND OF DAY'S TOTAL TO NATIONAL RECOMMENDED ALLOWANCES.
FIGURE II.- CONTRIBUTION OF LUNCH AND OF DAY'S TOTAL TO NATIONAL RECOMMENDED ALLOWANCES.
VITAMIN A

FIGURE III - CONTRIBUTION OF LUNCH AND OF DAY'S TOTAL TO NATIONAL RECOMMENDED ALLOWANCES.
FIGURE IV—CONTRIBUTION OF LUNCH AND OF DAY'S TOTAL TO NATIONAL RECOMMENDED ALLOWANCES.
Figure 3: Contribution of lunch and of day’s total to national recommended allowances.
FIGURE III - CONTRIBUTION OF LUNCH AND OF DAY'S TOTAL TO NATIONAL RECOMMENDED ALLOWANCES.
borderline, and below 25 per cent inadequate.

Of the day's total intakes, those which were 90 per cent or more of N.R.C. have been classified as being adequate to optimal, 89 per cent to 60 per cent adequate to borderline, and below 60 per cent inadequate. Table IV shows the average contribution of both the lunch and the day's total intake of twenty-one children classified in this manner.

Table V shows the percentage contribution of the lunch to the day's total intake. An analysis of the data demonstrates that only one-fourth of the children in November and one-third in March had lunches which contributed one-third or more of their day's total calorie intake. With regard to the other nutrients during November and March, respectively, the following approximate proportion of children met this criterion: protein, 1/4 and 1/3; calcium, 1/3 and 1/3; iron, 1/2 and 1/3; vitamin A, 1/2 or more and 1/3; thiamine, 1/8 and 1/3; riboflavin, 1/3 and 1/2 or more; niacin, 1/8 and 1/3; and ascorbic acid, 1/8 and 1/3.

The average percentage distribution of the calories from protein, fat, and carbohydrate during the first and second sessions, respectively, are: protein, 15.7 and 15.3; fat, 38.9 and 38.5; and carbohydrate, 46.6 and 47.5. The Holt and Fales' recommendation of 15 to 17 per cent protein calories, 34 per cent fat, and 49 per cent carbohydrate calories is in close agreement with this distribution.
Table IV

Adequacy of the Lunch and of the Day's Total Intake in Terms of N.R.C.

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<th>Iron</th>
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<td>Lunch Total</td>
<td>Lunch Total</td>
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<td>Both Sessions</td>
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* Number of Children
### Table V

#### Percentage Contribution of Nursery School Lunch to the Day's Total Intake

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<td>39.1</td>
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<td>8. A.K.</td>
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<td>9. R.H.</td>
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<thead>
<tr>
<th>Average</th>
<th>Calories</th>
<th>Protein</th>
<th>Calcium</th>
<th>Iron</th>
<th>Vitamin A</th>
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DISCUSSION

The average calorie consumption of the children during the November study was 1254 which is slightly higher than that of 1169 found in March. During November and March the girls averaged 1314 and 1244 calories, respectively; and the boys 1195 and 1083. McKay and Patton attributed low calorie intake to a number of factors, one of which was the onset of colds. During the present study it is of interest to note that there were more absences due to colds during March than November.

Due to the longer activity hours in the out-of-doors of the children at the University of Arizona nursery school it was expected that they would have a somewhat higher calorie intake when compared to N.R.C. than similar children in colder climates. However, the results in the present study agree with those of other studies such as Peterson at Cornell University in which no group consumed advocated levels of one-third of N.R.C. of most nutrients.

It was found in Pennsylvania mass studies that children failed to meet calorie recommendations of N.R.C. The authors of this study reported that this situation is far more prevalent than excessive intake of calories.

The average day's total protein intake in the first session was 49.2 gm. and that of the lunch 12.4 gm.; in the second, 44.3 and 12.3 gm. On the basis of weight, the children received 3.1 gm. of protein per kilogram during the first session and 2.7 gm. the second. Protein
intake in the first session agrees with the recommendations of Daniels et al.\(^5\) of 3.2 gm. per kilogram for this age. Davis and Scoular\(^26\) at North Texas State College found the average protein content of their lunch for the preschool child to be 11.4 gm.

Calcium is one of the mineral elements requiring special attention during childhood. The adequate diet of the young child, exclusive of milk, usually contains approximately 0.2 gm. of calcium with the remainder of the 1.0 gm. requirement normally supplied by milk. In the present study the average intake of milk at lunch was five and one-half ounces which contains 182 mg. of calcium. The lunch contained a total of 244 mg. of calcium, seventy-five per cent being, therefore, obtained from the milk. The average intake of milk for the day was nineteen ounces which contains 627 mg. of calcium. The day's total intake contained 793 mg. of calcium, seventy-nine per cent being, therefore, obtained from the milk. The present study included one child who was allergic to cow's milk. She drank a milk substitute which contained very little calcium.

The average iron content of the lunch was 2.3 mg. which is in close agreement with 2.5 mg., one-third of the N.R.C. for this age group. The average day's total intake of 7.2 mg. similarly agrees with 7.5 mg. of the N.R.C.

In the present study it was found that the children received from their day's total intake 0.54 mg. of thiamine per 1000 calories and 1.12 mg. of riboflavin per 1000 calories. This is in agreement with Oldham's\(^21\) recommendation for thiamine of 0.5 mg. per 1000 calories but more than double the same recommendation for riboflavin.
The average ascorbic acid content of the lunch was 7.6 mg., which is low when compared with the Hathaway and Meyer standards of 17.5 and 25.0 mg., respectively, for the preschool ages of 3 and 5 years. These investigators suggested that a mid-morning nourishment and noon meal at the nursery school should contribute at least fifty per cent of the child's ascorbic acid requirement for the day. Although in the present study the average day's total intake of 62.4 mg. of ascorbic acid exceeds standards, the low intake at the nursery school does not contribute to optimal utilization of this vitamin because of its uneven distribution throughout the day. Therefore, it is the recommendation of this investigator that more foods rich in ascorbic acid content be included in the noon meal at the University of Arizona nursery school. However, the introduction of a mid-morning serving of citrus fruit juice would tend to insure adequacy in this respect.
SUMMARY

The contribution of the nursery school lunch to recommended nutrient allowances of twenty-one preschool children at the University of Arizona has been investigated. Their ages ranged from thirty-three to fifty-three months. The study was divided into two parts, each two weeks in length with five days in each week, during November 1952, and March 1953. Lunch menus were planned by the investigator. Before serving, individual foods on each plate were weighed to an accuracy of one gram. Ten specific nutrients and calories in the lunch were calculated and averaged for each child. Records of estimated food consumed away from the nursery school, kept by the parents, were calculated in the same manner. The home intake together with the nursery school lunch comprised the day's total intake of each child.

It was found that the children consumed a lunch at the nursery school which contributed liberal amounts of vitamin A and riboflavin, considerably more than one-third of the recommended allowances of the National Research Council being supplied, but only one-fourth of the recommended calories, protein, calcium, iron, thiamine, and niacin. Ascorbic acid was below one-fifth of that recommended.

It was found that the day's total intake of the children in the first session contributed ninety per cent or more of the recommended allowances of the National Research Council for all nutrients and calories. However, in the second session the day's total intake contributed ninety per cent or more of the recommended allowances for
only protein, vitamin A, riboflavin, and ascorbic acid.

With regard to the percentage contribution of the lunch to the
day's total intake it was found that only one-fourth of the children
in November and one-third in March obtained from their lunch one-third
or more of their day's total calorie intake. The proportion of other
nutrients ranged from as low as one-eighth for ascorbic acid to as
high as one-half or more for vitamin A during the first session and
one-half or more for riboflavin the second.

These findings are in general agreement with those studies on
similar subjects living in the colder climates. It would seem to
indicate that there was no enhanced effect on food consumption due
to longer hours spent in the out-of-doors.

There was some indication of a seasonal difference in that the
children consumed somewhat more calories in November than in March.
Girls ate more than the boys during both sessions of the study.

Although the milk consumption averaged only nineteen ounces per
child per day it contributed between three-fourths and four-fifths of
the total calcium consumed.
## The Weekly Menu

<table>
<thead>
<tr>
<th>Monday</th>
<th>Tuesday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salmon Loaf</td>
<td>Liver Balls</td>
</tr>
<tr>
<td>Buttered Beets</td>
<td>Spring Peas</td>
</tr>
<tr>
<td>Spinach</td>
<td>Buttered Carrots</td>
</tr>
<tr>
<td>Graham Crackers – Margarine</td>
<td>Celery sticks</td>
</tr>
<tr>
<td>Milk</td>
<td>WW Bread – Margarine</td>
</tr>
<tr>
<td>Applesauce</td>
<td>Milk</td>
</tr>
<tr>
<td></td>
<td>Baked Custard</td>
</tr>
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<table>
<thead>
<tr>
<th>Wednesday</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Meat Loaf</td>
<td></td>
</tr>
<tr>
<td>Carrots</td>
<td></td>
</tr>
<tr>
<td>Mashed Potatoes</td>
<td></td>
</tr>
<tr>
<td>WW Toast – Margarine</td>
<td></td>
</tr>
<tr>
<td>Lettuce Leaf</td>
<td></td>
</tr>
<tr>
<td>Peach Halves</td>
<td></td>
</tr>
<tr>
<td>Milk</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choose Fondue</td>
<td>Hard Cooked Egg</td>
</tr>
<tr>
<td>Broccoli</td>
<td></td>
</tr>
<tr>
<td>Carrot Sticks</td>
<td>Buttered Green Beans</td>
</tr>
<tr>
<td>WW Bread – Margarine</td>
<td>Baked Potato – Margarine</td>
</tr>
<tr>
<td>Milk</td>
<td>Raw Apple Slices</td>
</tr>
<tr>
<td>Prune Whip</td>
<td>Peanut Butter Sandwich</td>
</tr>
<tr>
<td></td>
<td>Milk</td>
</tr>
<tr>
<td></td>
<td>Cherry Jello</td>
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## APPENDIX II

### The Weekly Menu with Substitutions

**For Susanne, Omitting Milk**

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<td>Meat Loaf</td>
<td>Liver Balls</td>
<td>Meat Loaf</td>
</tr>
<tr>
<td>Buttered Beets</td>
<td>Spring Peas</td>
<td>Carrots</td>
</tr>
<tr>
<td>Spinach</td>
<td>Buttered Carrots</td>
<td>Mashed Potatoes &amp; Milk</td>
</tr>
<tr>
<td>Graham Cracker</td>
<td>Celery Sticks</td>
<td>WW Toast - Margarine</td>
</tr>
<tr>
<td>- Margarine</td>
<td>Soyalac</td>
<td>Lettuce Leaf</td>
</tr>
<tr>
<td>Soyalac</td>
<td>Pineapple-Pear</td>
<td>Soyalac</td>
</tr>
<tr>
<td>Applesauce</td>
<td></td>
<td>Peach Halves</td>
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<table>
<thead>
<tr>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baked Ham</td>
<td>Hard Cooked Egg</td>
</tr>
<tr>
<td>Broccoli</td>
<td>Buttered Green Beans</td>
</tr>
<tr>
<td>Carrot Sticks</td>
<td>Baked Potato - Margarine</td>
</tr>
<tr>
<td>WW Bread - Margarine</td>
<td>Raw Apple Slices</td>
</tr>
<tr>
<td></td>
<td>Peanut Butter Sandwich</td>
</tr>
<tr>
<td></td>
<td>Soyalac</td>
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<td></td>
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### For Christine, Omitting Egg

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<tr>
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<th>Wednesday</th>
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<tbody>
<tr>
<td>Salmon (only)</td>
<td>Cooked Liver (only)</td>
<td>Hamburger</td>
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<tr>
<td>Buttered Beets</td>
<td>Spring Peas</td>
<td>Carrots</td>
</tr>
<tr>
<td>Spinach</td>
<td>Buttered Carrots</td>
<td>Mashed Potatoes</td>
</tr>
<tr>
<td>Graham Cracker</td>
<td>Celery Sticks</td>
<td>WW Toast - Margarine</td>
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<tr>
<td>- Margarine</td>
<td>Milk</td>
<td>Lettuce Leaf</td>
</tr>
<tr>
<td>Milk</td>
<td>Pineapple-Pear</td>
<td>Milk</td>
</tr>
<tr>
<td>Applesauce</td>
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<td>Peach Halves</td>
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<thead>
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<td>American Cheese</td>
<td>Creamed Tuna</td>
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<tr>
<td>Broccoli</td>
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<td>Baked Potato - Margarine</td>
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<tr>
<td>WW Bread - Margarine</td>
<td>Raw Apple Slices</td>
</tr>
<tr>
<td>Milk</td>
<td>Peanut Butter Sandwich</td>
</tr>
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<td>Applesauce</td>
<td>Soyalac</td>
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<td></td>
<td>Cherry Jello</td>
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</tbody>
</table>
APPENDIX III

Duties of Adult at Each Table

1. Note time child begins to eat.

2. Pour seconds of milk to 4 oz. mark on glass and note on record sheet.

3. To obtain seconds of main dish nod to Mrs. Pelch or substitute. One of them will pick up the plate, take it to the kitchen and return with second serving.

4. When child is finished with main dish bring to door of kitchen and hand to Mrs. Pelch or substitute.

5. Record weight of second sandwich on record sheet. A slip of paper with the weight indicated will be attached by means of a toothpick to each sandwich.

6. Name plates for desserts will be taped onto each side table. Place correct dessert before each child.

7. For second serving of dessert record its weight on record sheet. A slip of paper with weight indicated will be attached by means of a toothpick.

8. Leave all dishes in place upon leaving the table.

9. Note time child finishes eating on record sheet.
APPENDIX IV

Wednesday Nov. 12 | Data Sheet at Table (Sample)

<table>
<thead>
<tr>
<th></th>
<th>A. P.</th>
<th>L. A.</th>
<th>M. F.</th>
<th>A. K.</th>
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<tbody>
<tr>
<td>Time meal began: (please indicate)</td>
<td></td>
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<tr>
<td>Second milk - 4 oz.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Third milk - 4 oz.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other - 4 oz. (please indicate)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Second sandwich</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Second dessert</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time meal ended:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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</table>

Name of adult: ________________________
Dear Parent:

May I have your cooperation?

I am conducting a dietary study at the University Nursery School for a period of two weeks beginning November 10 through November 21. This study is to be done under the direction of Dr. Ethel Thompson, Professor in Nutrition, School of Home Economics, and with the cooperation of Mrs. Alice Books, Supervisor of the Nursery School. During this time the food which your child will eat at the noon meal will be carefully weighed, recorded, and calculated for nutrient content. Your child's other meals at home must also be recorded and that is where we hope you can work with us.

You will be of assistance if you would kindly note on the attached sheets of paper the amounts and kinds of food which your child will eat at home during the two weeks of the study excluding Saturdays and Sundays.

The following general directions may be helpful:

1. At each meal record immediately what your child eats so that guessing at a later time will be avoided.

2. Use standard measuring cups and spoons for an accurate measure of food and liquid.

3. Fill in appropriate blank spaces for breakfast, mid-afternoon, dinner, and bedtime snack. However, if nothing is eaten at any one of those periods leave it blank, but space is available if it is customary for your child to eat at those times.

4. There is a space after each meal for you to record the length of time it took to eat each meal.
5. Record the leftover food on the plate after each meal.

6. This record should be the usual home picture of food eaten and routines followed. Anything unusual, for one reason or another such as illness or overfatigue, please note in the section on remarks at the end of each daily record.
DIETARY RECORD AT HOME
for two weeks
November 10 through November 21
March 2 through March 13

PLEASE NOTE CAREFULLY the food your child eats:

Amount of food in
level tablespoons
or teaspoons
Amount of liquid
in cups
Leftover

Monday - November 10  Kind of food
Breakfast Time Meal began: Ended:

Fruit
Cereal served with milk
Milk to drink
Toast and butter
Other foods

Lunch at Nursery School Time meal began: Ended:

Salmon Loaf 2 Tablespoons
Buttered
Beets 1 Tablespoon
Spinach 1 Tablespoon
Whole Wheat
Cracker 2 medium
with marg.: 1 Teaspoon
Milk 4 oz. glass - 1/2 cup
Applesauce 2 Tablespoons

Mid-afternoon Time meal began: Ended:
Crackers
Milk
Other foods

Dinner Time meal began: Ended:
Main Dish
Egg, cheese, fish, meat, or soup
Green vegetable
Yellow vegetable
Bread and butter
Milk
Simple dessert
Other foods
Bedtime Snack Time meal began: Ended:
Crackers
Milk
Other Foods
Remarks:
### APPENDIX VI

**Wednesday Nov. 12**  
**DAILY DIETARY RECORD**

<table>
<thead>
<tr>
<th></th>
<th>Meat Loaf</th>
<th>Carrots</th>
<th>H. Potatoes</th>
<th>Mar.</th>
<th>Lettuce</th>
<th>Peach</th>
<th>Milk</th>
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</thead>
<tbody>
<tr>
<td>1. H.C.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. S.S.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>3. D.S.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>4. A.P.</td>
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<tr>
<td>5. L.A.</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>6. M.F.</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>7. A.K.</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. E.H.</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. R.H.</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>11. A.M.</td>
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<tr>
<td>12. A.S.</td>
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</tr>
<tr>
<td>13. P.W.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>14. G.R.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>15. D.D.</td>
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