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AN EVALUATION OF THE ADEQUACY  
OF DIETS PLANNED IN A  
HOME MANAGEMENT HOUSE

by

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A thesis submitted to the Faculty of  
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N. Mc.

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## CHAPTER I

### INTRODUCTION

The dietary habits of college women have increasingly interested dietitians, nutritionists and research workers for the past half-century. Food habits at college depend upon home dietary practices more or less modified by the influence of knowledge gained in college.

The data for this study were obtained from the records kept at one of the home management houses on the campus of the Woman's College of the University of North Carolina, at Greensboro, North Carolina. The occupants of the house were home economics seniors whose food habits would be expected to show the influence of four years of training in home economics. They averaged twenty-one years of age and 126 pounds in weight. The students came from middle class homes.

All home economics seniors at the Woman's College spend from five to nine weeks in one of the home management houses where their duties constitute the usual ones found in any household. The home management house studied was a detached building housing eight students and a director. The students carried a full class schedule including their home management house duties.

The food budget was established so that the students lived on low, medium and liberal cost levels which were 30¢ to 35¢, 40¢ to 45¢ and 60¢ per person per day, respectively. The buying was done on the retail basis mainly at neighborhood stores. Whenever possible, chain stores and the curb market were patronized.

The three periods studied covered three seasons. Two of these periods were under complete rationing and one when only sugar was rationed and meats and fats were scarce. All three cost levels were included in each period. Since this study was based on records and was not begun until almost the entire periods were completed, there is little possibility that it could have influenced the planning of the menus.<sup>1</sup> The menus used during the periods studied were frequently not those originally planned by the student and approved by the director. Market conditions varied to the extent that many last minute changes had to be made. This may explain some of the poor menus and some of the dietary inadequacies.

Dietary studies usually have a two-fold purpose. First, they may be used to judge the adequacy of food intake; and, second, they may indicate suitable standards if the observations are continued over a sufficiently long period and cover a sufficiently large number of people in supposedly normal health. This study was planned as an evaluation of adequacy of the diets of college seniors in home economics in the home management house.

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1. See Appendix, Tables VIII, IX and X.

CHAPTER II  
REVIEW OF LITERATURE

One of the earliest dietary studies conducted on college women was carried out by MacLeod and Griggs<sup>1</sup> at Vassar in 1918. The study was done to determine how the diet of Vassar students measured up to the theoretical standards for young women of college age at that time. They used the inventory method plus the weighing of both edible and inedible waste. At a cost of 14¢ per capita, they found the caloric consumption per person per day to be 2,698 calories.

The next important study was done at the University of Chicago by Blunt and Bauer.<sup>2</sup> They studied underweight non-home economics students. The use of students not trained in home economics eliminated the possibility of self-consciousness about eating habits. They found that the average caloric consumption was 1,830 calories and estimated their minimum need to be 2,000 calories.

In 1928 Searle and Arnold<sup>3</sup> at Iowa State University compared the accuracy of the long time study of an individual diet with the inventory method for a group over a shorter period. This study was conducted in a home management house which housed eight students. One of the group

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1. Annie Louise MacLeod and Mary A. Griggs, "Dietary Study at Vassar College," Journal of Home Economics, X (March, 1918) 97.

2. Katharine Blunt and Virginia Bauer, "Basal Metabolism and Food Consumption of Underweight College Women," Journal of Home Economics, XIV (May, 1922) 226.

3. Garnet N. Searle and Rossleene M. Arnold, "A Comparison of the Individual and Inventory Methods of Dietary Study," Journal of Home Economics, XX (February, 1928) 84.



was chosen for the individual study which lasted for four consecutive weeks. For this student all food taken to the table was weighed and the weight of all waste deducted. With this method they found food intake to be 65.8 gm. protein, 0.750 gm. calcium, 11.20 mgm. iron and 2,131 calories. With the inventory method for the whole group, no waste was measured and only "as purchased" figures were used in calculation. In this part of the study, the per capita consumption was 73.8 gm. protein, 0.932 gm. calcium, 13.49 mgm. iron and 2,599 calories. "To insure the accuracy of an inventory study, it seems necessary to determine the waste for that particular study by careful collection, weighing and analysis."<sup>4</sup>

At the University of Illinois in 1932 Hetler<sup>5</sup> conducted a study on 85 college women to determine the level of protein intake with relation to the basal metabolic rate. She found that the average daily intake was 0.94 gm. per kilogram of body weight. There appeared to be no definite interrelationship between the protein intake and the basal metabolic rate.

Coons and Schiefelbusch<sup>6</sup> at Oklahoma A. & M. in 1932 also did a study on the diets of college women in relation to their basal metabolic rate. They found that present day total food consumption of college women was lower than it had been a generation ago. In an analysis of

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4. Ibid.

5. Rossleene Arnold Hetler, "Protein Intake and Basal Metabolism of College Women," Journal of Nutrition, V (January, 1932) 69.

6. Callie Mae Coons and Anna T. Schiefelbusch, "The Diets of College Women in Relation to their Basal Metabolic Rate," Journal of Nutrition, V (September, 1932) 459.

the diets they found that protein was more deficient than the caloric content of the diets.

Pond and Grass<sup>7</sup> at Michigan State College reported in 1934 a study of patterns of food expenditures in the home management houses. Records of the home management houses at this college were compared for the years 1922 through 1933. Six to eight senior home economics students planned meals at three different cost levels. From 1922 to 1929 the liberal cost allowance was 80¢ per capita with the actual expenditure from 79¢ to \$1.00 and an average cost of 84¢; the medium allowance was 60¢ with an actual expenditure from 59¢ to 70¢ and an average of 64¢; and the low allowance was 30¢ with an actual expenditure of 27¢ to 35¢ and an average of 31¢. In the years from 1930 to 1933 the cost-of-food index decreased frequently, therefore, each year was different. The investigators found the amount spent for fruits and vegetables higher than that of other similar studies while the amount spent for meats and staples was lower.

In 1934 Kramer, Evers, Fletcher and Gallemore<sup>8</sup> at the Kansas Agricultural Experiment Station conducted balance studies on the protein, calcium and phosphorus intakes of college women as indicated by the output of nitrogen, calcium and phosphorus. The students were on freely chosen diets. They found that the protein intake per day was

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7. Julia Pond and Irma H. Grass, "Patterns of Food Expenditures in Home Management Houses at Michigan State College," Journal of Home Economics, XXVI (August, 1934) 410.

8. Martha M. Kramer, et al., "Protein, Calcium and Phosphorus Intakes of College Women as Indicated by Nitrogen, Calcium and Phosphorus Outputs," Journal of Nutrition, VII (January, 1934) 89.

62.8 gm. and 60.7 gm. for fall and winter, respectively, and the calcium was 1.04 gm. and 1.11 gm. for the same periods. For some subjects the calcium fell enough below the standard of 0.86 gm. to make the investigators deem it advisable to include more high calcium foods in the diet. They found no distinct seasonal variations.

At the University of California in 1934 a study of food economy in a university dormitory managed at moderate cost was reported by Goddard, Gardner, Gibson, Harbour and Hardison.<sup>9</sup> These data were collected during the depression years. One hundred and five university women were studied for two eight-day periods. The inventory method was used but both the edible and the inedible wastes were weighed. The food cost was 36¢ to 39¢ per capita and was considered as moderate cost. They found that the amount spent for meat was high, and the amount spent for cereals was low. In an analysis of the diet, it was found to fulfill all food requirements.

Wheeler and Malloy<sup>10</sup> at Vassar in 1935 studied 28 undergraduate women living on a liberal budget in a cooperative house. The students studied were not home economics trained. The cost per person per day averaged 43¢ for the year, but they were allowed to buy through the college and wholesale companies. Fifty-nine per cent of the total food money was spent for milk products, fruits, vegetables and eggs. The

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9. Verz R. Goddard, et al., "Food Economy in a University Dormitory Managed at Moderate Cost," Journal of the American Dietetic Association, IX (January, 1934) 353.

10. Ruth Wheeler and Ruth Malloy, "A Study of Food Freely Selected by a College Cooperative Housekeeping Group," Journal of the American Dietetic Association, X (March, 1935) 453.

protein, calcium, phosphorus, vitamin A, vitamin C and calories either met or were above the standard. The iron content of the diet was slightly low.

At Ohio State, McKay and Patton<sup>11</sup> in 1938 reported a study of food intake of freshmen women. The self-chosen diets were tabulated to show the average weekly use of milk, fruits and vegetables, whole grain cereals, eggs and meat. Judging only by the amounts of protective foods included, they were considered to be definitely inadequate.

Morris and Bowers<sup>12</sup> reported in 1939 at Utah State Agricultural College a study of the diets of 100 college women. These students were living under different conditions, such as, in private homes, boarding houses, bachelor quarters and dormitory. When records were compared with accepted standards for good nutrition, it was found that diets of all groups were consistently deficient in phosphorus, iron, thiamine and ascorbic acid. The differences found in groups living in different quarters were not great although the dormitory students received the best diet in both quality and quantity while those in private homes had the poorest.

In 1940 Jackson and Schuck<sup>13</sup> at Purdue reported a study comparing the nutritional adequacy of the diet of college women living on a limited and

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11. Hughina McKay and Mary B. Patton, "Food Intake of Freshman College Women," Journal of Home Economics, XXX (October, 1938) 583.

12. Sadie O. Morris and Mildred Bowers, "A Study of the Diets of One Hundred College Women," Journal of the American Dietetic Association, XV (May, 1939) 358.

13. Pearl Jackson and Cecilia Schuck, "A Comparative Study of the Nutritional Adequacy of the Foods Purchased by Groups of College Women on a Limited and on a Liberal Food Budget," Journal of Home Economics, XXXII (October, 1940) 559.



on a liberal food budget. Two cooperative houses with a minimum food budget were compared with a sorority house with a more liberal budget. The inventory method was used but no waste was weighed or estimated. Generally, for the amount of money spent, the cooperative houses purchased a more nearly adequate food supply than did the sorority house.

Jackson and Schuck<sup>14</sup> followed this report with another in 1941 on the same groups of students. The records were analyzed to determine the cost and caloric contribution of the different food classes. The results were compared with Stiebling's recommendations for diets at different cost levels. The food was evaluated on the "as purchased" basis for calories, protein, calcium, phosphorus and iron. The investigators found that for both groups the dairy products were too low while fats and sweets were too high.

In 1942 a comprehensive report of the dietary habits of college students was published by Reynolds, Ohlson, Pittman, McKay, Patton, Donelson, Leverton, Meiller and Bitting<sup>15</sup> wherein six mid-western colleges had participated. Three thousand four hundred and thirty two students from Iowa, Kansas, Minnesota, Nebraska, Ohio and Wisconsin kept individual records which included the approximate amount and kind of food eaten at table and between meals. The records were checked for the frequency of occurrence of milk; green or yellow vegetables; citrus fruits or tomato; meat, fish and poultry; and whole grain products. The selection of foods in the order of popularity was meat, milk, green and yellow vegetables,

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14. Pearl Jackson and Cecilia Schuck, "Nutritional Adequacy of Foods Purchased by College Women on Limited and More Liberal Food Budgets," Journal of the American Dietetic Association, XVII, (October, 1941) 784.

15. May S. Reynolds, et al., "The Dietary Habits of College Students," Journal of Home Economics, XXXIV (June, 1942) 379.

citrus fruits and tomato, and whole grains.

Pittman, McKay, Kunerth, Patton, Edelblute and Cox<sup>16</sup> reported in 1942 a study of the caloric intakes of twelve Kansas and fifteen Ohio women students. Analyses were made by aliquots of food eaten. They found that the mean caloric intake of different subjects varied greatly; and that the differences between subjects were significantly greater than the differences between periods for the same subject. The Kansas subjects had a higher mean intake than did the Ohio subjects. The mean caloric intake for subjects from both states was well below the commonly used standard for the moderately active woman.

Leverson and March<sup>17</sup> from the University of Nebraska in 1942 reported a study on the iron metabolism and requirement of young women. They studied students who were 16 to 27 years of age and who were living on self-chosen diets. These investigators state that "it now appears that iron excretion is not a criterion of the body's need or utilization of iron but rather a reflection of the rate or completeness of absorption and that many factors other than need may influence absorption."<sup>18</sup> In making iron metabolism studies they found no occasion to suggest more or less iron than is recommended in the current dietary standards for young women. They suggest rather that emphasis be placed upon diets optimum in other essential nutrients which have been shown to aid in efficient

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16. Martha S. Pittman, et al., "Caloric Intakes of College Women," Journal of the American Dietetic Association, XVIII, (July, 1942) 449.

17. Ruth M. Leverson and Alice G. Marsh, "The Iron Metabolism and Requirement of Young Women," Journal of Nutrition, XXIII (March, 1942) 229.

18. Ibid.

iron absorption and utilization.

McKay, Patton, Ohlson, Pittman, Leverton, Marsh, Stearns and Cox<sup>19</sup> reported in 1942 a study on the calcium, phosphorus and nitrogen metabolism of college women. They conducted three studies which were (1) a study of 124 students from four states living on self-chosen diets; (2) a study of an individual for 44 five-day periods at intervals from her nineteenth through her twenty-second years; and (3) a study of a group of nine young women eating basal diets supplemented by one, two and three cups of milk, respectively. With the 124 subjects they found that place, age and weight differences were not significant and that the intake was sufficiently related to retention. They found the requirements for equilibrium to be 0.8 gm. calcium, 1 gm. phosphorus and 9 gm. nitrogen. They also found that the type of diet is a factor influencing the calcium retention, therefore making it desirable for a generous calcium allowance for young women of college age; i. e., 17 to 24 years of age. The recommendation was made that the National Research Council standard of 1 gm. of calcium for girls 16 to 20 years of age should also be made for the college age group.

A report was made in 1943 by MacMillan and Leverton<sup>20</sup> from the University of Nebraska on the self-chosen diets of college girls in a cooperative dormitory. They made a study of food consumption and cost by the inventory method using only "as purchased" figures and weighing no waste.

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19. Hughina McKay, et al., "Calcium, Phosphorus and Nitrogen Metabolism of Young College Women," Journal of Nutrition, XXIV (October, 1942) 367.

20. Thelma J. MacMillan and Ruth M. Leverton, "The Self-Chosen Diets of College Girls in a Cooperative Dormitory," Journal of Home Economics, XXXV (October 1943) 514.

Their results were then compared with the Bureau of Home Economics standards for girls 16 to 20 years of age. They found that the standards were met in the amount of protein, thiamine, riboflavin and niacin in the diet. In the case of calories, calcium, vitamin A and ascorbic acid, the per cents of the standard obtained were 87%, 86%, 99% and 93%, respectively.

Winters and Leslie<sup>21</sup> reported in 1944 a study of the diet of twenty women in the moderate and low income groups at the University of Texas. With each group, records of estimated food intake were kept by the subjects and analyzed by the investigators. For the moderate income group the standards used were the recommended daily allowances for the moderately active woman. In this group the calories were 1/2 to 4/5 of the recommended amount; protein and calcium were adequate; while riboflavin, niacin and thiamine were 4/5, 3/5 and 1/2, respectively. The standards used for the low income group were those for a sedentary woman. Calories were 1/2 to 3/4 of the standard; protein and calcium were 1/2 while riboflavin, niacin and thiamine were 1/3.

In 1944 Leverton and MacMillan<sup>22</sup> reported from the University of Nebraska a study of planned and self-chosen low cost diets. They studied three groups of students. The experimental group consisted of eight girls living in a cooperative dormitory from October 1942 to April 1943. The authors planned the menus, selected the recipes and did the marketing at neighborhood stores for the experimental group. In the two control

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21. Jet C. Winters and Ruth E. Leslie, "A Study of the Diet of Twenty Women in the Moderate Income Group," Journal of Nutrition, XXVII (February, 1944) 185.

22. Ruth M. Leverton and Thelma J. MacMillan, "Planned and Self-Chosen Low Cost Diets," Journal of Home Economics, XXXVI (April, 1944) 225.



groups of six girls each, the students were on self-chosen diets. For all the specific nutrients except calories, the standards for a sedentary woman were used. They considered the standard for the moderately active woman high for college age women. For the experimental group the cost was \$1.69 per person per week. All of the specific nutrients except calories which were low, either met or exceeded the National Research Council's allowances. For the control groups the cost per person per week was \$2.10. The control groups received from 97% to 113% of the calcium and vitamins recommended; while for protein and calories they received only 84% and 76%, respectively. The investigators felt that if, as a minimum requirement, the calories recommended for the sedentary woman were used for college women, the diet, even on low cost, could be planned to contain adequate amounts of the specific nutrients. They considered that the greatest saving in food cost came from the use of unprepared cereals, large amounts of potatoes, inexpensive table and cooking fats and a minimum expenditure for the miscellaneous food items.

Dodds and MacLeod<sup>23</sup> in 1944 reported from the University of Tennessee a survey of the ascorbic acid status of college students. They made a survey of 345 college women who kept their own records and who were enrolled in courses in home economics and physiological chemistry. Through blood serum tests, they found that the freshman mean was 0.67 mgm. per cent while the upperclassmen had a mean of 0.84 mgm. per cent. Dodds and MacLeod found that their values agree with the findings of other workers

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23. Mary L. Dodds and Florence L. MacLeod, "A Survey of the Ascorbic Acid Status of College Students," Journal of Nutrition, XXVII (April, 1944) 315.

using comparable methods of analysis for similar groups in different localities.

Greenwood and Lonsinger<sup>24</sup> at Oklahoma A. & M. reported in 1944 two studies on the dietary habits of college women. The first study was concerned with the caloric intake and energy requirements of college women who were on self-chosen diets. Two hundred and three students kept their own food records for seven consecutive days. They estimated the sizes of portions used and noted the type of eating place patronized. The data were collected during three regular semesters and two summer sessions. The mean caloric intake was found to be 2,015.9 calories while the energy requirement, judged by body weight and age was 2,284.7 calories. The mean varied only slightly during the summer sessions. Further study<sup>25</sup> on the same group of students reported protein, calcium, phosphorus and iron intakes of 64.6 gm., 0.8288 gm., 1.1713 gm. and 10.335 mgm. per day, respectively.

In 1945 Donelson, Nelson, Ohlson, Pittman, Leverton, McKay, Kinsman, Armstrong and Reynolds<sup>26</sup> collaborated on a study of the nutritional status of midwestern college women. Seven midwestern states--Iowa, Kansas, Minnesota, Nebraska, Ohio, Oklahoma and Wisconsin--participated in the study

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24. Mary L. Greenwood and Barbara N. Lonsinger, "Food Intake of College Women: Caloric and Energy Requirement," Journal of the American Dietetic Association, XX (September, 1944) 524.

25. Mary L. Greenwood and Barbara N. Lonsinger, "Food Intake of College Women: Protein, Calcium, Phosphorus and Iron," Journal of the American Dietetic Association, XX (October, 1944) 671.

26. Eva G. Donelson, et al., "Nutritional Status of Midwestern College Women," Journal of the American Dietetic Association, XXI (March, 1945) 145.

using identical methods of investigation. The study entailed an analysis of food habits and an assessment of physical status. Food selections were evaluated from weekly records kept by the individual student. The nutritional status was determined by anthropometric measurements, basal metabolism determinations and complete blood analyses. A qualitative evaluation revealed a notable lack in the amount of citrus fruits and tomatoes used, an inadequate amount of green and yellow vegetables, milk and whole grain cereals. They found the mean caloric content of the diet to be 2,000 calories. The investigators concluded that calcium, phosphorus and protein were all needed in the amounts of 1 gm., 1 gm., and 56 gm., respectively; and that on a good diet 7.21 mgm. of iron daily would be sufficient.

A study was reported in 1946 by Charlotte M. Young<sup>27</sup> on the dietary habits of Cornell University women. Groups of ten young women each, living under different circumstances, such as, sorority house, private homes, campus controlled cottages with meals served in a central dormitory and a graduate house were studied. The students kept records of food intake for seven consecutive days in winter and spring. These records were analyzed in three ways. First, a weekly average of specific nutrients for each student with a composite average for each group was compared with the National Research Council's recommendations for 16 to 20 year olds and for a moderately active woman. Second, the records were analyzed for frequency of the occurrence of foods commonly listed

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27. Charlotte M. Young, "Dietary Study of Cornell University Women," Journal of the American Dietetic Association, XXII (January, 1946) 25.

in accepted dietary patterns. The third analysis was concerned with eating habits. As minimum requirements, the investigator arbitrarily set as her standard  $2/3$  of the National Research Council's recommendations for girls 16 to 20 years of age. If her standard is acceptable, the study was outstanding in evident adequacies of the specific nutrients. The outstanding discrepancy in the analysis of the food groups was found in the amount of green and yellow vegetables consumed. The study showed eating habits to be better than expected. The per cent of students missing breakfast was not great; and more fruit and milk were used as in-between meal snacks than "cokes" and candy.

In summarizing these studies reported in the years from 1918 to 1946, it can be said that most investigators have found the caloric recommendations to be high for college women. There is more controversy as to what standards should be for protein, calcium, iron and the vitamins. Some investigators feel that these nutrients are adequate while others feel that they are either high or low. As more studies are reported and as more research is done on the assimilation of foods by the human mechanism, standards acceptable to more research workers will be established.



## CHAPTER III

### METHODS

This study was made to evaluate the adequacy of the diets served in a home management house and of the influence upon it of cost and season.

The data for the study were obtained from records of food purchases and from inventories recorded before and after each period. The time the students spent in the house varied from five to nine weeks because of adjustment to the number of students and the length of the semester. The total number of meals served in the entire period was divided so that an equal number of meals was planned by each student. Each student was responsible for planning the meals on one cost level and assisted in the planning of meals on another level. The meals thus planned covered the three levels of 30¢ to 35¢, 40¢ to 45¢ and 60¢. The ideal plan, particularly for the purpose of such a study as this one, would have been for one student to plan menus on each cost level. The length of the terms in the house were such that the execution of this plan would have been impractical. One set of menus for each cost level was analyzed.

Each period for each cost level should have been for seven consecutive days. Most investigators have used as a minimum length of study seven consecutive days. In this study, less than a week was used for each period. For the winter and spring groups, six and one-third days constituted a period whereas the fall group was for four and one-third

days. The first two mentioned groups probably showed no effects of this slightly shorter time; while for the fall groups, there probably would have been results nearer the standard, had the longer period been possible. At times there were noticeable differences in a student's ability to get maximum food value for money spent. This was apparent in students whose responsibilities at home had been greater than other students.

The procedure for the collection of the data was the same for each set of menus evaluated. The "as purchased" weights of all foods bought were recorded, but no waste was weighed or estimated. An inventory was recorded before and after each period.

The total quantities were distributed according to the eleven food groups given by the United States Department of Agriculture.<sup>1</sup> These groups are: milk and cheese; potatoes and sweet potatoes; dried beans, peas and nuts; tomatoes and citrus fruits; green, leafy and yellow vegetables; other fruits and vegetables; eggs; meat, fish, and poultry; flour and cereals; fats and oils; sugars and syrups. Calories, protein, calcium, iron, vitamin A, ascorbic acid, thiamine, riboflavin and niacin were calculated for each food group. Tables compiled by the United States Department of Agriculture,<sup>2</sup> the National Research Council<sup>3</sup> and Taylor<sup>4</sup> were used for these calculations. The totals for each specific

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1. United States, Department of Agriculture. Family Food Consumption in the United States, Miscellaneous Publication No. 550, Washington, D. C. 1944.

2. Ibid.

3. National Research Council, Tables of Food Composition Giving Proximate Mineral and Vitamin Components of Foods (Based on National Research Council November 1, 1943, Army Tables) Committee on Food Composition.

4. Clara M. Taylor, Food Values in Shares and Weights, New York: The MacMillan Company, 1942.

nutrient were then reduced to the amount per person per day for comparison with the National Research Council's recommended dietary allowances for the sedentary woman.<sup>5</sup>

Data<sup>6</sup> from Teacher's College, Columbia University, place students in the sedentary group with a range of from 33 calories to 42 or 45 calories per kilogram of body weight per day or between 1,700 and 2,500 calories for women weighing 126 pounds. Sherman<sup>7</sup> in discussing caloric needs quotes Tigerstedt's Textbook of Physiology on estimates of food requirements for different degrees of activity. This showed that two seamstresses, using a sewing machine all day, required 1,900 and 2,100 calories per day, respectively. It would seem safe, therefore, to assume that the average home economics student, even in a home management house, would require not more than 2,100 calories per day. The dietary allowances for the sedentary woman were chosen as a standard for this study for these reasons and because the students were over 20 years of age.

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5. Ibid., p. 54.

6. Mary Swartz Rose, Foundations of Nutrition, New York: The MacMillan Company, 4th Edition, p. 59.

7. Henry C. Sherman, Chemistry of Food and Nutrition, New York: The MacMillan Company, 6th Edition, 1941, p. 184.

## CHAPTER IV

### DISCUSSION OF RESULTS

Since all records used in this study were on the basis of "as purchased" foods and since no waste was weighed or estimated, the values for the specific nutrients appear higher than actual intake. This factor was brought out by Jackson and Schuck<sup>1</sup> and MacMillan and Leverton.<sup>2</sup> Aside from losses in preparation there are also additional losses in the cooking processes. It is, therefore, essential to remember that in all instances, the amount per person per day of each specific nutrient estimated in this study would probably be lower if waste had been weighed or estimated, although there appeared to be comparatively little table waste. Searle and Arnold<sup>3</sup> state that in using the inventory method, for the sake of accuracy, all waste must be carefully collected and weighed. Kramer, Evers, Fletcher and Gallemore<sup>4</sup> state that group dietary studies do not show actual intake; but the weighed individual dietary study frequently necessitates changes in the individual's choice of food.

Generally speaking, from the review of literature most investigators have found that an adequate diet can be obtained, even on low cost levels, by careful planning and buying. Each cost level of this study will be

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1. Pearl Jackson and Cecilia Schuck, "A Comparative Study of the Nutritional Adequacy of the Foods Purchased by Groups of College Women on a Limited and on a Liberal Food Budget," Journal of Home Economics, XXXII (October, 1940) 559.

2. Thelma J. MacMillan and Ruth M. Leverton, "The Self-Chosen Diets of College Girls in a Cooperative Dormitory," Journal of Home Economics, XXXV (October, 1943) 514.

3. Garnet N. Searle and Rosseleene M. Arnold, "A Comparison of the Individual and Inventory Methods of Dietary Study," Journal of Home Economics, XX (February, 1928) 84.

4. Martha M. Kramer, et al., "Protein, Calcium and Phosphorus Intakes of College Women as Indicated by Nitrogen, Calcium and Phosphorus Outputs," Journal of Nutrition, VII (January, 1934) 89.



discussed separately with the adequacy or inadequacy of each specific nutrient in relation to cost and season.

LOW COST:

The allowance for the low cost level in the home management house was 30¢ to 35¢ per person per day. The actual expenditure for the winter, spring and fall groups was \$0.348, \$0.348 and \$0.336 per person per day, respectively.

Table I (see Appendix) shows the nutritive value of the low cost meals for the three seasons. The energy value of the diet was low in all periods but particularly so in spring and fall. The protein was above the standard in fall only; but on the basis of a 57 kilogram or 126 pound woman, it would have been adequate. Calcium fell below the standard in the spring, but it was above in winter and fall. The standard for calcium may be low since McKay, Patton, Ohlson, Pittman, Leverton, Marsh, Stearns and Cox<sup>5</sup> have recommended that the calcium standard for college girls should be 1 gm. per person per day. Iron was below the standard in each season although Donelson, Nelson, Ohlson, Pittman, Leverton, McKay, Kinsman, Armstrong and Reynolds<sup>6</sup> state that on a diet good in other respects 7.21 mgm. of iron daily is sufficient. Thiamine was adequate in winter and fall, but was low in spring. Ascorbic acid was above the standard in each season, but the amount in the fall would not have been sufficient

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5. Hughina McKay, et al., "Calcium, Phosphorus and Nitrogen Metabolism of Young College Women," Journal of Nutrition, XXIV (October, 1942) 367.

6. Eva G. Donelson, et al., "Nutritional Status of Midwestern College Women," Journal of the American Dietetic Association, XXI (March, 1945) 145.

to take care of losses in cooking and preparation. Riboflavin and niacin were both low in two seasons, but not in the same seasons.

Comparatively speaking, the winter season was more nearly adequate than the other two seasons studied, although it was slightly low in calories, protein, iron and niacin. The spring period was low in calories, protein, calcium, iron, thiamine and riboflavin. The fall season was lowest in calories, iron, riboflavin and niacin.

Table II (see Appendix) gives the weights per person per week of each food group for the three seasons on the low cost budget. In each season milk and milk products were adequate. The amount of potatoes and sweet potatoes, and the amount of dried beans, peas and nuts were low in all seasons. The amount of "other fruits and vegetables" was low in spring and fall. Eggs were low in spring and fall; and meat, fish and poultry were low in all seasons. Flour and cereals were low in spring while fats and oils were low in the fall. Sugars and syrups were low in each period. The winter season was better from this analysis as well as the analysis of the specific nutrients.

The quality of the low cost menus could have been improved by bringing the food groups up to the United States Department of Agriculture<sup>7</sup> recommendations for the sedentary woman. This would have eliminated the deficiencies in the specific nutrients since the food groups which are below the standard are the ones rich in the nutrients which are low. An increase in the amount of dried beans, peas and nuts used

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7. Family Food Plans for Good Nutrition, United States Department of Agriculture - A. W. I. - 78 Washington, D. C., December, 1943.

would have increased the amounts of the specific nutrients which were low. More eggs, meat, fish and poultry would have increased the amounts of protein, calcium and niacin. An increase in the fats and oils as well as the sugars and syrups would have brought the caloric content of the diets up to standard.

From Tables I and II it is evident that an adequate diet is available on low cost levels if menus and shopping are planned carefully. Although in each set of menus, as analyzed, the specific nutrients and food groups were somewhat below the standard, none is inadequate in all nutrients or food groups nor in the same ones for each season.

#### MEDIUM COST:

The allowance for medium cost was 40¢ to 45¢ per person per day. The actual expenditure for the winter, spring and fall groups was \$0.435, \$0.45 and \$0.483 per person per day, respectively.

Table III (see Appendix) shows the nutritive value of the meals on the medium cost level for the three seasons. Calories were more nearly adequate than on the low cost level, but were still below the standard. Protein, calcium, vitamin A and ascorbic acid either met or were above the standard in each season. Iron was adequate in winter, but was low for spring and fall. Thiamine was slightly low in spring and fall. Riboflavin was low in spring only. Niacin was low in each season, but particularly low in the spring and fall.

The winter season, low in only calories and niacin, was more nearly adequate than the spring and fall seasons. The spring season

was low in calories, iron, thiamine and was very low in niacin. The fall season was low in calories, iron, thiamine, riboflavin and niacin.

Table IV (see Appendix) shows the distribution of food groups on the per person per week basis. In each season, milk and cheese were adequate. Potatoes and sweet potatoes were low in each season while dried beans, peas and nuts were low only in spring. Tomatoes and citrus fruits were low in winter, due probably to high prices of Florida citrus fruits at that time and the unavailability of canned tomatoes. Leafy green and yellow vegetables were low in each season as were "other fruits and vegetables." Eggs were low in winter and fall, whereas meat, fish and poultry were low in each season. Flour and cereals, fats and oils were high in winter and fall. Sugars and syrups were high in winter and spring.

The deficiencies of the specific nutrients would have been eliminated in the medium cost menus as in the low cost ones with the improvement in the distribution of the food groups. An increase to standard of the amount of potatoes and sweet potatoes used would have improved the caloric content of the diet. A decrease in the amount of flour and cereals, fats and oils, sugars and syrups would have made it possible to increase the quantity of all fruits and vegetables thereby increasing the vitamin and mineral content of the diet generally.

Although the students were getting a diet slightly below standard at the medium cost level, it is entirely possible to receive an adequate diet at this level with more careful planning.



LIBERAL COST:

The allowance for the liberal cost level was 60¢ per person per day. The actual expenditure was \$0.573, \$0.585 and \$0.604, per person per day, respectively.

Table V (see Appendix) shows the nutritive value of the liberal cost menus. With the exception of thiamine in the spring group, all of the specific nutrients either met or were above the standard for each season.

Table VI (see Appendix) shows the distribution of the food groups with the amount per person per week for each group. There are no government standards available for comparison for the liberal cost level on the basis of food groups.

Table VII (see Appendix) is a summary of the amounts of the specific nutrients for each cost level and each season. From this table the variations appear to indicate that better planning would give an adequate diet. Since no waste was allowed for, the definite trend toward a better diet with increasing cost levels is significant. This agrees with Stiebling's<sup>8</sup> suggestion that with more money, more people get a better diet.

Calories increased in each season as the cost level increased. Protein increased with the cost level except in the medium cost for fall which may have been due to the fluctuation of the market in amounts and prices of meats and eggs. There was comparatively little variation

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8. Hazel K. Stiebling, "Adequacy of American Diets," Handbook of Nutrition, American Medical Association, PP. 403--424, Chicago, 1943.

in calcium intake since one pint of milk per person per day was bought and used regardless of cost level. The variations in calcium intake may be accounted for in quantities of cheese used. The small quantities of eggs and meat used on low cost menus in spring and fall brought the iron intake for these two seasons below normal. Leafy, green and yellow vegetables; eggs and meat were low in spring and fall on the medium level which would account for the low iron in those two seasons. Thiamine was low in all of the spring groups which may have been caused by a shortage of pork at that time and the use of less whole grain cereal products. Riboflavin was low in the low cost menus for spring and fall due probably to meat shortages and cost since the amount of milk in the diet was constant. Niacin was low on the low cost level for winter and fall and on the medium cost for spring and fall. These deficiencies may also have been due to fluctuations in cost and availability of meat.

It is apparent from the foregoing discussion and tables that the students living in the home management house were getting a completely adequate diet on only the liberal cost level. However, had the students given more careful attention to their menu planning, an adequate diet would have been possible on each cost level.

Seasonal differences appear to be definite; however, market conditions due to rationing and scarcities of various foods may have brought out what would seem to be seasonal differences. Other investigators<sup>9</sup> have found seasonal differences to be minute. The difference

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9. Martha M. Kramer, et al., "Protein, Calcium and Phosphorus Intakes of College Women as Indicated by Nitrogen, Calcium and Phosphorus Outputs," Journal of Nutrition, VII (January, 1934) 89.

in the length of the fall periods compared with those in spring and winter would have given margin for error in seasonal differences.

The quality of all of the menus for all seasons and cost levels could have been improved by the use of more dried beans and peas; eggs; glandular meats; seafoods; and whole grain cereal products. As is general in the United States there could have been a decrease in the amounts of fats and oils; sugars and syrups; and flour and cereals used on the medium and liberal cost levels.

As a general rule, legumes were unpopular with the students, consequently, they attempted to use this food group as infrequently as possible. The use of whole grain cereal products varied with the groups. The use of eggs varied only with price and availability. Meats of all kinds varied with availability. This was also true of fats and oils as well as sugars and syrups. The amounts of citrus fruits and tomatoes varied with market conditions.

## CHAPTER V

### SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

A study has been made of the adequacy of diets served in a home management house by home economics seniors living at three levels of income. All three cost levels were studied for winter, spring and fall.

Records were kept of all foods on the "as purchased" basis, and inventories were recorded before and after each period studied. The diets were analyzed for average content of calories, protein, calcium, iron, vitamin A, ascorbic acid, thiamine, riboflavin and niacin and the values compared with the National Research Council's recommended dietary allowances for the sedentary woman. However, since no waste was weighed or estimated, the diet appears better than it actually was.

The low cost level was found to be inadequate in all of the specific nutrients except vitamin A and ascorbic acid. The medium cost level while slightly deficient in calories, niacin and iron was more nearly adequate than the low cost level. For liberal cost all of the specific nutrients either met or exceeded the standards used for this study.

An adequate diet could have been obtained on each of the three cost levels as was shown in the fact that the inadequacies found were not the same for each cost level or season. Market conditions made it very difficult to carry out menus as planned. This would account for some inadequacies.



The quality of the diet would have been improved with a decrease in the amounts of sugars and fats in the liberal cost level and an increase in the amounts of legumes; green, leafy and yellow vegetables; whole grain cereals; eggs; meats, fish and poultry used for each season and each cost level.

There were striking differences in the nutritive value of the low and liberal cost levels; and the medium and liberal cost levels. The differences between the low and medium levels were less pronounced.

The inadequacies found in each instance could have been remedied by more attention to the details involving nutritional adequacy in menu planning. Students have a tendency to plan menus more for personal likes and dislikes and often neglect the principles of nutrition which they have been taught.

It is recommended that a study be made wherein the length of each period analyzed would contain the same number of meals planned by the same student to eliminate the possibility of differences in length of time influencing adequacy or inadequacy of the menus. The period studied should be at least one week. It is also recommended that a study be made during which waste would be studied for each cost level.

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APPENDIX

TABLE I

A COMPARISON OF THE NUTRITIVE VALUE PER PERSON PER DAY

LOW COST

AMOUNT PER PERSON PER DAY				
	Feb. 11- 18, 1945	Apr. 4- 10, 1945	Nov. 8- 11, 1945	N. R. C Recommen- dations Sedentary Woman
Dates				
Cost	\$0.348	\$0.348	\$0.336	
Meals Served	173	174	113	
SPECIFIC NUTRIENTS				
Calories	1992.	1843.	1737.	2100.
Protein - gm.	57.07	56.1	64.8	60.0
Calcium - gm.	.86	.78	.93	0.8
Iron - mgm.	11.81	10.16	10.27	12.0
Vitamin A - I. U.	13006.	9511.	7357.	5000.0
Thiamine - mgm.	1.27	1.10	1.22	1.2
Ascorbic Acid - mgm.	136.	137.	78.	70.0
Riboflavin - mgm.	2.26	1.59	1.57	1.8
Niacin - mgm.	10.04	23.8	10.79	12.0

TABLE II  
WEEKLY QUANTITIES OF FOOD PER PERSON  
LOW COST

	AMOUNT PER PERSON PER WEEK				U. S. D. A. Standard Sedentary Woman
	Group	Winter	Spring	Fall	
	Cost	\$0.348	\$0.348	\$0.336	
	Meals	173	174	113	
FOOD GROUPS					
Milk and Cheese - lbs.	(1) 9.1	(1) 7.49	(1) 7.42	4 1/2 qts.	
Potatoes & Sweet Potatoes - lbs.	1.82	1.19	1.61	2.	
Dried Beans, Peas & Nuts - lbs.	.014	--	.06	.25	
Tomatoes & Citrus Fruit - lbs.	3.43	2.38	2.17	1.5	
Leafy, Green & Yellow Vegetables - lbs.	1.54	2.03	1.96	1.5	
Other Fruits & Vegetables - lbs.	2.66	2.31	2.10	2.5	
Eggs - number	4	4	2	4	
Meat, Fish & Poultry - lbs.	.63	1.19	.98	2.	
Flour & Cereals - lbs.	2.59	2.38	2.73	2.5	
Fats & Oils - lbs.	.77	.77	.42	.75	
Sugars & Syrups - lbs.	.56	.70	.49	.75	

(1) Includes milk in pounds and weight of cheese used.

TABLE III

A COMPARISON OF THE NUTRITIVE VALUE PER PERSON PER DAY  
MEDIUM COST

AMOUNT PER PERSON PER DAY				
	Feb. 5 - 11, 1945	Mar. 29 - Apr. 4, 1945	Oct. 30 - Nov. 2, 1945	N. R. C. Recommen- dations Sedentary Woman
Dates				
Cost	\$0.435	\$0.45	\$0.483	
Meals Served	169	154	106	
SPECIFIC NUTRIENTS				
Calories	2094.	1913	1972.	2100.
Protein - gm.	62.6	62.0	62.6	60.0
Calcium - gm.	.89	.98	.96	0.8
Iron - mgm.	14.88	10.17	10.62	12.0
Vitamin A - I. U.	14275.	9363.	6629.	5000.
Thiamine - mgm.	1.21	1.09	1.19	1.2
Ascorbic Acid - mgm.	145.	162.	117.	70.0
Riboflavin - mgm.	2.29	1.88	1.70	1.8
Niacin - mgm.	11.87	4.65	9.9	12.0



TABLE IV  
WEEKLY QUANTITIES OF FOOD PER PERSON  
MEDIUM COST

	AMOUNT PER PERSON PER WEEK				U. S. D. A. Standard Sedentary Woman
	Group	Winter	Spring	Fall	
	Cost	\$0.435	\$0.45	\$0.483	
	Meals	169	154	106	
FOOD GROUPS					
Milk and Cheese - lbs.	(1) 7.56	(1) 7.91	(1) 8.61	4 1/2 qts.	
Potatoes & Sweet Potatoes - lbs.	1.75	1.12	1.96	2	
Dried Beans, Peas & Nuts - lbs.	.28	.05	.21	.12	
Tomatoes & Citrus Fruits - lbs.	1.75	2.87	4.06	2	
Leafy, Green & Yellow Vegetables - lbs.	3.01	2.45	1.75	3.5	
Other Fruits & Vegetables - lbs.	3.64	1.75	3.08	4	
Eggs - number	4	6	4	5	
Meat, Fish & Poultry - lbs.	1.47	1.33	1.33	2.5	
Flour & Cereals - lbs.	2.59	2.24	5.39	2.25	
Fats & Oils - lbs.	.84	.56	.98	.63	
Sugars & Syrups - lbs.	1.05	.84	.72	.75	

(1) Includes milk in pounds and weight of cheese used.

TABLE V

A COMPARISON OF THE NUTRITIVE VALUE PER PERSON PER DAY  
LIBERAL COST

AMOUNT PER PERSON PER DAY				
	Feb. 18 - 23, 1945	Apr. 10 - 17, 1945	Nov. 21 - 24, 1945	N. R. C. Recommen- dations Sedentary Woman
Dates				
Cost	\$0.573	\$0.585	\$0.604	
Meals Served	175	174	87	
SPECIFIC NUTRIENTS				
Calories	2398.	2369.	2644.	2100.
Protein - gm.	72.5	68.6	79.3	60.0
Calcium - gm.	.90	.82	.96	0.8
Iron - mgm.	14.11	13.9	16.45	12.0
Vitamin A - I. U.	14698.	14188.	8510.	5000.
Thiamine - mgm.	1.34	1.15	1.39	1.2
Ascorbic Acid - mgm.	185.	138.	115.	70.
Riboflavin - mgm.	2.5	2.33	2.17	1.8
Niacin - mgm.	17.25	24.98	14.36	12.0

TABLE VI  
WEEKLY QUANTITIES OF FOOD PER PERSON  
LIBERAL COST

	AMOUNT PER PERSON PER WEEK			
	Group	Winter	Spring	Fall
	Cost	\$0.573	\$0.585	\$0.604
	Meals	175	174	87
FOOD GROUPS				
Milk & Cheese - lbs.	(1) 7.70	(1) 7.21	(1) 8.38	
Potatoes & Sweet Potatoes - lbs.	2.52	1.75	2.45	
Dried Beans, Peas & Nuts - lbs.	--	.07	.06	
Tomatoes & Citrus Fruits - lbs.	3.01	3.43	1.96	
Leafy, Green & Yellow Vegetables - lbs.	2.87	1.68	2.52	
Other Fruits & Vegetables - lbs.	2.38	2.66	1.96	
Eggs - number	5	7	7	
Meat, Fish & Poultry - lbs.	2.73	1.89	2.45	
Flour & Cereals - lbs.	2.24	3.29	2.66	
Fats & Oils - lbs.	1.12	.84	1.26	
Sugars & Syrups - lbs.	.63	1.47	1.05	

(1) Includes milk in pounds and weight of cheese used.

TABLE VII

A COMPARISON OF THE NUTRITIVE VALUE FOR THREE COST LEVELS AND THREE SEASONS

		Amount Per Person Per Day									
		Winter - 1945			Spring - 1945			Fall - 1945			
Date		Feb. 11- Feb. 18	Feb. 5 to Feb. 11	Feb. 18 to Feb. 23	Apr. 4 to Apr. 10	Mar. 29 to Apr. 4	Apr. 10 to Apr. 17	Nov. 8 to Nov. 11	Oct. 30 to Nov. 2	Nov. 21 to Nov. 24	N. R. C. Recom- mendations Sedentary Woman
Actual Cost		\$0.348	\$0.435	\$0.573	\$0.348	\$0.45	\$0.585	\$0.336	\$0.483	\$0.604	
SPECIFIC NUTRIENTS											
Calories		1992.	2094.	2398.	1843.	1913.	2369.	1737.	1972.	2644.	2100.
Protein - gm.		57.1	62.6	72.5	56.1	62.0	68.6	64.8	62.6	79.3	60.0
Calcium - gm.		.86	.89	.90	.78	.98	.82	.93	.96	.96	0.8
Iron - mgm.		11.81	14.88	14.11	10.16	10.17	13.9	10.27	10.62	16.45	12.0
Vitamin A - I. U.		13006.	14275.	14698.	9511.	9363.	14188.	7357.	6629.	8510.	5000.
Thiamine - mgm.		1.27	1.21	1.34	1.10	1.09	1.15	1.22	1.19	1.39	1.2
Ascorbic Acid - mgm.		136.	145.	185.	137.	162.	138.	78.	117.	115.	70.0
Riboflavin - mgm.		2.26	2.29	2.5	1.59	1.88	2.33	1.57	1.70	2.17	1.8
Niacin - mgm.		10.04	11.87	17.25	23.8	4.65	24.98	10.79	9.9	14.36	12.0



TABLE VIII  
 TYPICAL ONE-DAY MENUS  
 LOW COST

	Winter	Spring	Fall
	February 13, 1945	March 10, 1945	November 9, 1945
Breakfast	Stewed Prunes Pancakes Syrup Oleomargarine Coffee Milk	Tomato Juice Scrambled Eggs Buttered Toast Coffee Milk	Tomato Juice Cream of Wheat Top Milk Buttered Toast Coffee Milk
Noon	Cream of Tomato Soup Saltines W. W. Bread Oleo Bread Pudding Milk	Chicken Soup Shredded Lettuce French Dressing Apple Brown Betty Milk	Soybean Casserole Cole Slaw Muffins Oleo Apple Butter Milk
Night	Fried Liver & Gravy Baked Diced Potatoes Collards Celery Curls Muffins Oleo Whipped Jello Coffee	Spaghetti & Meat Balls Turnip Greens Mixed Vegetable Salad Hot Rolls Oleo Fruit Cup Coffee	Salmon Loaf Escalloped Potatoes Buttered Carrots Cornmeal Muffins Oleomargarine Lemon Ice Coffee

TABLE IX  
 TYPICAL ONE-DAY MENUS  
 MEDIUM COST

	Winter	Spring	Fall
	February 7, 1945	March 30, 1945	October 31, 1945
Breakfast	Stewed Prunes Puffy Omelet Buttered Toast Coffee Milk	Apple Juice Oatmeal Top Milk Buttered Toast Jelly Coffee Milk	Grapefruit Juice Scrambled Eggs Buttered Toast Coffee Milk
Noon	Baked Potatoes Buttered Green Peas Waldorf Salad Orange Halves Milk	Macaroni & Cheese Head Lettuce French Dressing Cornmeal Muffins Cookies Milk	Cream of Tomato Soup Saltines Lettuce & Cucumber Salad Gingerbread Milk
Night	Sausage Patties Julienne Green Beans Creamed Rutabagas Head Lettuce & Mayonnaise Hot Rolls Oleo Apple Pie Coffee	Fried Fish Tartar Sc. Buttered Potatoes Carrots & Peas Celery Curls Hot Biscuits Oleo Banana Pudding Coffee	Meat Balls Mashed Potatoes Sauerkraut Carrot & Raisin Salad Muffins Oleomargarine Applesauce Coffee

TABLE X  
 TYPICAL ONE-DAY MENUS  
 LIBERAL COST

	Winter	Spring	Fall
	February 19, 1945	April 13, 1945	November 23, 1945
Breakfast	Apple Juice Grits Broiled Bacon Toasted Rolls Oleo Coffee Milk	Grape Juice Scrambled Eggs Fruit Muffins Oleo  Coffee Milk	Tomato Juice Poached Eggs on Toast Buttered Toast  Coffee Milk
Noon	Cream Cheese and Olive Sandwiches Asparagus Salad Orange Halves Milk	Tomato Soup Saltines Cottage Cheese Salad W. W. Muffins Oleo Baked Bananas Milk	Beef Pot Pie Asparagus Salad Raisin Biscuits Oleo Chocolate Pudding Milk
Night	Fried Shrimp Tartar Sauce Baked Potatoes Buttered Spinach Carrot & Celery Salad Lemon Pie Coffee	Beef Croquettes Baked Potatoes Buttered Green Peas Hearts of Lettuce Hot Rolls Oleo Fruit Cup Iced Tea	Spanish Steak Parsleyed Potatoes Green Peas Bran Muffins Oleo Blackberry Pie Coffee