

THE NUTRITIVE VALUE AND COST OF FOOD CONSUMED BY
MEN AND WOMEN IN A COLLEGE RESIDENCE HALL

by

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INTRODUCTION

Many private colleges recognize a responsibility for the housing and feeding of students who are unable to live at home while attending school. McPherson College, a denominational institution located at McPherson, Kansas, has met this responsibility by providing separate dormitories for men and women students with a common dining room for the group. This dining room, located in the basement of the women's dormitory, will accommodate one hundred thirty students seating eight at a table. The house mother appoints a host and hostess for each of the tables from the student group. Two waitresses serve the meals in family style. Second servings of all foods except meats and desserts are usually provided.

The kitchen equipment is old and inadequate. The storage space consists of a large ice refrigerator for perishables, two outdoor caves for semi-perishables, and a pantry for non-perishables.

Most of the food is purchased from wholesale houses by the business manager of the college. The small daily

orders are placed with a local groceryman by the head cook.

The menus are planned by two full-time women cooks who, as a rule, consider only one meal at a time. The lack of dietetic or institution training by those responsible for planning the meals, coupled with the fact that the food allowance was exceedingly low, suggested that the diet might be insufficient.

This dietary study was therefore made to determine the adequacy of the food served. It was also hoped that it might provide a working basis for the future for improving the quality and service of the food, and at the same time, help the administration to realize the need for more adequate training for those responsible for the meals served.

It was also desired to add to the body of knowledge concerning the cost and nutritive value of food consumed by a group of college men and women.

REVIEW OF LITERATURE

After a series of dietary studies in public institutions, Atwater (1), in 1901, proposed a daily standard for the moderately active adult male of 3,400 Calories, and 125 grams of total or 115 grams of available protein.

Bailey (2), in 1903, reported studies of the food consumed by two student clubs at the University of Kansas. The first club of 46 members consisted of twice as many women as men, yet the per capita daily food consumption was high, amounting to 3,923 Calories. The second club consumed only 3,437 Calories per person per day. The average daily per capita cost of the food served was 19.5 and 17.8 cents respectively.

In 1914-15, Gephart (13) made a dietary study of St. Paul's School at Concord, New Hampshire. This observation covered the entire school year and included a group of 360 boys ranging in age from 12 to 17 years. The caloric value of all food purchased was calculated, and at various times the waste and garbage were weighed and analyzed. The per capita food consumption was found to be 5,000 Calories and 160 grams of protein per day. Edible waste amounted to 15 per cent of the purchased food.

Borthwick (4), in 1917, reported the results of an investigation of the food consumed by students living in Hamilton Hall at the University of Montana. The cost of the food per capita per day for a period of seven months was 37 cents. The nutritive value computed for an eight day period showed an average consumption of 2,549 Calories,

73 grams protein, 0.78 gram calcium, 2.34 grams phosphorus, and 0.014 gram iron. No deduction was made for edible waste.

This same year a dietary study for a two-week period was made by Macleod and Griggs (22) at Vassar College. They obtained data as to the amount, kind, and quality of food consumed by the students, and compared its nutritive value with the theoretical requirements of the group. In calculating the food consumption, the values obtained for the analyzed waste were deducted. The total waste made up 26 per cent of the purchased food. Of this material, 10.6 per cent was edible, and 15.6 per cent inedible. The food consumption amounted to 2,698 Calories and 99.5 grams of protein per capita per day. The cost was 42 cents.

Bevier (3), in 1920, reported nine studies made of some 300 students living in sorority, church, and cooperative houses at the University of Illinois. Average data for these groups showed a daily expenditure per person of 40.3 cents, and a consumption of 2,419 Calories and 69.5 grams of protein. Only 75 per cent of these students appeared for breakfast.

A second study of St. Paul's School for boys was made by Hawley (19) in 1926-27. The diet was found to furnish

31 per cent more Calories, 66 per cent more protein, 60 per cent more calcium, 33 per cent more phosphorus, and 20 per cent more iron than the estimated need. The food waste amounted to 30 per cent, an increase of 15 per cent over that of the study made in 1914-15 (13). Hawley suggested that the diet would have been better if the amounts of meat, fish, and eggs consumed had been reduced and the fruits and vegetables increased.

In 1926, Kramer and Grundmeier (21) of Kansas State College collected dietary data from 60 student organizations. Twenty of the groups studied furnished records which could be used. An analysis of these showed an average daily consumption of 2,889 Calories, 81.8 grams protein, 0.57 gram calcium, 1.29 grams phosphorus, and 0.014 gram iron. Per 3,000 Calories, the dietaries supplied 85 grams of protein. Less than one half pint of milk per person per day was used. The average daily cost was 35.6 cents. The deficiencies of the diets were apparently not due to an inadequate food expenditure, but rather to poor planning and selection.

From the summary made by Hawley (17), in 1929, of a study of 250 groups in colleges and universities and of 12 published studies in 93 institutions, it would appear that

the average college student in these groups had an adequate diet. The factors which most nearly approached the minimum were Calories and iron. Most of the diets were low in fruits and vegetables. Those planned by dietitians were more adequate than those planned by untrained supervisors.

In the same year, Grace (16) of Oregon State College secured food records from 12 women's organizations. Analysis of the data showed a range of 2,156 to 2,765 Calories per person per day at a cost of 34 to 49 cents. With one exception, calcium was adequate in these diets. Phosphorus was above the standard, but iron was deficient for all but three groups. Only six of the groups averaged a pint of milk per person per day.

West (30), in 1931, found that organized houses at Kansas State College, when placed under the direction of trained workers, could furnish meals adequate from a dietary and esthetic standpoint with no increase in expenditure.

In 1934, Goddard et al (15) made a study of a residence hall for women students in the University of California at Los Angeles. Two eight-day periods were observed. Data for edible and inedible waste as well as the nutritive value for the food served were obtained. The estimated requirements, based on activity records for six women, were

more than adequately met for all of the nutrients except iron. The average cost per day was 38.9 cents for the first period and 36.0 cents for the second. The average protein consumption for the second period, while more than adequate, was lower by 16 grams per person per day than that of the first period.

In 1935, a study by Wheeler and Mallay (31) of a cooperative group at Vassar College showed an average per capita food expenditure of 43 cents per day. Of this amount, 59 per cent was spent for protective foods. The daily diet furnished per person 2,397 Calories, 70 grams protein, 0.92 gram calcium, 1.32 grams phosphorus, 0.012 gram iron, 6,675 units of vitamin A, and 227 units of vitamin C. The group averaged one pint of milk and one-half egg per person per day.

An investigation by Ryder (24), in 1931, of the food served at the women's residence hall at Kansas State College covered a period of two weeks during which time a total of 5,258 meals was eaten. The plan of Macleod and Griggs (22) was followed in obtaining the data. The calculated nutritive value of the food consumed was found to be 1,821 Calories, 56.1 grams protein, 0.79 gram calcium, 1.19 grams phosphorus, and 0.0124 gram iron per capita per day.

This fell below the standard only for Calories and iron.

In 1932, Shirley (28) observed 10 Kansas State College student organizations, 6 fraternities and 4 sororities. She found an average daily per capita consumption of 3,816 Calories, 118.5 grams protein, 0.91 gram calcium, 1.76 grams phosphorus, and 0.020 gram iron for the fraternities and 2,822 Calories, 86.4 grams protein, 0.78 gram calcium, 1.38 grams phosphorus, and 0.016 gram iron for the sororities. No account, however, was taken of edible waste.

Fowler (12), in 1933, observed the dietary of a fraternity at Kansas State College which was under the supervision of an untrained director. The nutritive value of the food eaten was found to be 2,915 Calories, 83 grams protein, 0.65 gram calcium, 1.29 grams phosphorus, and 0.007 gram iron per person per day. Edible waste was deducted in this study. The meals served lacked interest and variety in color, texture, and food combinations.

One year later, Conard (9) attempted to determine the effect of a lowered food budget on the dietary of a Kansas State College sorority group. With a food expenditure of 20.8 cents per person per day, this diet furnished 2,055 Calories, 58.1 grams protein, 0.50 gram calcium, 0.92 gram phosphorus, and 0.008 gram iron which was below the esti-

mated need for Calories and minerals, particularly iron. The diet was somewhat monotonous due to frequent repetition of foods, but acceptable in color, texture, and flavor.

Following the adoption of a cooperative plan of living at the women's residence hall at Kansas State College, a second study of this institution was made in 1935 by Schermerhorn (25). Data were obtained as in the first study by Ryder (24). The diet, after deducting the edible waste, was found to furnish a daily mean of 2,088 Calories, 65 grams protein, 0.75 gram calcium, 1.13 grams phosphorus, and 0.0096 gram iron. The total edible waste was lowered from 23 per cent in the 1931 study to 10.6 per cent in this one. The cost per person per day was cut from 36.6 cents to 32.0 cents. The need for Calories and iron was more nearly met than in the earlier study.

PROCEDURE

The plan of this study was explained to the group at the close of the noon meal on Friday, November 8, 1935. In order to test the method of procedure, a 24-hour trial period was carried on the following day.

The actual study covered 14 consecutive days beginning

with the evening meal on Sunday, November 10, and ending with the noon meal on Sunday, November 24. The dining hall was closed at noon on Sunday, November 10, which gave time between the morning and evening meals to obtain an inventory of the food supplies. This, together with the fact the 24-hour collection of edible waste could be ground and sampled most conveniently in the afternoon during the absence of the workers from the kitchen, made the evening meal the most practical time for the beginning of each 24-hour period.

The number of meals served to students, faculty, or guests, was recorded for each meal (Form 1). The menus used during the investigation were compiled (Table 1) and as files of those used previously were not available, records were also made of the menus for a period of two weeks before beginning the study. The latter furnished a check on the food served during the investigation, as it was desired to know if it were typical of that customarily eaten.

The height-weight-age record (Form 2) for each student was obtained from the office of the college health department. Height and weight were taken with heavy clothing and shoes removed. Age was recorded to the nearest birthday.

Form 1. NUMBER OF MEALS SERVED.

| Date | Meal | Students | | Faculty | | Guests | | Help | Total | |
|---------|-----------|----------|-------|---------|-------|--------|-------|-------|-------|-------|
| | | Men | Women | Men | Women | Men | Women | Women | Men | Women |
| 1935 | Breakfast | : | : | : | : | : | : | : | : | : |
| Nov. 10 | Dinner | : | : | : | : | : | : | : | : | : |
| | Supper | : 43 | : 32 | : 0 | : 2 | : 0 | : 2 | : 2 | : 43 | : 38 |
| | Breakfast | : 33 | : 21 | : 0 | : 4 | : 0 | : 2 | : 2 | : 33 | : 29 |
| Nov. 11 | Dinner | : 55 | : 42 | : 1 | : 4 | : 0 | : 0 | : 2 | : 56 | : 48 |
| | Supper | : 55 | : 46 | : 0 | : 4 | : 0 | : 0 | : 2 | : 55 | : 52 |

Table 1. MENUS.

Breakfast

Dinner

Supper

Sunday, November 10

Ham sandwiches
 Sandwich spread sandwiches
 Oatmeal cookies
 Raw apples
 Milk

Monday, November 11

Apple sauce 1
 Dry cereal - Milk
 Toast
 Butter
 Dried beef gravy
 Coffee
 Cocoa

Hamburger
 Stewed turnips
 Boiled potatoes
 Gravy
 Bread
 Butter
 Catsup
 Apple butter
 Dill pickles
 Baked apples
 Whipped cream

Macaroni and tomatoes
 Stewed turnips
 Buttered sweet potatoes
 Gravy
 Bread
 Butter
 Catsup
 Apple butter
 Lettuce salad
 Peaches
 Chocolate cake
 Milk

Tuesday, November 12

Apple sauce
 Toast
 Butter
 Dry cereal - Milk 1
 Oatmeal
 Milk
 Bacon
 Coffee
 Cocoa

Vegetable soup
 Crackers
 Roast beef
 Mashed potatoes
 Pickles
 Apple butter
 Bread
 Butter
 Cherry pie

Macaroni and cheese
 Fried potatoes
 Sliced cold beef
 Pork and beans
 Cottage cheese
 Bread
 Butter
 Ginger snaps
 Raw apples
 Milk

¹
 Milk in all breakfast menus served with cereal.

Table 1. (continued).

Wednesday, November 13

| | | |
|----------------------------------|-------------------|----------------------------|
| Apple sauce | Roast beef | Potato cakes |
| Toast | Gravy | Buttered string beans |
| Butter - Jelly | Dressing | Radishes - Celery |
| Cooked W. W. ² cereal | Boiled potatoes | Peanut butter |
| Corn flakes - Milk ¹ | Cole slaw | Jelly |
| Coffee | Bread | Apple-cabbage-banana salad |
| Cocoa | Butter | Pears |
| | Apple butter | Oatmeal cookies |
| | Chocolate pudding | Milk |
| | with xx cream | |

Thursday, November 14

| | | |
|--------------------------------|---------------------------|-----------------------|
| Apricots ³ | Fried cod fillet | Creamed corn beef and |
| Biscuits ³ | Browned potatoes | potatoes |
| Bacon | Macaroni and cheese, pork | Buttered peas |
| Butter | and beans, or turnips | Radishes |
| Jelly | Cabbage-pineapple salad | Raw carrots |
| Dry cereal - Milk ¹ | Dill pickles | Raw apple |
| Coffee | Bread | Ginger snaps |
| Cocoa | Butter | Milk |
| | Apple butter | |
| | Apple pie | |

Friday, November 15

| | | |
|--------------------------------|-----------------|-------------------------|
| Apple sauce | Boiled potatoes | Chili soup ⁴ |
| Dried beef gravy | Roast beef | Crackers |
| Toast | Rice soup | Spinach |
| Oleo | Spinach | Potato salad |
| Dry cereal - Milk ¹ | Bread | Bread |
| Coffee | Oleo | Oleo |
| Cocoa | Apple butter | Jelly |
| | Catsup | Celery |
| | Dill pickles | Raw carrots |
| | Fruit pudding | Oranges |
| | | Oatmeal cookies |
| | | Milk |

² W. W. = Whole wheat.

³ Football men had toast.

⁴ Football men had rice soup.

Table 1. (continued).

Saturday, November 16

| | | |
|-------------------|-----------------------|---------------------------|
| Stewed apricots 1 | Boiled beans | Scalloped potatoes |
| Dry cereal - Milk | Boiled potatoes | Fried apples |
| Oatmeal | Creamed beef | Baked beans or chili soup |
| Toast | Spinach or peas and | Bread |
| Butter | carrots ⁵ | Oleo |
| Coffee | Bread | Spinach or peas and |
| Cocoa | Oleo | carrots |
| | Tapioca cream pudding | Sliced peaches |
| | | Oatmeal cookies |
| | | Milk |

Sunday, November 17

| | | |
|----------------------------------|-------------------|-----------------|
| Canned cherries | Roast beef | Sandwiches |
| Dried beef gravy | Mashed potatoes | Oatmeal cookies |
| Toast | Gravy | Raw apple |
| Oleo | Buttered corn | Milk |
| Cooked W. W. cereal ² | Pineapple-carrot- | |
| Dry cereal - Milk ¹ | gelatin salad | |
| Coffee | Bread | |
| Cocoa | Oleo | |
| | Mixed fruit cup | |
| | Devil's food cake | |

Monday, November 18

| | | |
|--------------------------------|----------------------|----------------------------|
| Apple sauce | Meat loaf | Frankfurters |
| Baking powder biscuits | Boiled potatoes | Macaroni and tomatoes |
| Oleo | Gravy | Potatoes or scalloped corn |
| Jelly | Creamed onions | Bread |
| Dry cereal - Milk ¹ | Harvard beets | Oleo |
| Coffee | Bread | Jelly |
| Cocoa | Oleo | Mustard |
| | Catsup | Catsup |
| | Apple butter | Raw carrots |
| | Chocolate cornstarch | Raw apples |
| | pudding | Milk |

⁵ Football men had both vegetables.

Table 1. (continued).

Tuesday, November 19

| | | | |
|-------------------|---|-----------------|----------------------|
| Apple sauce | 1 | Vegetable soup | Fried potatoes |
| Dry cereal - Milk | | Crackers | Green beans |
| Toast | | Roast beef | Lettuce-banana salad |
| Oleo | | Boiled potatoes | Bread |
| Bacon | | Bread | Oleo |
| Apple butter | | Oleo | Jelly |
| Coffee | | Catsup | Raw carrots |
| Cocoa | | Dill pickles | Raw apples |
| | | Pumpkin pie | Milk |
| | | Whipped cream | |

Wednesday, November 20

| | | | |
|-------------------|---|-----------------|----------------------------|
| Apple sauce | 1 | Roast beef | Left over "round" (string |
| Dry cereal - Milk | | Mashed potatoes | beans, creamed onions, |
| Oatmeal | | Gravy | harvard beets, or carrots) |
| Cinnamon rolls | | Fried carrots | Boiled rice |
| Oleo | | Dressing | Brown sugar |
| Coffee | | Bread | Lettuce salad |
| Cocoa | | Oleo | Bread |
| | | Catsup | Oleo |
| | | Apple butter | Apple butter |
| | | Baked apples | Orange |
| | | | Milk |

Thursday, November 21

| | | | |
|--------------------------------|---|------------------|-----------------------------|
| Canned cherries or apricots | | Fried cod fillet | Macaroni and tomatoes |
| W. W. ² cereal | | Mashed potatoes | Baked beans or kidney beans |
| Grapenuts - Milk | 1 | Cabbage slaw | Oleo |
| Toast | | Apple butter | Bread |
| Jelly | | Catsup | Catsup |
| Oleo | | Bread | Peanut butter |
| Coffee | | Oleo | Peaches |
| Cocoa | | Apple pie | Oatmeal cookies |
| | | | Milk |

Table 1. (continued).

Friday, November 22

| | | |
|----------------------------------|----------------------|-----------------------|
| Cherries | Roast beef | Glazed sweet potatoes |
| Dried beef gravy | Browned potatoes | Macaroni and tomatoes |
| Toast | Boiled rice | Peas |
| Oleo | Bread | Bread |
| Dry cereal | Oleo | Oleo |
| W. W. cereal - Milk ¹ | Apple butter | Jelly |
| Coffee | Cornstarch-cocoanut- | Cookies |
| Cocoa | cream pudding | Raw apple |
| | | Milk |

Saturday, November 23

| | | |
|----------------------------------|------------------------|--------------------|
| Stewed apricots | Starchy vegetable stew | Vegetable soup |
| Dry cereal | Crackers | Crackers |
| W. W. cereal - Milk ¹ | Roast beef | Cheese |
| Griddle cakes | Boiled potatoes | Scalloped potatoes |
| Syrup | Bread | Bread |
| Oleo | Oleo | Oleo |
| Coffee | Dill pickles | Apple salad |
| Cocoa | Apple butter | Raw apple |
| | Orange | Milk |

Sunday, November 24

| | |
|--------------------------------|-------------------|
| Apple sauce | Roast beef |
| Toast | Mashed potatoes |
| Oleo | Gravy |
| Jelly | Lima bean |
| Oatmeal - Milk ¹ | Bread |
| Dry cereal - Milk ¹ | Oleo |
| Coffee | Banana salad |
| Cocoa | Jello-fruit salad |
| | Devil's food cake |

Form 2. HEIGHT-WEIGHT-AGE RECORD.

| Name | : | Sex | : | Age | : | Height | : | Weight | : |
|-----------------|---|--------|---|-----|---|--------|-----|--------|---|
| | | | | yr. | | ft. | in. | lb. | |
| Allen, Jean | : | Female | : | 18 | : | 5 | 4 | 147 | : |
| Albright, Wayne | : | Male | : | 17 | : | 5 | 10 | 146 | : |

Similar records were secured for the faculty and help.

In order to have some knowledge of the food consumed outside the dining hall, record sheets (Form 3) were given each person for each week of the study. These were to be filled out daily and returned at the end of the week.

An inventory (Form 4) was taken of all food supplies on hand at the beginning, and again at the end of the survey. A daily record (Form 5) was made of all food brought in during the time of the study. The amount of food used was determined by adding the weight of the food on hand at the beginning to the weight of the food brought in during the study, and from this total subtracting the weight of the food left at the close of the period. All foods were weighed on a platform scale which had been tested for accuracy.

Edible and inedible waste were collected separately. All parings, shells, seeds, bones, vegetable tops, and similar materials were classed as inedible. Edible materials included foods that had spoiled, those unfit for use in left over dishes, sugar left in cups or fruit dishes, scrapings from cooking utensils, discarded liquids from canned vegetables, whey from cottage cheese, foods accidentally spilled, and all other food losses. Plate and kit-

Form 3. BETWEEN-MEAL FOOD RECORD.

| Date | Kind of food eaten | Price | Amount | Place eaten | Time eaten | Reason for eating | | | |
|----------|--------------------|--------|---------|---------------|-------------|-------------------|--------|-----------|-------|
| | | | | | | Accessibility | Hunger | Sociality | Habit |
| Nov. 11: | Sundae | \$0.15 | 1 | Mary Ann | 2:00 p. m. | | | x | |
| Nov. 12: | Apple pie | | 1 piece | Box from home | 10:00 p. m. | x | | | |
| Nov. 13: | Candy bar | 0.05 | 1 | Bookstore | 10:30 a. m. | | x | | |

Form 5. DAILY INVENTORY OF FOOD SUPPLIES.

| | | On hand | | Received Monday, Nov. 11 | | Received Tuesday, Nov. 12 | |
|-------------|-----------|---------|---------|-----------------------------|--------------------------|------------------------------|-------------------|
| Product | Unit | Cost | | Unit | Cost | Unit | Cost |
| | | Unit | Total | Unit | Total | Unit | Total |
| Milk | 20 gal. | \$ 0.25 | \$ 5.00 | 12 $\frac{1}{2}$ gal. | \$ 0.25 : \$ 3.125 | 16 gal. | \$ 0.25 : \$ 4.00 |
| Bread | | | | | | | |
| Whole wheat | 29 loaves | 0.08 | 2.22 | 11 | 0.05 ¹ : 0.55 | 25 | 0.08 : 2.00 |
| White | 2 loaves | 0.08 | 0.16 | 4 | 0.05 : 0.20 | 5 | 0.08 : 0.40 |

¹ Day old bread obtained at reduced price.

chen waste were combined.

Students, under the supervision of the investigator, assisted in collecting the edible waste. Plates and serving dishes were carefully cleaned with rubber plate scrapers. Coffee and cocoa cups and milk glasses were drained and rinsed with small amounts of distilled water. Food particles clinging to cooking utensils were removed by scraping and rinsing.

As far as possible, the liquids and solids composing the edible waste were collected separately for ease in handling. To avoid contamination, each day's collection was stored in tightly covered aluminum containers until weighed and sampled. The refuse from the evening meal on one day and that from the morning and noon meals on the following day was considered the waste for one 24-hour period.

When a day's collection of edible waste had been weighed, the solids were run through a hand food chopper and thoroughly mixed. Because calculations for mixtures of this kind are impossible, a 10 per cent sample by weight of both the liquid and solid waste was taken for chemical analysis. A Harvard trip balance was used in weighing these samples. These two aliquots for a day were

combined and mixed with those of the preceding days to make a composite sample for each week. Formaldehyde was added as a preservative, and each week's composite was dried in a room at a temperature not to exceed 85° F. After the samples had dried to approximately constant weight, they were again put through the food grinder after which they were stored in glass jars until analyzed¹.

As far as possible, all visible fat in the edible waste was separated in collecting. Such procedure made for ease in handling and drying samples. This fat, which was approximately 100 per cent pure, was weighed at the end of the period and its caloric value calculated as nine Calories per gram. The sum of the calculated value for this fat and the values obtained by analysis for the rest of the edible waste, was subtracted from the calculated value for the total amount of food, to give the actual consumption. This amount divided by the total number of meals served and multiplied by three gave the daily per capita food intake.

The nutritive needs of the mean individual included

¹ Analyses by the Department of Chemistry, Kansas Agricultural Experiment Station.

in the study were based on Sherman's (26) accepted and Stiebeling and Ward's (29) tentative standards for the adult male unit.

The item-by-item method of calculating (23) was used to determine the energy, protein, calcium, phosphorus, and iron content of the food. Rose's tables (23) were supplemented by those from Chaney and Ahlborn (5), Chatfield et al (6, 7, 8), and by data supplied by commercial firms². When formulae for commercial products could not be obtained from the manufacturer, nutritive values for foods of a similar nature were substituted. The foods were calculated on the E. P. basis. The percentage of sugar, based on saccharimeter readings of the syrup of canned fruits, was determined according to Cruess (10). As suggested by Hawley (18), 60 per cent by weight of the contents of the can was considered as fruit and the remaining 40 per cent as liquid. The nutritive value for cooked food on hand at the end of the study was calculated from recipes. The vitamin content of the diet was estimated from the tables compiled by Gillett and Rice (14) and by Sherman (26).

*

Data for prepared breakfast foods from Kellogg's and The General Foods Corporation; for pickles and catsup, from H. J. Heinz Company.

Food prices were obtained from the sales slips on file in the office of the college business manager. In order to determine percentage cost and distribution of nutrients, the foods were divided into the following groups according to the plan of Sherman (26): (1) meat and fish; (2) eggs; (3) milk, cheese, and cream; (4) butter and other fats; (5) grain products; (6) sugar and other sweets; (7) vegetables; (8) fruits; (9) nuts; and (10) food adjuncts.

DISCUSSION OF RESULTS

The group of 109 persons fed at McPherson College during this investigation consisted of 101 students, 55 men and 46 women; six faculty members, five women and one man; and two women cooks. The mean weight for the men was 67.7 kilograms; for the women, 57.7 kilograms; and for the group, 61.4 kilograms. The mean heights were 69.8 inches for the men and 64.0 for the women with a group mean of 66.9 inches. The men averaged 20.6 years of age, and the women 22.8 years with a mean of 21.6 years for the group. The greater mean age for the women is explained by the fact that the group included a larger number of faculty members and also the cooks, who were older than the college students.

An estimate of the nutritive needs of the average individual composing the group was based on the standards (26, 29) for a 70 kilogram man of moderate activity, requiring 3,000 Calories, 70 grams protein, 0.68 gram calcium, 1.32 grams phosphorus, 0.015 gram iron, 3,990 units of vitamin A, 100 units of vitamin C, and 750 units of vitamin G. Adjusting these standards to a 61.4 kilogram person (the mean for the group) gave an individual standard of 2,630 Calories, 61.4 grams protein, 0.60 gram calcium, 1.16 grams phosphorus, 0.015 gram iron, 3,623 units of vitamin A, 88 units of vitamin C, and 658 units of vitamin G. Calculated on the basis of mean weight per capita, the iron standard would have been 0.013 gram per day. The mean weight for the men in the group, however, was only slightly below 70 kilograms, and as Sherman (26) recommends that women, due to their extra requirement for iron, be allowed the maximum amount regardless of weight, the iron standard in this study was placed at 0.015 gram per capita per day.

A study of the nutritive value of the diet as summarized in tables 2 and 3 shows the average daily per capita consumption to be 2,760 Calories, 92.2 grams of protein, 1.03 grams of calcium, 1.71 grams of phosphorus,

0.013 gram of iron, 5,094 units of vitamin A, 119 units of vitamin C, and 740 units of vitamin G. In comparing these findings with the per capita standard for the group, it is found that, except for iron, the estimated needs were more than met. The excess was negligible for Calories and vitamin G but amounted to 50 per cent for protein, 72 per cent for calcium, 74 per cent for phosphorus, 40 per cent for vitamin A, and 35 per cent for vitamin C. The need for iron, which if based on the weight of the group was almost met (0.013 gram), fell 13.3 per cent below the accepted standard of 0.015 gram per person. It is probable, however, that the iron loss in the waste, amounting to 18.7 per cent, is overestimated inasmuch as no precautions were taken to prevent contamination in collecting and grinding the sample for analysis. Per 3,000 Calories, the diet furnished 100.2 grams protein, 1.12 grams calcium, 1.86 grams phosphorus, 0.0149 gram iron, 5,610 units vitamin A, 129 units vitamin C, and 804 units vitamin G.

The comparatively small excess of Calories consumed in this study, amounting to only 130 per person per day, in reality probably was not an excess as 10 of the men were football players and may be considered as exceedingly active with a correspondingly greater energy requirement.

Table 2. SUMMARY OF NUTRITIVE VALUE OF FOODS CONSUMED.

| Food group | Consumed : | | | | | | |
|-------------------------------|------------|---------------|-------------|------------|------------|----------|------------|
| | A. P. | Calories | Protein | Calcium | Phosphorus | Iron | Cost |
| | lb. | | gm. | gm. | gm. | gm. | |
| Meat and fish | : 529.9 | : 334,053.7 | : 34,929.2 | : 22.59 | : 378.18 | : 4.695 | : \$ 71.70 |
| Eggs | : 41.5 | : 24,864.0 | : 2,251.2 | : 11.26 | : 30.24 | : 0.504 | : 7.84 |
| Milk and cheese | : 1,778.4 | : 581,529.4 | : 28,194.7 | : 1,018.01 | : 787.26 | : 2.004 | : 54.69 |
| Butter and other fats | : 160.2 | : 577,692.0 | : 687.2 | : 2.62 | : 2.96 | : 0.035 | : 28.59 |
| Grain products | : 715.7 | : 1,006,923.3 | : 33,110.1 | : 78.72 | : 507.31 | : 6.069 | : 57.29 |
| Sugar and other sweets | : 285.4 | : 380,688.6 | : 66.5 | : 1.14 | : 1.93 | : 0.049 | : 16.23 |
| Vegetables | : 1,381.1 | : 397,236.3 | : 14,233.1 | : 172.17 | : 380.30 | : 5.750 | : 55.26 |
| Fruits | : 725.0 | : 179,276.6 | : 1,842.2 | : 38.94 | : 54.59 | : 0.943 | : 37.74 |
| Nuts | : 11.1 | : 19,894.1 | : 1,406.0 | : 3.91 | : 21.74 | : 0.128 | : 1.33 |
| Food adjuncts | : 121.7 | : 53,181.7 | : 795.1 | : 4.60 | : 24.71 | : 0.257 | : 13.86 |
| Total | : 5,760.0 | : 3,555,339.7 | : 117,519.3 | : 1,353.96 | : 2,189.22 | : 20.344 | : 344.53 |
| Edible waste | : | : 240,402.7 | : 6,755.9 | : 109.37 | : 133.14 | : 3.804 | : |
| Total consumption | : | : 3,314,937.0 | : 110,743.4 | : 1,244.59 | : 2,056.08 | : 16.540 | : |
| Average per person per day | : | : 2,760.0 | : 92.2 | : 1.03 | : 1.71 | : 0.013 | : 0.286 |
| Standard adult male unit (26) | : | : 3,000.0 | : 70.0 | : 0.68 | : 1.32 | : 0.015 | : |
| Standard per person per day | : | : 2,630.0 | : 61.4 | : 0.60 | : 1.16 | : 0.015 | : |
| Per 3,000 Calories | : | : | : 100.2 | : 1.12 | : 1.86 | : 0.0149 | : |

Table 3. VITAMIN CONTENT OF DIET.

| Food | Weight | Vitamin A | Vitamin C | Vitamin G ² |
|-------------------------------|------------|-------------|-----------------------|------------------------|
| | lb. | units | units | units |
| Apples | : 225.38 | : 54,091 | : 2,500 ¹ | : 22,484 |
| Bacon | : 22.50 | : 1,800 | : | : 3,264 |
| Bananas | : 53.30 | : 85,280 | : 4,240 | : 8,492 |
| Beans, navy | : 20.25 | : 4,860 | : | : |
| Beans, string | : 45.90 | : 110,160 | : | : |
| Beets | : 15.60 | : 1,248 | : | : 3,550 |
| Bread, mixed commercial | : 348.75 | : 17,438 | : | : |
| Butter | : 38.50 | : 862,400 | : | : |
| Cabbage | : 101.85 | : 16,296 | : 32,640 ¹ | : 34,650 |
| Carrots | : 74.80 | : 1,124,992 | : 450 ¹ | : 21,018 |
| Celery | : 14.00 | : | : 600 | : |
| Cheese | : 13.75 | : 154,000 | : | : |
| Corn, canned | : 15.45 | : | : 750 | : |
| Eggs | : 37.00 | : 325,600 | : | : 23,520 |
| Lemons | : 0.78 | : | : 18,720 | : |
| Lettuce, head | : 59.50 | : 47,600 | : 1,800 | : 16,740 |
| Meat or muscle | : 337.42 | : 26,994 | : | : 130,135 |
| Milk, whole | : 1,764.60 | : 1,835,184 | : 26,475 | : 536,268 |
| Onions | : 34.65 | : | : | : 1,884 |
| Oranges | : 57.37 | : 18,358 | : 13,680 | : 10,400 |
| Peaches | : 44.14 | : | : 3,520 | : |
| Pears | : 13.39 | : | : | : 3,000 |
| Peas, canned | : 35.40 | : 99,120 | : 5,600 | : |
| Peppers | : 1.64 | : 4,592 | : | : |
| Pineapple | : 15.00 | : | : 1,200 | : |
| Potatoes, sweet | : 81.70 | : 111,112 | : | : |
| Potatoes, white | : 530.40 | : 84,864 | : | : 60,125 |
| Prunes | : 4.46 | : 21,408 | : | : |
| Spinach, canned | : 36.45 | : 816,480 | : 5,760 | : |
| Tomatoes, canned | : 107.29 | : 291,828 | : 25,680 | : 7,792 |
| Turnips | : 30.80 | : 2,464 | : | : 5,180 |
| Total | | 6,119,274 | : 143,615 | : 888,502 |
| Average per person per day | | 5,094 | : 119 | : 740 |
| Standard adult male unit (27) | | 3,990 | : 100 | : 750 |
| Standard per person per day | | 3,623 | : 88 | : 658 |
| Per 3,000 Calories | | 5,610 | : 129 | : 804 |

¹ Estimate based on amount served raw.

² Value based on average figures.

According to Sherman (27), a 50 per cent margin of safety in the protein intake is as much as is desired. In this study not only was the margin met, but an additional 50 per cent was supplied. In many low cost diets, the quantity of protein is sufficient, but it is often inadequate as to quality, chiefly because animal proteins which, as a rule, are of better quality than plant ones are not used in sufficient amounts on account of their cost. In this study, however, 56.2 per cent of the protein used was from animal and 43.8 per cent from plant sources. The animal protein furnished 88 per cent of the estimated requirement of 61.4 grams.

It may therefore be safely assumed, that there was no deficiency of protein either as to quantity or quality. It is probable rather that there was an undue excess. As the money expended for meat and eggs was only slightly above the recommended one-fifth (26), it might be desirable, while keeping the proportion of the food money down to this same low level to serve a smaller amount of the more expensive proteins. For example, more eggs might be used and also better cuts of meat which would permit of greater variety in preparation and service.

Quoting Sherman (27), "In the case of calcium, of

phosphorus, or of iron, judgment is more difficult than for protein, but here also the available evidence indicates that the allowance of the same fifty per cent margin above the laboratory findings of the amount needed to support equilibrium in the adult.....will suffice for the attainment of the best results." The recommended safety margin for calcium and phosphorus was more than met in this diet with an additional amount of 72.0 per cent of calcium, and 46.9 per cent of phosphorus. This was due largely to the generous use of milk in the diet. The safety margin for iron was not supplied and, in view of recent questioning concerning the availability of food iron, it is probably undesirable to fall below the standard, particularly when women are included in the group.

Due to insufficient data regarding the vitamin content of foods, and also because the vitamin losses due to waste, heat, and oxidation could not be determined, the vitamin findings are only suggestive. Until other than tentative standards are established and better methods for determination are available, it is not possible to conclude definitely that the vitamin content of the diet was either adequate or inadequate.

In comparing these findings with those of other inves-

tigators (tables 4 and 5), seven of the 11 studies showed an excess of Calories. The range per kilogram was from 31 in the study made by Ryder (24) to 65 in the first week's study by Goddard et al (15). The present study furnished 45 Calories per kilogram which is normal for moderate activity but slightly more than the allowance of 3,000 Calories per 70 kilograms as set by Sherman (26). All but one of the groups reported an excess of protein and calcium, two fell below the standard for phosphorus, and only one reported an adequate amount or an excess of iron. The data for vitamins are not sufficient to permit of comparison.

Table 6, summarizing edible and inedible waste, shows 7.4 per cent loss as edible food material and 7.3 per cent as inedible. The inedible and the total edible waste are both low in comparison with findings of other investigators (table 7). The fact that few fresh fruits and vegetables were used by this group would account for the low percentage of inedible waste. The low edible food waste may be partially explained by the continuous service of prepared foods until they were eaten. No food was discarded unless it was absolutely unfit to eat. Such materials as apple peelings which are commonly thrown away were used in jelly making.

Table 4. COMPARISON OF PER CAPITA NUTRITIVE VALUE OF FOOD SERVED TO COLLEGE GROUPS.

| Study | Year | Institution | Location | Av. wt. : :sub-jects | Calor-ies :per day | Calor-ies :per kg. | Pro-tein | Cal-ium | Phos-phor-us | Iron | Edible :waste :included |
|------------------|--------|------------------------|--------------------------|-------------------------|-----------------------|-----------------------|----------|---------|--------------|----------|-------------------------------|
| | | | | kg. | | | gm. | gm. | gm. | gm. | |
| Borthwick | :1917: | Women's res. hall | :Bozeman, Mont.: | | : 2549 | | : 73 | | | | |
| Macleod & Griggs | :1917: | Women's res. hall | :Poughkeepsie, New York | : 56.3 | : 2698 | : 48 | : 99.6 | | | | |
| Bevier | :1920: | Women's organiza-tions | :Urbana, Illinois | | : 2419 | | : 69.5 | | | | |
| Grace | :1929: | Women's organiza-tions | :Corvallis, Oregon | | : 2765 | | | | | | |
| Ryder | :1931: | Women's res. hall | :Manhattan, Kansas | : 58.2 | : 1821 | : 31 | : 56.1 | :0.79 | :1.197 | :0.01236 | no |
| Shirley | :1932: | Sororities | :Manhattan, Kansas | | : 2822 | | : 86.4 | :0.78 | :1.38 | :0.0160 | yes |
| Shirley | :1932: | Fraternities | :Manhattan, Kansas | | : 3816 | | :118.5 | :0.91 | :1.76 | :0.0200 | yes |
| Fowler | :1933: | Fraternities | :Manhattan, Kansas | : 65.3 | : 2915 | : 45 | : 82.8 | :0.65 | :1.87 | :0.0070 | no |
| Conard | :1934: | Sorority | :Manhattan, Kansas | : 55.7 | : 2055 | : 35 | : 58.1 | :0.50 | :0.92 | :0.0080 | no |
| Davis | :1934: | Cooperative group | :Manhattan, Kansas | : 67.3 | : 3415 | : 50 | : 94.8 | :1.41 | :2.04 | :0.0159 | no |
| Goddard et al | :1934: | Women's res. hall | :Los Angeles, California | : 57.1 | : 3699 | : 65 | : 91.0 | :0.75 | :1.34 | :0.0130 | no |
| Goddard et al | :1934: | Women's res. hall | :Los Angeles, California | : 57.1 | : 2501 | : 44 | : 75.0 | :0.51 | :1.15 | :0.0130 | no |
| Jackson | :1934: | Sorority | :Manhattan, Kansas | : 53.3 | : 2338 | : 44 | : 63.3 | :0.53 | :0.977 | :0.0069 | no |

Table 4. (continued).

| Study | :Year: | Institution | : Location | :Av. wt.: | :Calor-: | :Calor-: | :Pro-: | :Cal-: | :Phos-: | :Iron | :Edible |
|-------------------------------|--------|----------------------|-------------------------------|-----------|-----------|-----------|---------|--------|---------|---------|------------|
| | | | | :sub-: | :ies | :ies | :tein | :cium: | :phor-: | : Iron | :waste |
| | | | | :jects | :per day: | :per kg.: | | : Iron | | | :included: |
| | | | | kg. | | | gm. | gm. | gm. | gm. | |
| Wheeler & Mallay | :1934: | Cooperative group | :Poughkeepsie, : :New York | : 56.6 | : 2397 | : 42 | : 70.0: | :0.92: | :1.32 | :0.0118 | : yes |
| Schermerhorn | :1935: | Women's res. hall | :Manhattan, : :Kansas | : 60.5 | : 2088 | : 34 | : 65.0: | :0.75: | :1.13 | :0.0095 | : no |
| Atkinson | :1935: | College dining :hall | :McPherson, : :Kansas | : 61.4 | : 2760 | : 45 | : 92.2: | :1.03: | :1.71 | :0.0130 | : no |
| Standard adult male unit (26) | : | : | : | : 70.0 | : 3000 | : 43 | : 70.0: | :0.68: | :1.32 | :0.0150 | : no |

Table 5. COMPARISON OF NUTRITIVE VALUE OF FOOD SERVED TO COLLEGE GROUPS¹
EXPRESSED AS PERCENTAGE ABOVE OR BELOW SHERMAN'S STANDARD.

| Study | Year | Institution | Location | Av. wt. : sub-jects | Calories | Protein | Calcium | Phosphorus | Iron |
|------------------|--------|-------------------|------------------------------|------------------------|----------|-----------|---------|------------|-----------|
| Macleod & Griggs | :1917: | Women's res. hall | :Poughkeepsie, :New York | : 56.3 : | +11.0 | : +76.8 : | : | : | : |
| Ryder | :1931: | Women's res. hall | :Manhattan, :Kansas | : 58.2 : | -27.0 | : - 3.4 : | + 39.8 | : + 9.1 | : -17.6 : |
| Fowler | :1933: | Fraternity | :Manhattan, :Kansas | : 65.3 : | + 3.5 | : +25.0 : | + 2.5 | : +52.0 | : -50.0 : |
| Conard | :1934: | Sorority | :Manhattan, :Kansas | : 55.7 : | -14.0 | : + 4.3 : | - 9.9 | : -12.3 | : -46.6 : |
| Davis | :1934: | Cooperative group | :Manhattan, :Kansas | : 67.3 : | +18.0 | : +40.8 : | +115.6 | : +60.6 | : + 6.0 : |
| Goddard et al | :1934: | Women's res. hall | :Los Angeles, :California | : 57.1 : | +51.2 | : +59.3 : | + 36.3 | : +25.2 | : -13.3 : |
| Goddard et al | :1934: | Women's res. hall | :Los Angeles, :California | : 57.1 : | + 2.2 | : +31.3 : | - 7.2 | : + 7.4 | : -13.3 : |
| Jackson | :1934: | Sorority | :Manhattan, :Kansas | : 53.3 : | + 2.0 | : +18.8 : | + 1.9 | : + 2.9 | : -50.6 : |
| Wheeler & Mallay | :1934: | Cooperative group | :Poughkeepsie, :New York | : 56.6 : | - 1.5 | : +23.5 : | + 67.2 | : +23.3 | : -24.8 : |
| Schermerhorn | :1935: | Women's res. hall | :Manhattan, :Kansas | : 60.5 : | -19.0 | : + 7.4 : | + 27.1 | : + 0.8 | : -36.6 : |
| Atkinson | :1935: | College res. hall | :McPherson, :Kansas | : 61.4 : | + 4.8 | : +51.4 : | + 74.5 | : +47.4 | : -13.3 : |

¹ Calculated by investigator.

Table 6. SUMMARY OF WASTE.

| : Inedible : | | Edible | | | | | |
|--------------|--------------------|--------------------------|--------------------------|---------------------------|---------------------------|---------------------------|--------------------------|
| : Total | | : Calories | : Protein | : Calcium | : Phosphorus | : Iron | |
| Total | : 423 lb. | : 434.3 lb. ¹ | : 240,402.7 ⁵ | : 6755.9 gm. ⁴ | : 109.37 gm. ⁴ | : 133.14 gm. ⁴ | : 3.804 gm. ⁴ |
| Per cent | : 7.3 ² | : 7.4 ³ | : 6.8 | : 5.7 | : 8.0 | : 6.0 | : 18.7 |

Weight of food, A. P.⁶ 5760 lb.
 Weight of edible waste as collected.
 Solids 289.7 lb.
 Liquids 117.9 lb.
 Visible fat 7.4 lb.
 Distilled
 water (added) 19.3 lb.
 Total 434.3 lb.⁷
 Dry weight of edible waste 47.550 gm.

¹ Total edible waste = visible fat + solids + liquids + distilled water.

² Per cent inedible waste = $\left(\frac{\text{wt. of inedible waste}}{\text{wt. of food A. P.} - \text{wt. of visible fat}} \right) \times 100.$

³ Per cent edible waste = $\left(\frac{\text{wt. of total edible waste}}{\text{wt. of food A. P.} - \text{wt. of visible fat}} \right) \times 100.$

⁴ Grams of protein, calcium, phosphorus, and iron waste = percentage composition of each (table 12) x dry weight of edible waste.

⁵ $(\text{Cal.} / \text{gm.} \times \text{dry wt. of edible waste in gm.}) + (\text{Wt. of visible fat in gm.} \times 9).$

⁶ As Purchased.

⁷ Dry weight of edible waste calculated on dry weight of 10 per cent sample of total edible waste.

Table 7. COMPARISON OF PERCENTAGE OF FOOD WASTE IN GROUP DIETARIES.

| Study | Date | Group | Location | Ined- ible waste | Edible waste | | | | | |
|---------------------|-----------------|--------------------------------|------------------------------|------------------------|--------------|---------------|--------------|--------------|-----------------|--------|
| | | | | | Total | Calor- ies | Pro- tein | Calci- um | Phos- phorus | Iron |
| Atwater | :1886- :1906 | :Families and :institutions | :Nine states | : | : | : 13.0 | : 14.0 | : | : | : |
| Gephart | :1914-15 | :St. Paul's School | :Concord, :New Hampshire: | : | : | : 15.0 | : 18.0 | : | : | : |
| Macleod & Griggs | :1917 | :Women's res. hall | :Poughkeepsie, :New York | : 15.6 | : 10.6 | : | : | : | : | : |
| Hawley | :1926-27 | :St. Paul's School | :Concord, :New Hampshire: | : | : | : 30.0 | : 23.0 | : | : | : |
| Ryder | :1931 | :Women's res. hall | :Manhattan, :Kansas | : | : 23.0 | : 25.0 | : 19.0 | : 27.0 | : 21.7 | : 68.6 |
| Conard | :1933 | :Sorority | :Manhattan, :Kansas | : | : | : 11.9 | : 10.0 | : 12.0 | : 10.3 | : 31.0 |
| Goddard et al | :1934 : | :Women's res. hall | :Los Angeles, :California | : 13.6 | : 12.0 | : 20.0 | : 14.0 | : | : | : |
| Jackson | :1934 | :Sorority | :Manhattan, :Kansas | : | : | : 13.9 | : 16.7 | : 22.1 | : 16.7 | : 48.7 |
| Davis | :1934 | :Cooperative group | :Manhattan, :Kansas | : | : | : 9.0 | : 9.0 | : 8.0 | : 8.0 | : 20.0 |
| Schermer- horn | :1935 | :Women's res. hall | :Manhattan, :Kansas | : 8.8 | : 10.6 | : 14.0 | : 11.2 | : 13.7 | : 12.4 | : 32.7 |
| Atkinson | :1935 | :College dining hall | :McPherson, :Kansas | : 7.3 | : 7.4 | : 6.8 | : 5.7 | : 8.0 | : 6.0 | : 18.7 |

Checking the menus with those of an earlier two-week period indicated that the food used during this study was typical of the regular diet of the group. It was therefore assumed that those in charge of the meals were not influenced by the fact that a dietary study was being conducted.

Although the food consumed by a group may be adequate from the standpoint of nutrition, yet it can be very unsatisfactory in that it lacks variety in color, texture, flavor, and food combinations. This is especially likely to be true when low-cost menus are planned for only one meal at a time. The food selection and the method of preparation in this study were, as a rule, not varied sufficiently from day to day, and flavor combinations were not always pleasing.

In the 42 meals studied, in addition to the constant use of both apple jelly and apple butter, apples were served in one of six ways at 20 of the meals. In the day's menus (table 1) for November 12, they were served as apple sauce for breakfast, apple butter and baked apples at noon, and raw apples for supper. This repetition was not altogether the fault of the meal planning as a carload of apples had been purchased just before this study was

begun which necessitated their frequent use to prevent loss. Few attempts, however, were made to vary their preparation as is indicated by the fact that apple sauce was served eight times, and raw apples six times. The use of a commercial spread other than apple butter would also have relieved the monotony.

From tables 1 and 8 it may be noted that meat and fish were used 28 times during the 14 days, always at the noon meal and seven times for each of the morning and evening meals. Roast beef was served nine times; creamed meats made from corned beef and left over roast beef, seven times; bacon, three times; meat sandwiches, twice; and hamburger, sliced cold beef, meat loaf, and frankfurters, each once. White potatoes were served 21 times - for every noon meal, and for half of the evening meals. For dinner, they were served boiled, eight times; mashed, five times; and browned, once. When warmed over for supper they were fried, scalloped, creamed, or browned. Green or yellow vegetables including cabbage were used 17 times. Citrus fruits or tomatoes were served only seven times. Milk was provided as a beverage at every evening meal. A choice between coffee and cocoa made of milk was allowed for breakfast. Eggs, other than those used in

Table 8. FREQUENCY DISTRIBUTION OF FOODS SERVED.

| Beverages | | Vegetables | | Fruits | | Whole | Meat: | Fats | | | | | |
|----------------|-----------|------------|-------------|--------|----------|---------|-----------|---------|-----------|----|---|----|----|
| Cocoa made | Green or: | White : | Citrus or: | grain | and : | But- | ter : | Others: | products: | | | | |
| Milk:with milk | Coffee: | yellow | Raw:potato: | Other: | tomatoes | Others: | products: | fish: | Eggs: | | | | |
| 14 | 14 | 14 | 21 | 13 | 21 | 17 | 7 | 34 | 56 | 26 | 0 | 27 | 15 |

Times served in: 14 : 14 : 14 : 21 : 13 : 21 : 17 : 7 : 34 : 56 : 26 : 0 : 27 : 15 : 14 days

cooking, were never served. Whole wheat bread was used almost to the exclusion of white bread, and breakfast cereals of all kinds were consumed in large amounts.

Frequently these meals were not balanced. The following menu of boiled beans, boiled potatoes, creamed beef, bread, oleo, peas and carrots, or left over spinach, and tapioca cream pudding served on Saturday, November 16, is an example of the use of too many starchy foods. Foods high in starch, as macaroni and cheese, macaroni and tomatoes, lima beans, rice, bread dressing, and navy beans were generally served with potatoes and as a substitute for a second vegetable.

The meals also often contained too many protein-rich foods. To illustrate, the menu for supper of November 12 consisted of fried potatoes, macaroni and cheese, sliced cold beef, pork and beans, cottage cheese, raw apples, bread, butter, milk, and ginger snaps. The Sunday dinner menu for November 24, consisting of roast beef, mashed potatoes, gravy, lima beans, banana salad, bread, oleo, jello fruit salad, and devil's food cake is an example of a too-concentrated meal. It lacked cellulose in the form of leafy vegetables. The main course of the meal lacked contrast in color, texture, and flavor. The Friday dinner

menu for November 22, of boiled rice, roast beef, browned potatoes, bread, oleo, apple butter, and cornstarch coconut cream pudding was poorly balanced and not pleasing as to colors, flavors, or food combinations.

The large variety of foods served in a single meal contributed to monotony in the diet as a whole because of the necessary repetition of the same foods. Another practice which made the menus extremely monotonous was the use made of left overs. For example, spinach was prepared in too large a quantity so it appeared in exactly the same way four times, for dinner and supper on one day and again for both of these meals on the second day. As a rule, left overs were simply warmed over and seldom used as the basis of new combinations or dishes.

Following these practices regarding the use of left overs and the failure on the part of those who planned these meals to recognize the need for variety in texture, color, and food combinations may well be criticized. As this study was based on average and not individual food consumption, it is not probable that every student had as good a diet as these data indicate. From observation, and also from records of members of the foods classes, it was learned that the appetites of many of the students, espec-

ially of the women, were affected unfavorably by the repeated appearance of foods constantly prepared in the same way.

The student records of foods eaten between meals were too few and too inaccurate to be used in estimating food consumption, but they were interesting from the standpoint of food habits. Only 30 reports were returned representing 12.7 per cent of the group. From these reports, the foods eaten in order of frequency were as follows: fruits, candy, sandwiches, beverages, pop-corn, cake, pastry, peanuts, meats, and ice cream. In spite of the large number of apples served in the dining hall this fruit was selected for 53 of the 59 times fruits were eaten between meals. In checking the reasons for between meal eating, sociability was selected 35 times; accessibility, 23 times; and habit, once. Hunger was unchecked. Over 70 per cent of the between-meal eating occurred between 1:00 and 12:00 p. m. and 76 per cent of this between 8:00 and 11:30. Sixty per cent of the food eaten in the morning was between 9:00 and 11:00 a. m.

Other living habits of the students were revealed in the investigator's record of the meals eaten. Only 69.7 per cent of the men and 42.4 per cent of the women ate

breakfast. For dinner, the women led with 94.2 per cent eating this meal as compared with 92 per cent of the men. Only 86.3 per cent of the men and 77.2 per cent of the women reported for supper. A 100 per cent attendance was not attained for any of the three meals. The attendance at the noon meal, however, may be considered 100 per cent with a degree of accuracy, for it was observed that few if any students missed this meal unless they were out of town. Converting the number appearing for the morning and evening meals into terms of the noon meal, shows an attendance at breakfast of 75.7 per cent for the men and 50.3 per cent for the women, and at supper, of 93.8 per cent for the men and 81.5 per cent for the women.

It thus becomes evident that at best, a goodly proportion of the students, and especially the women, were not eating these meals at the residence hall. It probably meant that breakfast was omitted for the most part, due partially to the regular and perhaps early hour at which it was served. "Feeds" in the rooms and evening dinner invitations, coupled with the unattractive use of left overs for supper, may have been factors in the reduced attendance at this meal. Bevier (3), in a similar study, reported 75 per cent as having appeared at breakfast but

makes no reference to other meals. Schermerhorn (25) reported an attendance of 76.3 per cent for breakfast, 80.0 per cent for lunch, and 90.0 per cent for dinner.

The generally accepted idea that meat is a relatively expensive food appears to be true in this study as is shown in table 9. Although it represented the greatest money expenditure (21 per cent), protein is the only nutrient in which it ranked first (table 10), and then it supplied only two per cent more than grain products. Meat and fish furnished approximately one-tenth of the Calories in the diet and the consumption amounted to 0.39 pound, E. P., per capita per day.

Grain products, the second in money expenditure, ranked first as a source of Calories and iron, furnishing approximately one-third of both. They were second in protein and phosphorus, and although third in calcium, were not a good source of this mineral as they yielded less than six per cent of the total contained in the diet. More than 85 per cent of the bread eaten was made of whole wheat which provided a goodly proportion of the iron of the diet. The amount expended for vegetables and for milk respectively was approximately the same as was spent for grain products. Vegetables ranked second in iron and cal-

cium, third in phosphorus, and fourth in protein and Calories. The iron furnished by vegetables was two per cent less than that supplied by the grain products or about one-third of the total.

Although the money expended for milk and milk products was less than one-sixth of the total, these foods furnished more than 75 per cent of the calcium of the diet which more than met the group requirement for this mineral. These foods also ranked first as a source of phosphorus furnishing approximately 36 per cent of the total. For Calories, protein, and iron, milk and milk products ranked second, third, and fourth respectively. They, however, could not be considered a good source of iron as they furnished less than 10 per cent of the total. Although twice as much oleo as butter was served, dairy products supplied approximately 45 per cent of the vitamin A in this dietary. Milk and milk products, exclusive of butter, furnished approximately 33 per cent of the vitamin A, 19 per cent of the vitamin C, and 60 per cent of the vitamin G of the diet.

As the milk consumption per capita per day was 1.38 pints instead of the recommended pint per day for each adult, all the nutrients in the diet except iron and Cal-

Table 9. AVERAGE PERCENTAGE DISTRIBUTION OF
COST AND NUTRIENTS IN FOOD SERVED.

| Type of food | :Relative :cost | : Calories | : Protein | : Calcium | : Phosphorus | : Iron |
|----------------------------|--------------------|------------|-----------|-----------|--------------|--------|
| Meat & fish | : 20.8 | : 9.4 | : 29.7 | : 1.7 | : 17.3 | : 22.6 |
| Eggs | : 2.3 | : 0.7 | : 1.9 | : 0.8 | : 1.4 | : 2.5 |
| Milk, cheese, and cream | : 15.9 | : 16.4 | : 24.0 | : 75.2 | : 36.0 | : 9.9 |
| Butter and other fats | : 8.4 | : 16.2 | : 0.6 | : 0.2 | : 0.1 | : 0.2 |
| Grain products | : 16.6 | : 28.3 | : 28.2 | : 5.8 | : 23.2 | : 29.8 |
| Sugar and other sweets | : 4.7 | : 10.8 | : 0.1 | : 0.1 | : 0.1 | : 0.2 |
| Vegetables | : 16.3 | : 11.2 | : 12.2 | : 12.7 | : 17.4 | : 28.3 |
| Fruits | : 10.9 | : 5.0 | : 1.6 | : 2.9 | : 2.5 | : 4.6 |
| Nuts | : 0.4 | : 0.6 | : 1.2 | : 0.3 | : 1.0 | : 0.6 |
| Food adjuncts | : 4.0 | : 1.5 | : 0.6 | : 0.3 | : 1.1 | : 1.3 |

Table 10. RANK OF FOOD GROUPS BASED ON PERCENTAGE
DISTRIBUTION OF COST AND NUTRIENTS¹.

| | First | Second | Third | Fourth | Fifth |
|------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| Cost | :Meat and fish | :Grain products | :Vegetables | :Milk, cheese, :and cream | :Fruits |
| Calories | :Grains | :Milk, cheese, :and cream | :Butter and :other fats | :Vegetables | :Sugars and :other sweets |
| Protein | :Meat and fish | :Grain products | :Milk, cheese, :and cream | :Vegetables | :Eggs |
| Calcium | :Milk, cheese, :and cream | :Vegetables | :Grain products | :Fruits | :Meat and fish |
| Phosphorus | :Milk, cheese, :and cream | :Grain products | :Vegetables | :Meat and fish | :Fruits |
| Iron | :Grain products | :Vegetables | :Meat and fish | :Milk, cheese, :and cream | :Fruits |

¹ Food groups from table 9.

ories were greatly increased by its use. Milk therefore was relatively high in price only from the standpoint of Calories and iron, and in this study, as milk was obtained at wholesale, even these nutrients were inexpensive.

From observation, however, it was learned that a large number of the women students did not drink milk or the cocoa made with milk due to a misconception that it would cause them to gain weight.

Fruits are not outstanding in this particular summary (table 9) as their most important contributions to a diet are vitamins, organic acids, and flavors, none of which were considered in this evaluation. Only 10 per cent of the food money was spent for fruits, but considered in conjunction with vegetables the proportion of the food budget spent for these foods is relatively high, amounting to 27 per cent. They furnished, however, only 2.2 ounces of citrus fruits and tomatoes per capita per day.

Based on Gillett's recommendation (26) that the food budget be divided as follows: one fifth, more or less, for vegetables and fruit; one fifth, or more, for milk and cheese; one fifth, or less, for meats, fish, and eggs; one fifth, or more, for bread and cereals; one fifth, or less, for fats, sugar, and other groceries, the summary (table 11) shows an expenditure of more than one fifth for

fruits and vegetables; but less than that amount for milk and cheese and for bread and cereals. The expenditure of more than one fifth for fruits and vegetables was commendable. Although in this study more than a pint of milk per capita per day was provided at less than the recommended one-fifth of the food budget, an increase in expenditure would have been necessary in order to supply even one pint of milk had it been purchased at retail prices. More than one fifth of the food money was used for meats, fish, and eggs. The egg consumption, however, was low, averaging only 1.9 per person per week. It is doubtful if sufficient eggs can be included in a diet unless they are served as such occasionally. Because of the superior quality of the protein and the large amount of iron they contain, the recommended egg a day or at least four per person per week is highly desirable.

During this study a total of 3,603 meals supplying 3,314,937 Calories was served at an average cost of 28.6 cents per person per day, 9.5 cents per meal, 31.2 cents per 3,000 Calories, or approximately one cent per 100 Calories. This indicates that it is possible to supply a diet adequate in most respects for a comparatively small expenditure of money.

Table 11. PERCENTAGE DISTRIBUTION OF THE FOOD DOLLAR.

| Food group | : | Gillett's standard | : | Present study | : |
|-----------------------------------|---|--------------------------|---|---------------|---|
| Vegetables and fruits: | | One fifth, more or less: | | 27.18 | : |
| Milk and cheese | : | One fifth, or more | : | 15.87 | : |
| Meat, fish, and eggs | : | One fifth, or less | : | 23.08 | : |
| Bread and cereals | : | One fifth, or more | : | 16.62 | : |
| Fats, sugars, and other groceries | : | One fifth, or less | : | 17.50 | : |

Table 12. REPORT OF EDIBLE WASTE ANALYSES¹.

| | Per cent |
|----------------|----------|
| Protein | : 14.25 |
| Ether extract | : 19.34 |
| Crude fiber | : 1.45 |
| Moisture | : 7.60 |
| Ash | : 6.01 |
| N-free extract | : 51.35 |
| Carbohydrates | : 52.80 |
| Calcium | : 0.23 |
| Phosphorus | : 0.28 |
| Iron | : 0.008 |

¹ Analyses by the Department of Chemistry, Kansas Agricultural Experiment Station.

CONCLUSIONS

On the basis of present accepted nutritive standards for the individual, this dietary supplied Calories, protein, calcium, phosphorus, and vitamins A, C, and G in sufficient amounts. Iron was the only nutrient studied in which the diet was deficient. The findings suggest that the iron requirement, especially if women are included in the group, will not be met unless a definite effort is made to serve large amounts of iron-rich foods.

Even though meals planned by untrained persons may be fairly adequate from a nutritive standpoint, they are less likely to meet the aesthetic requirements than those supplied by trained workers. It is essential, if proper food attitudes are to be maintained by a group, that the food not only be adequate nutritionally but be attractively prepared and served.

Maintenance of low edible waste increased the nutrients provided by this low-cost diet.

Serving a large part of the fresh fruits and vegetables uncooked increased the vitamin C content of this diet without increasing the cost.

Buying food in quantity when practical, reduced food costs materially.

The number of students, especially women, who failed to eat breakfast was unusually large. Observations suggest that the 'no breakfast' habit, coupled with late hours and midnight 'feeds', was largely responsible for this.

In this study, milk supplied more than its share of calcium, phosphorus, protein, and Calories. Its inclusion in a liberal amount is especially recommended for such low-cost dietaries. Failure, however, of an individual to consume his share of the milk served will result in serious deficiencies in diets which offer no substitute for milk.

Due to an inadequate check on food consumed outside the dining room, a complete picture of the nutrition of the group is not possible.

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